

Energy Charter Protocol on Energy Efficiency and
Related Environmental Aspects
PEEREA

In-Depth Review of the Energy Efficiency Policy of Armenia



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Executive Summary

Executive Summary

The Republic of Armenia is a mountainous, landlocked country strategically located at the crossroads between Europe and Asia. The country has an area of approximately 29 740 km²¹ and is located in the South Caucasus region of Eurasia. Armenia borders Turkey in the west, Georgia in the north, Azerbaijan in the east, and Iran and the Azerbaijani exclave of Nakhijevan in the south. The capital of the Republic of Armenia is Yerevan and in 2014 the population of the country stood at 3,01 million.² Its population density is just over 100 people per km², making it one of the most densely populated countries in the region. The majority of the population lives in urban areas and approximately 38% of the population lives in Yerevan.

Prior to the fall of the USSR, Armenia was a Soviet Republic for 70 years. The Republic of Armenia declared independence from the USSR in August 1990, but was not officially recognised as an independent state until 1991. After the dissolution of the USSR, the country embarked on a path of democratic reform and transition from central planning to a market-driven economy. In accordance with the Constitution adopted by a nation-wide referendum on July 5th, 1995, Armenia became an independent and democratic nation with a presidential form of administration in which the President, elected by a national vote for a term of five years, appoints the Prime Minister. The legislative authority is the National Assembly and from 2017 all members of the Assembly will be elected by proportional representation.

Armenia's economy contracted by half after independence from Russia in 1991 due to the break down of value chains of the former USSR. Recovery was slow with a shift from heavy industry to services, which explains improvement in energy intensity. From 2000 to 2008, the economy benefited from massive expansion in the construction sector but the construction industry collapsed in the wake of the 2008-2010 financial crisis, following which Armenia's economy contracted by 14% before slowly recovering. Inflation is currently below 4%³ and the current account currently enjoys a small surplus.⁴ Poverty in Armenia increased in the wake of the global economic crisis, however, and currently affects almost 30 percent of Armenian households.

The World Bank ranks Armenia as 35th out of 189 countries in relation to ease of doing business.⁵ In relation to economic freedom, Armenia was ranked 52nd out of 178 countries, and 23rd out of 43 European countries, by the Heritage Foundation in 2015.

In a 2014 Readiness for Investment in Sustainable Energy (RISE) survey carried out by the World Bank, Armenia was assessed on three pillars of sustainable energy - energy access, renewable energy and energy efficiency. Regarding energy efficiency, the report noted that in spite of legislation passed in 2004, which helped to adopt a legal framework for energy efficiency, the country still lacks a national target for reducing energy intensity. One area in which Armenia scored poorly was regarding the incentives or mandates that energy supply utilities had to invest in energy efficiency. The report critiqued that utilities were not required to carry out energy efficiency or carbon-reduction activities. The same applies to investment into energy efficiency by public entities and large scale users, which have no binding energy saving obligations.⁶ Overall Armenia achieved RISE scores of 59/100 in renewable energy and 37/100 in energy

1 <http://www.gov.am/en/geography/>

2 <http://www.gov.am/en/demographics/>

3 <http://www.tradingeconomics.com/armenia/inflation-cpi>

4 In July 2015 the budget surplus was 58mUS\$. <http://www.tradingeconomics.com/armenia/current-account>

5 *Doing Business 2016: Armenia, The World Bank Group (2015)*

6 <http://rise.worldbank.org/data/exploreconomies/armenia/2014/energy-efficiency>

efficiency.⁷ Such scores indicate that much work is necessary to attract necessary further investment in both areas of sustainable energy.

Supply and demand

Total primary energy supply (TPES) of Armenia reached 2900 ktoe in 2013, 77% of which is imported. Armenia imports all of its oil and gas. With gas accounting for 63% of Armenia's primary energy, the country is highly dependent on gas imports, 80% of which come from Russia. The remainder of gas imports come from Iran, imported in exchange for Armenia's supply of electricity to Iran.

Armenia's electricity generation capacity is comprised as follows: 2433MW thermal (1380MW available), 815 MW nuclear (407.5MW available), 1182 MW hydro and a wind pilot of 2.6MW. At present, baseload capacity is provided by the nuclear power plant with nuclear fuel being flown in from Russia. Hydropower plants provide daily load regulation while thermal plants operate to cover peak demand, especially in the winter, and to provide backup when the nuclear power plant goes offline for maintenance. Roughly 50% of the generation facilities are more than 40 years old, however, and many will need to be closed in the short to medium term. The lifetime of Armenia's nuclear plant is to be extended to 2026, enabled by a \$300 million loan from Russia, with downtime to upgrade the plant to be undertaken in a phased approach over several years to minimise supply disruption.

Total final energy consumption (TFC) reached 2101 ktoe in 2013 and is on a rising trend. TFC is dominated by natural gas (62%), followed by electricity (22%) and oil products (15.4%). The share of natural gas almost doubled since 2000. The residential sector is the largest energy consumer, responsible for one third of the final energy consumption in 2013, followed by the transport sector (25 %) and industry (18 %). Some of the growth in gas is attributable to households leaving the district heating system and installing their own boilers. The latter was facilitated by low gas prices and the collapse of the district heating system in the 1990s. Road vehicles are another major contributor to the growth in gas consumption. A large share of vehicles in Armenia use compressed natural gas (CNG) instead of gasoline or diesel.

Legislative framework and market structure

The Energy Law was adopted in 2001 and regulates interrelations between legal entities involved in the energy sector, electricity, heating and natural gas consumers pursuant to the law and the state bodies. The law sets out a number of principles relating to, for example, market structure, competition, regulation of energy sector operations, consumer protection, investment promotion, safety, energy efficiency and environmental protection. This law is currently under review.

The gas sector is vertically integrated and dominated by ArmRusGazprom, which is fully owned by Russia's Gazprom. The company imports gas from Russia and Iran and also owns and operates the gas transmission and distribution networks in Armenia.

For the electricity sector, the privately-owned Electricity Networks of Armenia (ENA) acts as the single buyer of electricity through contracts with generating companies at regulated rates. Energy flows and payment delivery are monitored by the state-owned settlement centre. The system operator dispatches generators taking into account the economic dispatch order of plants as well as plants' operational constraints⁸ The system operator is state-owned and independent from the state-owned transmission company.

⁷ <http://rise.worldbank.org/data/exploreconomies/armenia/2014?topic=energy-access#energy-efficiency>

⁸ *Investment Plan for Armenia, April 2014*

While there are 175 generating companies in total, many of these are small hydro and wind facilities. Approximately two thirds of all generation capacity is state-owned. Around 60% of electricity generation capacity is thermal and of this, some 45% is owned by Russia and a third is owned by Armenia, with the remainder privately owned. Armenia also owns all nuclear capacity (though a Russian company, RAO UES, operates the facility) and around a third of hydro capacity.

Institutional arrangements and regulatory framework

Established in 1992, The Ministry of Energy and Natural Resources of the Republic of Armenia (MENR) is the highest executive authority to elaborate and implement the policies in the energy sector, which includes the reform process. It is responsible for system planning and investment planning for state-owned entities. The Ministry objectives also include provision of energy efficiency and renewable energy sector policy development and implementation, provision of the state policy of state technical control in the power sector and energy consumption, conducting supporting research, and obtaining and facilitating support from international organizations.⁹

The Ministry of Urban Development (MUD) is responsible for construction and building policies and regulation, and for overseeing most of the investments in this sector. MUD is also responsible for the Social Housing Strategy. The energy efficiency related tasks and functions are included in its Charter. The Ministry of Nature Protection coordinates the implementation of the activities aimed at meeting Armenia's commitments under UN Framework Convention on Climate Change.

The Public Services Regulatory Commission (PSRC) performs regulatory operations in energy, water and telecommunication sectors, relating to tariff design, service quality standards, licensing, compliance, dispute resolution between customers and licensees, and definition of electricity market rules. The PRSC regulates tariffs gas and electricity generation, transmission and distribution.

A comprehensive tariff study on Armenia was issued by the World Bank in June 2013. The study noted that the end-user tariffs had not been increased since 2009 and were no longer cost reflective. The Government recently reviewed tariffs and put forward proposals in 2015 to increase tariffs. These proposals met with considerable resistance from the public. Armenia has since revisited its proposals, with latest indications suggesting price decreases. The Government will publish final tariffs before the end of 2016.

Renewable energy tariffs were set by the PSRC in 2007 to stimulate private investment in renewable energy. New generating plants sign 15 year power purchase agreements (PPAs). Under these agreements Energy Networks Armenia (ENA) is obliged to pay the generator for all the power produced. The PSRC is required to adjust feed-in tariffs annually in line with changes in inflation and the USD to AMD exchange rate. MENR is currently investigating geothermal and utility-scale PV investment strategies which includes an international tender for 50 MW of PV. Future development of RES will depend on the price resulting from this competition.

Strategies and Policies

Several strategies and action plans are in place to develop the energy sector, improve energy security and advance energy efficiency. The 2013 National Energy Security Concept identifies

⁹ <http://www.minenergy.am>

the promotion, development and investment in renewable energy technologies as critical to Armenia diversifying its energy supply and achieving energy independence. The Armenian Development Strategy (ADS) and National Security Strategy (NSS) also emphasise the importance of renewable energy and energy efficiency in addressing energy security.

Important for energy efficiency action has been the Law on Energy Saving and Renewable Energy (2004) and the national programme on Energy Saving and Renewable Energy (2007). The National Energy Efficiency Action Plan (2011-2014) is a key instrument to deliver the high-level strategy and is in the process of being updated (NEEAP 2). The first NEEAP exceeded its overall target of reducing energy consumption by 63.3 Mtoe by nearly a factor of two. However, the sectoral targets were not all met. Most of the energy savings came from the public buildings and services sector and the transport sector, while there was under-performance in the residential buildings, industry, power, agriculture and forestry sectors.



Recommendations

Recommendations

General recommendations

The government should continue to work on the long term energy strategy to ensure that energy policy goals respect and fully reflect the potential of energy efficiency and renewable energy to contribute to wider political, economic, social and environmental goals. The government is to be commended for the ongoing efforts within National Energy Security Concept and when making decisions on increasing generation capacities the potential contribution of energy efficiency on reducing long term energy demand should be taken into account.

Energy Efficiency and Renewable Energy should continue to be high priority in all sectors and future energy-related policies should be supported by detailed analysis of energy efficiency potentials in the economy, and the barriers which delay the realisation of these potentials.

The Government should continue to ensure sufficient coordination and synergy between the national policies and international donors' initiatives. The institutional framework to support the implementation of Energy Efficiency policies, including the Ministry of Energy and Natural Resources, should be strengthened, in order coordinate and enforce concrete programs and actions in all economic sectors

Active engagement of relevant scientific research institutes should be encouraged in the efforts to address current challenges facing the energy sector, including the issues of increasing energy efficiency, reducing losses, ensuring reliability and high quality of power supply.

Government should ensure effective implementation of the second National Energy Efficiency Action Plan (NEEAP). The establishment of an effective institution is of key importance in this respect. A procedure for evaluation and review of progress should also be put in place.

From an economic point of view, the observed decoupling of GDP and energy consumption growth is positive and should be reinforced further.

While continuing promoting participating in the Covenant of Mayors, further efforts should be targeted to increase the capacity of municipalities to develop and implement their Sustainable Energy Action Plans, including financial capabilities.

Electricity, Gas and Heating Sectors

The modernization of the generation, transmission and distribution infrastructure needs to continue, in order to further minimise losses and utilise the existing energy saving potential.

The Government should continue to facilitate the progress on interconnections with neighboring countries to support regional integration of energy markets and to overcome isolation of the domestic energy market.

The Government, with the support from the PSRC, should review the market model as new interconnections develop and ensure adaptation of balanced market rules to reconcile with EU legislations and Eurasian Economic Union rules to remove regulatory and trade barriers.

The Government should continue the promotion of renewable energy in a cost effective way.

The ongoing efforts by the distribution company (Electric Network Armenia) to introduce smart technologies in metering should be encouraged.

Feasibility studies, including assessments on efficient use of heat, should be carried out as a basis for future decisions on development of co-generation.

Industry

The Government should consider a more proactive energy efficiency policy for the industry sector.

The Government should assess further expansion of mandatory energy auditing for large industries, consider voluntary auditing also for SMEs as well as incorporating a standardized approach to energy auditing. It should also encourage further industrial enterprises to implement actions to deliver cost-effective energy savings including the already adopted energy auditing system for the large energy consumers.

The Government should actively promote the adoption of energy management practices (such as ISO 50 001) to large industrial enterprises.

The Government should continue the process of aligning the existing industrial equipment standards to the best international practices.

The Government should encourage ongoing efforts to introduce clean resources planning as well as activities within the Global Cleantech Innovation Program for SMEs in Armenia. It should encourage establishment of networks of large industries in order to establish platform for information sharing and promotion of best practices to accelerate the identification, planning, and implementation of high impact energy efficiency measures.

The Government should consider extending the policy toolkit to include various incentive schemes for industrial enterprises that undertake energy audits in order to support the implementation of the audits recommended measures as well as other justified actions.

Buildings

The Government should put efforts into effective enforcement of recently adopted legislations in the building sector. The relevant technical regulations and standards should be adopted as soon as possible in order to improve the effectiveness of the whole regulatory system in the building sector.

Further strengthening of existing building legislations towards introducing requirements for near-zero consumption buildings should be considered.

The Government should continue striving to make public buildings a model for energy efficiency. Ensure the application of the latest best international standards regarding the performance of various building components – windows, heating, ventilation and cooling systems, etc.

The Government should encourage local authorities to undertake energy audits of all public buildings and develop dedicated programmes for improving the energy performance of public buildings to implement the requirements of the audits.

The Government should require that special energy efficiency criteria are introduced in procurement procedures for public expenditures on goods, services and works, with particular emphasis on the public building sector.

The Government should continue its efforts to raise public awareness by providing information on end-use energy efficiency measures, both in residential and public buildings.

The Government should utilise lessons learned from demonstration projects to inform subsequent government policies on the choice of institutional and regulatory reforms.

The Government should ensure necessary conditions are put in place to allow local authorities to finance energy efficiency measures in the longer term. It should also further encourage energy efficiency improvement by providing innovative financial mechanisms and creating attractive conditions for application of energy performance contracting and ESCOs.

Lighting and Energy Using Products

The Government should accelerate the process of development and adoption of common minimum energy performance standards for energy using products in line with respective EU and Eurasian Economic Union rules.

Authorities need to allocate sufficient resources for compliance, monitoring and verifying advertised performance for different appliance groups on energy efficiency requirements, regardless of whether they are imported or locally manufactured.

The Government should create the necessary conditions to support local authorities in developing and implementing projects for high-efficiency public lighting. It should also consider introducing financial incentives to facilitate the fast deployment of energy efficiency street lighting in the country.

The Government should continue to encourage the purchase of high-efficient household appliances.

Transport

The Government should improve the quality of urban planning, including transport infrastructure elements and traffic management, by setting up a system of transport sector energy efficiency indicators.

The Government should introduce policy packages (regulatory and incentives) that encourage more rapid turnover of the old vehicle fleet. Such measures could be in the form of discouraging the import of old vehicles, incentives encouraging quick fleet renewal by owners, vehicle fuel economy labels, tax and fiscal measures stimulating purchase of more efficient vehicles.

The relevant authorities should improve the quality of service, efficiency, accessibility and comfort of existing public transport systems in order to create alternative to private vehicle use in urban areas.



Краткое изложение

Краткое изложение

Республика Армения – горная страна, не имеющая выхода к морю и занимающая стратегически важное положение на пересечении путей, соединяющих Европу и Азию. Территория страны составляет примерно 29 740 км¹⁰. Армения расположена в Закавказском регионе в Евразии и граничит с Турцией на западе, Грузией на севере, Азербайджаном на востоке и Ираном и Нахичеванской автономной республикой, эксклавом Азербайджана, на юге. Столица Республики Армения – Ереван, в 2014 году население страны составляло 3,01 млн человек¹¹. Плотность населения составляет немногим более 100 человек на км², что делает Армению наиболее густонаселённой страной региона. Большая часть населения проживает в городских поселениях и примерно 38% населения – в Ереване.

До распада СССР на протяжении 70 лет Армения была советской республикой. Республика Армения объявила о своей независимости от СССР в августе 1990 года, но не была официально признана в качестве независимого государства до 1991 года. После распада СССР страна вступила на путь демократических реформ и перехода от централизованного планирования к рыночной экономике. В соответствии с Конституцией, принятой в результате национального референдума 5 июля 1995 года, Армения является независимым и демократическим государством с президентской формой правления, в котором Президент, выбранный народным голосованием, назначает Премьер-Министра. Законодательной властью является Национальная ассамблея; с 2017 года все члены Ассамблеи будут избираться по системе пропорционального представительства.

Экономика Армении сократилась вдвое после независимости от России в 1991 году из-за распада хозяйственных связей бывшего СССР. Восстановление шло медленно со сдвигом от тяжёлой промышленности к услугам, что объясняет улучшения в области энергоёмкости. С 2000 по 2008 год на экономике позитивно сказывалось массивное расширение строительного сектора, но строительная промышленность обрушилась по следам финансового кризиса 2008-2010 годов, после которого экономика Армении сократилась на 14%, прежде чем начать медленно восстанавливаться. На сегодняшний день инфляция держится ниже 4%¹² и на текущем счету страны образовался небольшой остаток¹³. Тем не менее, в результате мирового экономического кризиса бедность в Армении выросла и касается почти 30% армянских семей.

Всемирный банк ставит Армению на 35-е место из 189 стран по простоте ведения деловой деятельности¹⁴. По показателям экономической свободы Армения заняла 52-е место в списке 178 стран и 23-е в списке 43 европейских стран, по данным 2015 года Heritage Foundation.

В ходе проводившегося Всемирным банком в 2014 году исследования «Готовность к инвестициям в устойчивую энергетику» (*Readiness for Investment in Sustainable Energy, RISE*), была сделана оценка Армении по трём основным компонентам устойчивой энергетики – доступ к энергии, возобновляемая энергетика и энергоэффективность. В отношении энергоэффективности исследование отмечает, что несмотря на принятое в 2004 году законодательство, содействовавшее принятию правовой основы для энергоэффектив-

10 <http://www.gov.am/en/geography/>

11 <http://www.gov.am/en/demographics/>

12 <http://www.tradingeconomics.com/armenia/inflation-cpi>

13 В июле 2015 года бюджетный профицит был равен 58 млн долл. США. <http://www.tradingeconomics.com/armenia/current-account>

14 *Doing Business 2016: Armenia, The World Bank Group (2015)*

ности, в стране всё ещё отсутствует намеченная национальная цель по снижению энергоёмкости. Одной из областей, в которых Армения выступила слабо, стали стимулы или мандаты, в связи с которыми энергоснабжающие компании должны бы были инвестировать в энергоэффективность. В исследовании критикуется, что компании не обязаны предпринимать меры по энергоэффективности или снижению выбросов углерода. То же касается и инвестиций в энергоэффективность со стороны государственных компаний и крупных потребителей, которые не имеют юридически закреплённых обязательств по энергосбережению.¹⁵ В целом, индекс RISE для Армении составил 59/100 по возобновляемой энергии и 37/100 по энергоэффективности.¹⁶ Такие показатели свидетельствуют о том, что необходимо провести большую работу для привлечения требуемых дополнительных инвестиций в эти области устойчивой энергетики.

Спрос и предложение

Общее первичное предложение энергии (ОППЭ) Армении достигло 2900 тыс. т.н.э. в 2013 году, из которых 77% было импортировано. Армения импортирует всю свою нефть и газ. При том, что на газ приходится 63% первичной энергии Армении, страна крайне зависима от импорта газа, 80% которого поступает из России. Остаток импорта газа поступает из Ирана, он импортируется в обмен на армянские поставки электроэнергии в Иран.

Электрогенерирующие мощности Армении состоят из 2433 МВт тепловой генерации (располагаемая мощность 1380 МВт), 815 МВт атомной генерации (располагаемая мощность 407,5 МВт), 1182 МВт гидрогенерации и пилотной ветряной электростанции мощностью 2,6 МВт.

В настоящее время мощность для покрытия базовой нагрузки обеспечивается за счёт атомной электростанции, ядерное топливо для которой доставляется авиатранспортом из России. Гидроэлектростанции обеспечивают регулирование суточной нагрузки, при этом тепловые электростанции задействуются для покрытия пикового спроса, в особенности зимой, и для замены атомной электростанции, когда она отключена на время технического обслуживания. Тем не менее, порядка 50% объектов генерации старше 40 лет, многие из них предстоит закрыть в ближайшей или средней перспективе. Срок эксплуатации атомной электростанции Армении должен быть продлён до 2026 года благодаря российскому кредиту в размере 300 млн долл. США, при этом время простоя, используемое для обновления станции, будет разбито на несколько фаз на протяжении нескольких лет для минимизации срыва поставок.

Общее конечное потребление энергии (ОКП) достигло 2101 тыс. т.н.э. в 2013 году при сохраняющейся тенденции роста. В ОКП доминирует природный газ (62%), за ним следует электроэнергия (22%) и нефтяные продукты (15,4%). Доля природного газа почти удвоилась с 2000 года. Жилищный сектор является крупнейшим потребителем энергии, отвечающим за треть конечного потребления энергии в 2013 году; за ним следует транспортный сектор (25%) и промышленность (18%). Часть роста потребления газа объясняется уходом домохозяйств из системы централизованного теплоснабжения и установкой ими собственных бойлеров. Переходу к использованию собственных бойлеров способствовали низкие цены на газ и распад системы централизованного теплоснабжения в 1990-е годы. Дорожный транспорт также вносит значительный вклад в

¹⁵ <http://rise.worldbank.org/data/exploreconomies/armenia/2014/energy-efficiency>

¹⁶ <http://rise.worldbank.org/data/exploreconomies/armenia/2014?topic=energy-access#energy-efficiency>

рост потребление газа. Значительная доля транспортных средств в Армении использует сжатый природный газ (также называемый компримированным, КПП) вместо бензина или дизельного топлива.

Законодательная система и структура рынка

Закон «Об энергетике» был принят в 2001 году; в нём регулируются взаимоотношения юридических лиц, действующих в энергетическом секторе, электроэнергия, теплоснабжение и потребители природного газа в соответствии с законодательством и государственными учреждениями. Закон устанавливает ряд принципов, относящихся, например, к структуре рынка, конкуренции, регулированию операций в энергетическом секторе, защите потребителей, содействию инвестициям, безопасности, энергоэффективности и защите окружающей среды. Этот закон в настоящее время пересматривается.

Газовый сектор вертикально интегрирован, в нём доминирует АрмРусГазпром, полностью принадлежащий российскому Газпрому. Компания импортирует газ из России и Ирана, она также владеет и оперирует системами транспортировки и распределения газа в Армении.

В секторе электроэнергетики частная компания «Электрические сети Армении» (ЭСА) действует в качестве единого покупателя электроэнергии через контракты с генерирующими компаниями по регулируемым тарифам. Энергетические потоки и осуществление платежей отслеживает принадлежащий государству расчётный центр. Системный оператор осуществляет диспетчеризацию генерирующих компаний с учётом экономического порядка диспетчеризации станций, а также эксплуатационных ограничений станций¹⁷. Системный оператор принадлежит государству и действует независимо от принадлежащей государству компании по электропередаче.

При том, что всего существует 175 генерирующих компаний, многие из них – малые ГЭС и ветряные объекты. Примерно две трети всех генерирующих мощностей принадлежат государству. Около 60% электрогенерирующих мощностей – тепловые электростанции, из них примерно 45% принадлежат России и треть принадлежит Армении, остальные находятся в частном владении. Армении также принадлежат все атомные мощности (хотя российская компания РАО ЕЭС осуществляет управление АЭС) и около трети гидромо мощностей.

Институциональная организация и регуляторная система

Созданное в 1992 году Министерство энергетики и природных ресурсов Республики Армения (МЭПР) является высшим исполнительным органом, разрабатывающим и применяющим политику в энергетическом секторе, включающую процесс реформ. Оно отвечает за системное планирование и планирование инвестиций для государственных юридических лиц. В цели министерства также входит обеспечение разработки и применения политики в области энергоэффективности и сектора возобновляемой энергетики, обеспечение государственной политики по государственному техническому контролю в электроэнергетическом секторе и потреблении энергии, проведение поддерживающих исследований и получение и содействие поддержке от международных организаций¹⁸.

¹⁷ *Инвестиционный план для Армении, апрель 2014 г.*

¹⁸ <http://www.minenergy.am>

Министерство градостроительства (МГС) отвечает за политику и регулирование в сфере строительства и строений и за надзор над большинством инвестиций в этом секторе. МГС также отвечает за Стратегию социального жилья. Задачи и функции, связанные с энергоэффективностью, включены в его Устав. Министерство охраны окружающей среды координирует реализацию деятельности, направленной на выполнение обязательств Армении по Рамочной конвенции ООН об изменении климата.

Комиссия по регулированию общественных услуг (КРОУ) осуществляет регулирующие функции в секторах энергетики, водоснабжения и телекоммуникации, связанные с оформлением тарифов, стандартами качества услуг, лицензированием, соответствием, разрешением споров между клиентами и держателями лицензий и определением правил рынка электроэнергии. КРОУ регулирует тарифы на производство, передачу и распределение газа и электроэнергии.

Всестороннее исследование по вопросу тарифов в Армении было опубликовано Всемирным банком в июне 2013 года. В исследовании отмечается, что тарифы для конечных потребителей не повышались с 2009 года и больше не отражают уровня затрат. Правительство недавно пересмотрело тарифы и в 2015 году выдвинуло предложения по повышению тарифов. Эти предложения столкнулись со значительным сопротивлением общества. С тех пор Армения пересмотрела свои предложения, с последними признаками, указывающими на возможное снижение цен. Правительство опубликует окончательные тарифы до конца 2016 года.

Тарифы на электроэнергию из возобновляемых источников были (ВИЭ) установлены Комиссией по регулированию общественных услуг (КРОУ) в 2007 году для стимулирования частных инвестиций в сектор ВИЭ. Новые генерирующие станции подписывают соглашения о закупке электроэнергии сроком на 15 лет. В рамках таких соглашений ЗАО «Электрические сети Армении» обязано оплачивать генерирующей компании всю произведённую энергию. КРОУ должна корректировать закупочные тарифы ежегодно в соответствии с изменением курса инфляции и курса доллара США к армянскому драму. В настоящее время МЭПР изучает стратегии инвестиций в геотермальную энергетику и крупномасштабные фотоэлектрические системы, включающие международный тендер на 50 МВт фотоэлектрических мощностей. Будущее развитие возобновляемых источников энергии будет зависеть от цены, которая определится в результате этой конкуренции.

Стратегии и политика

Существует несколько стратегий и планов действий для развития энергетического сектора, повышения энергетической безопасности и прогресса в сфере энергоэффективности. Концепция национальной энергетической безопасности 2013 года определяет продвижение, развитие и инвестирование в технологии ВИЭ как ключевой фактор для диверсификации энергетических поставок и достижения Арменией энергетической независимости. Армянская стратегия развития (АСР) и Национальная стратегия безопасности (НСБ) также подчёркивают важность возобновляемой энергетики и энергоэффективности для обеспечения энергетической безопасности.

Закон «Об энергосбережении и возобновляемой энергетике» (2004 года) и национальная программа Энергосбережения и возобновляемой энергетики (2007 года) были важны для действия энергоэффективности. Национальный план действий в области энергоэффективности (2011-2014 годов) является ключевым инструментом для формулирования

стратегии высокого уровня; этот план сейчас в процессе обновления (НПДЭЭ 2). Первый НПДЭЭ превзошёл свою общую цель снижения потребления энергии на 63,3 млн т.н.э. практически в два раза. Тем не менее, по секторам не все цели были достигнуты. Большая часть энергосбережений пришлась на государственные здания, сектор услуг и транспортный сектор, в то время как в жилых зданиях, промышленности, электроэнергетике, сельском хозяйстве и лесном хозяйстве наблюдалось недовыполнение плановых показателей.



Рекомендации

Рекомендации

Общие рекомендации

Правительству стоит продолжить работу над долгосрочной энергетической стратегией с таким расчетом, чтобы цели энергетической политики соблюдали и полностью отражали потенциал энергоэффективности и возобновляемой энергетики для внесения вклада в более обширные политические, экономические, социальные и экологические цели. Нужно отдать должное правительству за его продолжающиеся усилия в рамках Национальной концепции энергетической безопасности и при принятии решений по наращиванию генерирующих мощностей, стоит учитывать потенциальный вклад энергоэффективности в снижение спроса на энергию в долгосрочной перспективе.

Энергоэффективность и возобновляемая энергетика должны оставаться важным приоритетом во всех секторах, и будущая политика, связанная с энергетикой, должна поддерживаться детальным анализом потенциалов энергоэффективности в экономике и барьеров, задерживающих реализацию этих потенциалов.

Правительству стоит продолжать обеспечивать достаточную координацию и синергию между национальными направлениями политики и инициативами международных доноров. Стоит укрепить институциональную структуру для поддержки реализации политики в сфере энергоэффективности, включая Министерство энергетики и природных ресурсов, для координации и применения конкретных программ и действий во всех экономических секторах.

Стоит стимулировать активное вовлечение соответствующих научно-исследовательских институтов в рамках усилий по решению нынешних вызовов, стоящих перед энергетическим сектором, включая вопросы повышения энергоэффективности, снижения потерь, обеспечения надежности и высокого качества электроэнергетических поставок.

Правительству стоит обеспечить эффективную реализацию второго Национального плана действий в области энергоэффективности (НПДЭЭ). В этом отношении, крайне важно создать эффективное ведомство. Также необходимо установить процедуру для оценки и обзора прогресса.

С точки зрения экономики, наблюдаемое прекращение корреляционной связи между ВВП и ростом потребления энергии является позитивным и требует дальнейшего укрепления.

При продолжении продвижения участия в Соглашении мэров, стоит целиться на дальнейшие усилия для расширения возможностей муниципалитетов по разработке и реализации их Планов действий по устойчивой энергетике, включая финансовые возможности.

Электроэнергия, природный газ и теплоснабжение

Необходимо продолжить модернизацию инфраструктуры генерации, электропередачи и распределения для дальнейшей минимизации потерь и использования существующего потенциала энергосбережения.

Правительству стоит продолжить содействие прогрессу в области объединения энергосетей с соседними странами для поддержки региональной интеграции энергетических рынков и преодоления изоляции внутреннего энергетического рынка.

Правительству, при поддержке КРОУ, стоит пересмотреть рыночную модель по мере возникновения новых объединений энергосетей и обеспечить адаптацию сбалансированных правил рынка для согласования с законодательством ЕС и правилами Евразийского экономического союза для удаления регулятивных и торговых барьеров.

Правительству стоит продолжить продвижение возобновляемой энергетики рентабельным способом.

Стоит содействовать нынешним усилиям распределительной компании («Электрические сети Армении») по внедрению умных технологий в области учета энергопотребления.

Необходимо провести технико-экономический анализ, включая оценку эффективного использования тепловой энергии, для обоснования будущих решений по развитию когенерации.

Сектор промышленности

Правительству стоит рассмотреть возможность более инициативной политики в сфере энергоэффективности для сектора промышленности.

Правительству стоит произвести оценку дальнейшего расширения обязательного энергетического аудита для крупных секторов промышленности, рассмотреть возможность добровольного аудита и для малых и средних предприятий, а также инкорпорирования стандартизированного подхода к энергетическому аудиту. Ему также стоит сильнее стимулировать промышленные предприятия принимать меры по достижению рентабельных энергосбережений, включая уже принятую систему энергетического аудита для крупных потребителей энергии.

Правительству стоит активно продвигать принятие практик энергетического управления (например, ISO 50 001) крупными промышленными предприятиями.

Правительству стоит продолжить процесс приведения существующих стандартов промышленного оборудования в соответствие с передовой международной практикой.

Правительству стоит стимулировать нынешние усилия по внедрению планирования чистых ресурсов, а также деятельности в рамках Глобальной программы инноваций в сфере чистых технологий (Global Cleantech Innovation Program) для МСП в Армении. Ему стоит поддерживать создание сетей крупных секторов промышленности с целью создания платформы для обмена информацией и содействия передовым практикам для ускорения определения, планирования и реализации высокоэффективных мер в области энергоэффективности.

Правительству стоит рассмотреть возможность расширения набора политических мер с целью включения в него различных стимулирующих схем для промышленных предприятий, проводящих энергетический аудит, для поддержки реализации аудитов, рекомендованных мер, а также иных обоснованных действий.

Сектор зданий

Правительству стоит приложить усилия для эффективного применения недавно принятого законодательства в строительном секторе. Необходимо принять как можно скорее соответствующие технические регламенты и стандарты, с тем чтобы повысить эффективность регулятивной системы в строительном секторе в целом.

Стоит рассмотреть возможность дальнейшего усиления существующего законодательства в сфере строительства и ввести требования для строений с потреблением, приближающимся к нулю.

Правительству стоит продолжить стремиться к превращению общественных зданий в модель энергоэффективности, обеспечить применение лучших новейших международных стандартов относительно показателей различных строительных составляющих – окон, систем отопления, вентиляции и охлаждения и проч.

Правительству стоит стимулировать местные власти проводить энергетические аудиты во всех общественных зданиях и разрабатывать специальные программы для улучшения энергетических показателей общественных зданий для реализации требований аудитов.

Правительству стоит установить требования о введении специальных критериев по энергоэффективности в порядок закупок при общественных расходах на товары, услуги и работы, с уделением особого внимания сектору общественных зданий.

Правительству стоит продолжить усилия по повышению осведомленности общества с помощью предоставления информации о мерах в области энергоэффективности для конечного потребителя, как в жилых, так и в общественных зданиях.

Правительству стоит использовать уроки, извлеченные из демонстрационных проектов, для определения возможных вариантов институциональных и регулятивных реформ при разработке последующих направлений правительственной политики.

Правительству стоит обеспечить создание необходимых условий, позволивших бы местным властям финансировать меры по энергоэффективности в долгосрочной перспективе. Ему также стоит продолжить стимулирование совершенствований в области энергоэффективности с помощью предоставления инновационных финансовых механизмов и создания привлекательных условий для заключения контрактов на повышение энергоэффективности и для сервисных энергетических компаний.

Освещение и энергопотребляющая продукция

Правительству стоит ускорить процесс разработки и принятия общих минимальных стандартов энергетических показателей для продуктов, использующих энергию, в соответствии с соответствующими правилами ЕС и Евразийского экономического союза.

Властям необходимо выделить достаточные ресурсы для соблюдения нормативных требований, мониторинга и проверки объявленных показателей для различных групп бытовых приборов по требованиям энергоэффективности независимо от того, импортируются ли они или производятся внутри страны.

Правительству стоит создать необходимые условия для поддержки местных властей при разработке и реализации проектов по высокоэффективному уличному освещению. Ему также стоит рассмотреть возможность введения финансовых стимулов для содействия быстрому распространению энергоэффективности в уличном освещении в стране.

Правительству стоит продолжить стимулировать приобретение высокоэффективных бытовых приборов.

Транспорт

Правительству стоит повысить качество городского планирования, включая транспортные элементы и регулирование движения транспорта, с помощью создания системы показателей энергоэффективности в транспортном секторе.

Правительству стоит ввести политические пакеты (регулятивные и стимулы), содействующие ускоренному обновлению старого автопарка. Эти меры могут принять форму осложнения импорта старых автомобилей, стимулов владельцам быстрее обновлять автопарк, маркировка экономии автомобильного топлива, налоговые и фискальные меры, стимулирующие приобретение более эффективных автомобилей.

Соответствующим властям стоит улучшить качество услуг, эффективность, доступность и удобство существующих систем общественного транспорта с целью создания альтернативы частному автомобильному пользованию в городских районах.



Background

Background

Country Overview

The Republic of Armenia is a mountainous, landlocked country strategically located at the crossroads between Europe and Asia. The country has an area of approximately 29,740 km²¹⁹ and is located in the South Caucasus region of Eurasia. Armenia borders Turkey in the west, Georgia in the north, Azerbaijan in the east, and Iran and the Azerbaijani exclave of Nakhichevan in the south. The capital of the Republic of Armenia is Yerevan and in 2014 the population of the country stood at 3.01 million.²⁰ Its population density is just over 100 people per km², making it one of the most densely populated countries in the region. The majority of the population lives in urban areas and approximately 38% of the population lives in Yerevan.

Prior to the fall of the USSR, Armenia was a Soviet Republic for 70 years. The Republic of Armenia declared independence from the USSR in August 1990, but was not officially recognized as an independent state until 1991. After the dissolution of the USSR, the country embarked on a path of democratic reform and transition from central planning to a market-driven economy. In accordance with the Constitution adopted by a nationwide referendum on July 5, 1995, Armenia is an independent and democratic nation with a presidential form of administration. The president is elected by a national vote for a term of five years. The executive authority is the Government of Armenia, headed by the prime minister, who is appointed by the president. The legislative authority is the National Assembly (composed of 131 deputies elected for a four-year term of office).

The Republic of Armenia is situated within the sharp continental climate belt. The climate specifics of the country are a function of its geographic location in low latitudes and mountainous terrain. Armenia is located in the Transcaucasus and its mountains are rich in copper, molybdenum, lead, clay, limestone and semi-precious stones. Armenia is also rich in natural sources of mineral water and has ten natural lakes, five canyons and numerous springs and mountainous rivers. Lake Sevan is the world's largest mountainous pool of fresh water with a surface of 1214 m². Armenia's highest mountain is the Aragats (4090 m).

Economic Background

From the 1950s into the 1980s, a powerful scientific, technical and industrial potential was established in Armenia. It functioned in all basic industrial branches of the former Soviet Union: chemical technologies, electrical engineering, radio electronics and the machine tool industry as well as the textile, mining and metallurgy industries. In terms of its production volumes and extensive cooperation networks, Armenia was among the four most industrial republics of the former Soviet Union.

After the collapse of the Soviet Union as a common economic area, the transport blockade and the energy crisis, the basic components of Armenian industry were destroyed and in the immediate post-independence period Armenia's economy contracted by half. This was largely due to the breakdown of the value chains of the former USSR.²¹ During the 1990s, Armenia managed to successfully implement a number of structural reforms and the economy underwent a profound transformation. A liberal foreign investment law was approved in 1994 and by 1995 an IMF-sponsored economic liberalization programme together with inflows

¹⁹ <http://www.gov.am/en/geography/>

²⁰ <http://www.gov.am/en/demographics/>

²¹ *Republic of Armenia, Accumulation, Competition and Connectivity, World Bank (2013). Available online: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/10/03/000333037_20131003152734/Rendered/PDF/811370revision0Box0379837B00PUBLIC0.pdf.xlv*

of foreign capital resulted in positive growth rates. The growth was built on increases in productivity and exports. In addition, favourable inflation and exchange rate dynamics led to a depreciation of the real exchange rate by 15%.²²

Armenia became an official WTO member in February 2003 and by the same year the economy had regained its pre-independence size. During this period the government began actively seeking investments from Armenians living abroad (the diaspora) into real estate in Armenia. This created a construction-centred growth model supported by foreign exchange inflows.²³ The newly created market-orientated environment enjoyed double-digit growth during the years leading up to 2008. The rates were underpinned by high rates of investment, which peaked at 35% of GDP. During the pre-2008 period, the construction sector accounted for more than a third of real GDP growth. Furthermore, the real exchange rate appreciated by nearly 60% and the outward orientation of the economy declined. Despite the rapid construction of residential buildings, prices increased and resulted in a bubble.

When the global financial crisis hit, investment declined, the construction industry collapsed and the economy shrank by 14%.²⁴ The crisis impacted on the country enormously and the double-digit growth of the pre-crisis period has been replaced by more moderate growth (5.1% in July 2015).²⁵ The growth rate is forecasted to decrease by the World Bank, driven by the regression in the construction sector and the recession in Russia. On the other hand, the construction sector is regarded as already having descended to its lowest level, and the value of exports has increased in recent years, resulting in a more favourable balance of trade. However, despite the growth, unemployment remains high and is currently at 18.2%.²⁶

Under the old Soviet planning system Armenia had developed a modern industrial sector that was able to provide machine tools, textiles and other manufactured goods to sister republics. This was often in exchange for raw materials and energy. Armenia has since switched to small-scale agriculture and away from the large agro-industrial complexes of the Soviet era. The country's geographical isolation, narrow export base and monopolies in important business sectors have made it particularly vulnerable to the recent deterioration in the global economy and slowdown in Russia. Armenia is particularly dependent on Russian commercial and governmental support and most key Armenian infrastructure is Russian owned and/or managed, especially in the energy sector.

Inflation is currently below 4%,²⁷ but the country has experienced fluctuations in the recent past. The budget deficit has been reduced in recent years and the current account currently enjoys a small surplus.²⁸ This is the first budget surplus since the pre-crisis period.

Armenia scores 74.22 on the Ease of Doing Business index. The score, which has risen 1.54% since 2015, is measured out of 100 and is known as the Distance to Frontier measure. It ranks Armenia as 35th out of 189 countries, up from 38th the previous year.²⁹

22 *ibid.*

23 *ibid.*

24 *ibid.*

25 <http://www.tradingeconomics.com/armenia/gdp-growth-annual>

26 <http://www.tradingeconomics.com/armenia/unemployment-rate>

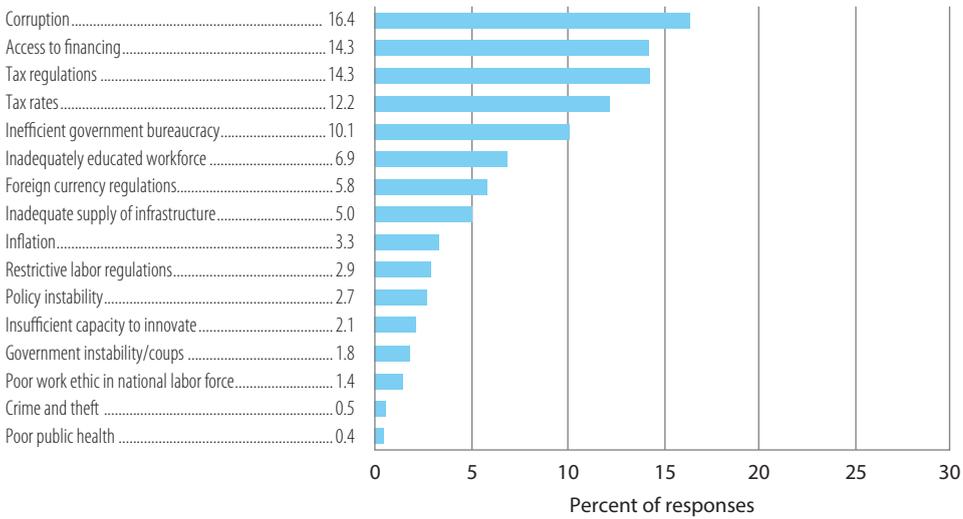
27 <http://www.tradingeconomics.com/armenia/inflation-cpi>

28 In July 2015 the budget surplus was 58mUS\$. <http://www.tradingeconomics.com/armenia/current-account>

29 *Doing Business 2016: Armenia, The World Bank Group (2015).*

Figure 1: Problematic factors for doing business.

The most problematic factors for doing business



Source: World Economic Forum: Global Competitiveness Report 2015–2016

Despite the various weaknesses of the economy it is still regarded as relatively liberal. According to the Heritage Foundation Index of Economic Freedom, Armenia’s economic freedom score in 2015 was 67.1.³⁰ This score ranked it as the 52nd freest country out of 178 countries included in the 2015 index. Within the European region the country ranks as 23rd out of 43.

Poverty in Armenia increased in the wake of the global economic crisis and currently stands at 32% of the population.³¹ In addition, energy poverty affects almost 30% of Armenian households. Energy poverty refers to households spending more than 10% of their budgets on energy. Armenia’s targeted social assistance programme, known as the Poverty Family Benefit Programme, helps to reduce poverty among vulnerable households.³²

In a 2014 Readiness for Investment in Sustainable Energy (RISE) survey carried out by the World Bank, Armenia was assessed on three pillars of sustainable energy – energy access, renewable energy and energy efficiency. With regard to energy efficiency, several aspects are noteworthy. Firstly, it noted that in spite of legislation passed in 2004, which helped in adopting a legal framework for energy efficiency, the country still lacks a national target for reducing energy intensity. One area in which Armenia scored poorly was regarding the incentives or mandates that energy supply utilities had to invest in energy efficiency. The report stated that utilities were not required to carry out energy efficiency or carbon reduction activities. The same applies to investment into energy efficiency by public entities and large-scale users, which have no binding energy-saving obligations.³³ Overall, Armenia achieved RISE scores of 59/100

30 <http://www.heritage.org/index/country/armenia>

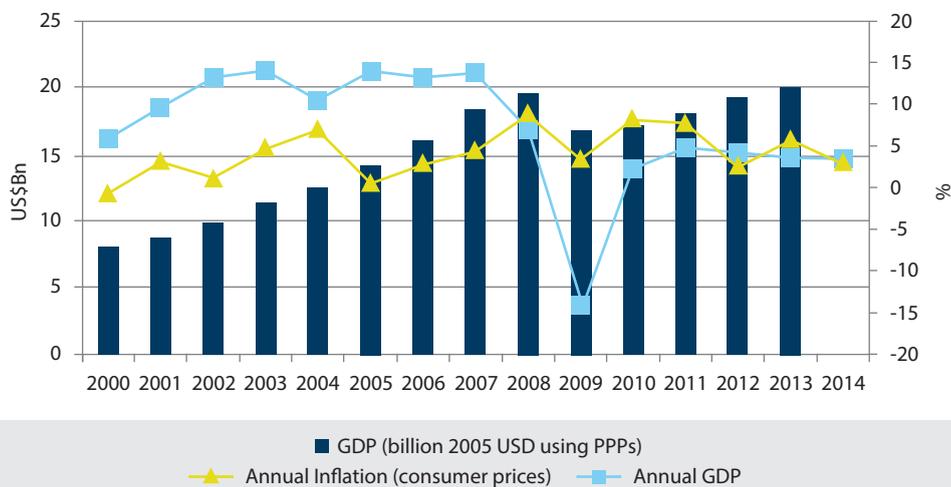
31 <http://data.worldbank.org/indicator/SI.POV.URHC>

32 The poor covered by PFBP were given discounts on their natural gas consumption. From April 1, 2011 to March 31, 2013, the discount applied to the first 300 cubic metres consumed. From April 1, 2013 until July 6, 2013, the discount applied to the first 75 cubic metres consumed. From July 7, 2013 to December 31, 2014 the discount applied to the first 450 cubic metres.

33 <http://rise.worldbank.org/data/exploreconomies/armenia/2014/energy-efficiency>

in renewable energy and 37/100 in energy efficiency.³⁴ Such scores indicate that much work is needed to attract necessary further investment in both areas of sustainable energy.

Figure 2: GDP & inflation development.



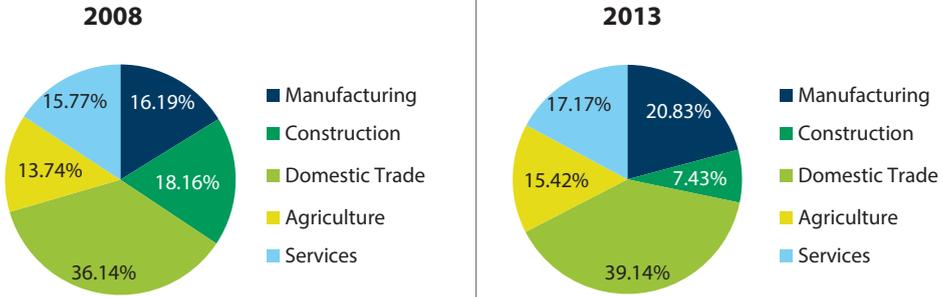
Source: IEA & World Bank

Figure 2 shows the high rates of GDP growth that Armenia enjoyed in the first years of the century. Although the global economic crisis was a major setback, the graph shows that the economy overtook its pre-crisis peak in 2013. While the growth rate is not as strong as ten years ago it can still be regarded as reasonably strong.

The charts in Figure 3 show the recent evolution of the Armenian economy. In both years the economy was of a similar size, and while most sectors increased their share of the economy, the construction sector suffered a contraction of approximately 60%.

³⁴ <http://rise.worldbank.org/data/exploreconomies/armenia/2014?topic=energy-access#energy-efficiency>

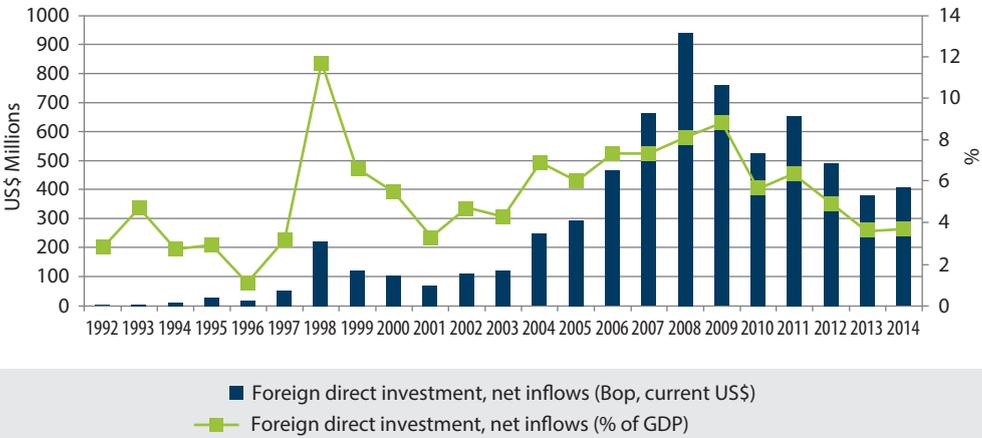
Figure 3: Change in economy by sector.



Source: World Bank

Figure 4 shows the net inflows of foreign direct investment (FDI) into Armenia since 1992. In 1998, FDI of little over 200m US\$ constituted approximately 12% of GDP. Although FDI increased year on year after 2001 up to 2008 where it peaked at approaching 1Bn US\$, FDI as a percentage of GDP only increased from 3.3% to 8.1% during the same period. That is to say that while FDI as a percentage of GDP grew by approximately 2.5x, actual FDI grew by 13.5x. The graph emphasizes the rapid development of Armenia's economy during this period and shows the role that FDI inflows played in the development of the construction sector.

Figure 4: Evolution of FDI.



Source: World Bank

Energy Supply and Demand

Energy balance

The total primary energy supply (TPES) of Armenia reached 2900 ktoe in 2013. According to International Energy Agency (IEA) energy statistics, about 77% of the primary energy supply of the energy sector comes from imports (Figure 5). About 6.5 mln m³ of natural gas are imported on average daily, over 80% coming from Russia, via Georgia, and the remainder from Iran. The natural gas from Iran is imported in exchange for Armenia's supply of electricity to Iran. The rate of exchange is 3 kWh per m³ of gas, which leaves about 30% of the electricity generated from the gas in the country.

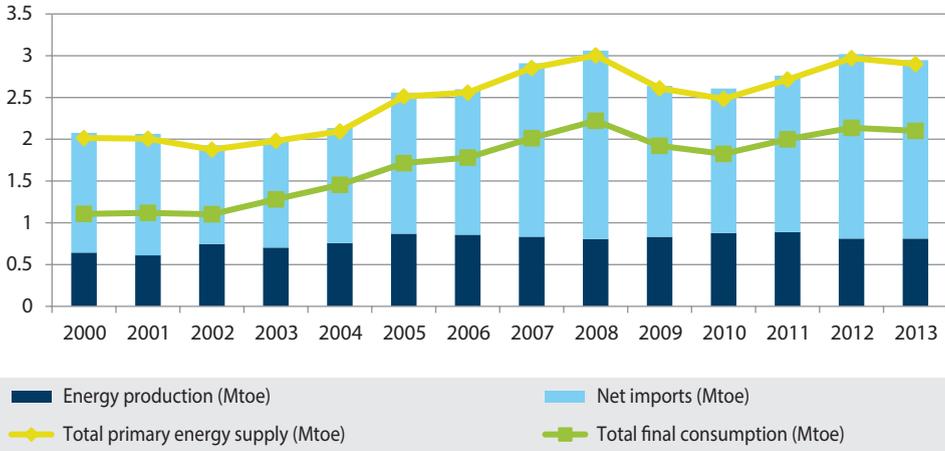
Table 1: Energy balance of Republic of Armenia, ktoe, 2013

	Oil products	Natural gas	Nuclear	Hydro	Biofuels and waste	Electricity	Total
Production	0	0	615.03	186.878	8.501	0	810.753
Imports	371.831	1864.386	0	0	0	12.728	2249.77
Exports	0	0	0	0	0	-112.918	-112.918
Total primary energy supply	324.587	1864.386	615.03	186.878	8.501	-100.19	2900.361
Total final consumption	324.587	1302.638	0	0	8.501	464.744	2101.295
Industry	0	280.015	0	0	0	103.974	383.989
Transport	138.722	372.744	0	0	0	10.664	522.13
Residential	0	486.641	0	0	0	174.408	661.641
Commercial and public services	0	40.294	0	0	0	81.7	121.994
Agriculture/forestry	0	0	0	0	0	12.986	12.986
Fishing	0	0	0	0	0	0	0
Non-specified (other)	148.104	122.944	0	0	8.501	81.012	360.794
Non-energy use	37.762	0	0	0	0	0	37.761

Source: IEA online energy statistics, 2015.

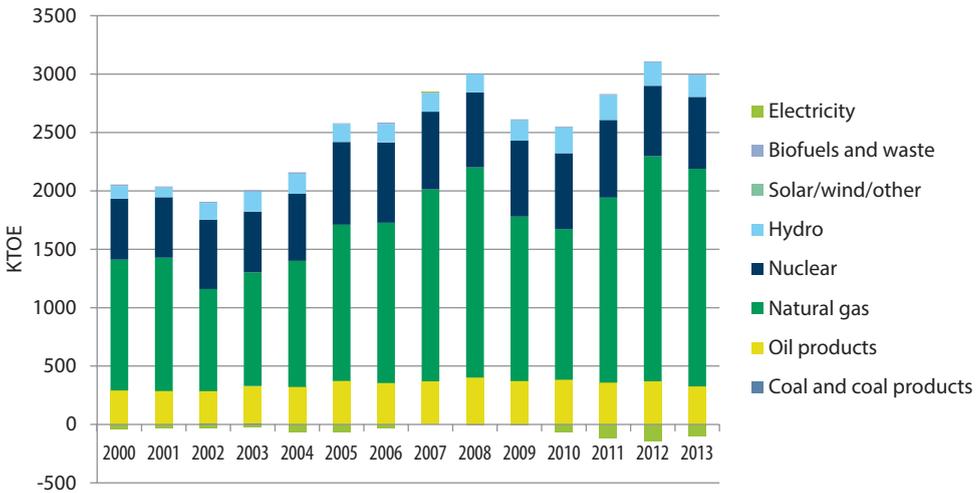
TPES increased by 9% on average per annum between 2003 and 2008, with the growth rate being interrupted during the recession in 2009 and 2010. Following the recovery from the crisis, the growth rate returned to 9% in 2011 and 2012. The share of natural gas in total primary energy supply grew from 56% to 64% during the period 2000 and 2013, while in the same period there was a small decrease in the shares of oil products and nuclear energy (Figure 6).

Figure 5: Energy production and imports.



Source: IEA online energy statistics, 2015

Figure 6: Total primary energy supply.

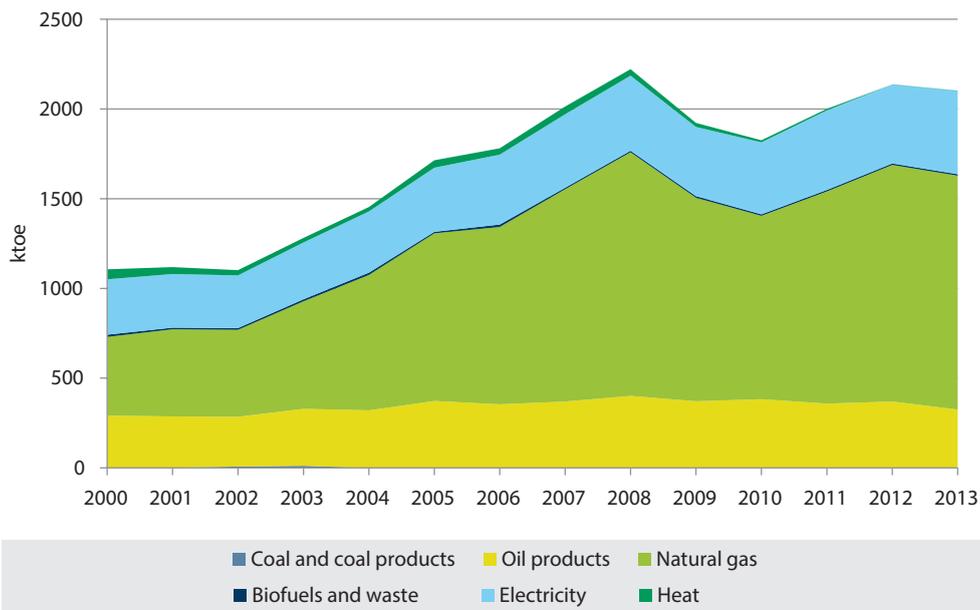


Source: IEA online energy statistics, 2015

Final energy consumption

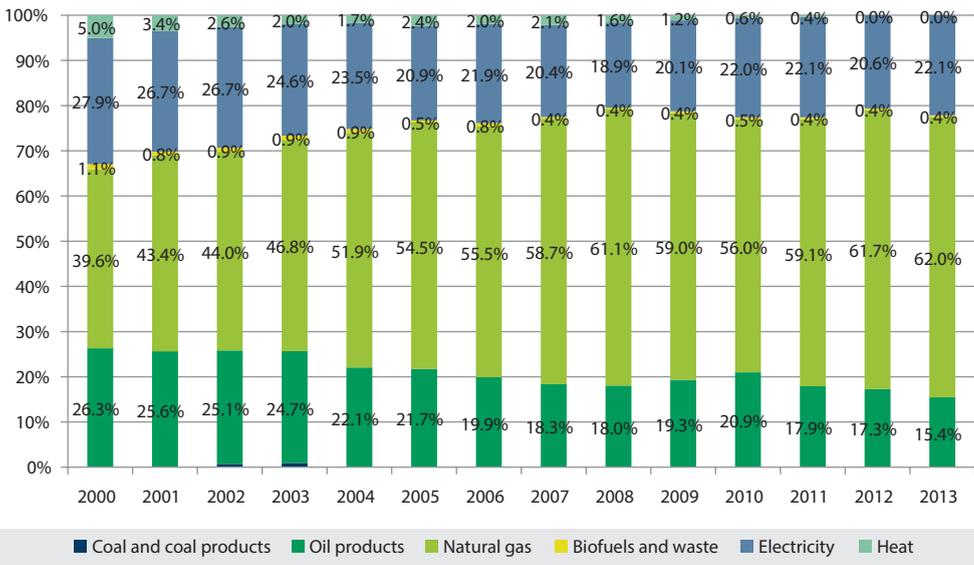
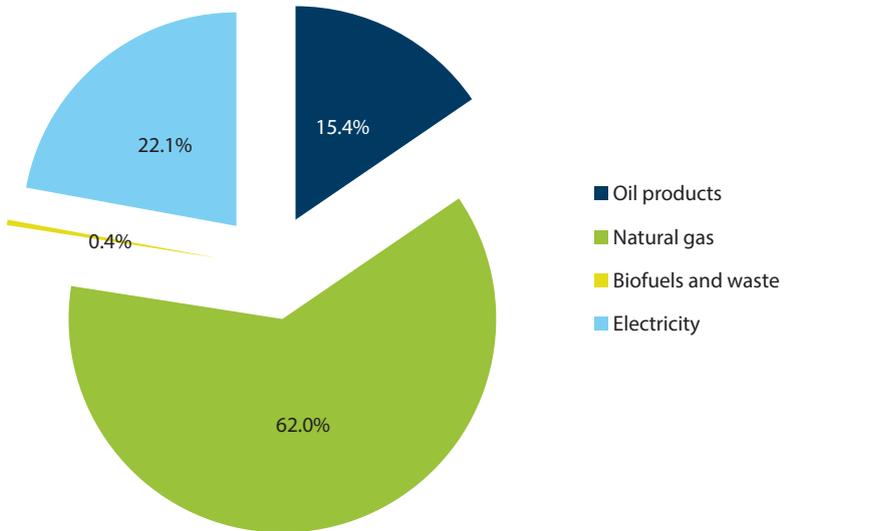
The total final energy consumption (TFC) reached 2101 ktoe in 2013 and, similarly to TPES, the consumption has been on a rising trend since 2000 (with the exception of the recession years of 2009 and 2010 (Figure 7). TFC is dominated by natural gas (62%), followed by electricity (22%) and oil products (15.4%). The share of natural gas has almost doubled since 2000, while the share of electricity and oil has decreased by 20% and 40%, respectively (Figure 8).

Figure 7: Total final consumption trend, 2000–2013.



Source: IEA online energy statistics, 2015

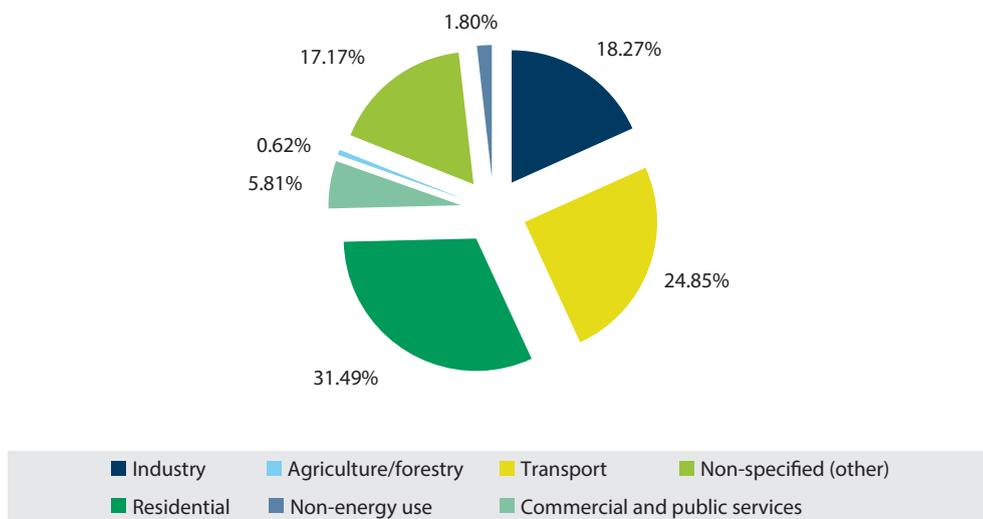
Figure 8: Total final consumption by energy source.



Source: IEA online energy statistics, 2015

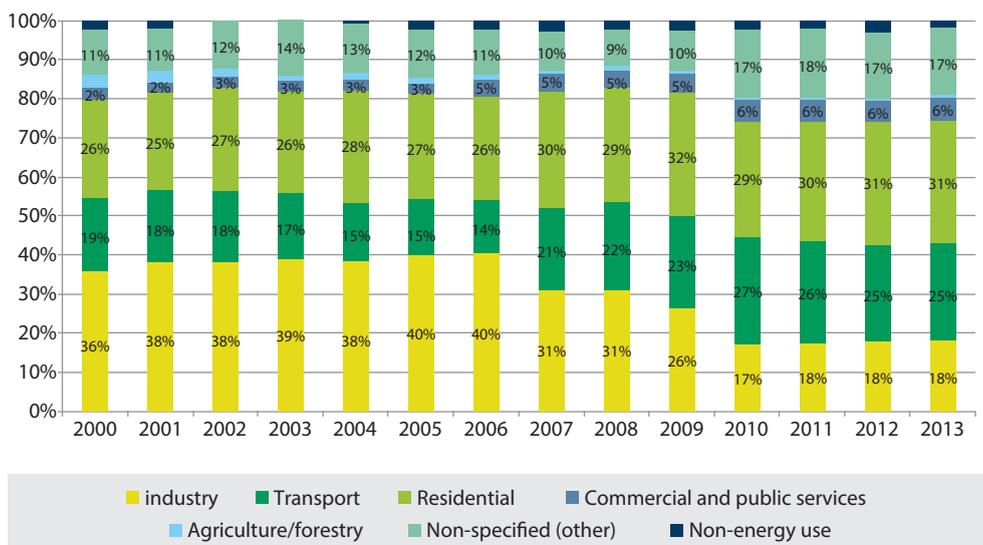
The residential sector is the largest energy consumer, responsible for one-third of the final energy consumption in 2013, followed by the transport sector (25%) and industry (18%). Industry's share has decreased twofold since 2000, mainly at the expense of the increased share of the transport sector and to some extent of the residential sector.

Figure 9: Total final energy consumption per sector (2013).



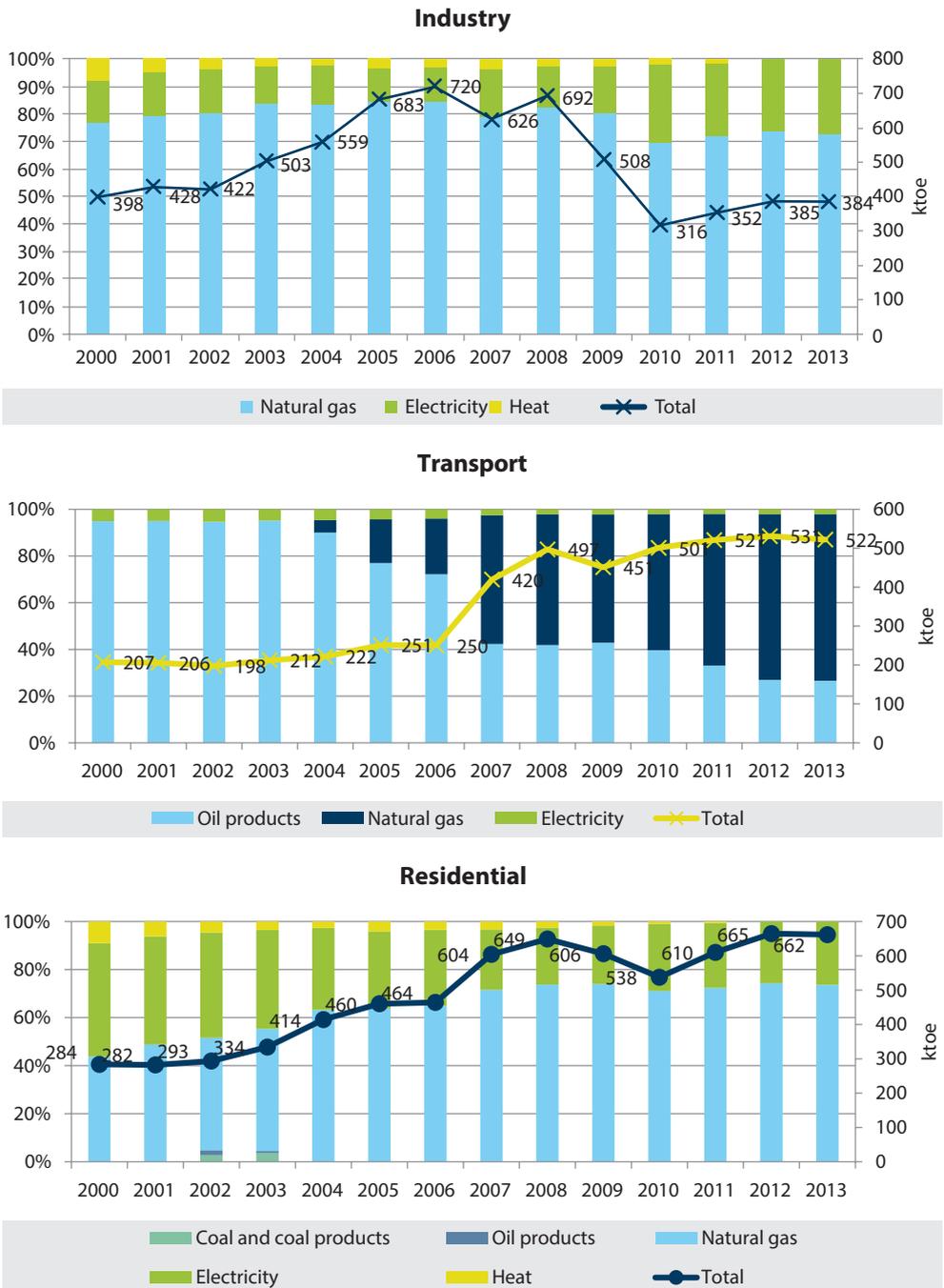
Source: IEA online energy statistics, 2015

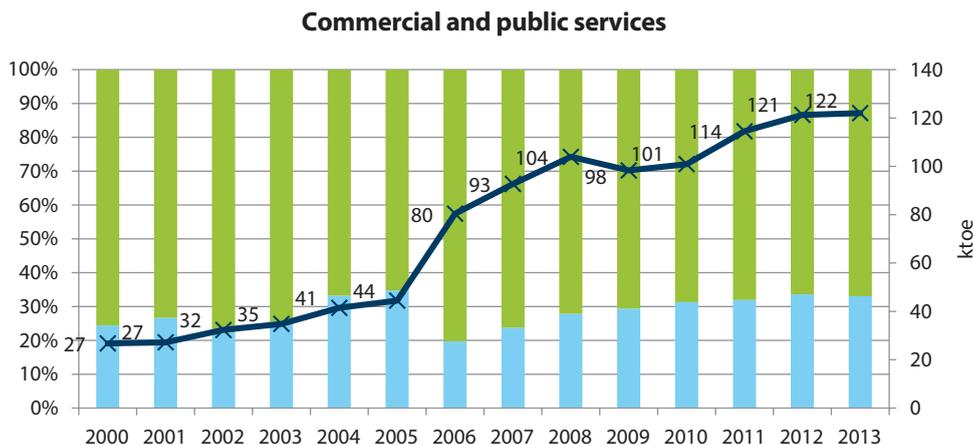
Figure 10: Trend in energy consumption by sector, 2000–2013.



Source: IEA

Figure 11: Energy consumption by fuel and by sector.





Source: IEA online energy statistics, 2015

Electricity, Natural Gas and Heat Supply

Armenia's electricity generation system has 3.3 GW installed capacity and 2.5 GW available capacity. Electricity generation in Armenia is provided by a mix of nuclear, gas, hydro and some RES power stations; some are privately owned and operated, some are wholly owned by the state. Roughly 50% of the generation facilities are more than 40 years old and many will need to be closed soon.

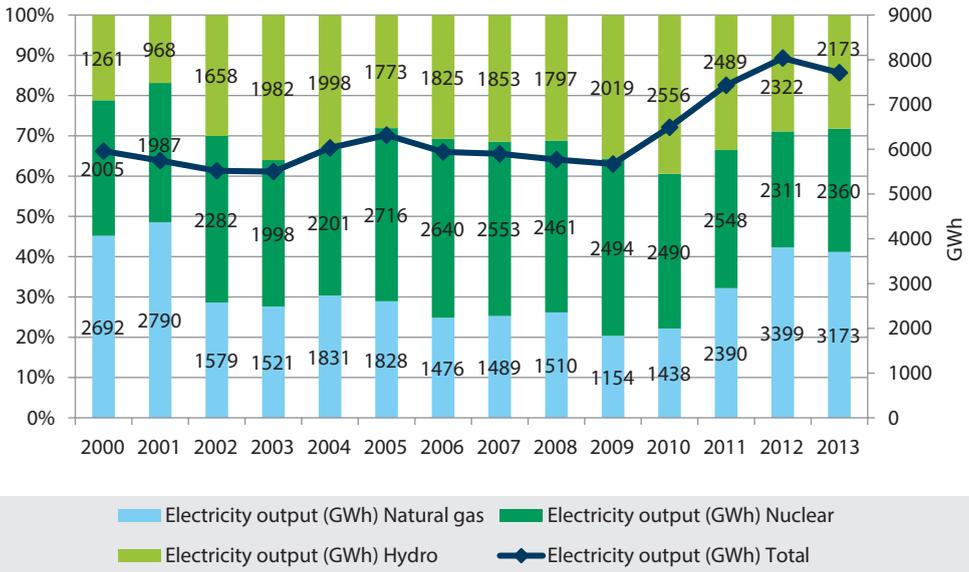
Generating companies include:

- Armenian NPP;
- Hrazdan Thermal Power Plant (TPP);
- Yerevan TPP;
- Sevan-Hrazdan Cascade of Hydro Power Plants (HPPs);
- Vorotan Cascade of HPPs; and
- Small HPPs and a wind power plant.

The installed capacity of thermal power plants (TPPs) is 2433 MW. The TPPs have dual firing capabilities and may burn both/either natural gas and/or mazut. The installed capacity of the Hrazdan TPP is 1110 MW, that of Yerevan TPP is 550 MW, Hrazdan-5 with 445 MW, and Yerevan CCGT has 242 MW. The available thermal capacity is 1380 MW.

The Armenian Nuclear Power Plant (NPP) came into operation in 1976 (the first unit), and in 1980 (the second unit). Two reactors of the type VVER-440/270 are installed with an aggregate capacity of 815 MW. The installed capacity of all HPPs is approximately 1182 MW, including 222 MW of small HPPs. There is one pilot wind farm with 2.6 MW installed capacity.

Figure 12: Electricity generation.



Source: IEA online energy statistics, 2015

Table 2: Installed generation capacities in Armenia.

Generation Type	Installed Capacity, MW	Ownership	Note
Thermal	2433		
Hrazdan TPP	1100	Russian Federation	
Yerevan TPP	550	GoA	50 MW operational
Vanadzor TPP	96	private	Not operational
Hrazdan TPP-5	445	private	
New CHP Yerevan TPP	242	GoA	Used for export to Iran
Hydropower	1182		
Sevan Hrazdan	556	private	
Vorotan	404	GoA	
Small HPPs	312	private	
Nuclear Power	408		
Metsamor NPP	408	GoA	
Wind	2.8	GoA	Commissioned in 2005, funded by Iranian government
Biogas	0.86	private	CDM project

Source: PSRC

There are nine major hydropower plants throughout the country. The largest is the Sevan Hrazdan Cascade, which is 90% owned by United Energy Systems of Russia. The one nuclear power plant, Metsamor, was built in 1979 and has an installed capacity of 815 MW, but only one of its two units is currently operational and currently stands at 407.5 MW. Nuclear fuel is flown in from Russia. Although the plant is government owned, UES signed an agreement in 2003 to operate the facility. Scheduled to close in 2016, an agreement was reached in September 2013 to extend the life of the plant by ten years. In May 2014, Russia agreed to a \$300 million loan for upgrading the plant to enable its life to be extended to 2026.

All electricity is sold to the single distribution company at regulated tariffs; dispatch is conducted on an order-of-merit basis. Significant investment is required in the generation as many of the existing assets, including the Metsamor nuclear plant, are coming to the end of their life cycles. The transmission network operator in Armenia is CJSC High Voltage Electricity Networks (CJSC) and mostly consists of 220 kV single-circuit lines. There is a 330 kV line interconnecting with the Agstafa substation in Azerbaijan (currently out of service, although it is technically operable), and a small number of 110 kV lines.

The transmission network has a meshed topology, is capable of meeting the internal demand, and has excess capacity to exchange with and transit power to the regional market.

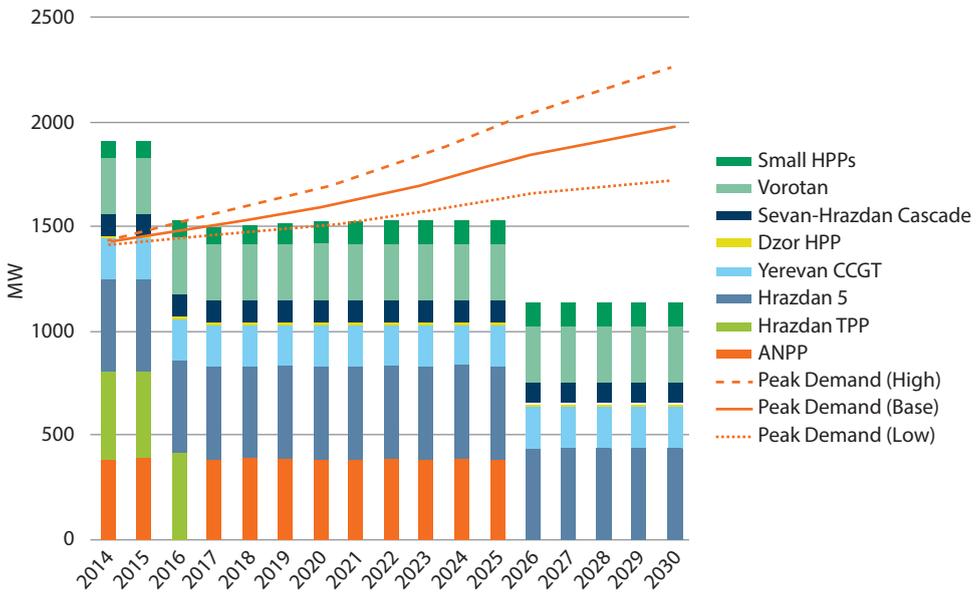
The electricity demand grew steadily over the last decade, with an average 4.5% annual growth from 2004 to 2008. Following the 7.4% drop in 2009, consumption has since increased by 5% and 3% in 2012 and 2013, respectively.

Figure 12 shows that electricity has three generation sources: nuclear and hydropower, which occupy approximately 30% each, and natural gas, which in 2013 comprised over 40% of generational capacity. The available capacity is low when compared to the installed capacity due to the age and poor condition of many generating plants.

The baseload capacity is provided by the nuclear power plant. Hydropower plants provide daily load regulation while thermal plants operate to support peaks, especially in the winter and when the nuclear power plant goes offline for maintenance. The Hrazdan-5 and Yerevan CCGT plants also generate electricity for export under the gas for electricity swap arrangement with Iran.

Given the growth in demand and the need to retire old generating facilities, Armenia could potentially face a capacity gap in meeting peak demand. The Ministry of Natural Resources and Energy (MENR) estimated in a recent investment plan for Armenia that at least 170 MW will be needed by 2018 to meet peak demand. An additional 830 MW will be needed as of 2026, when the existing NPP will be closed.

Figure 13: Forecasted gap between peak demand and installed capacity.



Source: MENR, Investment Plan for Armenia, April 2014

Transmission has been unbundled into two separate, state-owned entities – CJSC High Voltage Electricity Networks and CJSC Electricity System Operator. As the names imply, the former is the owner and operator of the transmission assets, while the latter carries responsibility for system operations. Both companies are state owned.

There is only one distribution company, the privately owned CJSC Electric Networks of Armenia, which manages the distribution network and the supply functions such as retail metering, billing and customer relations.

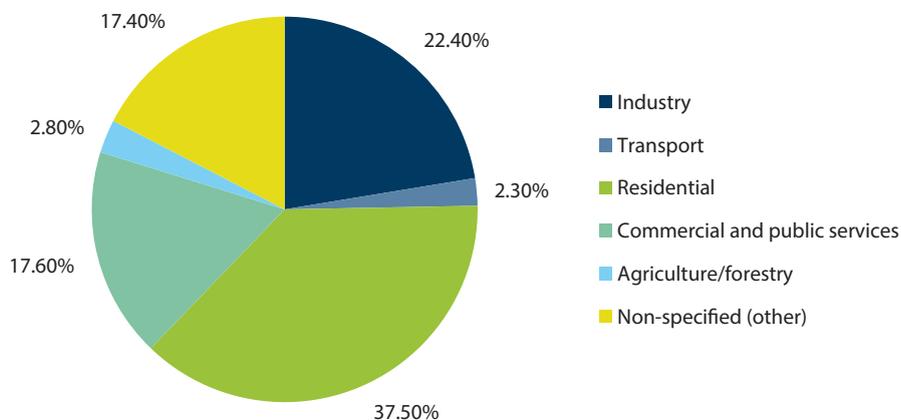
The electricity sector consists of nine major generation companies and many small generators (both private and state), one state-owned transmission company, one privately owned distribution company, one state-owned systems operator and a state-owned settlement centre.

Table 3: Breakdown of electricity consumption in 2013

Sector	ktoe	%
Industry	103.974	22.4%
Transport	10.664	2.3%
Residential	174.408	37.5%
Commercial and public services	81.7	17.6%
Agriculture/forestry	12.986	2.8%
Non-specified (other)	81.012	17.4%
Total	464.744	100.0%

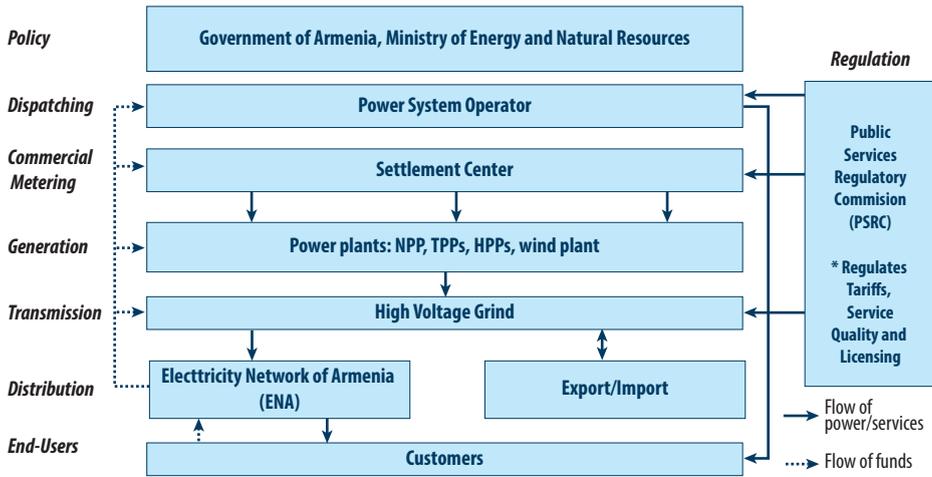
Source: IEA online statistics database, 2015

Figure 14: Breakdown of electricity consumption in 2013



Source: IEA online statistics database, 2015

Figure 15: Structure of electricity sector.



Source: MENR, Investment Plan for Armenia, April 2014

The market framework is based on the “single buyer model” with tariffs being regulated for generation, transmission and distribution. Under the framework, the Electricity Networks of Armenia (ENA) acts as the single buyer of electricity through contracts with generating companies at prices regulated by the PRSC. Energy flows and payment delivery are monitored by the Settlement Centre and the System Operator dispatches generators taking into account the economic dispatch order of plants as well as plants’ operational constraints.³⁵

Natural gas sector

There are 1,851.7 km of high-pressure pipelines in the country, of which 1,607.9 km are in operation. There are gas storage facilities in the country, with a current capacity of 135 million m³; there are plans to increase this number in the near future.

A large proportion of road vehicles in Armenia use compressed natural gas (CNG) as their fuel, rather than gasoline or diesel. This accounts for the high share of transport in natural gas consumption.

The gas sector remains vertically integrated. ArmRusGazprom, which is fully owned by Russia’s Gazprom, imports gas from Russia and Iran and also owns and operates the gas transmission and distribution networks in Armenia.

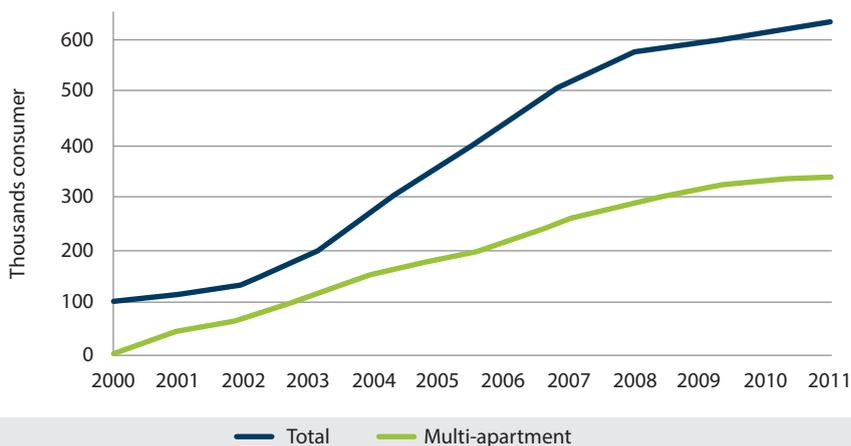
It would clearly be of benefit to increase the diversity of gas supply and decrease consumption to avoid exposure to market risks concomitant with dependency on one or two suppliers. However, this is not so simple. For example, 26% of Armenian gas is used for electricity generation, comprising 42% of the generation mix; 29% of generation is nuclear, but the nuclear power plant (NPP) is due for retirement. Armenia is faced with the choice of replacing that generation capacity with a CCGT power plant or a new NPP. The former is cheaper to build and run and comes on stream much more quickly, but increases dependence on gas;

³⁵ Investment Plan for Armenia, April 2014.

the latter is much more expensive, will take longer to build and will provide only the baseload, but improves energy security.

Since 2000 the natural gas distribution network has gradually expanded and many residential consumers, who were looking for alternative heating solutions following the collapse of the district heating system, connected to the gas network. As of 2013, 37% of the natural gas consumption is in the residential sector, mainly for heating and hot water purposes.

Figure 16: Increase of natural gas consumers in residential sector.



Source: Lessons learned from UNDP/GEF Project "Armenia – Improving Energy Efficiency of Municipal Heating and Hot Water Supply", UNDP Armenia.

Table 4: Breakdown of gas consumption in 2011–2014

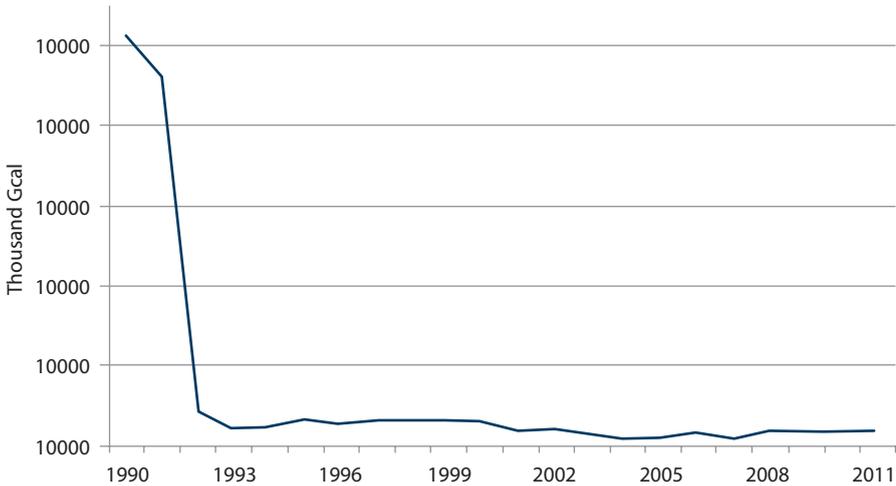
Structure of natural gas consumption by sectors (2011–2013)	2011	2012	2013	2014	Share in TFEC
Quantity of imported gas	2069.1	2455.5	2361.05	2450.9	(%)
Gas distributed through networks, including to:	1534.92	1608.9	1836.95	2008.8	82%
Population	550.75	542	538.93	515.4	26%
Power sector	184.91	231.9	402.80	594.1	29.6%
Industry	252.04	259.9	275.261	252.1	12.5%
Vehicle fuelling stations (CNG)	362.36	418	454.96	481.7	24%
Public sector	51.45	48.4	49.89	49.1	2%
Other consumers	133.42	108.7	114.52	116.3	6%
Average calorific value of natural gas (kCal/m ³)					8214

Source: Presentations during in-depth energy efficiency review mission, May 2016

District heating

Until the early 90s, centralized district heating provided heat for 64% of the country’s residential space (and more than 90% of residential space in multi-apartment buildings), however it collapsed after the dissolution of Armenia from the Soviet Union. The scope of the collapse of district heating systems is illustrated in Figure 17.

Figure 17: Heat production in district heating plants.



Source: Lessons learned from UNDP/GEF Project “Armenia – Improving Energy Efficiency of Municipal Heating and Hot Water Supply”; UNDP Armenia

Energy Pricing Policy

The Public Services Regulatory Commission (PSRC) is the body responsible for setting and reviewing tariffs in the electricity sector. According to the Energy Law, a tariff should be based on:

- Justified operation and maintenance costs
- Loan service costs
- Costs related to environmental standards
- Preservation costs
- Technical and commercial losses
- Costs of the safekeeping of the utilized nuclear fuel and requisite allocations to the Nuclear Plant Decommissioning Fund
- Reasonable profit
- Other justified costs as provided by legislation

The PSRC or the licensee can request a tariff review every six months. Once the request is

made, a tariff review must be submitted within 90 days. The PSRC has the authorization to set long-term tariffs for more than six months if it is considered necessary to provide investment security. Once the price is set, licensees cannot appeal against the size of a tariff.

Table 5: Electricity & gas tariffs

Electricity tariffs				
	Final Consumer Groups	Unit Size	Price (VAT)	Price (VAT)
			From 1 st August 2015	From 1 st August 2016
1	110 kV-powered consumers (2015-N174 N)	AMD / kWh	37.28	34.7
1.1	Night tariff	AMD / kWh	33.28	30.7
2	35 kV-powered consumers (2015-N174 N)	AMD / kWh	39.78	37.2
2.1	Night tariff	AMD / kWh	35.78	33.2
3	6 (10) kV-powered consumers (2015-N174 N)	AMD / kWh	45.78	43.2
3.1	Night tariff	AMD / kWh	35.78	33.2
4	0.38 kV-powered consumers (2015-N174 N)	AMD / kWh	48.78	46.2
4.1	Night tariff	AMD / kWh	38.78	36.2
5	Population (2015-N174 N)	AMD / kWh	48.78	46.2
5.1	Night tariff	AMD / kWh	38.78	36.2

	Appliances	Unit	Without VAT	VAT	Valid
1	"ArmRosgazprom" CJSC gas consumption by the population-house Annual fees for the maintenance of the system; (2012 №516N decision)				From July 7 2013
1.1	One gas burning appliance is available	AMD	1891.67	2270	
1.2	Two gas burning appliances are available	AMD	3783.33	4540	
1.3	Three or more gas burning appliances are available	AMD	5675.00	6810	

Gas tariffs						
	Consumption	Unit	Natural Gas Prices			
			From 7 th July 2013		From 1 st August 2016	
			No VAT	With VAT	No VAT	With VAT
1	"ArmRosGazprom" CJSC paroghnerin price of gas sold (2013 №190N decision)					
1.1	Up to 10,000 cubic metres of monthly consumption for consumers	AMD / thousand cubic metres	130.00	156.00	122.25	146.70
1.2	Over 10,000 cubic metres of monthly consumption for consumers	USD equivalent AMD / thousand cubic metres	230.82	276.98	214.63	257.56

Renewable energy tariffs were set by the PSRC in 2007 to stimulate private investment in renewable energy. New generating plants sign 15-year power purchase agreements (PPAs). Under these agreements, Energy Networks Armenia (ENA) is obliged to pay the generator for all the power produced. The PSRC is required to adjust feed-in tariffs annually in line with changes in inflation and the USD to AMD exchange rate.

Table 6: Renewable energy tariffs (from May 2015).

Renewable Energy Technology	Feed-in Tariff			
	May 2015-July 2016		July 2016-July 2017	
	AMD/kWh	US\$/kWh	AMD/kWh	US\$/kWh
Wind	34.957	0.08	42.645	0.1
Biomass	38.856	0.09	42.645	0.1
Small hydropower built on “natural water systems”	20.287	0.05	23.753	0.05
Small hydropower built on irrigation systems	13.523	0.03	15.832	0.04
Small hydropower built on “drinking water supply systems”	9.017	0.02	10.556	0.02

Source: PSRC. Exchange rate: 436.96 AMD to 1 US\$

End-user tariffs for electricity in Armenia were increased by approximately 18% in July 2013 and the revised tariffs are shown in Table 7 below.

Table 7: End user electricity tariffs (2013)

Final consumer groups	Unit size	Price pre-2015	Price 2015*	Price 2016*
35 kilovolt powered consumers (2013-N192 N)	AMD / kWh	24.17	39.78	37.2
Night tariff	AMD / kWh	20.83	35.78	33.2
6 (10) kV powered consumers (2013-N192 N)	AMD / kWh	29.17	45.78	43.2
Night tariff	AMD / kWh	20.83	35.78	33.2
0,38 kV powered consumers (2013-N192 N)	AMD / kWh	31.69	48.78	46.2
Night tariff	AMD / kWh	23.33	38.78	36.2
Population (2013-N192 N)	AMD / kWh	31.67	48.78	46.2
Night tariff	AMD / kWh	23.33	38.78	36.2

Source: PSRC.

Prices are with VAT (20%).

*In 2015, PSRC approved new electricity tariffs, and at the same time the government and ENA are co-financing 6.95 AMD for every kWh up to 250kWh per month per consumer/subscriber.

A comprehensive tariff study on Armenia was issued by the World Bank in June 2013. The study noted that the end-user tariffs had not been increased since 2009 and were no longer cost reflective. There were several reasons for this:

- The price of gas had increased by approximately 10% since that time.
- The Armenian dram had depreciated by 30% against the USD.
- Consumption had dropped by 7% as a consequence of the decline in economic activity over the previous five years, which had a direct effect on revenue since the tariff was only on energy.
- The 18% increase in July 2013 may to some extent have addressed these issues.

Gas sector

Gas tariffs are available to the public on the PSRC website, so there appears to be a high degree of transparency. There are also public consultations before the tariffs are finalized.

The end-user tariffs are set by the PSRC, and they are cost based. The tariffs include a forecast of justifiable expenses for the next 12 months. When assessing the OPEX, the regulator takes into account the out-turn for the previous year and forecasts reasonable changes such as the impact of inflation.

The tariffs are differentiated by the volume of gas consumption: there are 579,766 customers consuming less than 10,000 m³ per month, of which 572,361 are households, and 1,480 customers consuming more than 10,000 m³. This methodology is currently under review in Armenia.

In July 2013, the PSRC announced an 18% increase in the gas tariffs to AMD 156 (EUR 0.37/m³), which appears to have caused widespread concern among consumers. Gazprom Armenia had requested a 63% increase to AMD 221/m³ following a proposed increase by Gazprom in the gas import price from USD 180 to USD 270/1000 m³. However, media reports on 5 September stated that Gazprom had agreed to reduce the import price back to USD 180 if Armenia joined the Eurasian Economic Union (EEU), as proposed by the Russian Federation.

Energy and Energy Efficiency Indicators

As mentioned earlier, Armenia's economy almost collapsed after independence. The slow recovery and shift of the economy from heavy industry to services has decoupled the energy from economic growth and has kept the level of energy intensity relatively low. Over the 13-year period Armenia's ratio fell from over 0.25 to below 0.14. It currently enjoys approximately the same ratio as its neighbour Georgia.

Table 8: Evolution of energy intensity (toe per thousand 2005 US\$ PPP)

	2000	2005	2009	2010	2011	2012	2013
World	0.19	0.18	0.16	0.17	0.16	0.16	0.16
OECD Europe	0.13	0.13	0.12	0.12	0.11	0.11	0.11
Non-OECD Europe and Eurasia	0.44	0.35	0.29	0.30	0.30	0.29	0.28
Armenia	0.25	0.18	0.16	0.15	0.15	0.15	0.15
Azerbaijan	0.35	0.22	0.10	0.09	0.10	0.10	0.10
Belarus	0.38	0.29	0.22	0.21	0.21	0.21	0.19
Georgia	0.22	0.16	0.14	0.13	0.14	0.14	0.14
OECD Total	0.16	0.15	0.14	0.14	0.14	0.13	0.13
European Union-28	0.14	0.13	0.12	0.12	0.11	0.11	0.11

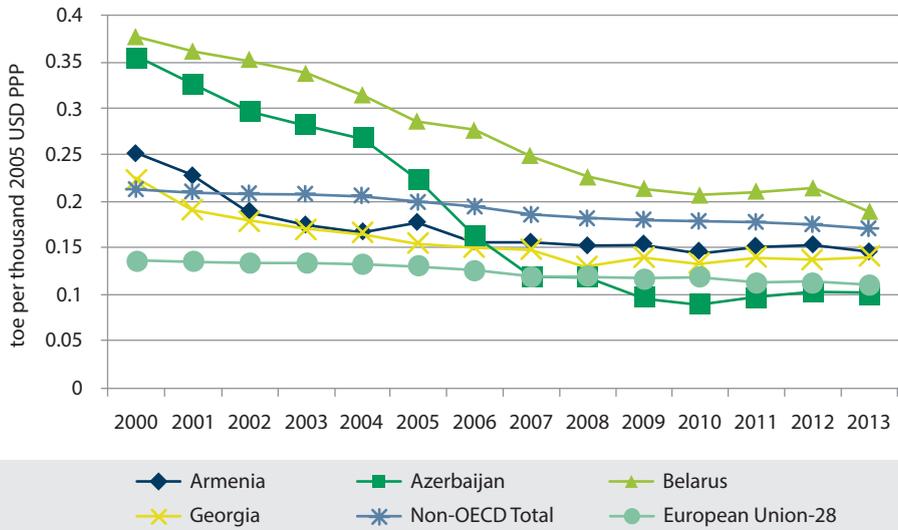
Source: IEA

Table 9: Evolution of GDP PPP and GDP energy intensity

	GDP average annual growth rate		Energy intensity annual growth rate	
	1999–2000	2000–2013	1990–2000	2000–2013
World	3.0%	3.8%	-1.5%	-1.4%
Armenia	-3.8%	7.6%	-9.1%	-4.0%
Azerbaijan	-5.2%	12.5%	-1.8%	-9.0%
Belarus	-1.2%	6.7%	-4.8%	-5.0%
Georgia	-9.3%	6.3%	-4.8%	-3.0%
OECD Total	2.8%	1.7%	-1.1%	-4.5%

Source: IEA

Figure 18: Total primary energy supply/GDP – energy efficiency.



Source: IEA



Energy and Energy Efficiency Policy

Energy and Energy Efficiency Policy

Strategic Framework

The energy sector of Armenia is expected to play a key role in the achievement of the strategic objectives of the government of Armenia (GoA) in the future. The 2013 National Energy Security Concept outlines the GoA's strategies for achieving energy security through fuel diversification, building up fuel reserves and reserve generation capacity. The Concept identifies the promotion and development of, and investment in, renewable energy technologies as being critical to Armenia diversifying its energy supply and achieving energy independence.

The Armenian Development Strategy (ADS) and National Security Strategy (NSS) also emphasize the importance of renewable energy and energy efficiency in addressing energy security. The ADS and NSS outline the strategic objectives for economic growth, poverty reduction and national security. Both policies highlight the fundamental importance of the energy sector in achieving these objectives. The strategic objectives of the ADS and NSS for the energy sector for the period 2012–2017 are:

- Increase of energy security;
- Development of renewable energy, including increased efficiency of existing hydropower potential and creation of alternative sources of energy supply;
- Improvement of system reliability;
- Development of regional trade;
- Replacement of depreciated power plants;
- Promotion of energy efficiency;
- Further development of nuclear energy.

Several energy sector strategic documents specify targets for achieving the GoA's stated objectives in the sector:

- (i) Energy Sector Development Strategy within the Context of the Economic Development in Armenia, approved by the GoA in 2005,
- (ii) The National Programme on Energy Saving and Renewable Energy, approved in 2007, and
- (iii) The Action Plan of the MENR of the Republic of Armenia in line with the National Security Strategy, approved in 2007.

The key principle of the energy strategy adopted by the Armenian Energy Ministry included ensuring sustainable development of the energy sector based on the prevailing economic trends. It sought to expand regional cooperation prospects, taking into account the experience gained by the energy sector.

A Strategy for Energy Sector Development until 2025–2030 in the Context of Sustainable Development of the Republic of Armenia was developed in 2005 and is now under scrutiny by the government of the Republic of Armenia. The core element of the strategy includes ensuring a reasonable level of the nation's energy security. Armenia has overcome the grave energy crisis and has learned the lessons of poor energy security. The energy security strategy is based on the implementation of a three-tier diversification that envisions:

- the use of varied generating capacities to produce electric power (hydro, thermal and nuclear);
- supplying the economy and the energy sector with the necessary variety of fuel and energy resources (natural gas, oil products, nuclear fuel, renewables);
- ensuring reliable (diversified) deliveries of fuel and energy resources through the use of gas and oil pipelines, railways, motor roads and power lines.

In 2013, a National Energy Security Concept was developed, which defines actions for fuel diversifications through renewables and nuclear power as well as building fuel reserves and increasing electricity generation capacity. A Schedule for Activities 2014–2020 was adopted in 2014 for the implementation of the energy security concept.

Legislative Framework

The Energy Law that was adopted in 2001 regulates interrelations between legal entities involved in the energy sector and electricity, heating and natural gas consumers pursuant to the law and the state bodies. Some of the basic principles of the state policies for the energy sector stated in the Law are as follows:

- Enhancement of competition and efficient operation in the energy sector.
- Regulation of energy sector operations.
- Protection and balance of interests between consumers and economic entities.
- Efficient use of domestic and alternative sources of energy, and the creation of economic and legal mechanisms to serve that purpose.
- Encouragement of investments, safety and environmental protection in the energy sector.
- Encouragement of scientific and technical progress and employment of new energy-efficient and energy-saving technologies, as well as encouragement of personnel training and retraining.
- Separation of the generation, transmission and distribution system operators, etc.

The Law on Energy Saving and Renewable Energy (2004) defines the principles of the state policy on energy efficiency and renewable energy with the following objectives:

- To strengthen the economic and energy independence and improve energy security
- To increase the reliability of the energy systems
- To establish and develop industrial infrastructure and service organizations for the promotion of energy saving and renewable energy
- To reduce adverse impacts on the environment and human health as a result of technological developments.

The Law stipulates that state policy in the area of energy saving and renewable energy shall be based on the principle of voluntary participation of the involved parties, and the following principles:

- Increasing the level of supply of indigenous renewable energy carriers to satisfy the energy demand of the economy;

- Implementation of energy-saving strategies, as well as the development and enforcement of legal and economic mechanisms for the promotion of renewable energy;
- Ensuring high priority of efficient use of energy given the increasing volumes of imported and extracted energy resources;
- Ensuring increasing usage of renewable energy resources as well as the application and development of new renewable energy technologies;
- Ensuring competitiveness of renewable energy resources and protection/enforcement of the rights of businesses engaged in the area of renewable energy;
- Ensuring high priority of issues of environmental protection and efficient (economic) usage of natural resources while implementing measures/activities aimed at the development of energy saving and renewable energy;
- Promotion of energy-efficient production of electric and/or heat energy, including for autonomous energy producers;
- Promotion of integrated activities between autonomous energy producers, using renewable energy resources, and the energy system aimed at the exchange of electric energy;
- Promotion of consumer choices and use of different energy carriers and energy efficiency technologies; and
- Implementation of energy-saving and renewable energy state (national)-targeted programmes.

In 2016, changes to the Law on Energy Saving and Renewable Energy were introduced as follows:

- The Government's policy on energy efficiency and renewable energy will be based on mandatory technical requirements for energy-intensive sectors to ensure energy savings and energy efficiency.
- Economic sectors will be classified by energy intensity and mandatory technical requirements for energy saving and energy efficiency will be determined for these new energy intensity categories. These technical requirements will be applied to state-funded programmes and initiatives (e.g. renovations).
- Market conditions - including further recovery in the domestic consumption market - for energy efficient equipment, devices and products which threaten human life and/or the environment will be established by a Government Decision of the Republic of Armenia.
- Energy flows will be enabled between independent renewable energy producers and license holders for electricity distribution. Independent renewable energy producers, whose installed capacity does not exceed the total capacity of electricity consumers being supplied (capped at 150 kW), will come out of the regulatory framework.

Government Programmes and Action Plans

The government has worked towards the implementation of the provisions of the Law on Energy Efficiency and Renewable Energy. The National Programme on Energy Saving and Renewable Energy of the Republic of Armenia was developed in 2007 with the main aim of

setting the targets for the energy-saving and renewable energy development in the country and outlining mechanisms for its implementation. The main goals of the National Programme on Energy Savings and Renewable Energy 2007 include:

- Alleviate the inefficient growth of the energy sector by securing intensive implementation of energy efficiency measures.
- Efficient consumption of energy resources and maximal employment of renewable energy resources, through the application of targeted economic and legal mechanisms.
- Increase the efficiency of energy resource consumption in all sectors of the economy.
- Plan the development of the energy resources of the country parallel to the advancement of energy saving and renewable energy, taking into account that increased energy efficiency usually has a low cost.
- Direct the finance policy of the country towards energy saving and renewable energy development.
- Organize, promote and provide equal accessibility to modern technologies for all members of society, consumer and corporate alike.

In 2011, the government adopted the First National Energy Efficiency Action Plan (NEEAP). This action plan was established to define concrete actions in order to fulfil the aims of the national policy to improve energy efficiency and the usage of renewable energy sources. The action plan was elaborated for the period 2011–2014. The first NEEAP defined a set of policy and programme measures for energy efficiency improvements in all relevant economic sectors.

A draft second NEEAP was prepared in 2015 and is currently under consideration by the government.

Table 10: First NEEAP targets per sector

Sector/Measure	Baseline final energy consumption	Cumulative sector saving target for 2014 (based on 2010 baseline)	
Horizontal/Cross-cutting measures	No target		
Building sector (residential)	695.7	%	2.7
		ktoe	18.8
Industry sector (including power generation)	206.9	%	1.7
		ktoe	3.5
Agriculture/Forestry	358.3	%	6.7
		ktoe	24.0
Сектор транспорта	499.6	%	3.1
		ktoe	15.5
Сельское хозяйство/ лесное хозяйство	140.1	%	1.1
		ktoe	1.5
ВСЕГО	1900.6	%	3.3
		ktoe	63.3

Institutional Framework

The **Ministry of Energy and Natural Resources of the Republic of Armenia (MENR)** is the highest executive authority to elaborate and implement the policies in the energy sector, which includes the reform process. It is responsible for system planning and investment planning for state-owned entities. The Ministry's objectives also include the provision of energy efficiency and renewable energy sector policy development and implementation, provision of the state policy of state technical control in the power sector and energy consumption, conducting supporting research, and obtaining and facilitating support from international organizations.³⁶

The Ministry was established in 1992 with a view to improving management efficiency and to leading the way for demonopolization and reform in the energy sector. Between 1996 and 2000 priority was given to ensure the sustained, reliable and safe operations of the power grid and the nuclear power plant in order to overcome the aftermath of the energy crisis. Armenian energy sector restructuring initiated by the Energy Ministry was the key to energy crisis management. During this period fuel consumption fell at a slower rate.

The **Public Services Regulatory Commission (PSRC)** performs regulatory operations in the energy, water and telecommunication sectors, including:

- Regulating tariffs, service quality and licensing
- Overseeing compliance with licensee obligations
- Mediating disputes between licensees and customers
- Defining electricity market rules
- Setting, monitoring and enforcing service quality standards³⁷

The **Ministry of Nature Protection of RoA** is the highest executive authority that elaborates and implements the policies of the Republic of Armenia government in the areas of environmental protection and sustainable use of natural resources. It also coordinates the implementation of the activities aimed at meeting the commitments of the Republic of Armenia under the UN Framework Convention on Climate Change. In 2015, the Ministry submitted to the UNFCCC the Intended Nationally Determined Contribution (INDC), striving to achieve the aggregated quantitative contribution of 633 mln ton CO₂eq for the period 2015–2050.

The **Ministry of Urban Development (MUD)** is responsible for construction and building policies and regulation, and for overseeing most of the investments in this sector. MUD is also responsible for the Social Housing Strategy. Energy efficiency-related tasks/functions are included in its charter. MUD has three separate units that have key roles in the urban development sector.

- The Urban Development Inspectorate is responsible for enforcement of building norms/standards.
- The "Licensing Centre" agency is responsible for issuing licenses for urban development sector organizations and specialists. The provisions for energy efficiency and energy-saving regulation in the construction sector were added to the MUD charter by the decision N225-N of the government of the RoA dated March 14, 2013. According to the Ministry of Urban Development action plan for 2014, the decision "On application of

³⁶ <http://www.minenergy.am>

³⁷ <http://www.psrc.am/am>

measures directed towards increasing energy saving and energy efficiency in objects constructed by the state means” is already being drafted for adoption by the RoA government.

- The Urban Development Project Implementation Unit is in charge of implementing client functions for urban development programmes through the state budget.

General recommendations

The government should continue to work on the long-term energy strategy to ensure that energy policy goals respect and fully reflect the potential of energy efficiency and renewable energy to contribute to wider political, economic, social and environmental goals. The government is to be commended for the ongoing efforts within the National Energy Security Concept and when making decisions on increasing generation capacities the potential contribution of energy efficiency to reducing long-term energy demand should be taken into account.

Energy efficiency and renewable energy should continue to be high priority in all sectors and future energy-related policies should be supported by detailed analysis of energy efficiency potentials in the economy, and the barriers that delay the realization of these potentials.

The government should continue to ensure sufficient coordination and synergy between the national policies and international donors’ initiatives. The institutional framework to support the implementation of energy efficiency policies, including the Ministry of Energy and Natural Resources, should be strengthened, in order to coordinate and enforce concrete programmes and actions in all economic sectors.

Active engagement of relevant scientific research institutes should be encouraged in the efforts to address current challenges facing the energy sector, including the issues of increasing energy efficiency, reducing losses, ensuring reliability and high quality of power supply.

Government should ensure effective implementation of the second National Energy Efficiency Action Plan (NEEAP). The establishment of an effective institution is of key importance in this respect. A procedure for evaluation and review of progress should also be put in place.

From an economic point of view, the observed decoupling of GDP and energy consumption growth is positive and should be reinforced further.

While continuing to promote participation in the Covenant of Mayors, further efforts should be targeted to increase the capacity of municipalities to develop and implement their Sustainable Energy Action Plans, including financial capabilities.

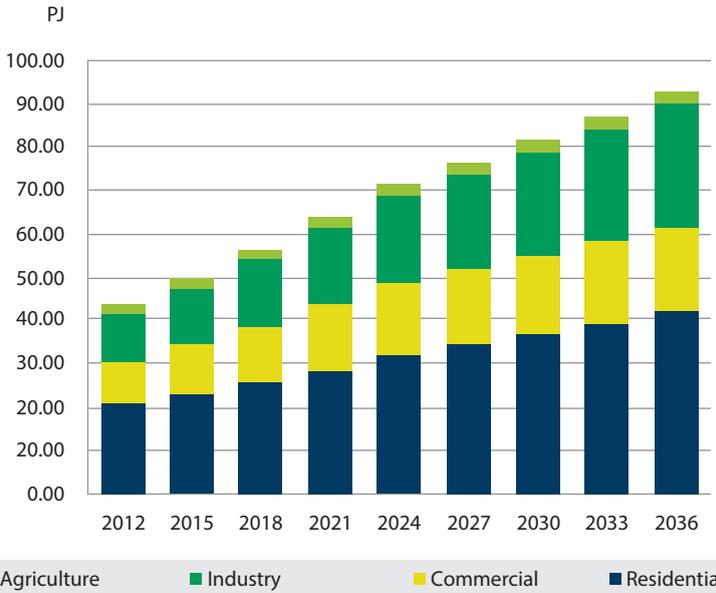


Assessment of the Energy Efficiency Potential
and Policies at Sectoral Level

Assessment of the Energy Efficiency Potential and Policies at Sectoral Level

As presented earlier, the residential sector was the largest energy consumer in 2013, responsible for one-third of the final energy consumption. The second biggest consumer was the transport sector (25%), followed by industry (17%). A recent report by USAID³⁸ projects that in 2036 the respective sectors' shares will grow to 45.6% for the residential sector, 29.8% for industry and 21.1% for the commercial sector.

Figure 19: Projected energy demand by 2036.



Source: Armenia Least-cost Energy Development Plan, USAID LEDS, 2015

According to the National Programme on Energy Saving and Renewable Energy, the potential for energy efficiency savings in Armenia is large, including 462 ktoe in the building sector (public and private sector) and 409 ktoe in industry (including 50.6% for the chemical and metallurgy sector and 24% for the food industry), while optimization of lighting in all sectors was estimated to save 475 GWh.³⁹ In 2015, the SE4All Copenhagen Centre commissioned a study⁴⁰ that also provides estimates of the technical energy efficiency potential in various sectors (Table 11).

³⁸ Armenia Least-cost Energy Development Plan, USAID LEDS, 2015.

³⁹ National programme for energy saving and renewable energy, USAID.

⁴⁰ Accelerating energy efficiency initiatives and opportunities. Eastern Europe, Caucasus and Central Asia, 2015.

Table 11: Summary of energy efficiency potential estimates

Power generation	126 ktoe
Industry	120 ktoe
Transport	491 ktoe
Services	33.4 ktoe
Residential	681 ktoe
Other	180.6 ktoe
Total	1 632 ktoe

Source: Accelerating energy efficiency initiatives and opportunities. Eastern Europe, Caucasus and Central Asia, 2015

As mentioned earlier, since 2010 Armenia has implemented the first NEEAP, however in many areas the enforcement of the policies introduced has been lacking and a number of measures have not been, or are only partially, implemented. As can be seen from Table 12, the activities in the public building and transport sectors were most successful and for both sectors savings have been achieved well beyond the target. At the same time, more efforts are still needed to unlock the potential for energy efficiency in the residential, industrial and agriculture sectors.

Table 12: First NEEAP targets per sector

Sector/Measure	Baseline final energy consumption	Cumulative sector saving target for 2014 (based on 2010 baseline)		Achieved in 2014, ktoe
Horizontal measures	No target			35.5
Building sector (residential)	695.7	%	2.7	0%
		ktoe	18.8	0.1
Industry sector (including power generation)	206.9	%	1.7	26.6%
		ktoe	3.5	55.1
Agriculture/Forestry	358.3	%	6.7	0.4%
		ktoe	24.0	1.4
Сектор транспорта	499.6	%	3.1	14.1%
		ktoe	15.5	70.6
Сельское хозяйство/лесное хозяйство	140.1	%	1.1	0.1
		ktoe	1.5	0.13
ВСЕГО	1900.6	%	3.3	6.3
		ktoe	63.3	120.3

Source: Draft second NEEAP

The following sections will provide an overview of the main policy instruments related to improving energy efficiency in different sectors, analyse the major barriers and obstacles to capturing the available potential and provide recommendations for improving the delivery of energy efficiency in Armenia.

Power Industry (Electricity and Natural Gas)

The reliance upon imported fuels combined with old and undermaintained transmission and distribution assets puts Armenia at risk of supply interruptions, price fluctuations and power outages. The electricity transmission infrastructure is old and undermaintained. The average age of transmission assets is 45 years. The high-voltage transmission network of Armenia consists of 220 and 110 kV power lines with a total length of approximately 4,500 km. The High Voltage Electricity Networks (HVEN) of Armenia estimates that around 520 km or 33% of the 220 kV transmission lines need urgent rehabilitation.

The government, with the support of donors, partially rehabilitated the 220 kV substations; however, still further efforts are necessary to increase the reliability of the power supply in the country.

The gas transmission network includes 1863 km of pipelines and connection to Russia through Georgia and Iran. The distribution network is maintained by Gazprom Armenia. The latter has carried out numerous gasification projects over the last decade, increasing the residential connection rate from 20% in 2002 to 95% by 2011. Gas distribution losses are relatively low and amounted to 2.3% in 2013.

The overall electricity losses are high, and according to recent studies about 30% of the total primary energy supplied is lost through transformation, transmission and distribution (USAID, 2014). As can be seen from Table 13, most significant are the losses in electricity transformation and distribution and hence the Armenian government has given high priority to measures to mitigate these losses. Armenia's National Energy Security Concept prioritizes the rehabilitation of key power transmission network assets as a prerequisite for a reliable power supply in the country.

Table 13: Energy losses in the Armenian energy system

per year	2005	2010	2011	2012	2013
Losses in energy transformation (ktoe)		768.216	897.205	897.192	
Losses in electricity transportation (GWh)	97.23	101.43	137.2	145.8	138.7
Losses in electricity distribution (GWh)	810.00	705.40	766.8	803.5	810.0
Losses in centralized heat pipelines (TJ)			11.22	4.53	3.48
Losses in natural gas pipelines (million m ³)			135.6	141.6	144.7

Source: PCRS, 2015

The Asia Development Bank's Power Transmission Rehabilitation Project started in 2014 and will upgrade the national power system operation's reliability and efficiency, and enhance transmission capacity. The project supports: (i) the expansion of the supervisory control and data acquisition (SCADA) system, (ii) the rehabilitation of two existing 220-/110-kilovolt (kV) substations, and (iii) institutional development, capacity building and project management. The project will increase the electricity supply to urban and rural consumers to support inclusive and sustainable economic development.

The World Bank supported the Electricity Transmission Network Improvement Project (ETNIP) for Armenia, which started in 2015 and will improve the reliability of the power transmission network and system management, and support the government's efforts in ensuring an

adequate electricity supply across the country. This project, through the rehabilitation of the several substations, will help reduce the number and duration of equipment failures caused by technical reasons, and thus improve the reliability of the power supply for almost 120,000 electricity consumers. The total financing of the project is US\$69.16 million, of which US\$17.16 million will be the government's contribution. The World Bank will provide a US\$52 million IBRD loan.

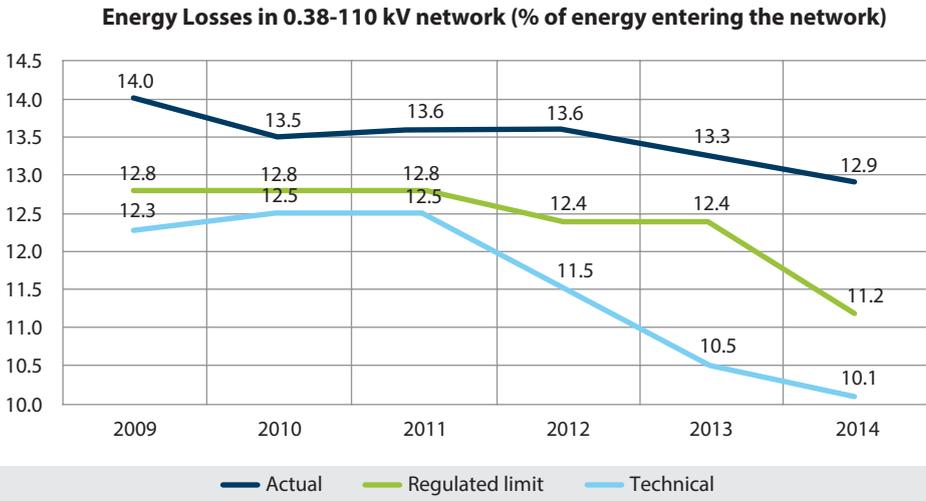
In addition to the high-voltage network losses and reliability issues, losses remain higher than allowed by the regulator in the low-voltage networks operated by the Armenian Electric Networks. The draft second NEEAP of Armenia estimates that the energy-saving potential in Armenia Electric Networks is about 62 GWh per year, which will result in financial savings of an average of 1.5 billion AMD.

Table 14: Energy efficiency potential in power and heat generation, transmission and distribution (as of 2013)

Integrated technologies of goods, work and services production	Units	Scale of economic activity	Units2	Specific consumption in 2010	Practical minimum	Actual consumption abroad	Comments	Estimated technical potential. 1000 toe
Gas-fired co-generation plant retrofits	mln kWh	667	goe/kWh	270.2	143.5	183.4	CCGT with 60% efficiency	84.56
Own needs consumption	mln kWh	135	%	4.30%	4.00%	5.00%	Global practice – North America	0.028
Electricity transmission	mln kWh	8,805	%	12.30%	6.90%	7.00%	Global practice – Japan	41.02
Gas-fired boiler retrofits	thou. Gcal	11	Kgoe/G cal	115.5	105.7		Equipment with 95% efficiency	0.14
Electricity consumption for heat generation by boilers	thou. Gcal	11	kWh/G cal	23	7	9	Finland	0.02
Heat distribution	thou. Gcal	10	%	10.60%	5.40%		Replacement of heat pipes (new technology)	0.14
Total for power and heat								125.93

Source: UNEP/SE4ALL/C2E2, "Accelerating energy efficiency initiatives and opportunities. Eastern Europe, Caucasus and Central Asia", 2015.

Figure 20: Energy losses in 0.38–110 kV network (% of energy entering the network).



Source: PSRC, 2015

Table 15: Losses in Armenia Electric Networks system and potential for energy saving

	2009	2010	2011	2012	2013	2014	Average
Losses, mln kWh							
Actual	711.0	705.4	766.9	803.5	810.0	789.9	764.4
Regulated limit	650.0	668.8	721.8	732.6	755.2	685.8	702.4
Technical	623.7	651.2	703.3	679.3	635.2	617.3	651.7
Energy-saving potential, mln kWh							
Total	60.9	36.6	45.1	70.9	54.8	104.1	62.1
Cost-saving potential, mln AMD							
Total	1 284.7	817.6	1 006.9	1 577.5	1 406.3	3 189.3	1 547.1

Source: Draft second NEEAP, Ministry of Energy and Natural Resources, 2015

Recommendations Electricity, Gas and Heating Sector

The modernization of the generation, transmission and distribution infrastructure needs to continue, in order to further minimize losses and utilize the existing energy saving potential.

The government should continue to facilitate the progress on interconnections with neighbouring countries to support regional integration of energy markets and to overcome isolation of the domestic energy market.

The government, with support from the PSRC, should review the market model as new interconnections develop and ensure adaptation of balanced market rules to reconcile with EU legislations and Eurasian Economic Union rules to remove regulatory and trade barriers.

The government should continue the promotion of renewable energy in a cost-effective way.

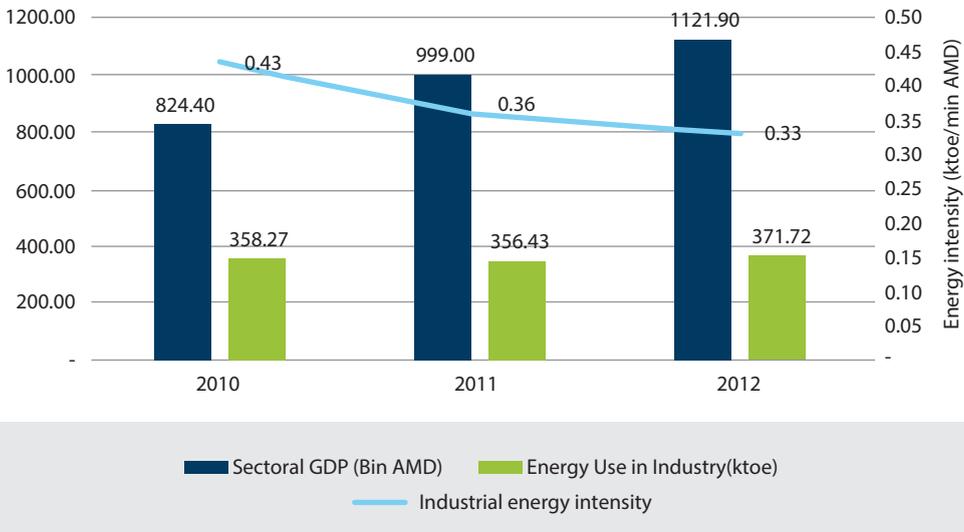
The ongoing efforts by the distribution company (Electric Networks of Armenia) to introduce smart technologies in metering should be encouraged.

Feasibility studies, including assessments on efficient use of heat, should be carried out as a basis for future decisions on the development of co-generation.

Industry Sector

The industrial sector consumed 383 ktoe in 2013 or about 18% of the total final consumption in Armenia, and as mentioned earlier this share is expected to grow in 2036 to 29.8%, making industry the second largest consumer after the residential sector. The average growth rate of industrial consumption has been 7% over the last four years. The recent USAID Least-cost Energy Development Plan projects an average growth rate of 3.8% annually until 2036.

Figure 21: Trends in industrial energy consumption 2009–2013.

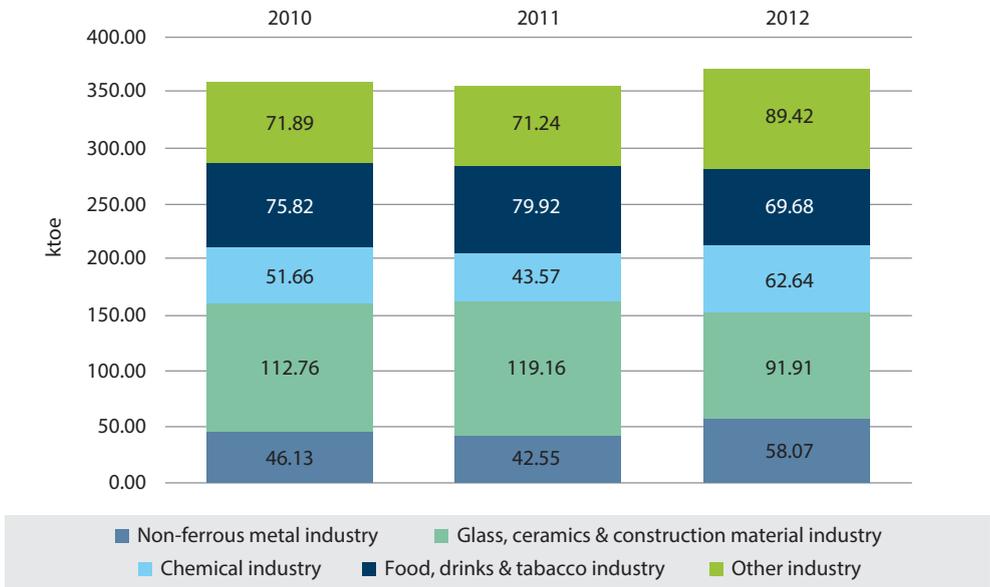


Source: Presentations made during in-depth energy efficiency review mission in Yerevan

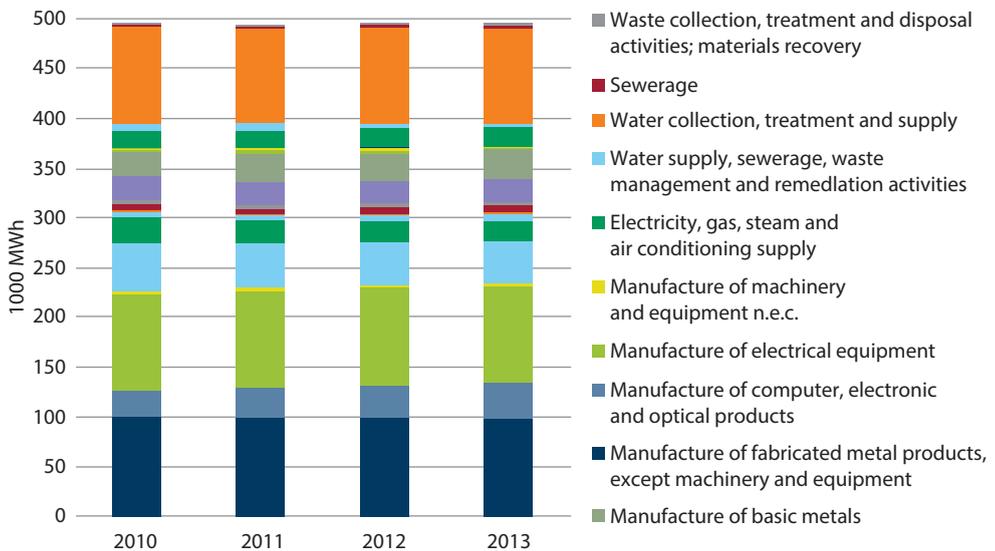


Source: IEA online database

In 2013, the industrial sector consumed 21% of the overall natural gas consumption and 22.5% of the total electricity consumption.

Figure 22: Industrial energy use by subsector, 2010–2012.


Source: Presentations during in-depth energy efficiency review mission in Yerevan, May 2016

Figure 23: Electricity consumption by industrial subsector.


Source: Presentations during in-depth energy efficiency review mission in Yerevan, May 2016

A report commissioned by the SE4All Copenhagen Energy Efficiency Centre⁴¹ assesses the technical energy efficiency potential for industry, using 2013 data on industrial activities. The potential is estimated for six energy-intensive industries and seven cross-cutting technologies. The total technical potential is estimated to be 119 ktoe, which is about 31% of the 2013 total industrial consumption.

Table 16: Energy efficiency potential in industry (as of 2013)

Integrated technologies of goods, work and services production	Units	Scale of economic activity	Units ²	Specific consumption in 2010	Practical minimum	Actual consumption abroad	Comments	Estimated technical potential, 1000 toe
Aluminium	10 ³ t	28	kgoe/t	1,292	1,119	1,763	Global practice	4.76
Zinc and lead ore	10 ³ t	16	kgoe/t	448	91		Global practice	5.74
Copper	10 ³ t	195	kgoe/t	637	343		Global practice	57.4
Cement production	10 ³ t	431	kgoe/t	16.8	7.7	13	Global practice	3.92
Meat and meat products	10 ³ t	77	kgoe/t	147.7	35		Chelyabinskaya Oblast	8.75
Bread and bakery	10 ³ t	293	kgoe/t	109.9	62.3		Tambovskaya Oblast	13.93
Efficient motors	10 ⁶ t units	0.2	kWh/motor	9,956	8,507		Global practice	21.21
Variable speed drives	10 ⁶ t units	0.1	kWh/derive	9,956	9,356		Global practice	3.92
Efficient industrial lighting	10 ⁶ t lights	0.1	kWh/light	247	160		Global practice	0.49
Total for industry								120.12

Source: Accelerating energy efficiency initiatives and opportunities. Eastern Europe, Caucasus and Central Asia, 2015

Recent initiatives have also confirmed the great potential for improving energy efficiency in industry through the implementation of energy management systems, building capacity in energy auditing and the application of best available technology practices for energy efficiency.

The UNIDO/REC Resource Efficiency and Clean Production Programme (RECPP) implemented audits of ten pilot enterprises and estimated that a 15–20 % cost-effective energy and water use reduction was possible. Also, recently the Ministry of Nature Protection, by transposing Best Available Techniques Reference Document (BREF) notes to various sectors of the economy (including cement production and copper smelters), identified a 15–18 % reduction in energy use accompanying the technological changes aimed at reducing environmental pollution.

UNIDO is also implementing a Cleantech programme for small and medium enterprises with the objective of further promoting innovation through clean energy technologies. The project is aimed at promoting an innovation ecosystem, driven by incentives, and is assisting in the design, deployment and scaling up of innovative clean and efficient technologies and processes across small businesses in the country. Through various activities in four main areas – energy efficiency, renewable energy, waste to energy and water efficiency – UNIDO is addressing some main barriers including:

⁴¹ *Accelerating energy efficiency initiatives and opportunities. Eastern Europe, Caucasus and Central Asia, 2015.*

- The lack of information about technology options, best practices and benchmarks within enterprises, and linkages between research institutes and industry remain weak,
- The lack of trained experts for mentoring entrepreneurs,
- The lack of an enabling policy and regulatory environment.

The draft second NEEAP estimates that the energy efficiency financing (in the form of loans) provided by IFIs to industry and SMEs in the period 2010–2015 was approximately 67 mln USD, however no information was available on the actual energy savings achieved.

Table 17: EE project financing by IFIs in industrial and SME sectors

	Total Loan Portfolio [USD]	Annual Lending Reported for 2010–2015						New Source 2016
		2010	2011	2012	2013	2014	2015*	
European Bank for Reconstruction and Development - EBRD								
- Industrial (specify)	3 560 000	800 000			2 760 000			
- SME (specify sector)	15 290 000	1 120 000			4 720 000	9 050 000	400 000	
Subtotal	18 850 000	1 920 000			7 480 000	9 050 000	400 000	-
Green growth Fund - GGF								
- Industrial (specify)	2 440 928					2 440 928		
- SME (specify sector)	921 872					921 872		
Subtotal	3 362 800	-	-	-	-	3 362 800	-	-
International Financial Corporation - IFC								
- Industrial (specify)	25 050 000					25 050 000		
Subtotal	25 050 000					25 050 000	-	-
German Development Bank - KfW								
- SME (specify sector)	20 000 000							20 000 000
Subtotal	20 000 000							20 000 000
TOTAL	67 262 800	1 920 000		18 965 000	7 480 000	37 462 800	400 000	20 000 000

Source: Draft second NEEAP, MENR

Recommendations Industry

The government should consider a more proactive energy efficiency policy for the industry sector.

The government should assess further expansion of mandatory energy auditing for large industries, consider voluntary auditing also for SMEs as well as incorporating a standardized approach to energy auditing. It should also encourage further industrial enterprises to implement actions to deliver cost-effective energy savings including the already adopted energy auditing system for the large energy consumers.

The government should actively promote the adoption of energy management practices (such as ISO 50 001) to large industrial enterprises.

The government should continue the process of aligning the existing industrial equipment standards to the best international practices.

The government should encourage ongoing efforts to introduce clean resources planning as well as activities within the Global Cleantech Innovation Programme for SMEs in Armenia. It should encourage the establishment of networks of large industries in order to establish a platform for information sharing and the promotion of best practices to accelerate the identification, planning and implementation of high-impact energy efficiency measures.

The government should consider extending the policy tool kit to include various incentive schemes for industrial enterprises that undertake energy audits in order to support the implementation of the audits' recommended measures as well as other justified actions.

Building Sector

Residential buildings

According to UNDP Armenia,⁴² 65% of Armenia's population of 3.23 million inhabitants live in urban areas. There are over 400,000 apartments with a total area of 25 million m² in multi-apartment buildings. The largest portion of the urban housing stock is between 30 and 60 years old, and it typically has poor thermal characteristics and is poorly insulated. All old buildings require some type of repair, and 11% of the buildings are in urgent need of reconstruction.

Buildings represent the largest energy end-use sector, accounting for 37.5% of electricity and 25.3% of gas consumption in Armenia (a major portion of both is consumed to cover the heating load, due to the absence/collapse of the centralized district heating system and switching to the individual heating options). In the early 2000s, construction of new buildings began to increase on average by 15–20 % annually. The projected energy consumption in residential buildings until 2030 according to the draft second NEEAP will continue to be between 27% and 29% of the total energy consumption.

⁴² *Improving Energy Efficiency in Buildings, UNDP project document.*

Table 18: Multi-apartment building stock growth in Armenia

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Space, m ²	194000	197000	285000	512000	294000	353000	386000	480000	521000
Growth rate, %		2	45	80	-43	20	9	24	9

Источник: Национальная статистическая служба

Figure 24: Building stock growth rate projections.



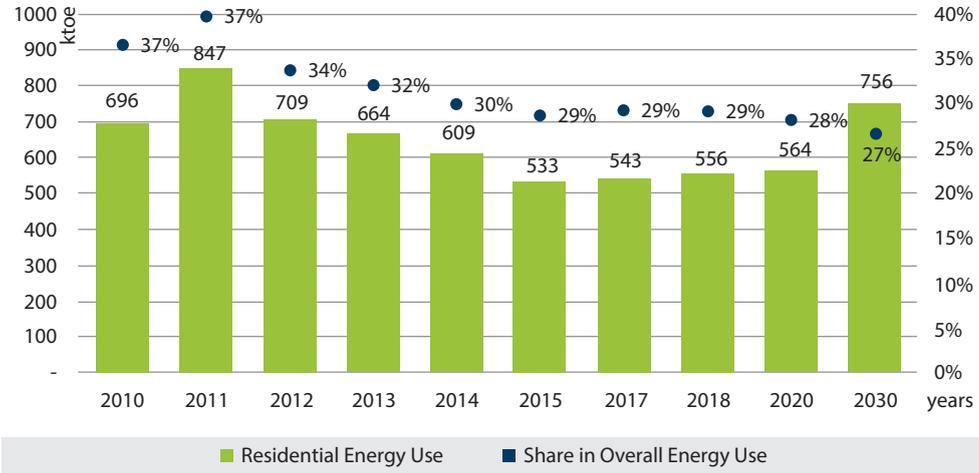
Source: Improving Energy Efficiency in Buildings, UNDP project document

A number of laws, regulations and standards were adopted recently that introduced energy efficiency requirements to newly constructed residential buildings as well as for renovation of public buildings, including:

- The Law on Urban Development.
- The Law on Energy Saving and Renewable Energy.
- Government Decision N225-N, dated March 14, 2013, on the provisions for energy efficiency and energy-saving regulation in the construction sector .
- Government Decision N1504-N, dated 25 January, 2014, "On the application of measures directed towards increasing energy saving and energy efficiency in objects constructed (reconstructed, renovated) by state means".
- Draft Government Decision on the introduction of systematic mechanisms for reconstruction (repair, renovation) of common spaces (roofs, basements) of multistorey buildings.
- "Construction Climatology", RACN II-7.01-2011 Construction norms.
- "Multistorey buildings" RACN 31-01 -2014 Construction norms.
- 26 National standards, including "Buildings' Energy Passport" NS.
- 17 EU and ISO energy efficiency standards and RA standard CN II-7-01-2011 Construction climatology updated.

- RA standard Energy Efficiency. Building energy passport AST 362-2013.
- RA standard Energy Audit methodology, AST 371-2016.
- Draft building code on thermal protection (adoption expected June 2016).

Figure 25: Energy use in residential sector, 2010–2030.



Source: Presentation on draft NEEAP, May 2016

The National Programme on Energy Saving and Renewable Energy of the Republic of Armenia (2007) is currently being implemented through the National Energy Efficiency Action Plan (2010). The Plan identifies measures, including new building codes, financial schemes for retrofitting public buildings and certification systems for construction materials. The energy efficiency- and energy-saving-related tasks and functions were added to the MUD charter just a few years ago by government decision N225-N dated March 14, 2013.

The project “Improving Energy Efficiency in Buildings”, financed by GEF/UNDP, started in 2013 with the objective of creating an enabling regulatory environment, skills and capacity among industry professionals and of introducing the principles of integrated building design into Armenian construction practices from the stage of building design through construction to maintenance of the buildings. The project helped Armenia to draft Technical Regulations, transposing the EU Energy Performance of Buildings Directive.

The project also supported the implementation of pilot projects for energy-efficient renovation of buildings, including modernization of a multi-apartment panel building in Yerevan. As a result of the energy efficiency measures introduced, the building energy consumption was reduced from 178 kWh/m² to 74 kWh/m²). A few other demonstration projects were also carried out in the newly constructed residential sector as well as Yerevan schools.

The National Programme on Energy Saving and Renewable Energy estimates a 40% potential for energy saving in Armenia’s building sector. According to the results of UNDP pilot projects, an average residential building in Armenia has a 30–50 % potential for energy saving at current energy prices.

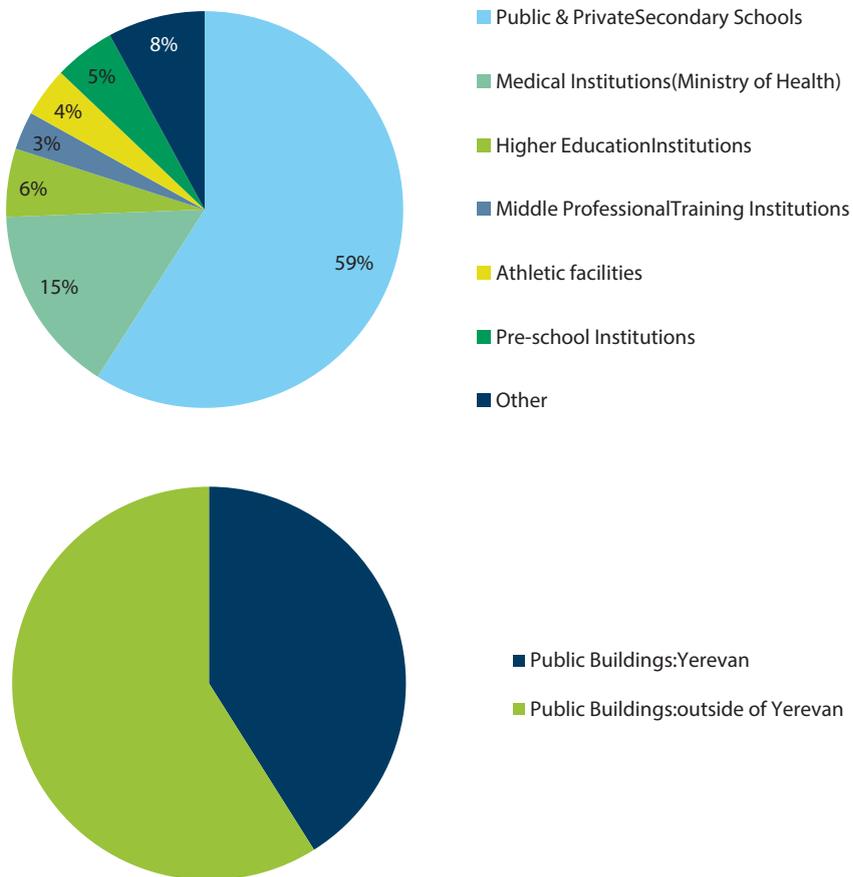
Main barriers to energy efficiency investments in multi-apartment residential buildings

- Implementation and enforcement of acting laws and regulations in the field of multi-apartment building maintenance and management.
- Weak capacity for building management, project development, financial planning and management, fundraising, human resources, reporting and customer/member relations.
- A lack of financial resources due to low maintenance fee rates and low collection rates.
- A lack of overall awareness and understanding of the legal regulatory framework, rights and responsibilities related to the home owners' associations, and benefits of EE, in general.

Public buildings

Schools, universities, colleges, kindergartens, medical institutions and athletic facilities comprise 92% of all public buildings. Over 40% of all public buildings are located in the capital of Armenia.

Figure 26: The number and area of public buildings in Armenia, 2013.



Source: Draft second NEEAP

The majority of public buildings are under governmental ownership and direct financing. Most have very low energy performance, largely due to the age, the poor condition of the building envelope and the lack of adequate energy management. On average such buildings have a 10–70 % potential for energy saving.

In 2012, the government of Armenia signed up to an EE programme (worth 10.7 million USD) supported by the World Bank and implemented by the R2E2 Fund. The programme is targeted at implementing energy-saving activities in public facilities to reduce the level of energy consumption by social and other public facilities. Most of the public buildings, however, are overheated with heating ensuring only 40–50 % of the comfort level. The R2E2 credit line has very strict eligibility criteria and can only finance energy efficiency measures that have attractive economic indicators (positive net present value) and successfully finance a number of energy efficiency projects in public buildings and street lighting. All implemented projects had a technical energy-saving potential above 20% and were able to repay the load from the actual savings achieved.

Table 19: Energy-saving potential in public buildings

Total Area of public buildings in Armenia (m²)	13 787 397
Total energy consumption in public buildings (MWh/year)*	1 764 787
Annual energy-saving potential (MWh/year)*	896 181
<i>* - based on R2E2 experience with 56 projects</i>	
Average energy consumption prior to EE in public buildings	128 kWh.m/yr
Average energy consumption after EE	63 kWh.m/yr
Average energy-saving rate	51%

Source: National Statistical Service and draft NEEAP

The Armenian Renewable Resources and Energy Efficiency (R2E2) Fund was created in 2006 with the main mission of facilitating investments in energy efficiency and renewable energy and providing an array of comprehensive assistance to project developers, investors, banks, condominiums, researchers and other stakeholders. It provides professional expertise to the government on issues related to green energy development strategies and legislation. The Fund continuously analyses situations, identifying barriers and proposing solutions to relevant government agencies. With the financial support of the World Bank, R2E2 also established a financing mechanism through a revolving lending tool, which finances energy efficiency and renewable energy projects in the public sector.

To date, the R2E2 Fund has completed and commissioned 47 subprojects (98 public facilities) with a total investment of US\$4.34 million and actual energy savings averaging 50.9%. Sixty-four projects (US\$9.89 million) were approved for implementation, of which one withdrew (National Gallery) due to a change in management. Of these, 47 (US\$4.3 million) are completed and commissioned, 11 (US\$4.2 million) are under construction and five (US\$1.3 million) are under procurement.

R2E2 overall results (as of May 2016)

- *Energy savings – 520, 240, 102 kWh*
- *Verified annual savings in cash – 568,835,391 AMD*
- *Average saving level – 50.8%*
- *Reduced CO₂ – 137,569 t*
- *Investments – \$9.89 mln.*
- *Number of public facilities – 98 commissioned and 89 ongoing*

Barriers for energy efficiency in public buildings and social housing

- Budget constraints of public building users and a limited ability to commit to a multi-year financial obligation such as a third-party energy performance contract or lease of efficient equipment
- The energy efficiency investments often cannot be implemented alone, due to the major need for capital renovation, for which there is a lack of sufficient funds
- Financing per person (per student, per patient, etc.) at a level not sufficient to cover fixed costs of building maintenance
- Lower comfort level, which, in turn, reduces the economic viability of energy efficiency investments
- A lack of direct incentive for the agency managing and operating the building to save energy or reduce operation costs
- Limited in-house technical capacity and skills for efficient management of energy use
- A lack of legal requirement for periodic energy audit and building energy performance certification.

Recommendations Buildings

The government should put efforts into effective enforcement of recently adopted legislations in the building sector. The relevant technical regulations and standards should be adopted as soon as possible in order to improve the effectiveness of the whole regulatory system in the building sector.

Further strengthening of existing building legislation towards introducing requirements for near-zero-consumption buildings should be considered.

The government should continue striving to make public buildings a model for energy efficiency and ensure the application of the latest best international standards regarding the performance of various building components – windows, heating, ventilation and cooling systems, etc.

The government should encourage local authorities to undertake energy audits of all public buildings and develop dedicated programmes for improving the energy performance of public buildings to implement the requirements of the audits.

The government should require that special energy efficiency criteria are introduced into procurement procedures for public expenditure on goods, services and works, with particular emphasis on the public building sector.

The government should continue its efforts to raise public awareness by providing information on end-use energy efficiency measures, both in residential and public buildings.

The government should utilize lessons learned from demonstration projects to inform subsequent government policies on the choice of institutional and regulatory reforms.

The government should ensure necessary conditions are put in place to allow local authorities to finance energy efficiency measures in the longer term. It should also further encourage energy efficiency improvement by providing innovative financial mechanisms and creating attractive conditions for the application of energy performance contracting and ESCOs.

Lighting and Energy-Using Products

The electricity-saving potential from the introduction of energy-efficient lighting in the residential sector in Armenia is very high and is estimated to be between 23 ktoe⁴³ and 26 ktoe,⁴⁴ or around 15% of the 2013 electricity consumption in the residential sector. In addition, lighting renovation in public and commercial buildings could save up to 32 ktoe or almost 40% of the total electricity consumption in the sector. Street and public lighting is reported to be another area with considerable technical potential for cost-effective improvement, particularly in Yerevan and other Armenian cities.

⁴³ *Accelerating energy efficiency initiatives and opportunities. Eastern Europe, Caucasus and Central Asia, 2015.*

⁴⁴ *National programme for energy saving and renewable energy, USAID, 2008.*

Municipal lighting in the capital city of Yerevan accounts for the largest consumption in the country: 90% of all urban lighting energy use nationwide, or about 56,000 MWh/year. According to a study undertaken within the UNDP/GEF Green Urban Lighting Project, the vast majority of bulbs used in street lighting in Yerevan are high-pressure sodium bulbs (HPS) of 250 W capacity (about 93% of all street lights), whereas in the other cities street lighting is “divided” among three main types of lights, namely HPS (46%), mercury bulbs (40%) and CFLs (13%).

There are currently no restrictions on the wattage of household lamps in Armenia. Regulations on lighting design and installation in the Republic of Armenia are integrated into building codes and health codes. The building code on natural and artificial lighting regulates the amount of light delivered into given indoor or outdoor spaces, with very limited requirements for energy efficiency. There exists a national law on product standards, including technical standards on lighting, but these existing lighting standards deal with health and safety, not energy efficiency. Furthermore, state procurement law requires equipment to be purchased based on initial costs, without taking life cycle costs into account, to the detriment of EE lighting, which costs less to operate and usually lasts longer than conventional lighting. There is also no state policy regarding the promotion of energy-efficient lighting products.

Table 20: Energy efficiency potential in lighting and energy-using products

Residential buildings								
Integrated technologies of goods, work and services production	Units	Scale of economic activity	Units2	Specific consumption in 2010	Practical minimum	Actual consumption abroad	Comments	Estimated technical potential, 1000 toe
Replacement of appliances with most efficient models	thou. people	3 017	toe/person	0.077	0.0385	0.084	Global practice	116.13
Lighting renovation	thou. light fixtures	15 775	W	50.85	20	35	Global practice	23.1
Renovation of cooking equipment	thou. m ²	94 652	kgoe/m ²	2.45	1.05	1.96	Global practice	132.51
Total residential buildings								271.74
Public and commercial buildings								
Integrated technologies of goods, work and services production	Units	Scale of economic activity	Units2	Specific consumption in 2010	Practical minimum	Actual consumption abroad	Comments	Estimated technical potential, 1000 toe
Renovation of cooking equipment	thou. m ²	11 335	kgoe/m ²	1.26	0.98	0.91	Global practice	2.94
Efficient gas-fired space-heating boilers	thou. m ²	11 335	kgoe/m ²	22.89	18.69	21.14	Global practice	29.33
Lighting renovation	thou. m ²	22 671	kWh/m ²	32.7	16.4	27.8	Global practice	31.92
Procurement of efficient appliances	thou. m ²	22 671	kWh/m ²	71.8	51.6	56.6	Global practice	39.34
Total public and commercial buildings								103.50
Total buildings								375.24

Source: Accelerating energy efficiency initiatives and opportunities. Eastern Europe, Caucasus and Central Asia, 2015

Energy-efficient appliances and energy-using products are also not regulated in Armenia. A few years ago a draft regulation on energy labelling of household appliances was drafted by MENR, which was approved in December 2015. At the same time, the electricity-saving potential from the replacement of appliances with more efficient models in households is estimated to be 116 ktoe and 39 ktoe in commercial and public buildings, respectively.

The general population has some awareness of the potential benefits of EE lighting products (e.g. CFLs) through the advertising of such lamps in various media; however, the low quality of the majority of such products available on the local market contributes to distrust toward them. There is no mechanism for ensuring consumer protection against low-quality, unlabelled lighting products, which sometimes even lack basic information about the producer. Higher-quality products are still too expensive for the majority of the population. As a result, most people continue to buy conventional incandescent lamps, thereby avoiding high upfront costs.

The UNDP-GEF “Green Urban Lighting Project”, which started in 2014, was aimed at demonstrating the benefits of modern illumination technologies and contributing to the reduction of municipal energy costs related to street lighting. The UNDP, in cooperation with other donors, assisted the **Energy Strategy Centre** of the Research Institute of Energy in organizing international conferences on Renewable Energy and Energy Efficiency. The project activities are structured around four components:

- Component 1: Knowledge of, and capacities for, green urban lighting – support implementation of technical audits of the urban lighting systems and develop training materials for municipal agencies, lighting and design specialists.
- Component 2: Pilot urban green lighting projects – provide technical assistance and incremental investment to support the implementation of pilot demonstration projects for energy-efficient public lighting in Yerevan and other selected urban areas.
- Component 3: Financial mechanisms for scaling up municipal energy-efficient lighting programmes – support for private, international and innovative municipal financing for energy-efficient urban and public buildings lighting.
- Component 4: National policies, codes and standards for energy-efficient lighting – support the development and implementation of broad policy instruments to promote energy-efficient lighting in Armenia, including a legislative mandate to phase out incandescent and other inefficient lighting, technical standards for lighting products, lighting provisions in building codes and procurement rules for public institutions.

The project estimated that the total energy-saving potential of comprehensive modernization of the street lighting system in the urban communities of Armenia is:

Yerevan

- Current total annual power consumption: 37 MWh
- Current annual GHG emissions: 16,500 tCO₂
- Energy-saving potential: 18 MWh/a (>50% potential)
- GHG emission reduction potential: 8,000 tCO₂/a

Other municipalities

- Current total annual power consumption: 8 MWh (estimation)
- Current annual GHG emissions: 3,500 tCO₂
- Energy-saving potential: 4.8 MWh/a (>60%)
- GHG emission reduction potential: 2,000 tCO₂/a

Table 21: Energy-efficient street lighting project results

Municipality	Reduced system capacity (kW)	Annual energy saving (MWh, %)	Annual cost saving (USD)	GHG emission reduction (tCO ₂)	Illumination level improvement (Lux)	Simple payback (years)
Yerevan	136.5	503 (63%)	45000	223.5	from 16 26	6.9
Yerevan (ZOO)	14.8	21.4 (77%)	1900	9.5	from 4 10	N/A
Alaverdi	16.5	24.5 (82%)	2200	10.8	from 4 13	6.1
Spitak	8.3	14.5 (58%)	1300	6.4	from 16 26	10.8
Sevan	13.0	28.5 (74%)	2900	12.7	from 16 20	4.5
Abovian	28.5	52.3 (82%)	5300	23.2	from 17 20	4.0
TOTAL	217.6	644.2	98600	286.1	-	-

Source: Presentation during in-depth energy efficiency mission, May 2016

Recommendations Lighting and Energy-Using Products

The government should accelerate the process of development and adoption of common minimum energy performance standards for energy-using products in line with the respective EU and Eurasian Economic Union rules.

Authorities need to allocate sufficient resources for complying with, monitoring and verifying advertised performance for different appliance groups on energy efficiency requirements, regardless of whether they are imported or locally manufactured.

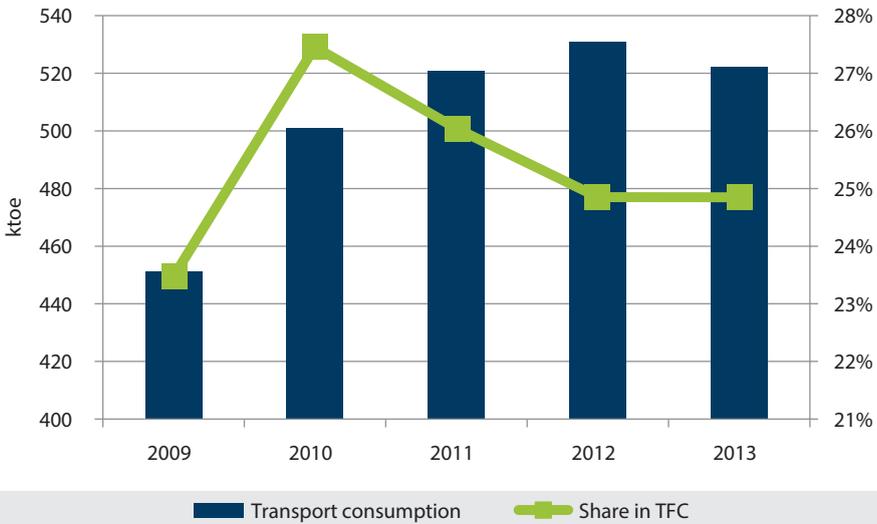
The government should create the necessary conditions to support local authorities in developing and implementing projects for high-efficiency public lighting. It should also consider introducing financial incentives to facilitate the fast deployment of energy-efficient street lighting in the country.

The government should continue to encourage the purchase of high-efficiency household appliances.

Transport

The transport sector consumed 522 ktoe in 2013 and for the last five years has been the second largest consumer in Armenia after the residential sector.

Figure 27: Transport sector energy consumption trend, 2009–2013.



Source: IEA online database

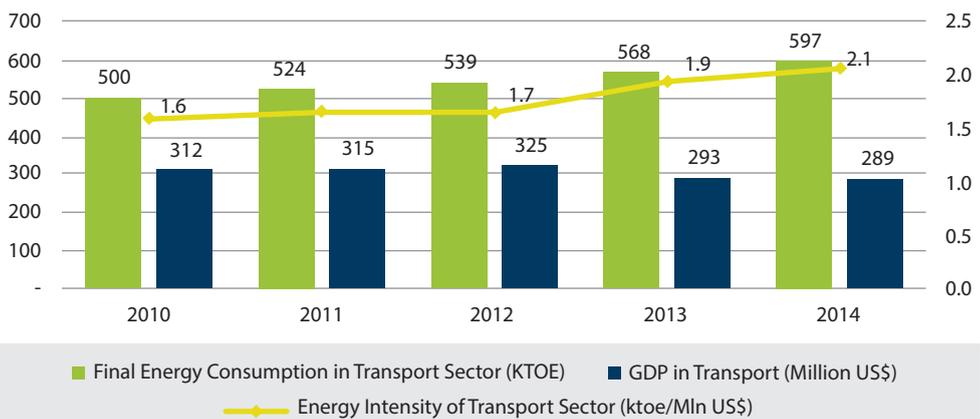
According to the Armenia Third National Communication to the UNFCCC there are about 436,000 registered road transport vehicles, of which 70% are in running condition.

Table 22: Running road transport fleet in 2010

Road transport category	Gasoline	Diesel	CNG	Total by category
Passenger cars	165 171	1 409	80 999	247 579
Buses and minibuses	3 962	1 902	5 521	11 385
Trucks	13 434	12 550	14 848	40 832
Total by fuel	182 567	15 861	101 368	299 796

Source: GHG inventory, 2013

Figure 28: Energy intensity of transport sector.



Source: Draft second NEEAP

The estimated energy efficiency potential for all transport categories including rail transport, aviation and electric transport (metro, trams and trolleybuses) is 490 ktoe, with the greatest potential coming from switching to effective hybrid automotive vehicles and modernizing diesel locomotives.

Table 23: Energy efficiency potential in transport sector

Integrated technologies of goods, work and services production	Units	Scale of economic activity	Units2	Specific consumption in 2010	Practical minimum	Comments	Estimated technical potential, 1000 toe
Railroad electric traction	10 ⁷ tkm gross	2 985	kgoe/10 ⁴ tkm gross	8	7	Values for some Russian regions	4.2
Diesel locomotives	10 ⁷ tkm gross	15 737	kgoe/10 ⁴ tkm gross	43.54	28	2020 target for Russia	244.58
Metro electric traction	10 ⁶ tkm gross	5	kgoe/10 ³ tkm gross	4.55	3.01	Moscow	0.007
Trolleybus electric traction	10 ⁶ tkm gross	2	kgoe/10 ³ tkm gross	5.53	4.13	Average for Russia	0.0028
Gas pipeline transport	10 ⁶ m ³ km	18 369	kgce/10 ⁶ m ³ km	19.74	17.5	2020 target for Russia	41.16
Eco-driving	10 ³ toe	181.3	kgce/10 ⁶ m ³ km	100%	95%	Global practice	9.1
Shifting to hybrid light-duty vehicles	10 ³ vehicles	173.6	toe/vehicles/year	0.861	0.518	Global practice	85.33
Shifting to hybrid buses	10 ³ buses	7.7	toe/buses/year	4.55	2.737	Global practice	20.79
Shifting to heavy-duty vehicles	10 ³ vehicles	28.7	toe/vehicles/year	5.25	3.164	Global practice	86.38
Air transport	10 ⁶ passenger-km	1.4	kgoe/passenger-km	42.21	37.989	Global practice	0.007
Total transport							491.54

Source: Accelerating energy efficiency initiatives and opportunities. Eastern Europe, Caucasus and Central Asia, 2015

The first NEEAP defined several measures, as listed below, aimed at reducing energy consumption growth in the transport sector, with a special focus on road and rail transport.

- Development of legislative background on fuel efficiency and emission norms
- Dissemination of information on technologies and energy saving
- Continuous replacement of minibuses by larger passenger buses and route optimization
- Expansion and modernization of electrified public transport
- Expansion and modernization of rail transport network (passenger and freight)

In addition, the draft second NEEAP includes:

- Continuous switching of road vehicles from gasoline to CNG

- Development of an integrated electro-transport network and services to cover unsatisfied demand in public transportation services in the greater Yerevan area

The “Armenian Transport Sector Development Strategy 2020” (2008) and the associated documents were updated as the Transport Sector Master Plan was integrated into the Armenia Sustainable Development Programme 2014–2025, and a dedicated investment plan was developed. This plan includes 58 investment projects, with the total cost estimated to be about US\$2 billion, of which about \$1.3 billion is for 49 new projects and \$0.7 billion for ten ongoing projects. The 14 TA projects, at an estimated cost of \$36.8 million, include feasibility studies for potential projects, advisory support for planning, technical knowledge transfer and institutional capacity development.

Recommendations Transport

The government should improve the quality of urban planning, including transport infrastructure elements and traffic management, by setting up a system of transport sector energy efficiency indicators.

Introduce policy packages (regulatory and incentives) that encourage more rapid turnover of the old vehicle fleet. Such measures could be in the form of discouraging the import of old vehicles, incentives encouraging quick fleet renewal by owners, vehicle fuel economy labels, tax and fiscal measures stimulating purchase of more efficient vehicles.

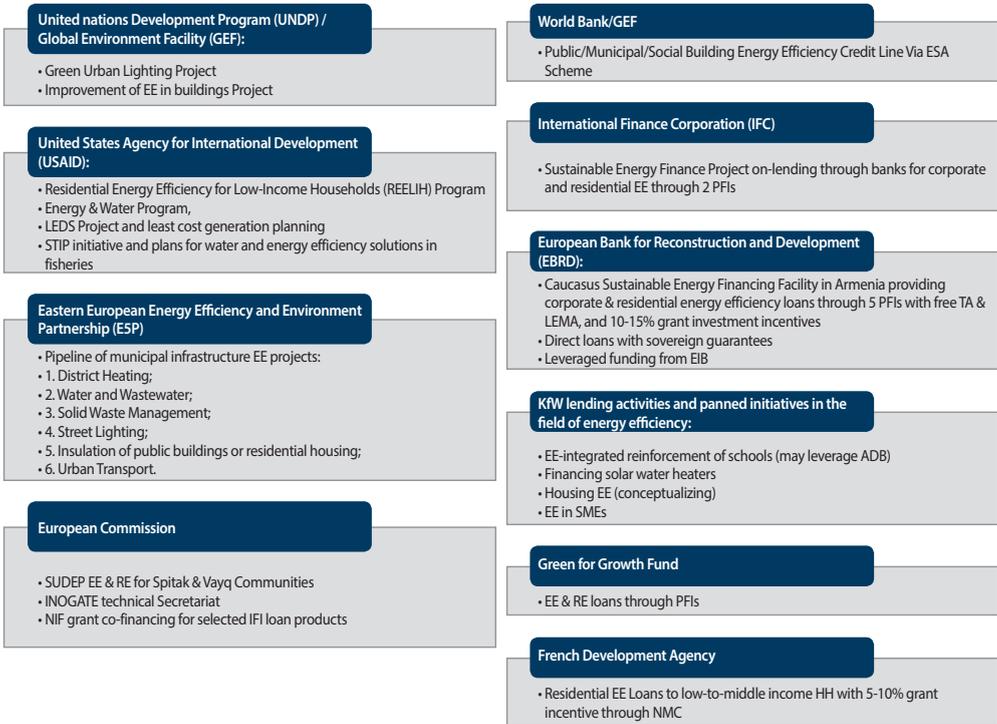
The relevant authorities should improve the quality of service, efficiency, accessibility and comfort of existing public transport systems in order to create alternatives to private vehicle use in urban areas.



Financing Energy Efficiency

Financing Energy Efficiency

Figure 29: Overview of main donors and IFI funds available for energy efficiency in Armenia.



Source: Draft second NEEAP

EBRD, AFD, IFC, GGF and KfW are implementing or planning credit facilities for the residential sector, predominantly through participating banks/credit institutions and offering energy efficiency loans for household energy-efficient retrofits, however none of them offer residential EE financing for building-level solutions.

In 2012, the GoA approved an EE project under the WB financing implemented by the R2E2 fund. The project is targeted at implementing energy-saving activities in public facilities to reduce the level of energy consumption by social and other public facilities. The cost of the project is estimated to be about 10.7 mln USD.

The French Development Agency works with national mortgage companies and 14 PFIs on household energy efficiency loans and EE mortgage loans with an overall EUR 10 million credit line and a target of 3000 households to be reached within the first year of the programme.

Under the European Bank for Reconstruction and Development (EBRD), the Armenia Sustainable Energy Financing Facility⁴⁵ has set up the EnergoCredit facility, which provides energy efficiency loans for residential and business clients. In addition, it has been working with MUD to assess the market for residential energy efficiency lending, which would target the

45 Armenian Sustainable Energy Financing Facility (ArmSEFF), <http://www.energocredit.am/>

energy-saving potential in existing residential buildings. EnergoCredit provides free technical assistance and advice on which technologies are eligible for financing (eligibility check).

Membership in the Eastern Europe EE and Environment Partnership (ESP) will enable very important EE projects to be implemented. The investment from Armenia will amount to about €1 million to be paid in instalments, in addition to which Armenia will be granted nearly €20 million.

KfW and the Republic of Armenia have signed an Inter-Governmental Agreement on three new loans aimed at:

- EE integrated reinforcement of schools
- EE credit line for SME ; and
- Housing EE credit line

International financial institutions (IFIs) provided more than \$87.96 mln energy efficiency lending through local financial institutions, which generated (leveraged) \$23.30 mln or more than 26% additional investments/contribution from other sources in the period 2010–2015. The biggest lenders were EBRD with a total amount of \$49.26 mln and IFC with a total amount of \$26.57 mln. The biggest proportion of EE loans in 2010–2015 was provided to industry, with more than 35%, with about 22% to the power sector/generation and 18% to small and medium enterprises (SMEs), with the transport sector being blended with industry and SMEs as well. About 14% were invested in municipal infrastructure projects. The smallest share of lending went to public buildings – about 0.3%.



Renewable Energy

Renewable Energy

Renewable Energy Resources Potential and Targets

In 2014, with the support of R2E2, the Scaling up renewable energy investment plan (SREP) for Armenia was developed, which includes comprehensive analysis of the renewable energy potential in Armenia, cost benefit and the viability of specific technologies. It also proposes targets and objectives for renewable electricity generation by 2020 as well as a financing plan.

Table 24: Renewable energy resources potential through technology

Technology	Capacity (MW)	Generation (GWh/yr)
Wind	300	650
Utility scale PV	830–1 200	1 700–2 100
Concentrated solar power	1 200	2 400
Distributed solar PV	1 300	1 800
Geothermal	At least 150	At least 1 100
Landfill gas	2	20
Small hydro	100	340
Biogas	5	30
Biomass	30	230
Total (electricity)	3 800–4 300	7 400–8 700
Solar thermal hot water	n/a	260
Geothermal heat pumps	n/a	4 430
Total (heat)		4 690

Source: SREP, 2014

In 2012, renewable energy generation represented only 6% of the total electricity generation (excluding large hydropower plants). The Armenian government has set ambitious targets for renewables to reach 21% of total generation by 2020 and 26% by 2025.

Table 25: Targets for renewable energy generation in 2020 and 2025

	Installed capacity (MW)		Generation (GWh)	
	2020	2025	2020	2025
Small Hydro	377	397	1 049	1 106
Wind	50	100	117	232
Geothermal	50	100	373	745
PV	40	80	88	176
TOTAL	492	677	1 627	2 259

Source: SREP, 2014

The targets in Table 25 update the renewable energy road map, developed in 2011. The updating of the targets, mainly due to the decline in the capital cost for PV projects in recent years, has increased the economically viable solar potential.

The Armenia MENR, with the support of the SREP, has identified two areas for strategic investment in renewable energy, namely geothermal power development and utility-scale solar PV. SREP resources will be used for further exploration of the Karkar geothermal site, with the aim of demonstrating the viability of geothermal energy. The SREP would also help catalyse private investments and show the potential of deploying solar PV on a commercial basis. According to the investment plan, the 40 ISD million funding is expected to catalyse nearly four times as much investment, most of it from the private sector.

Existing Activities in Renewable Energy Sector

In 2007, the PSRC set feed-in tariffs to stimulate investments in renewable energy. New plants sign 15-year power purchase agreements, under which the Electric Networks Armenia is obliged to purchase all the power produced. Feed-in tariffs are adjusted annually according to inflation and the USD/AMD exchange rate.

Table 26: Feed-in tariffs for renewable energy (May, 2015)

RE technology	Feed-in tariff (excl. VAT)	
	AMD/kWh	USD/kWh
Wind	34.957	0.08
Biomass	38.586	0.09
Small-scale hydro, built on "natural water systems"	20.287	0.05
Small-scale hydro, built on irrigation systems	13.523	0.03
Small-scale hydro, built on "drinking water supply systems"	9.017	0.02

Existing activities in the field of renewable energy in Armenia involve the continued development of private small HPPs, the rehabilitation of existing large HPPs and the development of some new large HPPs, the exploration of the Karkar geothermal site and the implementation of some small pilot renewable heating projects. This annex describes each of these activities.

Hydropower project rehabilitation and development

Small HPPs make up the vast majority of Armenia's renewable energy industry (apart from large HPPs). As of July 2016, 312 MW of small HPPs are operating, and 94MW of SHPPs have received licenses for development from the PSRC. Small HPP development has been supported by both private and commercial banks in Armenia, as well as international development banks. KfW has been supporting the development and rehabilitation of small HPPs through the Bank of America and other commercial banks in Armenia. Through this programme, domestic commercial banks have been able to offer relatively low-cost, long-term capital for small HPP development.

There has also been activity in the large hydropower industry. EBRD is financing the rehabilitation of the Sevan-Hrazdan HPP and KfW is financing the rehabilitation of the Vorotan cascade. Iran is allegedly providing finance for the construction of the Meghri hydropower project, which is scheduled to come online in 2021. The energy from the Meghri plant is expected to go to Iran for the first 15 years of its operation before ownership of the plant is given to Armenia.

Geothermal

The World Bank has financed ongoing assessments of the Karkar geothermal site, including an economic and financial appraisal of a potential plant at the site.

Renewable heating

Recently, two solar thermal heating projects have been implemented in the Shirak region of Armenia, through the GEF Small Grants Programme. One of these projects involved the implementation of solar thermal heating at a housing complex, and reduced natural gas consumption by approximately 40%. The other project was implemented at a kindergarten, and there are plans to expand the project to a nearby greenhouse. Greenhouses are major consumers of heat energy in Armenia and this project could provide valuable demonstration benefits for this particular implementation of renewable heat technologies.



Environment and
Climate Change Policies
Related to Energy

Environment and Climate Change Policies Related to Energy

Background

Climate change adaptation is a priority issue for the Republic of Armenia. As a mountainous, landlocked country, it is characterized by the vulnerability of ecosystems, an arid climate, active exogenous and desertification processes, and frequent natural disasters. These factors make Armenia more sensitive to current and projected climate change impacts.⁴⁶

The country's main environmental problems relate to the poor protection of forest areas (covering about 10–11 % of the country's total surface in 2012⁴⁷), resulting in illegal logging and solid waste management, and a reduction in the aggregate volume of river flow resulting from climate change. These issues have been identified by the government, and are being tackled, sometimes with assistance from international organizations.

The Republic of Armenia produced its first National Environmental Action Programme (NEAP) in 1998, which listed many and diverse environmental challenges, although it did not establish a comprehensive method for assessing and tackling the identified issues. Nonetheless, some programmes and action plans were prepared and implemented following the first NEAP, especially concerning environmental legislation. The second NEAP (or NEAP-2) was published in 2008, and it was aimed at building on the first programme by developing a more comprehensive approach. A third NEAP is reportedly awaiting adoption by the government, and is set to be published soon.

Administrative structure

The Ministry of Nature Protection was created as the Ministry of Nature and Environment Protection after Armenian independence in 1991. The Ministry is the central executive body with responsibility for environmental protection and natural heritage, and is in charge of coordinating actions for the implementation of the UN Framework Convention on Climate Change (UNFCCC) in the country.

The Ministry is currently developing a long-term action plan, the third National Environment Action Programme (NEAP), subject to approval by the government.⁴⁸ It will replace the existing NEAP-2, produced in 2008.

There are four separate agencies dealing with different environmental matters:

- The Bio-Resource Management Agency, which provides services in the field of biodiversity conservation and resource management.
- The National Environmental Inspectorate, which has supervisory responsibilities for the functions and application of environmental protection and natural resource use in reproduction.
- The Waste Matter and Air Pollution Management Agency, which establishes waste and emission quotas for legal entities and individual entrepreneurs. It runs the registry of waste inventory, including formation, processing and disposal sites.
- The Water Resource Management Agency, which deals with surface and underground water management in accordance with the national programme. It also provides

⁴⁶ <http://unfccc.int/resource/docs/natc/armnc3.pdf>

⁴⁷ <http://www.tradingeconomics.com/armenia/forest-area-sq-km-wb-data.html>

⁴⁸ <http://unfccc.int/resource/docs/natc/armnc3.pdf>

qualitative and quantitative monitoring demand for water resources development, and keeps an inventory of the state's water resources.

The NEAP-2 highlights the need to establish an institution dedicated to Environmental Impact Assessments, through comprehensive legal institutional regulation, in order to facilitate control and implementation of relevant environmental legislation.

Environmental legislation and implementation

According to the NEAP-2, the Republic of Armenia lacks an overarching law defining environmental policy in general. The objective of such a law would be to provide a basis for the complex management of the different elements for environmental sustainability, and ensure a uniform approach when adopting general measures from international agreements, including policies; programmes; strategies and reports; sustainable development and management approaches; standards; methods and norms; transfer, exchange and application of technologies; implementation of monitoring and studies; collection, presentation and exchange of information; and involvement and awareness of the public in decisions made in the environmental sphere.

Additionally, the NEAP-2, published in 2008, argues that there are several contradictions or imperfections, or absence of enforcement mechanisms for certain provisions envisaged under legal acts regulating the environmental sphere. No new laws relating to environmental matters have been adopted since 2008, although government decrees have introduced additional measures concerning air pollution and international conventions:

- The Law on Atmospheric Air Protection (1994).
- The Law on Energy (2001) and the Law of the Republic of Armenia on Energy Saving and Renewable Energy (2004).
- The Law of the Republic of Armenia on Waste (2004).
- The Forest Code of the Republic of Armenia (2005).

Armenian government decrees:

- On Approval of Maximum Permissible Concentration of Air Polluting Substances in Settlements and Maximum Permissible Norms of Hazardous Substances in Emissions from Vehicles Operated in the Republic of Armenia (Decree No. 160-N dated 2 February, 2006);
- On Implementation of Projects within the Framework of the Clean Development Mechanism of the Kyoto Protocol under the United Nations Framework Convention on Climate Change (Decree No. 974-N dated 13 July, 2006,);
- On Approval of the Procedure on Examination of Design of Maximum Permissible Emission Norms for Organization with Stationary Sources of Atmospheric Air Pollution and on Granting Emissions Permits (Decree No. 953-N dated 21 August, 2008);
- On Approval of Order on Projection, Notification of, and Response to Dangerous Hydrometeorological Events Affecting Extra-normative Pollution of Atmospheric Air, Climate Change, and Ozone Layer Conditions (Decree No. 1186-N dated 16 October, 2008);
- On Approval of Action Plan to be Implemented by the Republic of Armenia Under Commitments of a Number of Environmental Conventions (Decree No. 1594-N dated 11 October, 2011).

Environmental policy

The first National Environmental Action Plan (NEAP) produced a series of programmes and action plans that were approved or endorsed by governmental by-laws. Tangible results were achieved in an environmental legislative and regulatory framework, through the development and implementation of sectoral development plans and strategies. Reportedly, public awareness of environmental issues has also increased.

While a new NEAP is in the process of being prepared, the second NEAP (2008) is the most recent strategic document laying out environmental priorities. It established an overall framework for integrated environmental management in the Republic of Armenia that aims at optimizing utilization of the country's natural resources and identification of an overall environmental conservation policy.

The main environmental challenges identified in the NEAP-2 are poor natural resource management; pollution of air, soil and water; disposal of solid waste; the depletion of lakes and similar water basins; the lack of public involvement and unequal availability of natural resources; desertification; reduction of biodiversity; exceeding marginal permissible proportions of emissions and leakages into the environment; non-regulated utilization of hazardous substances and waste; and epidemics, and potential natural and technical disasters.

Furthermore, the budget dedicated to environmental issues is not significant, only reaching 0.25–0.27 % of the GDP. According to the NEAP-2, more than half of the economic resources supposedly reserved for environmental purposes are actually used to finance other priorities.

According to the latest Communication to the UNFCCC, the Republic of Armenia is implementing the following measures:

- **Forestry:** As a result of the energy crisis in 1992–1995, illegal mass logging led to extremely negative consequences for forest ecosystems. Nonetheless, reforestation and forest conservation activities have been implemented since 1998, and Armenia has expressed the intent to increase forest land to 20.1% by 2050. The “National Forest Policy and Strategy” (2004) and “National Forest Programme” (2005) were aimed at ensuring the conservation, restoration, natural reproduction and sustainable use of forest.
- **Solid waste management:** Current programmes being implemented in Armenia are aimed at enhancing solid waste management systems. In particular, a landfill gas recovery and flaring system is being introduced in the Yerevan landfill within the framework of the clean development mechanism (CDM) under the Kyoto Protocol.
- **Water resource management and adaptation to climate change:** Summers in most of the regions of the country are usually characterized by hot and dry weather conditions. According to model predictions, these conditions will worsen, leading to negative impacts on water resources and agriculture. Armenia has assessed the vulnerability of water courses, reservoirs and Lake Sevan (the largest body of water in the Caucasus region). Adaptation measures for these issues are presented in the Communication to the UNFCCC, and include actions to take relating to administration and planning, research and information, and infrastructure and monitoring.

International and regional agreements and protocols

Active participation of the Republic of Armenia in international integration processes is considered a critical guarantee for ensuring environmental safety in the country. Hence,

the country has joined several conventions to date, such as the Convention on Biodiversity, the Convention on the Conservation of European Wildlife and Natural Habitats, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, and the Convention on Environmental Impact Assessment in a Transboundary Context.

The government of Armenia declared in its latest National Environment Action Programme (2008) that it will take the necessary steps to also join the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, as well as ensure ratification of a number of environmental agreements and the conformity of national legislation.⁴⁹

Kyoto Protocol

The Republic of Armenia ratified the UNFCCC in 1995 and joined the Kyoto Protocol in 2002 as a non-Annex I country. The Third Communication to the UNFCCC secretariat was prepared by the Ministry of Nature Protection of the RA with the funding of the Global Environmental Facility (GEF) and support from the UN Development Programme in Armenia. It includes information on emissions of greenhouse gases in the country and their removal from the atmosphere for the period covering 2007–2012, climate change scenarios and adaptation measures.

By a Decree of the Government of the Republic of Armenia, No. 974, adopted on 13 July, 2006, on “Implementation of Projects in the Framework of Clean Development Mechanism (CDM) under the Kyoto Protocol”, the Ministry of Nature Protection was appointed as the designated national authority (DNA) for CDM under the Kyoto Protocol. The procedure for submission and approval of CDM projects was approved, according to which projects should be in line with the sustainable development strategy and criteria of the country. As of 2014, the CDM Executive Board had approved six projects in Armenia, as shown in Table 27.⁵⁰

Table 27: Registered CDM project proposals as of April 2016

Sector	Number of project proposals	GHG reduction, in thousand tons/year CO ₂ eq.
Energy	1	222.65
Alternative energy ⁵¹	4	88.06
Agriculture	0	0
Waste	1	130
Forestation and afforestation	0	0
Total	6	440.72

Source: UNFCCC CDM project search

The CDM project set out to contribute to the main reduction in GHG emissions by dealing with leak detection and repair in gas production, processing, transmission, storage and distribution systems, thereby illustrating the efficiency potential in repairing and upgrading aging infrastructure in Armenia. The project involves the main transmission operator in the country, Gazprom Armenia, and Dutch company Eco Energy B.V. The crediting period for this project extends from 2012 to 2022. The four alternative energy CDM projects include one biogas and

⁴⁹ <http://faolex.fao.org/docs/pdf/arm152365.pdf> p. 40

⁵⁰ <http://unfccc.int/resource/docs/natc/armnc3.pdf>

⁵¹ Lusakert biogas plant and Yeghegis, Argichi and Jradzor small HPPs.

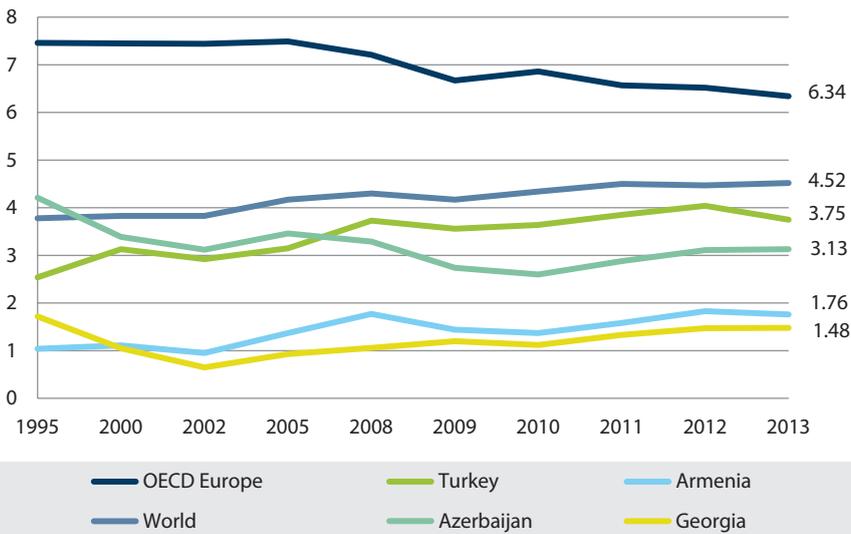
three small hydroelectric plants. Two of the hydro projects have not found a foreign party to participate with yet, while the other has been approved and authorized with the participation of several European public or private entities.

As shown in Figure 30, GHG reduction has not yet taken place in Armenia. Although emissions peaked in 2008 with 5,559 kT of CO₂ emissions and decreased in 2009 and 2010, they increased again in 2011. Moreover, a report commissioned by Austria’s Development Bank⁵² suggests that greenhouse gas emissions will greatly increase in a business-as-usual scenario until 2020, mainly due to an increase in the local energy demand for electricity and heat.

In general, there was an increase in GHG emissions in the period 2000–2008, due to higher rates of economic development. The decrease in 2009–2010 was mainly in the energy and industrial processes and product use (IPPU) sectors, caused by the global economic crisis. There was also an increase in F-gas (HFC) emissions, used as substitutes for ozone layer depletion substances, mainly due to increased development of cooling and air-conditioning equipment.

Armenia’s industrial sector shows large saving potential through improvements of operational procedures and processes, and the implementation of energy-efficient technologies. Additionally, due to rising costs of energy imports and thus high operation costs, companies are forced to reduce energy costs in order to remain competitive, which increases the appeal of energy-efficient technologies.

Figure 30: tCO₂ per capita.



Source: IEA

Paris Agreement

Armenia submitted its Intended Nationally Determined Contribution (INDC) to the UNFCCC on September 29th, 2015, two months ahead of the Paris COP21 (Conference of the Parties).⁵³

52 Allplan GmbH (2013), “Energy Efficiency Finance. Country report: Armenia”. Available at: <http://www.oe-eb.at/en/osn/DownloadCenter/Studies/Energy-Efficiency-Finance-Armenia.pdf>

53 <http://newsroom.unfccc.int/unfccc-newsroom/armenia-submits-its-climate-action-plan-ahead-of-2015-paris-agreement/>

In the document, Armenia highlights its vulnerability to climate change, and hence its intent to pursue an ecosystem approach in its mitigation actions. The report also supports the UNFCCC's definition of a fair approach to climate change, reflected in a "common, but differentiated responsibility", which considers the different levels of historical responsibility among countries in contributing to the increase of greenhouse gas concentration in the atmosphere.

Armenia's commitment to the COP21 is to limit its GHG emissions to an annual average of 5.4 CO₂ eq. tons per capita for the period 2015–2050. In 2010, Armenia's tons of CO₂ emissions per capita was 1.37, and total GHG emissions (CO₂ eq.) comprised 2.14 tons per capita.

The INDC document states that the main contribution to climate change mitigation will come from the following sectors:

- Energy (including renewable energy and energy efficiency)
- Transport (including development of electrical transport)
- Urban development (including buildings and construction)
- Industrial processes (construction materials and chemical production)
- Waste management (solid waste, waste water, agricultural waste)
- Land use and forestry (afforestation, forest protection, carbon storage in soil)

In particular, the government acknowledges the need to restore the capacity of Armenia's forests to increase carbon absorption, and considers that the optimal level of forest land would be 20.1%, which should be achieved by 2050. Additionally, the report acknowledges the role of the Nationally Appropriate Mitigation Actions (NAMA) format, which has already been followed in some projects carried out by the UNDP in Armenia. In particular, it highlights the importance of the Measuring Reporting and Verification (MRV) system for the implementation of INDC mitigation measures.



Annex 1:
General Economics and Energy Data

Annex 1: General Economics and Energy Data⁵⁴

Table 28: Energy balance

ktoe

Indicators	2000	2002	2005	2008	2009	2010	2011	2012	2013
Total Primary Energy Production	643.211	747.106	868.546	804.567	832.407	877.781	886.79	810.774	810.753
Net imports	1504.128	1238.411	1775.898	2288.148	1835.297	1822.774	2005.806	2353.946	2249.77
TPES	2014.6	1876.378	2512.308	3004.069	2609.97	2483.201	2715.568	2970.593	2900.361
TFC	1106.735	1101.991	1713.99	2221.717	1922.037	1825.311	2000.456	2136.695	2101.295

Table 29: Total Primary Energy Supply (TPES) structure

ktoe

Products	2000	2002	2005	2008	2009	2010	2011	2012	2013
Coal and coal products	0	7.988	0	0.888	0	0.592	0	1.184	0.592
Crude, NGL and feedstocks	0	0	0	0	0	0	0	0	0
Petroleum products	291.234	276.741	372.423	400.482	371.472	382.359	358.293	368.668	324.587
Natural gas	1119.973	874.987	1338.419	1800.196	1408.67	1290.754	1584.694	1927.395	1864.386
Nuclear	522.515	594.703	707.806	641.352	649.952	648.909	664.024	602.261	615.03
Hydro	108.446	142.588	152.478	154.542	173.634	219.816	214.054	199.692	186.878
Geothermal	0	0	0	0	0	0	0	0	0
Solar/wind/other	0	0	0	0.172	0.344	0.602	0.258	0.344	0.344
Combustible renewables and waste	12.25	9.815	8.262	8.501	8.477	8.454	8.454	8.477	8.501
Electricity	-39.818	-30.444	-67.08	-2.064	-2.58	-68.284	-114.208	-137.428	-100.19
Total Primary Energy Supply	2014.6	1876.378	2512.308	3004.069	2609.97	2483.201	2715.568	2970.593	2900.361

⁵⁴ IEA online statistics database 2015.

Table 30: Total Final Energy Consumption (TFC)

Ktoe

Products	2000	2002	2005	2008	2009	2010	2011	2012	2013
Coal and coal products	0	7.988	0	0.888	0	0.592	0	1.184	0.592
Petroleum products	291.234	276.741	372.423	400.482	371.472	382.359	358.293	368.668	324.587
Natural gas	438.546	484.514	934.299	1357.373	1134.006	1021.441	1182.294	1318.046	1302.638
Combustible renewables and waste	12.25	9.815	8.262	8.501	8.477	8.454	8.454	8.477	8.501
Electricity	308.826	293.776	357.932	418.82	385.968	401.362	442.986	440.32	464.744
Heat	55.879	29.157	41.074	35.653	22.113	11.104	8.43	0	0
Total Final Consumption	1106.735	1101.991	1713.99	2221.717	1922.037	1825.311	2000.456	2136.695	2101.295

Table 31: Basic energy-related Indicators

Indicators	2000	2002	2005	2008	2009	2010	2011	2012	2013
Population (million)	3.076	3.047	3.015	2.977	2.968	2.963	2.964	2.969	2.977
GDP (billion 2005 US\$)	2.755	2.755	4.9	6.745	5.791	5.918	6.196	6.643	6.875
GDP (billion 2005 US\$ PPP)	7.993	9.912	14.218	19.571	16.802	17.171	17.978	19.273	19.947
Primary Energy Intensity (TPES/GDP) (toe per thousand 2005 US\$)	0.73	0.55	0.51	0.45	0.45	0.42	0.44	0.45	0.42
Primary Energy Intensity (TPES/GDP PPP) (toe per thousand 2005 US\$ PPP)	0.25	0.19	0.18	0.15	0.16	0.14	0.15	0.15	0.15
TPES/Population (toe per capita)	0.65	0.62	0.83	1.01	0.88	0.84	0.92	1	0.97
Electricity Consumption/GDP (kWh per 2005 US\$)	1.45	1.1	0.93	0.72	0.83	0.84	0.84	0.82	0.81
Electricity Consumption/Population (kWh per capita)	1294.86	1231.05	1504.48	1630.5	1616.58	1676.34	1753.71	1837.99	1879.74
Energy-related CO ₂ Emissions ⁵⁵ (Mt)	3.42	2.91	4.13	5.27	4.27	4.05	4.67	5.44	5.24

55 CO₂ emissions from fuel combustion.

Table 32: Electricity generation

GWh

Products	2000	2002	2005	2008	2009	2010	2011	2012	2013
Coal and coal products	0	0	0	0	0	0	0	0	0
Petroleum products	0	0	0	0	0	0	0	0	0
Natural gas	2692	1579	1828	1510	1154	1438	2390	3399	3173
Nuclear	2005	2282	2716	2461	2494	2490	2548	2311	2360
Hydro	1261	1658	1773	1797	2019	2556	2489	2322	2173
Solar/wind/other	0	0	0	2	4	7	3	4	4
Combustible renewables and waste	0	0	0	0	0	0	0	0	0
Total electricity generation	5958	5519	6317	5770	5671	6491	7430	8036	7710

Table 33: Heat production

TJ

Products	2000	2002	2005	2008	2009	2010	2011	2012	2013
Coal and coal products	0	0	0	0	0	0	0	0	0
Petroleum products	0	0	0	0	0	0	0	0	0
Natural gas	68.286	37.093	43.9	44.282	23.431	11.799	8.957	2.15	3.033
Nuclear	0	0	0	0	0	0	0	0	0
Hydro	0	0	0	0	0	0	0	0	0
Solar/wind/other	0	0	0	0	0	0	0	0	0
Combustible renewables and waste	0	0	0	0	0	0	0	0	0
Total heat production	68.286	37.093	43.9	44.282	23.431	11.799	8.957	2.15	3.033



Annex 2:
Selected End-Use Data Tables

Annex 2: Selected End-Use Data Tables

Table 34: Total final energy consumption by sector

Ktoe

Sectors	2000	2002	2005	2008	2009	2010	2011	2012	2013
Residential	283.836	293.474	460.394	648.978	606.03	537.604	610.071	664.724	661.641
Industry sector	397.901	421.83	682.622	692.167	508.056	315.623	351.84	384.804	383.989
Commercial and public services	26.743	32.333	44.433	103.918	98.306	100.906	114.492	121.263	121.994
Transport sector	207.1	197.642	251.162	497.064	451.169	501.143	520.988	530.997	522.13
Agriculture/Forestry	40.936	19.78	23.478	19.178	10.664	10.836	10.406	11.868	12.986
Non-energy use	23.407	0	39.051	50.301	48.295	41.798	39.935	66.447	37.761
Non-specific (other)	126.813	136.932	212.85	210.111	199.517	317.4	352.724	356.593	360.794
Total final consumption	1106.735	1101.991	1713.99	2221.717	1922.037	1825.311	2000.456	2136.695	2101.295

Table 35: Final energy consumption of the residential sector

Ktoe

Energy products	2000	2002	2005	2008	2009	2010	2011	2012	2013
Coal and coal products	0	7.988	0	0.888	0	0.592	0	1.184	0.592
Electricity	133.988	128.656	148.178	154.112	147.662	150.328	164.518	171.14	174.408
Natural gas	124.32	137.343	293.446	477.572	448.195	381.598	441.684	492.4	486.641
Heat	25.528	13.325	18.77	16.406	10.173	5.086	3.869	0	0
Petroleum products	0	6.162	0	0	0	0	0	0	0
Combustible renewables and waste	0	0	0	0	0	0	0	0	0
Total residential sector	283.836	293.474	460.394	648.978	606.03	537.604	610.071	664.724	661.641

Table 36: Final energy consumption of the service sector

Ktoe

Energy products	2000	2002	2005	2008	2009	2010	2011	2012	2013
Electricity	20.21	25.112	28.982	74.992	69.402	69.316	77.916	80.496	81.7
Heat	0	0	0	0	0	0	0	0	0
Oil products	0	0	0	0	0	0	0	0	0
Natural gas	6.533	7.221	15.451	28.926	28.904	31.59	36.576	40.767	40.294
Coal and coal products	0	0	0	0	0	0	0	0	0
Combustible renewables & waste	0	0	0	0	0	0	0	0	0
Total services sector	26.743	32.333	44.433	103.918	98.306	100.906	114.492	121.263	121.994

Table 37: Final energy consumption of the industry sector

Ktoe

Energy products	2000	2002	2005	2008	2009	2010	2011	2012	2013
Coal and coal products	0	0	0	0	0	0	0	0	0
Petroleum products	0	0	0	0	0	0	0	0	0
Natural gas	307.694	339.95	578.36	572.214	409.342	219.563	254.141	283.324	280.015
Combustible renewables and waste	0	0	0	0	0	0	0	0	0
Electricity	59.856	66.048	81.958	100.706	86.774	90.042	93.138	101.48	103.974
Heat	30.351	15.832	22.304	19.247	11.94	6.018	4.561	0	0
Total industry sector	397.901	421.83	682.622	692.167	508.056	315.623	351.84	384.804	383.989



Annex 3:
Energy Efficiency Financing
Facilities and Programmes

Annex 3: Energy Efficiency Financing Facilities and Programmes

Title of the energy-saving measure	End-use targeted	Duration
Financing for Energy Efficiency: Implementation of energy-saving activities in municipal and social public facilities (R2E2/GEF/WB)	Social and public facilities	Start: 2012 End: 2017
New construction and capital renovation of public buildings and social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings	New construction and capital renovation of public buildings and social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings	Start: 2016 End: 2020 (ongoing)
Legal Support, Financing and Information: Improvement of Energy Efficiency in Buildings; development of secondary legislation for EE in buildings, as well as funding for the first pilot thermal modernization of a residential multi-apartment building in the Avan district of Yerevan and social housing in the towns of Goris and Akhouryan	Residential multi-apartment buildings, social housing, significant reconstruction of existing buildings, secondary legislation for EE in buildings	Start: 2013 End: 2017
Financing for EE & Public Procurement for EE: UNDP Green Urban Lighting Project GHG Emission reduction by increasing energy efficiency of municipal lighting in the cities of Armenia	Municipal lighting electricity use in the cities of Armenia	Start: 2013 End: 2017
Financing for Energy Efficiency: GGF	EE and RE solutions for household space heat and lighting efficiency (windows, doors, heat supply, lighting, distribution systems) and SMEs	
Financing for Energy Efficiency: KfW EE loans for households and SMEs	Residential energy end-use, SME EE of production processes, space heat conservation	Start: 2009 End: 2015
Financing for Energy Efficiency: Household energy efficiency loans and EE mortgage loans (NMC/AFD)	Household EE loans and EE mortgage loans; residential buildings and private homes' space heating, hot-water preparation	Start: 2014 End: 2020

Achieved energy savings in 2014 toe	Achieved energy savings in 2017 toe	Achieved energy savings in 2018 toe	Achieved energy savings in 2020 toe	Status in relation to 1 st EEAP
401	4,006	5,609	8,814	partially completed
-	11,442	14,653	21,037	partially completed
1,200	1,200	1,200	1,200	partially completed
	47	47	47	partially completed
35,069	841,656	361,847	176,747,728	partially completed
3,078	12,310	15,388	24,620	partially completed
-	141	164	211	partially completed

Title of the energy-saving measure	End-use targeted	Duration
Financing for Energy Efficiency: Energy efficiency loans for residential and business clients, EBRD ArmSEFF	EE loans for residential and business clients (corporate energy efficiency, sustainable energy financing facilities, cleaner energy production, municipal infrastructure energy efficiency)	Start:v2006 End: 2015
Financing for Energy Efficiency: Residential energy efficiency bank-based commercial loan through HFHA Condo, REELIH and SUDEP Projects	Residential energy end-use in space heating and hot-water preparation	Start: 2013; End: 2018
Financing for Energy Efficiency: Eastern European Energy Efficiency and Environment Partnership (ESP)	Facilitation of energy efficiency finance in municipal infrastructure with grant co-financing	Start: 2015 End: ongoing
Financing for Energy Efficiency & Public Procurement for EE: EE-integrated reinforcement of Schools by KfW	Public & service buildings (schools)	Start: 2016 End: 2020
Financing for Energy Efficiency: KfW Housing EE credit line	Residential energy end use, heating, hot-water preparation, lighting	Start: 2016 End: 2020
Financing for Energy Efficiency: KfW EE loans for SMEs – EE credit line	Commercial energy end use, heating, hot-water preparation, lighting, process heat, etc.	Start: 2016 End: 2020
Mitigating Tariff Increase with Low-income Energy Efficiency Programme	Residential energy end use, lighting efficiency	Start: 2015 End: 2016
Sum of savings:		

Achieved energy savings in 2014 toe	Achieved energy savings in 2017 toe	Achieved energy savings in 2018 toe	Achieved energy savings in 2020 toe	Status in relation to 1 st EEAP
341,655	341,655	341,655	341,655	partially completed
30	4,914	5,067	5,067	partially completed
-	-	-	-	partially completed
none, new measure	39,897	39,897	39,897	partially completed
new measure	The exact EE savings depend on the specific measures which will be financed through the subloans	Appropriate indicators and energy-saving forecast will be provided as soon as the project concept is fully developed	0	partially completed
new measure	The exact EE savings depend on the specific measures which will be financed through the subloans	Appropriate indicators and energy-saving forecast will be provided as soon as the project concept is fully developed	0	partially completed
	40,531	58,545	94,573	new measure
381,431.78	1,297,798.45	844,070.60	177,284,847.82	

Source: Second NEEAP



Annex 4:
Abbreviations

Annex 4: Abbreviations

ADS	Armenian Development Strategy
AFD	Agence Française de Développement
AMD	Armenian Dram
CCGT	Combined cycle gas turbine
CDM	Clean Development Mechanism
CNG	Compressed natural gas
DNA	Designated National Authority
E5P	Eastern European Energy Efficiency and Environment Partnership
EBRD	European Bank of Reconstruction and Development
ENA	Electricity Networks of Armenia
FDI	Foreign Direct Investment
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse gas
GoA	Government of Armenia
HPP	Hydro power plant
IEA	International Energy Agency
IFC	International Finance Corporation
IFI	International finance institution
KfW	Kreditanstalt für Wiederaufbau (a German government-owned development bank)
kgoe	kilograms of oil equivalent
KWh	kilowatt hour
MENR	Ministry of Energy and Mineral Resources of the Republic of Armenia
MUD	Ministry of Urban Development of the Republic of Armenia
NEAP	National Environment Action Plan
NEEAP	National Energy Efficiency Action Plan
NPP	Nuclear power plant
NSS	National Security Strategy
PEEREA	Protocol on Energy Efficiency and Related Environmental Aspects
PFI	Private Finance Initiative
PPP	Purchasing Power Parity
PSRC	Public Service Regulatory Commission of the Republic of Armenia

PV	Photovoltaics
R2E2	Armenia Renewable Resources and Energy Efficiency Fund
RISE	Readiness for Investment in Sustainable Energy
RoA	Republic of Armenia
SME	Small and Medium Enterprise
SREP	Scaling Up Renewable Energy Investment Plan
tCO ₂ /a	Tons of carbon dioxide per annum
TFC	Total final consumption
tkm	ton kilometre
toe	tonne of oil equivalent
TPES	Total primary energy supply
TPP	Thermal power plant
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar
VAT	value added tax



Annex 5:
Organizations Met During In-depth
Energy Efficiency Review Mission

Annex 5: Organizations Met During In-depth Energy Efficiency Review Mission

Ministry of Energy and Mineral Resources of the Republic of Armenia
(currently Ministry of Energy Infrastructure and Natural Resources
of the Republic of Armenia)

Ministry of Finance of the Republic of Armenia

Ministry of Agriculture of the Republic of Armenia

Ministry of Urban Development of the Republic of Armenia

Public Service Regulatory Commission of the Republic of Armenia

Armenia Renewable Resources and Energy Efficiency Fund (R2E2)

Alliance to Save Energy
Energocredit

EU Delegation in Armenia

Armenian Office for Covenant of Mayors

United Nations Development Programme (UNDP)

United Nations Industrial Development Organization (UNIDO)

Energy Charter Protocol on Energy Efficiency and
Related Environmental Aspects
PEEREA

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