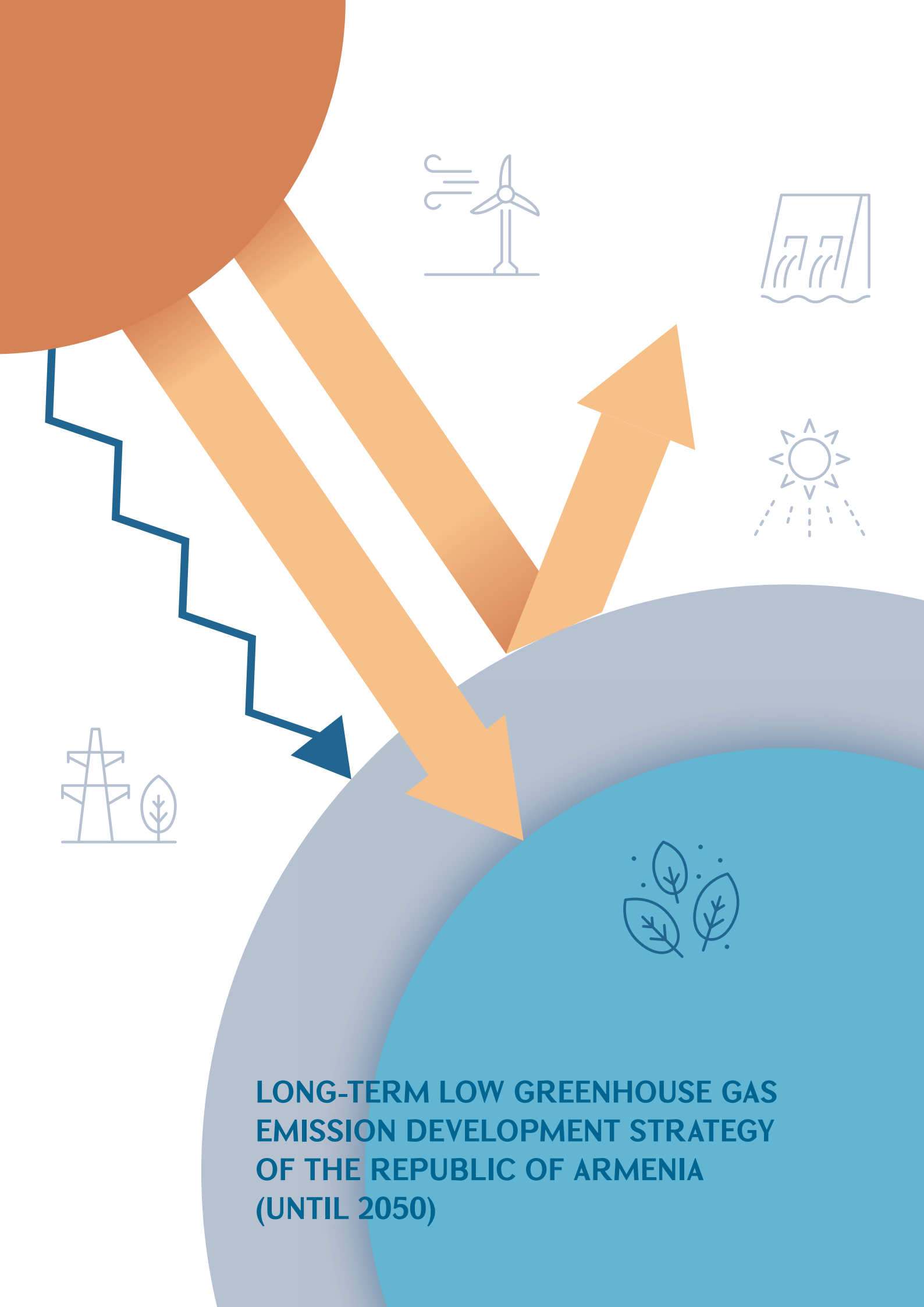

LONG-TERM LOW GREENHOUSE GAS EMISSION DEVELOPMENT STRATEGY OF THE REPUBLIC OF ARMENIA (UNTIL 2050)

The Foreword of the Minister of Environment

The Republic of Armenia aims to mitigate the impacts of climate change in the country and at the same time acknowledges the importance of global efforts to reduce greenhouse gas emissions.

With the adoption of the Long-term Low Greenhouse Gas Emission Development Strategy (until 2050), the Government of the Republic of Armenia reaffirms its ambition to reduce greenhouse gas emissions to 2.07 t CO_2 equivalent per capita by 2050. This goal is in line with both provisions of the Government's program and the international commitments undertaken by the Republic of Armenia.

The Republic of Armenia has entered a phase of high economic growth and structural transformations in the economy. In this context, we strongly acknowledge that in case the growing trends of greenhouse gas emissions are not limited by systemic approaches, the emissions will increase comparably with the economic growth rate.

With this Strategy the Government aims to ensure a long-term agenda for climate commitments, provide early and predictable signals for local and international investors, harmonize development goals with climate actions, as well as systematically consider the climate mitigation possibilities across the entire economy, pursuing to transform the existing challenges into real possibilities.

The implementation of the Strategy, besides reducing the amount of greenhouse gas emissions, will have a positive impact on livelihoods of local communities in terms of improving economic growth, social well-being, environmental protection and safety.

We highly appreciate our continued cooperation with the development partners in tackling climate change. Of course, in addition to the domestic capacities of the economy, it brings significant potential to achieve the long-term vision.

Taking this opportunity, I want to express my gratitude to the European Union and the United Nations Development Programme for the provided support in developing the Strategy.

Hakob Simidyan

Minister of Environment
Republic of Armenia

DECREE

OF THE GOVERNMENT OF THE REPUBLIC OF ARMENIA

28 December 2023 N 2318 - L

ON APPROVAL OF LONG-TERM LOW GREENHOUSE GAS EMISSION DEVELOPMENT STRATEGY OF THE REPUBLIC OF ARMENIA (UNTIL 2050)

Guided by 4 part of article 146 of the Constitution of the Republic of Armenia, parts 2, 5 and 19 of article 4 of the Paris Agreement and 8 part of article 11 of the Law on Government structure and activity, the Government of the Republic of Armenia resolves to:

1) Approve Long-Term Low Greenhouse Gas Emission Development Strategy of the Republic of Armenia (until 2050) in accordance with Annex.

2) For the Chairman of the Inter-Agency Coordinating Council on implementation of requirements and provisions of the United Nations Framework Convention on Climate Change and the Paris Agreement (Council), the Deputy Prime Minister coordinating the environment sector: to ensure hearings of the progress reports on implementation of the actions defined by Long-Term Low Greenhouse Gas Emissions Development Strategy of the Republic of Armenia (until 2050).

3) For the Minister of Environment: to ensure the submission of the progress reports on the implementation of the actions defined by Long-Term Low Greenhouse Gas Emissions Development Strategy of the Republic of Armenia (until 2050) at the Council session and their publication on the official website of the Ministry.

4) This decree shall enter into force on the day following its publication.

PRIME MINISTER
OF THE REPUBLIC OF ARMENIA
N. PASHINYAN
Yerevan

Annex

RA Government Decree

N 2318-L of 28 December 2023

LONG-TERM LOW GREENHOUSE GAS EMISSION DEVELOPMENT STRATEGY OF THE REPUBLIC OF ARMENIA (UNTIL 2050)

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ABBREVIATIONS

ACC	Adaptation to climate change
AIS	Automated information system
ANPP	Armenian Nuclear Power Plant
BUR3	Third biennial update report of Armenia
CC	Climate change
CJSC	Closed join-stock company
DFI	Development finance institution
EBRD	European Bank for Reconstruction and Development
ECA	Export credit agency
ENA	Electric Networks of Armenia CJSC
GCF	Green Climate Fund
GDP	Gross domestic product
GHG	Greenhouse gas
HFCs	Hydrofluorocarbons
HPP	Hydropower plant
ICT	Information and communication technologies
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial processes and product use
ISO	International Organization for Standardization
KfW	German Development Bank (KfW)
KPI	Key performance indicators
LLC	Limited liability company
LT-LEDS	Long-term low greenhouse gas emission development strategy
MRV	Monitoring, reporting and verification platform
NDC	Nationally determined contributions
PV	Photovoltaic
RA	Republic of Armenia
SC	Statistics Committee
TFC	Total fixed cost
TPES	Total primary energy supply
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	UN Framework Convention on Climate Change
UNFPA	United Nations Population Fund
WAM	With additional measures scenario
WM	With measures scenario
WOM	Without measures scenario

ACRONYMS

thou.	thousand
eq	equivalent
mln.	million
bln	billion
toe	ton of oil equivalent

MEASUREMENT UNITS

g	gram
Gg	gigagram (109^9 g or thousand t)
t	tonne
m	meter
m^3	cubic meter
mm	millimeter
cm	centimeter
km	kilometer
km^2	square kilometer
km^3	cubic kilometer
ha	hectare
GJ	gigajoules (10^9 J)
TJ	terajoules (10^{12} J)
kWh	kilowatt hours (10^3 Wh)
MW	megawatt (10^6 W)
GWh	gigawatt hours (10^9 Wh)
m/s	meter per second
^0C	degree Celsius

CHEMICAL COMPOUNDS

CO_2	carbon dioxide
CH_4	methane
N_2O	nitrous oxide
HFCs	hydrofluorocarbons
PFCs	perfluorocarbons
SF_6	sulfur hexafluoride
CO	carbon monoxide
NMVOC	non-methane volatile organic compounds
NO_x	nitric oxides
SO_2	sulfur dioxide

ENERGY UNITS' CONVERSION

1 toe = 41.868 GJ = 11.63 MWh

1 GWh = 3.6 TJ = 86 toe

1. INTRODUCTION

1. Today climate change is a global challenge. Since the 1970s the world has been experiencing a change in climate conditions, it manifests itself in an increase in temperature and decrease in precipitation. As a result of human activity, there was a significant increase in greenhouse gas emissions contributing to the strengthening of the greenhouse effect thus leading to additional warming of the Earth's surface and atmosphere. Climate change currently observed and expected in the future is associated with widespread and irreversible consequences for anthropogenic and natural systems, and carries risks to economic, energy, food security and sustainable development. To minimize these risks, it is necessary to significantly reduce greenhouse gas emissions and promote protection of absorbers and to adapt the systems of administration, economy sectors and infrastructure to changing climate conditions.

2. Climate change has a significant impact on the Republic of Armenia, namely, the number of natural disasters increases and natural cycles change (an increase in the number of droughts, early frosts, forest fires and floods), biodiversity is being decreased. During the period of 1990-2019 deviation of the average annual temperature from the baseline period (1961-1990) was on average +1.23°C. In 2019, a deviation of +1.5°C from annual average temperature for the period of 1961-1990 was recorded. Therefore, despite the insignificant share of Armenia in global anthropogenic greenhouse gas emissions of 0.02%, the country has actively joined the global processes to combat climate change.

3. The Republic of Armenia ratified the UN Framework Convention on Climate Change (UNFCCC) in May 1993, the Kyoto Protocol in December 2002 and its Doha Amendment and Paris Agreement in February 2017. The Paris Agreement is the first legally binding global climate change agreement, which sets out a plan for combating climate change aiming to limit global warming to well below 2°C compared to pre-industrial levels, while striving to reduce it to 1.5°C.

4. Article 4 of the Paris Agreement states that all parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies (LT-LEDS), considering their common but differentiated responsibilities and respective capabilities in light of different national conditions. LT-LEDS shall guide countries on the path to achieving this goal while ensuring that high, sustainable, balanced and equitable growth is harmonized with climate plans. LT-LEDS supports solving a wide range of issues, such as alignment of ambitious development goals and climate measures, provision of a long-term agenda for short- and medium-term commitments, delivery of early and predictable messages to high-emitting sectors and economic entities, consideration of climate change mitigation opportunities across the economy, development of economic policy in line with the trends of technological progress in the context of transforming challenges into opportunities.

5. The program of the RA Government lay emphasis on the issue of increasing the country's resilience to climate change by contributing to implementation of the best adaptation practices, active participation in global efforts towards low-carbon development, and proper fulfilment of international commitments on climate change mitigation.

6. Pursuing these goals and adhering to its international commitments in the fight against climate change, the RA Government implements Long-Term (until 2050) Low Emissions Development Strategy of the Republic of Armenia.

2. MAIN FACTORS INFLUENCING GREENHOUSE GAS EMISSIONS

7. Carbon dioxide (CO_2) emissions dominated in greenhouse gas national inventory report of the Republic of Armenia for 2019, with a share of about 55.7% of the total emissions, followed by methane (CH_4) – of 24.2%, nitrous oxide (N_2O) – of 11.4% and hydrofluorocarbons (HFCs) – for roughly 8.7%.

8. The energy sector (including transport) is responsible for 94.9% of all carbon dioxide emissions, because of high emissions volume from thermal power plants, motor transport and residential sector. Carbon dioxide emissions from IPPU sector made about 5.0% of total carbon dioxide emissions. Carbon dioxide emissions from the waste sector are negligible.

9. Methane emissions are mostly from the energy sector (with its share of 44.6%) due to fugitive emissions from natural gas system. The second largest source of methane emissions is the agriculture sector (with its share of 35.0%) where the emissions are mainly produced due to cattle enteric fermentation. The waste sector is the third (with its share of 20.4%).

10. Most of nitrous oxide emissions (91%) are from the agriculture sector mainly due to nitrogen fertilizer management and direct and indirect emissions from managed soils.

11. Emissions share of HFCs (from the use of refrigerators, air conditioners and other appliances) and sulfur hexafluoride (from the use of electrical equipment), is continuously increasing.

Energy sector

12. The energy sector is by far the largest producer of GHG emissions. In 2019, the energy sector accounted for 64.0% of Armenia's total GHG emissions (66.2% of net emissions). The energy sector includes emissions from the use of fuels to generate energy including fuel used in transport and fugitive emissions related to transmission, storage, and distribution of natural gas.

13. In 2019, Armenia produced 7,642.5 mln kWh electricity, of which 28.8% came from nuclear power plant, 39.9% – from thermal power plants, 31.0% – from hydro power plants, and 0.4% – from wind and solar plants. Since 1990, Armenia gradually and completely phased out mazut from the electricity production.

14. In 2019 the energy sector greenhouse gas emissions decreased by 3.2 times compared to the year 1990, while Total Primary Energy Supply (TPES) decreased by 2.4 times, which is an evidence of low-carbon development trends in the economy of Armenia. Key factors for such trends are the structural changes in economy towards the increased share of services sector and decreased share of energy intensive industries, replacement of mazut with natural gas in energy production, significant increase in the use of natural gas in the transport sector, which replaced diesel and gasoline, recommissioning of Armenian Nuclear Power Plant, increasing share of renewable sources and energy efficiency actions.

15. Greenhouse gas emissions from **residential subsector** make up 19.1% of the energy sector emissions. In the residential sector of Armenia 50.3% are individual houses and 49.7% are multi-apartment buildings.

16. In 2015 UN and PACE estimated that 6% of Armenia's multi-apartment buildings is in "good" condition; 64% is "fair"; and 30% is "poor". Around 75% of multi-apartment buildings were built in 1951-1990, and they do not meet the requirements of thermal protection.

17. Natural gas consumption (68.5%) is dominant in the energy consumption structure of households, while natural gas and electricity together cover 89.2% of energy consumption. The share of renewables in energy resources remains low. In 2019, solar energy consumption in the household sector amounted to 4.3 ktoe or 0.5% of the total energy consumption.

18. **Transport subsector** generated 30.1% of the energy sector greenhouse gas emissions in 2019. Armenia is landlocked and has serious transport constraints that affect economic competitiveness due to high transport costs and expensive infrastructure development and maintenance. According to international comparisons in the current level of economic development the transport sector in Armenia is energy intensive.

19. In terms of decarbonization of the economy the most crucial role plays the fact that more than 60% of motor vehicles in Armenia already use natural gas as a fuel. In this regard, the structure of the vehicle fleet and the state of public transport are decisive factors.

20. 85% of vehicles in the RA are passenger cars. According to the data of the first half of 2022 the share of electric vehicles in the structure of the vehicle fleet is less than 3%; there are more than 100 charging stations for electric vehicles.

21. Modernization and popularization of public transport, development of electric transport, expansion of electric vehicles usage, and development of suitable infrastructure are pivotal in terms of decarbonization of the transport sector.

22. Other significant emission source in the energy sector were **fugitive emissions of natural gas**, share of which in 2019 was 15.7%.

Agriculture, Forestry and Other Land Use

23. The second largest source of GHG emissions was the agriculture sector with a share of 18.8% of total emissions (19.5% of net emissions) excluded forestry and other land use. Emissions from the agriculture sector include methane emissions from enteric fermentation of domestic livestock, manure management and biomass burning, nitrous oxide emissions from manure management, biomass burning and from managed soils.

24. 95.6% of the total methane emissions from agriculture came from enteric fermentation, and 4.0% from manure management, while 4.7% of the total nitrous oxide emissions from agriculture came from manure management and 95.2% from soils management.

25. **Forestry and other land use category** acted as a carbon dioxide sink: the net removals were 373.0 Gg CO_2 eq in 2019.

26. Irregular cuttings and insufficient forest protection measures resulted in reduction of carbon sink potential of forests, as well as increase of fire risk.

Industrial Processes and Product Use

27. In 2019, this sector emissions accounted for 11.5% of Armenia's total GHG emissions (11.9% of net emissions). Emissions from this sector include non-energy related carbon dioxide emissions from mineral industry – cement, lime and glass production, carbon dioxide emissions generated from lubricant and paraffin use, HFCs emissions from use of refrigerators, air conditioners and other appliances, as well as sulfur hexafluoride emissions from use of electrical equipment. Emissions from the sector include also sulfur dioxide emissions from metal industry, non-methane volatile organic compounds emissions from solvent use, asphalt production, as well as food and beverage production.

28. The most significant carbon dioxide emissions' source in this sector is cement production (258.95 Gg CO_2), which accounts for 82.2% of the CO_2 emissions from the sector and 2.4% of Armenia's total CO_2 emissions.

29. Emissions from the use of HFCs, substitutes for ozone depleting substances in refrigeration and air conditioning systems made 969.5 Gg CO_2 eq, while SF_6 emissions from the use of electrical equipment are negligible – only 3.3 Gg CO_2 eq.

Waste sector

30. The main emissions of the waste sector are from landfills (CH_4), combustion of waste (CO_2, CH_4 and N_2O) and wastewater treatment (CH_4, N_2O). The waste sector emissions amounted to 628.7 Gg CO_2 eq in 2019, which accounts for 5.6% of the total emissions (5.8% of net emissions). Landfill emissions accounted for 67.2% of the total waste sector emissions, while emissions from the combustion of waste accounted for 3.3%, and emissions from wastewater treatment accounted for 29.5% of the total waste sector emissions.

31. Landfill emissions are the result of significant underdevelopment of waste management system, where best available technologies and practices are not yet introduced. Realization of certain national and regional solid and municipal waste management programmes in coming years combined with additional climate-specific measures should be the key to reducing the waste sector emissions.

3. LT-LEDS SCENARIO MODELLING

32. Low-carbon development goals of Armenia are considered under three scenarios.

33. **The Without Measures (WOM)** scenario does not involve taking any measures and actions to reduce GHG emissions. This scenario assumes emissions growth in all sectors: energy, industrial processes, agriculture, forestry and other land use, waste.

34. The **With Measures (WM)** scenario includes ongoing and planned measures to reduce GHG emissions for all considered sectors. This scenario envisages an increase in forested areas, which will increase carbon sink capacity, thus reducing GHG emissions, as well as additional measures in energy, industrial processes, agriculture and waste sectors. This scenario, if implemented, makes it possible to achieve the 2030 target.

35. The **With Additional Measures (WAM)** scenario is ambitious and, if implemented, makes it possible to achieve the 2030 and 2050 targets.

36. Each scenario is comprehensively represented by GHG emissions in five sectors under consideration: energy, industrial processes and product use, agriculture, forestry and other land use and waste.

37. Historical and forecasted data for the period till 2028 were taken for GDP series. Scenario modelling is based on the assumptions that in the long-term GDP of Armenia will grow by an average of 4% per annum, and the population will reach 5 million by 2050.

38. GHG emissions projections were made based on regression analysis of time series for the above five sectors. The dependence on real GDP of the GHG emissions data of each sector was estimated. Based on model parameters, i.e. slope and intercept, projections for 2031-2050 were made for each sector according to WOM, WM and WAM scenarios.

39. Modelling of the **energy sector** was carried out for 2012-2030 based on the results obtained using the LEAP model and continued till 2050 per measure. In addition to the available input data, demographic and macroeconomic long-term vision and expert assumptions on possible factors were used in the model. Data on sectors for 2012-2019 were taken from GHG inventory reports. 2020, 2025 and 2030 forecasts were taken from the RA BUR3. Missing data (2020-2025 and 2020-2030) was filled by uniform linear distribution in line with known upper and lower values of each year of time series. Fugitive emissions of methane gas from the natural gas system were also included in the study as separate time series.

40. Modelling of **industrial processes and product use, agriculture, and waste** sectors for the WOM scenario was carried out based on 1995-2019 time series. 1990 was not included in the time series, since 1990 values do not represent a number of GHG emissions observations and were considered non-representative.

41. In the calculations of **forestry and other land use** sector projections, carbon absorption from the atmosphere was estimated for two subcategories of forest land: "Forest land remaining forest land" and "Land converted to forest land".

    1) **Forest land remaining forest land** – these lands should not have had land use changes

for more than 20 years preceding the reporting year. In this subcategory the forested areas of Armenia were considered, which did not have land use changes for more than 20 years.

2) **Planting of new forests is deemed to be the subcategory of "Lands converted to forest land" in 2006 IPCC guidelines.** These lands are in a transition stage and have been converted from other land to forest land as a result of land use changes for 20 years preceding the reporting year. The dynamics of changes in the area of newly planted forests before 2030 and 2050 served as a basis for calculations. According to 2006 IPCC guidelines under the forest land categories changes in carbon stock in living biomass, dead organic matter, soil, and greenhouse gases other than CO_2 released in biomass burning are estimated. However, due to lack of complete data, GHG sink/emission were estimated only for living biomass. In the conditions of Armenia, forests are the main source of carbon sink/emission, accounting for about 99% of the annual carbon sink.

42. The calculations were made based on the data on forested areas of the country, areas of newly planted forests, using the software package of IPCC guidelines.

1) Average annual growth of natural forests in above-ground biomass (GW): GW = 0.835 oven-dry tonnes/ha is the GW average weight, which was derived per forest zones and tree species based on studies conducted in the region. It was calculated based on the average annual growth of natural wood in 1 hectare of forested areas in Armenia: 1.5 cubic meter/ha, and the average basic wood density: 0.557 oven-dry tonnes/moist cubic meter derived per tree species – GW = 1.5 cubic meter/ha x 0.557 oven-dry tonnes/moist cubic meter = 0.835 tonnes d.m./ha.

2) Comparison of the GW factor calculated for Armenia with the values assigned in Guidelines (2006 IPCC Guidelines, Volume 4, Chapter 4, Table 4.9) shows that it is in the range of values provided for the forests of mountain systems of temperate zone – R = 0.23 tonne d.m./ (tonne d.m.) for above-ground biomass of 75-150 t/ha.

3) Above-ground to below-ground biomass ratio (R) is taken from 2006 IPCC Guidelines (2006 IPCC Guidelines, Volume 4, Chapter 4, Table 4.4, with reference to above-ground biomass in Table 4.7), which was chosen per climate zone – temperate zone and per ecological zone – temperate zone mountain systems. GTOTAL = 0.835 tonnes d. m. annual /ha x (1+0.23) = 1.027 (equation 2.10): CF = 0.48 tonne C/ (tonne d.m.). Carbon fraction of dry matter of 0.48 tonne C/ (tonne d.m.) is taken from 2006 IPCC guidelines (2006 IPCC Guidelines, Volume 4, Chapter 4, Table 4.3) which was chosen per temperate climate zone.

43. The projections made using the described regression analysis methodology were subsequently adjusted as follows:

1) Forecasts of electricity generation volume and demand for the energy sector were adjusted considering projected growth of population and final energy consumption percentage in energy and transport sectors, which is 33%.

2) Data forecasted for the sectors for 2025-2030 as a result of regression analysis conducted based on 1995-2019 series for other sectors under WM and WAM were further adjusted for the reduction rate of the energy sector.

44. UNFPA and the RA Statistical Committee data were used as basic data on **population**. Based on the targeted growth of population of 5 million by 2050, the population has been increased linearly on an even basis from 2024 to 2050.

45. Calculation model for WM and WAM scenarios incorporated various GHG emission reduction measures and introduced new **renewable energy** capacities. Reductions resulting from these activities were deducted from total GHG emissions per sector.

46. Solar, wind, hydro and nuclear energy was converted from capacity (MW) to emissions (Gg) using the number of hours in a year, Armenia's grid emission factor (0.436 t CO_2 eq/MWh) and capacity factors (93% for nuclear energy, 25% for solar energy, 35% for wind energy and 37% for hydro energy).

47. Nuclear energy values for the period after 2036 were converted and subtracted from the corresponding years. At the same time, half of the converted values was deducted from the electricity generation sector, and the other half from the demand sector. Converted value of nuclear energy was deducted till 2050 for two sectors. This assumption is again based on the fact that if the capacity figure is ensured, it will continue to be generated at the same level till 2050.

48. Reductions in **fugitive emissions from natural gas storage and transmission** were calculated based on changes in the electricity mix, i.e. reduction in the share of natural gas and expansion of renewable energy resources.

49. Data on **forest areas** for WM and WAM scenarios take into account the indicators expected as a result of the implementation of the forest sector development policy, as well as the country's commitments, which were converted to GHG emissions Gg CO_2 eq using the IPCC methodology.

50. Reductions in GHG emissions from enteric fermentation in **agriculture, forestry and other land use sector** were calculated based on the number of imported improved breeds. The quantitative effect (reduction in emissions) of increased feed digestibility of cattle was calculated based on cows' total number forecast. The forecasts in 2050 were made by extrapolating the values projected by the strategy of the main directions ensuring economic development in agricultural sector of the Republic of Armenia for 2020-2030. Reductions in the irrigation sector were calculated based on the area of irrigated land. Data on reductions was taken from BUR3.

51. Potential GHG reductions from the use of **fertilizers** were calculated using the emission rates of carbamide and nitrogen oxides taken from the IPCC Guidelines for National Greenhouse Gas Inventories.

52. For calculation of **biogas, decarbonization of buildings and landfill gases** data on GHG emission reductions provided by BUR3 were used.

53. GHG emission reductions in the **transport** sector were calculated based on the number of imported electric vehicles and reduction of the total number of vehicles.

54. Data on emissions in **cement production** were also calculated using the factors of the IPCC Armenia project.

4. LT-LEDS TARGET AND ITS LINKAGE WITH NDC TARGET

55. By Intended nationally determined contributions 2015 (INDC), the Government has set a long-term target for GHG emissions reduction until 2050, declaring the intention to achieve ecosystem climate neutrality. In 2021 the implementation period by the revised 2021-2030 NDC was fixed 2030 and mitigation target to 40% below 1990 levels was set at the same time ensuring that the 2015 long-term target set by the INDC is maintained.

56. **For the long term, the RA Government has set a target to reduce GHG emissions to 2.07 t CO_2 eq/capita by 2050.**

57. The timeline of the most part of the RA strategic documents is until 2030 or 2040. Based on these documents LT-LEDS provides a long-term decarbonization vision until 2050, outlining key policies of GHG emitting sectors.

58. The NDC goal for 2030 is not to exceed the GHG emission in amount of 15,047 Gg CO_2 eq, which supposes to reduce emissions by 40% compared to 1990. If the WOM scenario is implemented, it will not be possible to achieve the 2030 target and it will be necessary to reduce another 3,830.7 Gg CO_2 eq. With the implementation of the WM and WAM scenarios the set target of 2030 will be achieved (see Figure 1).

59. When implementing the WOM and WM scenarios, it is impossible to achieve the 2050 target, it is necessary to reduce GHG emissions by 7.2 and 1.9 Gg CO_2 eq/capita respectively. However, with the implementation of the WAM scenario, the target is achievable already from 2038 (see Figure 2).

60. Sectoral scenarios until 2050 formed based on predicted indicators are presented in Table 1.

Figure 1. Gross GHG emissions under the WOM, WM and WAM scenarios by 2030, Gg CO2 eq

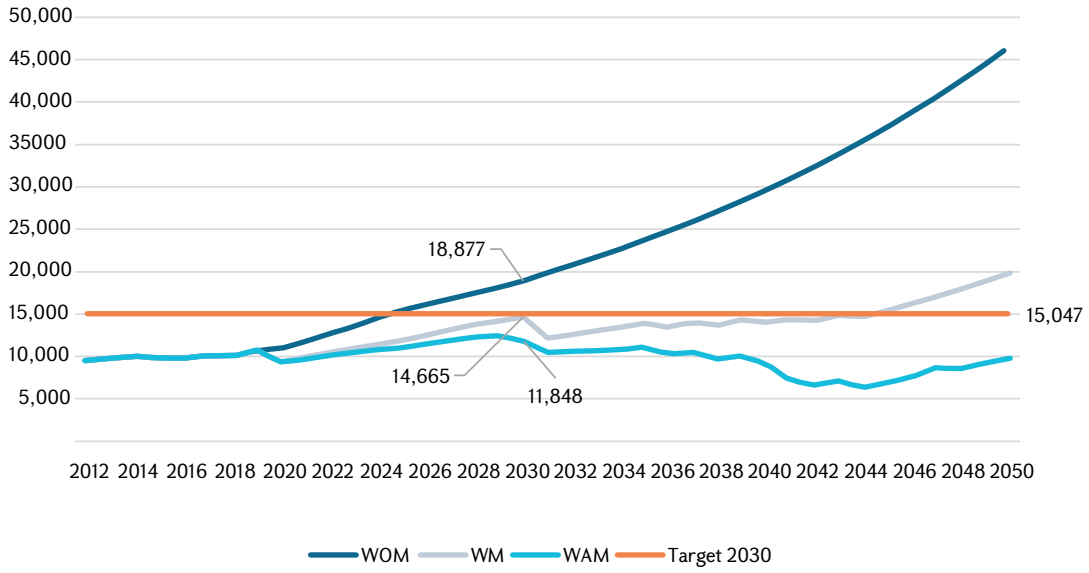


Figure 2. GHG emissions under the WOM, WM and WAM scenarios by 2050, tonne CO2 eq per capita

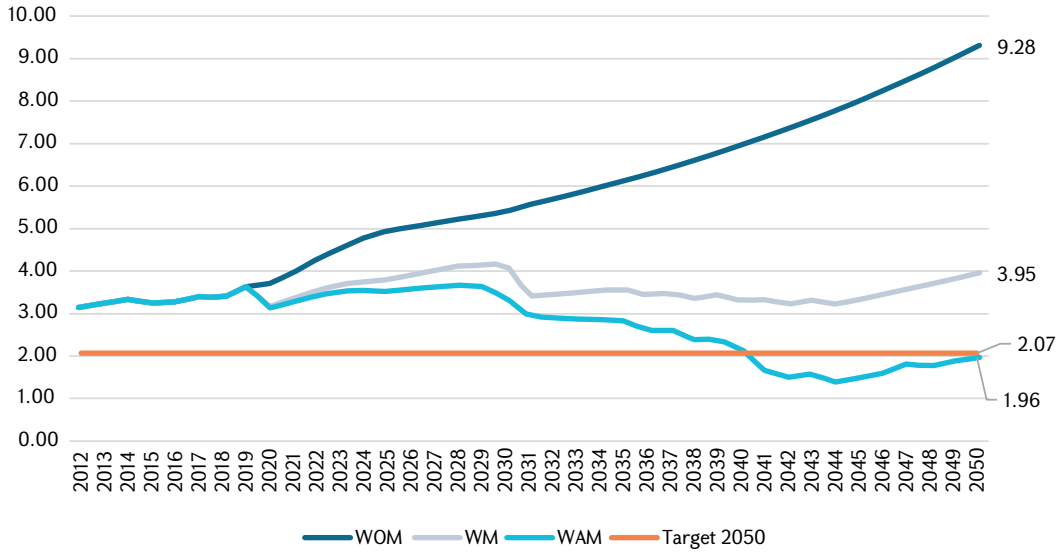


Table 1. GHG emissions calculated by sectors and years, Gg CO_2 eq

	2030			2040			2050		
	WOM	WM	WAM	WOM	WM	WAM	WOM	WM	WAM
Targeted gross GHG emissions	**15,047**						**10,350**		
Net GHG emissions	18,877	14,665	11,848	29,603	14,064	9,197	46,412	19,765	9,777
Energy	14,522	11,153	8,934	23,556	11,416	7,745	37,860	17,099	8,561
Energy generation	5,226	2,398	1,511	10,000	3,201	811	17,735	5,553	1,288
Fugitive emissions	2,951	2,560	1,453	4,420	1,121	776	6,567	1,563	980
Transport	2,876	2,808	2,706	4,141	3,109	2,688	6,145	4,492	2,769
Construction materials	2,704	2,639	2,543	3,893	3,074	2,615	5,777	4,183	2,324
Other demand	766	747	720	1,102	911	855	1,636	1,307	1,200
Industrial Processes and Product Use	1,729	1,442	1,280	2,665	1,594	1,172	4,050	1,725	1,334
Agriculture, Forestry, and Other Land Use (without Forestry and Other Land Use)	2,491	2,078	1,714	3,088	1,882	1,193	3,972	1,967	1,044
Waste	768	641	569	927	298	212	1,162	484	348
Forestry	-633	-648	-648	-633	-1,125	-1,125	-633	-1,510	-1,510

5. LT-LEDS DEVELOPMENT SCENARIOS

61. The above-mentioned three scenarios of low-emission development of Armenia are built based on the below set of sectoral developments.

62. Reduction in GHG emissions in the **energy sector** is to be achieved by the introduction of new renewable and nuclear energy capacities.

63. Under scenarios WM and WAM, the target capacity of solar energy is planned to increase by 1500 MW by 2050. Total GHG emissions reduction for 2023-2050 period should be 26,105 Gg CO_2 eq.

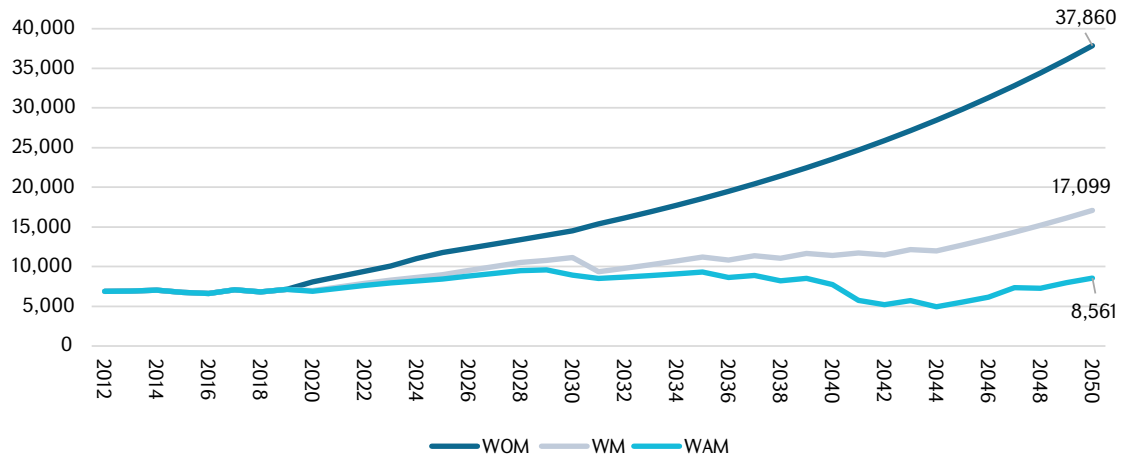
64. For both WM and WAM scenarios the role of nuclear power is crucial. It is planned to complete the construction of the nuclear power plant by 2036 and start its operation. It is estimated that it will reduce GHG emissions by 3,675 Gg CO_2 eq in 2050, or 41,416 Gg CO_2 eq in total for 15 years.

65. Additionally, the WAM scenario implies introduction of wind- and hydropower capacities. It is assumed that wind energy capacities will increase from 2031 and reach 500 MW in 2040. (maintaining capacity until 2050). As a result, the total reduction of GHG emissions for 2031-2050 should be 10,360 Gg CO_2 eq. The installed capacity of small hydropower plants is planned to increase from 380 MW to 430 MW by 2040. In addition, the construction of three HPPs with total capacity of 241 MW during 2040-2050 period is also considered in this scenario. As a result of the mentioned measures in hydropower field, it is planned to reduce GHG emissions by 2,425 Gg CO_2 eq during 2031-2050.

66. Another assumption was introduced into the model, according to which fugitive emissions would also be reduced based on the accepted targets for decrease of system losses and the expected reduction of the share of natural gas in the country's energy mix due to introduction of alternative energy sources.

67. Fugitive emission values in 2050 will be: WOM scenario - 6,567 Gg CO_2 eq, WM scenario – 1,563 Gg CO_2 eq, and WAM scenario - 980 Gg CO_2 eq. Under the WM and WAM scenarios the amount of fugitive emissions reduction in 2031-2050 will be 5,004 Gg CO_2 eq and 5,587 Gg CO_2 eq respectively compared with WOM scenario (see Figure 3).

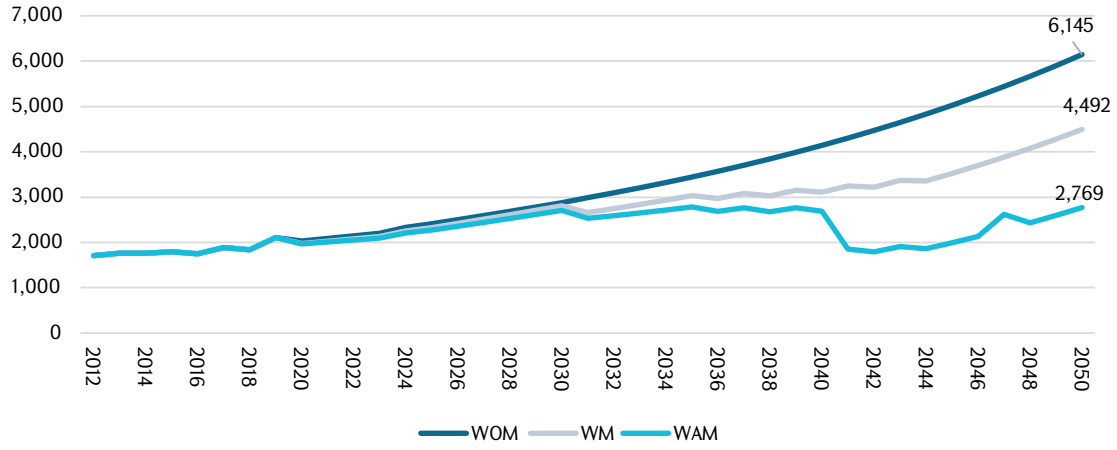
Figure 3. Energy sector GHG emissions, Gg CO_2 eq



68. In the **transport subsector** the increase in the number of electric cars is of key importance. According to the WM scenario 50,000 new electric cars are expected to be imported by 2030. By 2050 it is planned to gradually increase the number of electric cars to 200,000, which will reduce emissions by 6,620 Gg CO_2 eq during 2030-2050. In addition, the expansion of the hybrid format of work will provide a 10% reduction in the number of natural fuel powered cars and will lead to a total emission reduction of 3,099 Gg CO_2 eq within 10 years during 2041-2050.

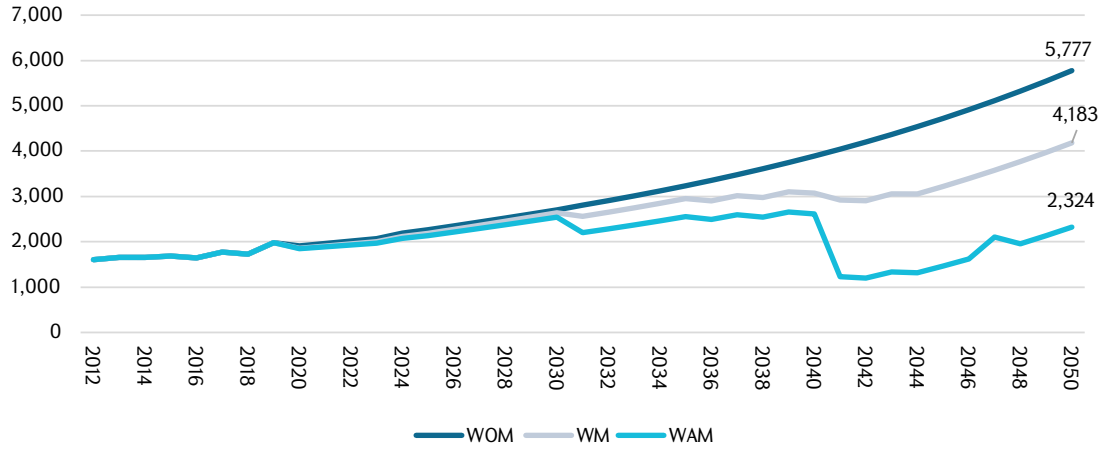
69. For the WAM scenario the replacement by 400,000 electric vehicles by 2050 is expected to provide a total of 11,034 Gg CO_2 eq emissions reduction. The expansion of the hybrid work format will allow to reduce the number of natural fuel powered cars by 40% and will lead to a total emission reduction of 9,175 Gg CO_2 eq within 10 years from 2041 (see Figure 4).

Figure 4. Transport subsector GHG emissions, Gg CO_2 eq



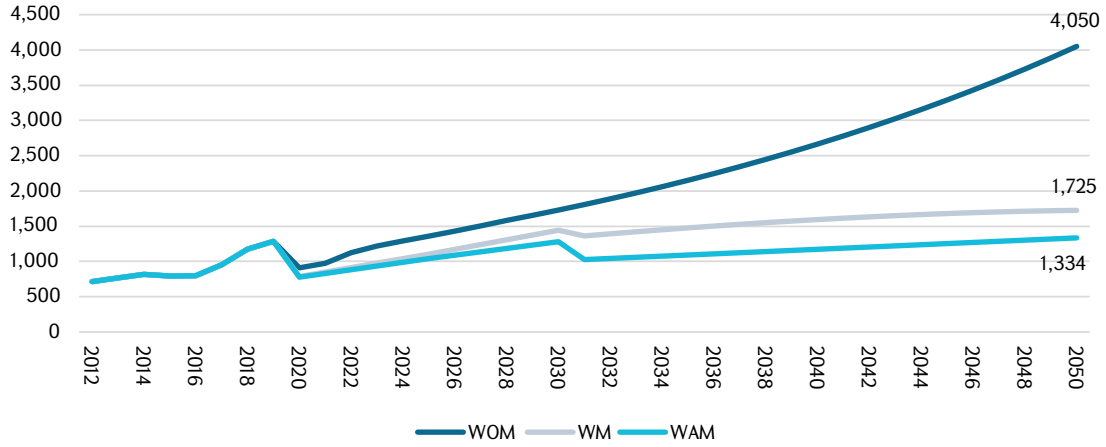
70. In the **residential subsector** (only multi-apartment buildings) it is planned to continue to improve the energy efficiency of new and retrofitted buildings. In the WM scenario it will allow to reduce emissions by 5,800 Gg CO_2 eq during 2031-2050. The WAM scenario assumes that GHG emissions reduction during 2031-2050 would be 23,200 Gg CO_2 eq (see Figure 5).

Figure 5. Residential subsector GHG emissions, Gg CO_2 eq



71. In the **Industrial Processes and Product Use** sector reductions in GHG emissions will be achieved throughout modernization of equipment and upgrade of technological processes, primarily in cement production. For the WM scenario total reductions from 2030 to 2050 are 3,492 Gg CO_2 eq. In the WAM scenario a more progressive measure would result in 9,323 Gg of CO_2 eq GHG emissions reduction for the same period (see Figure 6).

Figure 6. IPPU sector GHG emissions, Gg CO_2 eq



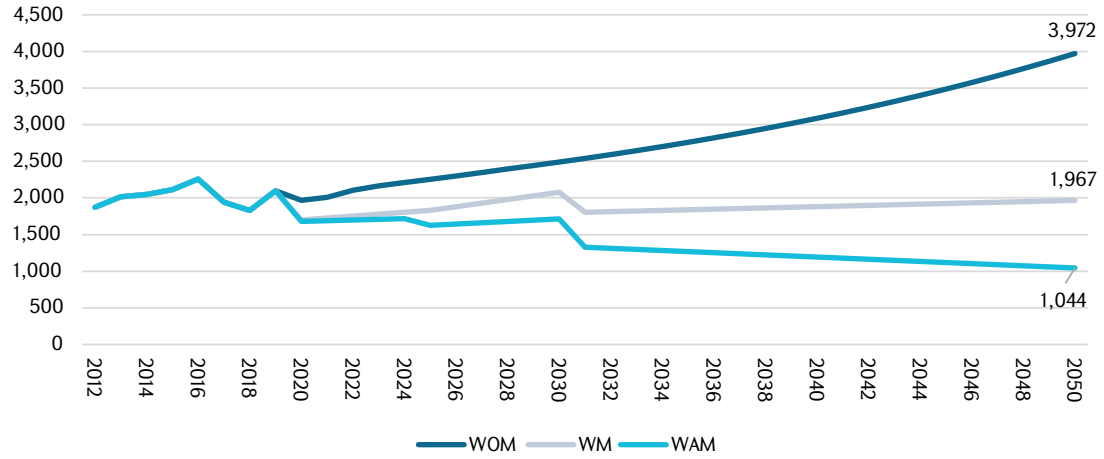
72. In the **agriculture sector** it is planned to reduce GHG emissions throughout manure management and receiving biogas, improving irrigation conveyance efficiency, and importing cattle with higher feed digestibility (see Figure 7).

73. Throughout manure management and receiving the biogas in WM scenario it will allow to achieve 3,240 Gg CO_2 eq reduction from 2031 to 2050. The WAM scenario implies 3,860 Gg of CO_2 eq reduction.

74. Improved irrigation conveyance efficiency and reduction of energy consumption in irrigation schemes of 36 thousand hectares in the WM scenario will allow to gain the total GHG reductions of 1,313 Gg CO_2 eq from 2031 to 2050. Implementation of these measures on 232 thousand hectares in the WAM scenario would ensure 7,543 Gg of CO_2 eq reduction.

75. It is also planned to import cattle with higher feed digestibility. 3,000 cattle will be imported each year according to the WM scenario, which will reduce emissions by 1,206 Gg CO_2 eq during 20 years (2031-2050). Import of 10,000 new breeds yearly would cause 1,625 Gg CO_2 eq reduction as displayed in the WAM scenario.

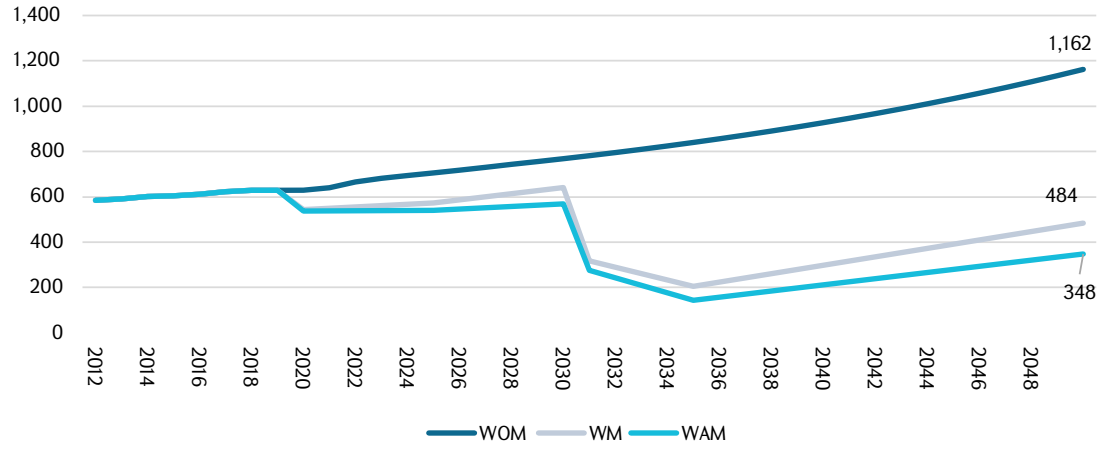
Figure 7. Agriculture, forestry, and other land use sector GHG emissions, Gg CO_2 eq



76. Activities planned for the **waste sector** include establishment of landfill gas capture and utilization plants, reduction of organic waste and introduction of a separate collection system, elimination of open burning, as well as implementation of the best available technologies in the process of utilization, particularly incineration of hazardous waste. These measures will reduce a total of 5,880 Gg CO_2 eq over 20 years (2031-2050) according to both WM and WAM scenarios.

77. The collection and use of biogas from wastewater treatment facilities with at least 50% of wastewater utilized in 2050 will reduce 735 Gg CO_2 eq between 2031 and 2050 according to the WM scenario. The WAM scenario requires complete utilization doubling the reduction to 1,470 Gg CO_2 eq (see Figure 8).

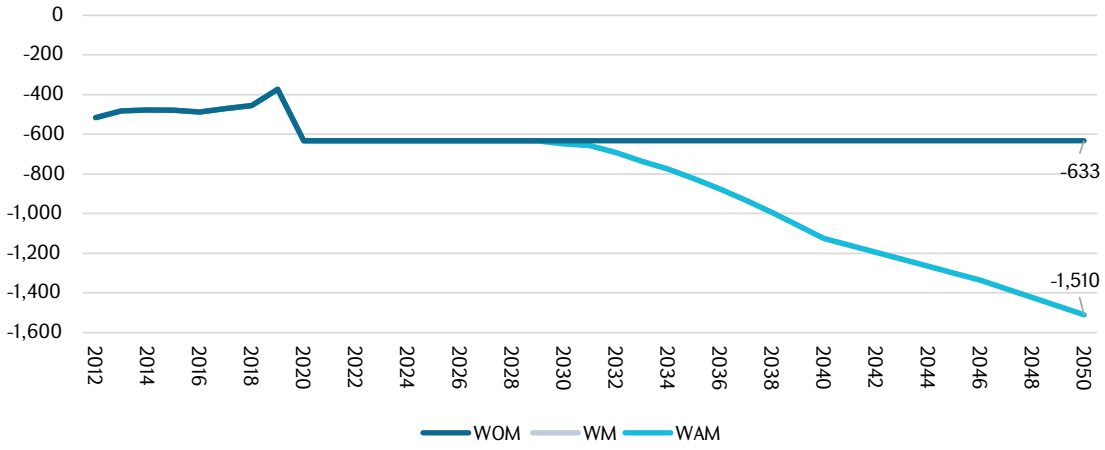
Figure 8. Waste sector GHG emissions, Gg CO_2 eq



78. In the **forest land sector** (includes the forested areas of the timber fund, specially protected areas and agricultural land) it is planned to increase the forest area, improve reforestation and sustainable forest management practices by expanding carbon sink potential. For the WOM scenario for 2050 the targeted forest area is 350,891.2 hectares.

79. Within the WM and WAM scenarios, the possibility of up to 450,000 hectares of forest covered area is considered. In general, over 20 years (2031-2050) the total CO_2 absorption will amount to 21,934 Gg CO_2 eq. The WM and WAM scenarios match (see Figure 9).

Figure 9. Forestry GHG emissions, Gg CO_2 eq



6. PRIORITIES AND MEASURES FOR IMPLEMENTATION OF LT-LEDS

1. Structuring and classification of key actions

80. Significant reductions in GHG emissions and CO_2 sink enhancement require fundamental changes in production and consumption patterns, major transition from the unsustainable combustion of natural fuels to carbon-free technologies, large-scale application of green innovation in the energy, industry, transport, multi-apartment buildings, agriculture, forestry, land use and waste management sectors. Therefore, actions of different nature and levels will be implemented.

81. **Supporting actions** include state support programs to assist initiatives in the field of GHG reduction and increase in GHG absorption (for example, support for the large-scale introduction of renewable energy sources, creation of various mechanisms for climate-projects financing).

82. The Government puts emphasis on measures aimed at maximizing the use of own energy resources (i.e. energy independence) and focuses on renewable energy sources and energy efficiency.

83. The Government plans to introduce mandatory accounting for low-carbon activities through implementation of international standards (e.g. ISO standards). The possibility of introducing favorable business conditions for entities implementing low- and carbon-free technologies will be considered.

84. **Market actions** include introduction of a GHG trading system and achievement of net zero greenhouse gas emissions.

85. **Limiting actions** include introduction of quotas for GHG emissions, introduction of internal and external fees and penalties for exceeding certain limits on GHG emissions.

86. LT-LEDS also targets implementation of policy and measures at various levels.

87. On the **strategic** level the Government aims at ensuring decarbonization processes throughout major framework and sectors wide policy initiatives, enhancing research and development (R&D), education and awareness, offering favorable fiscal conditions.

88. On the **tactical** level the Government mainly focuses on improving regulatory field in order to facilitate the emissions reduction and carbon sink growth in key sectors.

89. On the **technical** level the Government provides key sector-specific solutions, which in case of being implemented have a direct impact on achieving GHG emissions reduction and carbon sink targets.

2. Key measures

90. Table 2 below presents the key measures based on which LT-LEDS scenarios have been built.

Table 2. Measures per scenarios (WM and WAM)

Measure	Quantitative goals by 2050	With Measures (WM)			With Additional Measures (WAM)		
		Timeframe	GHG emissions reduction Gg CO_2 eq	Estimated cost (AMD mln.)	Timeframe	GHG emissions reduction Gg CO_2 eq	Estimated cost (AMD mln.)
1) **Nuclear power**							
1) Implementation of the ANPP unit 2 design lifetime extension for 2026-2036 by 2030, construction of nuclear unit with replacing capacity on the ANPP site after the expiration of the ANPP unit 2 design lifetime (including its extensions)	1,060 MW (WM&WAM)	2036-2050	2050 – 3,765 Total – 41,416	140,000 – 650,000	2036 - 2050	2050 – 3,765 Total – 41,416	140,000 – 650,000
2) **Solar power**							
2)Solar PV construction according to the RA Energy Sector Development Strategy (until 2040) 3)Introduction of new SPV capacities in 2040-2050	1,500 (WM&WAM)	2023– 2050	2050 – 1,432 Total – 26,105	Above 600,000	2023–2050	2050 – 1,432 Total – 26,105	Above 600,000
3) **Wind power**							
4)Wind power construction according to the RA Energy Sector Development Strategy (until 2040), MW 5)Introducing new production-scale wind power capacities, MW	500 MW (WAM)	-			2025-2050	2050 – 668 Total – 10,360	Above 250,000

6) Introducing utility-scale wind power capacities, MW							
4) **Hydro power**							
7)Construction and operation of small hydropower plants 8)Construction and operation of three new HPPs	from 380 to 450 MW (WAM) 210 MW (WAM)	-			2036 – 2050	2050 - 411 Total – 2,425	Above 250,000
5) **Sequestration of carbon dioxide (forestry)**							
9)Increasing the forest coverage and forests absorption capacity	up to 450,000 hectares (WM&WAM)	2031 – 2050	2050 - 1,510 Total – 21,934	Above 90,000	2031 – 2050	2050 - 1,510 Total – 21,934	Above 90,000
6) **Transport**							
10) Increasing the number of electric vehicles	200,000 EVs (WM) 400,000 EVs (WAM)	2031 – 2050	2050 - 420 Total – 6,620	Infrastructure construction investment above 420,000	2031–2050	2050 - 841 Total –11,034	Above 450,000
11) Gradual decline of 1% or 4% per annum in the traditional fuel vehicles market due to popularization of the hybrid format of work and reduction in need for daily transportation to the workplace	10% (WM) 40% (WAM)	2041 – 2050	2050 - 323 Total – 3,055		2041-2050	2050 - 898 Total – 9,175	
7) **Industrial Processes and Product Use**							
12) Introduction of new technological approaches and implementation of projects aimed at increasing energy saving and energy efficiency and reduction of emissions in cement production, in particular:	Energy savings Composition of cement	2031 – 2050	2050 - 391 Total – 3,492		2031-2050	2050 - 642 Total – 9,223	

a. reduction of the clinker content of cement products. b. increase of the energy efficiency of kilns. c. installation of power management systems and the utilization of energy efficient equipment such as high-pressure grinding rolls for clinker comminution and variable speed drives for fans. d. utilization of the heat from cement production. e. minimization of the shell heat losses of equipment.							
8) **Energy saving and energy efficiency in buildings**							
13) "De-risking and Scaling-up Investment in Energy Efficient Building Retrofits" UNDP-GCF project 14) Increasing the efficiency of heating and cooling systems and introducing high energy efficiency standards for new buildings (class A) 15) Thermo-modernisation of existing buildings, not less than XX m2/year, connection of renewable energy resources installations for heat and power supply of buildings 16) Automated (smart) control systems for lighting and heating in public areas 17) Reduction of heat loss through hot water or air supply network	Energy savings (GWh/ year) At least % of residential and public buildings (including retrofitted and new buildings) meet energy efficiency requirements of at least class C	2031 – 2050	2050 - 435 Total – 5,800		2031-2050	2050 - 1,914 Total – 23,200	

18) Establishment of municipal energy management units							
9) **Agriculture, Forestry and Other Land Use (without Forestry and Other Land Use)**							
19) Reduction of methane emissions from cattle manures management	Captured methane	2031 – 2050	2050 - 200 Total – 3,240		2031-2050	2050 - 250 Total – 3,860	
20) Reduction of energy consumption and improved irrigation conveyance efficiency in irrigation schemes	Hectares (ha) with improved irrigation and drainage services 36,000 (WM) 360,000 (WAM)	2031 – 2050	2050 - 82 Total - 1,313		2031-2050	2050 - 531 Total – 7,543	
21) Reduction of methane emissions from the cattle's enteric fermentation 22) Import, breeding of animals with high digestibility of fodder, crossing with local cows to improve the local Caucasian grey breed and reduce the number of the local breed	The number of new breeds: 240,000 (WM) 380,000 (WAM)	2031–2050	2050 - 68 Total – 1,206	Infrastructure construction investment above 400,000	2031-2050	2050 - 108 Total – 1,624	Above 600,000
10) **Waste**							
23) CH_4 emission reduction through the capture and combustion of landfill gas	Captured landfill gas (WM&WAM)	2031–2050	2050 - 140 Total – 5,880		2031-2050	2050 - 140 Total – 5,880	
24) Introduction of organic waste processing facilities (aerobic stabilization (composting) and/or anaerobic digestion with biogas and fertilizer production) and waste gasification plants (with energy and/or chemical production) 25) Biogas in all wastewater treatment plants	Utilization of the sewage sludge, % (WM&WAM)	2031–2050	2050 - 70 Total – 735		2031-2050	2050 - 140 Total – 1,470	

3. Sectoral priorities

91. The strategy includes priority actions in each sector aimed at reducing GHG emissions, which will be performed in parallel to implementation of key actions. They include:

a. Climate policy

1) Integration of climate considerations and risks into sectoral and marz development strategies;

2) Establishment and improvement of the national system of measurement, reporting and verification;

3) Introduction of a climate finance tagging system to ensure monitoring and reporting of international, public and private cash flows related to climate change;

4) Development and introduction of educational and training modules on climate change.

b. Energy

5) Implementation of energy storage measures;

6) Studies of opportunities and feasibility of utilizing biomass, biogas, hydrogen;

7) Utilization of carbon absorption and storage technologies, parallel to their full-scale application at the international level;

8) Improvement of passenger flow management and transport infrastructure;

9) Expansion of the electric public transport network and improvement of the existing system;

10) Optimization of passenger and freight transport, creation, and expansion of infrastructure for bicycles, electric scooters, and walking;

11) Enhancement of digitalization and online services;

12) Ensuring renewal and modernization of the vehicle fleet, including the bus fleet, with a gradual transition to vehicles using alternative energy sources/carriers (electricity, gas, biofuels, hydrogen).

c. Waste

13) Minimization of solid waste (primarily biodegradable);

14) Separate collection of waste at the source of generation;

15) Transition to sustainable landfill management practices;

16) Improvement of wastewater treatment technologies;

17) Introduction of organic waste separate collection system;

18) Elimination of open burning at active (unmanaged) landfills;

19) Elimination of unmanaged landfills;

20) Development of a circular economy by ensuring reduction of waste in the value chain through deployment of resource-efficient, waste-free technologies and digitization of production processes.

d. Agriculture

21) Discovering and realizing the potential of organic agriculture;

22) Strengthening of national institutional capacities of technical knowledge and expertise on climate change mitigation and adaptation;

23) Strengthening of farmers' capacities through commonly used approaches such as communication, training, practical on-job training, demonstration farms, farmers' field schools and establishing producers' networks for knowledge sharing;

24) Strengthening of capacities of agricultural advisory and support services including introduction of practices for mitigation and production enhancement, by providing access to the best practices and technologies and building capacity to implement them.

e. Land

25) Ensure sustainable land management system;

26) Decrease of the area of degraded lands (agricultural, arable, desertification-prone, solonchaks) where remediation measures have been taken and soil organic carbon content is stable or increasing;

27) Introduction of sustainable grassland management systems.

f. Forestry

28) Nationwide forest inventory;

29) Improvement of forest management practices – implementing additional measures for reforestation, forest fires prevention, monitoring and fighting programs, improving forests pests and diseases control, rehabilitation of degraded forest ecosystems where needed, replacing monoculture reforestation technologies with mixed forests with higher absorption characteristics;

30) Application of new technologies aimed at reducing GHG emissions and increasing absorption of GHG in forests and other ecosystems;

31) Prevention of deforestation and forest degradation in forest lands and specially protected nature areas;

32) Implementation of activities aimed at increasing forest productivity;

33) Study of possibilities of introducing mechanisms for reduction of greenhouse gas emissions (REDD+) to regulate the rights of receiving, selling, and possessing loans;

34) Improvement of forest zoning system considering climate change risks and adaptation aspects.

g. Industry

35) Deployment of a system for increased responsibility of producers;

36) Introduction of new technological approaches aimed at increasing energy saving and energy efficiency, as well as reducing emissions in cement production.

37) Use of alternative building materials instead of cement (if possible) with less or no GHG emissions;

38) Introduction of new production technologies with reduced GHG emissions combined with carbon capture and storage.

7. INVESTMENT AND FINANCING FRAMEWORK FOR LT-LEDS

92. For implementation of the proposed measures the estimated indicative amount of investments is **2,150 - 2,890 billion AMD** (5,375 - 7,225 million USD, calculated at the exchange rate of 1 USD = 400 AMD). For the financing of the proposed measures there will be considered the following types and sources of financing not prohibited by the law.

93. For implementation of LT-LEDS the following types of sustainability financing have been applied:

    1) **Green bonds:** bond proceeds are invested exclusively in projects that generate environmental benefits determined by defined criteria.

    2) **Transition bonds:** new asset class for the companies which have a key role to play in the shift to sustainable economy, but do not have the appropriate green assets to issue green bonds. Proceeds raised are used to finance projects with pre-defined climate transition-related activities.

    3) **Sustainability linked loans:** incentives for the borrower with lower cost of funding if pre-agreed improvements in sustainability performance are being met and/or exceeded over the life of the loan.

    4) **Green equity funds:** a structured investment vehicle designed to channel capital from different investors into green businesses or projects. Investments may therefore include equity stakes in areas such as:

        a. Renewable energy generation and development;

        b. Water or waste treatment facilities;

        c. Clean transport or electric vehicles.

94. Efficient sources of financing for Armenia include:

    1) Development finance institutions (DFIs) focused on implementing their government's foreign investment and growth agenda.

    2) Export credit agencies (ECAs) which provide insurance cover guarantees to lending banks to mitigate both political and commercial risks.

    3) Blended finance, which involves the use of financial instruments to catalyze private capital.

95. To ensure decarbonization of the economy and transition to low-carbon development the Government will consider the selective implementation of carbon pricing instruments (emissions trading system, carbon tax, offsetting mechanisms and results-based carbon financing) as appropriate.

1) Through the **emissions trading system,** the state sets a limit or maximum threshold for the emitters in the relevant sectors and issues tradable quotas or units corresponding to the total volume of emissions permitted within the limit. To maintain the minimum cost level of their emissions targets, the entities involved may undertake internal reduction measures or purchase emissions units in the carbon market. The entities having excess quotas may sell them or store up for further use.

2) **Carbon tax** sets a price on greenhouse gas emissions, either by directly applying a carbon-based standard or by using the carbon content of a substance or activity subject to taxation as the tax base. Carbon tax is a financial incentive for reduction of greenhouse gas emissions, providing an opportunity to reduce the burden of tax liabilities. It may be designed in a way to lead to other benefits as well, such as increased income, reduced air pollution and improved efficiency of the tax system. The main difference between carbon tax and emissions trading system is that carbon tax sets carbon price, whereas emissions trading system sets a cap on emissions. Carbon taxes are therefore a more stable and predictable price incentive for investors. They both contribute to the reduction of emissions by encouraging emissions reductions at minimal cost. Both instruments encourage investors and entrepreneurs to develop new low-carbon technologies and generate public revenue, including for being used for climate change mitigation purposes in the long run.

3) **Offsetting mechanism** sets GHG emission reductions resulting from program actions, which may be sold both on domestic and foreign markets. Carbon credits are issued through offsetting programs. In the case of a program-based offsetting mechanism, an entity develops a project that will result in real and verifiable reductions in GHG emissions. If the program is introduced and operates over a period of time, and the resulting emissions reductions are measurable, reportable and verifiable, they may be sold in the form of carbon credits to another party who may need them for offsetting its own emissions against those reductions. Such carbon credits may be used in terms of corporate policy objectives related to compliance with an international agreement, a national mechanism (such as a carbon tax or emissions trading system) or mitigation of GHG emissions (voluntary offsetting scheme).

96. The Government also seeks to develop a "Debt-for-Climate" financial swap mechanism, which aims at leveraging additional finance for implementation of climate change mitigation and adaptation measures and projects while contributing to effective debt management.

97. In terms of choice of financing mechanisms for LT-LEDS certain preferences are formed based on GHG emitting sectors, considering characteristics and financial drivers of the sector's players.

98. For the purpose of development of **energy** sector and reduction of GHG emission stable financing flows may be ensured from the following sources:

1) Climate funds and multilateral development banks;

2) Placement of sovereign and corporate green bonds;

3) Closed-end investment funds;

4) Equity crowdfunding platforms;

5) Business angel networks.

99. The major share of the suppliers of **agricultural** production currently comprises small farms and households. As a result of the implemented policy, the formation of new largescale participants is assumed, for which the following financing mechanisms may become available:

1) Sustainability linked loans;

2) DFI/international financial institution (IFI) finance;

3) Private investments.

100. These forms of financing may be conditional on development and application of rotational grazing technology, improvement of gene bred by import of new breeds. For implementation of the projects green securitization may also be used if households/producers are managed to be grouped, by supporting breed change and manure handling projects.

101. Provision of grants to absorb transaction costs or mitigate certain risks can improve investment viability. Incorporating debt or equity into the capital structure of low carbon projects under favorable terms can also unlock returns.

102. In the **industrial processes** sector the financing from GCF offers flexible interest rates for corporate sector companies achieving their environmental/sustainability KPIs.

103. With the expansion of the construction sector in Armenia, the demand for cement is growing, which enables the companies of the sector easily make a good use of sustainability linked loans and DFI/IFI finance for implementation of low-carbon cement technologies.

104. Emissions from landfills are the result of poorly developed waste management systems where the best available technologies and practices have not been implemented yet. In the coming years, implementation of national and regional solid and household waste management programs should become the main opportunity to reduce waste sector emissions. Local self-government bodies and economic entities have the opportunity to attract appropriate financial resources for application of modern technological solutions through projects implemented by DFI, subvention programs implemented by the Government, initiatives within the scope of public-private partnership, as well as through application of exemption from tariff, in particular, import duty for technological equipment imported within the scope of investment projects implemented in the priority sector.

8. MONITORING AND EVALUATION FRAMEWORK FOR LT-LEDS

105. To track quantitative targets, the Government establishes a unified system of monitoring and evaluation of quantitative targets.

106. Data collection is based on the international indicators used to track progress towards Sustainable Development Goal (SDG) 13 which evaluates the actions of countries in the fight against climate change.

107. Data will be collected on an annual and biennial basis. Data collection will be carried out both for the main target values in the field of reducing GHG emissions, and for sectoral ones (Table 3).

108. The monitoring of key indicators is coordinated by the inter-agency coordinating council on climate change.

109. In carrying out the evaluation, the Government will rely on the following main criteria:

1) Relevance – the extent to which the measure corresponds to the priorities and policies of the target group;

2) Effectiveness – the extent to which the measure achieves the objectives set;

3) Efficiency – the ratio of results in relation to the invested resources;

4) Impact – positive and negative changes that were caused by implementation of the measure;

5) Sustainability – whether the results obtained during the implementation of the measure will continue to be generated also after the end of funding.

110. When implementing the strategy, the following types of evaluation are planned:

1) Evaluation on an annual basis and GHG emissions inventory on a biennial basis;

2) Mid-term evaluation of the national program or strategy;

3) Evaluation at the end of the program or strategy;

4) Post factum evaluation.

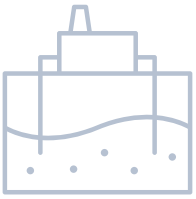
111. The Government will publish information received after annual monitoring and evaluation in the reports of various nature. The main purpose of reports is to inform stakeholders and decision makers about GHG emissions reduction activities, resources expended, progress towards goals and changes in ongoing projects.

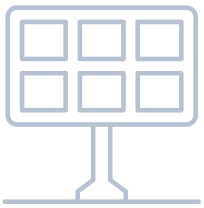
112. Reflecting on the vision established in the strategy and considering the NDC and strategic program for development of the energy sector, the Government will review the strategy in full or partially as may be required.

Table 3. Key indicators for monitoring and evaluation

	Indicator name	Brief description	Purpose	Responsible	Presentation method
1	Gross GHG emissions	Total GHG emissions produced by all sectors	Fulfilment of international commitments	Ministry of Environment	Biennial transparency report
2	GHG emissions by sectors	Final amount of GHG produced (including Land Use, Land Use Change and Forestry)	Fulfilment of international commitments	Ministry of Environment	Biennial transparency report
3	Capture and storage of carbon dioxide	The amount of GHG captured	Fulfilment of international commitments	Ministry of Environment	Biennial transparency report
4	Electricity distribution network losses	Reduction of GHG emissions in the electricity generation sector	Losses reduction improves overall energy efficiency, therefore reduces GHG emissions	Ministry of Territorial Administration and Infrastructure	Annual
5	Total installed capacity of small hydropower plants	The amount of energy that all plants are able to produce at a peak performance	Increases the share of green energy in the RA energy mix, therefore reduces the volume of carbon dioxide	Ministry of Territorial Administration and Infrastructure	Annual
6	Total installed capacity of wind power plants	The amount of energy that all plants are able to produce at a peak performance	Increases the share of green energy in the RA energy mix, therefore reduces the volume of carbon dioxide	Ministry of Territorial Administration and Infrastructure	Annual
7	Total installed capacity of autonomous solar power plants	The amount of energy that all plants are able to produce at a peak performance	Increases the share of green energy in the RA energy mix, therefore reduces the volume of carbon dioxide	Ministry of Territorial Administration and Infrastructure	Annual
8	Total installed capacity of small solar plants	The amount of energy that all plants are able to produce at a peak performance	Increases the share of green energy in the RA energy mix, therefore reduces the volume of carbon dioxide	Ministry of Territorial Administration and Infrastructure	Annual
9	Change in the share of solar energy production in total	Dynamics of the total amount of energy supply from solar photovoltaic plants	Green energy is a key tool for reducing carbon dioxide emissions	Ministry of Territorial Administration and Infrastructure	Annual
10	Battery energy storage systems capacity	The amount of energy that can be stored by battery system	Battery storage technology allows to accumulate green energy and use it when direct supply is not possible	Ministry of Territorial Administration and Infrastructure	Annual
11	Vehicle fleet renewal rate	The amount of old ineffective vehicles replaced by new ones	Old vehicles do not comply with energy efficiency standards and produce more GHG than new ones	State Revenue Committee	Annual
12	Electric vehicles growth rate	The number of electric vehicles entering the market	Electric vehicles are a key tool for reducing carbon dioxide emissions in the transport sector	State Revenue Committee	Annual

13	Share of public transport in passenger transportation	The number of passengers using public transport instead of personal	Reduction of the share of private vehicles, direct reduction of GHG emissions	Ministry of Territorial Administration and Infrastructure	Biennial
14	Nitrous oxide emissions from using organic fertilizers	The amount of nitrogen suboxide emitted throughout the application of organic fertilizers	Nitrous oxide is a powerful GHG – one of the main threats from agricultural sector	Ministry of Economy	Biennial
15	Number of high-yielding cows and new breeds	Number of cows of certain breeds	Reduces GHG emissions per kg milk by increasing milk yield per cow	Ministry of Economy	Biennial
16	Forest covered area	Size of forest covered areas	Increases the RA absorption capacity	Ministry of Environment	Biennial
17	Restoration and sustainable management of degraded forests	Number of forests restored	Increases the RA absorption capacity	Ministry of Environment	Biennial
18	Thermo-modernization of existing buildings	Dynamics of the use of energy-saving and heat-saving technologies	Improves overall energy efficiency, therefore reduces GHG emissions	Urban Development Committee	Annual
19	Share of residential and public buildings meeting efficiency class C requirements	Number of buildings certified for energy efficiency class C	Improves overall energy efficiency, therefore reduces GHG emissions	Urban Development Committee	Biennial
20	Share of sewage sludge utilization	Amount of wastewater used for biogas production	Reduction of methane gas emissions from sewage sludge	Ministry of Territorial Administration and Infrastructure	Biennial
21	Amount of collected waste	Amount of waste collected by a specialized operator	Reduction of methane emissions and development of circular economy	Ministry of Territorial Administration and Infrastructure	Annual
22	Share of sorted out waste	Share of sorted waste to be recycled in solid municipal waste	Recycling of sorted out waste allows to reduce the amount of landfilled waste, therefore reduces GHG emissions	Ministry of Territorial Administration and Infrastructure	Annual





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