Under the Convention on Long Range Transboundary Air Pollution

Case Study on EECCAs: Armenia and Montenegro Technological Pathway toward the Amended Gothenburg Protocol Ratification

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Overview

- Approach used
- Summary of results obtained in Serbia, Moldova, Kazakhstan and Georgia
- Case study 5: Armenia

Armenia: introduction

- ✓ **Armenia ratified the 1979 Convention on Long-range Transboundary Air Pollution (CLRTAP) in 1997 and the 1984 Geneva Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) in 2014**
- ✓ Armenia did not ratify any Protocol up to now
- ✓ Armenia prepared a "**National Action Plan for ratification of CLRTAP protocols and meeting of correspondent commitments**" in 2014. A reviewed and updated plan was prepared recently by international consultants to the United Nations under the assistance programme to support countries in Eastern Europe, the Caucasus and Central Asia (EECCA) with the aim to encourage ratification of the key Protocols to the CLRTAP taking in to account the bilateral agreement with the EU

Armenia: introduction

- ✓ **An action plan of the government of the Republic of Armenia** for 2021-2026 for objectives for each of the ministries. For environment different objectives and actions such as :
  - Elaborating a policy on ambient air preservation for reducing and limiting emissions,
  - Introducing unified and modern systems for permits and licences,
  - Improving the system of environmental impact assessment
- ✓ A **Comprehensive and Enhanced Partnership Agreement (CEPA)** between the European Union and the European Atomic Energy Community and their Member States, and the Republic of Armenia **entered into force in 2021 with an agenda for** legislative approximation to EU norms in many sectors

Armenia: Air quality situation

The Republic of Armenia has its own limit values for air quality

In the scope of the CEPA, the EU directives 2008/50 and 2004/102 should be implemented

The limit values are as follows:

Air pollutants	Ambient air quality standard (maximum permissible concentration)
SO_2	24 hour mean: 0.05 mg/m³ Max. Daily: 0.5 mg/m³
NO_2	24 hour mean: 0.04 mg/m³ Max. Daily: 0.085 mg/m³
NO	24 hour mean: 0.06 mg/m³ Max. Daily: 0.4 mg/m³
CO	24 hour mean: 3 mg/m³ Max. Daily: 5 mg/m³
Dust	24 hour mean: 0.15 mg/m³ Max. Daily: 0.5 mg/m³
O_3	24 hour mean: 0.03 mg/m³ Max. Daily: 0.16 mg/m³

Air quality monitoring in the Republic of Armenia is carried out by the Hydrometeorology and Monitoring Center (HMC)

Home (armmonitoring.am)

Armenia: Air quality situation

Air quality is measured in 10 cities of the Republic: Yerevan, Gyumri, Vanadzor, Alaverdi, Hrazdan, Ararat, Tsaghkadzor, Charentsavan, Kapan, and Kajaran cities, as well as in the Amberd station (regional first level of transboundary air pollution monitoring)

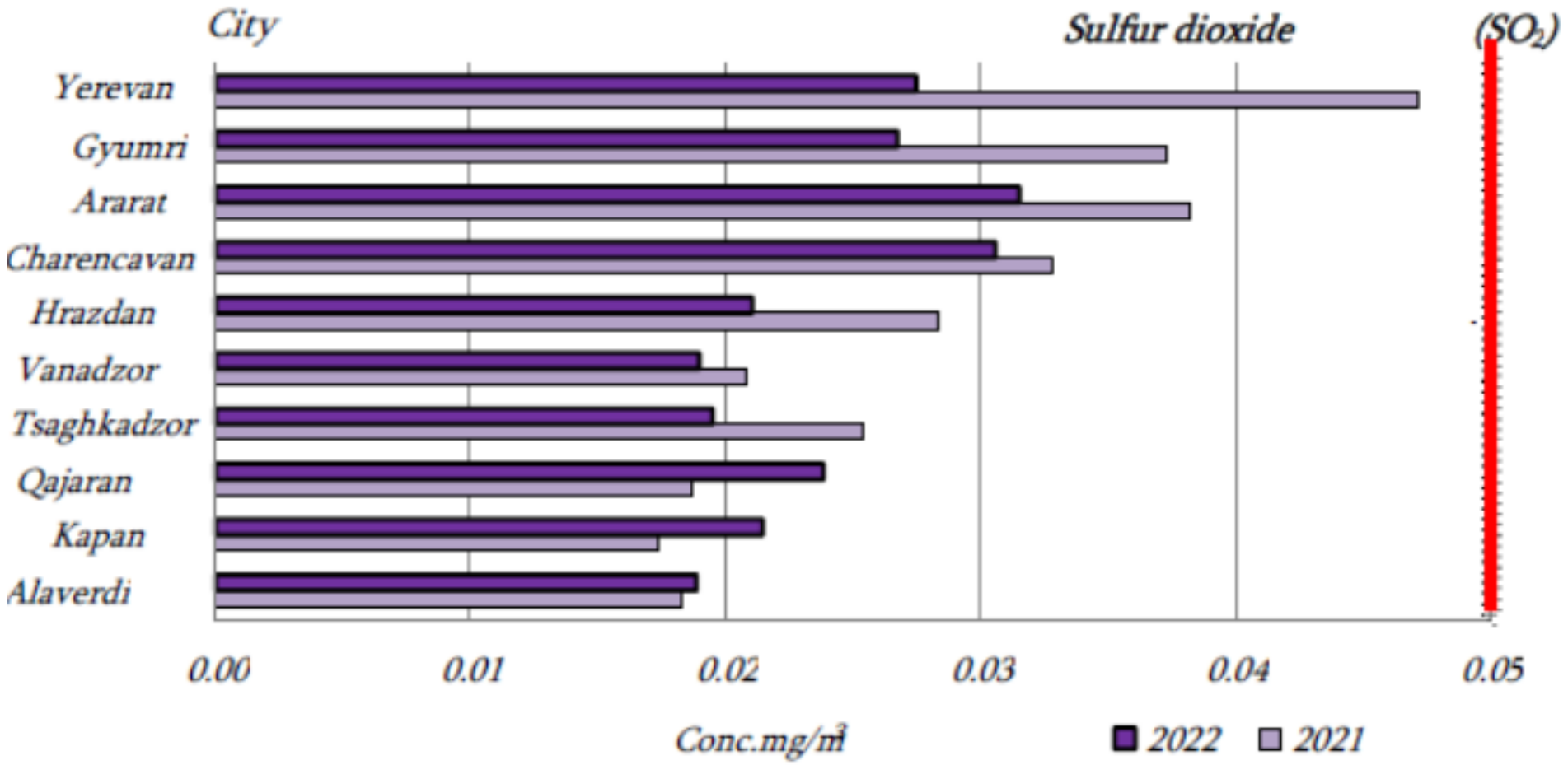
Not-automated method	Automated method	Passive sampling
Dust	Carbon monoxide	Sulphur dioxide
Sulphur dioxide	Sulphur dioxide	Nitrogen dioxide
Nitrogen dioxide	Nitrogen oxides (mo-noxide, dioxide, total oxides)	
Nitrogen oxide	Ground-level ozone	
Ground-level ozone		
Aromatic hydrocarbons		

Monitoring is mainly done by manual sampling based on either wet chemical methods or passive sampling.

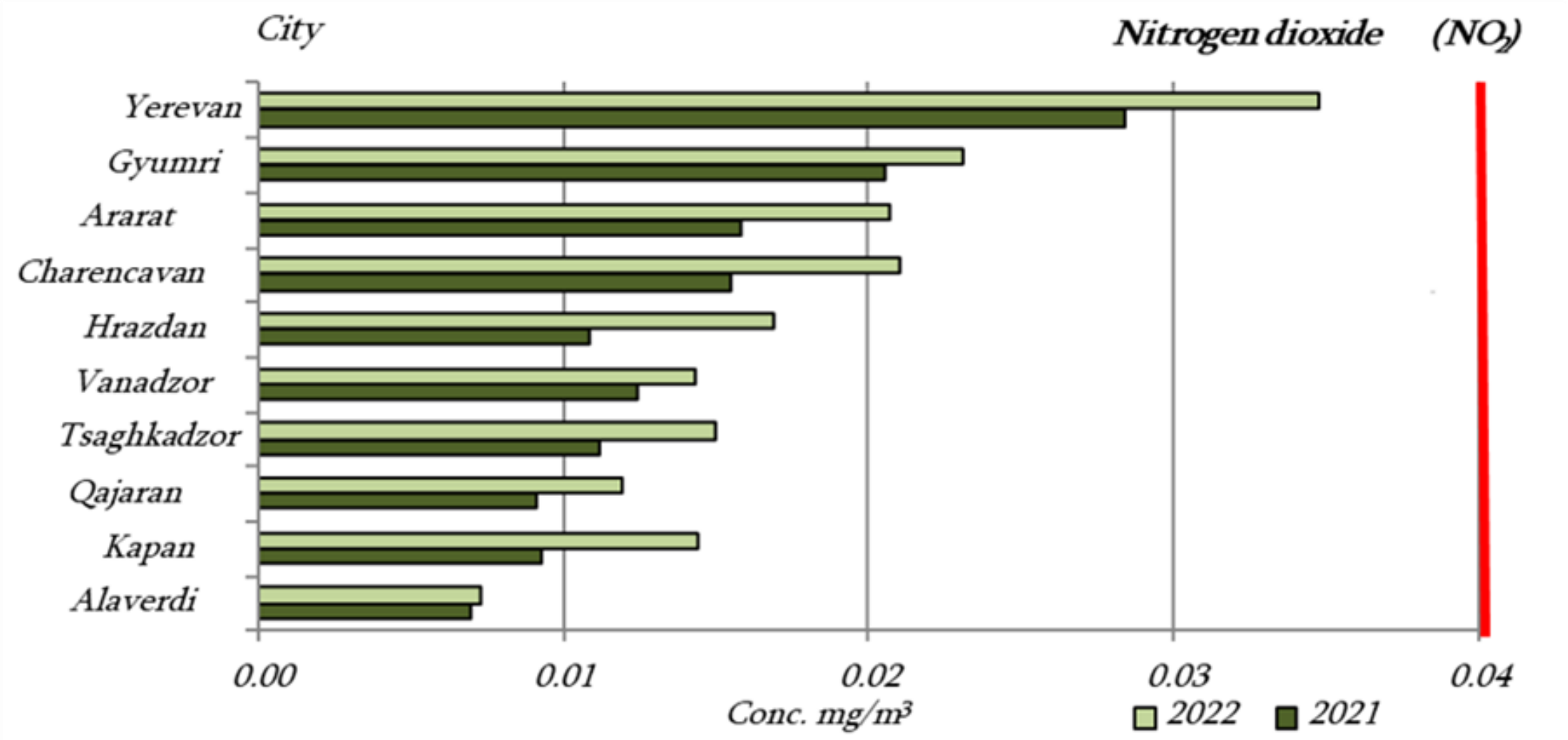
Air quality monitoring is carried out daily throughout the year.

The sampling systems consists of a pump, electronic or membrane gas meters and glass tubes impregnated with different reagents for NO2, SO2 and ozone.
Similarly, dust (total supended particles, TSP) is sampled with specific filter material (AFA), which is also used for chemical analysis of heavy metals.

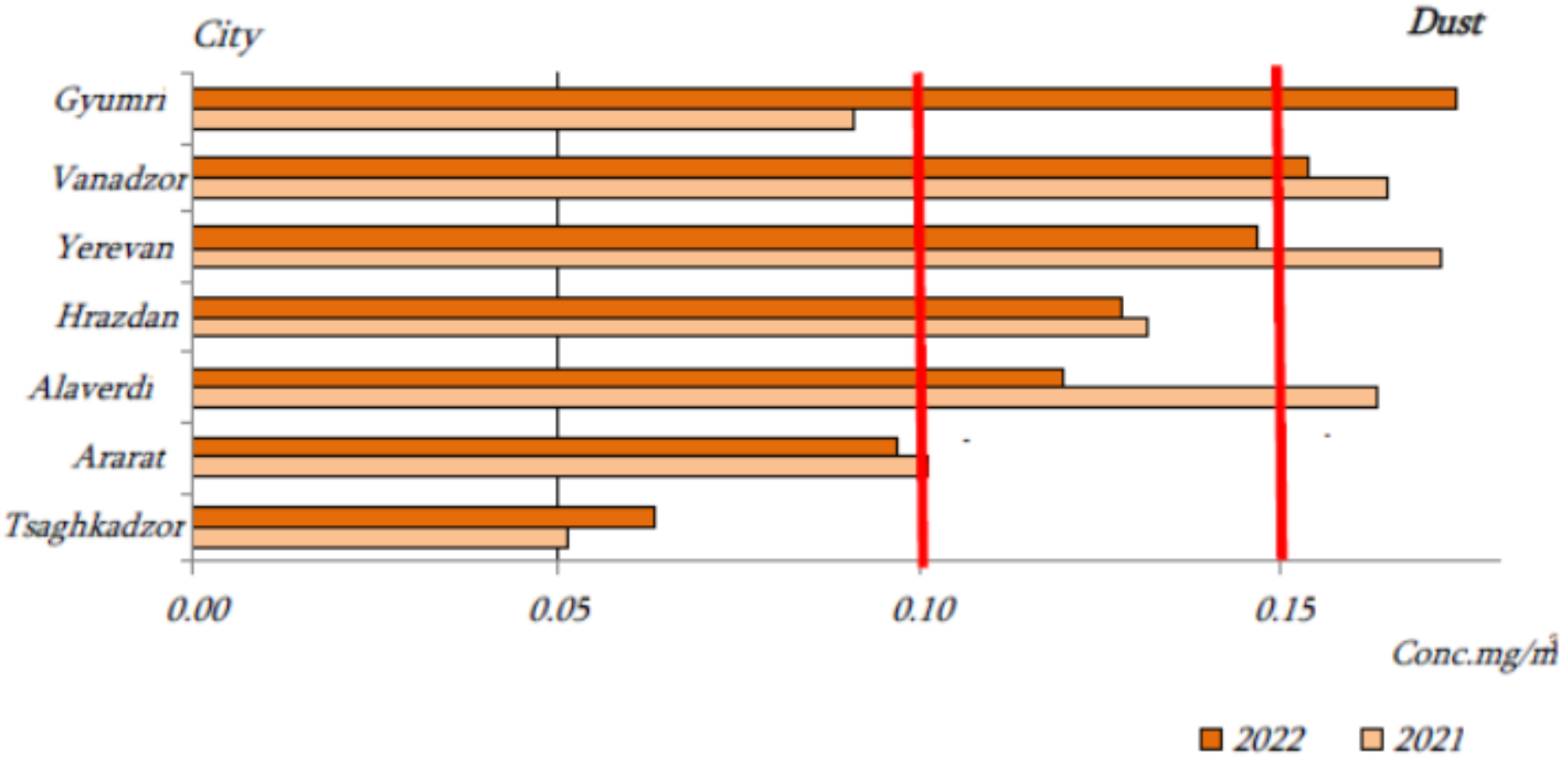
Armenia: Air quality situation – SO2



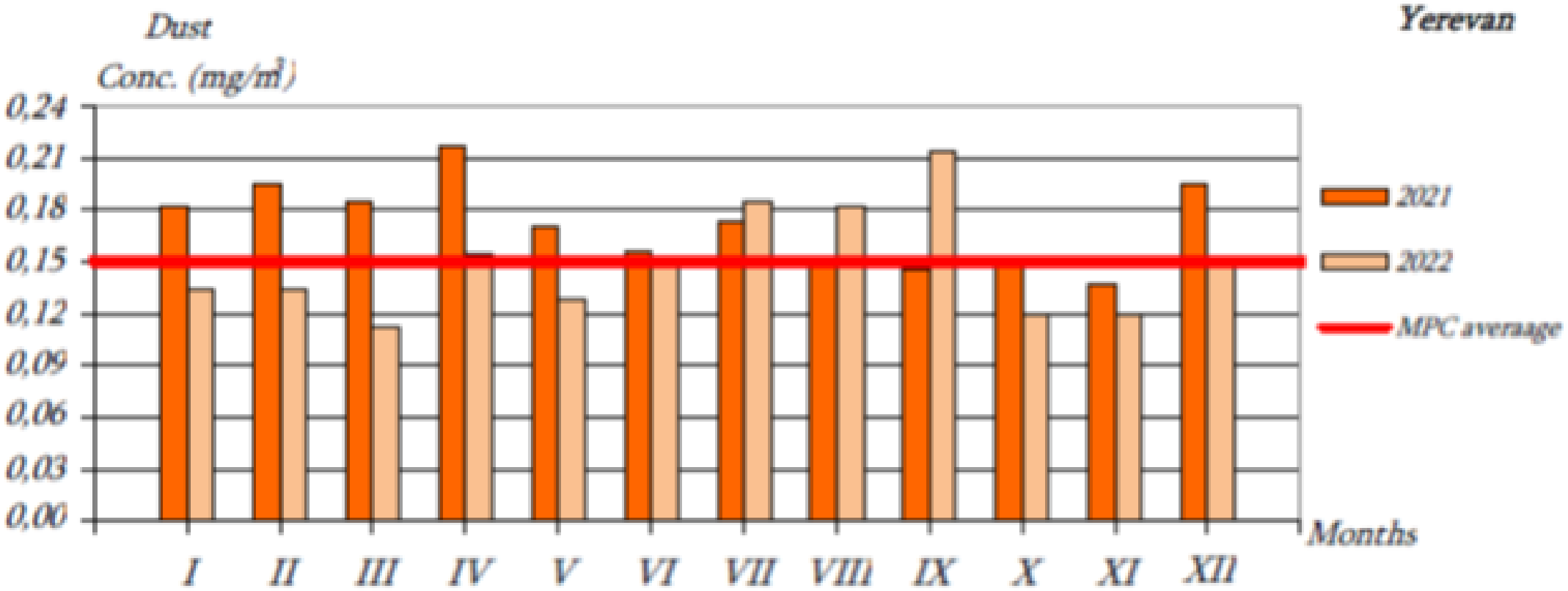
Armenia: Air quality situation – NO2



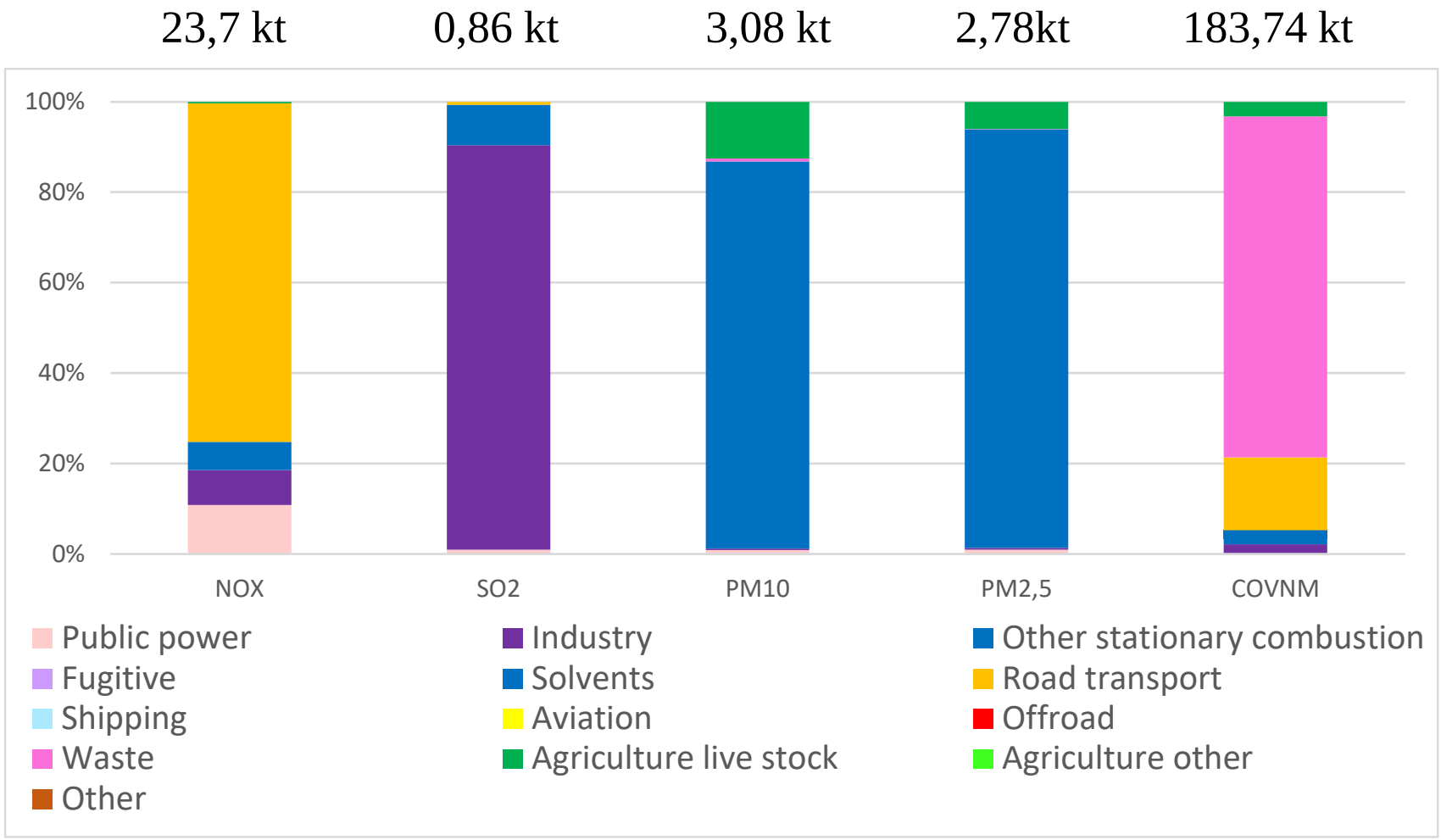
Armenia: Air quality situation – dust



Armenia: Air quality situation – Dust in Yerevan



Armenia: Main sources of pollutants in 2021



NOx: road transport (75%); Public power (11%)

SO2: Industry: 89%; other combustion 9%

PM10: Other combustion: 86%; livestock: 13%

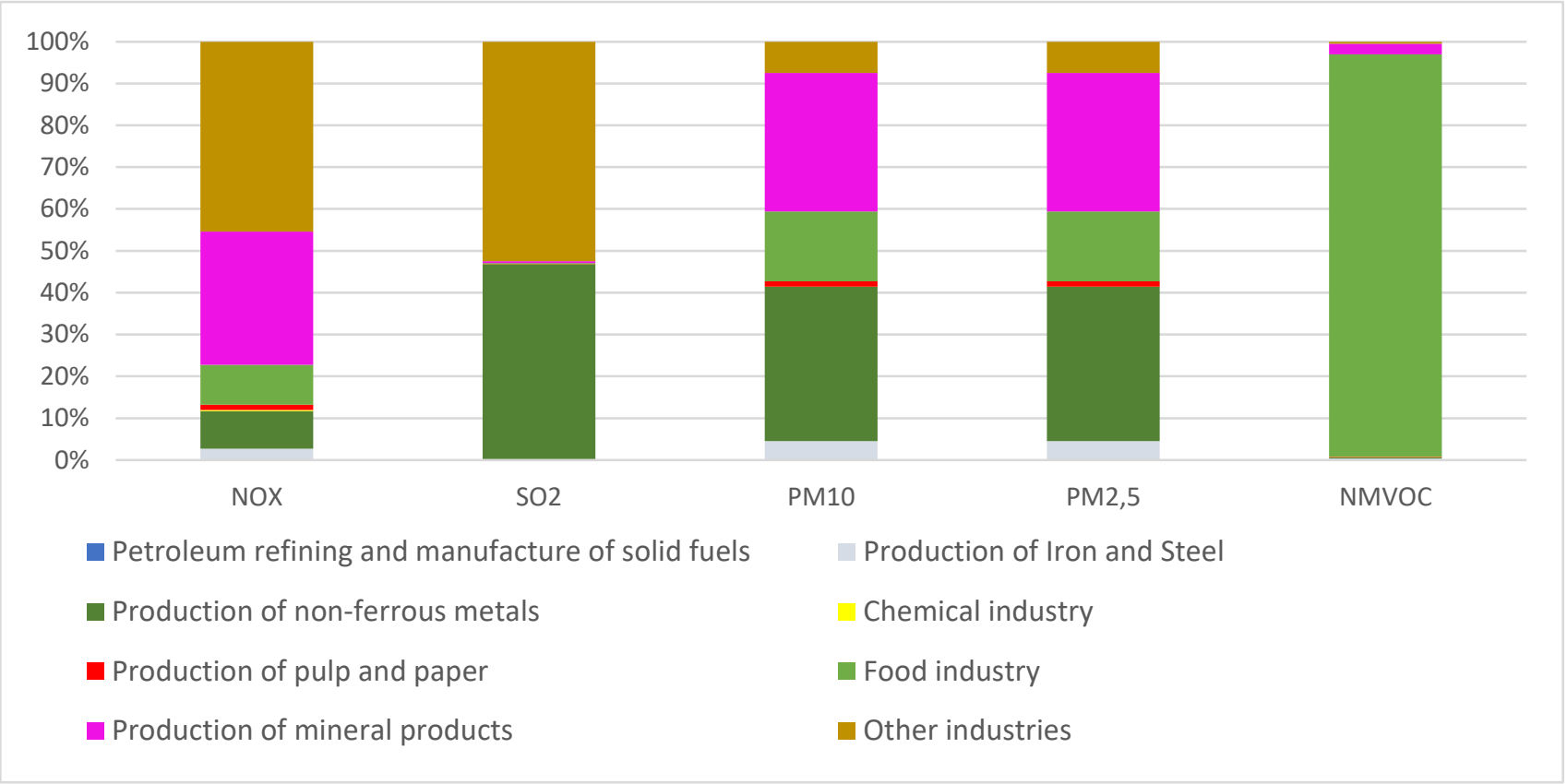
PM2.5: Other combustion: 93%; livestock: 6%

NMVOC: Waste: 75%; Road transport: 16%

Source: Emission inventory submission 2023 for the Convention (CEIP web site)

Armenia: Industrial sources in 2021

1.83 kt 0.077 kt 0.011 kt 0.011 kt 3.91 kt



NOx: Other industries: 45%; Mineral products: 32%

SO2: Other industries 52%; non-ferrous metals: 47%

PM10: Non-ferrous metals: 47%; Mineral products: 33%

PM2.5: Non-ferrous metals: 47%; Mineral products: 33%

NMVOC: Food industry: 96%

Source: Emission inventory submission 2023 for the Convention (CEIP web site)

Armenia: road transport

- ✓ No detailed information on emissions per different types of vehicles
- ✓ Main source of NOx emissions (75 %) and second largest source of NMVOC (16%)

Armenia: Use of solvents

- ✓ No detailed information on the different sources of solvent emissions
- ✓ Only domestic product uses are estimated

Source: Emission inventory submission 2023 for the Convention (CEIP web site)

Programme for improving emission inventories

National emission inventories are an important knowledge base and key data for decision making

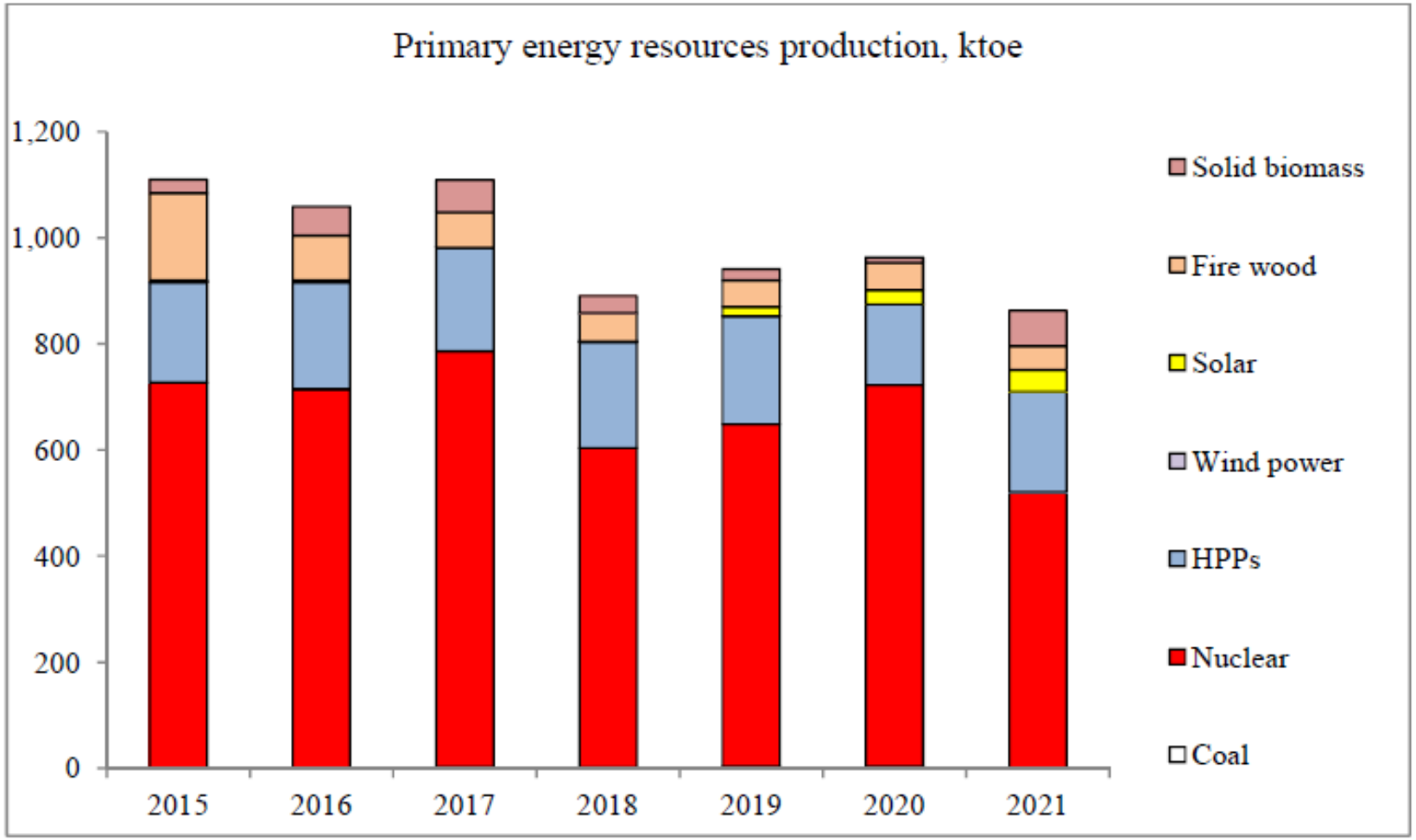
In the scope of an UNDP-GEF project “Building Armenia’s National Transparency Framework under Paris Agreement”, the Republic of Armenia is working on :

- ✓ Institutional setting of GHG emission inventory
- ✓ Reconcile LRTAP reporting and GHG inventory data for common database

Gaps known in the air emission inventory, such as :

- ✓ No detailed inventory of road transport
- ✓ Absence of some sources (diffused sources, wastes, uses of solvents (except domestic products))
- ✓ Emission inventory reported only for the current year (difficulty to have time series)
- ✓ Incomplete set of activity data

Armenia: main domestic sources of primary energy production



The main domestic sources of primary energy production are nuclear energy and hydro energy with shares of 60.4% and 22.0% correspondingly in 2021.

Source: Energy balance of Armenia - 2021

Armenia: 4 large thermal power plants

There are **four large thermal power plants** in Armenia for the production of electricity, all using natural gas

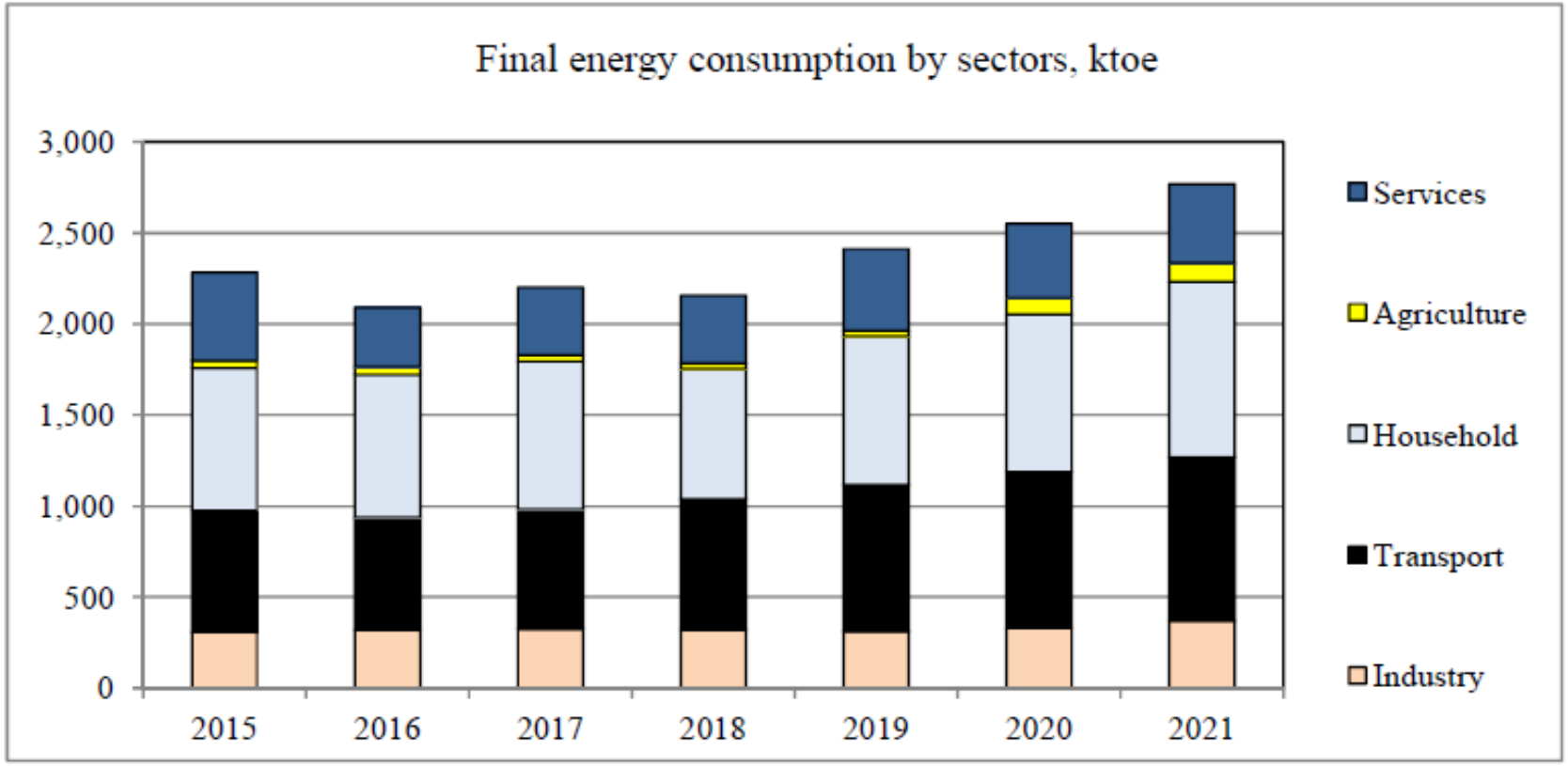
- ✓ "Yerevan TPP" CJSC, which although is combined cycle production unit, operated in condensation mode during 2021 and produced 1652.7 mln. kWh of electricity.
- ✓ "Hrazdan TPP" OJSC condensing power unit, owned by "Gazprom Armenia" CJSC, produced 1576.9 mln. kWh of electricity (Five oil and gas boilers are used to power four co-generation turbines).

  The old plant, which consists of seven units, is 550 MWe (gas turbines and boilers)
- ✓ "Hrazdan-5" condensing power unit owned by "Gazprom Armenia" CJSC was not operated in 2021.

  480 MWe. Combined Cycle Gas Turbine (CCGT) power plant that is used for Baseload
- ✓ A new 254 MW combined cycle production unit has been operated by "ArmPower" CJSC since 29 November, 2021 with 148.1 mln. kWh electricity production.

Source: Energy balance of Armenia - 2021

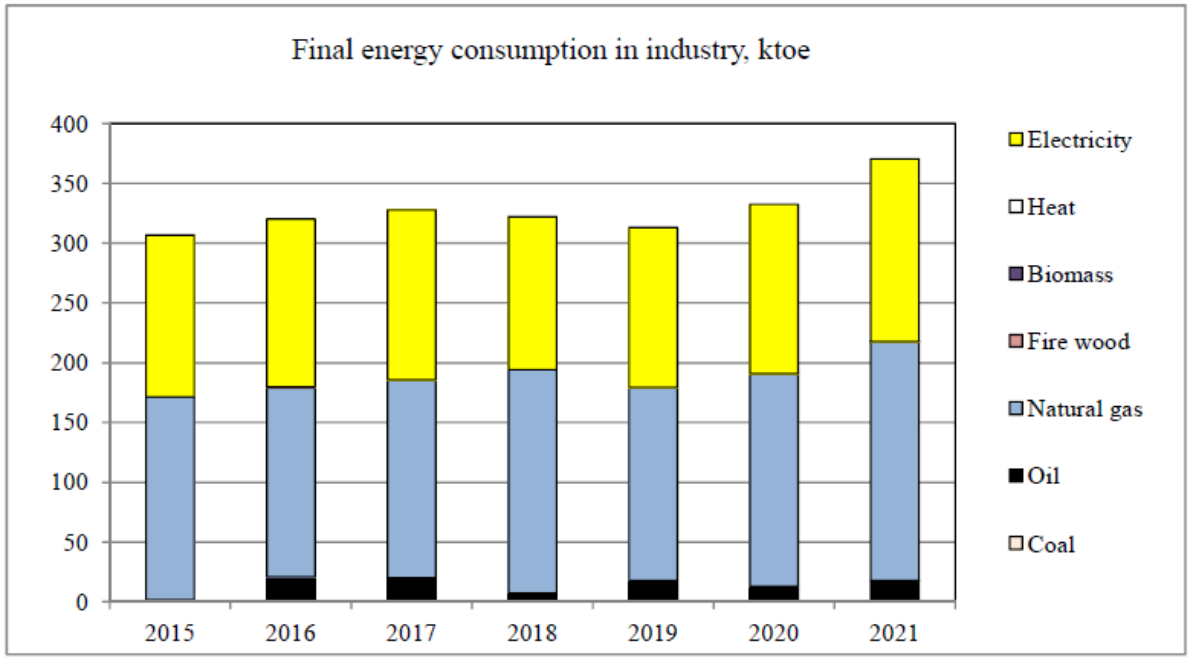
Armenia: final energy consumption

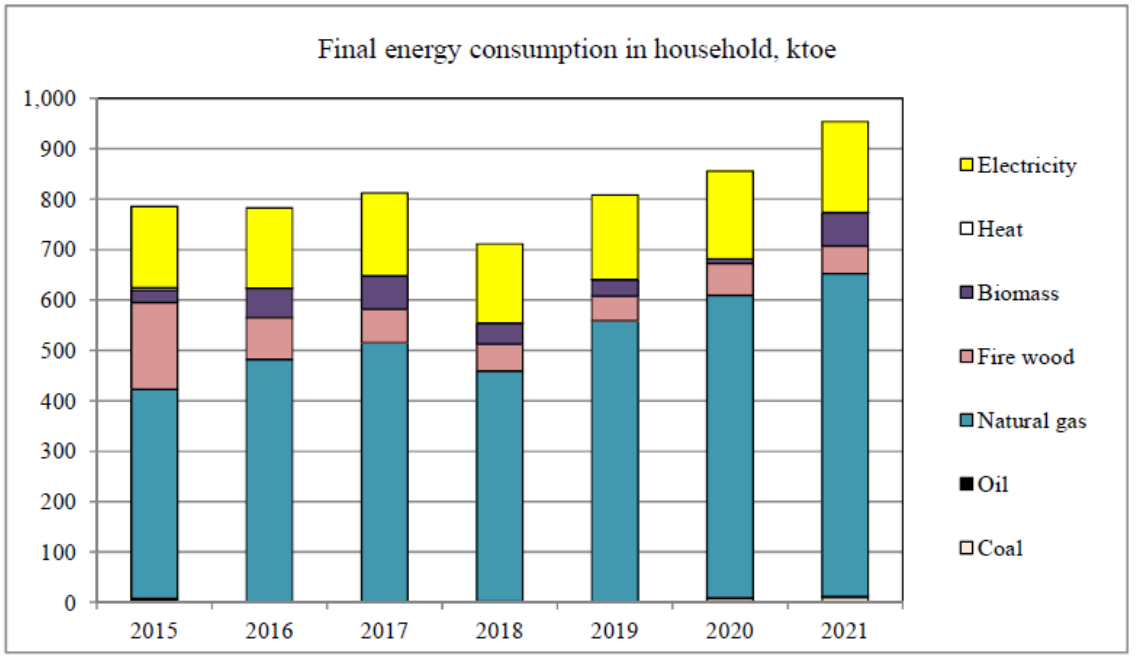


- ✓ In 2021, the main sector of the energy consumption was the household which share was 34.7% against the total amounts of the final consumption for energy purposes.
- ✓ The transport share was 32.5%.
- ✓ The share of service sector was 15.7%, and industry – 13.4%.

Source: Energy balance of Armenia - 2021

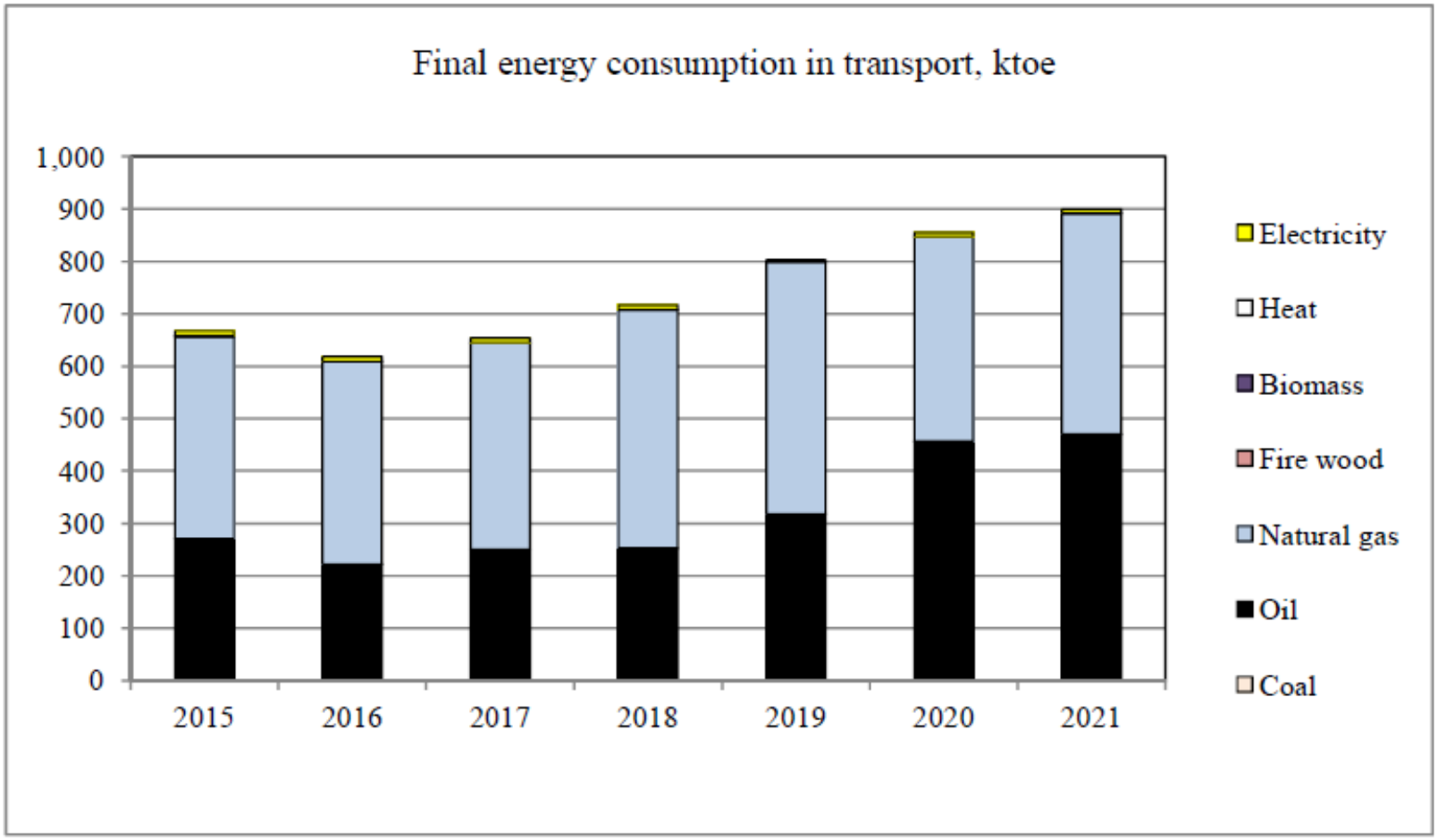
Armenia: energy consumption in industry and household





Source: Energy balance of Armenia - 2021

Armenia: energy consumption in transport



Source: Energy balance of Armenia - 2021

Armenia: regulations on industrial plants

Industrial activities: Permitting procedures and controls of industrial plants

- Regulations set out emission thresholds for which media-specific permits are required, as well as maximum allowable concentrations (MAC) for certain pollutants
- According to the 1994 Law on Atmospheric Air Protection, permits are required for entities that exceed 2 billion m^3 of the required volume of air use per year (or 2 000 m^3 per second)
- Operators can apply for permits to local offices of the Ministry of Environment through paper applications. The digitisation of the permit application procedure is ongoing
- Permitting is single-media based, with a separate application required for each environmental medium
- Applicants must pay a small fee for permit applications
- The Environmental Protection and Mining Inspection Body is responsible for inspections in enterprises
- The frequency of inspections depends on risk-based parameter (defined by a risk audit methodology). A decree establishes three categories of risk for economic entities, with a corresponding frequency of inspection: high risk (once a year); medium risk (once in three years); and low risk (once in five years)

Armenia: regulations on industrial plants

Industrial activities (including use of solvents): limit values implemented

- Legislation sets out maximum allowable concentration (MACs) of certain pollutants (As example, a 2006 government resolution sets out MACs for 389 atmospheric pollutants, also indicating their level of toxicity)

Comparison with ELVs pf technical annexes

Up to now, it was not possible to compare limit values implemented in Armenia with limit values of the technical annexes IV, V, VI and X of the amended Gothenburg Protocol

Armenia: regulations on industrial plants

Industrial activities (including use of solvents): evolution of regulations

- ✓ According to the roadmap for the implementation of the commitments of **CEPA**, the **legislative framework for adopting the EU Directive 2010/75/EU of 24 November 2010 on industrial emissions** (integrated pollution prevention and control) **should be implemented from 2024 to 2027**, with, among other:
  - Adoption of national legislation and designation of competent authority(ies).
  - Determination of structures for which a permit is required (Appendix I)
  - Creation of a combined permit system (Articles 4 to 6, 12, 21 and 24 and Annex IV)
  - Establishing a compliance monitoring mechanism (Articles 8, 14(1)(d) and 23(1))
  - Application of the Best Available Technologies, taking into account the reference documents for the Best Available Technologies (Articles 14(3) to (6) and 15(2) to (4))
  - Setting emission limit values for combustion plants (Article 30 and Annex V)
  - Development of programs to reduce the total volume of annual emissions from existing plants (alternative to setting emission limit values for existing plants) (Article 32)

Armenia: regulation on petrol distribution

Distribution of petrol (Stage I and Stage II): current situation

Limit values for VOC emissions from storage and distribution of petrol, excluding the loading of seagoing ships (stage I)
Limit values for VOC emissions for car refueling at service station (stage II)

The distribution of Petrol is not yet regulated in the Republic of Armenia

Armenia: regulation on petrol distribution

Distribution of petrol (Stage I and Stage II) : evolution of regulations

Limit values for VOC emissions from storage and distribution of petrol, excluding the loading of seagoing ships (stage I)

Limit values for VOC emissions for car refueling at service station (stage II)

- ✓ According to the roadmap for the implementation of the commitments of **CEPA, the legislative framework for adopting the Directive 94/63/EC on the control of volatile organic compound (VOC) emissions resulting from the storage of petrol and its distribution from terminals to service stations should be implemented from 2026 to 2029,** with, among other:
  - Adoption of national legislation and designation of competent authority(ies).
  - Detection of all gasoline storage and transfer stations (Article 2)
  - Determination of technical measures aimed at reducing the loss of gasoline during loading/unloading of mobile containers from storage facilities and loading stations at transfer stations and filling stations (Articles 3, 4 and 6 and Annex III)
  - Establishing compliance requirements for loading docks and portable containers for all tank cars (Articles 4 and 5)
- ✓ There is no plan for stage II

Armenia: Suphur content of gas oil

Sulphur content of gas oil: current situation

Armenia implements the regulation on the sulphur content of fuels of the Eurasian Economic Union 013/2011

This regulation implements among other requirements for the characteristics of **fuel oil** with a limit of sulfur of 3.5% but no limit for Gas oil which is a medium distillate product.

Armenia: Suphur content of gas oil

Sulphur content of gas oil: Evolution of situation

- ✓ According to the roadmap for the implementation of the commitments of **CEPA, the legislative framework for adopting the Directive 93/12/EEC relating to the sulphur content of certain liquid fuels should be implemented from 2020 to 2023,** with, among other:
  - Adoption of national legislation and designation of competent authority(ies).
  - Definition of an effective fuel sampling system and appropriate analytical methods for sulfur content determination (Article 6)
  - Prohibition of the use of fuel oil and petroleum distillate (gas oil) in the event that the sulfur content during their application to the soil exceeds the specified limit values (Article 3(1), unless the exceptions specified in Articles 3(2) and 4(1) are applicable)

Armenia: solvent in paints and varnishes

Solvent in paints and varnishes (annex XI): current situation

There is no regulation limiting the solvent content of paints and varnishes

Armenia: solvent in paints and varnishes

Solvent in paints and varnishes : Evolution of the situation

- ✓ According to the roadmap for the implementation of the commitments of **CEPA**, the legislative framework for adopting the **Directive 2004/42/EC** of the European Parliament and of the Council of 21 April 2004 **on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC should be implemented from 2021 to 2026**, with, among other:
  - Adoption of national legislation and designation of competent authority(ies)
  - Setting up maximum VOC content limit values for paints and varnishes (Article 3 and Annex II)
  - Establishment of requirements ensuring labelling of products placed on the market and placing on the market of products complying with relevant requirements (Article 3 and 4)

Armenia: small domestic appliances using wood and manure

There is no plan focussing on emissions from small domestic heating appliances

Armenia: road transport vehicles

Road transport vehicles :

There is no production of vehicles in Armenia
All vehicles to be produced or to be imported into the country, must comply with the norms of the following UN ECE regulations :
N83 - 05 - level B ,
N24 - 03,
N49 - 04 - level B,
CO - 4 g / kWh,
CmHn - 0,55 g / kWh,
NOx - 2 g / kW h (UNECE rules N 49 - 03 ESC test cycle)

Fuel Sulphur content (in ppm):

- Armenia adopted a **sulphur limit of 10 ppm in petrol from Jan 2010**

Armenia: road transport vehicles

Restriction on used car importation:
Vehicles (M 1, more than 3.5 tons of maximum mass, M 2, M 3, N 1, N 2, N 3, gas and diesel engine) to be imported into the country, after 1 January 20 15, must comply with the norms of the following UN ECE regulations (5 - the ecological class):

UN ECE rules N 49 - 04 of the B levels (01.10.1995)
UN ECE rules N 24 - 03, addendum 1 (only for diesel engines)

Armenia: Technological Pathway to comply with the AGP technical provisions

NOx Annex V

Large combustion plants and industrial plants

A combination of primary and secondary measures

- combustion optimisation
- combination of primary techniques for NOx reduction such as air or fuel staging, flue-gas recirculation, low-NOx burners (LNB)
- selective non-catalytic reduction (SNCR)
- selective catalytic reduction (SCR)

Armenia: Technological Pathway to comply with the AGP technical provisions

PM (Annex X)

In all large combustion plants and industrial sectors covered:

Fabric filters and electrostatic precipitators are the techniques recommended to able compliance with limit values implemented by the Annex

- Fabric filters
- Electrostatic precipitators

When desulphurisation is also conducted, the following techniques are also available:

- wet flue-gas, desulphurisation (FGD),
- dry or semi-dry FGD system.

The proper sizing of the equipment is essential.

Armenia: Technological Pathway to comply with the AGP technical provisions

PM (Annex X)

Only recommended limit values are proposed in the AGP, is the **domestic heating** with solid fuels.

- Development of the use of efficient appliances, based on the Code of good practices developed by UNECE

Armenia: Technological Pathway to comply with the AGP technical provisions

VOC (Annex VI)

Industrial plants using solvents

Depending on activities using solvents, primary measures and end of pipe techniques such as adsorption, oxidation

Armenia: Main conclusions

- Air quality: PM concentrations very high and main concern in term of air quality,
- Emissions: large impact of road transport in NOx emissions. For PM, domestic heating is the largest source of emissions (however the emission inventory does not assess correctly diffuse sources of emissions. The mining sector is recognized as a huge sector emitting emissions
- An EU cooperation programme (CEPA) to align the national regulations with a large number of EU Directives in the Republic of Armenia, especially the IED, the air quality directives
- A technological pathway quite common for combustion plants and industrial plants covered by the technical annexes
- For small domestic appliances, the reduction techniques are known. The Code of good practices for wood burning and small combustion installations developed by UNECE should be used.

By the implementation of the provisions in key EU Directives, the Republic of Armenia would be in the condition to comply with the requirements of the four AGP technical annexes IV, V, VI, X and XI in particular their ELVs, tentatively around 2032-35, EU directives not covered by the CEPA should be included additionally (stage II)

Useful links

Reports on emission inventory: IIR and NFR tables
https://www.ceip.at/status-of-reporting-and-review-results/2021-submission

Thank you very much for your attention!

Questions?

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