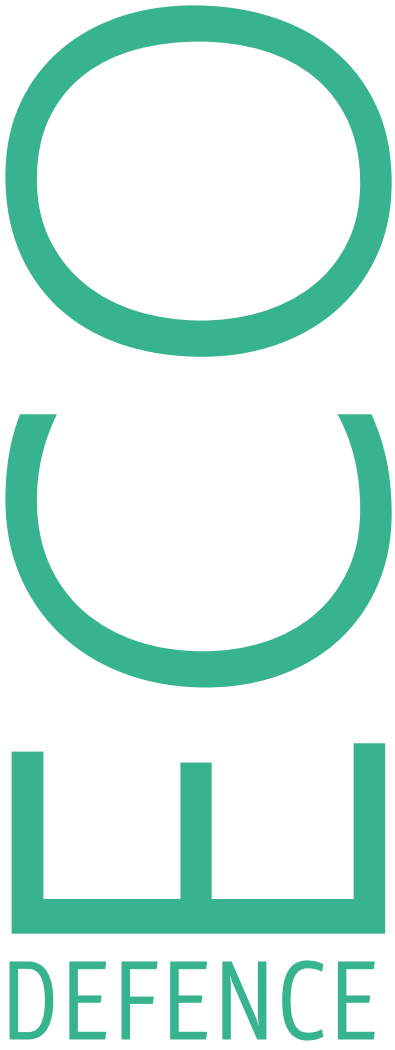


PLAN FOR HIGHER ENVIRONMENTAL STANDARDS IN DEFENCE 2022-2024

Driven by the Work Program of the Government of the Republic of North Macedonia covering the period 2020-2024, as well as the relevant NATO documents in the field of environmental protection, the challenges of climate change to security, as well as the need to increase energy efficiency in defence, the Ministry of Defence adopted a Plan for higher environmental standards in defence which will be implemented in the period from 2022 to 2024, and which will introduce exceptionally high environmental standards during the implementation of defence activities. This Plan will significantly reduce the impact of the Army's infrastructure on climate change, and it will also affect the efficient and rational use of defence funds.

The plan for higher environmental standards in defence 2022-2024 covers four separate areas of action, namely:

1 REPLACEMENT OF HEATING ENERGY AT ARMY FACILITIES TO REDUCE POLLUTION

2 PLAN FOR INSTALLATION OF PHOTOVOLTAIC POWER PLANTS AT APPROPRIATE FACILITIES IN THE ARMY BARRACKS FOR THE PRODUCTION OF ELECTRICITY

3 INCREASING THE ENERGY EFFICIENCY OF THE ARMY FACILITIES AND RENOVATING THE HEAT DISTRIBUTION NETWORK IN THE ARMY BARRACKS

4 ADDITIONAL MEASURES TO REDUCE HARMFUL ENVIRONMENTAL IMPACTS

RELEVANCE OF CLIMATE CHANGE IN DEFENSE

The Government of the Republic of North Macedonia recognized from the very beginning the need to change the approach of the institutions, the private sector and the citizens towards the protection of the environment. In that context, in the Work Program of the Government of the Republic of North Macedonia for the period 2020-2024, in the area "Protection of the environment and green development", "a clean, healthy and well-preserved environment as a support for a sustainable economy and society in which satisfied citizens live" is defined as an important challenge in this mandate.

The Ministry of Defence sees the introduction of higher environmental standards in defence as a step forward towards the integration of "environmental protection" in other government policies and areas of action, especially considering that this Plan includes activities that fully correspond to the stated goals in the Government Program - pollution control and reduction, as well as the use of environmentally friendly fuels and the use of renewable energy sources.

After all, the steps presented in the Plan for higher environmental standards fit and complement the steps foreseen in the Government Program, especially the goal "by 2024, no state institution will be heated with old and non-ecological heating systems and all public institutions are to be heated with central heating, gas, high-efficiency inverter air conditioners or heat pumps".

As the 30th member country of NATO, North Macedonia bases its defence policies and plans on the goals and guidelines of the Alliance, which in the field of eco-defence are clearly defined in the NATO 2030 concept, as well as in the communique of the heads of state and governments of the Member States, from the Summit in Brussels on 14 June 2021.

Namely, NATO 2030 as a concept envisages an ambitious agenda that will enable NATO to remain ready, strong and united in the new era of global challenges. Point seven of General Secretary Jens Stoltenberg's proposals indicates the need for a significant reduction in gas emissions caused by army activities, as well as army facilities and infrastructure, with an exceptionally ambitious goal - "zero emissions of the so-called greenhouse gases until 2050". The concept also indicates that NATO will be better positioned to realize its fundamental goals if it sees the challenge of climate change and quickly and efficiently adapts and mitigates the consequences of these climate changes that are visible even today.

The Brussels Communiqué, on the other hand, indicates that climate change tests the resilience and readiness of civil systems to respond to natural disasters, and it also refers to the significance of climate change in the context of NATO's security and readiness for the realization of its main tasks - defence and deterrence.

The guidelines presented in the Government Program and in the NATO documents show that the Ministry of Defence's plan for the development of defence in "eco-defence" fully coincides with the vision at the national level and at the level of the Alliance, for a defence that does not have a harmful impact on the environment.

CURRENT CONDITION

The Ministry of Defence prepared a comprehensive analysis for increasing energy efficiency, that is, reducing the consumption and costs of electricity and heat energy in the barracks.[i] The purpose of this analysis was to find solutions to increase the electrical energy and thermal efficiency of the Army's facilities and barracks by using new, efficient and renewable technologies that would lead to a reduction in CO2 emissions and thus to a cleaner life environment.

The current annual consumption of electricity is 10,369 MWh, and the annual costs, according to the current conditions, are 53,814,041 den. (€875,025). Annual emissions of CO2 only based on consumed electricity, according to calculations, are at the level of about 4,863 tons.

A challenge for the energy efficiency of the Army's facilities is their current condition, which is mostly characterized by unrenovated buildings, dilapidated infrastructure and an inefficient heat energy distribution network.

Regarding the heating of the barracks, except for the facilities in the "Ilinden" barracks in Skopje, all the other barracks are heated with polluting fuels - fuel oil and extra light fuel, while separate Army facilities outside the barracks are also heated with wood.

The annual energy consumption for the production of thermal energy for the Army facilities in the barracks amounts to 1192 tons of fuel oil, 125.83 tons of extra light fuel and 754,086 Nm3 of natural gas, and the annual costs for the purchase of energy amounts to 51,562,461 den. (€838,414). The annual emissions of CO2, due to the use of fuel oil, extra light fuel and natural gas for the production of thermal energy, according to the calculations, are at the level of approx.5,347tons per year.

1 REPLACEMENT OF HEATING ENERGY AT ARMY FACILITIES TO REDUCE POLLUTION

For now, only one of the Army barracks, the "Ilinden" barracks in Skopje, uses natural gas as energy for heating. The Ministry of Defence has already taken decisive steps forward in terms of replacing fuel oil with natural gas in two Army barracks - the "Strasho Pindzur" barracks in Petrovec and the "Boro Menkov" barracks in Kumanovo, where the plans were completed last year, and after conducting a public procurement procedure, two companies are already working in the field and it is expected that by the end of 2021 these two large barracks will be completely diverted from fuel oil and extra light fuel to natural gas.

According to the Plan and the conducted analyses, after the change of the heating energy from fuel oil to natural gas for the "Strasho Pindzur" barracks in Petrovec, annual CO2 emissions will decrease by 55%, from the existing 705 tons to 318 tons, and the savings will amount to 51290 euros per year.

BARRACKS	CURRENT HEATING ENERGY	NEW TYPE OF HEATING ENERGY	REDUCTION OF CO2 EMISSIONS	ESTIMATED FUNDS SAVING (€)
"STRASHO PINDZUR" - PETROVEC	FUEL OIL	COMPRESSED NATURAL GAS	55%	51 290

Part of the "Goce Delchev" barracks in Skopje, which is located in one of the most urban parts of the city, still uses extra light fuel as a partial source of heating energy, although there is a central heating city network in the immediate vicinity. By connecting all the buildings of this barracks to the central heating city network, CO2 emissions will be reduced by 35%, from the existing 29 tons to 19 tons, and savings of 5,024 euros will be generated per year.

BARRACKS	CURRENT HEATING ENERGY	NEW TYPE OF HEATING ENERGY	REDUCTION OF CO2 EMISSIONS	ESTIMATED FUNDS SAVING (€)
"GOCE DELCHEV" - SKOPJE	EXTRA LIGHT FUEL	BEG DISTRIBUTION NETWORK	35%	5 024

With the change of energy in the "Chede Filipovski - Dame" barracks in Kichevo to compressed natural gas, CO2 emissions will be reduced by 48%, from the existing 552 tons to 265 tons, and more than 11,000 euros will be saved per year.

BARRACKS	CURRENT HEATING ENERGY	NEW TYPE OF HEATING ENERGY	REDUCTION OF CO2 EMISSIONS	ESTIMATED FUNDS SAVING (€)
"CHEDE FILIPOVSKI - DAME" - KICHEVO	FUEL OIL	COMPRESSED NATURAL GAS	48%	11 324

With the planned changes for the use of compressed natural gas in the "Kuzman Josifovski - Pitu" barracks in Tetovo, where fuel oil is currently used as heating energy, CO2 emissions will be reduced by 52%, from the existing 549 to 263.5 tons. and 11,264 euros will be saved per year.

BARRACKS	CURRENT HEATING ENERGY	NEW TYPE OF HEATING ENERGY	REDUCTION OF CO2 EMISSIONS	ESTIMATED FUNDS SAVING (€)
"KUZMAN JOSIFOVSKI - PITU" - TETOVO	FUEL OIL	COMPRESSED NATURAL GAS	52%	11 264

In the **"Boro Menkov" barracks in Kumanovo**, on the other hand, with the replacement of the existing extra light fuel as energy with heating with natural gas, CO2 emissions will be reduced by 31%, from the existing 352 tons to 243 tons, and savings of 66 855 euros will be generated per year.

BARRACKS	CURRENT HEATING ENERGY	NEW TYPE OF HEATING ENERGY	REDUCTION OF CO2 EMISSIONS	ESTIMATED FUNDS SAVING (€)
"BORO MENKOV" - KUMANOVO	EXTRA LIGHT FUEL	COMPRESSED NATURAL GAS	31%	66 855

According to the analysis, with the change of heating energy from fuel oil to compressed natural gas in the **"Jane Sandanski" barracks in Shtip**, CO2 emissions will be reduced by 52%, from the existing 743 tons to 357 tons and savings of 15 490 euros will be generated per year.

BARRACKS	CURRENT HEATING ENERGY	NEW TYPE OF HEATING ENERGY	REDUCTION OF CO2 EMISSIONS	ESTIMATED FUNDS SAVING (€)
"JANE SANDANSKI" – SHTIP	FUEL OIL	COMPRESSED NATURAL GAS	52%	15 490

By changing the heating energy in the **"Mirche Acev" barracks in Prilep** from fuel oil to natural gas, CO2 emissions in the atmosphere will be reduced by 52%, from the existing 1098 tons to 528 tons, and savings of 22,513 euros will be generated annually.

BARRACKS	CURRENT HEATING ENERGY	NEW TYPE OF HEATING ENERGY	REDUCTION OF CO2 EMISSIONS	ESTIMATED FUNDS SAVING (€)
"MIRCHE ACEV" – PRILEP	FUEL OIL	COMPRESSED NATURAL GAS	52%	22 513

OVERVIEW OF ARMY BARRACKS HEATING METHODS AND CHANGES ACCORDING TO THE PLAN FOR HIGHER ENVIRONMENTAL STANDARDS IN DEFENSE 2022-2024

BARRACKS	CURRENT HEATING ENERGY	NEW TYPE OF HEATING ENERGY	REDUCTION OF CO2 EMISSIONS (t) AFTER THE CHANGE	ESTIMATED FUNDS SAVING (€)
"ILINDEN" - SKOPJE	NATURAL GAS	INVESTMENTS IN DISTRIBUTION NETWORK	340	62 350
"STRASHO PINDJUR" - PETROVEC	FUEL OIL	COMPRESSED NATURAL GAS	387	51 220
"GOCE DELCHEV" - SKOPJE	EXTRA LIGHT FUEL	BEG DISTRIBUTION NETWORK	10	5 024
"CHEDE FILIPOVSKI - DAME" - KICHEVO	FUEL OIL	COMPRESSED NATURAL GAS	287	11 324
"KUZMAN JOSIFOVSKI - PITU" - TETOVO	FUEL OIL	COMPRESSED NATURAL GAS	285	11 264
"BORO MENKOV" - KUMANOVO	EXTRA LIGHT FUEL	COMPRESSED NATURAL GAS	109	66 855
"JANE SANDANSKI" – SHTIP	FUEL OIL	COMPRESSED NATURAL GAS	387	15 490
"MIRCHE ACEV" – PRILEP	FUEL OIL	COMPRESSED NATURAL GAS	570	22 513
	TOTAL:		2,375 t	€246,040

The Ministry of Defence has a large number of small isolated facilities where outdated and non-ecological types of heating are used. This Plan envisages for their replacement with heat pumps, pellets and compressed natural gas in the period 2022-2024.

OVERVIEW OF THE HEATING METHOD IN ARMY'S SMALL AND SEPARATE FACILITIES (SF) AND THE CHANGES ACCORDING TO THE PLAN FOR HIGHER ENVIRONMENTAL STANDARDS IN DEFENSE 2022-2024

FACILITY	CURRENT HEATING ENERGY	NEW TYPE OF HEATING ENERGY	REDUCTION OF CO2 EMISSIONS (t) AFTER THE CHANGE	ESTIMATED FUNDS SAVING (€)
SF "OTOVICA" - VELES	EXTRA LIGHT FUEL	COMPRESSED NATURAL GAS	18.80	11,500
SF "EREBINO" - TETOVO	EXTRA LIGHT FUEL	COMPRESSED NATURAL GAS	28,17	17 250
SF "KRIVI DOL" - SHTIP	WOOD	PELLETS	9.40	4 500
SF "CHELOPECI" - KICHEVO	EXTRA LIGHT FUEL/WOOD	PELLETS	9.40	5 750
SF "FURKA" - GEVGELIJA	EXTRA LIGHT FUEL	HEAT PUMP	18.80	10 970
SF "CHAVKA" - DELCHEVO	EXTRA LIGHT FUEL/WOOD	HEAT PUMP	23.47	13 680
SF "LISEC" - VINICA	EXTRA LIGHT FUEL/WOOD	HEAT PUMP	18.80	10 970
SCN "PLACHKOVICA" - SHTIP	EXTRA LIGHT FUEL	PELLETS	9.40	5 750
MILITARY STADIUM - SKOPJE	EXTRA LIGHT FUEL	COMPRESSED NATURAL GAS	32.87	20 130
HOTEL "SHAR" - POPOVA SHAPKA	EXTRA LIGHT FUEL	COMPRESSED NATURAL GAS	46.94	28 750
SF "SOPISHTE" - SKOPJE	EXTRA LIGHT FUEL	HEAT PUMP	9.40	5 478
"VILA LOZJE" - OHRID	EXTRA LIGHT FUEL	HEAT PUMP	9.40	5 478
TOTAL:			234.85 t	€140,206

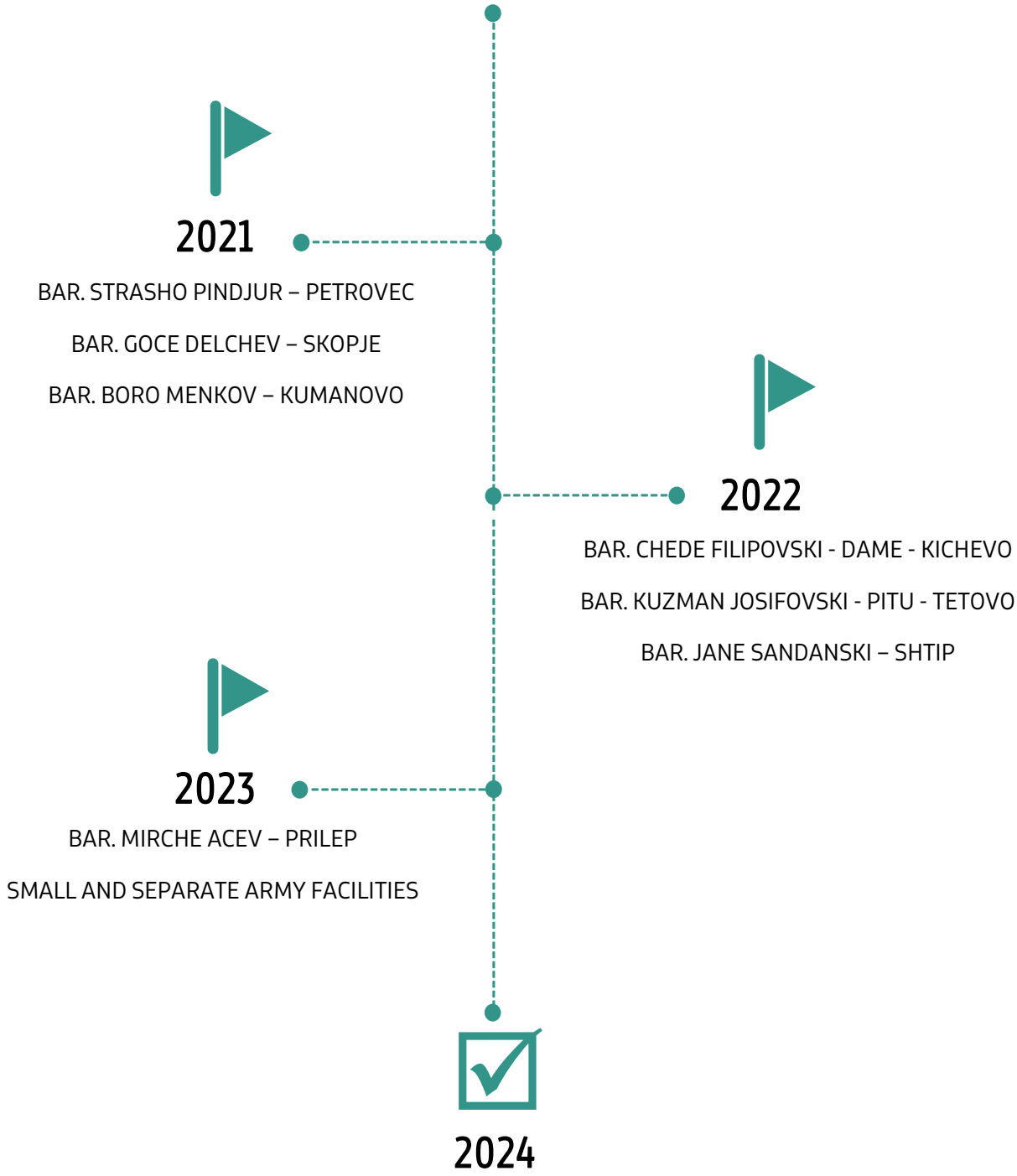
By repurposing the heating method in the facilities in the barracks and the small and isolated facilities, CO2 emissions in the atmosphere will be reduced by 42.5% i.e. by 2610 tons, and the savings will amount to approx €386,246 (23 754 129 Denar) annually.

42%

LESS CO2

DYNAMIC PLAN

HEATING ENERGY REPLACEMENT IN ARMY FACILITIES



ROUNDING UP THE PROCESS OF COMPLETE HEATING ENERGY REPLACEMENT IN ARMY FACILITIES

2 INSTALLATION OF PHOTOVOLTAIC POWER PLANTS AT ARMY BARRACKS FACILITIES

According to the comprehensive analysis of the Ministry of Defence, by utilizing the solar potential and installing photovoltaic power plants in the barracks, by the end of 2024 the Army will cover its electricity needs exclusively from its own production.

The Plan for the installation of photovoltaic power plants in the Army barracks is designed according to the latest module technology (example: Trina Solar with a peak power of 500 Wp[1]) and inverters (example: ABB PVS – TL with AC power of 100 kW).

In the comprehensive analysis, 252 designs of photovoltaic power plants were made for each of the Army barracks for which the hourly electricity production was determined, followed by making a comparison with the electricity consumption for each of the barracks respectively, in order to analyse the cost benefit of the system.

In part of the Barracks, there is already an existing distribution network (transformer stations and electric power network) which has the possibility to accept the power of the photovoltaic power plants and to accept the production of electricity from them.

The projected installed power of photovoltaic power plants on the roofs of the army barracks buildings is 10.26 MWp, with an annual electricity production of 12,833.2 MWh. At the same time, the electricity savings that will be generated by installing the photovoltaic power plants will amount to 5,435 MWh, and in addition, surplus electricity will be generated in the amount of approximately 7,398 MWh.

THE TOTAL INVESTMENT FOR INSTALLATION OF THE PLANNED PHOTOVOLTAIC POWER PLANTS, ACCORDING TO THE CURRENT MARKET CONDITIONS, IS PROJECTED AT A LEVEL OF €5,337,280

THE COST-BENEFIT ANALYSIS SHOWS THAT THIS INVESTMENT IS COST-EFFECTIVE,
WITH AN AVERAGE RETURN ON THE TOTAL INVESTMENT OF ABOUT 8.5 YEARS[2]

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[1]Wp – watt peak, the maximum electrical capacity that a solar cell can produce under ideal conditions, i.e. a solar panel aimed directly at the sun in conditions with zero clouds.

[2]The analysis was done in May 2021, at much lower electricity prices on the market. It is realistic to expect that the cost-benefit in the current conditions would be higher.

INSTALLATION OF PHOTOVOLTAIC POWER PLANTS, PER BARRACKS

According to the analysis, a photovoltaic power plant with an installed power of 864 kWp, and an annual production of electricity of 1 GWh, is planned to be constructed in the "Ilinden" barracks in Skopje. Due to the favourable conditions for the full utilization of the solar potential, the construction of an additional photovoltaic plant with a power of 1,408 kWp is planned in this barracks, which will produce electricity of 1.8 GWh annually. With the installation of these two photovoltaic power plants in the "Ilinden" barracks, the total installed power would amount to 2.3 MWp, while the total annual electricity produced would amount to 2.8 GWh. For comparison, the current annual consumption of electricity in this barracks is 2.6 GWh.

BARRACKS	CURRENT ANNUAL CONSUMPTION OF EE IN MWH	INSTALLED PPP CAPACITY IN MWP	ANNUAL PRODUCTION OF EE IN PPP IN MWH	REDUCTION OF CO2 EMISSIONS AFTER INSTALLATION OF PPP	ESTIMATED ANNUAL SAVINGS OF FUNDS (€)
"ILINDEN" - SKOPJE	2,617	2,3	2,787	66%	63 183

The photovoltaic power plant planned for construction in the "Strasho Pindzur" barracks in Petrovec will have a power of 2.6 MWp, with an annual electricity production of 3.2 GWh. The current annual consumption of electricity for the needs of this barracks is 3.7 GWh, which indicates that the needs of purchasing electricity with the installation of the photovoltaic power plant will be greatly reduced.

BARRACKS	CURRENT ANNUAL CONSUMPTION OF EE IN MWH	INSTALLED PPP CAPACITY IN MWP	ANNUAL PRODUCTION OF EE IN PPP IN MWH	REDUCTION OF CO2 EMISSIONS AFTER INSTALLATION OF PPP	ESTIMATED ANNUAL SAVINGS OF FUNDS (€)
"STRASHO PINDJUR" - PETROVEC	3,712	2.6	3.221	87%	92 273

The "Goce Delchev" barracks in Skopje has the capacity to build a photovoltaic power plant with a power of 504 kWp, with an annual production of 629,755 kWh (0.6 GWh). The total annual electricity consumption is currently 1.4 GWh.

BARRACKS	CURRENT ANNUAL CONSUMPTION OF EE IN MWH	INSTALLED PPP CAPACITY IN MWP	ANNUAL PRODUCTION OF EE IN PPP IN MWH	REDUCTION OF CO2 EMISSIONS AFTER INSTALLATION OF PPP	ESTIMATED ANNUAL SAVINGS OF FUNDS (€)
"GOCE DELCHEV" - SKOPJE	1,489	2.5	630	42%	26 937

"Chede Filipovski - Dame" barracks in Kichevo has a large number of buildings, but due to their inadequacy for construction of photovoltaic power plants, according to the analysis, it is planned to install the photovoltaic systems on a metal structure in the parking lot in the barracks, with an installed power of 696 kWp, that is, with

an annual electricity production of 970,400 kWh (~1 GWh). The current consumption of electricity in this barracks is 811,816 kWh.

BARRACKS	CURRENT ANNUAL CONSUMPTION OF EE IN MWH	INSTALLED PV PP CAPACITY IN MWP	ANNUAL PRODUCTION OF EE IN PV PP IN MWH	REDUCTION OF CO2 EMISSIONS AFTER INSTALLATION OF PV PP	ESTIMATED ANNUAL SAVINGS OF FUNDS (€)
"CHEDE FILIPOVSKI - DAME" - KICHEVO	812	0.7	970	100%	20 893

The "Kuzman Josifovski - Pitu" barracks in Tetovo has the capacity to build a photovoltaic power plant with a power of 1.3 MWp, with an annual production of 1.6 GWh. The current consumption of electricity in this barracks is 552,790 kWh.

BARRACKS	CURRENT ANNUAL CONSUMPTION OF EE IN MWH	INSTALLED PV PP CAPACITY IN MWP	ANNUAL PRODUCTION OF EE IN PV PP IN MWH	REDUCTION OF CO2 EMISSIONS AFTER INSTALLATION OF PV PP	ESTIMATED ANNUAL SAVINGS OF FUNDS (€)
"KUZMAN JOSIFOVSKI - PITU" - TETOVO	553	1,3	1,588	100%	17 120

In the "Boro Menkov" barracks in Kumanovo, according to the analysis, it has been established that there is a capacity for the construction of a photovoltaic power plant with a power of 928 kWh, and an annual electricity production of 1.2 GWh. The annual consumption of this barracks is currently 508,656 kWh, that is, less than half of the production planned after the installation of the photovoltaic power plant.

BARRACKS	CURRENT ANNUAL CONSUMPTION OF EE IN MWH	INSTALLED PV PP CAPACITY IN MWP	ANNUAL PRODUCTION OF EE IN PV PP IN MWH	REDUCTION OF CO2 EMISSIONS AFTER INSTALLATION OF PV PP	ESTIMATED ANNUAL SAVINGS OF FUNDS (€)
"BORO MENKOV" - KUMANOVO	509	0.9	1,163	100%	14 172

The "Jane Sandanski" barracks in Shtip, like the rest of the Army barracks, is an excellent location for the construction of a photovoltaic power plant. In the case of the Shtip barracks, the installed power of the photovoltaic power plant will be 1.1 MWp, and the annual production of electricity – 1.4 GWh. The current consumption of electricity in this barracks is 676,000 kWh, i.e. less than half of the production planned after the installation of the photovoltaic power plant.

BARRACKS	CURRENT ANNUAL CONSUMPTION OF EE IN MWH	INSTALLED PV PP CAPACITY IN MWP	ANNUAL PRODUCTION OF EE IN PV PP IN MWH	REDUCTION OF CO2 EMISSIONS AFTER INSTALLATION OF PV PP	ESTIMATED ANNUAL SAVINGS OF FUNDS (€)
"JANE SANDANSKI" - SHTIP	676	1.1	1,414	100%	19 838

OVERVIEW OF ELECTRICAL ENERGY CONSUMPTION, PRODUCTION OF PHOTOVOLTAIC POWER PLANTS IN THE BARRACKS AND THE FUNDS REQUIRED FOR THEIR CONSTRUCTION

BARRACKS	CURRENT ANNUAL CONSUMPTION OF EE IN MWH	INSTALLED PV PP CAPACITY IN MWP	ANNUAL PRODUCTION OF EE IN PV PP IN MWH	FUNDS FOR CONSTRUCTION OF PV PP (€)	ESTIMATED FUNDS SAVING (€)
"ILINDEN" - SKOPJE	2,617	2,3	2,787	1 630 720	63 183
"STRASHO PINDJUR" – PETROVEC	3,712	2.6	3.221	1 352 000	92 273
"GOCE DELCHEV" – SKOPJE	1,489	0.5	630	262 080	26 937
"CHEDE FILIPOVSKI - DAME" - KICHEVO	814	0.7	970	361 920	20 893
"KUZMAN JOSIFOVSKI - PITU" - TETOVO	553	1,3	1,588	665 600	17 120
"BORO MENKOV" - KUMANOVO	509	0.9	1,163	482 560	14 172
"JANE SANDANSKI" – SHTIP	676	1,1	1,414	582 400	19 839
TOTAL:	**10,370**	**9.4**	**11,773**	**€5,337,280**	**€254 417**

ACCORDING TO THE COMPREHENSIVE ANALYSIS, THE INVESTMENT OF AROUND €5.3 MILLION HAS A RETURN PERIOD OF 8.5 YEARS, WHICH, CONSIDERING THE AMORTIZATION PERIOD OF 25 YEARS, REPRESENTS AN EXTREMELY GOOD INVESTMENT

THE SAVINGS OF FUNDS INTENDED FOR ELECTRIC ENERGY AFTER THE INSTALLATION OF THE PHOTOVOLTAIC POWER PLANTS ARE ESTIMATED AT THE LEVEL OF € 254,417 ANNUALLY[3]

According to the models offered for the project for construction of photovoltaic power plants in the Army barracks, and the limited budgetary resources (since the priority is placed to modernization of the Army), the Steering Group in the Ministry of Defence assessed that the most appropriate solution would be the public-private partnership model.

[3]The analysis was done in May 2021, at much lower electricity prices on the market. It is realistic to expect that the cost-benefit in the current conditions would be higher

3 INCREASING THE ENERGY EFFICIENCY OF THE ARMY FACILITIES AND RENOVATING THE HEAT DISTRIBUTION NETWORK IN THE ARMY BARRACKS

RECONSTRUCTION OF FACILITIES

In the course of 2020-2021, several facilities in the barracks were reconstructed, in accordance with the principles of increasing the energy efficiency of Army's facilities. All capital projects that were implemented in 2020 were with mandatory consideration of the efficient efficiency principles, which implies allocation of larger funds from the budget of the Ministry of Defence, but in the long term it is economically cost-effective and at the same time contributes to a cleaner environment. Thus, for example, at least 20% of the total cost of capital projects in 2020 was intended for achieving energy efficiency (thermal facades, changing doors and windows, renewing the roof structure).

A completely renovated and modernized building according to NATO standards, which is used by the South Eastern Europe Brigade, hosted by the Republic of North Macedonia, was put into use in the "Boro Menkov" barracks in Kumanovo. The ruined building was turned into a fully functional building in record time.

In the "Ilinden" barracks in Skopje, two buildings covering more than 7,500 square meters were reconstructed.

The Army Rangers facility in "Ilinden" barracks is a completely renovated army facility with complete reconstruction and infrastructural modernization, which is taking place after 50 years of use. In order to preserve energy efficiency, a complete thermal insulation was made, which includes the replacement of all doors and windows and installation of a thermal facade.
In the building of the Army Honour Guard and the Support Battalion of the General Staff and Skopje garrison, a new thermal facade has been installed, all windows and doors have been replaced, thermopane glasses are used, and the roof structure has also been changed.

The reconstruction of another facility in the "Ilinden" barracks, two facilities in the "Jane Sandanski" barracks in Shtip, and two facilities in the "Goce Delchev" barracks in Skopje, including a Military Academy facility, is in progress.

RENEWAL OF THE DISTRIBUTION NETWORK

In addition to the conversion of the heating method of the barracks from fuel oil and extra light fuel to natural gas and compressed natural gas, as well as the connection to the hot water distribution network, according to the conducted analyses, about 25% of the total heat energy production is to cover the losses generated due to the obsolete heat energy distribution network. These are buildings that have not been invested in for more than

50 years, which are old, made with old type of materials, old technologies, and therefore energy loss is both an economic and environmental problem.

In order to reduce costs and CO2 emissions, in the past two years, the hot water distribution network is being replaced in a large part of the barracks, as follows:

- in the "Mirche Acev" barracks in Prilep, the entire external hot water distribution network in the length of about 1200 meters has been completely replaced
- In the "Strasho Pindjur" barracks in Petrovec, 450 meters of external hot water distribution network were replaced
- In the "Ilinden" barracks in Skopje, about 350 meters of external steam and condensation distribution network were replaced
- In the "Boro Menkov" barracks in Kumanovo, an external hot water distribution network in length of about 350 meters was replaced.
- In the "Boro Menkov" barracks in Kumanovo, the replacement of the external hot water distribution network is underway.

In the upcoming period, according to the Plan for higher environmental standards in defence, the heat energy distribution network will be reconstructed in:

- "Ilinden" barracks in Skopje
- "Jane Sandanski" barracks in Shtip
- "Kuzman Josifovski - Pitu" barracks in Tetovo.

4 ADDITIONAL MEASURES TO REDUCE HARMFUL ENVIRONMENTAL IMPACTS

CONTINUOUS MONITORING OF GAS EMISSIONS AND THE ENVIRONMENTAL IMPACT OF ARMY ACTIVITIES, INCLUDING MILITARY EXERCISES AND TRAINING

In the past few years, the Ministry of Defence has established the practice of monitoring the largest training activities of the Army of the Republic of North Macedonia at the Training Area Krivolak.
In cooperation with the AMBICON university laboratory at Goce Delchev University in Shtip, two large subsequent exercises "Decisive Strike" in 2019 and "Decisive Strike 21" in 2021 have been monitored so far, and it has been determined that the army activities of these two extremely large army exercises did not cause environmental pollution.
The monitoring of the quality of ambient air in terms of the concentration of suspended solid particles in the wider zone of TA "Krivolak" during the performance of major military activities at this training area will continue in the future.

USE OF ADDITIVES TO REDUCE HARMFUL EXHAUST GASES

In order to reduce the harmful exhaust gases resulting from the use of diesel fuels in engineering machinery, trucks and motor vehicles, the Army introduced the mandatory use of diesel exhaust gas treatment fluid also known as AdBlue.
AdBlue is a liquid used in newer passenger and cargo motor vehicles equipped with a diesel engine whose exhaust gas treatment system works on the principle of Selective Catalytic Reduction. This fluid enables the fulfilment of the most restrictive European norms of EURO V and EURO VI emission by reducing the level of nitrogen oxide emitted through the exhaust system by up to 90%, through conversion into harmless compounds for humans and the environment such as nitrogen and water.

[iv] "Analysis of the possibilities for increasing energy efficiency and electricity production by photovoltaic power plants in the barracks in the Republic of North Macedonia", Prof. Dragan Minovski, May 2021