Health co-benefits of Macedonian NDC

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Background

- Paris Agreement & North Macedonia
  - signed (2015) and ratified (2017), as a non-Annex I country to UNFCCC
  - **2015** - submitted the Initial Nationally Determined Contribution (NDC)
    - Pledge: “To reduce the CO2 emissions from fossil fuels combustion for 30%, that is, for 36% at a higher level of ambition, by 2030 compared to the business as usual (BAU) scenario.”
  - **2021** – submitted the enhanced NDC
    - Pledge:
      - In 2030, 51% reduction in greenhouse gas emissions compared to 1990 levels
      - Expressed in net emissions, in 2030, 82% reduction compared to 1990 levels

Enhanced NDC

- Includes 63 mitigation policies and meas
  sectors:
  - Energy (incl: energy supply, residential and
    transport) - 32
  - Agriculture - 4
  - Land Use, Land Use Change and Forestry (LU
  - Waste - 4
  - Additional PAMs (enablers of mitigation acti
    - Emissions coverage: Economy-wid
    - GHGs covered: CO_2, CH_4, N_2O

PAM 19 Construction of passive buildings

Main objective: After 31.12.2020 all new building should be nearly zero-energy buildings

Description: The measure considers construction of new passive residential buildings in compliance with the EU Directive 2010/31/EU. Thi
measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the building into operation.

Timeframe	Type	Sector	Gases	Scope
2020 – 2040	Technical, regulatory	Households	CO_2, CH_4, N_2O	National

Relevant planning documents, legal and regulatory acts	• Strategy for Energy Development of North Macedonia up to 2040 • Law on energy efficiency
Methodology [for estimating the emissions]	Bottom-up modeling and least-cost optimization using the MARKAL model. IPC Methodology
Assumptions	Construction of new passive buildings, while meeting the standard for at least A+ class (1 kWh/m2) starting from 2020 and continuously increasing their number so that in 2040, 85% of new buildings are assumed to be passive.
Status of implementation [idea, planning phase, under implementation]	Under implementation
- Steps taken	• Law on Energy Efficiency adopted.
- Steps envisaged	• National Building Renovation Strategy to be developed and adopted • Establishment of an Energy Efficiency Fund

Indicators		Value in the last reporting year	Indicative trajectory		Target value
		2016-2018*	2020	2025	2030
Progress	Area retrofitted (m^2)				
Emissions reduction (Gg CO_2-eq)		3.1	0.3	4.5	17.0
Other	Final energy savings (ktoe)	1.0	0.4	2.6	8.5
	Primary energy savings (ktoe)	1.5	0.4	3.4	10.5

Finance	Budget	1068 M€
	Source of finance	Private, donors through commercial EE loans, EE fund, financial support at municipalit level
Implementing entity		• Ministry of Economy, Energy Agency • Donors and financial institutions • Investors (households)
Monitoring entity		Ministry of Economy, Energy Agency
Contribution for the achievement of the SDGs		direct: 7 · indirect: 1, 12, 13

Enhanced NDC

- Additional aspects
  - Economic and environmental evaluation of PAMs - using the Marginal Abatement Cost **(MAC) Curve** tool
  - Social asp
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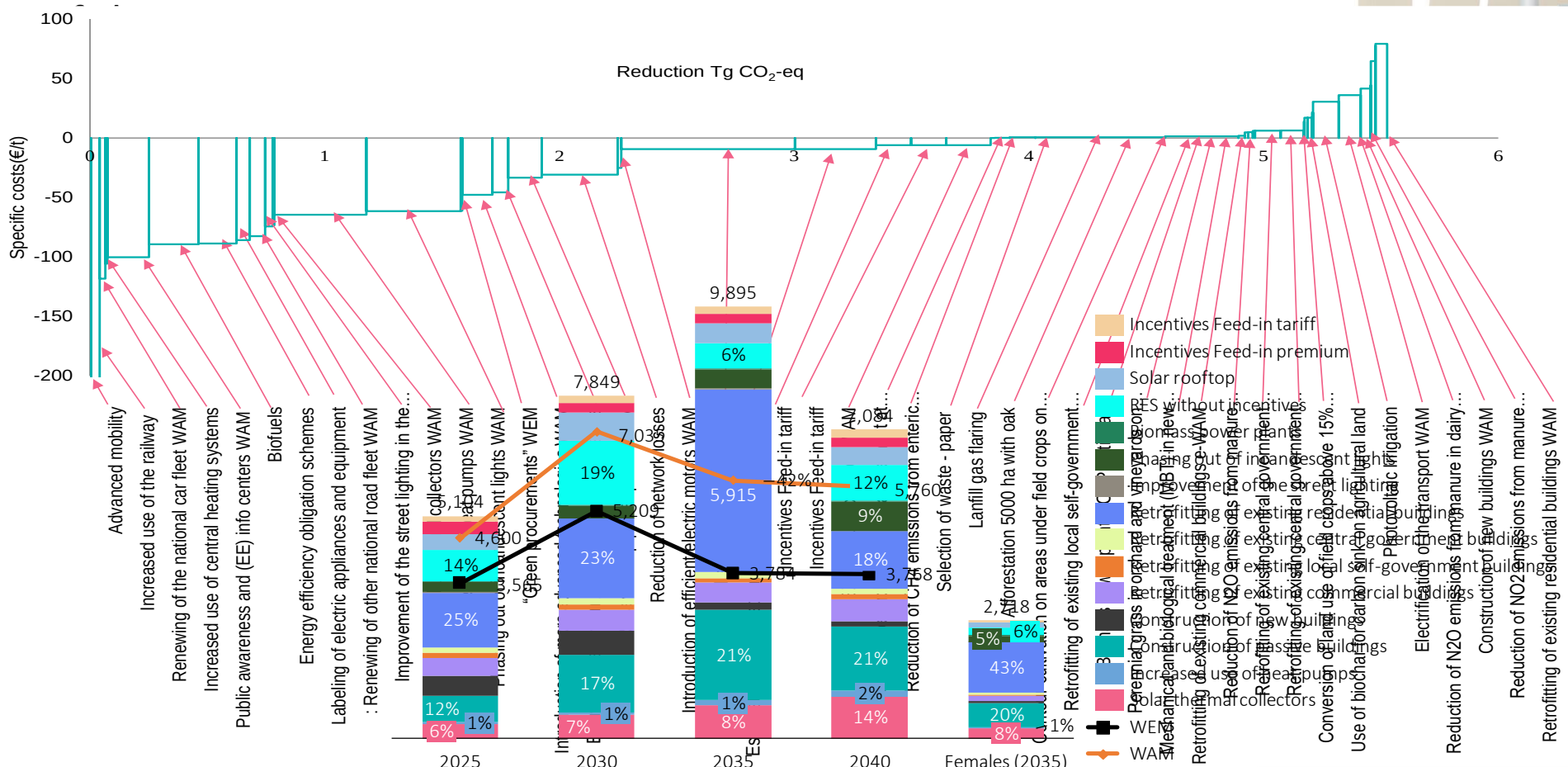


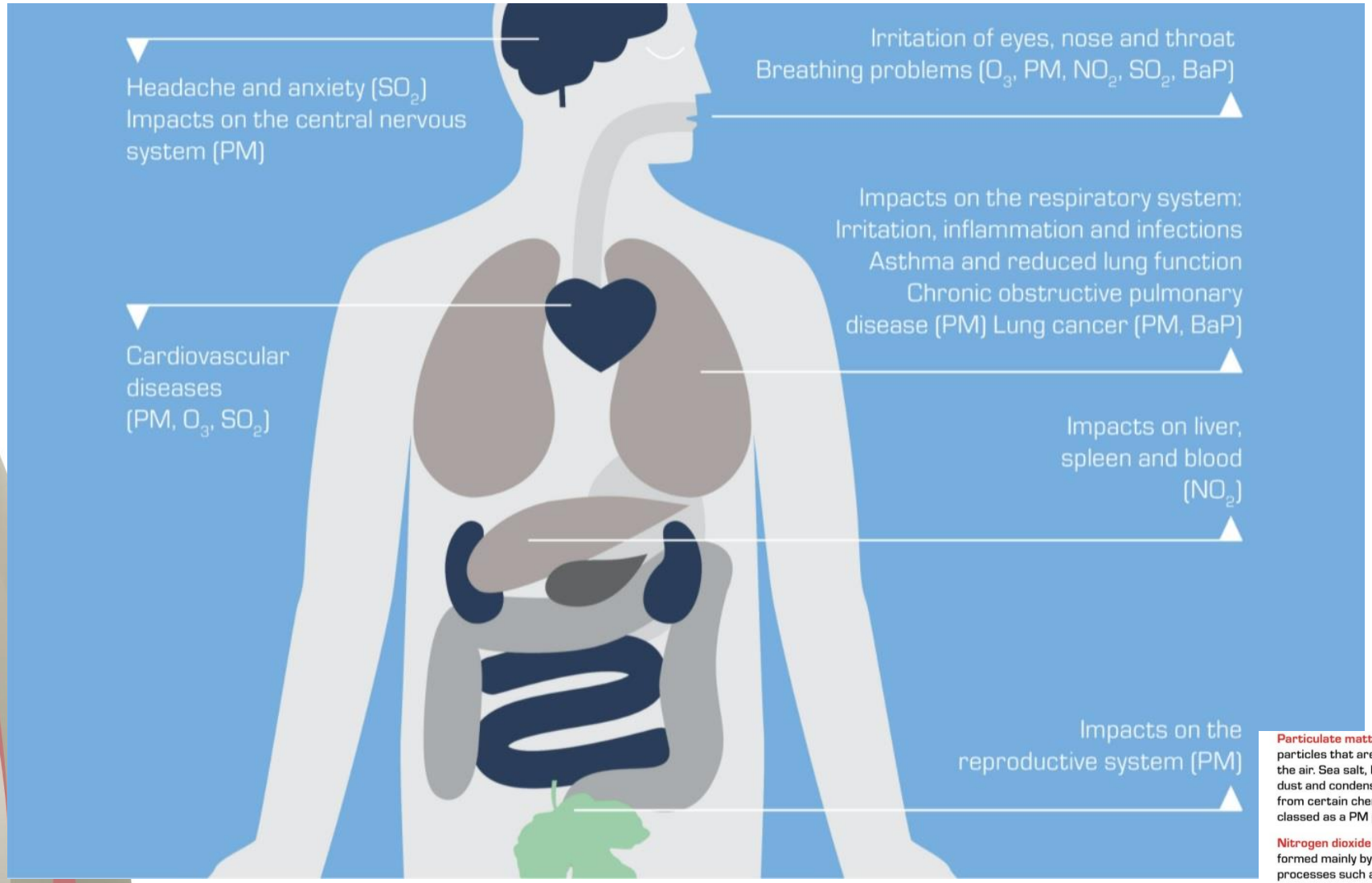
Motivation for the study

- To evaluate the **benefits on human health** associated with **improvements in ambient air quality** that could be expected from implementation of the proposed PaMs (in the **energy sector**).

Tools used

- **MARKAL** (MARket ALlocation) Model
  - Developed by IEA ETSAP
  - To calculate the air pollutants emission reductions
- **CaRBonH** (Carbon Reduction Benefits on Health) tool
  - Developed by the WHO Regional Office for Europe (for 53 Member States)
  - To estimate the health co-benefits and related economic gains

Health Impact of Air Pollution



Particulate matter (PM) are particles that are suspended in the air. Sea salt, black carbon, dust and condensed particles from certain chemicals can be classed as a PM pollutant.

Nitrogen dioxide (NO_2) is formed mainly by combustion processes such as those occurring in car engines and power plants.

Ground-level ozone (O_3) is formed by chemical reactions (triggered by sunlight) involving pollutants emitted into the air, including those by transport, natural gas extraction, landfills and household chemicals.

Sulphur dioxide (SO_2) is emitted when sulphur containing fuels are burned for heating, power generation and transport. Volcanoes also emit SO_2 into the atmosphere.

Benzo(a)pyrene (BaP) originates from incomplete combustion of fuels. Main sources include wood and waste burning, coke and steel production and motor vehicles' engines.

Source: https://www.eea.europa.eu/themes/signals/signals-2013/infographics/health-impacts-of-air-pollution/view

CaRBonH calculation tool

- Aim – to quantify the physical and economic consequences for human health achieved through improvements in country-level air quality from domestic carbon reductions
  - Health hazards are calculated using an impact pathway analysis
    - (explicitly traces the fate of pollutants from the moment they are released into the environment, followed by atmospheric dispersion and eventual removal by deposition and chemical transformation)
  - Health outcomes are calculated using epidemiological associations
    - (risk functions that link population response to changes in ambient exposure level)
  - The health benefits of reduced air pollution are transformed into economic costs using unit health costs (cost per case of disease or death)
- Excel-based tool, organized into four parts:
  - User input, Tool output, Tool calculations, and Databases
- Apportions the results according to reductions in national emissions plus additional health benefits achieved from emission reductions that occur in other countries – the transboundary pollution effect

CaRBonH calculation tool

What does the user need to input?

Plot Area

User inputs at country- or regional-level

Emissions reductions (time period: 2020, 2030)

- *Greenhouse gas (GHG) emission reductions as percentage and absolute change relative to a particular Base Year*
- *Ambient air pollution emission reductions of fine particulate matter (PM2.5), sulphur dioxide (SO_2), nitrogen oxides (NOx), and ammonia (NH_3) as absolute change relative to future business as usual emissions scenario in either 2020 or 2030*

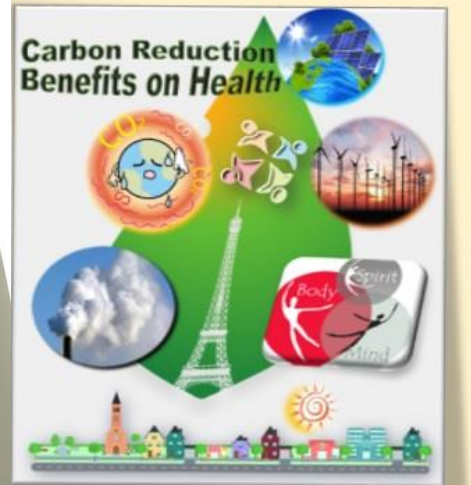
Data may be specified for a single country/region, or for a group of countries (e.g., Annex I countries only, or EU-28).

CaRBonH Calculator at a glance
(Version 1.0R, 10-Nov-2018)

CaRBonH
Excel-based calculation tool

Pre-loaded databases
(country – level)

Default data



- **Demographics:** Population size by age group, life expectancy, natural mortality rate
- **Exposure:** Source–Receptor matrices, anthropogenic share of total emissions, country-to-population weighted downscaling factors, and mass ratio of PM2.5 to PM10
- **Epidemiology:** Concentration–Response functions
- **Economics:** Cost per case of illness, or death (value of statistical life, value of a life year)

Data may be modified/supplemented by user.

What does the model deliver?

Tool output results are summarized in tables and also shown graphically

Population exposure changes

PM2.5 concentration changes are calculated using source-receptor matrices which characterise the country-level impact on air quality from the combined effect of lower domestic emissions and reduced regional (transboundary) pollution from neighbouring countries. Country-specific modifiers are applied to convert spatially averaged concentrations to population-weighted values.

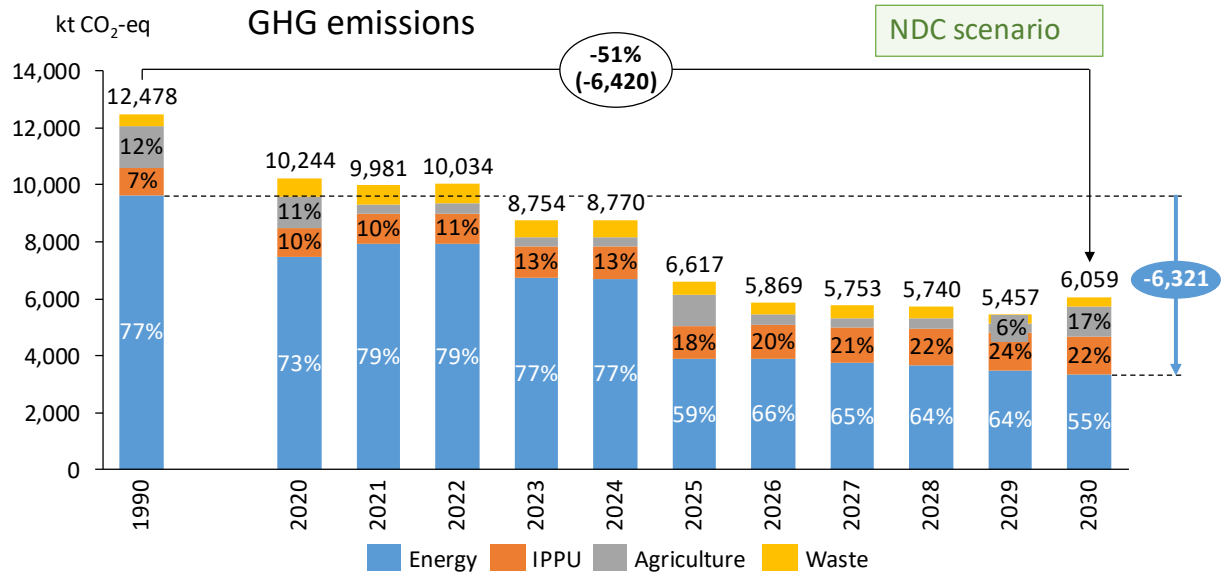
Physical health benefits

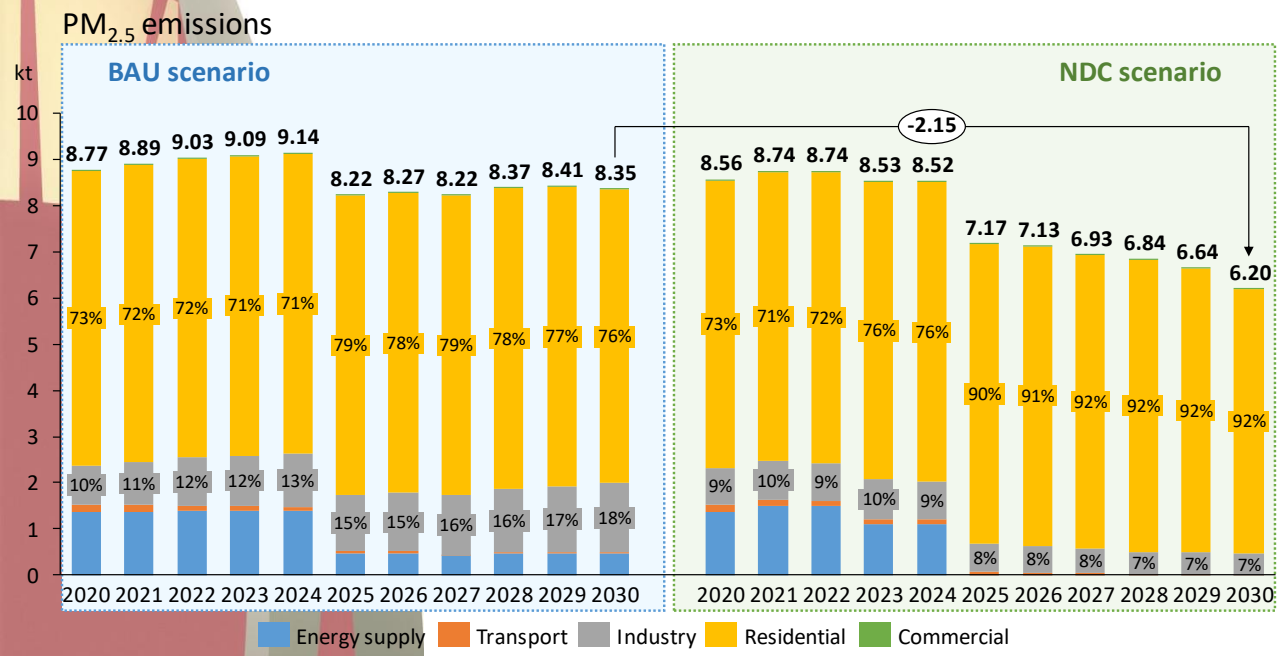
In addition to prevented premature mortality (and life years gained), tool calculates prevented annual illnesses in the vulnerable population (prevented cases of asthma, bronchitis, lost work days, hospital admission, etc.)

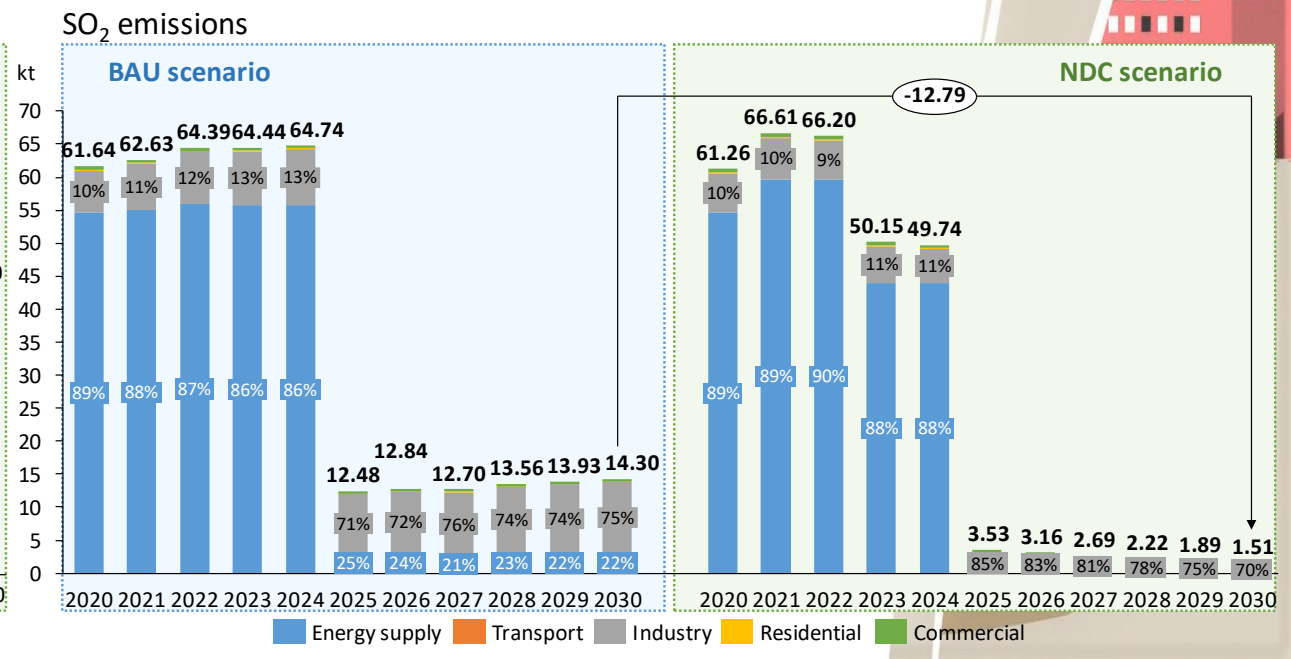
Economic benefits

Unit health costs are used to convert health effects into economic costs, taking into account health care expenditures, economic losses in productivity, and welfare loss from pain and suffering. Both physical and economic benefits may be distinguished according to reductions in national and regional emissions.

Input parameters







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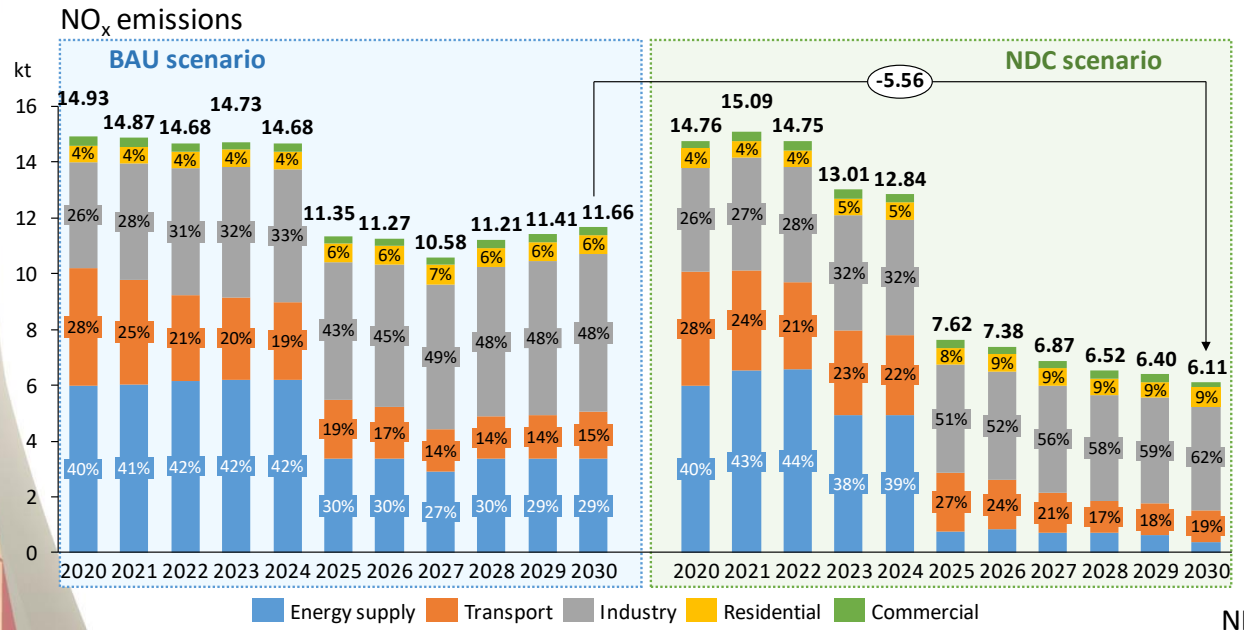
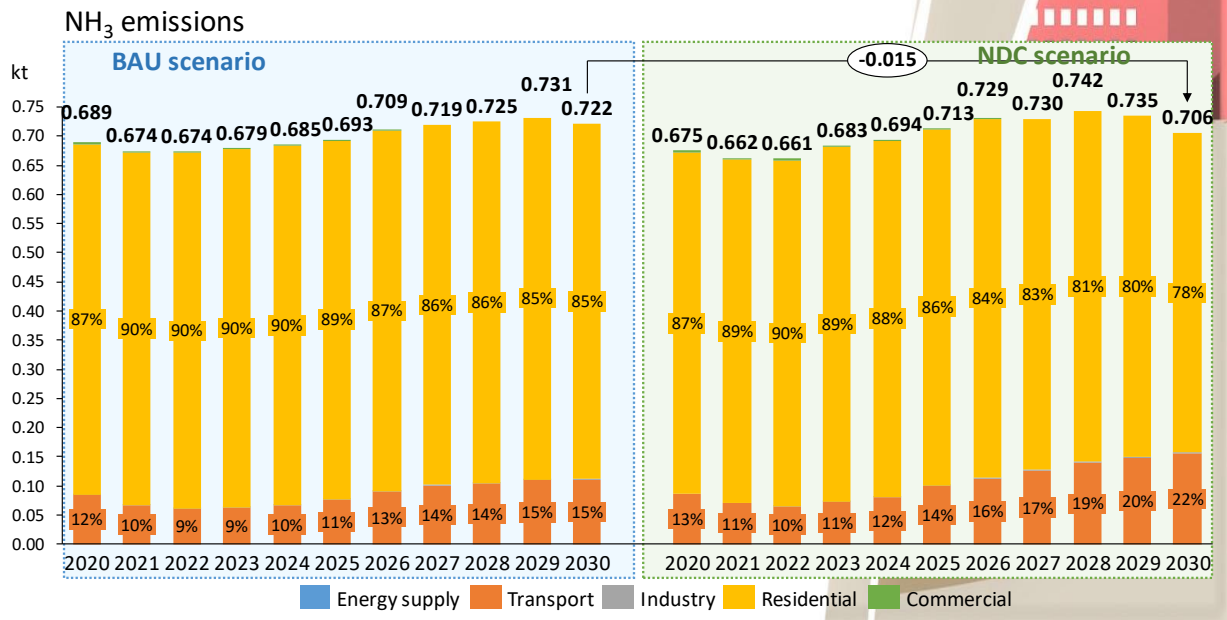
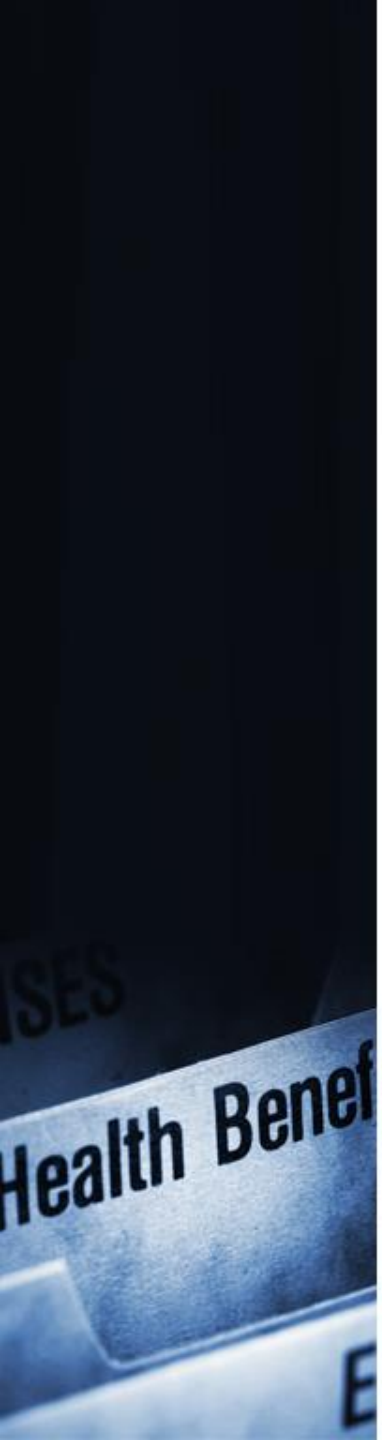
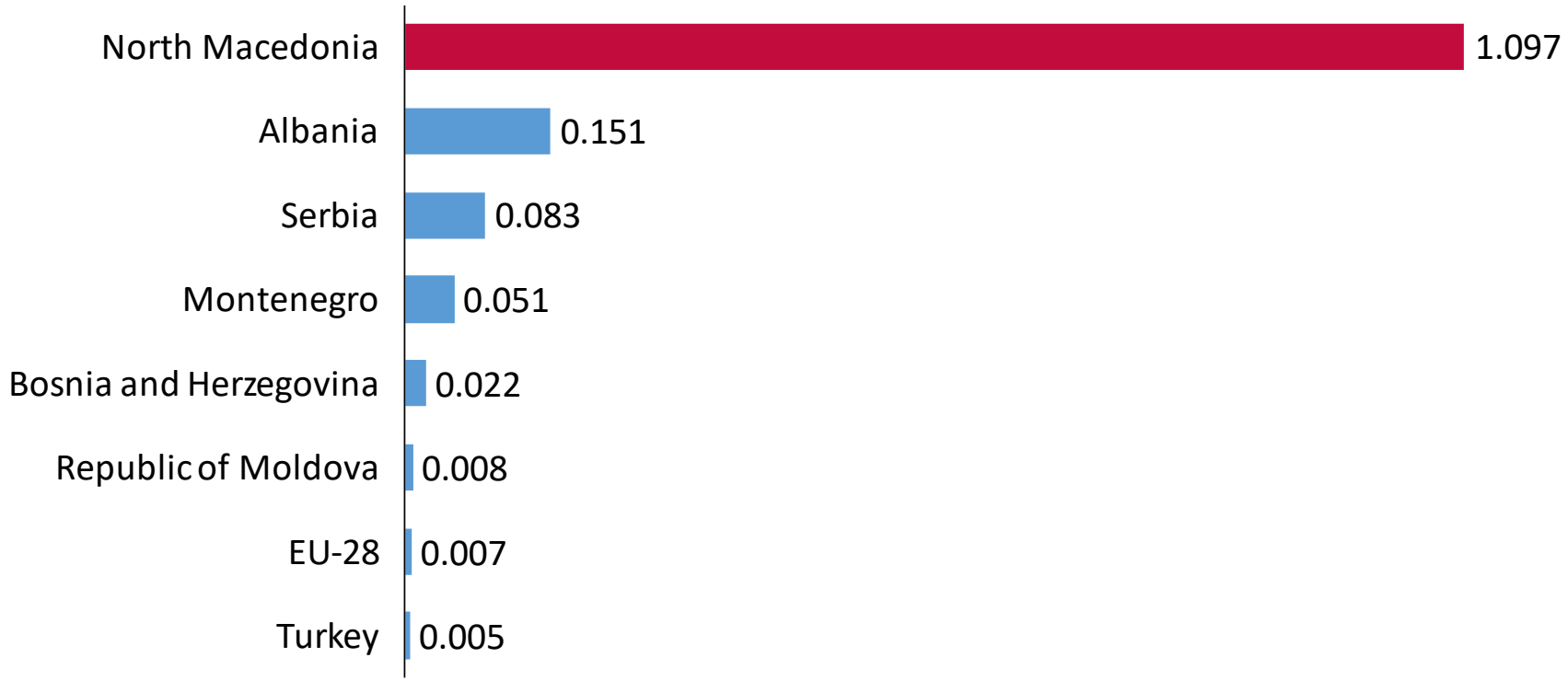




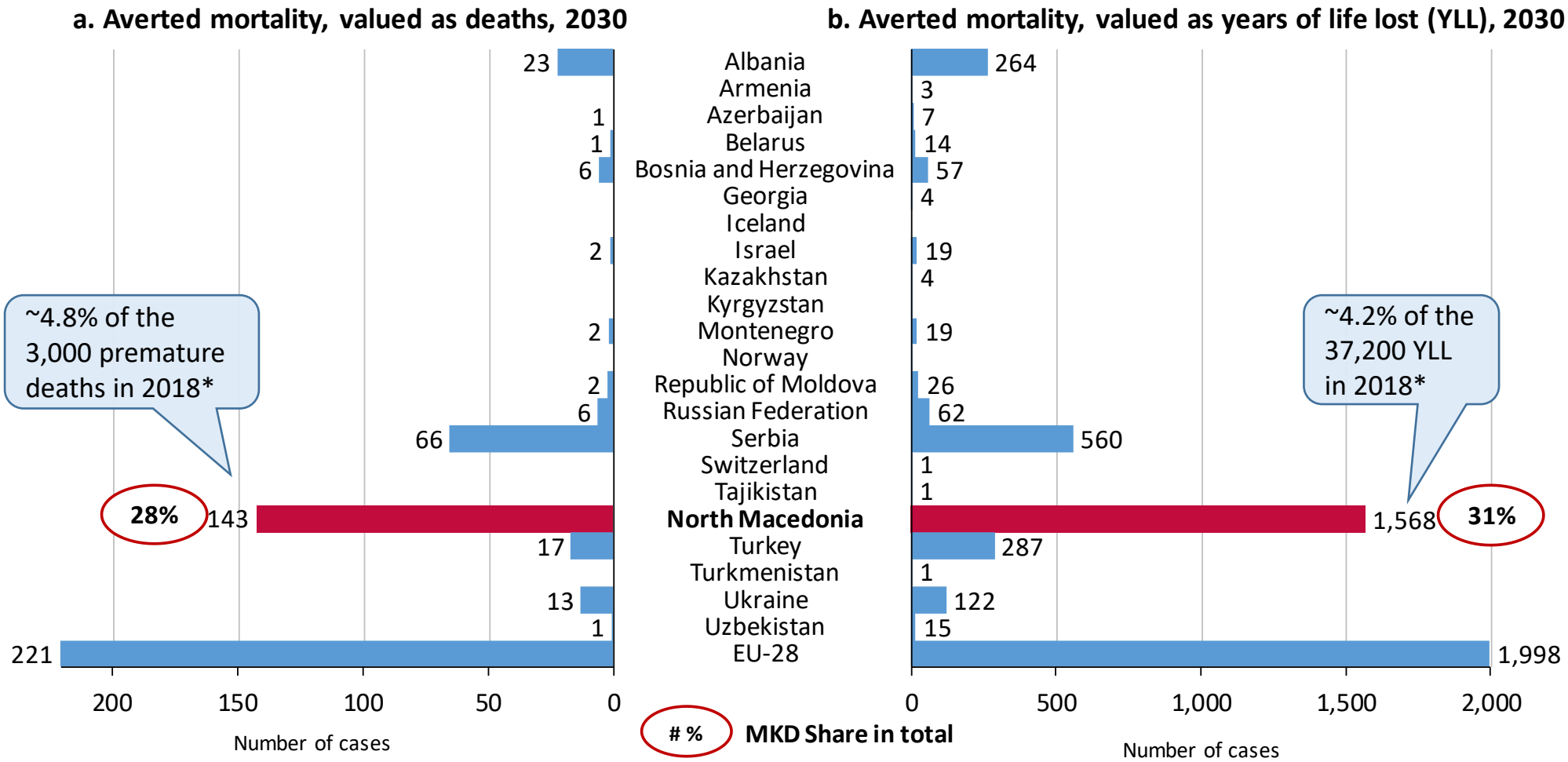


Results

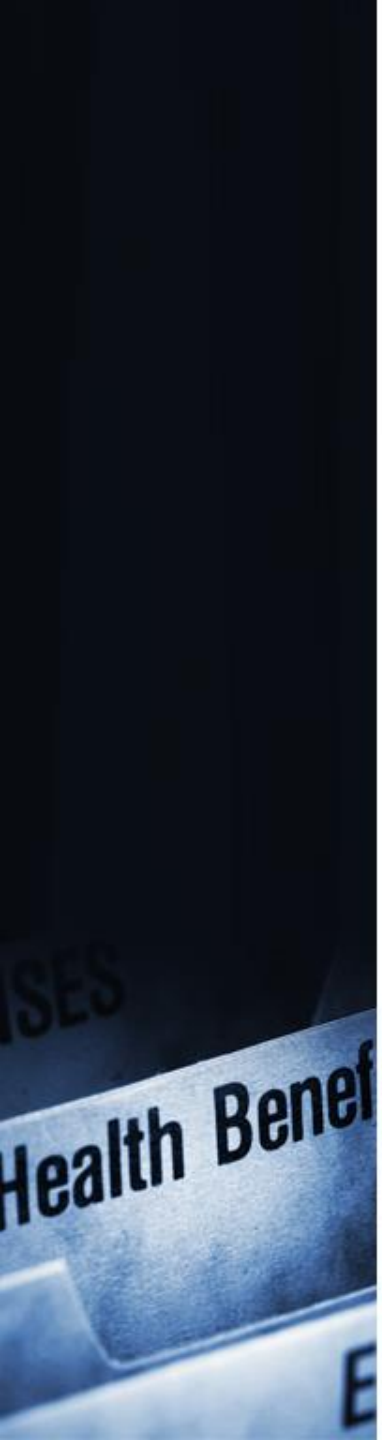
- $PM_{2.5}$ concentration changes (reduced exposure of population), in $\mu g/m^3$



Results - Health benefits (physical cases)



*attributed to exposure to average annual $PM_{2.5}$ concentrations at a level of 30.7 µg/m^3, estimated by the European Environment Agency (EEA)



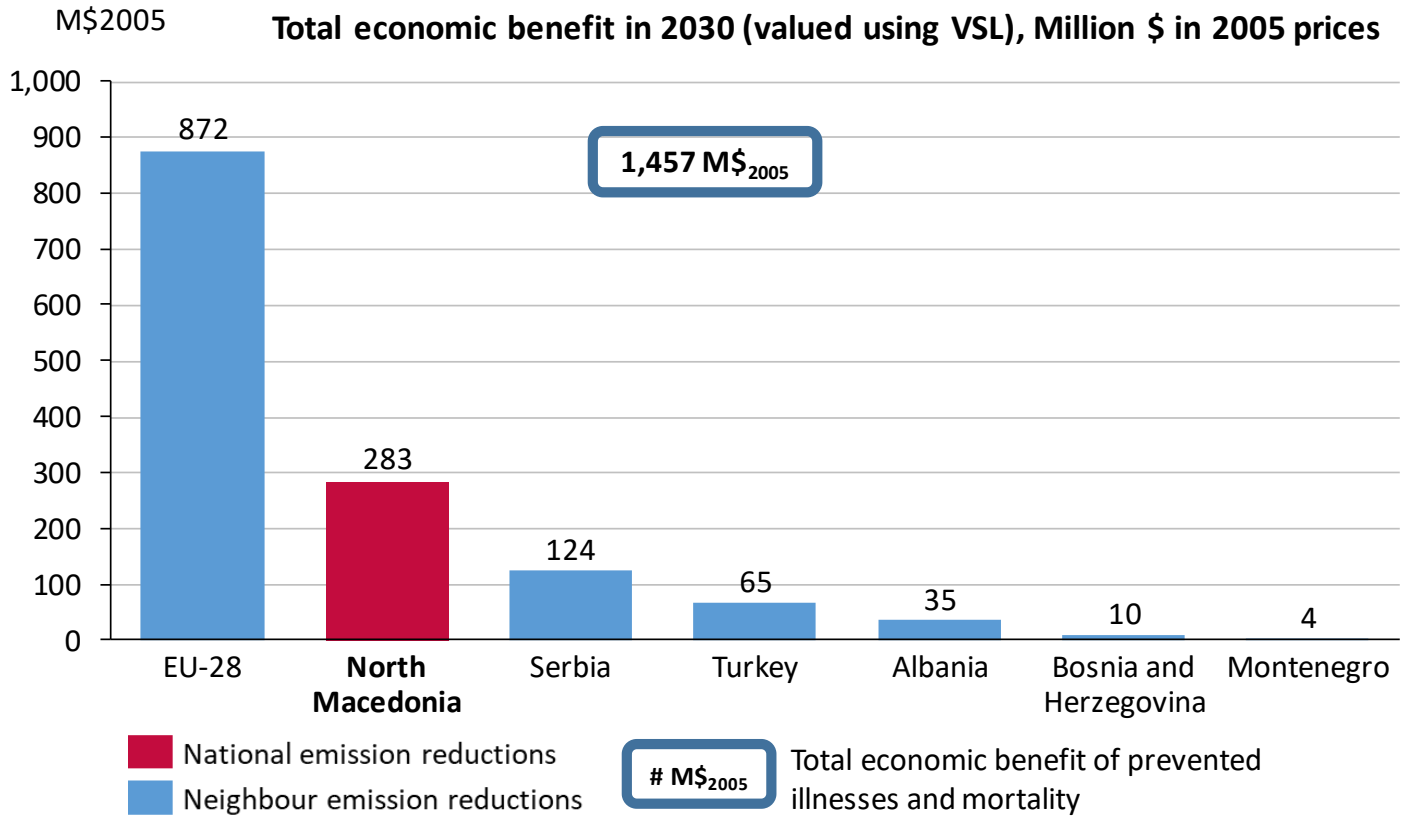
Results - Health benefits (physical cases)

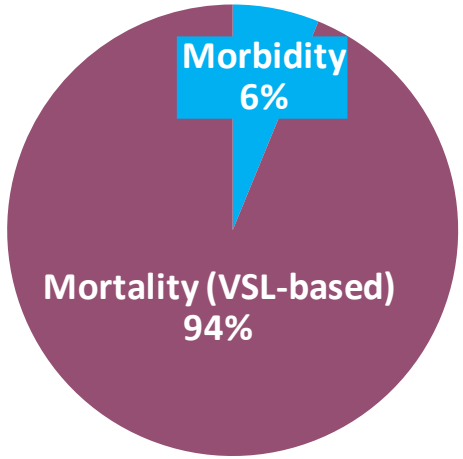
Prevented cases of illness (morbidity)

Country/Region	Children		Adults	Labor force	All ages		Mortality	
	Bronchitis	Asthma	Bronchitis	WLD	RAD	HA	Deaths	YLL
North Macedonia	**629**	**2,788**	**98**	**6,973**	**182,320**	**112**	**143**	**1,568**
Total	**2,259**	**11,436**	**344**	**92,166**	**584,521**	**346**	**504**	**5,032**

WLD = work lost days; RAD = restricted activity days; HA = hospital admissions; YLL = years of life lost.

Results - Health benefits (economic value)



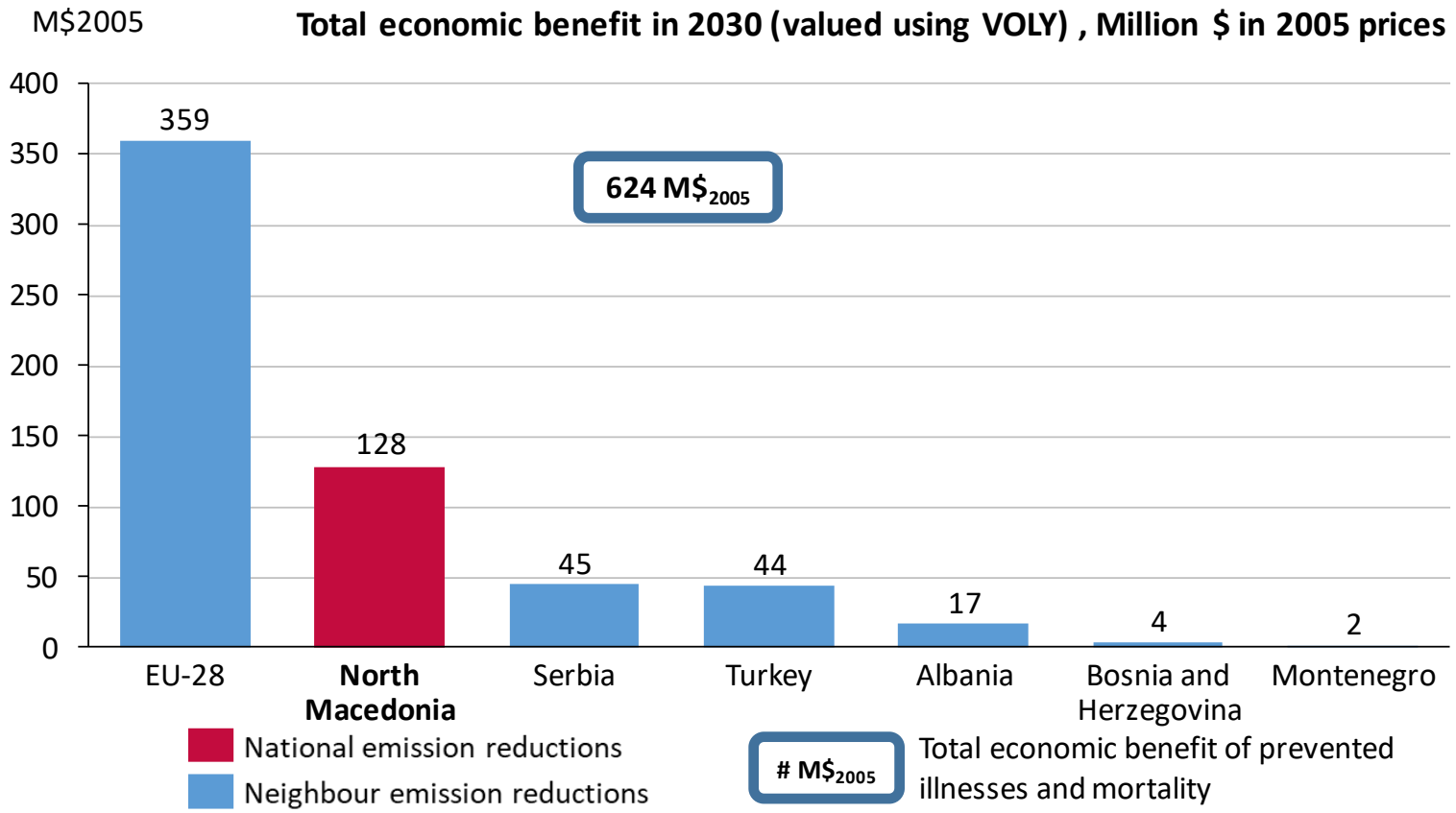


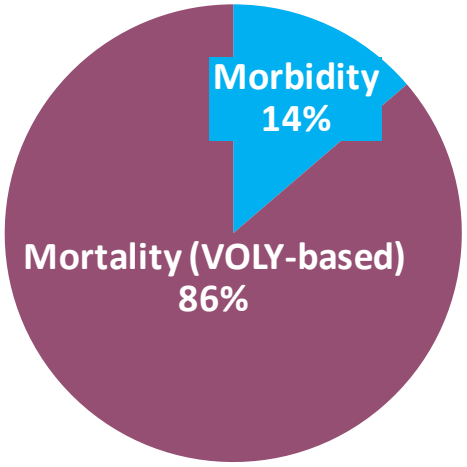
MK

Economic benefit - 266 million US$2005 (VSL metric), 2.8% of the country's GDP in 2019 (in 2005 prices)

VSL = Value of Statistical Life (the social price of anonymous death)

Results - Health benefits (economic value)



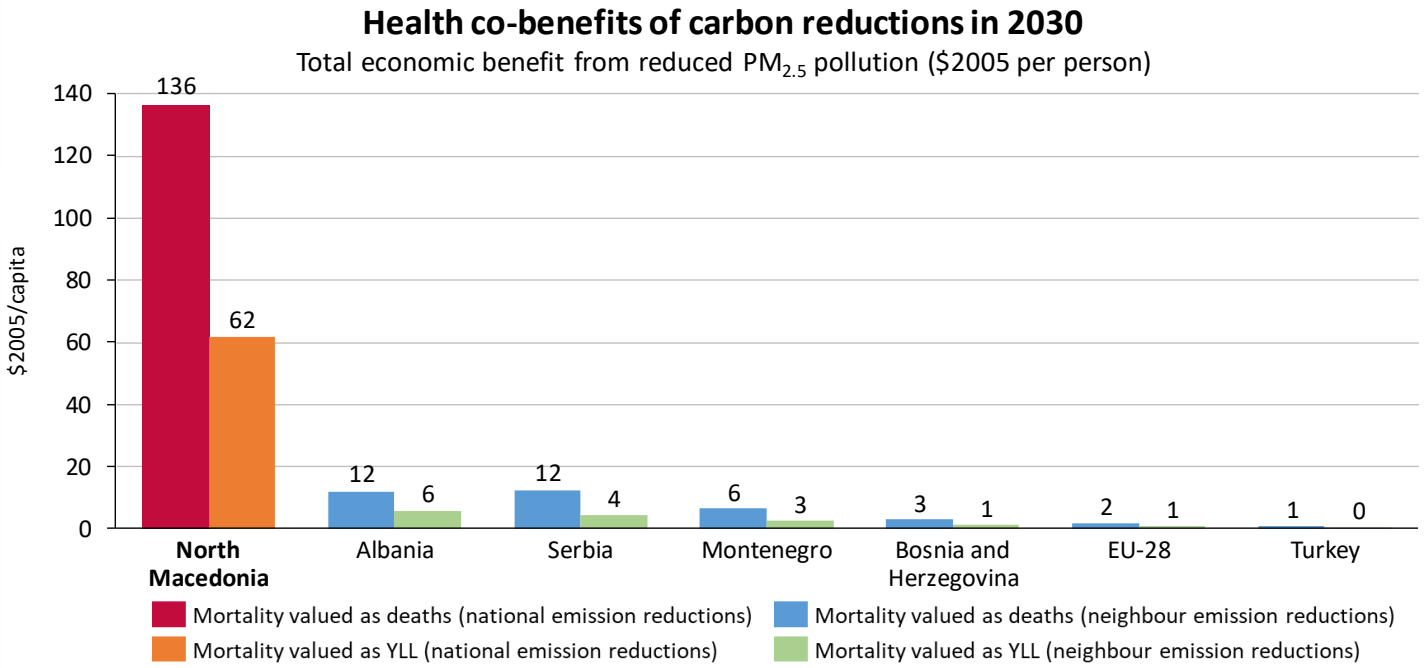


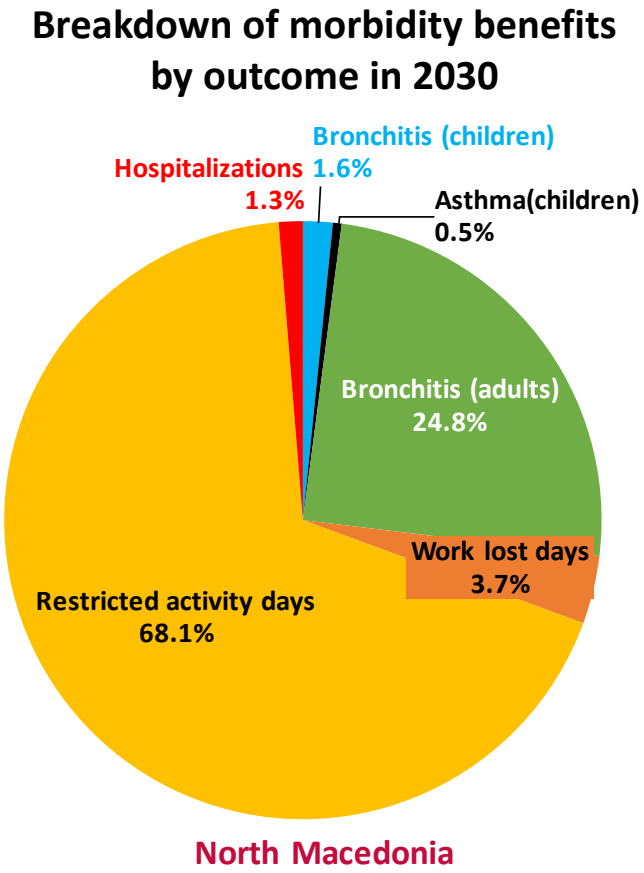
MK

Economic benefit - 111 million US$2005 (VOLY metric), or 1.2% of the country's GDP in 2019 (in 2005 prices)

VOLY = Value of Life Year

Results - Health benefits (economic value)





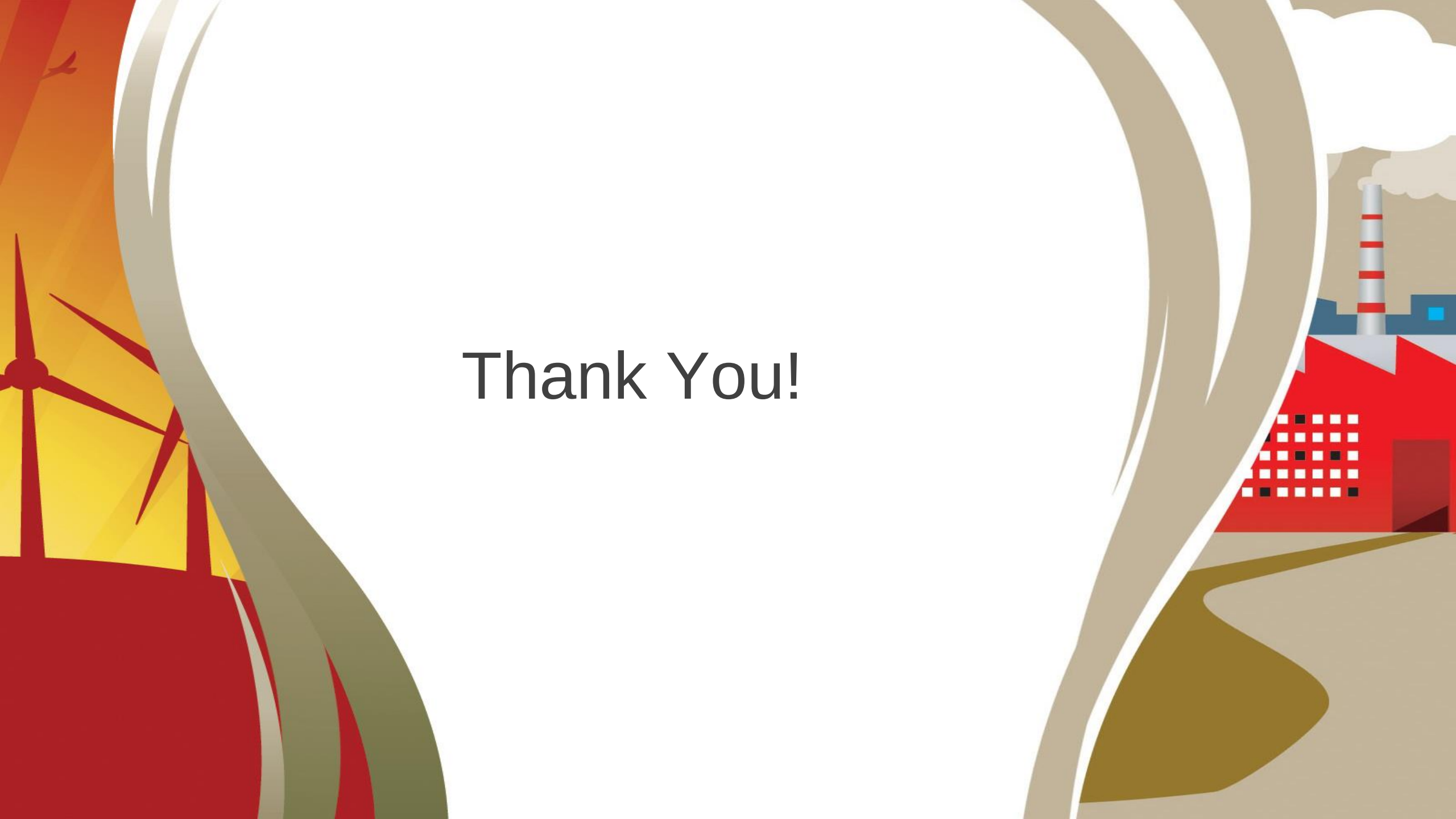
Economic benefit of the prevented illnesses (morbidity) per capita are 8.47 US$2005,or 2.75% of the MK current health expenditures/capita in 2018 (estimated to be almost 308 US$2005)

Conclusions and next steps

- At national level:
  - to **enhance the ongoing NDC process**, delivering additional support of the country's commitment to a successful transition to a low-carbon economy
  - will enable qualitative and quantitative analyses of the synergies and trade-offs between the NDC and a number of SDGs, primarily SDG3: Good Health and Well-being.
- At international level
  - will **represent a best practice example of "going beyond carbon reduction"** and addressing additional aspects which are equally important for society
  - should be promoted and shared with other countries in order to advance the transition to a decarbonized world

Follow-up activities:

- CLIMAQ-H – new updated version of the tool
- Integration of the economic parameter of the health co-benefits in the MAC curve


Thank You!