

Summary

of the research results regarding the ways of household heating as the largest air polluter in Skopje Valley, and
the Roadmap on reducing pollution from heating 2017-2025

What has the Study shown?

- Heating is the largest air polluter in Skopje Valley, household heating for the most part.
- Studies made in the last two years show that even **90% of the total PM particulate emissions** come from household heating (i.e. biomass - firewood).
- In January 2017, UNDP, in collaboration with the City of Skopje and Ministry of Environment and Physical Planning, conducted a field study (by collecting geo-tagged data through mobile phones) regarding the ways of household heating on a representative sample of 5044 households around the Skopje Region (all 17 municipalities).
- Study results show that:

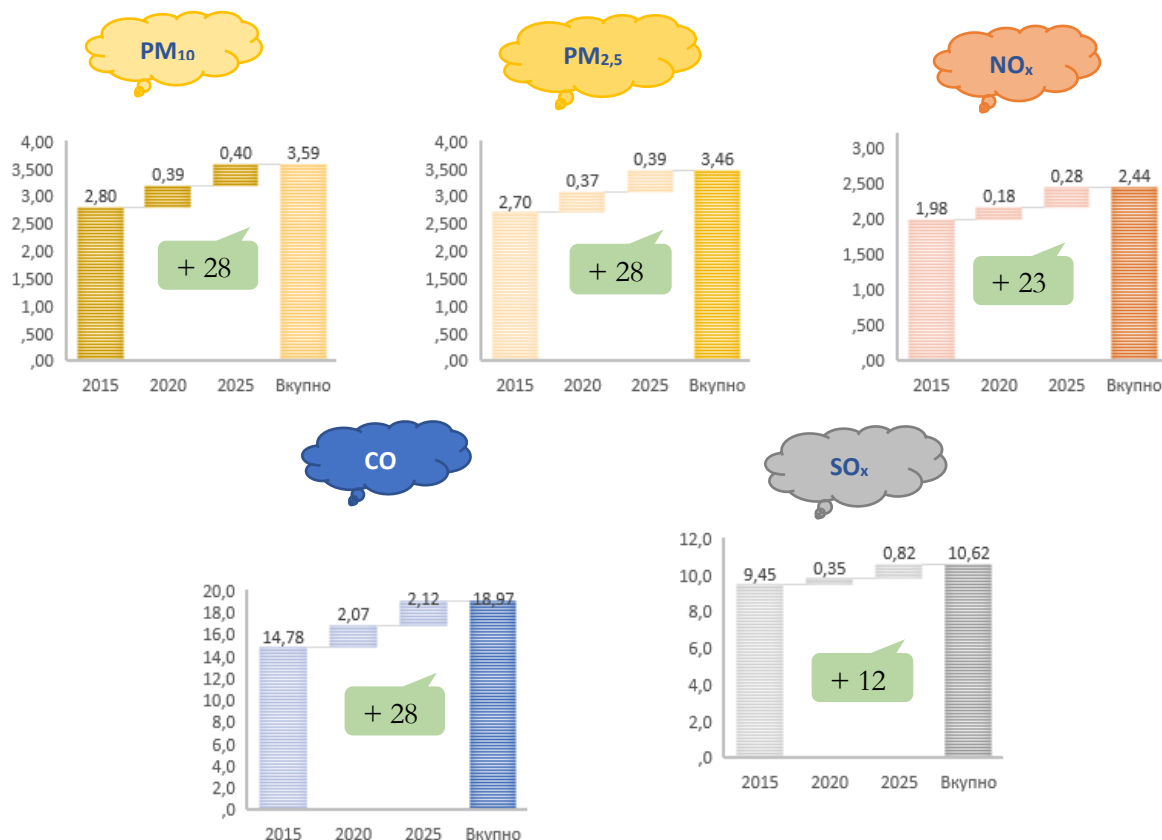
Households are heated by:	Percent	Number of households surveyed	Estimate of the total number of households
Firewood	44.7	2,257	73,220
Electricity	31.1	1,567	50,835
Central heating	21.2	1,070	34,712
Pellets and briquettes	1.5	78	2,530
Fuel-oil	1	44	1,427
Coal	0.4	22	714
Other solid fuel	0.1	6	195
		5,044	163,633

- In terms of **buildings' thermal performance**, even **50.8%** of the buildings **have no insulation at all**, while **42%** have less than the thermal insulation proscribed by the 2013 Regulation on New Buildings, and **only 7.2%** have insulation in accordance with regulations, or as shown in the Table below:

Households which:	Percent	Number of households surveyed	Estimate of the total number of households
- have no insulation at all	50.8	2,562	83,147
- have less than the thermal insulation proscribed	42	2,118	68,710
- have insulation in accordance with the provisions of the 2013 Regulation on Buildings' Energy Performance	7.2	363	11,776
Total		5,044	163,633

- Although every individual in Skopje is complaining about pollution, only a modest 1.3% said that when choosing a heating system, they were guided by the criterion of how much pollution it produced. The main criterion in the selection of a heating system among citizens is affordability (initial investment and monthly costs) and this is important for 74% of respondents.
- Even 44% of the households said they would connect to central heating if available, even if the price was slightly higher compared to the system they used currently.

If specific measures are not taken to reduce local pollution, not only would it not be reduced, but it would be increased as follows:



The way forward?

We set an ambitious goal:

Significant reduction of polluting emissions from household heating as the largest air polluter in Skopje Valley, i.e. a decrease of the emissions of:

- **PM₁₀ and PM_{2.5} by about 62%;**
- **CO and SO_x by about 50% and 54% respectively;**
- **NO_x by about 22%.**

How can this be achieved?

By a combined and appropriately coordinated implementation of the following three measures in the period from 2017 to 2025 (The scenario is called “Skopje breaths”):

- ▶ Replacement of existing firewood, coal and oil stoves with:
 - More efficient firewood stoves,
 - Pellet stoves,
 - Heat pumps (including inverter air conditioners),
 - Natural gas central heating system
- ▶ Improving the insulation of homes
- ▶ Increasing the number of central heating users

To reduce local pollution from household heating to the levels as in the objectives outlined above, **55.8% of households in urban areas and 22.2% in rural areas should be covered by some of the measures by 2020**, or **81.3% and 42% by 2025 for urban and rural areas respectively**. Detailed targets would look as follows:

Description:	Target by 2020		Target by 2025	
	Urban areas	Rural areas	Urban areas	Rural areas
Number of households covered by one of the measures	55.8%	22.2%	81.3%	42%
- will meet the most stringent criteria for an energy efficient facility	8960	2660	15600	4290
- will use more efficient firewood stoves	9000	3100	20400	6770
- will use pellet stoves	6630	790	7280	1460
- will use heat pumps	8140	2770	16280	5390
- will use natural gas stoves	930	280	2700	450
- Increased share of central heating system users	3000	/	10000	/

- If this strategy is implemented, the modeling shows that the total number of **households** using firewood **would decrease** and they would account for **35.4%** of the total number of households in **2025**, or they would be reduced by around **18,000 households**.
- The share of households using electricity would remain the same, because the number of households using heat pumps (including inverter air conditioners) would go up.
- The number of **households** using **pellet stoves** would **increase** by at least **8,500 households** and they would account for 6.1% of the total number.
- Also, the number of households connected to the **central heating system** would **increase** by at least **10,000 households**.

- Finally, the number of households using coal, **although accounting for only 0.4% or around 700 households in 6 municipalities in the region**, should change by **2020**, and **there should be no households using coal at all**, while the number of households heated on fuel oil (accounting for about 1% now) should be reduced to a minimum.

For the implementation of these three measures, a Roadmap was drawn up, elaborating 14 activities grouped in the following categories:

- Education of citizens and change in their habits related to the ways of heating
- Legislation changes
- Enabling and creating partnerships with the private sector
- Subsidizing target groups that cannot be covered by another activity or (tax) incentives for an accelerated implementation of certain measures
- Establishing a system to monitor the implementation (with a recommendation to develop a Source Apportionment study and create a methodology and system for forecasting and timely development of measures)

The detailed measures and activities are presented in the document: Roadmap for reducing local air pollution caused by household heating (2017-2025).

Estimated implementation budget

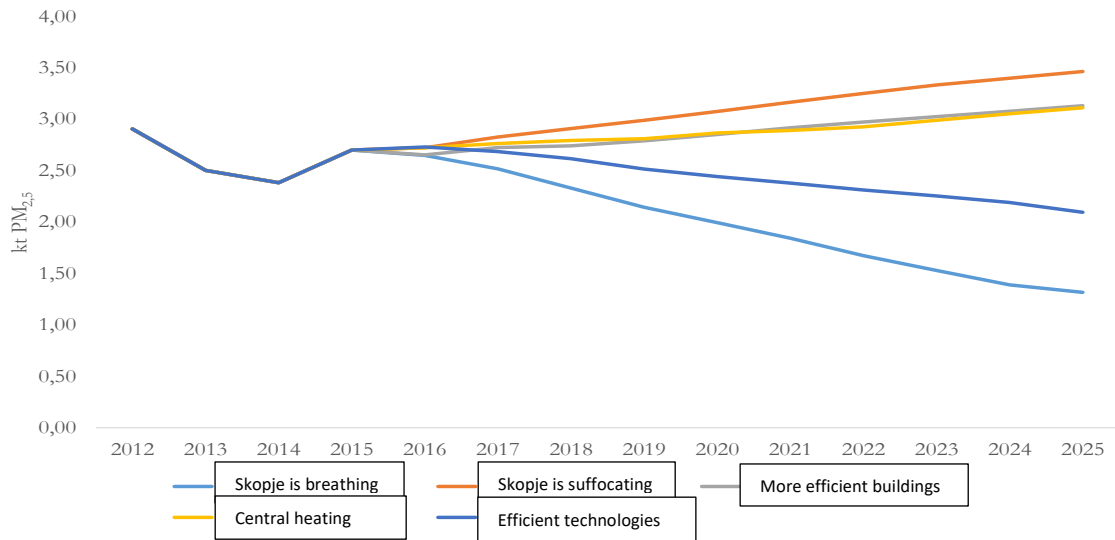
The realization of this scenario requires **€ 378 Mill.** for the period from 2017 to 2025, of which about **€ 325 Mill.** would be allocated to the renovation of buildings (facades, roofs, floors, etc.) to meet the **strict** energy efficient facility criteria. This is the highest amount of total costs, that should be covered by several sources, based on a detailed financial plan that should be developed.

In order to respond to the anticipated increase of the number of subscribers to the central heating system, the BEG company will invest around **€ 200 Mill.** for the construction of new CHPs.

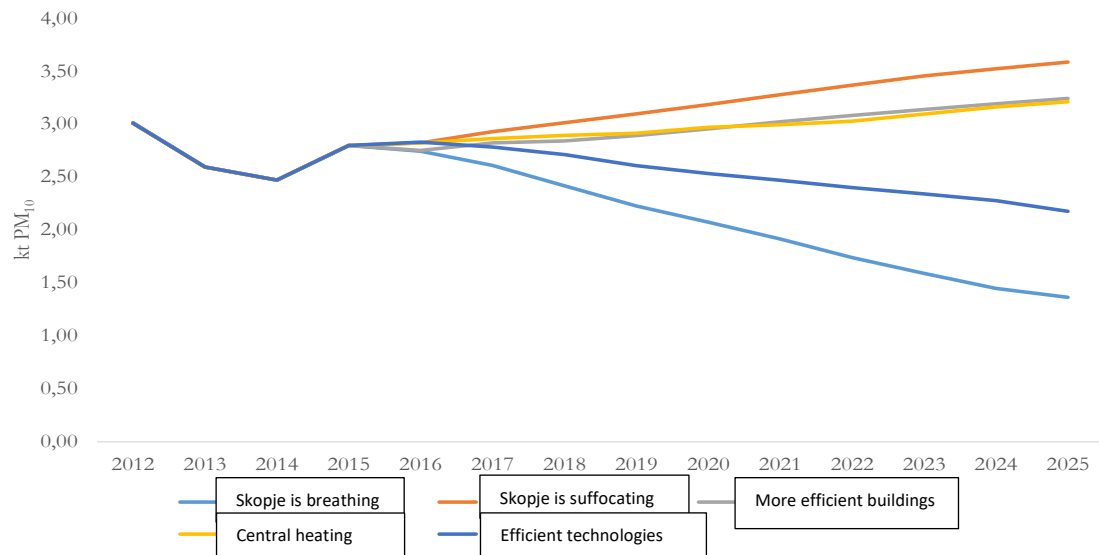
Roadmap implementation launch, educational campaign implementation and coordination, as well as design and testing of all activities, require at least € 1 million for a period of 2.5 years. It is expected that thereafter, these activities will continue to be implemented with seamless coordination, and monitoring and guidance, if and where necessary, with minimum financial implications.

“Skopje is breathing clean air for 50 denars per day per household”

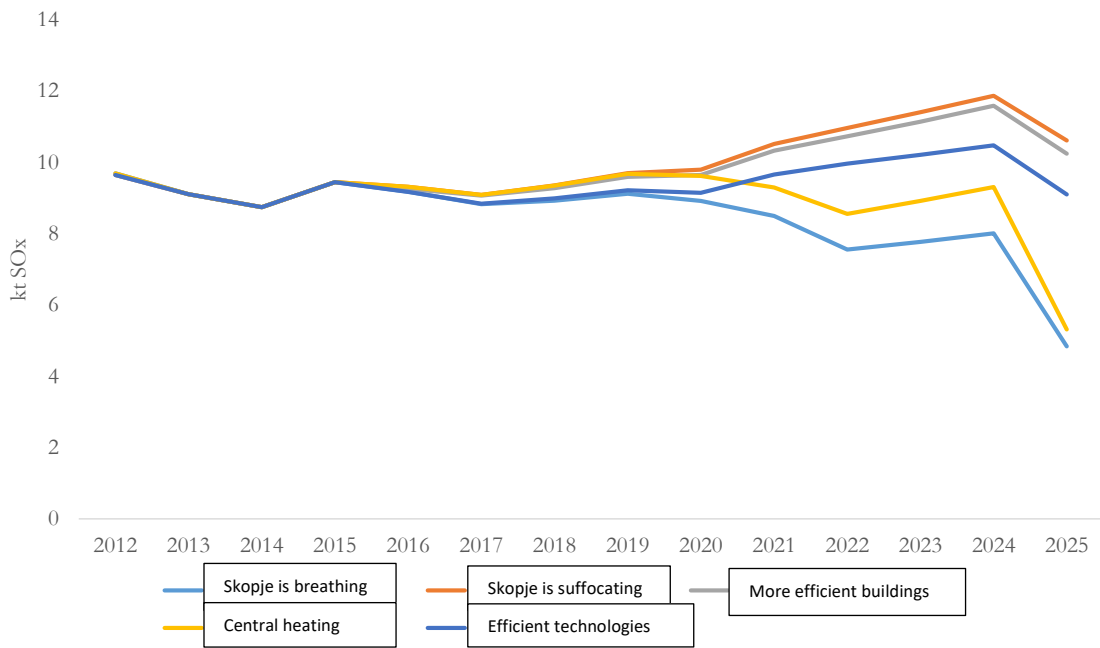
Graphic presentation of the results expected from the combined implementation of all three measures together.



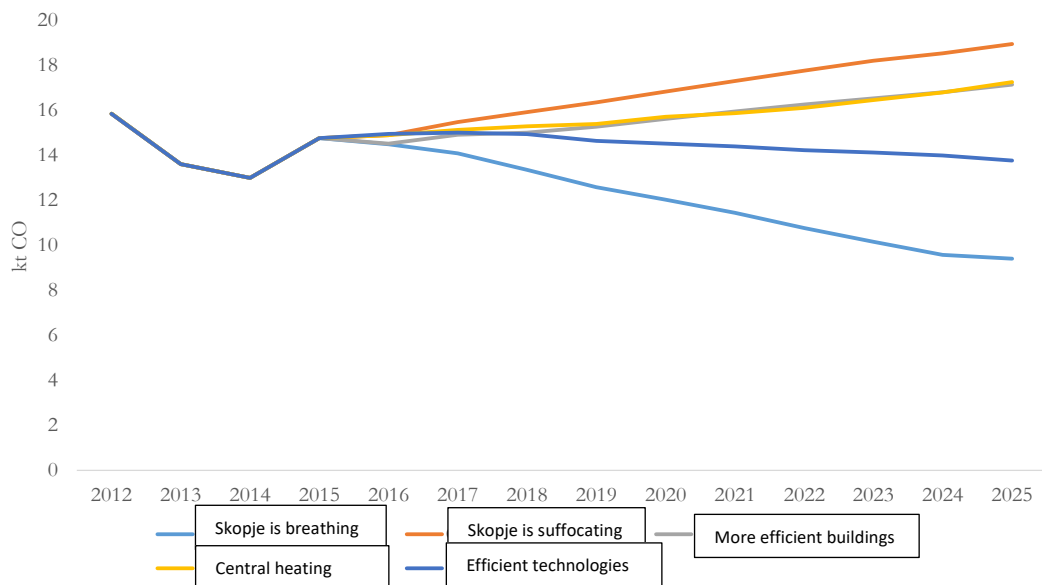
Comparison of PM_{2.5} in the scenarios "Skopje is suffocating" and "Skopje is breathing" and in each individual measure



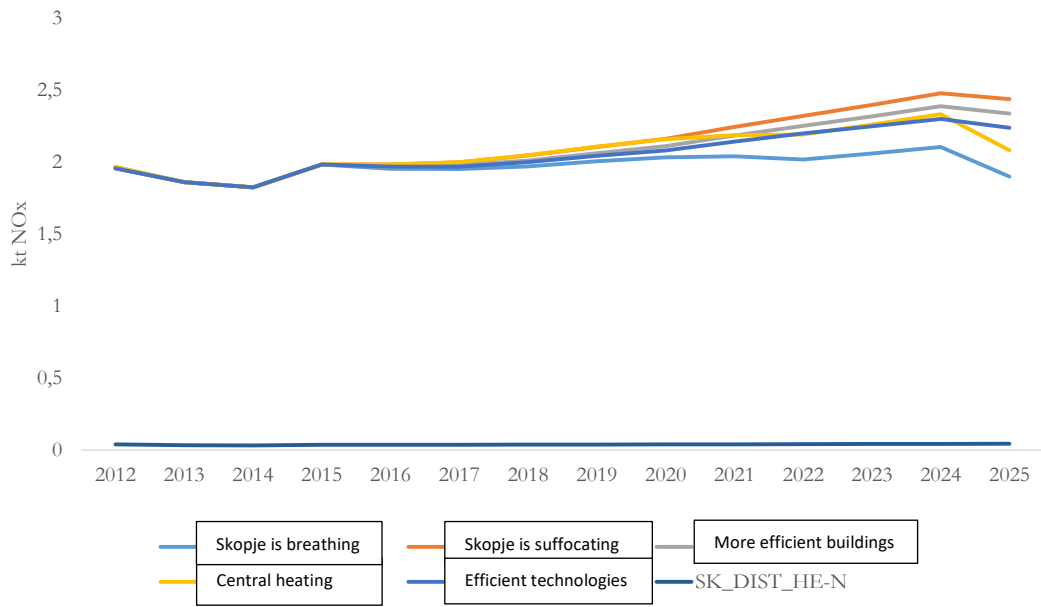
Comparison of PM₁₀ in the scenarios "Skopje is suffocating" and "Skopje is breathing" and in each individual measure



Comparison of SO_x in the scenarios “Skopje is suffocating” and “Skopje is breathing” and in each individual measure



Comparison of CO in the scenarios “Skopje is suffocating” and “Skopje is breathing” and in each individual measure



Comparison of NO_x in the scenarios "Skopje is suffocating" and "Skopje is breathing" and in each individual measure