



AIR QUALITY IN MONGOLIA – CHALLENGES, INITIATIVES AND NEEDS OF NATIONAL ENVIRONMENTAL LABORATORY

**NEACAP National Workshop on Air Quality Management in Mongolia:
Developments and Prospects
Ulaanbaatar, Mongolia
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- 1. AIR QUALITY MONITORING, QA/QC, DATA MANAGEMENT**
- 2. ANALYTICAL RESEARCH ON EMISSION SOURCES AND AIR POLLUTION COMPONENTS**
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INTRODUCTION

Mongolia:

- land-locked country,
- harsh climate, hot & dry summer and cold and dry winter
- Ulaanbaatar- the coldest capital



Ulaanbaatar:

- surrounded by high mountains
- located in valley



Affected by atmospheric circulation



AIR POLLUTION

NATURALLY

- Sulfur dioxide SO₂
- Nitrogen dioxide NO₂
- Carbon monoxide CO
- Ozone O₃
- Particulate matter PM_{2.5}
- Particulate matter PM₁₀
- Organics,
- Heavy metals,
- Ions

ANTROPOGENIC



Household stoves & HBO - **80%**



Vehicles - **10%**



TPP - **6%**



Others - **4%**

NATIONAL AIR QUALITY MONITORING NETWORK



In 1976:
- first manual AQMS

In 2009:
- first automatic AQMS

2025: Nationwide automatic AQMS - 40

19 of 40 are located in Ulaanbaatar, capital of Mongolia.

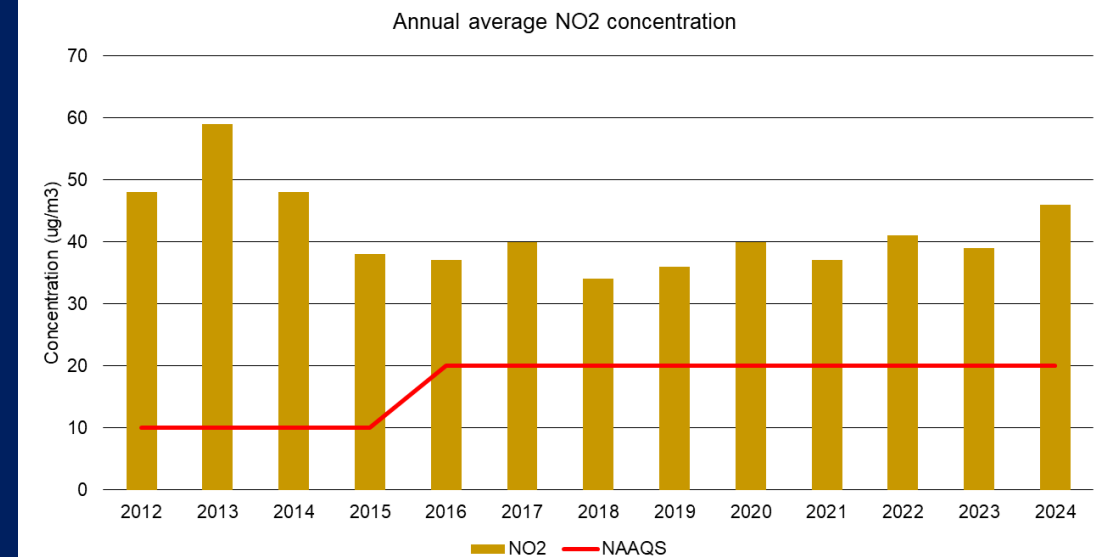
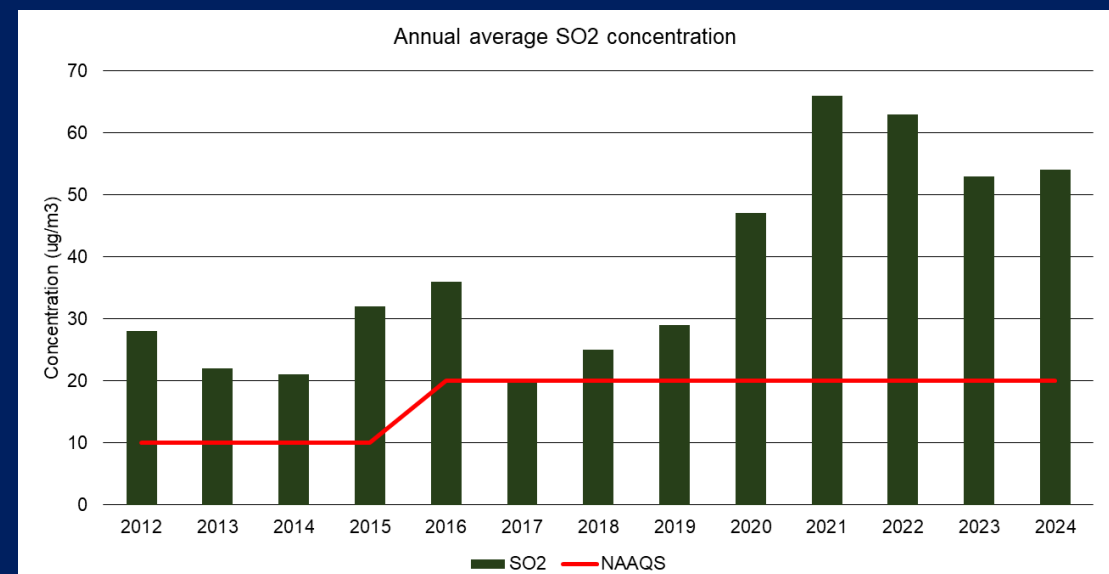
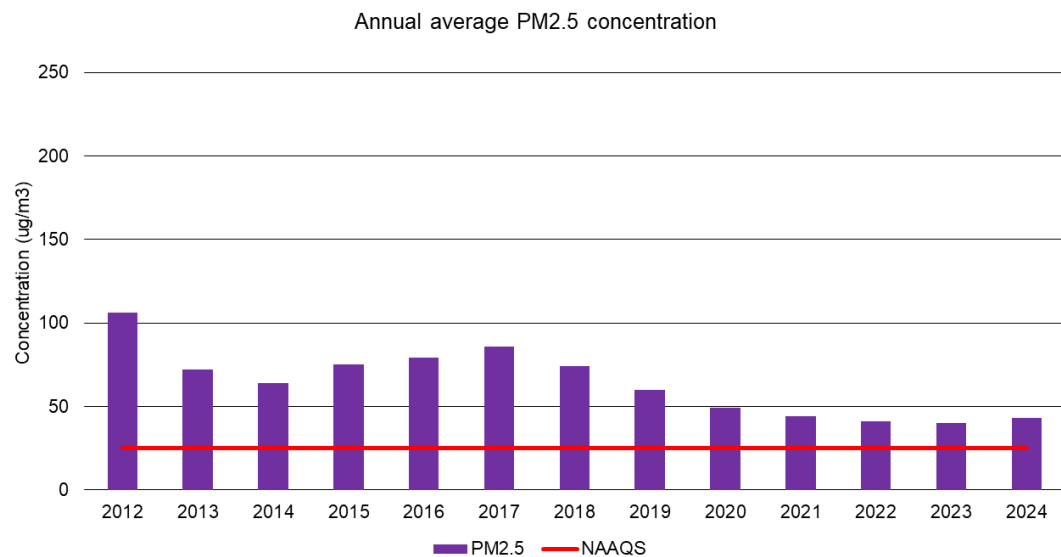
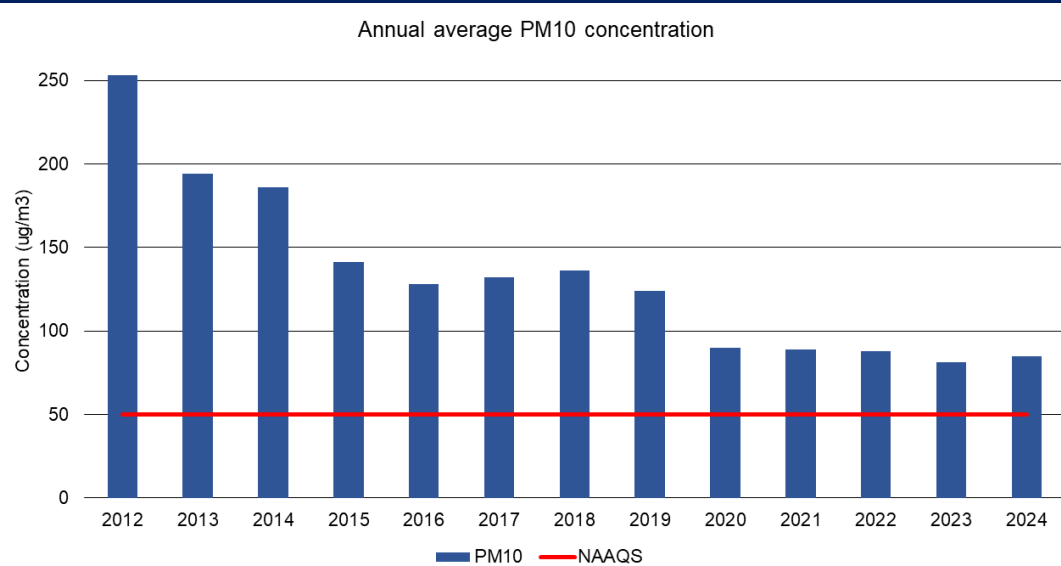
AIR QUALITY STANDARDS

In Mongolia, the National Ambient Air Quality Standard (NAAQS) was promulgated in 1978 and subsequently revised in 1998, 2007, 2016, and 2025.

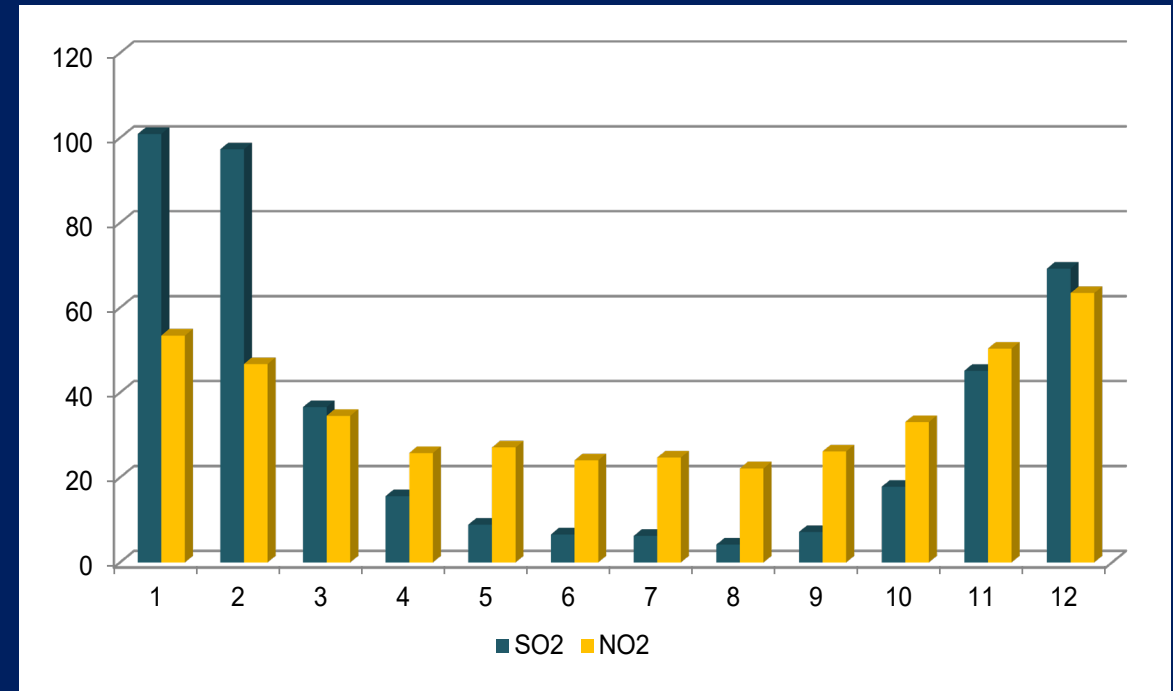
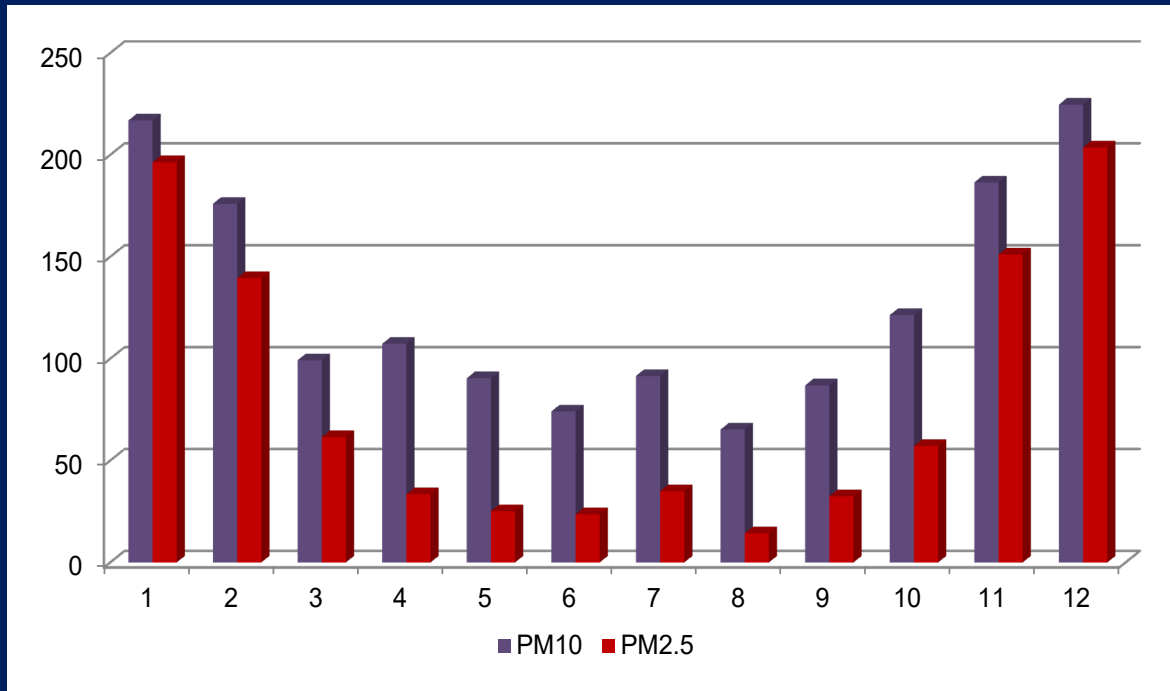
Parameters, unit	Average time	Mongolia MNS4585:2025	China GB3095-2012		Korea	USA
			Level 1	Level 2		
PM2.5, ug/m ³	24 hour	37.5	35	75	35	35
	Annual	15	15	35	15	9
PM10, ug/m ³	24 hour	100	50	150	100	150
	Annual	50	40	70	50	-
NO2, ug/m ³	20 min	200	-	-	-	-
	1 hour	-	200	200	191	-
	24 hour	50	80	80	115	191
	Annual	30	40	40	57	100
SO2, ug/m ³	20 min	450	-	-	-	-
	24 hour	50	50	150	132	200
	Annual	20	20	60	53	-
CO, mg/m ³	20 min	60	-	-	-	-
	1 hour	30	10	10	-	-
	8 hour	-	-	-	-	-
	24 hour	4	4	4	10	10
O3, ug/m ³	8 hour	100	100	160	120	140

AIR QUALITY

Annual average of the PM₁₀, PM_{2.5}, SO₂, and NO₂ from 2012-2024

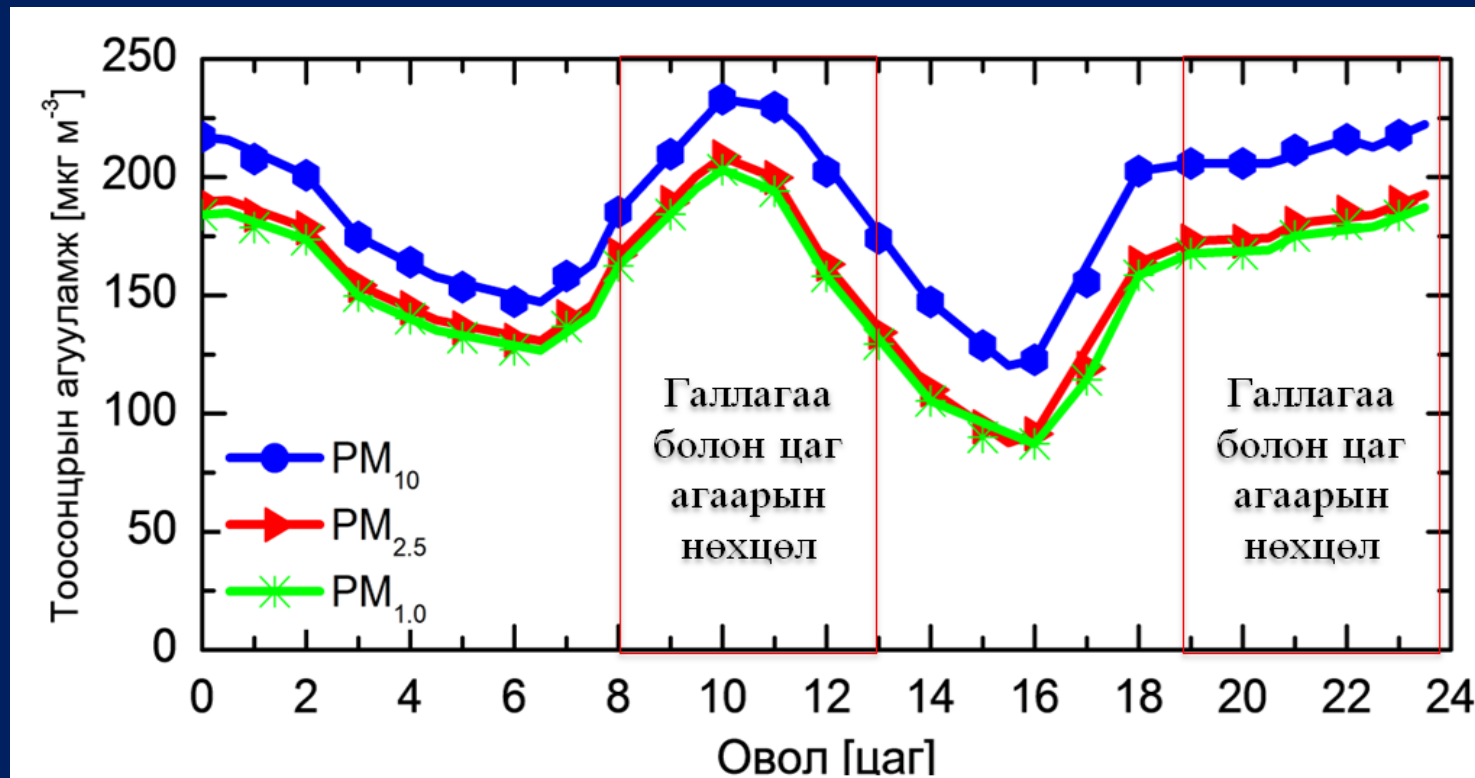


Monthly variation of air pollution in Ulaanbaatar



Strong monthly/seasonal variation, winter high and summer low, was observed for coarse and fine particulate matters as well sulfur dioxide due to usage of coal.

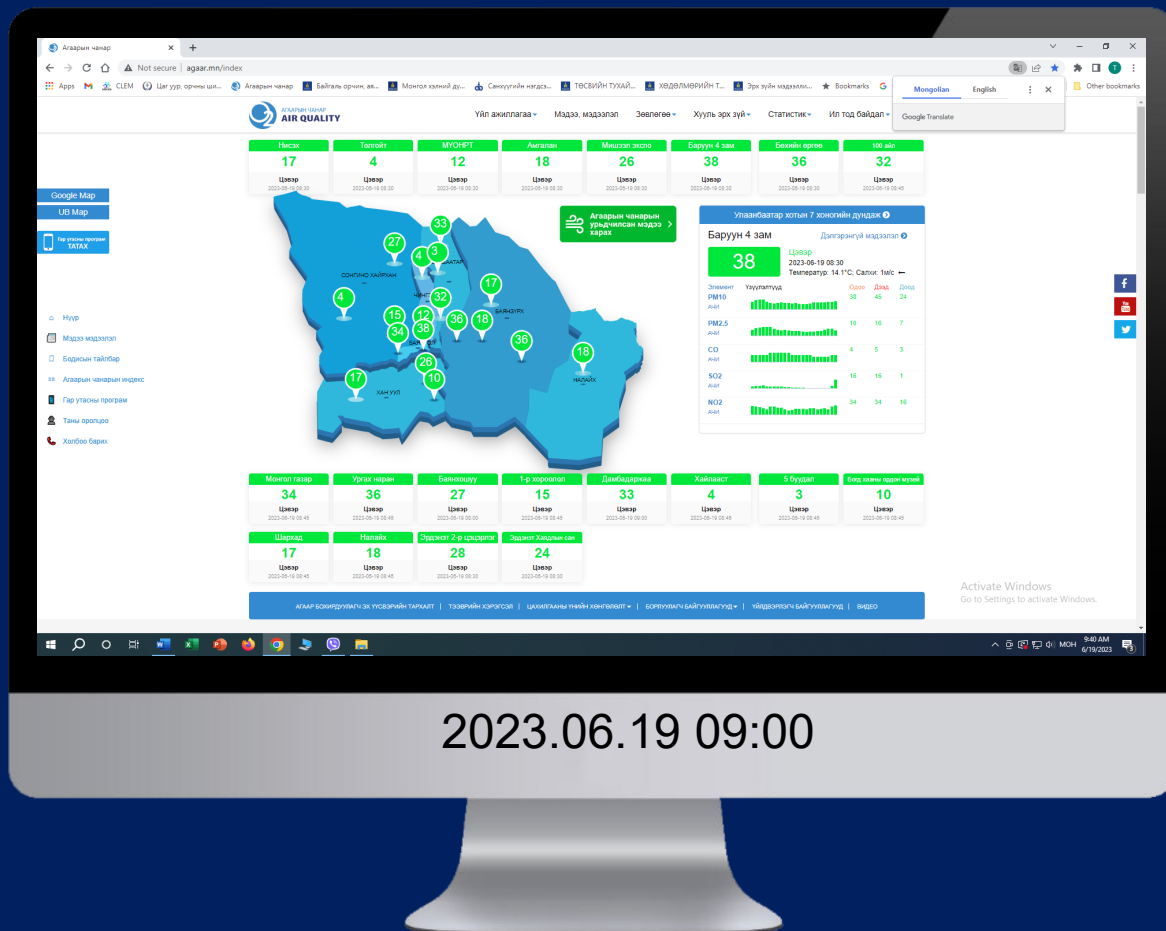
Diurnal variation of particulate matter in Ulaanbaatar during the winter season /near Nisekh/



- Strong diurnal variation was observed due to space heating and weather condition.
- Fine particles consists of more than 85% of coarse particles during the winter time in Ulaanbaatar, indicating pollution is mainly from burning activities.

INFORMATION SYSTEM

www.agaar.mn



O2 application



QUALITY ASSURANCE/QUALITY CONTROL



COMPARISON BETWEEN DOMESTIC LABORATORIES

Sample	SO ₂ min mg/mL	SO ₂ max mg/mL	NO ₂ min mg/mL	NO ₂ max mg/mL
CLEM	0.433	1.733	0.453	1.360
21-Lab	0.431	1.849	0.409	1.324

Sample	pH	SS mg/L	COD mg/L	BOD mg/L
CLEM	6.55	194	401	188
WSSA	6.67	169	386	164

Sample	HCO ₃ mg/L	COD – Mn mg/L	EC мкСм/см
CLEM	37.8	2.4	83.7
"Green Lab" LLC	37.0	2.5	83.4

QUALITY ASSURANCE/QUALITY CONTROL

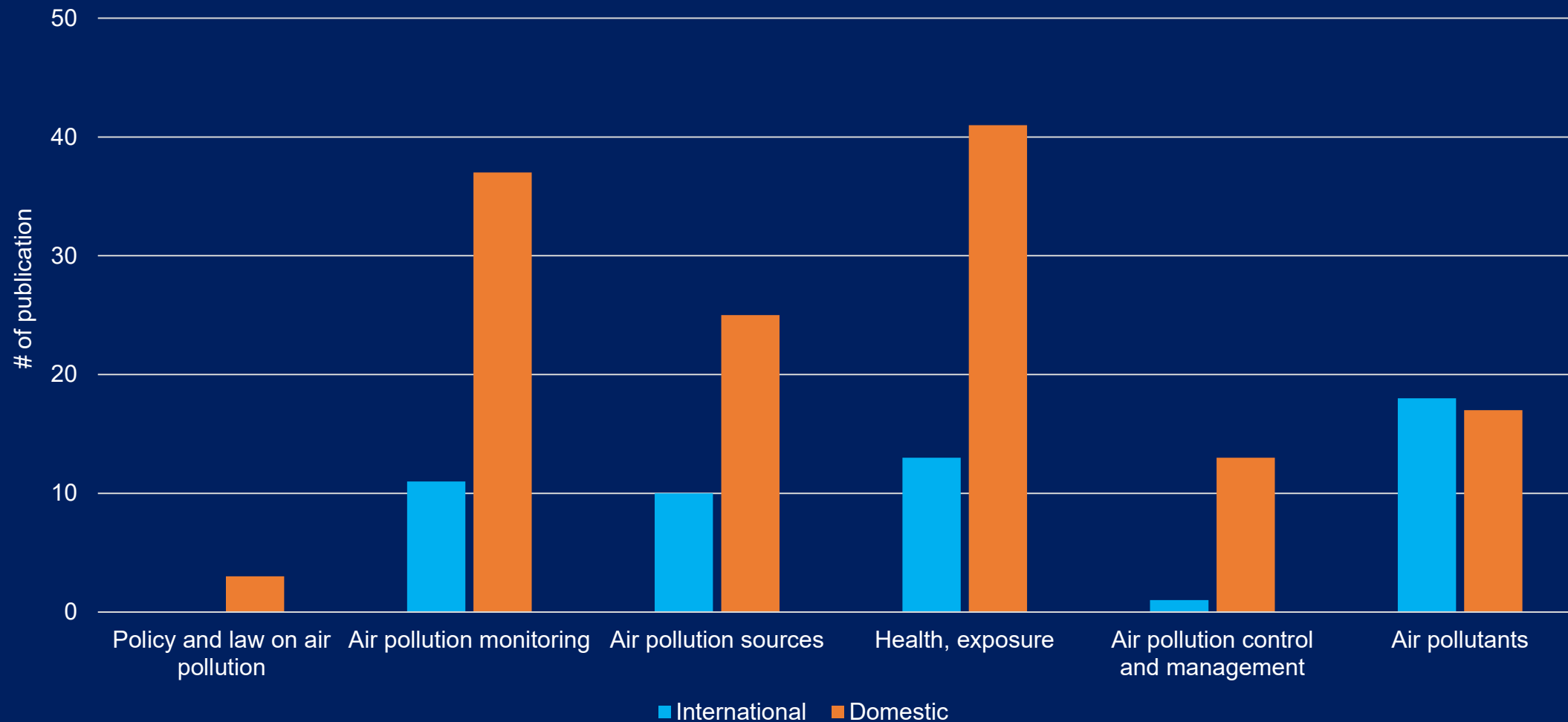


COMPARISON BETWEEN INTERNATIONAL LABORATORIES

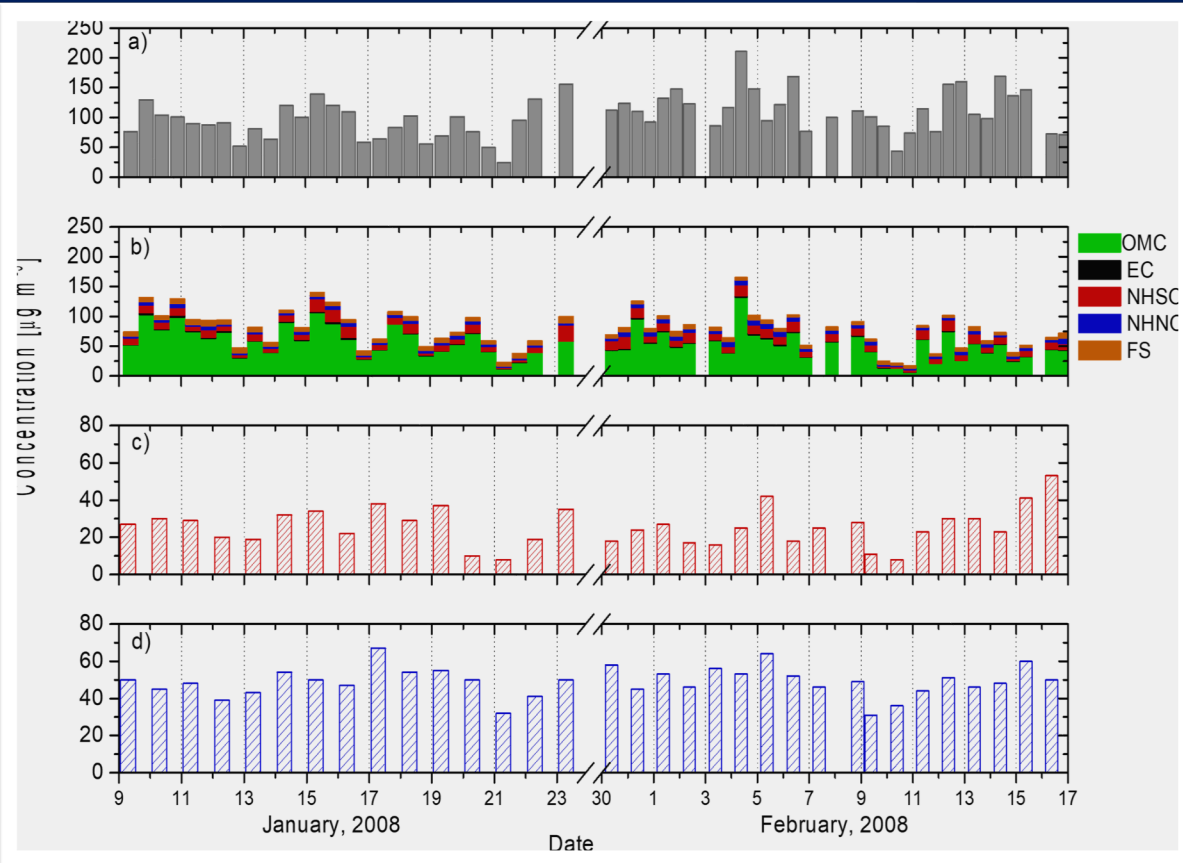
Sample	pH	EC mS/cm	Alkalinity meq/L	SO ₄ ²⁻ mg/L	NO ₃ ⁻ mg/L	Cl ⁻ mg/L
CLEM	6.40	2.92	0.112	4.05	0.62	1.89
EANET	7.06	3.03	0.119	3.83	0.55	1.75

Sample	pH	EC mS/cm	SO ₄ ²⁻ mg/L	NO ₃ ⁻ mg/L	Cl ⁻ mg/L
CLEM	5.54	16.1	2.27	3.20	1.03
WMO	5.98	16.4	2.00	2.41	0.89

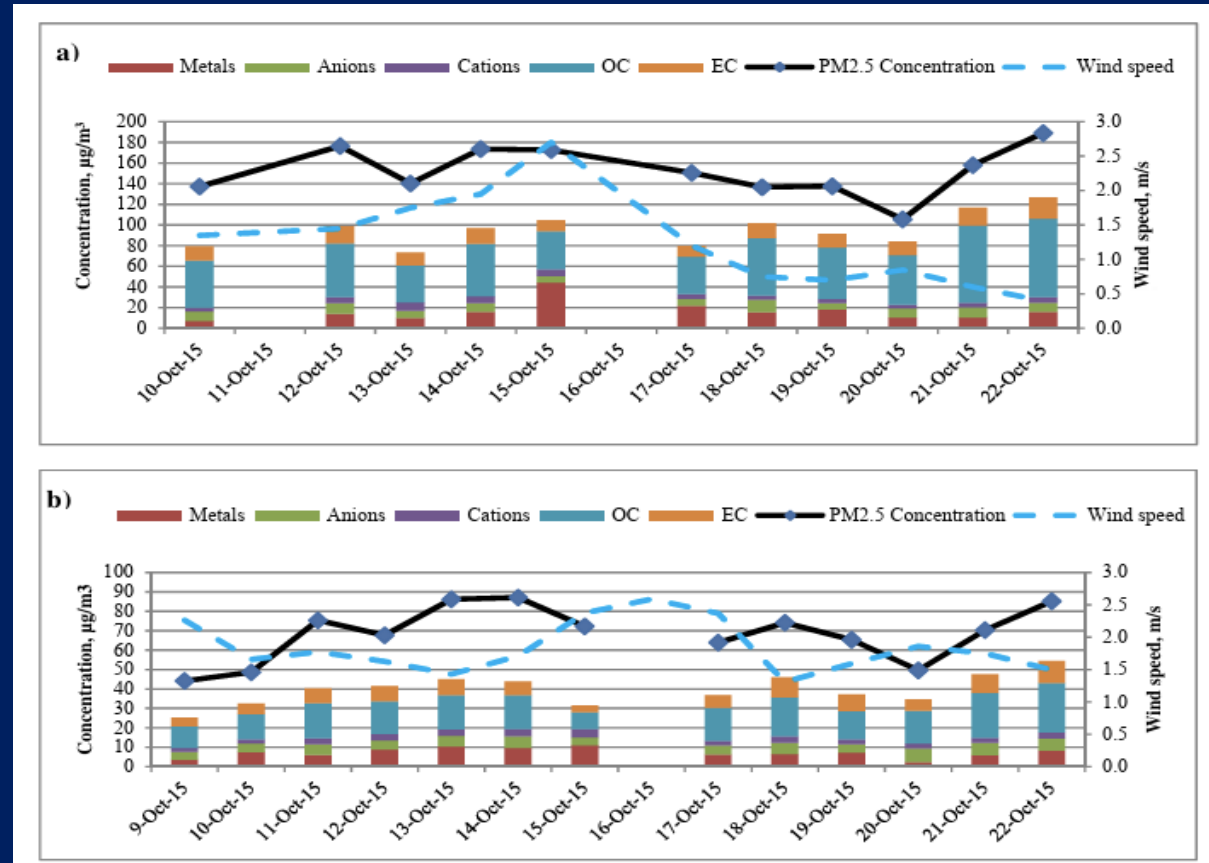
STUDIES ON AIR POLLUTION



ANALYTICAL RESEARCH ON EMISSION SOURCES AND AIR POLLUTION COMPONENTS



[Source: Batmunkh et al. 2013]



[Source: Baldorj et al. 2015]

ANALYTICAL RESEARCH ON EMISSION SOURCES AND AIR POLLUTION COMPONENTS

Air Sampling



Chemical analysis of
particulate matter

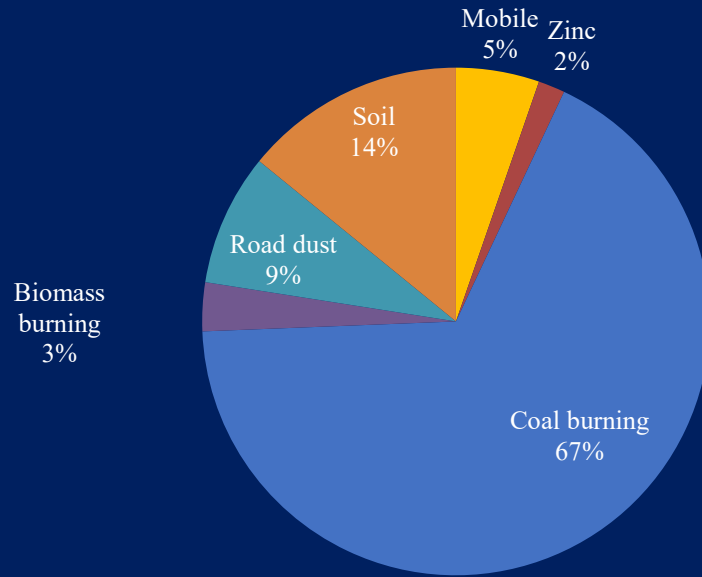


Emission sources of PM
(PMF, CMB)



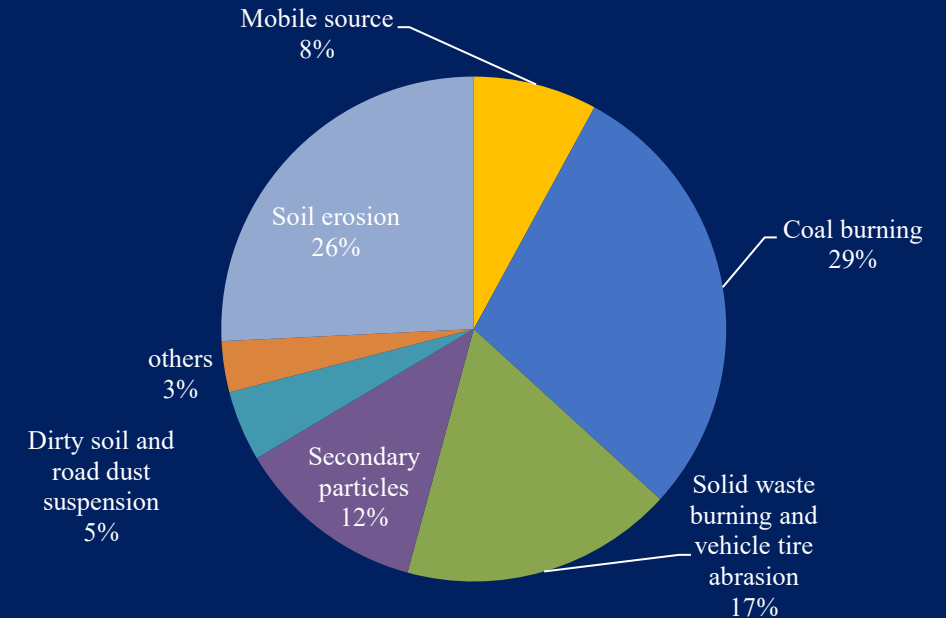
Results

PM2.5 source contribution in UB
(winter season 2004-2008)



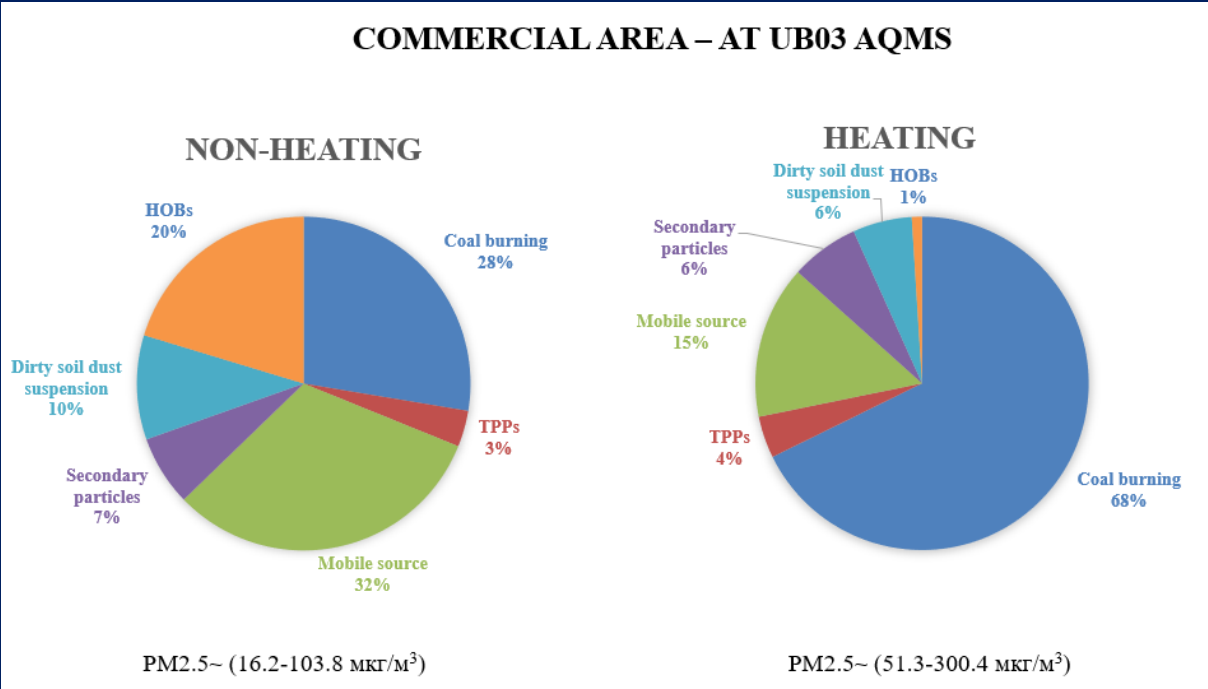
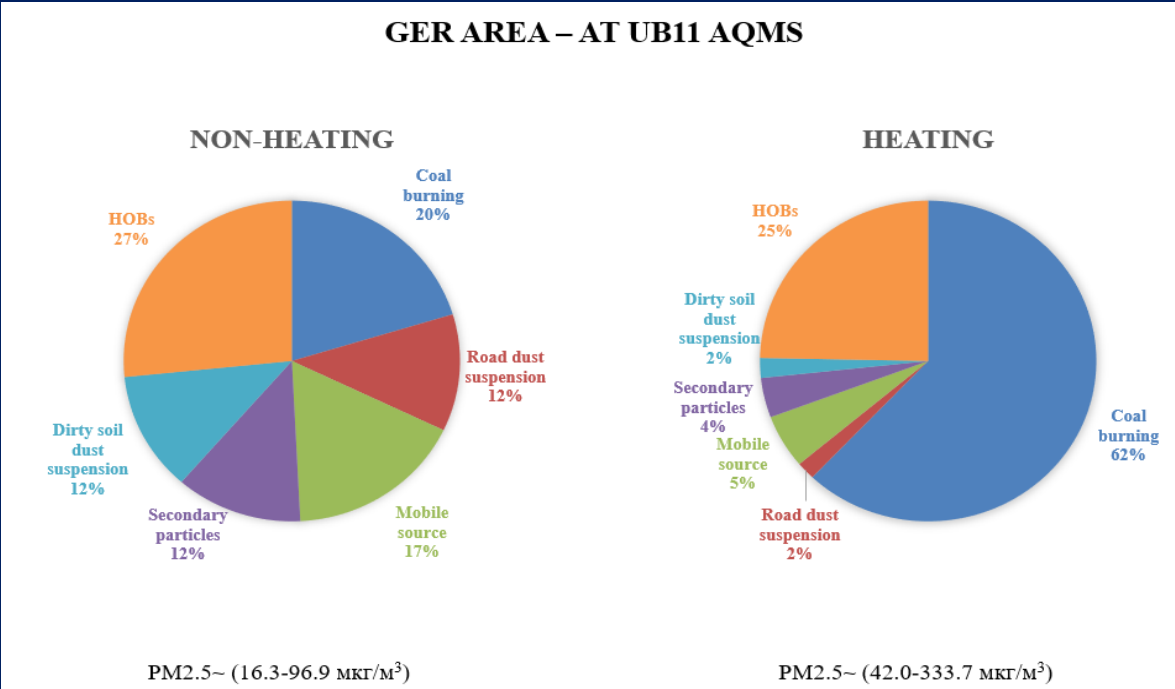
[source: Davy et al. 2011]

PM2.5 source contribution in UB (all
season 2014-2016)



[source: JICA 2017]

IDENTIFICATION OF AIR POLLUTION SOURCES



ANALYTICAL RESEARCH ON EMISSION SOURCES AND AIR POLLUTION COMPONENTS

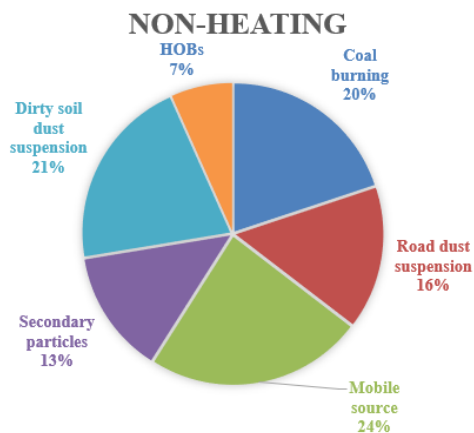
Air Sampling

Chemical analysis of
particulate matter

Emission sources of PM
(PMF, CMB)

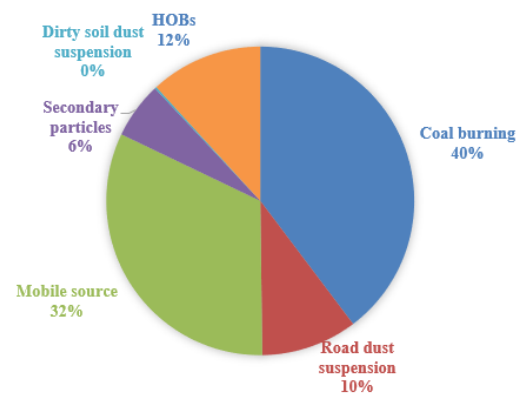
Results

ROADSIDE– AT UB02 AQMS



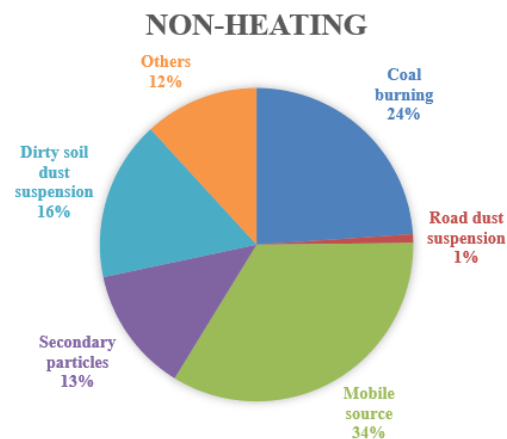
PM_{2.5}~ (18.5-45.1 мкг/м³)

HEATING

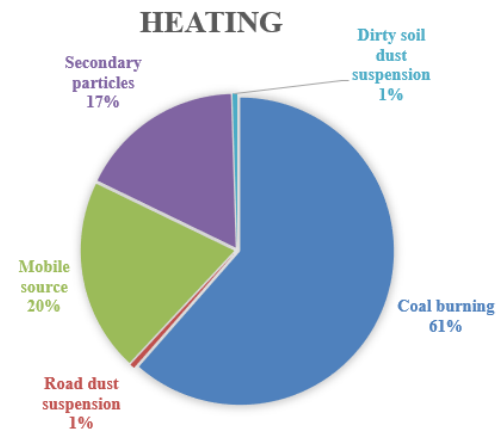


PM_{2.5}~ (34.4-212.9 мкг/м³)

DOWNTOWN– AT ROOF TOP OF NAMEM BUILDING



PM_{2.5}~ (2.3-28.8 мкг/м³)



PM_{2.5}~ (8.6-97.7 мкг/м³)

CHALLENGES



Air pollution remains a serious challenge for Mongolia, especially in Ulaanbaatar. However, through national actions, legal frameworks, and international collaboration, we are making progress toward cleaner, healthier air.

Air pollution emission sources are highly depending on sampling sites and sampling time. Hence, in order to implement air pollution control measures, target area and time should be considered.

The expansion of monitoring capacity and integration of new technologies are critical steps forward.

EXPANSION OF THE CENTRAL LABORATORY OF ENVIRONMENT MONITORING

PURPOSE OF THE PROJECT



- building the Central Laboratory for Environmental Monitoring (CLEM) and introducing new analysis equipment and
- improving air pollution measurement system

A General Agreement on a loan from the Economic Development Cooperation Fund for 2017-2020 has been signed.

The parties have signed a protocol of negotiations.

A consulting service agreement has been signed.



2018.01.16



2020.09.14



2020.12.02



2022.01.13



2023.06.23



2023.06 – 2024.12

The feasibility study has been approved.

The loan agreement has come into effect.

- Engineering Geology and Geodetic Survey
- General Conclusion of the State Geological Survey
- A-Task
- Technical Conditions

EXPANSION OF THE CENTRAL LABORATORY OF ENVIRONMENT MONITORING



- 4-floor new laboratory building
- More than 100 parameters will be analyzed.



Highly sensitive and precise analytical instruments will be installed.

- Pollutants organics: PCBs, PAHs, POPs, VOCs
- Heavy metals: As, Pb, Cu, Zn, Ni, Li, Mo, Mn, Se, V, Fe, Cd, Cr, Ca

Expanding air quality monitoring network



The capacity of engineers and technicians will be improved.

- Organics: GC-MS/FID/ECD, HPLC
- Heavy metal: ICP-MS, ICP-OES, XRF
- Carbon analyzer: ECOC, TOC

THANK YOU FOR ATTENTION.