ULAANBAATAR AIR POLLUTION

CHALLENGES AND POLICIES TO REDUCE IT

Oyun Sanjaasuren
45% of the country’s population lives in Ulaanbaatar

60% of UB’s households lives in the Ger District Population of the Ger Districts doubled since 2010

1/3 of the population still lives below poverty line
Nomadic pastoralism
Financial Overview
URBAN MIGRATION

• An estimated 600,000 former herders have moved to the country’s capital Ulaanbaatar in the past 30 years
<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Mongolian National Air Quality Standard</th>
<th>Oct-Dec Average Concentration in (μg/m³)</th>
<th>Number of Days which Exceeded the Standard in October and December in (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Threshold in (μg/m³)</td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td></td>
<td>24h</td>
<td>Annual</td>
<td></td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>100</td>
<td>50</td>
<td>178</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>50</td>
<td>25</td>
<td>137</td>
</tr>
<tr>
<td>SO$_2$</td>
<td>50</td>
<td>20</td>
<td>44</td>
</tr>
<tr>
<td>NO$_2$</td>
<td>50</td>
<td>40</td>
<td>49</td>
</tr>
</tbody>
</table>
In winter, burning of raw coal for warmth

Emission from 350 thousand registered vehicles

Pollutant Sources
Ger District in the Summer
Ger District originally not meant for permanent settlements

- The ger districts that radiate from the centre of Ulaanbaatar are the result of the impromptu planning, the rapid and uncontrolled urbanization of people migrating to the capital in search of economic opportunities.
UB City in January
Most of the low-income households live in the ger district of Ulaanbaatar

As of 2016, Mongolia had a population of 3.1 million
Traditional nomadic herders

Climate Change: +2.24
Leading to more Desertification, Pasture degradation, melting glaciers and permafrost thawing.

More frequent natural disasters — dzud (drought + cold winter = livestock perishing)
Practical actions

✓ Clean Stoves /distribution of ~170,000 clean stoves to ger district households/
<table>
<thead>
<tr>
<th>Projects</th>
<th>Distribution of Clean stoves</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Millennium Challenge Corporation, Clean air fund</td>
<td>97787</td>
<td>TOTAL USD 30 mln MCC; 15 mln WB; 30 mln Govt CAF</td>
</tr>
<tr>
<td>Clean air fund</td>
<td>29518</td>
<td></td>
</tr>
<tr>
<td>Ulaanbaatar Clean Air project, (WB) Clean air fund</td>
<td>40813</td>
<td>During 2011-2013 average of 91% subsidy and during 2014-2015 66% subsidy of price was given to every household purchase of clean stoves</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>168118</strong></td>
<td></td>
</tr>
</tbody>
</table>
Results of Clean stove project

- The EEP stove subsidy program had 65% lower emissions of PM$_{2.5}$ compared to traditional stoves under typical usage conditions.

- Ulzii stoves significantly reduced PM$_{2.5}$ emissions by 74% in houses and 83% in gers. Smaller reductions were also observed for Khas stoves in houses (46% reduction) and Dul stoves in both houses and gers (reduction of 31% and 38%, respectively) compared to traditional stoves.

(MCC project monitoring report, 2014)
The EEP stove subsidy program reduced ambient PM$_{2.5}$ concentrations over UB attributable to heating stoves by an estimated 30%, with largest reductions in highly polluted areas that were more heavily targeted by the program.

There was no sustainability of the stove policies which resulted in the retraction of the emissions reduction after 2014.
2012-2017 Winter PM$_{2.5}$

Monthly Average

in (mkg/m$^3$)
PM$_{10}$ - Monthly Average in (µg/m$^3$)

Figure 1. Monthly average concentration of PM10 in winter, 2012-2017
2012-2017: Last 6 Winters Dynamics for SOx and NOx

**NO₂ Monthly Average in (mkg/m³)**

**SO₂ Monthly Average in (mkg/m³)**
## JICA Study on Low-Emission Stoves & Fuel

<table>
<thead>
<tr>
<th>Type of stove and fuel</th>
<th>Av. Dust concentration in (mg/Nm³)</th>
<th>Difference in (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baganuur's coal + Traditional stove</td>
<td>293</td>
<td></td>
</tr>
<tr>
<td>Baganuur's coal + Improved stove</td>
<td>122</td>
<td>-58</td>
</tr>
<tr>
<td>Semi coke + Traditional stove</td>
<td>55</td>
<td>-81</td>
</tr>
<tr>
<td>Semi coke + Improved stove</td>
<td>27</td>
<td>-91</td>
</tr>
</tbody>
</table>
Air quality monitoring stations in UB City
PM$_{10}$ Peak heating hour in the evening:

- 2326 Bayankhoshuu Area
- 4984 100 Ail Area

PM$_{10}$ Average daily and average of 11 monitoring stations: 500
Examples of very polluted days this winter

$\text{PM}_{2.5}$ μg/m$^3$ 

(Average of 11 Monitoring Stations) 

January, 12th
AFFORDABILITY - MAIN CHALLENGE

FROM all the initial pilots, tests and studies — one of the main barriers is:
Affordability

• Almost all the other interventions are more expensive than the current raw coal burning option and therefore subsidies, at least initial, are needed for deployment of clean technologies

A step-by-step approach to setting up an affordability mechanism is needed

• Not possible to go solo (infrastructure) for heating only — integrated solution is a must — and that becomes expensive
GCF-ADB project AHURP: Example of Addressing Barriers

- Ulaanbaatar Green Affordable Housing and Resilient Urban Renewal Project
- to deliver **10,000** green housing units that are energy efficient, affordable, and designed to maximize the use of renewable energy. 100 hectares of *ger* areas will be redeveloped into green eco-districts
- GCF funding would be used to reduce the barriers towards the implementation of AHURP
- “Integrating modern energy efficiency technology into prevailing standards for design, construction and operation of buildings, and utilities services. The policy and legal framework for energy efficiency in building construction and renewable energy are mostly in place, but the regulatory framework and the institutional capacity to implement these policies are still in development. Most importantly, the economic and environmental benefits that are recognized at government levels have not been translated into economic incentives for building owners and developers to adopt energy efficiency measures”
instability of policies - barrier

- Political aspects – political will, public attitude, unstable policies, public awareness raising
- President’s office 2011-2013 – in charge of NC
- Then PM’s office 2014-till now
- CAF 2012-2014; dissolved 2015; recreated 2018
- Secretariat to NC created in 2011 and dissolved 2015
- A new agency may be created in 2018
SOLUTIONS & WAY FORWARD

- GOVERNANCE, political will and public participation
- Low-emission stoves
- Clean fuel (e.g. semi-coke briquettes)
- Electrical and gas heaters
- Insulation and energy-efficient buildings
- Re-development of ger district/infrastructure
- Moving to flats/mortgage schemes
- Renewables including geothermal
The Anthropocene Epoch
• Unhealthy environments already linked to 23% of global deaths
• Unprecedented scale of global environmental change

• Pressures on health are increasing (e.g. food, water, natural disasters, pollution, infectious disease, toxin exposure)

• A more preventive approach is critical
• Critical need for coordination/integration for long-term environment and health issues
Global Statistics from Lancet Countdown on Health & Climate Change

- Global population PM$_{2.5}$ exposure has increased by 11.2% since 1990
- PM$_{2.5}$ concentrations in most cities (87.3%) exceed the suggested annual guideline of WHO which is 10µg/m$^3$
- Energy sector is responsible for 70% of NO$_x$ and 90% of PM$_{2.5}$ emissions
- Each year, the number of premature deaths caused by outdoors and indoor activities are 3 and 4.3 million people respectively
Trend: Consumption Current and Future

2030:
- 300% growth of Middle classes in developing countries
- Middle-class consumers will triple
- World GDP is projected to grow by 325% between 2007 and 2050
- 60% of GDP is consumer spending on goods & services
- 70 million people each year are entering an income bracket equivalent to between $6,000 (US) and $30,000 (US)

Source: Goldman Sachs, 2008

The expanding world middle class
2 400 000 Deaths Averted from Measures Aiming to Reduce Black Carbon Emissions (UNEP 2011)

- Improved biomass stoves
- Modern coke ovens
- Remove big smokers / DPF
- Cooking with clean fuel
- Pellet biomass heating stoves
- Improved brick kilns
- Coal briquettes replacing coal
- Reduce agricultural burning
- Reduce flaring
… In 338 cities in China, PM2.5 had been reduced by 6.5 percent from 2016 levels, reaching 43 micrograms per cubic meter,…
Solutions lie within reach and should be based on the redefinition of prosperity to focus on the enhancement of quality of life and delivery of improved health for all, together with respect for the integrity of natural systems.