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Air Pollution”**

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Stoves in Ulaanbaatar

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Cookstoves in Gers of Ulaanbaatar

In Ulaanbaatar, if there is single largest source at the ground level for air pollutants, that would be coal and fuel wood combustion in the cookstoves of Gers. Many homes are *Gers*, the traditional Mongolian dwellings consisting of a wooden frame beneath several layers of wool felt. Other homes in these districts are generally wood constructions of variable quality and levels of insulation. In 2006, sixty percent of the 220,000 registered households in Ulaanbaatar (presented in Figure 10) approximately 130,000 households live in the Ger areas. Because of the increasing in-migration trends from neighboring provinces, there is no clear estimate of total number of households.

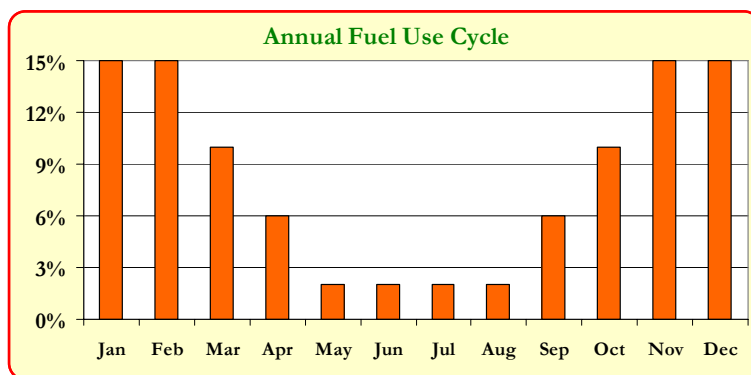
Figure 16: Ger areas and Cookstoves



General statistics reveal that the total number of Ger households is not a direct estimate of number of stoves in use. In some wooden households, as seen in Figure 16, it is estimated to have up to 2 stoves. The total number of stoves in the Ger areas is expected at least 30% more than the reported number of households.

Traditionally, the residents of Ger areas use coal and fuel wood for their cooking and heating purposes, which are sold in sacks along the roadside (see Figure 17). Per year, each household is estimated to use 5 tons of raw coal and 3.0 m³ of fuel wood. Most of the raw coal is supplied from the local coal mines with high ash content. One complaint by a Ger resident is that the price per sack of coal and fuel wood has been constant, but the volume of fuel per sack has gone down over the years ~ 30 kg two years ago vs. 25 kg per sack of coal now. So, on an average these residents tend to spend more for the same amount of fuel than they used to.

Figure 17: Cookstoves and annual fuel usage cycle in Gers



Most of the coal is used during the heating season, with fuel wood concentrated in the late spring and summer months. Figure 17 also presents as estimated coal consumption cycle in a year, with nearly 60 percent of the annual coal consumption coming in the months of November to February.

Fuel mix used in the stoves very much depends on the local resources. In the Gers, there is extensive use of conventional and unconventional fuels as resources, which adds to the uncertainty of total pollutant levels from cookstoves usage. Figure 18 illustrates the use of unconventional fuels such as rubber tubs and bricks dipped in coal tar. These are generally available to the households and are in use for intermittent cooking and heating needs. There is no clear estimate of the extent of usage of these materials.

Figure 18: Unconventional fuels used in Ger areas



Source: *Dr. Sarantuya Myagmarjav, MNE*

Another commonly used fuel, which is also available at lesser price, is the pressed coal. The variety of pressed coal available to the public has been scrutinized for its quality – mainly high percentage of ash content compared to raw coal. This is primarily because the glue used to press the crushed coal to make briquette shaped pressed coal. Originally, these were sold

under the name of briquettes, but the distinction should be made between pressed coal and briquette. The latter has higher calorific value and produces less ash. Currently, there are 23 manufacturing groups producing pressed coal, and the production levels have dropped over the years, because of complaints on ash content.

Figure 19: Pressed coal in Ulaanbaatar

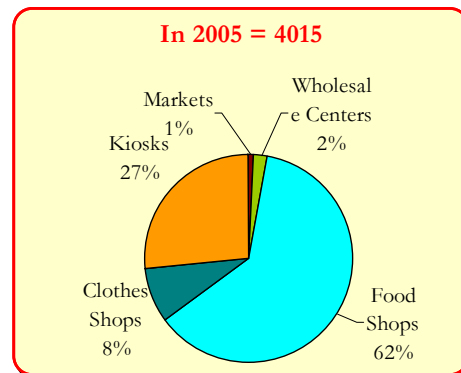
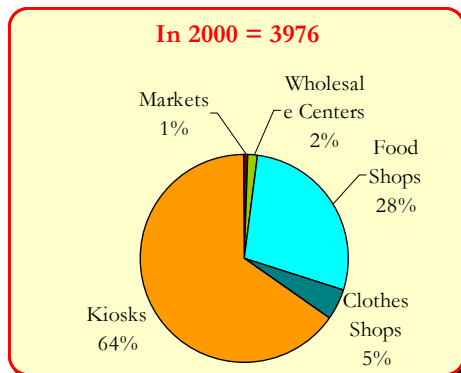
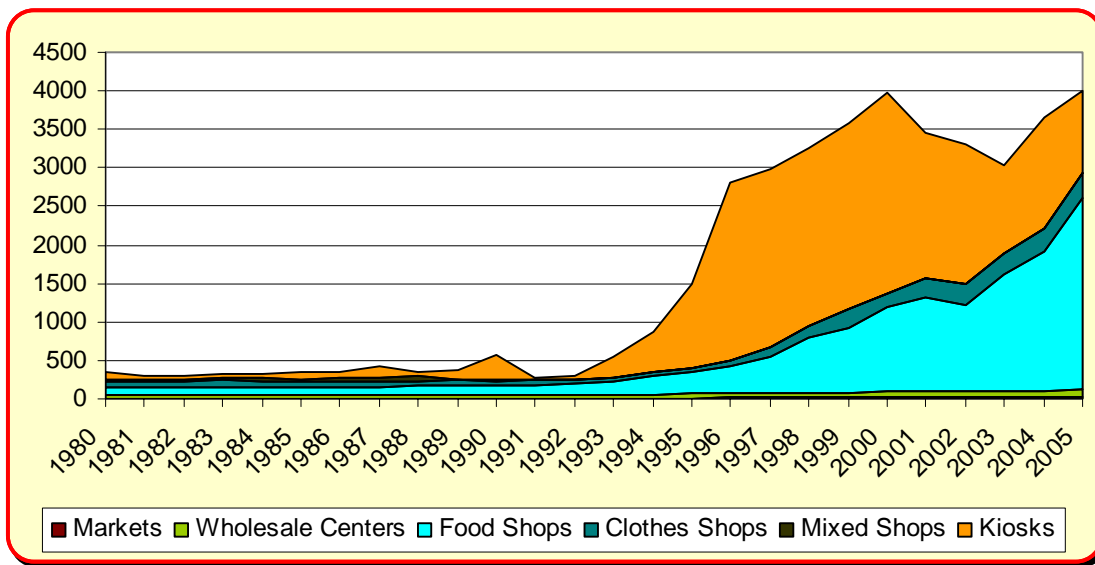


The technology to make briquettes and charcoal briquettes out of saw dust is slowly building momentum in Ulaanbaatar, with at least three private manufacturers supplying a limited amount to select costumers. These briquettes are available at a higher price (details in the later section) compared to raw coal. There is also limited consumption of Liquefied Petroleum Gas (LPG) in the Gers, because of the price differences. Most of the LPG is utilized in the housing complexes.

Cookstoves in Kiosks

In Ulaanbaatar, kiosks and food shops are an unaccounted source of pollution. Especially in the Ger areas, only source mentioned is the household level fuel consumption for cooking and heating. Since the expansion of the Ger areas in the mid-90's and increased in-migration from neighboring districts, the number of food shops have more than doubled in the last five years – from 1,100 in 2000 to 2,500 in year 2005. Most of these shops use smaller, if not similar type of cookstoves for cooking and heating.

Figure 20: Kiosks and food shops in Ulaanbaatar



Source: Ulaanbaatar Statistical Year Book, 2006

Food shops also use a mix of coal and fuel wood for heating. Recent surveys estimate fuel consumption at the rate higher than that of households at 8 tons of coal per year, which is completely unaccounted for in the annual emissions inventory.

Table 2: Survey results for Kiosks and Food Shops (May, 2007)

Type	District	Area, m ² (Stove)	Working Hours	Fuel Consumption	
				Coal	Wood
Kiosk	SB	9 (Standard)	9.00am-23pm	7 ton/yr	9kg/day
	SB	12 (Standard)	24 hours	20 kg/day	10kg/day
	SKH	4 (Standard)	6am-24pm	20 kg/day	10kg/day
	SKH	9 (Standard)	9am-20pm	20 kg/day	
	SKH	7.5 (Standard)	7am-24pm	30 kg/day	
Food Shop	SB	56 (Standard with heating wall)	7.00am-23pm	30 kg/day	
	BG	42 (Water heating)	9am-22pm	8 ton/yr	
	CH	72 (Water heating)	9am-22pm	10 ton/yr	
	BG	9 (Water heating)	9am-22pm	5 ton/yr	
Average				8.2 ton/yr	

Improved Stoves in Ger areas

Under a pilot program, approximately 20,000 improved stoves have been disseminated in Mongolia since 2001, most of them installed in UB. Figure 49 presents an installation in Ulaanbaatar, where the stove is being used in a modernized kitchen to use the heat from stove on two floors. The advantage of this program was inclusion of kitchen improvement strategy along with stove, which adds to the aesthetics of some houses, as shown below. This pilot study also included indoor air pollution assessments, results of which are published¹ and available for review.

Surveys conducted after piloting the program, it is estimated to save up to 2 tons of coal (40 percent of saving compared to standard stove) and 1.5 m³ of fuel wood (50 percent) per

¹ www.esmap.org

stove per year. Even though savings of up to \$50 per year on cost of coal are possible (retail price of coal at \$25 per ton), a key barrier to uptake identified is that the cost of an improved stove is nearly double that of a traditional stove, costing MNT 70,000 (\$70) as opposed to MNT 40,000 (\$40). There are currently more than 10 private manufacturers who are trained and financed under this program to supply these stoves and looking for means to scale-up the program. Program also promotes use of scrap metal from ship yards as stove material, which is aimed at bringing the stove cost down. Contact person for this program in Ulaanbaatar is Ms. Oyuntsetseg (Email: oyunnaad@yahoo.com, Phone: +976 99115526)

Figure 49: Improved cookstoves and manufacturing in Ulaanbaatar



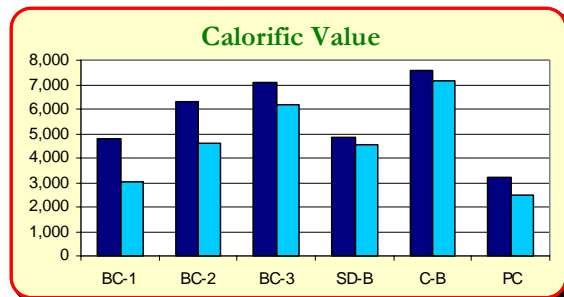
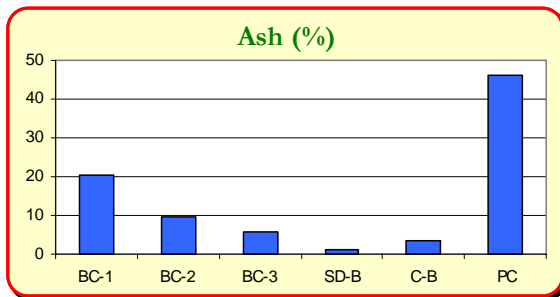
The Municipality is considering a policy to subsidize the cost of more efficient stoves for poor households but the impact is too early to judge. While demonstrated effective in

reducing emissions, dissemination would have to increase significantly to have a measurable impact on air quality.

Briquettes or smokeless coal

Charcoal, made out of wood chunks, saw dust, and some low grade coals, is a desirable fuel because it produces a hot, long-lasting, virtually smokeless fire. Combined with other materials and formed into uniform chunks called briquettes, it is popularly used for outdoor cooking in the developed countries. In Ulaanbaatar, given the usage of coal in the stoves and stoves contribution to the ground level pollution, this is also a viable solution to reduce outdoor and indoor air pollution. Main difference between this scenario and the introduction of improved stoves is the central control of fuel manufacturing and use. In this case, there will be a centrally located industry, which is responsible for manufacturing the clean fuel, with improved emission standards compared to the regular raw coal being burnt in Gers.

Figure 51: Briquettes in use in Ulaanbaatar and fuel characteristics



Currently, there are three private factories (partly funded by the local Xac Bank) manufacturing briquettes out of saw dust. Their conclusion is that the demand for these briquettes is high, even though the price is higher than the local raw coal, mainly because of better fuel characteristics. Figure 51 presents results for fuel testing conducted for product from one of the private manufacturers. One of the manufacturers, presented in the picture (Contact information: Mr. Dash Ulzii, Email: DASH@magicnet.mn; Phone: +976 9111 3536), has a plant capacity of 2,000 tons a year and interests in expanding the production 20,000 tons in the coming years.

In the figure BC is the standard brown coal, three different types. The lowest is the commonly available for household use. And the rest are SD-Saw dust briquette, C-B is the charcoal briquette and PC is the pressed coal (see Figure 19).The calorific value of the briquettes is 2-3 times higher than locally available coal, and 2-5 % Ash content compared to 20+ percent in the raw coal. These briquettes are also available in the pellet form (shown in the packet in the picture), with higher burning efficiency. Although the price of briquettes (see Table 11) is currently 5 times higher than locally available raw coal, the energy content (2-3 times more) and ash content (5-10 times lower) make up the rest. Mr. Dash expects this price to come to down to 60,000 MNT with the production capacity going up.

Table 11: Price of various household fuels

Fuel Type	Price (MNT) per ton
Raw coal	21,000
Pressed coal	40,000
Sawdust briquette	100,000
Charcoal briquette	200,000 to 300,000
Sawdust + Charcoal	100,000
Sawdust pellets	100,000