

Potential for use of solar energy to reduce air pollution in the urban centers

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Introduction

- Air pollution in urban centers is increasing. Especially in the capital and also in some provincial centers such as Arvaikheer, Bayankhongor, Murun.
- **The reason:** Its varied. This presentation focuses on air pollution caused by burning raw coal and wood in ger district. Some study shows this constitutes 60% of current air pollution in the city.
- **Damage.** Dense population in urban centers. Detrimental health effect.
- **Activities being carried out:** No specific activities in provincial centers. There are measures in the capital such as energy efficient stoves, ger insulation, using smokeless fuel, converting ger districts to apartments etc
- **To achieve more results:** Changing heat generation technology and source
- **Potential for use of RE to reduce air pollution in urban centers:**
 - * Reducing coal and wood consumption on energy producing
 - * Changing the heat producing technology
 - * renewable energy technology has developed and became competable with the traditional thermal source

Wind energy resource: Surrounding mountains, valleys, mountainsides of Tuul river basin are rich in wind energy resource. Depending on data of "Morin uul" climate station, there is a capacity of 70 wind park with 50 MWt each. It has to be verified by the wind resource measurement however those wind parks will have a capacity of 8400 MWt*hour of energy per year

Solar energy resource: We have a capacity of energy and electricity production using solar energy in Ulaanbaatar. In ger district area solar energy can be used as a thermal power, solar can be used as electricity in agricultural and urban area. Ger district area is being considered as 10000 acre, agriculture area is in total of 3538 acres and annually 87795 MWt*hour of thermal power energy, and capacity of 28483 MWt*hour of electricity can be produced.

Water energy resource assessment:

Tuul river water energy:

- Potential resource: capacity 158500 kWt (1369973.4 MWt*hour electricity per year)
- Capacity for technic and technology operation resource 139300 kWt, 1203957 MWt*hour per year
- Capacity for potential economical operation resource 93470 kWt (809397 MWt*hour per year)

Capacity of potential energy producing resource using Thermal pump

Potential for taking heat from every longitudinal 1 meters of 444000 waterholes with 100 meter's depth and technical potential for using it 2500 hours and 2800 MWt*hour of energy producing per year.

- Also soil or ground water temperature can be used.

Using solar energy to reduce Ulaanbaatar city's air pollution

1. Mongolian traditional house (ger), apartment heat systems, solar energy solution for disposable hot water supply

Calculation depended on the Ulaanbaatar city's degree(temperature)*time balance, 40% of the thermal consumption is in daytime and 20% is in sunless moments of morning and evening, 40% is in during the night(from 9pm-6am in the morning).

Therefore there is a question that "How many percent of necessary heat consumption should be taken from solar energy and how many percent from different source?". However the investment amount will increase if solar heating system usage rises, operation expenses will decrease (For example: if the another source is an electricity, electricity expense will decrease).

Especially in December and January, solar energy source must be combined with other thermal or electricity source.

How much amount should be used from which source will be used is going to be described with the minimum amount of annual converted operation expense(total of operation expense of the year and depreciation allocation). For current price situation, we did calculation on mathematical model which expresses 60 percent of the heat consumption can be provided by the solar energy for customer who uses 5 ton coal, 4 cubic.m of wood for heat necessary season.

Solar energy+electricity combined thermal collector system will heat Ger and Apartment as described below.

- + Heating the ger by solar energy during the sunny daytime
- + Using the cheap price of the electricity system during the low pressure period in sunless time during the morning and evening
- + Using the cheap price of the electricity system during the low pressure period in night using the electricity heat system

During the heating described as above, it may affect sufficiency of electricity system capacity and normal electricity normal characteristics.

Solution: Calculating that electricity heater will work completely in night period and produced electricity price will be same with the current minimum pressure period price using the economic method. In other hand, household's day electricity capacity doesn't overcome the electrical heater capacity used in night, so by installing limiting automatics for heater capacity, we can limit the electricity consumption being used in other purpose during the night.

Using solar energy+electricity combined heat system can increase the electricity usage in night period and increase the power plant equipment quality. And also income of energy factories and efficiency of energy suppliers, transmitters and dispensers will be increased.

Providing the solar energy and electricity combined heat system for private lodges and houses

There are approximately 87000 private houses in Ulaanbaatar (not including Bagakhangai, Baganuur, Nalaikh). Depending on previous studies and experiment results, in 2012-2013, NREC and Solar house company has started to provide successfully about 20 private houses of 60-80km.m with combined heating system and planning to have an integrated result from these works. Below are the examples of the combined heat system provided houses.



Solar energy+electricity combined heat system for Mongolian traditional house (ger)

There are 66000 gers in Ulaanbaatar /not including Bagakhangai, Nalaikh, Baganuur/. For households, it is 7000 -13000 KWT*hours.

Areas far from city center are not very easy to connect to the integrated energy system and loaning for the apartments are not quite developed so using solar energy is the good solution for these issues.

Main idea of the proposal:

1. Construct bathroom inside the Mongol ger with 2-3kw.m, low price. Nad enter these bathroom from ger with small steps /same as tourist camp's/. Install the toilet, shower, container for heated water by solar energy.

3. Installing the solar heating collectors outside ger on the iron pipes

After implementing these ideas:

1. People don't need to build apartments or houses and excessively save the expenses.

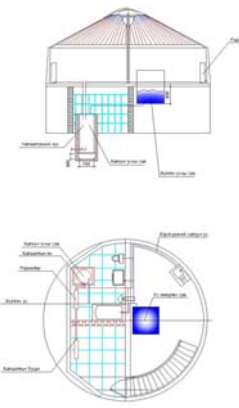
2. No need to pay for heat system and hot water

3. Easy to reduce the air pollution

4. the condition of household

5. Coal and ash will decrease

And using this combined technology system, approximately 650000 tons of CO2 emission will decrease.



Example of Sun collector installation outside of the mongolian traditional house (ger)



Songinokhairkhan district, 8th quarter, public bath

To heat the water, 70 kW*hour of energy is necessary. If 168 public baths of Capital city use the solar energy for heating, 4600 tons of CO2 emission will decrease.

Using solar energy heat system to provide kindergardens and schools with hot water

Recent years, sickness rate of hepatitis is increasing and became same issue with the air pollution of the Ulaanbaatar, which is related to hand sanitation, but must be considered hot and cold water scarcity in random schools are the main issue and affecting children health. For example, kindergarden #124 in 10th quarter of Chingeltei district and school #57 of 11th quarter in same district, we made some calculation using solar vacuum collector. Other kindergardens and schools can be heated by this method. Mark of TZ47/1500-30C 6 sun heat collector will be installed on both kindergarden and school.

Each has 240 l of capacity and will heat 1440 l of water per day. We can see that it is possible to heat the water of the kindergarden's and school's far from the integrated water sewage system. This will improve the studying condition of the students. Regarding the conclusion of the doctors, can prevent 80% of the children to get sick from dirty hands. We have calculated the necessary amount of the electricity amount for heating 1440 l of water per day and it's 84 kWt*H electricity to heat the water. About 70 schools and kindergardens use 1411200 kWt*H of electricity and can prevent and reduce 1552 tons of CO2 emission.

Хүлээн авагч Нарны гэрэл

Ойлгогч тольнууд

Хүлээн авагч: 600-1200°C температуртай агаар

Парабол тавган ойлгогч Нарны гэрэл

Хүлээн авагч

Хүлээн авагч: 600-1200°C температуртай агаар буюу гелий

Conclusion:

1. We can prevent almost 500-700 thousand tons of carbon dioxide emission if we implement the solar energy system as mentioned above.
2. Suggested technologies can be used in other urban areas
3. Air pollution of Ulaanbaatar has increased and it has been years.
4. There aren't any good results and solution worth reducing air pollution.
5. Ulaanbaatar air pollution is the result of the household stove.
6. Нийслэлийн АБ-г үндсэн арга хэлбэр нь түлшний төрөл, дулаан үйлдвэрлэх технологийг өөрчлөх явдал мөн.
7. Улаанбаатарын АБ-г бууруулахад эрчим хүчний цэвэр бөгөөд байгалиасаа үргэлж нөхөн төлжиж байдаг сэргээгдэх эрчим хүчийг ашиглах нь амьдралаас урган гарч байна. СЭХ-ний технологийн хөгжил өндөр түвшинд хүрч зарим улс орон өөрийн эрчим хүчний хэрэгцээний тодорхой хувийг СЭХ-ээр хангах зорилт, хөтөлбөрүүдийг дэвшүүлэн түүнээ амжилттай хэрэгжүүлж байна.

7. Main criteria of using the renewable energy is **RE resource**. There is a capacity of 936000 MWt*h renewable energy resource. By now there aren't any studies and measurement of these.

7.1. To detect the **wind** energy resource, constant parameters of wind, percentage of wind with stable speeds are should be examined for a long term with modern equipment.

7.2. **Sun radiations** which are coming on horizontal surface in Ulaanbaatar are being measured in climate stations. To use the solar energy, it definitely need to measure the horizontal radiations. There are water station on Tuul river, but not in sub rivers.

7.3. **Underground heat**: To do the measurement of soil heat transmission coefficient and **underground temperature** permanently in deep ground and seasonally.

7.4. Detecting the **ground water** resource

Suggested technologies can be used in other urban areas to reduce air pollution.

Thank you very much for your attention!