

## **Solar Energy Resource in Mongolia and Electrification for Nomadic Families**

*Legden, M.*

Renewable Energy Corporation, Mongolian  
Academy of Sciences

*Ulaanbaatar, T.*

Earth Science Center, Physics and Electronics School,  
National University of Mongolia

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### **Абстракт**

Энэ өгүүлэлд Монгол орны нутаг дэвсгэр дэх нарны энергийн нөөцийн түгэлт, түүнийг ашиглахад шаардагдах нарны элементүүдийг зөв сонгох боломжийг харуулав.

### **Introduction**

The consumption of energy resource is rapidly increasing. On the other hand the global environment is degrading year by year due to the use of fossil fuels.

Therefore, to solve these problems, development clean energy resources have become one of the most important tasks assigned to modern science and technology. Solar energies have attracted world-wide attention because it is clean, inexhaustible and available everywhere in the world. Mongolia is not big country with small population of about 2.3 million people. According to the final statistical data of 1996 there are 1600 bags, 200 frontier guards, 168000 nomadic families still live without electric supply. These bags and frontier guards located mainly in rural and remote areas such as mountain, Gobi and Steppes. These are short of energy resource also far away from AC network or very difficult to connect with the electric grid. Therefore, photovoltaic or electric generator is the most suitable power supply these areas.

## **Solar Energy Resource in Mongolia**

Mongolia situated between the 42-th and 49-th geographical latitudes in Northern Hemisphere. The amount of energy from sunshine is very rich. It has been recording solar radiation data every 10 minutes by 200 pyronometers since 1990. Fig.1 shows the investigation detail of solar radiation distribution in Mongolian territory.

From Fig.1 we can see that solar radiation in  $45^{\circ}$  tilted plane is very high from 4.2 to 6.2 kWh m<sup>-2</sup> day<sup>-1</sup>. This shows there are amount of dispersed radiation which is approximately the equal with the annual main daily global solar radiation in India (4.6-6.4 kWh m<sup>-2</sup> day<sup>-1</sup>). The territory is divided into 5 regions depending on solar radiation measurement and about 80 % of territory covered by more than 4-th and 5-th regions (kWh m<sup>-2</sup> day<sup>-1</sup>), especially, this is higher in Gobi and Steppe regions. Fig.2 shows the duration of solar radiation hour per year. The result indicates that major part of the country's territory classified as rich in solar radiation and duration of solar radiation in year from 2600 to 3200 hours because of Mongolian clear sky. From Fig.2 we can see the relatively clear sky condition, particularly, the duration of solar light more than 2900 hour per year.

## **Solar Home Lighting System**

The Renewable Energy Corporation (REC) developed 4 models of solar home lighting systems:

- 30 Watt
- 50 and 55 Watt
- 100 Watt

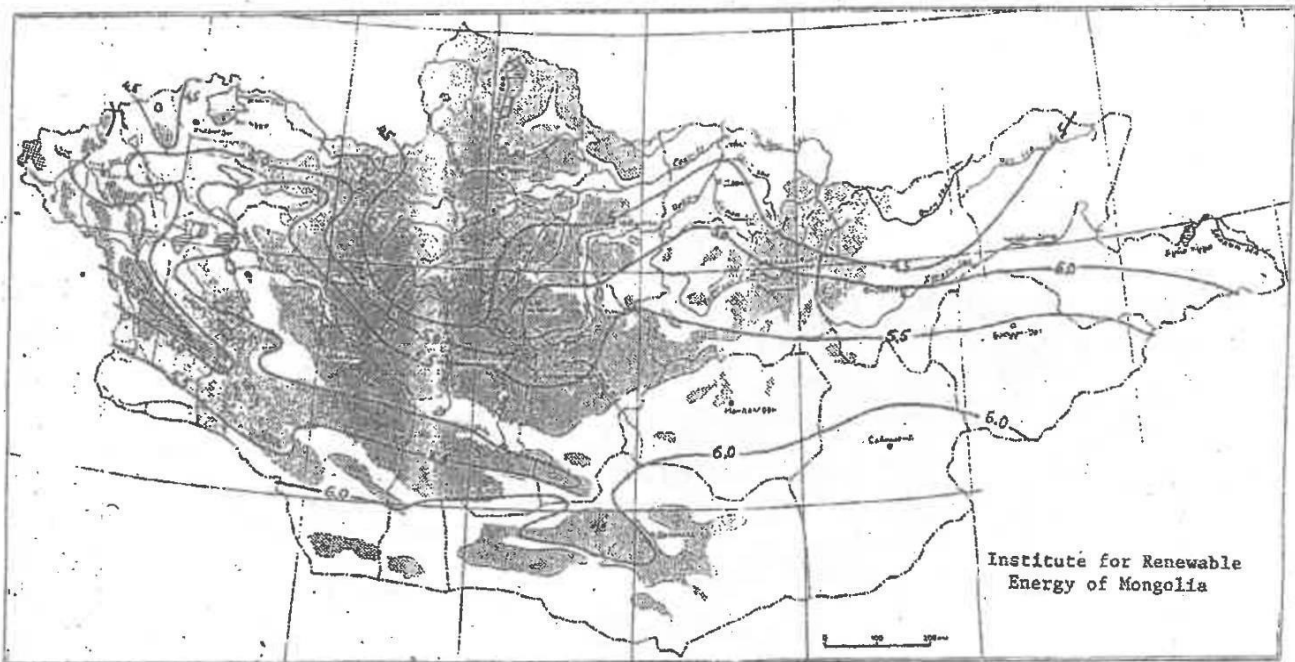
- more than 120 Watt

This solar home lighting system has a PV module (30, 50-55, 100, more than 120), frame and cables, ampere-hour battery (60, 70, 120, 180), a battery control unit BCU, one fluorescent tube with electronic ballast, and DC-AC inverted for radio, TV, and satellite antenna power supply. For example, 50 Watt system can generate 180 Watt-hour (Wh) in average a day supply power to black-and-white TV, one fluorescent lamp, an incandescent bulb and a radio for four-five hours. Installation of the system takes about 2-3 hours. Brief drawings in Fig.2 annual maintenance of the power supply consists of regulate refills of distilled water into the battery. The panels last for a least 20 years but battery has to be replaced every two to three years. The first three models are very usefull for nomadic famillies, therefore, they like to buy them. The model 4 is suitable to supply electricity in hospital, school and dormitory of soum center. During 1990-1996 the Institute of Renewable Energy have imported more than 1500 solar home lighting systems from Russia, Japan, Austria, United Kingdom, China and installed in the nomadic families, schools, hospitals of soum center and frontier guards.

## Conclusion

Mongolia is very rich in solar energy resource, therefore, first 3 models of solar home lighting systems are most suitable to use in the electric supply for nomadic families. But 4-th model is very useful to the hospitals and dormitories of soum centers.

ANNUAL MEAN DAILY GLOBAL RADIATION IN MONGOLIA (45°)  
(in kWh/sq.m/day)



Figure

DURATION OF SOLAR RADIATION HOUR PER YEAR

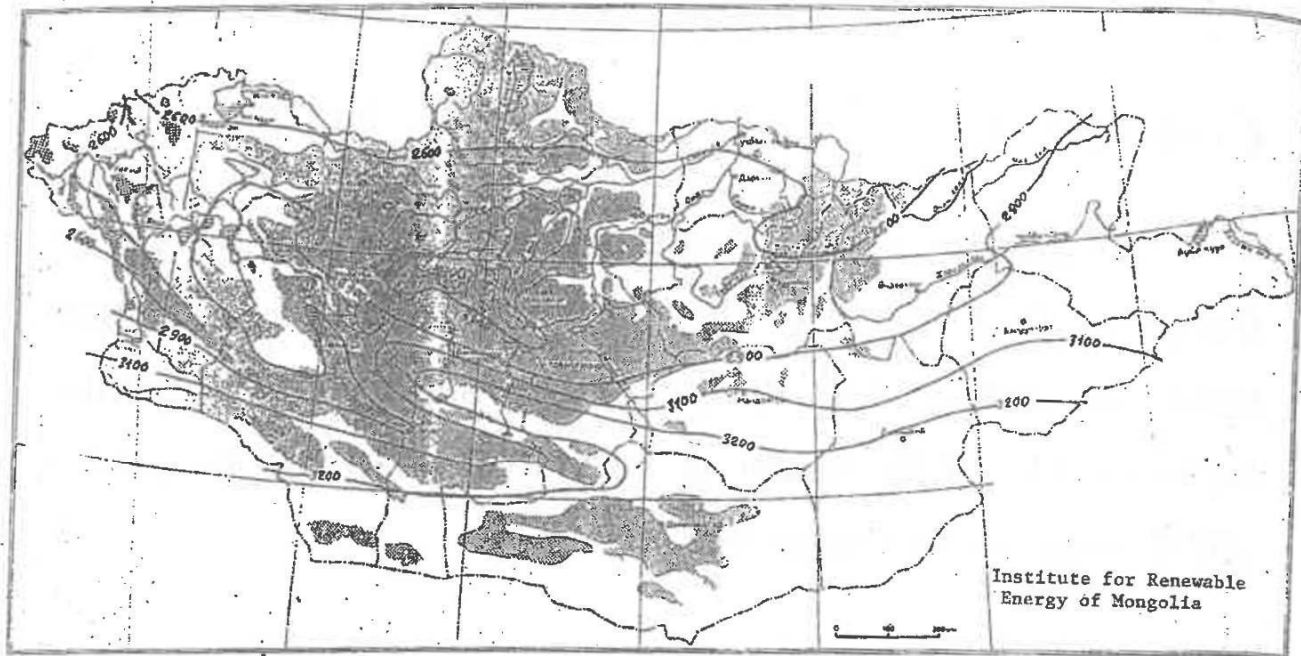


Figure.

DURATION OF SOLAR RADIATION HOUR PER YEAR



Figure.