

# Capturing the Sun in the Land of the Blue Sky

## *Providing Portable Solar Power to Nomadic Herders in Mongolia*

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### SUMMARY

The Renewable Energy and Rural Electricity Access Project (REAP) helped the Government of Mongolia (GoM) successfully complete its ambitious, *National 100,000 Solar Ger Electrification Program*. The Program provided a vast, dispersed community of over half a million nomadic herders with access to modern forms of electricity through portable solar home systems (SHS). The REAP was funded by the World Bank including grants from the International Development Association (IDA), Global Environment Facility (GEF) and the Government of the Netherlands.

Mongolia is a geographically vast country covering over 600,000 square miles but has a relatively small population of less than three million people. About 1.2 million of Mongolia's citizens live in the urban capital of Ulaanbaatar, while the remaining population is widely dispersed throughout the country with a large number residing in sparsely populated, rural areas. A quarter of the population is composed of herders who lead a nomadic existence. This nomadic lifestyle is a legacy of thousands of years of traditional culture and is dependent upon a harmonious co-existence with nature. The per capita income in Mongolia at the start of the millennium was about US\$470

per year, with income amongst herders even lower. At the time, herders had limited or no access to modern electricity services.

In 2000, the Government of Mongolia (GOM) began the *National 100,000 Solar Ger Electrification Program*, an ambitious initiative to improve the lives of about half a million herders by providing modern electricity services.

The program provided photovoltaic solar home systems (SHS) that were portable in design making the systems adaptable to the nomadic lifestyle of herders and complementing their traditional way of life. Through grants from several donor nations, the GoM had provided over 30,000 herder families with SHSs by 2005.

Despite this progress, the herder electrification effort was beginning to stagnate. The GoM recognized that considerably more effort was necessary not only to keep the program on track but to scale-up implementation in order to achieve the *National 100,000 Solar Ger Electrification Program* target.

In 2006, the World Bank agreed to assist the GoM scale-up its efforts to electrify nomadic herders through REAP. The aim of REAP was to add 50,000 SHSs to the existing total so that *the National 100,000 Solar Ger Program* could

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reach around 80,000 systems in total. The World Bank was able to bring to this effort its experience with successful rural electrification initiatives in other countries to help redesign some key aspects of the program as well as adapt new features to accommodate challenges unique to Mongolia.

Specifically, the REAP included a cost sharing mechanism with the herders that expanded the program for maximum impact. Under this arrangement, the herders had to purchase the SHSs, but given their limited income, the project provided a subsidy to cover roughly half of the cost of the systems, making them more affordable. A generous grant that was provided by the Government of the Netherlands augmented GoM funds helping finance the initial procurement of SHSs and providing the

provide critical after-sales care and maintenance within reasonable proximity to herders – services that would otherwise require costly travel to the capital in Ulaanbaatar. The availability of such services dispersed across many rural areas is vital for maximizing and sustaining the benefits of the SHS program.

The SSCs also played a crucial role that helped address a key challenge to providing rural electricity access in Mongolia. Successful herder electrification was predicated on the development of the widest possible sales distribution network that could reach the widely dispersed population in Mongolia's vast landscape. The 50 SSCs, with at least one in each of Mongolia's 21 provinces/aimags, served as an important conduit for promoting and selling SHSs throughout the country. The



A typical Mongolian collapsible tent dwelling, known as a ger, with a Solar Home System panel

Photo credit: The United Nations/Eskinder Debebe

buy-down subsidy. The recovered funds were in turn used to cover the costs of additional systems which further helped scale-up the implementation of the *National 100,000 Solar Ger Program*. The equipment sold under REAP were also inspected for quality and certified to meet stringent standards enabling herders to purchase them with confidence. An extensive awareness campaign assured herders could make an informed choice in the purchase and maintenance of a SHS. Each system included a warranty in the event a defect was found following the sale. The SHS could be returned for a replacement at one of 50 Sales and Service Centers (SSCs) that were established throughout the country under REAP. The SSCs

SSCs, which are privately operated, were selected, trained, and certified under REAP to ensure they maintain adequate qualifications and knowledge to service the SHS industry in Mongolia. Most SSCs sell the SHSs bundled together with other consumer electronics and appliances that could be used by herders with electricity. As a result, the project helped create new business opportunities and commercial markets that previously did not exist. REAP also continued to utilize the existing GoM Soum Administrative Network that was organizationally far reaching. SSCs often partnered with one of 342 village/soum administrations to further extend their reach to herders located in even more remote areas.

Village/Soum Administrators would accept orders and then help distribute SHSs to herders upon receipt of the systems. Under REAP, 10 of the SSCs were also certified as private dealers, who would self finance the wholesale procurement of SHSs directly from the market in line with established standards. These certified, private dealers would then sell the systems at a discount based on the herder's eligibility for the buy-down subsidy. Although the private sector was an important element that complemented the GoM Soum Administration Network, the relatively small size of the Mongolian market and the limited financing capacity of the private dealers made it difficult to achieve sufficient economies of scale. Therefore, the GoM through REAP, competitively procured large batches of SHSs to secure "bulk" prices that were then sold through the public distribution networks of Soum Administrators and privately owned SSCs – forming a unique public-private partnership in the supply of SHSs in Mongolia. The lower costs that resulted from the bulk procurement were passed through to the benefit of the herders.

Through considerable efforts of the GoM and all others involved, REAP has exceeded its original targets by almost thirty five percent, and has helped the GoM successfully complete the *National 100,000 Solar Ger Electrification Program* by 2012. As a result, more than half a million people covering between 60-70 percent of Mongolia's nomadic herder men, women, and children, now have access to modern electricity that enriches their lives while preserving their cultural traditions. Of course, there are still some 200-300 thousand of the herder population that still lack access to electricity, so there is still

much work to be done. The hope, however, is that the systems and institutions developed under REAP will continue this effort of bringing electricity to nomadic herders throughout the country. The GoM's National Renewable Energy Plan (2005-20) is aiming for universal connectivity by 2020. As Mongolia currently experiences an economic boom from the exploitation of its mineral wealth, efforts such as herder electrification can help ensure that this important community, which connects the country to its rich history, can maintain their way of life without being left behind.



Lights powered by solar electricity  
Photo credit: Stephan Bachenheimer/World Bank

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## BACKGROUND

Mongolia is a vast, landlocked country covering an area of over 600,000 square miles. Despite its geographical size, Mongolia's population is only about 2.8 million people. Of this population, approximately 1.2 million people reside in the capital, Ulaanbaatar with another estimated 600,000 people living in other small urban centers. The remaining population is geographically dispersed over large swathes of rural areas across Mongolia with a small proportion of them living in village settlements or hamlets called soums. A unique feature in Mongolia is that about 700,000-800,000 people living in rural areas, or about a quarter of the total population, are nomadic herders.

degrees Celsius, and the cold weather lasts for most of the year. As a result, the land is barren most of the time with scarce vegetation. Therefore, herders have little choice but to roam the vast rural country side in search of pastures where livestock can graze. Herders frequently relocate with all of their belongings including the portable tents they use for housing, commonly referred to as Gers, as they go in search of pastureland. However, they are in regular contact with the local villages or soums to which they are registered for conveniences including restocking supplies, community activities, administrative matters etc. Given their nomadic lifestyles, herders do not have access to basic infrastructure and other services, including electricity; the herders largely live a life of self sufficiency. Most of their energy needs are met through the

**FIGURE 1: Map of Mongolia**



Source: CIA World Fact Book and World Bank

Mongolian herders lead a lifestyle that is a legacy of ancestral generations and traditional culture. This lifestyle is epitomized by a harmonious co-existence with nature. Yet it is a rugged and nomadic way of life. It is said that the Mongolian herder survives in the winter and thrives in the summer. In Mongolia, winters are harsh with temperatures dropping to as low as -30

burning of coal, firewood, or dung, and when available, kerosene and candles, for heat and lighting.

Life in the rest of Mongolia, such as the capital, Ulaanbaatar, stands in stark contrast to the herder's rural existence. The Mongolian economy, which had a Gross Domestic Product (GDP) of about US\$1.1



billion at the start of the Millennium, has recently experienced rapid growth<sup>1</sup>. Buoyed by a large mining boom resulting from international demand for the country's vast mineral wealth, Mongolia experienced an economic growth rate of 17.2 percent in 2011 – one of the fastest in the world. Sustained economic growth swelled real GDP to over US\$8.5 billion by 2011 with per capita income at around US\$3,000. However, the benefits of the growing economy do not always reach the large proportion of the population that make up the rural communities and traditional herders. Ulaanbataar, which is characterized

## NATIONAL 100,000 SOLAR GER ELECTRIFICATION PROGRAM

In 2000, the Government of Mongolia (GoM) embarked on an ambitious program to provide modern electricity to its large herder population which could be adapted to their nomadic way of life. The goal of the *National 100,000 Solar Ger Electrification Program* (The Program) was to electrify over 500,000 herders and their families. Mongolia is often referred to as the “Land of the Blue Sky” due to its clear skies that provide an unusually high number of brightly sunlit days in a year, even during



Solar power providing lighting inside a Mongolian ger

Photo credit: Stephan Bacheneimer/World Bank

by the typical hustle and bustle of a large urban center, is distinctly different from the serene, sparsely populated, rural environment where economic activity is scattered across wide distances. Therefore, it is a development imperative that these rural communities and herder populations are not left behind in country's rapid economic expansion. This must be done in part by ensuring they have access to modern amenities and services that would improve their quality of life.

winter months. It is estimated that over 2/3 of the country receive high levels of incoming solar radiation in the range of 5.5-6.0 kWh/m<sup>2</sup> per day<sup>2</sup>. The average number of sunny days in Mongolia exceed over 250 days a year. Therefore, harnessing solar energy is a useful way to provide electricity to herders that is also a clean and renewable source making it more sustainable over time. Providing portable solar home systems (SHS) is a practical way of technology adapted to meet the lifestyle needs of a nomadic herder that frequently relocates. Herders can quickly dismantle the portable

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<sup>1</sup> The economic information presented in this paragraph is based on World Bank data.

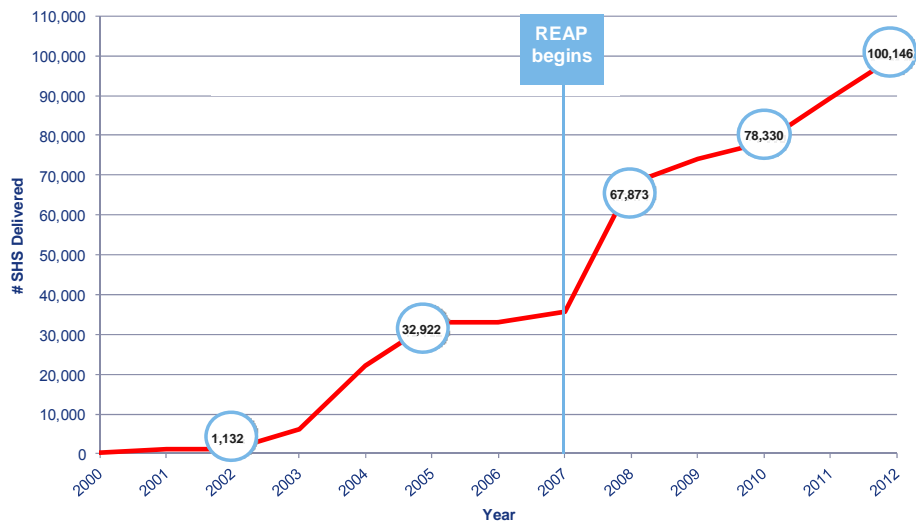
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<sup>2</sup> Mongolian Institute for Sustainable Economic Development.

SHS at the same time they breakdown their Gers and then re-install them once they reach the next destination where their livestock will graze. These portable SHSs help provide electricity to herders while helping preserve their traditional way of life. Despite their nomadic, rural lifestyle, by utilizing the portable SHSs, herders can realize the many benefits of electricity; from lighting to connection to an extended outside world through radio, television and, in increasing instances, to greater communication using mobile phones through the growing cellular network in the country.

always leveraged to further expand the program, the pace of implementation was beginning to stagnate as the bi-lateral grant funds depleted. The Soum Administration network needed to be complemented with additional channels to scale-up implementation as well as to progressively reach more remote herders. Aftercare services within reasonable proximity to herders were also significantly lacking, bringing into question the long-term sustainability of the program<sup>3</sup>. The GoM was determined to scale-up implementation of the *National 100,000 Solar Ger Electrification Program*, and requested assistance from the World Bank. The

**FIGURE 2: Implementation of the National 100,000 Solar Ger Electrification Program**



Source: Ministry of Mineral Resources and Energy, Mongolia

The *National 100,000 Solar Ger Electrification Program* got off to an initial slow start, but with the assistance of several bilateral donor countries, the program picked up some pace between 2002 and 2006 to successfully distribute nearly 33,000 SHSs to herder families, as illustrated in Figure 2. These SHSs were funded through bilateral grants and distributed to remote locations through the existing GoM network of Soum Administrators. However, since the costs recovered from herders were not

objective was to have the World Bank transfer global knowledge from successful rural electrification efforts in other countries while accommodating needs specific to the challenging circumstances in Mongolia.

<sup>3</sup> Adiyabat et al, A Study on the Evaluation of Solar Home System Viewed by Users – A Case of Nomadic Families in Mongolia, IIEE Renewable Energy, 2006.

## RENEWABLE ENERGY AND RURAL ELECTRICITY ACCESS PROJECT

The Renewable Energy and Rural Electricity Access Project (REAP) was designed to help scale-up the implementation of the *National 100,000 Solar Ger Electrification Program*, among other goals<sup>4</sup>. In particular, the World Bank would assist the GoM redesign certain aspects of the *National 100,000 Solar Ger Electrification Program* to achieve its goals in a timely and sustainable manner. More specifically, the World Bank would help the GoM leverage available funding to maximize scale, enhance the distribution network to reach herders in more remote and isolated areas, and ensure that the benefits of the program are sustained over time. The design enhancements would rely on lessons from successful international experience from rural electrification schemes in other countries such as China<sup>5</sup>, Bangladesh<sup>6</sup>, and Sri Lanka<sup>7</sup>, that have been supported by the World Bank. The REAP was approved by the World Bank's board of executive directors on December 19, 2006. It helped scale-up the implementation of the *National 100,000 Solar Ger Electrification Program* and enhanced its impact, as illustrated in Figure 2.

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<sup>4</sup> The REAP also helped fund improvements in soum electrification including the rehabilitation of mini-grids and investments in Renewable Energy Technology (RET) hybrid systems to power many of them; and strengthen the institutional capacity within Mongolia to implement renewable energy projects and policies.

<sup>5</sup> Renewable Energy Development Project (REDP) financed by the World Bank in China.

<sup>6</sup> Rural Electrification and Renewable Energy Development Project (RERED) series funded by the World Bank in Bangladesh,

<sup>7</sup> Energy Services Delivery Project and Rural Electrification and Renewable Energy Development Project in Sri Lanka funded by the World Bank.

## Leveraging Herder Payments for Maximum Impact

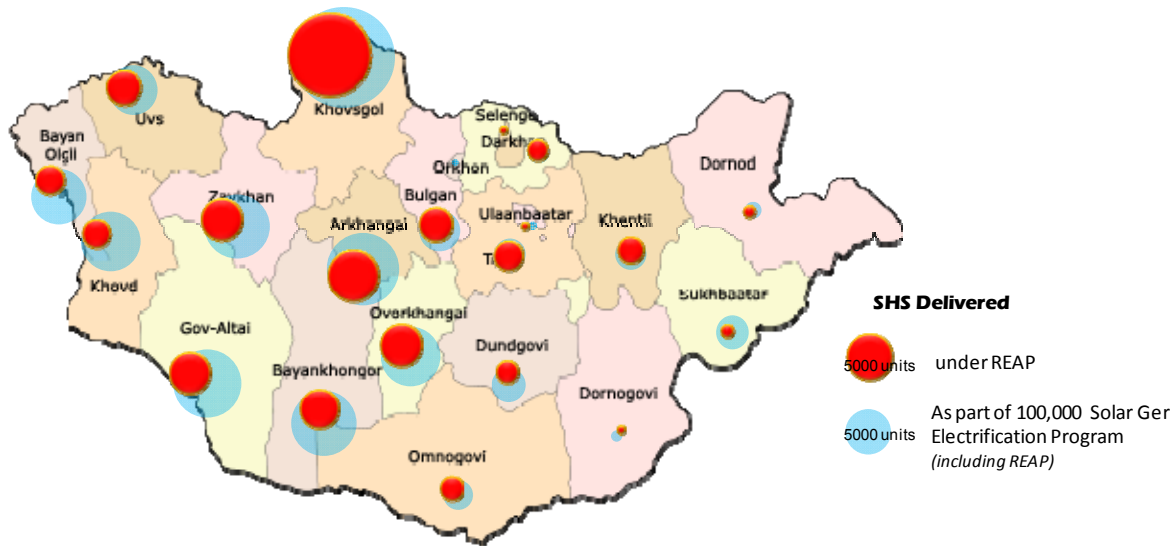
Prior to REAP, the SHSs that were provided through the *National 100,000 Solar Ger Electrification Program* were mostly funded through grants from bilateral donors. The systems were then sold to herders mainly through the GoM's network of village/soum administrators. Since herder incomes were limited, affordability was a key challenge that needed to be addressed. Therefore, the systems were either provided free of charge or sold at a lower price than it would have cost had the SHSs been purchased through the market. Where costs were recovered, these funds were absorbed into the GoM budget instead of being re-deployed towards purchasing additional SHSs. In other words, the recovered funds were not effectively leveraged to further expand sales. Although those who were fortunate to receive the subsidy benefited from the SHS purchases, a large number of herders were left without access to electricity due to limitations in available funding. As the bi-lateral donor funds depleted, implementation of the program began to stagnate. The *National 100,000 Solar Ger Electrification Program*, while benefitting many, was falling short of its goals.

An important feature under REAP was to craft a cost recovery scheme commensurate with most herder incomes, and ensure that the collected funds were re-mobilized towards further expanding the sale of additional SHSs to more herder families. The Program continued to recognize that affordability was a major challenge, and that some cost buy-down or discount was necessary in order to expand utilization of SHSs among herders. The objective was to achieve an appropriate balance between cost recovery and affordability that met the economic circumstances of the herder population in Mongolia. Under REAP, the *National 100,000 Solar Ger Electrification*

Program would provide a fixed subsidy set at US\$160 per system for units with a capacity of 50 watts or more and US\$80 per systems that are smaller in capacity. The subsidies covered approximately half the cost of an SHS. To help pay for the subsidy, the World Bank facilitated a grant of US\$4 million from the Government of the Netherlands<sup>8</sup>, which augmented the GoM funds that were allocated in the national budget for the same purpose<sup>9</sup>. The

sold as a part of the *National 100,000 Solar Ger Electrification Program* reaching herders in every province/aimag in the country, as illustrated in Figure 2. It was more than double the almost 33,000 systems sold previously from 2000 to 2005. It is not a coincidence that by leveraging approximately half the costs, the Program doubled its expansion! It is common practice in internationally successful rural electrification programs to recover costs to

**FIGURE 3: Scaling-Up and Expanding Reach of the Herder Electrification Program**



Source: Ministry of Mineral Resources and Energy, Mongolia

remaining costs of SHSs under REAP would be paid by the herders. However, the recovered funds were now channelled back to the Program to cover the cost of SHSs. The result was a significant scale-up in the number of SHSs sold, as illustrated in Figure 1. Under REAP, over 67,000 SHSs were

the most reasonable extent possible. Not only does it enable a project to maximize the impact of often limited funds, but there is evidence of greater “ownership” and “value” placed on the equipment by rural customers. This can lead to efforts at better care for equipment, including after-sales servicing, leading to more sustainable benefits for the electrification program.

<sup>8</sup> The Government of the Netherlands provided a total grant of \$6 million through the World Bank for REAP. \$4 million was allocated towards funding the SHS subsidy while the remaining \$2 million contributed to the development of Renewable Energy Technology (RET) systems in village level off-grid small distribution systems.

<sup>9</sup> The subsidy funds were further augmented later with a reallocation of \$290,560 from the International Development Association (IDA) grant in REAP to meet increasing demand for SHSs amongst herders.



## Expanded Rural Reach of Electricity Services

Many rural communities in Mongolia are in remote and isolated areas in what is commonly referred to as the “country side”. Often, these communities reside in sparsely populated and distant areas, which is a driving factor in why it can be uneconomical to connect them to traditional electricity grids. Therefore, many small rural villages or hamlets (soums<sup>10</sup>) rely on isolated mini-grids with its own small power generation source to provide electricity to its residents,



A herder inspecting a solar home system before purchasing at a Sales and Service Center

Photo credit: Stephan Bachenheimer/World Bank

often for only few hours a day<sup>11</sup>. Electrifying nomadic herders is an even bigger challenge since they are mobile and roam far beyond remote soums into further isolated areas in search of land for grazing. Although portable SHSs present an electrification solution adapted to a mobile population, many herders are difficult to reach given their migratory lifestyle. Ultimately, to provide modern electrification solutions to nomadic herders, a far reaching network was needed to inform them about portable electrification options, take orders,

<sup>10</sup> A soum is a rural administrative area that is comparable to a small village usually made up of between 150 to 200 dwellings/residences.

<sup>11</sup> A separate component in REAP helped rehabilitate a number of mini-grids and install Renewable Energy Technology (RET) systems in rural soums.

process payments, distribute the systems, and to train them to install the units in their mobile dwellings. It is also important to familiarize herders with the operation of SHSs, and make after sales repairs and maintenance as available as possible.

*Soum Administrator Network:* The GoM already had a network of administrators that were based in each of the 342 soums scattered throughout the country. This Soum Administration Network proved to be instrumental in kick-starting the *National*

*100,000 Solar Ger Electrification Program*. Although herders roam the country side and do not stay in one location, they are still associated<sup>12</sup> with a soum near which they usually camp during the short summer months. This existing institutional arrangement, established in every soum, is a useful modality to reach distant herders. It is common for herders to visit Soum Administrators when they are camped near the village to deal with administrative and other matters. The *National 100,000 Solar Ger Electrification Program* utilized the Soum Administrative Network to promote SHSs by raising their awareness and physically distributing the systems to

<sup>12</sup> Mongolian herders are required to formally register with a Soum Administration based on their association.

herders in their jurisdiction. Although Soum Administrators were not specialized generally in energy related matters, and in particular photovoltaic technology, coverage increased as they understood the importance of promoting this national effort that would benefit many of their constituents. Given its success, the REAP retained the Soum Administration Network as a key distribution channel, and looked to build upon it to further scale-up coverage and reach.

rural areas in which they operated. Many SSCs found it enterprising to sell SHS and provide electricity to herders as it created a substantial market for associated consumer electronics and appliances. As a part of the REAP, 50 SSCs were established throughout Mongolia with at least one in each of the twenty one provinces/aimags in the country, as illustrated in Figure 3. The number of SSCs in a given province reflected its market size for SHSs. For example, due to the relatively small herder population in Orkhon province/aimag, it has one SSC



Owner of a private Sales and Service Centers established under REAP showing his equipment

Photo credit: Migara Jayawardena

[Network of Private Sales and Service Centers \(SSCs\)](#): Prior to REAP, the *National 100,000 Solar Ger Electrification Program* relied solely on the GoM’s network of soum administrators. However, in order to scale-up the program and reach more herders, the REAP was designed to also enlist the support of the private sector. REAP set out to establish a network of Sales and Service Centers (SSCs) across the country to complement the soum network and expand the reach of the *National 100,000 Solar Ger Electrification Program*. The SSCs were existing private entities throughout Mongolia that were selected through local advertisements, and then trained and certified by the REAP Project Implementation Unit (PIU). They were local businesses that were mostly engaged in electrical and electronic related services in

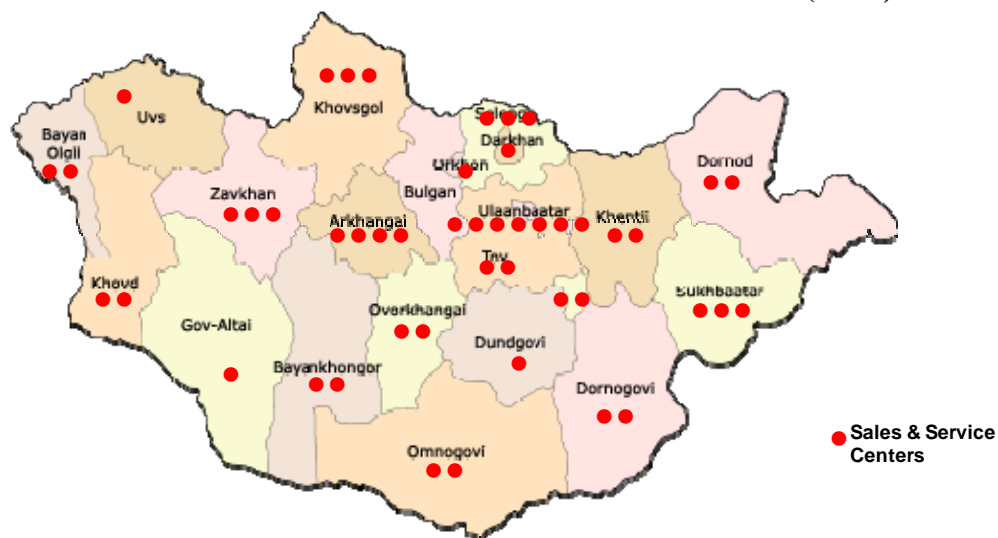
while a more populated province/aimag such as Arkhangai has four. This extensive network of SSCs proved to be instrumental in connecting with herders who were potential customers for SSCs and selling much of REAP’s bulk-procured SHSs.

For many herders, a sales outlet with knowledgeable and well trained staff was within proximity. Herders only needed to travel a relatively small distance to the nearest SSC to purchase SHSs or get one repaired. Previously, such transactions would require a costly trip to the capital in Ulaanbataar, which, for most herders, would be too far and unaffordable. Despite this wide network of SSCs, there are some herders that are still too remote given the geographic scale of Mongolia. In such

cases, many SSCs work with Soum Administrators to extend their reach. The Soum Administration Network is used to raise herder awareness, take orders, and distribute systems upon payments. The SSCs serve as a distributional hub using the Soum Administrators as an extension of their business enterprise to help them reach distant herders. It is a public-private partnership that has been highly effective in widening the coverage of the network for delivering SHSs under the *National 100,000 Solar Ger Electrification Program*.

uncompetitive compared with subsidized SHSs sold through other outlets. Administratively, dealers could collect the subsidy that they passed on to herders through the discounted sales price, from the GoM upon confirmation of sale. However, private SHS dealer markets in rural Mongolia were at an embryonic stage. Therefore, the aim was to initially pilot the development of a private dealer network that would complement the existing sales of SHSs that were procured and financed by the GoM. Expansion would depend on the

**FIGURE 4: Extensive Network of Sales and Service Centers (SSCs) Network**



Source: Ministry of Mineral Resources and Energy, Mongolia

Under REAP, 10 of the SSCs were also certified as private SHS dealers. It was envisaged that small private providers with sufficient incentives could self-finance the purchase of SHSs. They could then proceed to reach herder populations without access to electricity in remote areas in order to sell the systems. Herders purchasing SHSs from private dealers received the same subsidy of US\$80/ US\$160 per unit that was extended to systems sold through the GoM’s Soum Administration Network and other SSCs. In the absence of the subsidy, sales by private dealers would have been constrained due to the limited income of most herders and the resulting lack of affordability; and

capacity and speed at which the private market could grow. The 10 private dealers certified under REAP proved to be a useful complement to the Soum Administration Network and other SSCs, since these companies specialized in the technology and were willing to pre-finance their SHSs inventory until the final sale to herders. However, private dealers’ capacity to finance was limited, leading to the purchase of SHSs from manufacturers in relatively small volumes. The limited size of the wholesale purchases prevented many private dealers from taking advantage of economies of scale and lower prices. Bulk purchases by the GoM proved to be more effective at

securing the most competitive pricing, which was important given that affordability of SHS for herders is a key consideration.

The expansive distribution network of private dealers, SSCs, and Soum Administrators together with the support of the GoM formed public-private partnerships that proved to be highly successful in serving herders in even the most remote areas in Mongolia. This was critical because the success of the *National 100,000 Solar Ger Electrification Program* depended critically upon the availability of the widest possible distribution network for maximum reach. Utilizing an expanded network of public and private channels, REAP was able to distribute over 67,000 SHSs, making a vital contribution that helped achieve the target of the *National 100,000 Solar Ger Electrification Program*.

electrification programs, to incorporate some mechanism to ensure the quality of the products being distributed. In many remote and rural areas in Mongolia, herders have little access to information that would enable them to differentiate the quality and reliability of various SHSs that may be sold in the market. The nascent state of the market for SHSs means that there is little historical information related to the past performance of different products that consumers can rely on to make informed purchases. The information that is easily available to herders is asymmetric. Therefore, the SHS equipment sold through REAP were required to meet internationally recognized technical standards and were rigorously tested for performance. Bulk purchases were tested at the manufacturer as well as upon receipt. Certified private dealers were also required to maintain high quality standards and confirm compliance



Herder transporting a newly purchased solar home system to his ger

Photo credit: Stephan Bacheneimer/World Bank

### **Ensuring Quality and Reliability**

REAP introduced several other measures that successfully reflected tried and tested international experience in order to enhance the impact of the *National 100,000 Solar Ger Electrification Program*.

*Certification of Quality Standards:* It is common global practice, when introducing technologies such as photovoltaic SHSs for

by subjecting equipment to tests at a project laboratory. All systems sold through the project also included a limited warranty. As a result, herders, who spend about an entire month of income to purchase SHSs, can buy systems sold through the REAP with confidence.



**After-Sales Care:** Another key aspect of sustaining the benefits of SHS's is to make after-sales care and services readily available and affordable. Over time, like most electronic equipment, SHSs require care and maintenance. Servicing the SHS module, repairing or replacing the controllers, or replacing batteries are common after-sales services without which the systems could become inoperable. Prior to REAP, repairing SHSs would usually require a trip to the capital in Ulaanbaatar, which, as stated previously, is financially untenable for many herders. However, the SSCs that were established under REAP are fully trained and certified to perform these basic maintenance and repair services. With at least one SSC in each province/aimag, herders have convenient access within reasonable distances when SHSs require maintenance and repairs. It maximizes the benefits of the SHSs sold through the *National 100,000 Solar Ger Electrification Program* and beyond.

### REAPing Results

The changes introduced by REAP to the design of the *National 100,000 Solar Ger Electrification Program* contributed to scaling-up its implementation and meeting its targets. Commencing at the end of 2006, REAP was originally designed to add 50,000 SHSs to the approximately 33,000 systems that were already distributed by the GoM's program. The remaining 17,000 SHSs to achieve the national target of 100,000 SHSs were expected to be implemented by the private dealers and SSCs on an ongoing basis following the completion of REAP. Instead, due to an aggressive effort by the GoM to scale-up, REAP exceeded the project target by almost thirty five percent by selling over 67,000 systems; and helped achieve the target established in the *National 100,000 Solar Ger Electrification Program*.



Herders assembling a ger along with solar home system

Photo credit: Stephan Bachenheimer/World Bank



Battery and controller for solar home system

Photo credit: Migara Jayawardena



A ger with solar home system and satellite dish

Photo credit: Migara Jayawardena

## IMPACTS OF HERDER ELECTRIFICATION PROGRAM

The *National 100,000 Solar Ger Electrification Program* successfully achieved its goal in 2012. Through the program, the GoM distributed 100,146 SHS, providing modern electricity services to over half a million herders and their families. It reached herders in all twenty one provinces/aimags in Mongolia covering 342 villages/soums; and in Ulaanbataar, as illustrated in Figure 5. Based on the

electrification needs<sup>13</sup>. The availability of electricity is also providing herders with an opportunity to listen to radio as well as view television using satellite dishes. There is also increasing penetration of cellular phones amongst<sup>14</sup> the herder population, made possible due to the availability of electricity for charging the equipment. The proliferation of technology in rural areas is reducing herders' isolation and connecting them to a wider world.

**FIGURE 5: Distribution of SHSs by Province/Aimag**

	Name of Province/Aimag	# of soums reached	Total SHS sold
1	Arkhangai	19	8,323
2	Bayankhongor	20	7,645
3	Bayan-Ulgii	14	6,398
4	Bulgan	16	4,729
5	Govi-Altai	20	7,722
6	Govisumber	3	234
7	Darkhan	4	434
8	Dornod	15	2,067
9	Dornogobi	13	1,336
10	Dundgobi	15	3,818
11	Zavkhan	24	7,296

	Name of Province/Aimag	# of soums reached	Total SHS sold
12	Orkhon	3	512
13	Umnugobi	17	3,512
14	Uvurkhangai	19	6,757
15	Selenge	17	2,658
16	Sukhbaatar	13	3,824
17	Tuv	26	4,031
18	Khovd	18	6,658
19	Khubsgul	24	11,744
20	Khentii	19	3,617
21	Uvs	15	5,664
22	Ulaanbaatar	8	1,167
<b>TOTAL</b>		<b>342</b>	<b>100,146</b>

Source: Ministry of Mineral Resources and Energy, Mongolia

national statistics for 2010, *the National 100,000 Solar Ger Electrification Program* has connected an estimated seventy four percent of Mongolia's herder population. Very few herders had access to electricity prior to the GoM initiative in 2000. It is common now to see solar (photovoltaic) panels outside most herder dwellings/gers when travelling through the Mongolian countryside. As a result, many herders are experiencing an improvement to their quality of life. Herders with SHSs now use electricity for lighting instead of sub-optimal options such as kerosene or candles. Since solar power is a clean and renewable energy source, it presents an environmentally friendly option for meeting herder

*The National 100,000 Solar Ger Electrification Program* is also stimulating economic activity. There is greater private participation in the distribution and sale of SHSs in Mongolia as a result of the certified private dealers and network of SSCs that were established under REAP. It has expanded what was initially a nascent

<sup>13</sup> In addition to its local environmental impact, the SHS distributed through the National 100,000 Solar Ger Electrification Program are estimated to help avoid 12,498 tonnes of carbon dioxide (CO<sub>2</sub>) annually making a modest contribution to benefit global climate change.

<sup>14</sup> The Information and Communication Infrastructure Development project supported by the World Bank is increasing cellular coverage in Mongolia, including in rural areas, made possible due to the increasing availability of electricity.

market in rural areas. However, a much larger effect is the economic opportunities that are created due to the increase in demand from herders for consumer electronics. The availability of electricity has created a vibrant market of over half a million herders for purchasing light bulbs, radios, satellite dishes, televisions, and cellular phones, amongst other items. It is a market that would not exist in rural Mongolia at the current scale without the availability of electricity for these herders. There is evidence that these consumer

designed to improve rural livelihoods are relying on televisions, for example, to communicate to herders about opportunities for insuring against livestock losses due to inclement weather. There are also increasing instances of cellular telephones being used to arrange business transactions, for example, for the sale of cashmere during the season – an important source of income for many herders. Although a primary objective of the electrification effort was to directly improve the quality of life for herders, the SHSs are also contributing



A herder family gathering under the lights in their ger

Photo credit: The United Nations/Eskinder Debebe

electronic products are also improving the business prospects for herders. Radios and televisions, which enable herders to stay connected to the “outside world” is serving as a conduit for information. It has become an important medium for obtaining weather and other market information. Weather reports enable herders to navigate and adapt to harsh and changing weather conditions such as heavy rains, dust storms and extreme winters that may be exacerbated due to impacts of climate change. Such information is critical for better livestock management that lead to enhanced security and improved livelihoods for herders. Even other World Bank projects<sup>15</sup> that are

towards advancing income-generating economic activities in rural Mongolia. As rural incomes grow, there is evidence that there is increasing demand from herders for SHSs with higher (wattage) capacity for use with additional devices and equipment such as refrigerators. As Mongolia’s mineral resources drive its economic growth at a breathtaking pace, the various efforts to support development in rural areas, particularly for nomadic herders, becomes increasingly important. It is one way to ensure that these traditional cultures are not left behind in the economic boom, and that modern amenities can be adapted to meet the needs of a herder’s way of life.

<sup>15</sup> Index Based Livestock Insurance Project that is funded by the World Bank