Spring 2017

Barriers to the Diffusion of Renewable Energy Technology in Mongolia Lee, Madeline Academic Director: Sanjaasuren, Ulziijargal Claremont McKenna College International Relations Mongolia: Ulaanbaatar, Darkhan, Salkhit, Hatgal Nomadism, Geopolitics, and the Environment SIT Study Abroad Spring

Madeline Lee
SIT Study Abroad

Barriers to the Diffusion of Renewable Energy Technology in Mongolia

Lee, Madeline
Academic Director: Sanjaasuren, Ulziijargal
Claremont McKenna College
International Relations
Mongolia: Ulaanbaatar, Darkhan, Salkhit, Hatgal

Nomadism, Geopolitics, and the Environment
SIT Study Abroad
Spring 2017

Abstract

As the international community looks promote sustainable development in developing countries, many policies have focused on the introduction of renewable energy technology (RET). For Mongolia specifically, RET is both a viable and optimal option, considering the country's vast natural resources and the unsustainability of the country's existing energy system. However, Mongolia has faced challenges with the development of its RET sector and still largely relies on international assistance and funding to develop largescale projects.

This study analyzes the barriers that Mongolia faces to the effective diffusion of RET into Mongolian society. Over the course of four weeks, 10 individuals were interviewed and 94 individuals were surveyed on their opinions of the energy sector and renewable energy technologies in Mongolia. Interviews and surveys were conducted and distributed in various localities within Mongolia, including Ulaanbaatar, Darkhan, Salkhit, and Hatgal. Results indicate a large gap between the level of public involvement with renewable energy and the government's goals for Mongolia's renewable energy sector. This gap is largely due to insufficient public education regarding renewable energy. While the government of Mongolia is partially responsible for the public's lack of awareness, data collected indicate that the government of Mongolia is not adequately equipped with sufficient institutional knowledge to educate the public.

Thus, international actors able to assist developing countries with the implementation of renewable energy technology must ensure that any assistance is all-encompassing and contributes to the establishment of sustainable systems within developing countries, rather than promoting short-term programs that fail to fully initiate a societal shift towards the use of renewable energy. This is especially important in Mongolia, where barriers to the diffusion of renewable energy technology can be overcome with additional international guidance and successful technological transfer.

Keywords: Development, Renewable energy, International relations

Table of Contents

Acknowledgements

There are multiple individuals I would like to thank for assisting me in my research.

To Ulzii Bagsch, Shijir, Maralaa, and Oyuka—thank you for enduring my rapid-fire questions and energy at SIT, and for providing guidance for this project that no one else could have. To Oyuka specifically—thank you for traipsing through Salkhit with me and stopping at every single ger in sight to ask if they were willing to fill out a survey.

To A. Javkhlan—thank you for your honest advice and input on this topic, and for helping me realize how all of the information I gathered fit together.

To Ruby, Altanchimeg, Maralaa, Baigal, and Soyol—thank you for providing impeccable translation skills and allowing me to complete all of this research presented in this report.

To Nicole Schaefer-McDaniel—thank you for replying to all of my incessant inquiries on formatting and the inclusion of data, as well as your advice on how to go about my research.

To my families in Bayankhongor and Ulaanbaatar—thank you for making me a part of your lives without hesitation, and for letting me be a part of your family, if even for such a short time.

And to all of the participants who took part in the surveys I distributed and the individuals who let me interview them—I owe the entirety of this report to you; thank you for letting me ask you questions about energy and renewable systems with minimal explanation.

List of Figures and Tables

Figures

Tables

Terminology and Abbreviations

Terminology

aimag	Largest administrative unit of division within Mongolia; comparable to a province
bag	Administrative unit of division for soums
diffusion	In the context of renewable energy, the implementation and expansion of renewable energy technology in Mongolia
ger	Traditional housing structure for Mongolian nomads
renewable energy	energy produced by natural restorable renewable sources such as solar, wind, hydropower, geothermal and biomass
soum	Administrative unit of division for aimags (provinces); comparable to a county

Abbreviations

ERC	Energy Regulatory Commission (Mongolia)
GoM	Government of Mongolia
GWh	gigawatt-hour
HPP	hydropower plant
IPCC	Intergovernmental Panel on Climate Change
JCM	Joint-Crediting Mechanism
MEGD	Ministry of the Environment and Green Development
MEGDT	Ministry of the Environment, Green Development, and Tourism
MNET	Ministry of Nature, Environment, and Tourism
MoE	Ministry of Energy
MW	megawatt
µg/m^3	micrograms per cubic meter
NGO	non-governmental organization
NREC	National Renewable Energy Center (Mongolia)
NREL	National Renewable Energy Laboratory (US)
NREP	National Renewable Energy Program (Mongolia)
PV	photovoltaic
RET(s)	renewable energy technology
SDV	Sustainable Development Vision – 2030

TPP	thermal power plant
TW	terawatt
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
WCS	Wilderness Conservation Society

As the international community—namely, developed countries—pivots towards advocating for policies promoting sustainable development in light of the effects of climate change, it is crucial to discuss the implications of this shift on developing nations. The promotion of renewable energy is one of the pillars of sustainable development policy for its ability to alleviate air pollution, promote rural development, increase a country's energy independence, and mitigate the effects of climate change (Martinot, Chaurey, Lew, Moreira, & Wamukonya, 2002). Thus, the promotion of renewable energy technology (RET) has become a priority in many developing nations.

Even with assistance from more developed nations, often with robust renewable energy sectors, developing countries still face many challenges regarding the implementation of RET. Reddy and Painuly (2004) note that "even after governments' best efforts to promote RETs, they have failed to emerge as prominent competitors to the conventional energy technologies" (p. 1432). Historically, programs to introduce RETs to developing countries were largely unsuccessful. Beginning in the 1970s and 1980s, development agencies took an interest in introducing small-scale RETs to developing countries. Their projects "focused on technical demonstrations or on projects that were narrowly self-sustaining but could not be replicated" (Martinot, Chaurey, Lew, Moreira, & Wamukonya, 2002, p. 313). Martinot et. al (2002) also note that "projects often did not demonstrate institutional and commercial viability and lacked mechanisms for equipment maintenance, sustainable sources of credit and expertise, and incentive structures for sustained operating performance" (p. 313). As the international community looks to initiate more largescale, sustainable RET projects throughout the developing world, the approach for aid and financial provision must be reexamined.

As a developing country, Mongolia is currently in the throes of transitioning its coal-reliant society into one that promotes and relies on renewable energy. Given the country's geographic location and climate, the technical implementation of RET is both sensible and optimal. However, Mongolia is facing many challenges to the successful diffusion of RETs.

1.1 Unsustainability of Existing Energy System

Following the collapse of the soviet regime in Mongolia in 1990, the country has urbanized rapidly, primarily due to vast natural coal deposits. As

the Energy Charter Secretariat notes, Mongolia's industrial energy demand increased 32.3% from 2000 to 2010 (*In-depth review of the investment climate and market structure in the energy sector of*, 2013). This is largely due to the expansion of Mongolia's transportation sector, which will only continue to grow as the country continues to use coal as its main source for economic growth. The Government of Mongolia (GoM) estimates that annual energy demand will increase between 500-600MW by 2020, equivalent to an annual increase of 3.5% (Chen, Gönül, & Tumenjargal, 2016).

Mongolia's rapidly growing energy demand is becoming increasingly problematic considering that the country is currently unable to independently sustain its domestic energy systems. The country's power grid is comprised of five independent systems: the Central Energy System, Western Energy System, Altai-Uliastai Energy System, Eastern Energy System, and the South Gobi Region (Bayasgalanbaatar, 2015). Coal-fired thermal power plants (TPP) account for 85% of Mongolia's electricity generating capacity; however, many of these plants were constructed between 1960 and 1980 during Mongolia's communist regime, and are reaching the limit of their operating capacity (Chen, Gönül, & Tumenjargal, 2016, p. 10). As a result of these plants' inability to respond to changes in load demands, Mongolia relies on imported energy from Russia and China to meet demand, especially during peak-hours (*In-depth review*, 2013, p. 60). Chen et. al (2016) report that "imports from Russia increased dramatically to 1195.5 gigawatt-hours (GWh) in 2013, compared to only 366 GWh recorded in 2012" (p. 7) (Figure 1).

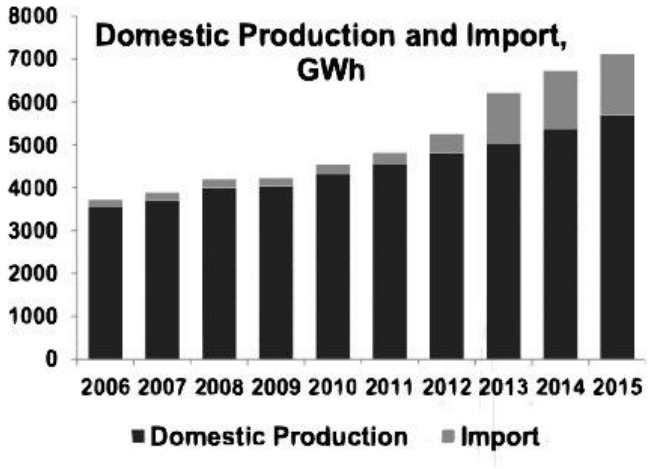

Figure 1. Comparison of domestic power production versus import quantity (Ministry of Energy).

1.2 Viability of Renewable Energy in Mongolia

A comprehensive analysis of Mongolia's renewable energy capacity was completed by the U.S. National Renewable Energy Laboratory (NREL) in 1998 to determine the country's ability to support RET. The NREL identified over 160,000 km^2 of land as containing "good-to-excellent wind resource potential," which "could support over 1,100,000 MW of installed capacity" (Elliott et al., 1998, p. 132). Using data from the NREL, Mongolia's National Renewable Energy Center (NREC), and the National Renewable Energy Centre of China, Chen et. al (2016) project that the "combined electricity output from Mongolia's wind and solar resources could reach 15,000 terawatt-hours (TWh) per year, enough to meet the total electricity demand of neighbouring China in 2030" (p. XIV). Figure 2 demonstrates the NREL's findings regarding each of Mongolia's 21 aimags (provinces) relative capabilities for wind electric potential.

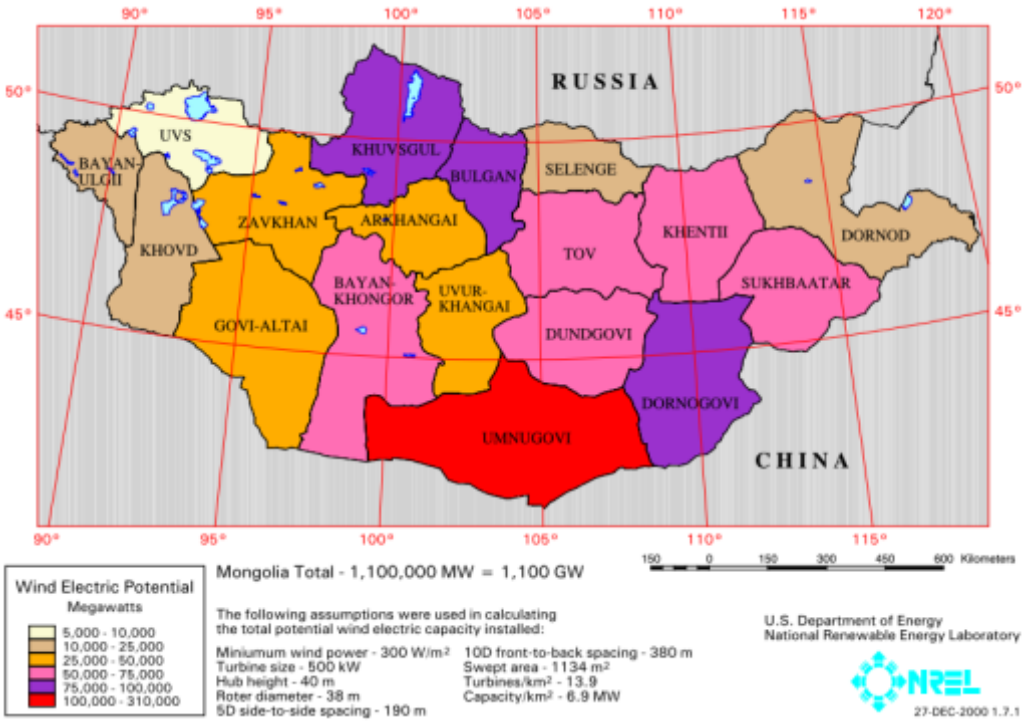

Figure 2. Good-to-excellent wind electric potential of Mongolia (U.S. National Renewable Energy Laboratory).

1.2.1 Mongolia's renewable energy facilities. Historically, largescale renewable energy facilities in Mongolia have taken the form of hydropower plants. In 2013, the Salkhit wind farm (52 MW) became "Mongolia's first utility-scale non-hydro renewable energy facility" (Chen et al., 2016). As of 2016, the total installed capacity of renewables accounted for 7% of Mongolia's total power generation (Chen et al., 2016, p. 3).

There are currently multiple projects across Mongolia being developed to further expand the country's renewable energy capacity. An additional 52 MW wind farm is being developed in Sainshand (a town in the Gobi desert), and is expected to begin commission in 2017 (Chen et al., 2016). Refer to Figure 3 for a more detailed image of proposed renewable projects. These additional projects are the beginning of a larger paradigm shift within the existing energy sector; renewable energy facilities are overseen by private corporations, as opposed to the existing plants, which function under a state-run regime put in place during Mongolia's communist era (Chen et al., 2016).

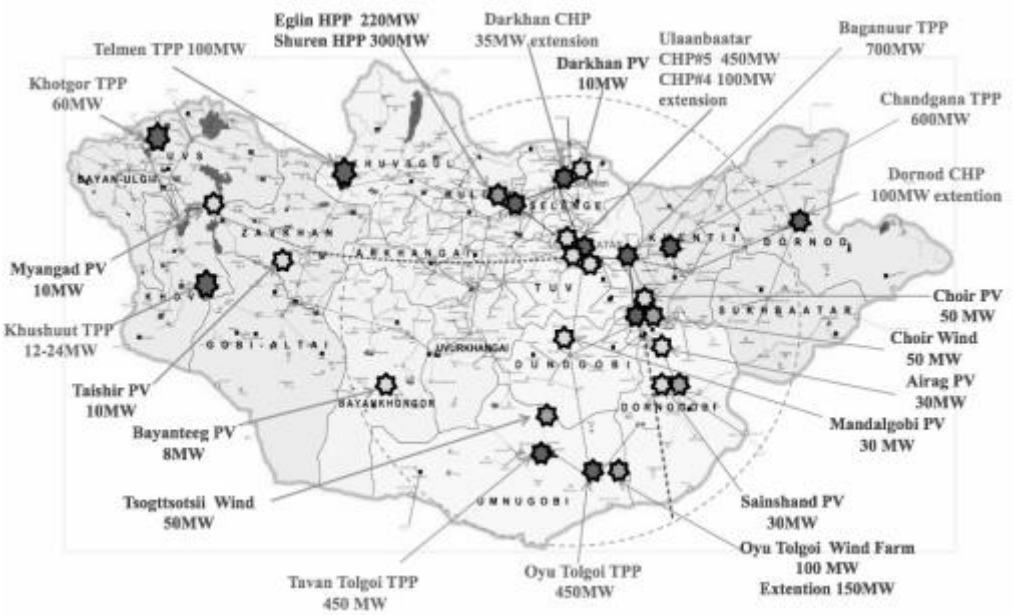

Figure 3. Planned renewable facilities (Namjil, 2016).

1.3 Relevant Legislation

Mongolia's renewables sector is regulated by a compendium of laws that address various aspects of the industry. At the core of the compendium is the Law on Energy, which was passed by Parliament in 2001 to "regulate matters relating to energy generation, transmission, distribution, dispatching and supply activities, construction of energy facilities and energy consumption" ("Law on Energy," 2014). The law was amended in 2015, with changes aimed at "strengthen[ing] public-private partnerships and creat[ing] a market-oriented framework for the energy sector" (Chen et al., 2016, p. XIV).

Mongolia's Energy Regulatory Commission (ERC) was established with the Law on Energy (2001) to "regulate generation, transmission,

distribution, dispatching and supply of energy" ("Introduction," n.d.). Overall, the ERC's objective is to:

> issue the operational licenses, to review and approve the tariffs of the licensees, to protect equally the rights of the consumers and licensees as well as to create condition for fair competition among the generators and suppliers in accordance with the Law on Energy (Lkhagva, 2014).

The role of the ERC in regulating and evaluating energy suppliers is increasingly important as the nature of Mongolia's energy sector shifts from a regime run by state-operated facilities to one where private corporations are able to oversee the functioning of their own renewable energy facilities.

In 2007, the Mongolian Parliament passed the Renewable Energy Law, which defined relevant terms relating to renewable energy, outlined regulatory practices, and specified pertinent authorities within the renewable energy sector ("Renewable Energy Law," 2007). The Law was most recently amended in 2015, to include the addition of a "support tariff," which aims to "compensate the tariff difference between conventional and renewable energy sources" (Lkhagva, 2014). The amendment seeks to encourage investment in Mongolia's renewable energy industry.

To address Mongolia's changing energy sector from a policy perspective, Parliament approved the State Policy on Energy in 2015, which outlines a long-term plan to reform Mongolia's energy sector for the years 2015-2030 (Yeren-Ulzii, 2016). One of the primary goals of the Policy is to "transfer the state dominated energy sector into private based competitive market" (Yeren-Ulzii, 2016). The Policy also seeks to increase the portion of Mongolia's installed energy capacity that is generated by renewables, and sets goals for 20% of installed capacity by 2020 and 30% by 2030. (Yeren-Ulzii, 2015).

1.4 Government Motivation for the Implementation of RET

The GoM views renewable energy as a method to advance multiple policy priorities: increasing Mongolians' access to electricity, mitigating the current hazards associated with the country's reliance on coal, expanding the country's sustainability profile, and presenting Mongolia as a serious participant within international community—specifically, the growing global renewable energy market. Each of these agenda items has required a different

approach to introducing RETs to the greater public; as a result, RET currently exists in Mongolia in multiple forms.

1.4.1 Expanding Mongolians' access to electricity. The first widespread project that the GoM pursued regarding renewable energy as a solution to limited electricity access was the "100,000 Solar Gers" program, which aimed to provide 100,000 nomadic herding families living in rural Mongolia with photovoltaic (PV) systems (Myagmar, 2015). Prior to "100,000 Solar Gers," which started in 1999, the vast majority of herders and the majority of Mognolia's rural population did not have access to electricity. As the World Bank (2006) notes, herders' lack of access to electricity is primarily due to:

> (i) high costs of household power systems coupled with low incomes of many herder households; (ii) substantial logistic difficulties of developing the supply chain to support a decentralized market for a small and mobile customer base spread over a vast landscape; and (iii) a nascent market which lacks basic quality and service standards (p. 2).

These factors, coupled with Mongolia's vast natural resources in terms of sun and wind, make RET an appealing answer to the question of how to bring electricity to Mongolia's herding population.

In line with "100,000 Solar Gers" is Mongolia's National Renewable Energy Program (NREP). Approved by Parliament in 2005, the NREP set a plan for the renewable industry for the years 2005-2020. The program sought to "increase the penetration of renewable energy in the energy system of Mongolia, improve the structure of power supply, and utilize renewable energy in off-grid soums (districts) and settlement to ensure ecological balance and improve the economic efficiency" ("National Renewable Energy Programme (2005-2020)," 2013). 12 soums gained electricity access through hybrid PV-wind-diesel systems located in the soum centers (Ch., 2013). The NERP additionally introduced targets for percentage-level development of Mongolia's renewable energy installed capacity; specifically, it set a goal of 20% by the year 2020 ("СЭРГЭЭГДЭХ ЭРЧИМ ХҮЧНИЙ ҮНДЭСНИЙ ХӨТӨЛБӨР /2005-2020 он/," 2005).

Both "100,000 Solar Gers" and the NREP received funding and resources from international actors. In 2006, Mongolia received assistance from the World Bank to sustain the ger program, which had stagnated despite

funding from Japan and China. As of 2013, the program had increased electricity access to 60-70% of Mongolia's herding population ("Mongolia: Portable Solar Power for Nomadic Herders," 2013). Out of the 12 projects implemented in different soums under the NREP, "a large number . . . were demonstration projects, financed by foreign donor organizations. Equipment used in these projects was mostly imported" (Tamir, Urmee, & Pryor, 2015, p. 2).

1.4.2 Mitigating hazards resulting from an overreliance on coal. In addition to acting as a solution to limited electricity access, the GoM is also turning to RET as a way to ameliorate hazardous levels of air pollution within Mongolia's metropolitan centers caused by extensive burning of coal during the country's harsh winters. Pollution has led to a widespread public health emergency, reaching a maximum of "750 micrograms per cubic metre ($\mu g/m^3$) in the winter season . . . which is significantly higher than the World Health Organization guideline level of 10 $\mu g/m^3$" (Chen et al., 2016, p. 2).

The RETs that are primarily being considered for combatting air pollution differ from the PV panels and hybrid systems underlying "100,000 Solar Gers" and the NREP; a presentation from the ERC highlighted the potential use of solar heating systems and heat pumps, as well as the concept of solar passive housing (Ts., 2017). The Government of Japan has been an active partner in Mongolia's efforts to increase the efficiency of its heating systems, implementing multiple projects in the capital of Mongolia, Ulaanbaatar. These projects fall under the larger initiative by the Japanese government called the Joint Crediting Mechanism (JCM), which allows Japan to sponsor projects in other countries to reduce greenhouse gas emissions and to use the resulting reduction as credits for itself ("Overview," n.d.). JCM initiatives are constructed in multiple forms depending on a country's specific needs and policy priorities.

In 2017, Parliament passed the National Program on Air and Environmental Pollution Reduction, which creates a framework for addressing Mongolia's increasing air pollution. The Program cites multiple of Mongolia's sustainable development plans as justification, including the Green Development Policy, Sustainable Development Vision – 2030. Additionally, the Program describes necessary steps to achieve the objectives and goals it

sets out: promoting the adoption of RETs is listed as a step to improving air quality ("Агаар, орчны бохирдлыг бууруулах үндэсний хөтөлбөр," 2017). A presentation from the ERC states objectives of the National Program: "domesticating renewable energy technology will be supported, and connecting consumers who have not been able be connected to centralized infrastructure system, to independent engineering supply system, and developing engineering sub- networks" (Ts., 2017).

1.4.3 Expanding Mongolia's sustainability profile. Mongolia's president, Tsakhiagiin Elbegdorj, has designated environmental conservation as a priority within his policy agenda ("Biography," n.d.). Within relevant legislation, further integration of RET and an increased reliance on renewable energy are consistently listed as critical to advancing Mongolia's environmental ambitions. The GoM's environmental agenda has largely taken place within the context of abiding by the international community's guidelines for sustainable development. The UN defines "sustainable development" as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs," and requires the synchronization of "economic growth, social inclusion and environmental protection" ("Sustainable Development Agenda," 2016).

Sustainable development has been a key focus in multiple policies passed by Parliament (Table 1).

Table 1

Implemented policies relating to sustainable development

Policy	**Year passed**
Green Development Policy	2014
Partnership for Action on Green Economy (PAGE)	2014
Sustainable Development Vision – 2030 (SDV)	2016
UN Sustainable Development Goals	2016

The Green Development Policy has specifically been a priority within the GoM, most notably within the Ministry of Environment, Green Development, and Tourism (MEGDT). An English translation states that the Green Development Policy:

> supports the global commitment to change current development trends, and transition to a socially inclusive, low greenhouse gas and reduced waste development model, by changing and conserving natural resources and ecosystem value, along with increasing human well-

being and reducing poverty ("НОГООН ХӨГЖЛИЙН БОДЛОГО," 2014).

The Green Development Policy outlines six objectives, the first of which is to "promote a sustainable consumption and production pattern with efficient use of natural resources, low greenhouse gas emissions, and reduced waste generation" ("НОГООН ХӨГЖЛИЙН БОДЛОГО," 2014). A more detailed explanation of how to achieve the objective explains reducing greenhouse gas emissions by 20% by 2030, which will be possible if the GoM attains its goal of reaching 30% of installed energy capacity as renewably sourced by 2030.

An Action Plan released by the MEGDT specifically mentions education as critical to achieving the GDP's fifth objective, which is to "encourage education, science, and technology to serve as the catalyst for green development, and develop cultural values and livelihoods that are in harmony with nature" (*Action Plan, Green Development Policy of Mongolia*, 2016, p. 43).

1.4.4 Expanding Mongolia's international presence. Mongolia is positioning itself to participate in the developing Asia Super Grid (ASG), a project initiated by Japan in 2011 (Movellan, 2016). The ASG seeks to employ renewable energy resources from countries across Asia, including Japan, China, South Korea, and Russia—all of whom signed a memorandum of understanding in 2016 "to conduct technical and economic feasibility studies toward creating the international transmission network in Northeast Asia" (Movellan, 2016). An eventual system would enable Mongolia to export its generated renewable energy to other nations within the grid. Underlying the ASG is the "Gobitec concept," which "represents the idea of producing clean energy from renewable energy sources in the Gobi Desert and to deliver the produced energy to regions with a high demand of electric energy" (*Gobitec and Asian Super Grid for Renewable Energies in Northeast Asia*, 2014, p. 10)

Mongolia's consistent attention to its presence within the international community is notably in line with its goal of consistent involvement on the world stage; its National Security Concept states that "The basic methods for ensuring Mongolia's independence and sovereignty shall be political and diplomatic actions. Accordingly a multi-pillared foreign policy directed towards building active relationships and cooperation with foreign states and

international institutions shall be implemented" ("National Security Concept of Mongolia," 1994).

1.5 Process of RET Diffusion

Due to Mongolia's lack of institutional knowledge and infrastructure regarding the development and implementation of RET, the country will need to continue to seek international assistance for the development of its renewables sector. Mongolia's ongoing process of RET diffusion is in line with existing literature: multiple actors are involved, including a developing country, a more developed nation or nations to serve as partners, and potentially other international actors such as intergovernmental organizations or additional international governments. Given Mongolia's dearth of institutional knowledge, successful diffusion of RET requires the transfer of both knowledge and technology from the more developed nations.

1.5.1 The role of technological learning and technology transfer.

As (Metz, Davidson, Martens, van Rooijen, & Van Wie McGrory, 2000, p. 3) note in a Special Report for the Intergovernmental Panel on Climate Change (IPCC), sustainable development also encompasses the establishment of institutional knowledge within developing nations as to how best initiate the construction of sustainable industries and practices. Developing countries require assistance with "developing human capacity (knowledge, techniques and management skills), developing appropriate institutions and networks, and with acquiring and adapting specific hardware" (Metz et al., 2000, p. 3). The process by which these systems are developed is commonly referred to as "technological learning," defined by Huenteler, Niebuhr, & Schmidt (2016) as "the accumulation of technological knowledge and experience" (p. 7). Huenteler et. al (2016) explain that "one of the key challenges for international climate policy is therefore to actively promote technological capabilities in developing countries and to enable countries to reap the full learning benefits from mitigation investments they make and attract" (p. 7).

The success of efforts to develop technological learning largely stems from the success of "technology transfer," defined by the Intergovernmental Panel on Climate Change (IPCC) (in the context of climate change) as "a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different

stakeholders such as governments, private sector entities, financial institutions, NGOs and research/education institutions" (Metz et al., 2000, p. 3).[1] Technology transfer is seen as critical to establishing sustainable systems in developing countries to mitigate the effects of climate change. Metz et. al (2000) further explain that successful technology transfer requires the developing nation to be able to not only understand, but also to replicate and manipulate the taught technology in the context of subjective indigenous considerations. The technology must also be compatible with existing systems.

1.5.2 Barriers to the diffusion of RET. Multiple studies have been done to assess the barriers that arise when developing countries seek to implement RET. Primary barriers that have been identified include: "cost-effectiveness, technical barriers, and market barriers such as inconsistent pricing structures, institutional, political and regulatory barriers, and social and environmental barriers" (Painuly, 2001, p. 75). Moreover, the presence or absence of different barriers can depend on multiple subjective factors, such as the specific RET in question, or factors unique to geographic location.

In order to achieve successful RET diffusion, multiple steps must be taken to address country-specific barriers. Painuly (2001) argues that in order to successfully promote the utilization of RETs, it is critical to identify the correct barriers "through administration of questionnaires/interview of the stakeholders," only after which it is appropriate to utilize "feedback from stakeholders on the measures to overcome the barriers, obtained by extending the questionnaire/interview to include questions related to the possible measures" (p. 85).

1.5.2.1 Considerations specific to Mongolia. Mehta, Rao, and Terway (2007) identify one of the main problems that resulted when Mongolia's power system changed from the "vertically-integrated public sector monopoly" it utilized at the time of the Soviet collapse: a "lack of accountability and the poor collection and dissemination of disaggregated sector data" (p. 218-219). Moreover, the closed-loop energy system created by the Soviets enforced a system in which the average citizen is unaware of the

[1] Metz et. al list the five stages of technology transfer as "assessment, agreement, implementation, evaluation and adjustment, and replication."

details of their energy providers, on account of the system being formerly state-administrated. As Mongolia develops its renewables sector, it must be able to both hold stakeholders accountable and produce data on the viability of the sector. These processes must be learned through the development of RETs.

1.6 Research Objectives

This study seeks to examine existing barriers to successful diffusion of RET in Mongolia, as well as potential ways to overcome these barriers through domestic and international policy reform. It will examine the role and influence of international institutions and the potential ways in which they can change their approach to more effectively aid the GoM in implementing successful RET programs. This study additionally hopes to illuminate motivation behind public attitudes towards renewable energy.

II. Methodology

2.1 Location

Data collection for this study took place at multiple sites across Mongolia, including the cities and towns of Darkhan, Salkhit, Hatgal, and Ulaanbaatar (Figure 4). Darkhan and Salkhit were selected on account of their status as sites of prominent renewable energy installations (a 10MW solar farm and a 52MW wind farm, respectively) (Boldsukh, 2017; Chen et al., 2016). Hatgal and Ulaanbaatar served as localities that do not host largescale renewable energy facilities. Localities with hydropower facilities were not visited on account of multiple factors, including the more controversial nature of hydropower as an industry with geopolitical implications (as opposed to the relatively neutral nature of solar and wind being domestic operations) and due to time constraints. Small-scale projects were not visited due to time constraints and the fact that this study aims to examine the diffusion of RET as a means of widespread energy generation, which is primarily initiated through largescale projects.

Figure 4. Sites of survey distribution (Google Maps).

Each area where participants were surveyed varied in layout, size, and organization. Darkhan (population: 79,938) (“Дархан сумын Статистик мэдээ,” 2015) and Ulaanbaatar (population: 1.37 million) (“Нийслэлийн статистикийн газар," 2014) are metropolitan centers, with established social services and centralized urban areas; Hatgal (population: 2,796) (*2007 Semi-annual progress report*, 2007) is composed of households set up in a structure similar to many ger districts—each household is typically centered in a fenced area adjacent to other fenced households; Salkhit (population data unavailable)

is made up of households (primarily gers) spread out across the land adjacent to the Salkhit wind farm. More detailed information on where survey responses were collected can be found in Appendix G.

There were also differences in both the duration of data collection and the distributed survey at each site. Refer to Table 2:

Table 2

Logistics for each data collection site

Site	Date of data collection	Data collected
Darkhan	May 10-12	Surveys (I), interviews
Salkhit	May 14	Surveys (I)
Khuvsgul	May 21	Surveys (II)
Ulaanbaatar	May 23-25	Surveys (II), interviews

Variations in the duration of each trip were due to available financial resources, as well as limitations regarding staying for longer periods of time in certain locations (it was not feasible to stay overnight in Salkhit). Population size also factored into the duration of each trip—more time was spent in Darkhan and Ulaanbaatar to maximize the amount of surveys collected, considering each location has a noticeably larger population than the other locations.

While interviews were sought in every location visited, it was not possible to interview people in every location due to both time and translation constraints. As a result, interviews were only able to be conducted in Ulaanbaatar and Darkhan. Two interviews were conducted in Darkhan and ten interviews were conducted in Ulaanbaatar.

2.2 Participants

Survey I was distributed to both individuals residing directly next to renewable energy facilities and individuals further removed from renewable facilities (Figure 5). In Darkhan and Salkhit, both areas hosting largescale renewable energy facilities, it was critical to survey individuals living in closest proximity to renewable energy facilities. Individuals living in the general vicinity of largescale facilities (i.e. surrounding town) were also surveyed. For Survey II, which was distributed in areas where renewable energy facilities were not immediately present (such as Hatgal and Ulaanbaatar), survey respondents were determined predominantly based on the discretion of hired translators, and were not sought out with any particular

characteristics in mind. As a result, the selection was largely done randomly. Refer to Figure 6 for details on the professions of Survey II candidates (determined based on survey location).

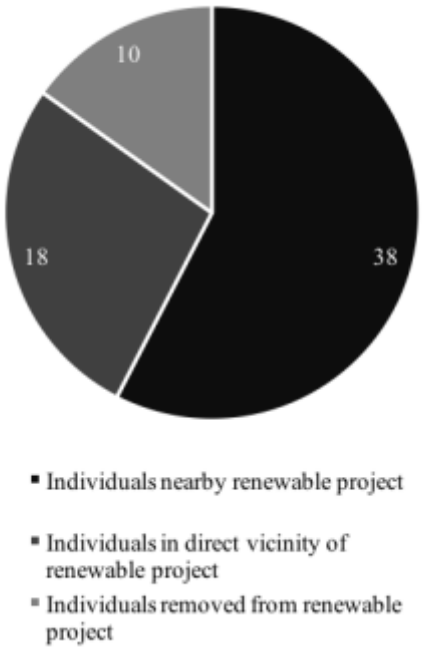

Figure 6. Makeup of respondents for Survey I.

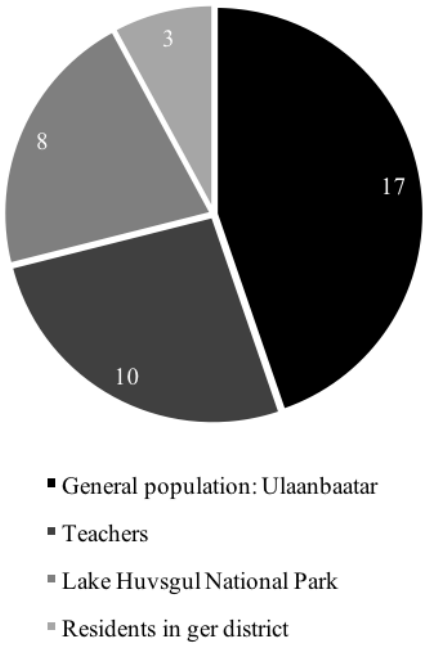

Figure 5. Makeup of respondents for Survey II.

Interviews were conducted with individuals whose professions relate to either renewable energy or environmental policy more generally, as the goal of each interview was to glean additional information about the renewables sector from the context of each individual's specific occupation. Interviewees were selected in part due to contacts from the School of International Training, as well as other interviewees' contacts. Due to time constraints and limited translator ability, interviews were unable to be conducted with survey respondents.

2.3 Measures & Procedures

2.3.1 Timeline. Data collection for this study spanned from May 5-26. Data was primarily collected through the distribution of two surveys. Interviews were also held to gather additional information, which helped to better inform the content in the surveys.

2.3.2 Surveys. Surveying was selected as the primary method of data collection because it allowed for the maximum collection of information considering the surveyed population (the general public). Moreover, while a translator was utilized to orchestrate conversations with survey respondents,

these conversations did not require translators to utilize much of the highly technical language that is often required when discussing renewable energy.

Throughout the course of the research period, two different surveys were distributed to a total of 94 participants. Each respondent completed either Survey I or Survey II; there was no overlap between respondents of Survey I and respondents of Survey II. Due to scheduling challenges, Survey I was developed prior to any interviews; as a result, the questions addressed general areas that aimed to assess individuals' opinions on the current and future status of Mongolia's renewable energy sector. Interviews were conducted in the week following the distribution of Survey I to individuals in Darkhan, Salkhit, and Ulaanbaatar. Information obtained in these interviews was subsequently utilized to inform the development of questions for an additional survey (Survey II), with the goal of better gauging individuals' personal knowledge about renewable energy and Mongolia's energy sector as a larger topic. Refer to Appendices A, B, D, and E for the text of both surveys in Mongolian and English.

Every survey respondent, regardless of language ability, received and completed the survey in Mongolian. Surveys were filled out either by participants themselves or by available translators, with the majority of surveys filled out by respondents independently. Refer to Table 3 for more information on the logistics of both surveys.

Table 3

Logistics for each survey

Survey	Sites	Respondents	Questions	Duration	Dates
I	Darkhan	35	8	5-10 minutes	May 10-11
	Salkhit	21			May 14
II	Hatgal	8	10		May 21
	Ulaanbaatar	30			May 24

2.3.3 Interviews. Each interview was between 15 and 40 minutes, and did not follow a specific set of questions. Questions were prepared beforehand based on each interviewee's occupation, and questions that were asked also depended on information that was mentioned throughout the course of the interview. Detailed notes were handwritten during each interview, regardless of whether or not the interview was able to be recorded. All handwritten notes were typed at the conclusion of each interview. Refer to Appendix H for lists

of each set of general interview questions that were posed to various interviewees. Consent forms were obtained for all interviewees, and were collected retroactively when necessary. When interviews were able to be recorded, transcripts were typed retroactively.

A total of 10 interviews were conducted. Due to varying circumstances for each interview, analysis of the information occurred differently for each interview. Refer to Table 4 for more details regarding each interview.

Table 4

Logistics for each interview

Date	Affiliation	Language	Translator	Recorded	Follow-up
10/5/2017	Solar Power International, LLC (Darkhan)	Mongolian, English	Present	Yes	Transcript typed retroactively
11/5/2017	Ministry of Environment and Tourism (Darkhan)	Mongolian	Present	Yes	Translated by outside translator retroactively
16/5/2017	Wilderness Conservation Society (WCS) (Ulaanbaatar)	English	Absent	No	Handwritten notes were typed
16/5/2017	Newcom, LLC (Ulaanbaatar)	English	Absent	No	Handwritten notes were typed
16/5/2017	NovaTerra, LLC (Ulaanbaatar)	English	Absent	No	Handwritten notes were typed
24/5/2017	Ногоолин Хороо (Ulaanbaatar)	Mongolian, English	Present	No	Handwritten notes were typed
24/5/2017	Ногоолин Хороо (Ulaanbaatar)	English	Absent	Yes	Transcript typed retroactively
26/5/2017	Nationally Appropriate Mitigation Actions in the Construction Sector in Mongolia (Ulaanbaatar)	English	Absent	Yes	Transcript typed retroactively
26/5/2017	Ministry of Environment (Ulaanbaatar)	Mongolian, English	Present	Yes	Transcript typed retroactively
26/5/2017	Ministry of Energy (Ulaanbaatar)	English	Present	Yes	Transcript typed retroactively

2.4 Data Analysis

2.4.1 Surveys. Upon the collection of completed surveys, all survey responses were entered into a spreadsheet. Comprehensive results for Survey I and Survey II can be found in appendices C and F, respectively. Each completed survey was assigned a code for reference depending on which survey was completed, where the survey took place, and additional locational context if relevant; a complete list of survey codes can be found in Appendix H. Locational distinction was made between individuals living next to versus farther away from renewable energy facilities, as well as between individuals of distinct professions. Individuals' professions were taken into account when the information was made known, considering that subsections of the surveyed population work in professions that are topically specific (i.e. government employees, teachers). This distinction was made to determine if individuals within a specific industry were more or less informed than individuals in another industry. Profession was determined only in instances where respondents were surveyed at their place of work. All survey responses were used in the final report, but not every respondent answered every single question. Questions unanswered by respondents will be indicated by a marking of "-".

Subsequent to initial data entry, completed surveys were sorted based on whether or not the respondent had made additional comments in Mongolian. Surveys with additional comments were separated and translated by individuals (different than translators hired to help with the survey distribution) on May 24 and 26. There were also a limited number of survey respondents who answered additional questions (such as "When did you purchase your solar panel?") or who verbalized additional information during the survey process; this information was taken into account in the results section

2.4.2 Interviews. Both interview transcripts and notes were reviewed to determine common themes. These themes were recorded and cross-referenced with survey answers to best inform the information presented in the discussion section.

2.5 Limitations

As a result of being unable to interview individuals before the distribution of Survey I, the questions ultimately failed to address many of the critical issues that this study eventually focused on, such as public engagement with the topic of renewable energy and the larger energy system in Mongolia. Similarly, Survey II did not include questions from Survey I that ended up being critical to establishing the presence of barriers within Mongolia to the diffusion of RET—in particular, the question of what would prevent individuals from wanting their own RET system.

Moreover, because Survey II was developed after trips to Darkhan and Salkhit, it was not possible to distribute Survey II to either individuals residing in the direct vicinity of renewable energy projects or individuals living in cities with prominent renewable energy facilities. As a result, it was not possible to gain information on the level of knowledge individuals' in the vicinity of RET facilities have about energy systems. Thus, the results are limited in their scope to accurately reflect the impact that the presence of a RET facility has on individuals' knowledge of energy systems.

Due to a limited amount of time to survey individuals in Ulaanbaatar, it was not possible to interview more individuals from key populations within the city, such as residents of the ger district. Requiring the use of a translator also impacted which locations were visited, as the translators largely used their own discretion to select specific locations to distribute surveys.

Throughout all parts of data collection—including surveying, interviewing, and general background information collection—language continually presented a challenge. Language presented the largest barrier in terms of access to interviewees, as any interviewees that required translation necessitated coordinating multiple individuals' schedules. The nature of the study also made translation challenging; rather than employing vocabulary used on a regular basis, interview questions and the resulting answers often contained highly specific and technical vocabulary that presented challenges for translators.

While minimal, the likelihood of respondents misinterpreting questions' nuanced intentions on account of translation differences is still pertinent. Due to the language barrier, as well as questions containing terms that potentially do not have a direct translation in Mongolian, it was not

possible to ensure that the resulting translation of each question carried the precise intended inquiry.

A limited amount of time also restricted the amount of information that was able to be obtained from interviewees, who informed much of the information in this study obtained from government perspectives. Interviewees were critical to obtaining background information, and the data collected may have been better informed with additional interviews.

Existing research on the topic of renewable energy diffusion in Mongolia is also limited, and therefore collecting accurate background information to adequately inform the development of surveys and interview questions was difficult.

2.6 Ethics

Throughout this study, considerations for human subjects and ethics were respected. Each interviewee completed a consent form after the conclusion of his or her interview, and survey respondents were informed of their anonymity in the research process.

The identity of all participants in this study is protected through anonymity and considerations for confidentiality were upheld when constructing the results section.

III. Results

3.1 Public Awareness Regarding Energy Systems

3.1.1 General public. Responses from Survey II indicate that public knowledge about Mongolia's existing energy system is limited: only 8.3% of respondents indicated knowing "a lot" about Mongolia's electric grid (63.9% responded "some"; 27.8% responded "not much"). Respondents' knowledge about the renewable energy sector in Mongolia was comparable to their knowledge about the current power system. Only one respondent (2.7%) indicated knowing "a lot" about the renewables sector; 59.5% indicated knowing "some" and 37.8% indicated knowing "not much" (Figure 7). When asked if they thought the public should know more about renewable energy, respondents overwhelmingly answered affirmatively (92.1% answered "yes").

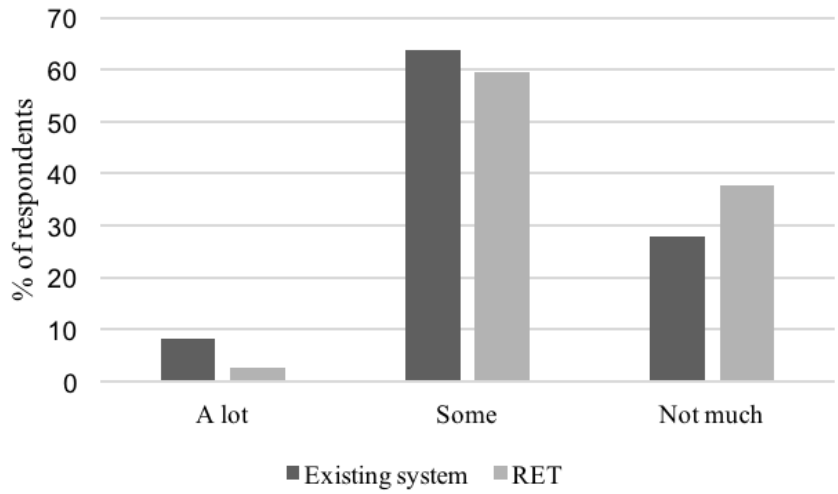

Figure 7: Respondents' knowledge levels about energy systems (existing versus renewable).

Both survey respondents and interviewees testified to a discrepancy in the renewable energy knowledge of individuals living in the countryside versus urban areas. While it was not possible to interview or survey nomadic individuals who utilized PV panels, a representative from the MoE confirmed that as a result of the 100,000 Solar Ger program and receiving PV panels, individuals' residing in the countryside are generally more informed about the processes involved with renewable energy.

Regarding differences not based in geographic residency, interviewees from all sectors (government, private corporation, and NGO) spoke to the fact that knowledge of renewable energy is often associated with a certain level of

privilege and socioeconomic status. Individuals who have reached higher levels of education are more likely to know about renewable energy than the average citizen of Mongolia.

3.1.2 Individuals with experience in the energy sector. A representative from the MoE discussed individuals' knowledge about renewable energy specifics within the MoE, and mentioned that many of the individuals currently working in the renewable energy industry had previously worked in the mining and coal industry, and through either self-education or outside education had sought out additional information about renewable energy.

3.2 Public Perception of Energy Systems

3.2.1 Existing power system and electric grid. Survey II asked respondents if they are satisfied with "Mongolia's current energy system." There was not a substantial margin between respondents who responded "yes" (51.4%) versus "no" (48.6%). When asked if they thought Mongolia's current energy system was sustainable, the majority (67.6%) answered "no".

3.2.2 Renewable energy systems. Survey I asked respondents about their interaction with RET facilities. 96.4% of respondents answered "no" when asked if they had been personally affected by the presence of renewable energy projects. 94% of respondents indicated having either a neutral or positive perception of renewable energy projects (52.8% positive; 41.5% neutral). These results were consistent across the various groups that were surveyed.

3.2.3 Future of the renewable energy sector. When asked about policies the GoM is currently pursuing regarding renewable energy (Survey I and II), respondents gave responses that were generally supportive. In the context of the GoM's efforts to target the development of the renewable energy sector through largescale (as opposed to smaller systems) facilities (Survey I), 83.3% of respondents indicated that largescale projects (as opposed to small-scale projects) were the first thing that came to mind when they thought of renewable energy projects. 7.4% of respondents indicated an inclination towards smaller-scale projects, with 5.6% indicating that both large and small-scale projects came to mind.

Regarding the GoM's goal to achieve 30% of installed capacity as from renewable sources by 2030, 89.3% of respondents answered that this goal is realistic (Survey I and II).

Multiple interviewees spoke to the prospect of Mongolia's renewable energy industry eventually being sustained through solely domestic corporations. A representative from Solar Power International, LLC, specifically espoused the belief that the renewable energy sector will eventually be able to become entirely Mongolian and without foreign influence, but this shift will only come after Mongolia's institutional knowledge about renewables is able to expand.

3.3 Public Education

Between Survey I and Survey II, the majority of respondents (73.9%) remarked having received no education about renewable energy. The percentage of people who had received no education did not vary significantly based on individuals' occupations (see Figure 8). The highest concentration of people who had received education about renewable energy came from

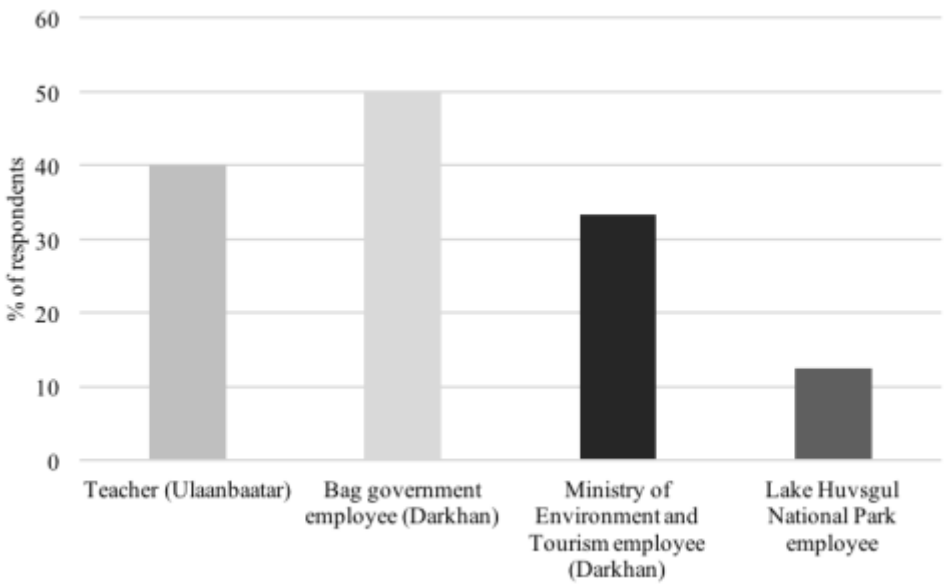

Figure 8. Percentage of respondents who had received educatio*n* about renewable energy (based on profession).

individuals who work in the offices for government of the bags in Darkhan soum.

Individuals' lack of knowledge regarding renewable energy was also evident in many answers to question 8 of Survey I. Respondents were asked if they would be open to installing a renewable energy system for their own home, to which 55.4% responded "no". When asked about their motivation for not wanting to install a personal renewable energy system, the majority (48.6%) indicated the reason to be a lack of information, 29.7% stated they had no interest, and 13.5% stated that cost would prevent them (Figure 9).

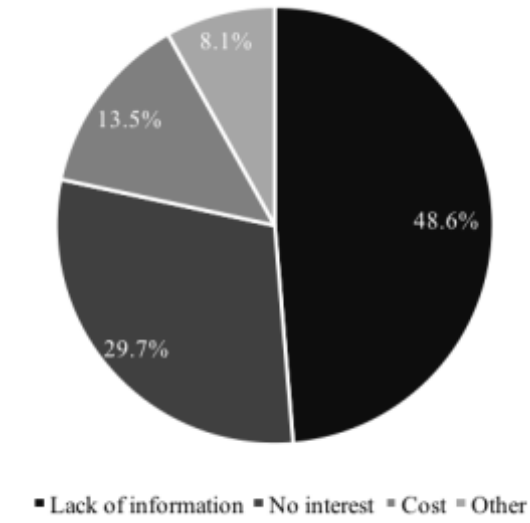

Figure 10. Respondents' reasoning for not installing a renewable system.

3.3.1 Role of government. Survey II asked participants to indicate their recommended method for increasing public knowledge of renewable energy policy. The majority (34.2%) of those surveyed believe that the GoM should be responsible for educating the public about renewable energy (Figure 10). Individuals within the GoM reported varying accounts of ministries' approaches to educating the public about RETs.

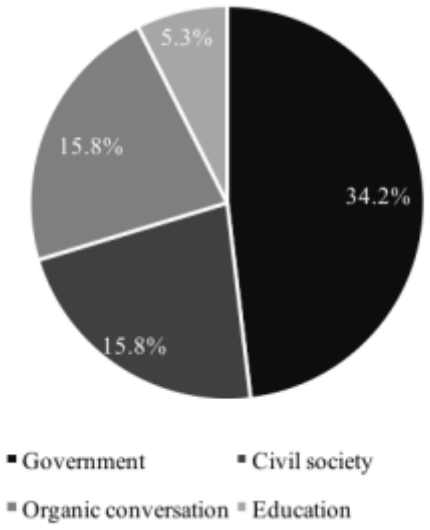

Figure 9. Who should be responsible for educating the public about renewable energy.

3.3.1.1 Darkhan and Salkhit. In Darkhan, a representative from the Ministry of Environment and Tourism (MET) reported projects in development to educate high school students about RET, and also highlighted

the importance of educating people through mainstream avenues, such as television programs.

Survey results reaffirmed television as a source of education about RET for individuals. Out of the 15 respondents who stated they had received education about renewable energy, four of these listed their source of education as television. All four respondents who stated they had learned about renewable energy from television lived in either Darkhan or Salkhit. This substantiates information elicited from multiple interviewees, multiple of who specifically noted a lack of government-led initiatives to educate the public on renewable energy policies. There was no significant mention of NGOs playing a role in educating people about renewable energy policy.

The MET in Darkhan also mentioned the development of programs to encourage individuals to visit Darkhan's solar plant, and reported support from the greater GoM regarding increasing visitors to the plant. On an case-by-case basis, the MET has coordinated visits from various organizations to the solar plant.

3.3.1.2 Ulaanbaatar. Individuals within various GoM ministries reported differing education efforts. A representative from the MEGDT confirmed the GoM's role as a message disseminator, mentioning ongoing campaigns to train individuals on how to conduct workshops and other informational opportunities for the greater public on RET. It was specifically noted that these campaigns were focused on training individuals to educate the public, rather than campaigns specifically targeted at the public. The MEGDT and MoE both referenced 8th Renewable Energy Forum, which took place on May 5, 2017, as a way to educate the public.

3.3.2 Role of renewable energy companies. Two individuals (IS-WF1 and IS-WF5) residing at the base of the Salkhit wind farm specifically mentioned that they had received information from the company that operates the wind farm, Clean Energy LLC. They remarked that representatives from Clean Energy had visited them to inform them of the project, and that they were given information to dispel common misconceptions that often accompany such projects (i.e. that wind farms will force herders to move their herding sites, that the turbines will disrupt normal weather patterns). Out of the thirteen respondents that were surveyed at their residences at the base of

the Salkhit Wind Farm, IS-WF1 and IS-WF5 were the only respondents who indicated they had received education from Clean Energy. Outreach was limited to families residing in close proximity to the wind farm, and families that lived marginally further away stated they had not received any information from the company on its project.

Both survey respondents and representatives from renewable energy systems companies (including Solar Power International, LLC; Newcom, LLC; and NovaTerra, LLC) attested to companies' efforts to inform the public on the details of renewable energy installations. This distribution of information has taken multiple forms, including (as seen in Salkhit) dispelling individuals' misconceptions about renewable systems (i.e. that wind turbines will change weather patterns and that their placement will require herders to restructure their herds) as well as proactively providing the public with information as to the logistics and details of a renewable system. A representative from NovaTerra specifically mentioned attending public hearings in locations where the company is planning the construction of a wind farm to address concerns and distribute information.

3.4 Public Engagement Trends

3.4.1 Role of personal experiences. Multiple interviewees spoke to the level of public engagement with renewable energy as dependent on various other factors, such as the level of air pollution. Representatives from Newcom, NovaTerra, WCS, and Ногоолин Хороо (a local NGO that aims to demonstrate the power of solar passive heating) stated that as the air pollution in Ulaanbaatar has grown in recent years, they have noticed an increase in individuals' support of renewable energy as a way to combat air pollution. A representative from Ногоолин Хороо stated in an interview that he noticed an increase in people's interest in his work following a prominent movement in the ger district to combat air pollution.

One interviewee stated that his personal prediction for what the tipping point to critical mass will be: a failure of the CHP system, ultimately resulting in an energy crisis that sheds light on the unsustainable and faulty nature of Mongolia's existing power system. This attitude of "forcing" people into seeing that renewable energy is optimal for them was echoed by an individual from NovaTerra, who mentioned that while herders were initially hesitant to

let companies begin largescale solar installations on land they typically used for herding sites, they have begun to be more receptive to the renewable projects as mining companies continue to permanently degrade the land around them with their own projects.

Active public engagement regarding the development of laws passed by the GoM was discussed by one interviewee, who mentioned how the Renewable Energy Law had largely been campaigned for by a RET company who sought to benefit from the law establishing a kind environment for investment and market entry.

IV. Discussion

4.1 Positive Indicators for Future Success of the Diffusion of RET

4.1.1 Public perception The Mongolian public generally did not report negative feelings towards the government's RET ambitions. Rather, survey responses indicated a general lack of involvement with government policies on RETs, the reasoning behind which is multi-dimensional. Overall, however, respondents' answers as to their perception of RET indicated that the GoM does not have to focus a lot of energy on changing the public's overall opinions of RET. While it could be more positive, they are not facing an overwhelming amount of negativity towards RETs.

4.1.2 Government policies. As Sawin (2004) comments, "every country that has succeeded thus far in developing renewable energy on a substantial scale has been committed over the long-term to this goal, with consistent policies that include a package of policy mechanisms" (p. 3). So far, the GoM has taken positive steps to support a robust renewables sector. Interviews with representatives from the MEGD and the MoE highlighted the multi-faceted mechanisms that the GoM has implemented, most prominently regarding policymaking and public outreach. The legislative regime that supports renewable energy policy has increasingly included clauses to expand investment in Mongolia's renewable sector. With its plan for at least until 2030 regarding goals about RETs, the GoM has taken important first steps to establishing eventual success.

4.1.2.1 Legal structure. Sawin (2004) specifically mentions the importance of establishing financial incentives to promote investment in the renewables sector, such as providing government subsidies for renewable energy and the establishment of a feed-in (pricing) system. The GoM has implemented multiple incentive systems, including the provision of subsidies, the recent addition of a support tariff to the Renewable Energy Law, and classification of renewable energy equipment as exempt from customs and value-added taxes, increase the incentive to invest in RETs (*Renewable Energy Law (2015)*, 2015).

4.1.2.2 Education efforts. Specific ministries within the GoM are already achieving success with campaigns to educate the public. As seen in Darkhan, people are in fact receiving information through the government's

programs. These efforts are also important because they address public education on multiple levels, as opposed to a narrow approach to address the dearth of awareness. This is in line with a statement from a representative within the MoE in Ulaanbaatar, who noted that education should happen for all ages, and that everyone should be talking about renewable energy, not just adults.

4.1.2.3 Future plans. A representative from the MoE, as well as an individual from Arig Bank (who spoke at the recent Renewable Energy Forum, May 5, 2017) also mentioned the government's eventual plans to enable individuals to implement net metering systems in their own homes, which would allow them to install their own RETs and sell the generated energy back to the grid. The eventual development of this program would add diversity to Mongolia's RET profile, thus maximizing opportunities for citizens to become involved.

4.2 Barriers to the Effective Diffusion of RETs

Suzuki (2015) lists factors that have been agreed upon by previous researchers as barriers to technology development in developing countries. Many of these factors were mentioned by interviewees and are mostly applicable as comments on the status of the GoM. The most relevant barriers Suzuki (2015) mentions in relation to this study's findings are "limited capacity to assess, adopt, and absorb technological options;" "lack of knowledge of technology operation and management;" "lack of skilled personnel/training facilities;" "potential lack of commercial viability," "uncertain government policies;" "lack of infrastructure;" "lack of information and awareness;" and "lack of consumer acceptance" (p. 231). Survey I respondents' responses about what would prevent them from installing their own renewable systems are in line with the aforementioned barriers—especially "lack of information."

4.2.1 Barriers in Mongolia relative to other developing nations. A study completed by Reddy and Painuly (2004) ultimately found that the largest barrier to effective diffusion of RETs in the Maharashtra State, India, was financial reasons—people were unable to justify spending more money on energy derived from renewable sources when their existing energy system was fully functional. However, the Maharashtra State has no history of being ruled

by a communist regime—which continues to significantly inform and shape the implementation of policy and public discussion in Mongolia to this day.

Thus, it is unsurprising that the majority of survey respondents answered that the biggest source of apprehension when considering installing their own renewable system was a lack of information, rather than financial factors.

4.3 Necessary Steps to Increase Public Knowledge About RETs

Pfeiffer and Mulder (2013) reference Popp, Hascic, and Medhi's (2011) finding that "increased knowledge has a robust, albeit small, effect on renewable energy investments across 26 OECD countries." To maximize the potential for success regarding implementation of the GoM's renewable energy agenda, education about renewable energy must increase at all levels of society within Mongolia. This includes implementing a critical shift in how both the public and the government view their involvement in the policymaking process.

4.3.1 Role of the GoM. The role of a developing country's government is critical to the successful diffusion of RET. Reddy and Painuly (2004) developed a chart regarding the taxonomy of barriers to RET diffusion, and indicated that all of the barriers (awareness and information; financial and economic; market; technical; institutional and regulatory) except for one (behavioral) were perpetuated by the existing country's organization system; the individual was regarded as responsible for behavioral barriers. While the GoM has thus far taken steps to address many of these barriers, there is much more that can be done to remove additional barriers.

4.3.1.1 Awareness and information. While specific ministries within the GoM have embraced their role as educators for the public about RET, it is critical that all government ministries recognize their part in public education. If ministries within the GoM continues to view themselves only in a policymaking (as opposed to educating) role, the public will be ill-equipped to embrace the eventual paradigm shift the GoM hopes to introduce into the energy sector. Within government, various agencies could potentially collaborate to develop an outreach mechanism for the public (i.e. a joint project to develop curriculum in schools about renewable energy between the MNE and the Ministry of Education). Joint projects would not only allow for

the sharing of resources and human capital, but would also align ministries in a common cause

4.3.1.2 Technical. Reddy and Painuly (2004) also recommend the construction of RET demonstration programs, in part, to "prove their technical and economic viability" (p. 1446). Engaging the public through demonstrations of renewable energy is especially relevant in Mongolia, considering that a large percentage of the population, by nature of living in the capital city, is physically removed from where RET facilities would be installed. Demonstration programs could also be led by actors who are not explicitly government ministries, such as the NREC. A representative from the MoE stated that the NREC has been successful with public outreach in the past, and could potentially begin constructing public education campaigns as ministries continue to develop and amend RET policy.

The government must also be open to implementing strategies that are not traditionally within the realm of renewable energy, such as solar passive heating—which is one of the main things Ногоолин Хороо advocates for in the context of the ger district and limited access to what are often expensive resources. Creating a system for public input on these issues that was genuinely followed up by members of the GoM would also indicate to the public that the GoM is invested in their long-term well-being and health.

4.3.1.3 Institutional and Regulatory. There are additional institutional shifts that the GoM can begin to make in order to maximize its success with the diffusion of RET. The GoM would benefit from taking the advice of Mehta et. al (2007), who underscore the necessity of governments holding energy companies accountable in order to sustain progress within new energy systems. Additionally, it is critical to ensure that policies regarding RET remain consistent regardless of turnover in the government and Parliament. Huenteler et. al (2016) explain that "learned capabilities degenerate rapidly if organizations have a rapid workforce turnover, face an instable regulatory framework, or pursue unsustainable business models" (p. 7). Traditionally, Mongolia has faced widespread policy shifts with every new election cycle. While the Renewable Energy Law has so far remained intact between administrations, it is critical that future administrations uphold the Law in the future.

According to Metz et. al (2000), the ideal environment for successful technology transfer is one "within a framework of helping to find new sustainable paths for economies as a whole" (p. 3). The GoM will not achieve success if it attempts to isolate its sustainable policies within individual ministries and sectors; rather, it needs to formulate an approach that integrates sustainability into all levels of governmental policy.

4.3.2 Role of the public. While it is ultimately the GoM's job to both inform citizens of and garner support for government policies, the public must be receptive to attempts to introduce new information about the energy sector. When individuals do receive education about RETs, the onus is on them to internalize this information and to take it seriously—multiple survey respondents from Salkhit stated that despite education from Clean Energy, LLC, they were still skeptical about the potential negative impacts of wind turbines on their herds. This kind of unfounded skepticism could potentially present problems if it continues to increase. That being said, respondents living close to Salkhit Wind Farm specifically reported more misconceptions about wind turbines than other respondents—something that the government should address in the future.

Results indicate that the nature of individuals' conversations regarding renewable energy could begin shifting as the public is faced with higher levels of air pollution and other issues that are adversely affecting them. The founder of Ногоолин Хороо stated that his motivation for founding his NGO was "out of necessity" in regards to global conversations about the state of the environment; it is likely that if the government does not change its approach to public engagement and education, members of the public will take matters into their own hands. As more Mongolians are presented with situations in which renewable energy could potentially act as a solution, such as those heavily impacted by the dangerous levels of air pollution in Ulaanbaatar, discussion around the viability of renewable energy is likely to increase.

4.3.3 Role of the private sector. As Mongolia's renewable energy sector expands, private companies are becoming increasingly relevant in a way they have not been before on account of the closed, state-run energy regime. These companies bring a unique perspective; while they are removed from much of the government bureaucracy, they must still abide by the

policies set in place by the government and Parliament regarding renewable energy. Moreover, they must determine their level of engagement with the public, and are ultimately responsible for ensuring the public is aware of the projects that they plan and ultimately implement.

While results indicate that public engagement from RET companies has thus far been limited to individuals in the vicinity of RET projects, companies could potentially explore the expansion of expand their education efforts to the broader public. Similar to how NGOs have begun to take on a larger role in public education in the absence of coordinated government education campaigns, corporations could do the same, especially given their expertise on the technicalities of RET policy. In light of a lack of public input on previously passed laws regarding renewable energy, such as the Renewable Energy Law, increased public engagement with legislators would be an effective way to distribute additional information about the details of RET to the public. Corporations could oversee these interactions, and encourage the public to be involved in the legislative process as more policies are implemented regarding the renewables sector.

4.3.4 Role of international actors. Metz et. al (2000) introduce Article 4.5 of the UNFCCC, which states that developed countries:

> shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention (p.3).[2]

In order to ensure developing countries' success in their efforts to introduce sustainable policies, developed countries must play a large role in facilitating the creation and adoption of policy, as well as the development of infrastructure and new systems. Huenteler, Niebuhr, and Schmidt (2016) note that in order for developing countries to catch up in the field of renewable technology, "removing trade barriers and providing developing countries with

[2] Metz et. al (2000) also quote the ultimate objective of the UNFCCC: "to achieve, in accordance with the relevant provisions of the Convention, stabilisation of greenhouse gas concentrations in the atmosphere at such a level that would prevent dangerous interference with the climate system. Such a level should be achieved within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."

intellectual property rights (IPR) and resources for technology imports is not sufficient to enable countries to catch up to the technological frontier" (p. 7) This was found to be true during the implementation of the NREP. Tamir, Urmee, and Pryor (2015) examined the installation of small scale RETs as a result of the NREP, and found that "In most cases, the equipment was selected by the contractors, who had little or no experience in installation, or in the operation of renewable energy devices" (p. 5). Moreover, these contractors failed to account for critical aspects of Mongolia such as its extreme temperatures, which did not allow for the equipment to properly function.

As Mongolia continues to develop its renewables sector, international partners must play an active role in not only financing projects, but in comprehensively contributing to the GoM's simultaneous development as a body able to independently oversee the production of RET facilities and projects. Huenteler et. al (2016) clarify that:

> Technological learning is not an automatic by-product of investments . . . Organizations need to pursue conscious efforts to create the ability, in the form of a skilled workforce and organizational processes, to absorb the new knowledge and experience that they generate (p. 7).

The development of these organizational processes will be the distinguishing factor in whether or not the GoM is able to develop a self-sustaining RET industry.

V. Conclusion

As Mongolia further develops its renewables sector, the GoM will need to reform its current strategy for introducing RET to the public. This strategy is currently insufficient in garnering the public support that will be necessary to ensure success with the implementation of largescale projects.

While there is currently a lack of public encouragement for RETs, this lack of encouragement was found to not be the result of negative perceptions towards RETs. Rather, findings showed that a lack of information has potentially led the public to become largely apathetic towards policies regarding renewable energy. This problem stems from a lack of understanding as to how the power system, and more specifically the renewable energy system, in Mongolia functions.

The reason for lack of effective RET diffusion in Mongolia is due mostly to a lack of knowledge in the public, which is exacerbated by the government's failure to educate the public on its robust RET agenda. This failure of education is potentially on account of lasting impacts of a communist system that did not promote public education. Moreover, the existing energy system in Mongolia is one that happens largely without public input, which reinforces a similar setup for the renewable energy sector.

The role of international actors as educators regarding best practices in the RET sector will become increasingly important as Mongolia seeks to implement more largescale projects that will require an increased amount of funding and public support. Considering the growing role of international actors within Mongolia's RET sector, more research should be done on the specific dynamics and interactions between the GoM and international actors. Analysis of this relationship would hopefully provide preliminary information for how international actors can best impart technological learning on Mongolia, which has so far been challenging. Additional research should also be conducted regarding future education initiatives that the GoM can introduce to the public, considering the existing lack of knowledge about government policies.

References

2007 Semi-annual progress report. (2007). Retrieved from https://web.archive.org/web/20080528115803/http://www.rprpmongolia.mn/pdf/2007semi_annual_report_eng.pdf

Action Plan, Green Development Policy of Mongolia. (2016).

Bayasgalanbaatar, B. (2015). *Strategy and Policy for Development of Renewable Energy Sector*. Ulaanbaatar. Retrieved from http://www.jcm-mongolia.com/wp-content/uploads/2015/11/6.-20151110_Ministry-of-Energy.pdf

Biography. (n.d.). Retrieved May 27, 2017, from http://www.president.mn/eng/president/biography.php

Boldsukh, C. (2017). Darkhan's solar power station to officially start operations. Retrieved May 25, 2017, from http://theubpost.mn/2017/01/17/darkhans-solar-power-station-to-officially-start-operations/

Ch., B. (2013). *Renewable Energy Development of Mongolia*. Retrieved from http://www.carecprogram.org/uploads/events/2013/ESCC-Meeting-KAZ/005_104_209_Renewable-Energy-Development-in-Mongolia.pdf

Chen, Y., Gönül, G., & Tumenjargal, M. (2016). *Mongolia: Renewables Readiness Assessment*. Retrieved from http://www.irena.org/DocumentDownloads/Publications/IRENA_RRA_Mongolia_2016.pdf

Elliott, D., Schwartz, M., Scott, G., Haymes, S., Heimiller, D., & George, R. (n.d.). Wind Energy Resource Atlas of Mongolia. Retrieved from http://www.nrel.gov/docs/fy01osti/28972.pdf

Gobitec and Asian Super Grid for Renewable Energies in Northeast Asia. (2014). Retrieved from https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwj11ZHbmprUAhUBGpQKHXlDABUQFgg1MAA&url=http%3A%2F%2Fwww.energycharter.org%2Ffileadmin%2FDocumentsMedia%2FThematic%2FGobitec_and_the_Asian_Supergrid_2014_en.pdf&usg=AFQjCNEbtdfZYESZNFOc9Bb1L6y8Bu3zJA

Huenteler, J., Niebuhr, C., & Schmidt, T. S. (2016). The effect of local and global learning on the cost of renewable energy in developing countries. *Journal of Cleaner Production*, *128*, 6–21. Retrieved from http://ac.els-cdn.com.ccl.idm.oclc.org/S0959652614006441/1-s2.0-S0959652614006441-main.pdf?_tid=d826bdf8-4297-11e7-94cc-00000aacb360&acdnat=1495860739_2b7fece16237732b66e549e9cdeecd05

In-depth review of the investment climate and market structure in the energy sector of. (2013). Retrieved from http://www.energycharter.org/fileadmin/DocumentsMedia/ICMS/ICMS-Mongolia_2013_en.pdf

Introduction. (n.d.). Retrieved May 24, 2017, from http://erc.gov.mn/en/introduction

Law on Energy. (2014). Retrieved May 18, 2017, from https://www.iea.org/policiesandmeasures/pams/mongolia/name-37136-en.php?s=dHlwZT1lZSZzdGF0dXM9T2s,&return=PG5hdiBpZD0iYnJl

YWRjcnVtYiI-PGEgaHJlZj0iLyI-SG9tZTwvYT4gJnJhcXVvOyA8YSBocmVmPSIvcG9saWNpZXNhbmRtZWFzdXJlcy8iPlBvbGljaWVzIGFuZCBNZWFzdXJlczwvYT4gJnJhc
Lkhagva, J. (2014). *Renewable Energy Regulation Policy in Mongolia*. Retrieved from http://neamf.ulaanbaatar.mn/wp-content/uploads/2014/09/Jambaa-eng.pdf
Martinot, E., Chaurey, A., Lew, D., Moreira, J. R., & Wamukonya, N. (2002). Renewable Energy Markets in Developing Countries. *Annu. Rev. Energy Environ*, *27*, 309–48. https://doi.org/10.1146/annurev.energy.27.122001.083444
Mehta, A., Rao, H. S., & Terway, A. (2007). Power sector reform in Central Asia: observations on the diverse experiences of some formerly Soviet Republics and Mongolia. *Journal of Cleaner Production*, *15*, 218–234. https://doi.org/10.1016/j.jclepro.2005.12.013
Metz, B., Davidson, O. R., Martens, J.-W., van Rooijen, S. N. M., & Van Wie McGrory, L. (2000). *Methodological and Technological Issues in Technology Transfer*.
Mongolia: Portable Solar Power for Nomadic Herders. (2013). Retrieved April 22, 2017, from http://www.worldbank.org/en/results/2013/04/08/portable-solar-power-for-nomadic-herders
Movellan, J. (2016). The Asia Super Grid – Four Countries Join Together to Maximize Renewable Energy. Retrieved May 18, 2017, from http://www.renewableenergyworld.com/articles/2016/10/the-asia-super-grid-countries-join-together-to-maximize-renewable-energy.html
Myagmar, A. (2015). *Asian Super Grid*. Beijing. Retrieved from https://www.iea.org/media/workshops/2015/techplatformchinasmartgrid2015/AsianSuperGrid.pdf
National Renewable Energy Programme (2005-2020). (2013). Retrieved May 18, 2017, from https://www.iea.org/policiesandmeasures/pams/mongolia/name-37137-en.php
National Security Concept of Mongolia. (1994). Retrieved April 28, 2017, from http://www.nsc.gov.mn/sites/default/files/images/National Security Concept of Mongolia EN.pdf
Overview. (n.d.). Retrieved April 29, 2017, from http://gec.jp/jcm/about/index.html
Painuly, J. P. (2001). Barriers to renewable energy penetration; a framework for analysis. *Renewable Energy*, *24*, 73–89. Retrieved from www.elsevier.nl/locate/renene
Pfeiffer, B., & Mulder, P. (2013). Explaining the diffusion of renewable energy technology in developing countries. *Energy Economics*, *40*, 285–296. Retrieved from http://ac.els-cdn.com.ccl.idm.oclc.org/S0140988313001503/1-s2.0-S0140988313001503-main.pdf?_tid=59bf746e-4297-11e7-a206-00000aacb35e&acdnat=1495860527_1e774e3c5249fae45db2bd059b5b94e9
Popp, D., Hascic, I., & Medhi, N. (2011). Technology and the diffusion of renewable energy. *Energy Economics*, *33*(4), 648–662. https://doi.org/10.1016/j.eneco.2010.08.007

Reddy, S., & Painuly, J. P. (2004). Diffusion of renewable energy technologies— barriers and stakeholders' perspectives. *Renewable Energy*, *29*, 1431–1447. Retrieved from http://ac.els-cdn.com.ccl.idm.oclc.org/S0960148103003975/1-s2.0-S0960148103003975-main.pdf?_tid=5cd5c2d2-42fd-11e7-8592-00000aacb35e&acdnat=1495904341_b48c3ca0ed495578f6af511f10ed73d4

Renewable Energy for Rural Access Project (REAP) - Project Information Document Appraisal Stage. (2006). Retrieved from http://documents.worldbank.org/curated/en/288521468273887512/pdf/Project0Inform1nt010Appraisal0Stage.pdf

Renewable Energy Law (2015). (2015).

Sawin, J. L. (2004). *National Policy Instruments: Policy Lessons for the Advancement & Diffusion of Renewable Energy Technologies Around the World*.

Sustainable Development Agenda. (2016). Retrieved May 28, 2017, from http://www.un.org/sustainabledevelopment/development-agenda/

Suzuki, M. (2015). Identifying roles of international institutions in clean energy technology innovation and diffusion in the developing countries: matching barriers with roles of the institutions. *Journal of Cleaner Production*, *98*, 229–240. Retrieved from http://ac.els-cdn.com.ccl.idm.oclc.org/S0959652614008932/1-s2.0-S0959652614008932-main.pdf?_tid=1373fdf8-4298-11e7-9206-00000aab0f6b&acdnat=1495860838_5f91c5454ef31d032aa9c44849439040

Tamir, K., Urmee, T., & Pryor, T. (2015). Issues of small scale renewable energy systems installed in rural Soum centres in Mongolia. *Energy for Sustainable Development*, *27*(August 2015), 1–9. https://doi.org/10.1016/j.esd.2015.04.002

Ts., A. (2017). *Renewable Energy on Energy Conservation policy*. Ulaanbaatar.

Yeren-Ulzii. (2015). *Power Sector of Mongolia, Regional Cooperation Policies*. Ulaanbaatar. Retrieved from http://www.unescap.org/sites/default/files/Mr. Yeren-Ulzii - Mongolia Presentation.pdf

Yeren-Ulzii. (2016). *Energy Sector of Mongolia, Sustainable Development Policy*. Ulaanbaatar. Retrieved from http://www.switch-asia.eu/fileadmin/user_upload/RPSC/event/23-25May16-Mongolia/23May/5_Yeren_Energy_English.pdf

Агаар, орчны бохирдлыг бууруулах үндэсний хөтөлбөр. (2017). Retrieved May 28, 2017, from http://www.mne.mn/mn/news/show/3485

Дархан сумын Статистик мэдээ. (2015). Retrieved May 23, 2017, from http://www.darkhan.mn/index.php/2014-01-15-01-49-21/80-2013

Нийслэлийн статистикийн газар – Статистик үзүүлэлт – 01. Хүн амын тоо, хүйсээр, оны эхэнд, мянган хүн. (2014).

НОГООН ХӨГЖЛИЙН БОДЛОГО. (2014). Retrieved May 19, 2017, from http://www.legalinfo.mn/annex/details/6438?lawid=10482

СЭРГЭЭГДЭХ ЭРЧИМ ХҮЧНИЙ ТУХАЙ. (2007). Retrieved May 8, 2017, from http://www.legalinfo.mn/law/details/465

СЭРГЭЭГДЭХ ЭРЧИМ ХҮЧНИЙ ҮНДЭСНИЙ ХӨТӨЛБӨР /2005-2020

он/. (2005). Retrieved April 22, 2017, from http://www.legalinfo.mn/annex/details/3220?lawid=6485

Appendices

A. Survey I [Mongolian]
B. Survey I [English]
C. Survey I results
D. Survey II [Mongolian]
E. Survey II [English]
F. Survey II results
G. Survey codes
H. General interview questions

Appendix A

Survey I [Mongolian]

Сэргээгдэх эрчим хүчний бодлогын талаарх судалгаа

Таны нэр:
Таны нас:
Оршин суугаа газар:
Ам бүл:
1. Сэргээгдэх эрчим хүчний төсөл, хөтөлбөрүүдийн талаар та ямар ойлголттой байдаг вэ? А. Эерэг Б. Сөрөг В. Тодорхой ойлголтгүй Г. Өөр (тайлбарлана уу) .....
2.Монголын сэргээгдэх эрчим хүчний салбарын ирээдүйг хэрхэн харж байна вэ? А. Засгийн газар болон гадаадын компанийн төсөл давамгайлна Б. Хувийн компануудын төсөл давамгайлна В. Төсөл хөтөлбөрүүд бага хэрэгжинэ Г. Өөр (тайлбарлана уу) .....
3. Эрчим хүчний яамнаас тавьсан 2030 он гэхэд сэргээгдэх эрчим хүчний үйлдвэрлэл/эзлэх хэмжээг 30 хувьд хүргэх зорилтын талаар та юу гэж бодож байна вэ? А. Биелэх боломжтой Б. Биелэх боломжгүй В. Өөр (тайлбарлана уу) .....
4. Та сэргээгдэх эрчим хүчний талаар мэдээлэл авч байсан уу? А. Үгүй Б. Тийм (тийм дугуйлсан бол ямар мэдээлэл авч байснаа тайлбарлана уу) .....
5. Сэргээгдэх эрчим хүч, түүнтэй холбоотой төсөлд өөрийн биеэр хамрагдаж байсан уу? А. Үгүй Б. Тийм(тийм дугуйлсан бол хэрхэн хамрагдаж байсан тухайгаа тайлбарлана уу) .....
6. Сэргээгдэх эрчим хүчний төсөл гэхээр танд ямар төсөөлөл бууж байна вэ? (Нэгээс илүү хариулт дугуйлж болно) А. Том хэмжээний бүтээн байгуулалт (олон өрхийг хамарсан) Б. Жижиг хэмжээний бүтээн байгуулалт (нэг өрхөд зориулсан) В. Өөр (тайлбарлана уу) .....
7. Та өөрийн гэртээ сэргээгдэх эрчим хүчний систем (жишээ нь: нарны толь) суурилуулах талаар бодож байсан уу? А. Тийм Б. Үгүй В. Өөр хариулт (тайлбарлана уу) .....
8. Өмнөх асуултанд (7) үгүй гэж хариулсан бол, ямар шалтгаанууд таны боломжийг хязгаарлаж байна вэ? А. Өртөг өндөртэй Б. Хангалттай мэдээлэл байхгүй В. Сонирхож үзээгүй Г. Бусад (тайлбарлана уу) .....
Нэмэлт мэдээлэл байвал доор бичнэ үү. .....

Судалгаанд хамрагдсан танд баярлалаа. Амжилт хүсье

Appendix B
Survey I [English]

Renewable Energy Survey

Name:

Age:

Area of residence:

Number of people in household:

1. What is your perception of renewable energy projects?

A) Positive

B) Negative

C) Neutral

D) Other (please explain below):

_____

2. What do you see as the future of renewable energy in Mongolia?

A) More projects from the government and foreign companies

B) More projects from private companies

C) Fewer projects overall

D) Other (please explain below):

_____

3. What do you think of the government's goal to have 30% of Mongolia's energy come from renewable sources by 2030?

A) Realistic

B) Unrealistic

C) Other (please explain below):

_____

4. Have you received any education about renewable energy?

A) Yes (please explain below)

B) No

If yes, please explain the details of your education:

_____

5. Have you been personally affected by the presence of renewable energy projects?

A) Yes (please explain below)

B) No

If yes, please explain how you have been personally affected below:

_____

6. What comes to mind when you think of renewable energy projects? (Circle all that apply)

A) Large-scale installation (able to serve many households)

B) Small-scale installation (serves single household)

C) Other (please explain below):

_____

7. Would you ever be open to installing a renewable energy system (i.e. solar panels) for your own home?

A) Yes
B) No
C) Other (please explain below):

_____

8. If you answered no to the previous question (7), what factors would limit you from installing your own renewable energy system?

A) Cost
B) Lack of information
C) No interest
D) Other (please explain below):

_____

Please include any additional comments below:

_____

Thank you!

Appendix C

Survey I results

Code	City	Context	Survey date	Age	1. What is your perception of renewable energy projects?	2. What do you see as the future of renewable energy in Mongolia?	3. What do you think of the government's goal to have 30% of Mongolia's energy come from renewable sources by 2030?	4. Have you received any education about renewable energy? (Y/N/O)	5. Have you been personally affected by the presence of renewable energy projects?	6. What comes to mind when you think of renewable energy projects?	7. Would you ever be open to installing a renewable energy system (i.e. solar panels) for your own home?	8. If you answered no to the previous question (7), what factors would limit you from installing your own renewable energy system?
ID-GD1	Darkhan	Gers outside of Darkhan Solar Plant	10-May	73	А) Positive	Б) More projects from private companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	А) Yes	Д) N/A
ID-GD2	Darkhan	Gers outside of Darkhan Solar Plant	10-May	59	А) Positive	–	А) Realistic	Б) Yes	–	А) Large-scale installation (able to serve many households)	А) Yes	Д) N/A
ID-GD3	Darkhan	Gers outside of Darkhan Solar Plant	10-May	77	–	–	А) Realistic	А) No	А) No	–	Б) No	В) No interest
ID-GD4	Darkhan	Gers outside of Darkhan Solar Plant	10-May	76	–	–	А) Realistic	–	А) No	А) Large-scale installation (able to serve many households)	А) Yes	Д) N/A
ID-GD5	Darkhan	Gers outside of Darkhan Solar Plant	10-May	52	А) Positive	Б) More projects from private companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	А) Yes	Д) N/A
ID-BG1	Darkhan	Bag offices	11-May	31	В) Neutral	В) Fewer projects overall	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	В) No interest
ID-BG2	Darkhan	Bag offices	11-May	53	Б) Negative	Б) More projects from private companies	А) Realistic	Yes w/explanation	А) No	Б) Small-scale installation (serves single household)	Б) No	Б) Lack of information
ID-BG3	Darkhan	Bag offices	11-May	34	А) Positive	А) More projects from the government and foreign companies	А) Realistic	Б) Yes	А) No	А) Large-scale installation (able to serve many households)	Б) No	В) No interest
ID-BG4	Darkhan	Bag offices	11-May	35	В) Neutral	А) More projects from the government and foreign companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
ID-BG5	Darkhan	Bag offices	11-May	32	А) Positive	Б) More projects from private companies	А) Realistic	Б) Yes	А) No	А) Large-scale installation (able to serve many households)	А) Yes	Д) N/A
ID-BG6	Darkhan	Bag offices	11-May	46	А) Positive	А) More projects from the government and foreign companies	А) Realistic	Б) Yes	А) No	А) Large-scale installation (able to serve many households)	Б) No	А) Cost

ID-BG7	Darkhan	Bag offices	11-May	38	B) Neutral	A) More projects from the government and foreign companies	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
ID-MNE2	Darkhan	Ministry of Environment and Tourism	11-May	39	A) Positive	A) More projects from the government and foreign companies	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
ID-MNE4	Darkhan	Ministry of Environment and Tourism	11-May	44	A) Positive	A) More projects from the government and foreign companies	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
ID-MNE5	Darkhan	Ministry of Environment and Tourism	11-May	44	B) Neutral	Г) Other (please explain below):	B) Other (please explain below):	A) No	A) No	A) Large-scale installation (able to serve many households)	B) Other	Б) Lack of information
ID-MNE6	Darkhan	Ministry of Environment and Tourism	11-May	53	A) Positive	A) More projects from the government and foreign companies	A) Realistic	Б) Yes	Б) Yes	A) Large-scale installation (able to serve many households)	A) Yes	Д) N/A
ID-MNE1	Darkhan	Ministry of Environment and Tourism	11-May	29	A) Positive	A) More projects from the government and foreign companies	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	A) Yes	Д) N/A
ID-MNE3	Darkhan	Ministry of Environment and Tourism	11-May	34	A) Positive	A) More projects from the government and foreign companies	A) Realistic	Б) Yes	A) No	B) Other (please explain below):	A) Yes	A) Cost
ID-M1	Darkhan	Market	11-May	34	A) Positive	A) More projects from the government and foreign companies	A) Realistic	Б) Yes	A) No	A) Large-scale installation (able to serve many households)	Б) No	–
ID-M2	Darkhan	Market	11-May	43	B) Neutral	A) More projects from the government and foreign companies	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
ID-M3	Darkhan	Market	11-May	27	B) Neutral	A) More projects from the government and foreign companies	Б)Unrealistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
ID-M4	Darkhan	Market	11-May	23	A) Positive	Б) More projects from private companies	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	A) Yes	Д) N/A
ID-M5	Darkhan	Market	11-May	30	A) Positive	A) More projects from the government and foreign companies	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	–
ID-M6	Darkhan	Market	11-May	37	B) Neutral	Г) Other (please explain below):	B) Other (please explain below):	A) No	A) No	A) Large-scale installation (able to serve many households)	A) Yes	Б) Lack of information
ID-M7	Darkhan	Market	11-May		B) Neutral	Г) Other (please explain below):	B) Other (please explain below):	A) No	A) No	A) Large-scale installation (able	Б) No	Г) Other (please explain below):

										to serve many households)		
ID-M8	Darkhan	Market	11-May	29	В) Neutral	В) Fewer projects overall	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	Г) Other (please explain below):
ID-M9	Darkhan	Market	11-May	46	А) Positive	А) More projects from the government and foreign companies	А) Realistic	А) No	А) No	В) Other (please explain below):	Б) No	В) No interest
ID-M10	Darkhan	Market	11-May	49	В) Neutral	А) More projects from the government and foreign companies	В) Other (please explain below):	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
ID-M11	Darkhan	Market	11-May	52	В) Neutral	Б) More projects from private companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	В) No interest
ID-M12	Darkhan	Market	11-May	43	В) Neutral	А) More projects from the government and foreign companies	А) Realistic	Б) Yes	А) No	В) Other (please explain below):	Б) No	Б) Lack of information
ID-M13	Darkhan	Market	11-May	39	А) Positive	Б) More projects from private companies	А) Realistic	Б) Yes	А) No	А) Large-scale installation (able to serve many households)	Б) No	В) No interest
ID-M14	Darkhan	Market	11-May	30	В) Neutral	А) More projects from the government and foreign companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	В) No interest
ID-M15	Darkhan	Market	11-May	39	В) Neutral	Б) More projects from private companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
ID-M16	Darkhan	Market	11-May	37	А) Positive	Б) More projects from private companies	А) Realistic	Б) Yes	А) No	Б) Small-scale installation (serves single household)	А) Yes	Д) N/A
ID-M17	Darkhan	Market	11-May	34	А) Positive	А) More projects from the government and foreign companies	А) Realistic	Б) Yes	А) No	А) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
IS-N1	Salkhit	Surrounding gers	14-May	49	В) Neutral	А) More projects from the government and foreign companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	Г) Other (please explain below):
IS-N2	Salkhit	Surrounding gers	14-May		А) Positive	А) More projects from the government and foreign companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	А) Yes	Д) N/A
IS-N3	Salkhit	Surrounding gers	14-May	46	В) Neutral	А) More projects from the government and foreign companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	А) Yes	Д) N/A

IS-N4	Salkhit	Surrounding gers	14-May	54	А) Positive	А) More projects from the government and foreign companies	А) Realistic	Б) Yes	А) No	А) Large-scale installation (able to serve many households)	Б) No	А) Cost
IS-N5	Salkhit	Surrounding gers	14-May	41	А) Positive	Б) More projects from private companies	А) Realistic	А) No	Б) Yes	А) Large-scale installation (able to serve many households)	А) Yes	В) No interest
IS-N6	Salkhit	Surrounding gers	14-May	46	Б) Negative	А) More projects from the government and foreign companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	А) Cost
IS-N7	Salkhit	Surrounding gers	14-May	19	А) Positive	Б) More projects from private companies	А) Realistic	Б) Yes	А) No	А) Large-scale installation (able to serve many households)	Б) No	–
IS-N8	Salkhit	Surrounding gers	14-May	24	В) Neutral	В) Fewer projects overall	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	А) Yes	Г) Other (please explain below):
IS-WF1	Salkhit	Lives at base of wind farm	14-May		А) Positive	Б) More projects from private companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	А) Yes	Д) N/A
IS-WF2	Salkhit	Lives at base of wind farm	14-May		А) Positive	В) Fewer projects overall	А) Realistic	А) No	А) No	В) Other (please explain below):	А) Yes	А) Cost
IS-WF3	Salkhit	Lives at base of wind farm	14-May	33	В) Neutral	Г) Other (please explain below):	В) Other (please explain below):	А) No	А) No	–	А) Yes	Б) Lack of information
IS-WF4	Salkhit	Lives at base of wind farm	14-May	28	В) Neutral	Б) More projects from private companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
IS-WF5	Salkhit	Lives at base of wind farm	14-May	66	А) Positive	Б) More projects from private companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	А) Yes	Д) N/A
IS-WF6	Salkhit	Lives at base of wind farm	14-May	41	В) Neutral	А) More projects from the government and foreign companies	А) Realistic	А) No	А) No	Б) Small-scale installation (serves single household)	А) Yes	Б) Lack of information
IS-WF7	Salkhit	Lives at base of wind farm	14-May	60	А) Positive	А) More projects from the government and foreign companies	А) Realistic	А) No	А) No	В) Other (please explain below):	А) Yes	Д) N/A
IS-WF8	Salkhit	Lives at base of wind farm	14-May	41	В) Neutral	А) More projects from the government and foreign companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	В) No interest
IS-WF9	Salkhit	Lives at base of wind farm	14-May	37	А) Positive	А) More projects from the government and foreign companies	А) Realistic	Б) Yes	А) No	А) Large-scale installation (able to serve many households)	А) Yes	Д) N/A
IS-WF10	Salkhit	Lives at base of wind farm	14-May	17	Б) Negative	А) More projects from the government and foreign companies	А) Realistic	А) No	А) No	А) Large-scale installation (able	А) Yes	В) No interest

										to serve many households)		
IS-WF11	Salkhit	Lives at base of wind farm	14-May	17	А) Positive	Б) More projects from private companies	А) Realistic	А) No	А) No	Б) Small-scale installation (serves single household)	А) Yes	Д) N/A
IS-WF12	Salkhit	Lives at base of wind farm	14-May	42	–	Б) More projects from private companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	В) No interest
IS-WF13	Salkhit	Lives at base of wind farm	14-May	24	В) Neutral	Б) More projects from private companies	А) Realistic	А) No	А) No	А) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information

Appendix D

Survey II [Mongolian]

Хүйс:
Нас:
Оршин суугаа хаяг:
Нэр (бичихгүй байж болно):

1. Та Монголын цахилгаан эрчим хүчний (шугам сүлжээ) тухай хэр их мэдэх вэ?
    а. Хангалттай (цахилгаан эрчим хүчний тухай хууль болон бодлогуудын талаар сайн мэддэг)
    б. Бага зэрэг (цахилгаан эрчим хүчний системийн талаар бага зэрэг мэддэг)
    в. Сайн мэдэхгүй (цахилгаан эрчим хүчний бодлогын талаар ихэнхийг нь эсвэл бүр юу ч мэдэхгүй)

2. Монголын одоо ашиглаж байгаа эрчим хүчний системийн талаар ямар ойлголттой байдаг вэ?
    а. Тогтвортой (үйл ажиллагаа нь удаан хугацаанд үргэлжилнэ)
    б. Тогтворгүй (өөрчлөх хэрэгтэй)
    в. Бусад (доод зайнд дэлгэрэнгүй тайлбарлана уу)

    _____

3. Та Монголын одоо ашиглаж байгаа эрчим хүчний системийн талаар сэтгэл хангалуун байдаг уу?
    а. Тийм
    б. Үгүй (тайлбарлана уу)

    _____

4. Та Монголын сэргээгдэх эрчим хүчний бодлогын талаар хэр сайн мэддэг вэ?
    а. Хангалттай (сэргээгдэх эрчим хүчний тухай хууль болон бодлогуудын талаар сайн мэддэг)
    б. Бага зэрэг (цахилгаан эрчим хүчний системийн талаар бага зэрэг мэддэг)
    в. Сайн мэдэхгүй (сэргээгдэх эрчим хүчний бодлогын талаар мэдэхгүй)

5. Та сэргээгдэх эрчим хүчний тухай хүмүүстэй (гэр бүл, найз нөхөд, хамт олон гэх мэт) ярилцдаг уу?
    а. Үгүй (сүүлийн нэг жилд энэ талаар ярилцаагүй)
    б. Хааяа (жилд хэдхэн удаа)
    в. Тогтмол (сар болгон)
    г. Байнга (дор хаяж долоо хоногт нэг удаа)

6. Хүмүүс сэргээгдэх эрчим хүчний талаар илүү их мэдэх хэрэгтэй гэж боддог уу? (Яагаад гэдгийг тайлбарлана уу)
    а. Тийм
    б. Үгүй

    _____

7. Хэрэв 6-р асуултад тийм гэж хариулсан бол хүмүүсийн мэдлэг, мэдээллийг хэрхэн нэмэгдүүлэх хэрэгтэй гэж бодож байна вэ?
    а. Засгийн газраас олон нийтийг хамарсан үйл ажиллагаа явуулах
    б. Төрийн бус байгууллага/иргэний хөдөлгөөн олон нийтийг хамарсан үйл ажиллагаа явуулах
    в. Хүмүүсийн хооронд харилцан яриа зохион байгуулах
    г. Сургуульд хөтөлбөр болгож оруулах

8. Эрчим хүчний яамнаас тавьсан 2030 он гэхэд сэргээгдэх эрчим хүчний үйлдвэрлэл/эзлэх хэмжээг 30 хувьд хүргэх зорилтын талаар та юу гэж бодож байна вэ?
    а. Биелэх боломжтой
    б. Биелэх боломжгүй
    в. Өөр (тайлбарлана уу)

    _____

9. Та сэргээгдэх эрчим хүчний талаар мэдээлэл авч байсан уу?
    а. Үгүй
    б. Тийм (тийм дугуйлсан бол ямар мэдээлэл авч байснаа тайлбарлана уу)

    _____

10. Та сэргээгдэх эрчим хүч хэрэглэж байсан туршлага байгаа юу?
    а. Үгүй
    б. Тийм (хэрхэн ашиглаж байснаа тайлбарлана уу)

    _____

Танд баярлалаа!

Appendix E

Survey II [English]

Gender:
Age:
Place of residence:
Name (optional):

1. How much do you know about the electricity grid in Mongolia?
   a. A lot (familiar with most policies and laws relating to the electricity grid)
   b. Some (somewhat aware of electricity grid systems)
   c. Not very much (mostly or entirely unaware of policy relating to the electricity grid)

2. What is your perception of Mongolia's current energy system?
   a. Sustainable (will continue functioning in the long-term)
   b. Unsustainable (will need to undergo change)
   c. Other (please explain below)

3. How do you feel about Mongolia's current energy systems?
   a. Satisfied
   b. Unsatisfied (please explain why)

4. How much do you know about renewable energy policy in Mongolia?
   a. A lot (familiar with most policies and laws relating to renewable energy)
   b. Some (somewhat aware of renewable energy policy)
   c. Not very much (mostly or entirely unaware of renewable energy policy)

5. How often do you talk about renewable energy with people (family, friends, coworkers, etc.)?
   a. Never (no conversations within the past year)
   b. Infrequently (a few times a year)
   c. Frequently (about every month)
   d. Often (at least once a week)

6. Do you think that people should know more about renewable energy (please explain why)?
   a. Yes
   b. No

7. If you answered yes to #6, how do you think public awareness about renewable energy should be improved?
   a. Government campaigns
   b. Campaigns from NGOs/civil society
   c. Organic conversations between people
   d. Education/curricula in schools

8. What do you think of the government's goal to have 30% of its energy sourced renewably by 2030?
   a. Realistic
   b. Unrealistic
   c. Other

9. Have you received any education about renewable energy?
   a. Yes
   b. No

10. Have you ever utilized renewable energy in your own life?
    a. No
    b. Yes (if yes, please explain how)

Appendix F

Survey II results

Code	City	Context	Survey date	Sex	Age	1. How much do you know about the electricity grid in Mongolia?	2. What is your perception of Mongolia's current energy system?	3. How do you feel about Mongolia's current energy systems?	4. How much do you know about renewable energy policy in Mongolia?	5. How often do you talk about renewable energy with people (family, friends, coworkers, etc.)?	6. Do you think that people should know more about renewable energy (please explain why)?	7. If you ans you think pu renewable e improved?
IIH-NP1	Hatgal	ADB/Ministry of Enviro offices	22-May	M	40	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	a. Satisfied	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	а/г
IIH-NP2	Hatgal	ADB/Ministry of Enviro offices	22-May	F	48	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	a. Satisfied	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	б. Campaigns
IIH-NP3	Hatgal	ADB/Ministry of Enviro offices	22-May	F	30	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	в. Not very much (mostly or entirely unaware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	a. Governme
IIH-NP4	Hatgal	ADB/Ministry of Enviro offices	22-May	F	45	в. Not very much (mostly or entirely unaware of policy relating to the electricity grid)	a. Sustainable (will continue functioning in the long-term)	б. Unsatisfied (please explain why)	в. Not very much (mostly or entirely unaware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	а/б
IH-NP5	Hatgal	ADB/Ministry of Enviro offices	22-May	M	45	a. A lot (familiar with most policies and laws relating to the electricity grid)	a. Sustainable (will continue functioning in the long-term)	a. Satisfied	в. Not very much (mostly or entirely unaware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	б. Campaigns
IIH-NP6	Hatgal	ADB/Ministry of Enviro offices	22-May	M	24	в. Not very much (mostly or entirely unaware of policy relating to the electricity grid)	б. Unsustainable (will need to undergo change)	a. Satisfied	в. Not very much (mostly or entirely unaware of renewable energy policy)	a. Never (no conversations	a. Yes	в. Organic co people

											within the past year)		
IIH-NP7	Hatgal	ADB/Ministry of Enviro offices	22-May	M		в. Not very much (mostly or entirely unaware of policy relating to the electricity grid)	в. Other (please explain below)	б. Unsatisfied (please explain why)	в. Not very much (mostly or entirely unaware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	a. Governme
IIH-NP8	Hatgal	ADB/Ministry of Enviro offices	22-May	F	23	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	а/б/в/г
IIU-1	UB	Park	24-May			б. Some (somewhat aware of electricity grid systems)	a. Sustainable (will continue functioning in the long-term)	a. Satisfied	б. Some (somewhat aware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	a. Governme
IIU-2	UB	Park	24-May	M	27	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	б. Some (somewhat aware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	a. Governme
IIU-3	UB	Park	24-May			–	–	a. Satisfied	б. Some (somewhat aware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	в. Organic co people
IIU-4	UB	Park	24-May	M	28	в. Not very much (mostly or entirely unaware of policy relating to the electricity grid)	a. Sustainable (will continue functioning in the long-term)	a. Satisfied	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	г. Education/
IIU-5	UB	Park	24-May	F	26	в. Not very much (mostly or entirely unaware of policy relating to the electricity grid)	a. Sustainable (will continue functioning in the long-term)	a. Satisfied	в. Not very much (mostly or entirely unaware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	a. Governme
IIU-6	UB	Man on bus	24-May	M	33	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	а/г
IIU-7	UB	Taxi driver	24-May	M	>40	a. A lot (familiar with most policies and laws relating to the electricity grid)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	в. Not very much (mostly or entirely unaware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	а/б/г
IIU-8	UB	Taxi driver	24-May	M	43	–	–	a. Satisfied	a. A lot (familiar with most policies and laws relating to renewable energy)	a. Never (no conversations within the past year)	a. Yes	г. Education/
IIU-9	UB	Library	24-May	M	34	в. Not very much (mostly or entirely unaware of policy relating to the electricity grid)		a. Satisfied	б. Some (somewhat aware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	б. Campaigns
IIU-10	UB	Library	24-May	F	>40	в. Not very much (mostly or entirely unaware of policy relating to the electricity grid)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	в. Not very much (mostly or entirely unaware of renewable energy policy)	в. Frequently (about every month)	a. Yes	в. Organic co people

IIU-11	UB	Outside school	24-May	M	35	б. Some (somewhat aware of electricity grid systems)	a. Sustainable (will continue functioning in the long-term)	a. Satisfied	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	б. Campaigns
IIU-12	UB	Outside school	24-May	F	42	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	а/г
IIU-15	UB	Outside school	24-May	M	32	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	a. Satisfied	–	б. Infrequently (a few times a year)	a. Yes	a. Governme
IIU-16	UB	Outside school	24-May	M	47	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	а/б/в/г
IIU-17	UB	Outside school	24-May	M	26	б. Some (somewhat aware of electricity grid systems)	a. Sustainable (will continue functioning in the long-term)	a. Satisfied	б. Some (somewhat aware of renewable energy policy)	в. Frequently (about every month)	a. Yes	б. Campaigns
IIU-GD1	UB	Ger district	24-May	M	34	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	а/б/в/г
IIU-GD2	UB	Ger district	24-May	M	27	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	в. Organic co people
IIU-GD3	UB	Ger district	24-May	M	>50	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)		в. Not very much (mostly or entirely unaware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	а/б
IIU-S1	UB	School	24-May	F	26	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	в. Not very much (mostly or entirely unaware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	а/б/в/г
IIU-S2	UB	School	24-May	M	~30	в. Not very much (mostly or entirely unaware of policy relating to the electricity grid)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	в. Not very much (mostly or entirely unaware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	б. Campaigns
IIU-S3	UB	School	24-May			в. Not very much (mostly or entirely unaware of policy relating to the electricity grid)	a. Sustainable (will continue functioning in the long-term)	a. Satisfied	в. Not very much (mostly or entirely unaware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	a. Governme
IIU-S5	UB	School	24-May	M	28	б. Some (somewhat aware of electricity grid systems)	a. Sustainable (will continue functioning in the long-term)	a. Satisfied	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	a. Governme
IIU-S6	UB	School	24-May	M	23	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	a. Satisfied	б. Some (somewhat aware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	a. Governme
IIU-S7	UB	School	24-May	M	33	a. A lot (familiar with most policies and laws relating to the electricity grid)	б. Unsustainable (will need to undergo change)	a. Satisfied	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	a. Governme

IIU-S8	UB	School	24-May	F	49	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	а/б
IIU-S9	UB	School	24-May			б. Some (somewhat aware of electricity grid systems)		б. Unsatisfied (please explain why)	б. Some (somewhat aware of renewable energy policy)	б. Infrequently (a few times a year)	a. Yes	а. Governme
IIU-S10	UB	School	24-May	M	23	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	a. Satisfied	б. Some (somewhat aware of renewable energy policy)	в. Frequently (about every month)	a. Yes	а. Governme
IIU-13	UB	Outside school	24-May		47	б. Some (somewhat aware of electricity grid systems)	a. Sustainable (will continue functioning in the long-term)	a. Satisfied	в. Not very much (mostly or entirely unaware of renewable energy policy)	б. Infrequently (a few times a year)	б. No	а. Governme
IIU-14	UB	Outside school	24-May		50	б. Some (somewhat aware of electricity grid systems)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	б. Some (somewhat aware of renewable energy policy)	a. Never (no conversations within the past year)	б. No	в. Organic co people
IIU-S4	UB	School	24-May	M	25	в. Not very much (mostly or entirely unaware of policy relating to the electricity grid)	б. Unsustainable (will need to undergo change)	б. Unsatisfied (please explain why)	в. Not very much (mostly or entirely unaware of renewable energy policy)	б. Infrequently (a few times a year)	б. No	в. Organic co people

Appendix G

Survey codes

Codes for Survey I

City	Specific location	Code	# Surveyed
Darkhan	Gers/homes next to Darkhan Solar Plant	ID-GD#	5
	Bag government offices	ID-BG#	7
	Ministry of Environment and Tourism	ID-MNE#	6
	Local market	ID-M#	17
Salkhit	Homes in general vicinity of wind farm	IS-N#	8
	Homes at the base of the wind farm	IS-WF#	13
Total			56

Codes for Survey II

City	Specific location	Code	# Surveyed
Hatgal	Offices within Lake Huvsgul National Park	IIH-NP#	8
Ulaanbaatar	Unspecified location	IIU-#	17
	Ger district	IIU-GD#	3
	School 2	IIU-S#	10
Total			38

Appendix H
Interview Questions

Solar Power International

1. What is your name?
2. What is your occupation?
3. How long have you had your current job?
4. What is your experience with renewable energy?
5. What do you see as the future of renewable energy in Mongolia?
    a. Bigger projects (like Darkhan)
    b. Smaller projects (like for single families)
6. Do you think the RE industry will ever become mostly private?
7. Public outreach efforts?
8. How did you get involved with RE?
9. Other contacts?

Darkhan MET

10. What is your name?
11. What is your occupation?
12. Has your job ever involved renewable energy?
13. If yes ^^, how has your job involved RE?
14. What do you see as the future of renewable energy in Mongolia?
    a. Bigger projects (like Darkhan)
    b. Smaller projects (like for single families)
15. In the future, do you think Mongolia will be able to stop relying on foreign companies for help with renewable projects?
16. How informed do you think the public is about renewable energy?
17. What do you think of the government's plan to increase renewable energy projects?
18. Thank you – do you recommend I talk with anyone else?

General

4.1.1 What is your occupation?
4.1.2 How long have you had your current job?
4.1.3 What is your experience with renewable energy?
4.1.4 When did you first learn about renewable energy?
4.1.5 How do you see the renewable energy sector intersecting with other areas of environmental policy in Mongolia?