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Accounting for Intermediaries and Transnational Linkages in the Multi-Level Perspective: Mongolia's Renewable Energy Transition

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Acronym List

ADB	Asian Development Bank
ASG	Asia Super Grid
CDM	Clean Development Mechanism
CER	Certified emission reduction
CHP	Combined heating and power plant
COP	Conference of Parties
CSO	Civil society organization
DOE	Department of Energy
EBRD	European Bank for Reconstruction and Development
FCCC	Framework Convention on Climate Change
FDI	Foreign direct investment
FIT	Feed-in tariff
GCF	Green Climate Fund
GDP	Gross domestic product
GEF	Global Environment Facility
GGGI	Global Green Growth Initiative
GHGs	Greenhouse gases
GoM	Government of Mongolia
GWh	Gigawatt hour
HPP	Hydropower plant
IEA	International Energy Agency
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IPRs	Intellectual property rights
IRENA	International Renewable Energy Agency
JICA	Japan International Cooperation Agency
MDB	Multilateral development bank
MT CO_2e	Metric tons of carbon dioxide equivalent
MW	Megawatt
NAMAs	Nationally Appropriate Mitigation Actions
NHRE	Non-hydropower renewable energy
NREL	National Renewable Energy Laboratory
ODA	Official development assistance
OT	Oyu Tolgoi
PC	Pulverized coal
PV	Photovoltaic
R&D	Research and development
RE	Renewable energy
RET	Renewable energy technology
RPS	Renewable portfolio standard
SBA	Stand-by arrangement
SDGs	Sustainable Development Goals
SNM	Strategic Niche Management

TAP	Technology action plan
TIS	Technological innovation systems
TM	Transition management
TPP	Thermal power plant
TRIPS	Trade-Related Aspects of Intellectual Property Rights
TW	Terawatt
TWh	Terawatt hour
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

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Introduction

As the international community has gradually concluded that development and sustainability are far from mutually exclusive, attention has been devoted towards examining how to initiate sustainable development processes. Sustainable development as a concept was first defined in a report released by the Brundtland Commission in 1987 titled "Our Common Future" as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[1] The concept was elaborated upon in 1992 at the UN Conference on Environment and Development, known as the Rio Earth Summit, out of which came some of the most defining international environmental conventions to this day: Agenda 21, the Rio Declaration on Environment and Development, the Statement of Forest Principles, the United Nations Framework Convention on Climate Change (FCCC), and the UN Convention on Biological Diversity.[2]

While there are many policy options for those looking to pursue sustainable development agendas, the energy sector is often at the forefront of conversations regarding sustainable development. One of the primary contributors to GHG emissions, and consequently, climate change, is the energy sector: the Intergovernmental Panel on Climate Change's (IPCC) 2014 Fifth Assessment Report states that "Emissions of CO_2 from fossil fuel combustion and industrial processes contribute about 78& of the total GHG [greenhouse gas] emissions increase from 1970 to 2010."[3] Whereas energy systems

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[1] Brundtland Commission, *Our Common Future* (Oxford University Press, 1987).
[2] "United Nations Conference on Environment and Development (1992)," *United Nations*, last modified May 23, 1997, accessed November 11, 2018, http://www.un.org/geninfo/bp/enviro.html.
[3] O. Edenhofer et al., eds., "Summary for Policymakers," in *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel*

fueled by the combustion fossil fuels release immense amounts of GHG emissions into the atmosphere, renewable energy systems, .

A report released by the Intergovernmental Panel on Climate Change (IPCC) in October 2018 states that the most important step that the international community must take to address the acceleration of climate change is to confront existing unsustainable energy systems.[4] Thus, countries have increasingly looked to renewable energy technologies as the effects of climate change become more catastrophic: the Renewable Energy Policy Network for the 21st Century, which tracks renewable energy policies worldwide, reported that the number of countries with either a renewable energy target increased from 45 in 2010 to 179 in 2017.[5]

As the impetus to expand global renewable energy resources grows, renewable energy technologies are simultaneously becoming feasible for all, rather than only developed, countries. The term "sustainable energy" has become paramount in the push for sustainable development. While widely defined, sustainable energy sources "are affordable, safe, and available in sufficient quantity to enable continued economic and social development while promoting environmental stewardship."[6] Energy sources that are commonly considered sustainable are wind, solar, hydro, geothermal, and biomass. A

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on Climate Change (Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press, 2014), 5.

[4] Coral Davenport, "Major Climate Report Describes a Strong Risk of Crisis as Early as 2040," *The New York Times*, October 15, 2018, sec. Climate, accessed November 14, 2018, https://www.nytimes.com/2018/10/07/climate/ipcc-climate-report-2040.html.

[5] *Renewables 2005 Global Status Report* (Washington, DC, USA and Paris, France: Worldwatch Institute and Renewable Energy Policy Network for the 21st Century, 2005), 19; *Renewables 2018 Global Status Report* (Paris, France: REN21 Secretariat, 2018), 19.

[6] *Building a Sustainable Energy Future* (National Science Board, April 10, 2009), 9, accessed November 2, 2018, https://www.nsf.gov/nsb/publications/2009/comments_se_report.pdf.

number of other terms are used to refer to sustainable energy sources, such as low-carbon and renewable sources.

Renewable energy technologies are especially critical considering steadily-rising demand for electricity worldwide. With rapid population growth, the Organization for Economic Cooperation and Development (OECD) estimates in the *World Energy Outlook 2018* under its New Policies Scenario that global energy demand is set to increase by more than 25% by 2040.[7] The report also states that as solar photovoltaic energy becomes more competitive, its installed capacity will eclipse that of wind before 2025, hydropower around 2030, and coal before 2040. Additionally, some models project that coal has seen its heyday; under the New Policies Scenario, "a rising tide of electricity, renewables, and efficiency improvements stems growth in coal consumption."[8]

In order for the international community to successfully shift away from fossil fuel energy sources towards renewable options, significant resources must be allocated towards the process of energy transitions. While there are multiple terms often used in conjunction with energy transition, such as sustainability or low-carbon transition, energy transition will be defined as "a change in the state of an energy system as opposed to a change in individual energy technology or fuel source."[9] The field of energy transitions encompasses a wide swath of intersecting disciplines, pulling from social, economic, environmental, technological, and cultural perspectives. This research was borne out of

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[7] *World Energy Outlook 2018: Executive Summary* (International Energy Agency, November 2018), 1.
[8] Ibid., 3.
[9] Arnulf Grubler, Charlie Wilson, and Gregory Nemet, "Apples, Oranges, and Consistent Comparisons of the Temporal Dynamics of Energy Transitions," *Energy Research & Social Science* 22 (December 1, 2016): 18.

studying energy transitions mainly in developed, Western nations, with a focus on entire system transitions. Research on the dynamics of long-term shifts in society's use of energy resources has been ongoing since at least the 1960s.[10]

Academia discussing the process of energy transitions incorporates extensive theories on topics such as sociotechnical change, technology diffusion, and energy transitions more broadly. These theories parse out actors involved in transitions and the dynamics governing their actions in different ways, assigning agency to a variety of stakeholders from government to the private sector.

Yet even though the international community has reached a consensus on the importance of shifting the makeup of global energy systems away from fossil fuels and towards renewables, there is a notable lack of progress, especially in developing countries. Energy transitions have been successfully completed in developed nations with ample technical and economic resources; all countries in the Group of 20 (G20) had, as of 2017, implemented policies supporting power generation from large-scale renewable energy systems.[11] There is no dearth of knowledge and technical expertise regarding the necessary processes to implement renewable energy systems; the technology and innovations are confirmed to work. Rather, a lack of understanding of the factors not merely technical impedes the successful diffusion of renewable energy systems: "While several authors point to the central importance of understanding the political and socio-cultural dimensions to the technological transition taking place across developing

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[10] Aleh Cherp et al., "Integrating Techno-Economic, Socio-Technical and Political Perspectives on National Energy Transitions: A Meta-Theoretical Framework," *Energy Research & Social Science* 37 (March 1, 2018): 176.

[11] IRENA, *Opportunities to Accelerate National Energy Transitions through Enhanced Deployment of Renewables*, (Report to the G20 Energy Transitions Working Group) (Abu Dhabi: International Renewable Energy Agency, 2018), 15.

countries, few authors have explored these aspects in empirical depth."[12] Considering that empirical analysis has been primarily in terms of technology and economics, "[w]ork on the political aspects . . . is almost non-existent, save for a handful of contributions dealing with energy, climate change, and development more broadly."[13] A lack of empirical evidence regarding the policy and societal processes necessary to facilitate low carbon technology transfer has resulted in "policy rhetoric on low carbon technology . . . fail[ing] to reflect the reality of how technology transfer can be achieved."[14]

Many have found that frameworks originally constructed to analyze ongoing societal transitions in Western, developed nations fall short of sufficiently accounting for the unique variables and challenges faced by developing countries.[15] Developing countries across the globe are in the process of implementing their own renewable energy systems, and must navigate a myriad of competing actors, interests, and policy realities. Research on transitions in developing countries has substantially grown in the past ten years, specifically in Asian and African countries, such as India, China, South Africa, and Tanzania.[16]

One of such countries attempting to shift the makeup of its energy system towards renewable sources is the central-Asian nation of Mongolia. The ongoing energy transition in Mongolia is but a microcosm of a larger shift in development towards ensuring that as

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[12] David Ockwell et al., "The Uptake and Diffusion of Solar Power in Africa: Socio-Cultural and Political Insights on a Rapidly Emerging Socio-Technical Transition," *Energy Research & Social Science* 44 (October 1, 2018): 123.
[13] Ibid.
[14] Mahesh Sugathan and Muthukumara S. Mani, "The Role of Trade and Investment in Accelerating Clean Energy Diffusion: Private-Sector Views from South Asia," in *Low-Carbon Technology Transfer: From Rhetoric to Reality*, ed. David G. Ockwell and Alexandra Mallett, First. (London: Routledge, 2012), 5.
[15] Anna J. Wieczorek, "Sustainability Transitions in Developing Countries: Major Insights and Their Implications for Research and Policy," *Environmental Science & Policy* 84 (June 1, 2018): 204–216.
[16] Ibid., 211.

energy system interventions are undertaken in developing countries, they take into account two underlying considerations: development and climate.[17] There has been little research done on the diffusion of renewable energy technologies in Mongolia in particular, specifically using the methods and frameworks common for analyzing energy transitions. Mongolia is classified by the World Bank as a lower middle-income country; electricity in Mongolia is primarily generated by coal fired power plants constructed in the mid-1900s during Mongolia's Soviet rule. [18] These power plants are unsustainable, and discussions to replace them have been ongoing for decades.[19]

According to Mongolia's National Statistics Office, the population of Mongolia in 2017 population was 3,177,899 across Mongolia's 603,909 square miles, making it one of the least densely populated (by some accounts, the least densely populated) countries in the world.[20] Out of the total population, 1,462,973 are estimated to live in Ulaanbaatar, the capital of Mongolia.[21] The rest of the population is primarily nomadic, residing across the country throughout Mongolia's 21 *aimags* (provinces).

For Mongolia in particular, undertaking an energy transition towards renewable energy systems is pragmatic. In 2001, the U.S. Department of Energy's (DOE) Natural Renewable Energy Laboratory (NREL) released the "Wind Energy Resource Atlas of Mongolia," detailing the wind resources in all provinces in Mongolia as well as potential

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[17] Laurence Delina, "Multilateral Development Banking in a Fragmented Climate System: Shifting Priorities in Energy Finance at the Asian Development Bank," *International Environmental Agreements: Politics, Law and Economics; Dordrecht* 17, no. 1 (2017): 75.
[18] "Mongolia | Data," *World Bank Data*, accessed October 3, 2018, https://data.worldbank.org/country/mongolia.
[19] *Third National Communication of Mongolia Under the United Nations Framework Convention on Climate Change* (Ulaanbaatar: Ministry of Environment and Tourism, May 2018).
[20] "Mongolia," *Central Intelligence Agency: The World Factbook*, accessed November 4, 2018, https://www.cia.gov/library/publications/the-world-factbook/geos/mg.html.
[21] Үндэсний Статистикийн Хороо, "Хүн Ам," *Үндэсний Статистикийн Хороо*, accessed December 15, 2018, http://1212.mn/Stat.aspx?LIST_ID=976_L03.

sites for prospective wind energy projects. Sponsored by the DOE and the U.S. Agency for International Development (USAID), the Atlas was meant to "help accelerate the large-scale use of wind energy technologies in Mongolia."[22] The NREL found that about 10% of Mongolia (equivalent to 160,000 km^2) has "good-to-excellent wind potential for utility scale applications" (Figure 1).[23] NREL estimates Mongolia's total renewable

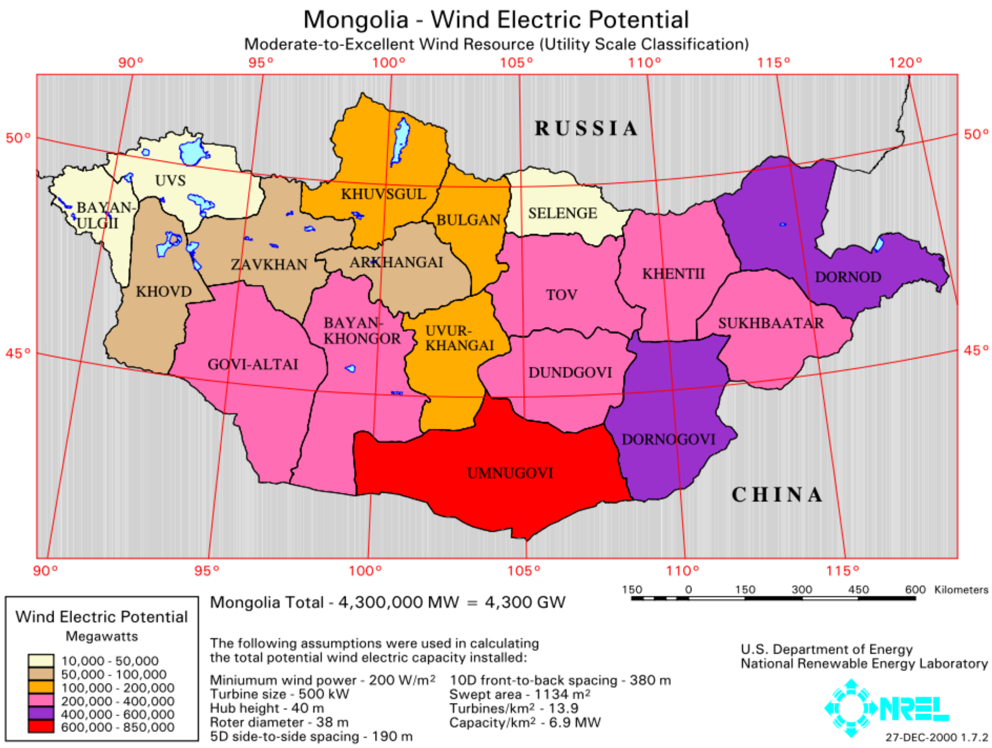

Fig. 1. Wind electric potential of Mongolia (Wind Energy Resource Atlas of Mongolia, 2001).

energy potential to be 2.6 terawatts (TW), with a potential electricity output from the country's solar and wind resources combined of 15,000 terawatt-hours (TWh) per year. This output would be "enough to meet the total electricity demand of neighbouring China

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[22] D Elliott et al., *Wind Energy Resource Atlas of Mongolia* (National Renewable Energy Laboratory, 2001), 1.
[23] Ibid., x.

in 2030."[24] Additionally, while Mongolia's experience with large-scale renewable energy systems is limited, small-scale systems (such as standalone solar panels) exist across the country, particularly in rural and nomadic households.[25]

Increased utilization of renewable energy sources is advantageous to Mongolia for multiple reasons. Mongolia has been dramatically affected by climate change. A study by the Asian Development Bank (ADB) found that under the "business-as-usual (BAU) scenario in which current patterns of development continue," Mongolia will be the country most severely affected in terms of percentage loss of annual gross domestic product (GDP) due to climate change.[26] With climate change, both the magnitude and frequency of extreme weather events will likely increase; these events include both droughts and *dzuds*, which are "[e]xtreme weather event[s] or condition[s] that can be caused by sudden heavy snowfall, long-lasting or frequent snowfall, extreme cold or ice, or storms that cause often massive livestock deaths from hunger, exhaustion, and cold."[27] Herders also report experiencing other effects of climate change, such as overall decreases in precipitation, including the earlier melting of snow; decreases in both biodiversity and the number of pasture plant species; and the drying up of rivers, lakes and springs.[28]

For the Mongolian government, developing renewable energy technologies advances multiple policy priorities, such as increasing access to electricity, bolstering the country's

[24] Yong Chen, Gürbüz Gönül, and Makhbal Tumenjargal, *Mongolia: Renewables Readiness Assessment*, 2016, XIV.
[25] "Projects: Renewable Energy for Rural Access Project (REAP)," *World Bank*, last modified 2013, http://projects.worldbank.org/P099321/renewable-energy-rural-access-project-reap?lang=en.
[26] Michael Westphal, *Economics of Climate Change in East Asia* (Asian Development Bank, 2013), 154.
[27] Asian Development Bank, *Making Grasslands Sustainable in Mongolia: Adapting to Climate and Environmental Change* (Mandaluyong City, Philippines: Asian Development Bank, 2013), x.
[28] Ibid.

sustainability, mitigating hazards existing from the current reliance on coal, and positioning Mongolia as a serious participant within the growing global renewable energy market.

This paper will analyze Mongolia's ongoing energy transition using socio-technical theory, specifically, the Multi-Level Perspective (MLP). The literature review will discuss ongoing societal discussions about sustainable development and the undertaking of energy transitions, as well as socio-technical frameworks commonly drawn on to analyze such transitions. Chapter II will explore the application of the MLP to developing countries' energy transitions in particular, noting the theory's shortcomings in describing these transitions and looking at proposals to make the MLP more accommodating. Chapters III through V will employ the MLP to examine Mongolia's ongoing energy transition towards renewable energy systems and additionally consider discrepancies between Mongolia's own experiences and the trajectory described by the MLP. Finally, Chapter VI will supplement information in previous chapters by introducing data collected from surveys disseminated in locations throughout Mongolia.

Methodology

Research for this thesis was conducted primarily using online and print resources. One of the main limitations for this thesis was the limited availability of online and up-to-date resources on the status and details of Mongolia's ongoing energy transition. In order to account for these informational gaps, in-person surveys and interviews were additionally conducted in Mongolia in two phases—May 2017 and March 2019. The survey process, which took place in May 2017, is discussed in Chapter VI. Interviews were conducted in both May 2017 and March 2019. The second phase of interviews were conducted in Ulaanbaatar from March 19, 2019 to March 22, 2019. Interviewees were identified with assistance from employees from the School for International Training, as well as prior connections established during the first interview phase. Survey and interview (in May 2017) research was approved by the Local Review Board. Interviews conducted in March 2019 were exempt from review by the Institutional Review Board at Claremont McKenna College.

Chapter I: Literature Review

The question of how to achieve "sustainable development" has posed a monumental challenge for the international community since the term was initially defined in 1987. At the forefront of this challenge are questions regarding the relative responsibility, obligation, and action of each actor in the international community towards achieving the elusive goal of sustainable development.

The international community has attempted for decades to unite for the purpose of facilitating "development." At the Millennium Summit in 2000, members of the UN adopted the United Nations Millennium Declaration, which sought overall to reduce extreme poverty worldwide by 2015.[29] Following the conclusion of the Summit, the goals specified in the Declaration became known as the eight Millennium Development Goals (MDGs): to eradicate extreme poverty and hunger, achieve universal primary education, promote gender equality and empower women, reduce child mortality, improve maternal health, combat HIV/AIDS, malaria and other diseases, ensure environmental sustainability, and form a global partnership for development.[30]

Considering that the time period established for the MDGs ended in 2015, the UN decided in 2012 to develop post-2015 goals to build on the MDGs, which prompted the formation and adoption of the 17 Sustainable Development Goals (SDGs) in 2015. The SDGs aim to encompass the multi-faceted nature of sustainable development as an overarching target—rather than being centered around a focus of ending extreme poverty, the goals call for implementing strategies to improve and address healthcare, inequality,

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[29] United Nations General Assembly, "A/RES/55/2 'United Nations Millenium Declaration'" (United Nations, September 18, 2000).
[30] "United Nations Conferences, Meetings and Events: Millennium Summit," *United Nations*, accessed April 23, 2019, https://www.un.org/en/events/pastevents/millennium_summit.shtml.

infrastructure, economic growth, environmental challenges, and more, recognizing that these strategies must be highly interconnected.[31]

The interconnectedness of sustainable development issues demands a corresponding interconnectedness amongst engaged actors. For a solution to be implemented, it must be both approved and forged by not only all levels of government, but the private sector, civil society, and the general populous as well. Actors within transitions can include community members, the media, officials at every level of government, civil society groups, and advisory bodies, all of which are motivated by not just "cost-benefit calculations but also entrenched beliefs, conflicting values, competing interests, unequal resources, and complex social relations."[32] The vast number and relative position of stakeholders means that in addition to the diffusion of new technologies, successful implementation of low-carbon technologies involves "changes in user practices, cultural discourses, and broader political struggles."[33] There is widespread contention between relevant actors as to best practices for implementing low-carbon solutions, which is exacerbated by the knowledge that technologies will only be successfully adopted if they both "successfully harness technical principles" *and* align with relevant social norms.[34]

An additional challenge is posed by the existential motivation driving many sustainable development processes, in particular, energy transitions. Due to the underlying intent of mitigating climate change (which demands high levels of coordination) driving low-carbon transitions, such transitions are purposive, or goal-

[31] United Nations, "Sustainable Development Goals," *Sustainable Development Knowledge Platform*, accessed April 23, 2019, https://sustainabledevelopment.un.org/sdgs.
[32] Frank W. Geels et al., "The Socio-Technical Dynamics of Low-Carbon Transitions," *Joule* 1, no. 3 (2017): 463.
[33] Ibid., 464.
[34] Ibid.; Sugathan and Mani, "The Role of Trade and Investment in Accelerating Clean Energy Diffusion: Private-Sector Views from South Asia," 10.

oriented, rather than emergent, or uncoordinated, as historical transitions have been.[35] This means that actors involved already have some sort of pre-determined vision as to what the transition should accomplish, which due to the large number of actors involved, can result in tension between opposing agendas.

That sustainable energy transitions are often initiated as a means to mitigate the effects of climate change also adds a unique dimension of temporal pressure to the transitions. This precludes many processes involved in transitions, including low-carbon technology transfer, from happening at the pace of natural market and innovation processes.[36] Historically, energy transitions are considered to take decades, potentially even longer than a century, to fully unfold.[37] While the timeline of a transition highly depends on the relative definitions and position of whomever is defining the transition, it is commonly accepted that society's transition to clean energy sources must happen at a pace far more rapid than we have traditionally been accustomed to.[38]

Energy transitions are also hindered by the economic nature of the climate change problem, in that the responsibility for dealing with climate change is a tragedy of the commons. The ultimate goal of low-carbon technology transfer is to deliver a public good

[35] Adrian Smith, Andy Stirling, and Frans Berkhout, "The Governance of Sustainable Socio-Technical Transitions," *Research Policy* 34, no. 10 (December 1, 2005): 1501–1502.
[36] Sugathan and Mani, "The Role of Trade and Investment in Accelerating Clean Energy Diffusion: Private-Sector Views from South Asia," 7.
[37] Arnulf Grubler, "Energy Transitions Research: Insights and Cautionary Tales," *Energy Policy* 50, Special Section: Past and Prospective Energy Transitions - Insights from History (November 1, 2012): 11.
[38] Benjamin K. Sovacool, "How Long Will It Take? Conceptualizing the Temporal Dynamics of Energy Transitions," *Energy Research & Social Science* 13, Energy Transitions in Europe: Emerging Challenges, Innovative Approaches, and Possible Solutions (March 1, 2016): 202, 211.

(such as climate change mitigation), but the transfer itself must be incentivized "in the absence of an obvious market."[39]

Additional barriers to sustainable energy transitions in developing countries exist beyond those realized by the nature of the climate change problem. Barriers posed by any traditional energy transition are exacerbated by the limited institutional capacity of many developing countries, requiring technology transfer to simultaneously occur both horizontally (between countries) and vertically (from research stages to implementation or research and development), whereas for many developed countries, this transfer would occur only vertically.[40] Other broad categories of barriers include market structure, infrastructure, financial, institutional, interaction, technological, behavioral, political, and more.[41] Many scholars have devoted attention to identifying both barriers to renewable energy diffusion and potential strategies for overcoming these barriers.[42]

I.1 Theory on Transitions

Given that the challenges posed by the prospect of sustainable development are so broad, scholars have turned to theoretical frameworks to help dissect and clarify the ongoing dynamics present in such challenges. This allows sustainable development to be viewed not only as a nebulous, ideological ideal, but rather as a logical process that can be approached systematically and analytically wherein society is transitioning from using incumbent to novel systems. Transitions have been widely studied; a transition can be

[39] Sugathan and Mani, "The Role of Trade and Investment in Accelerating Clean Energy Diffusion: Private-Sector Views from South Asia," 7.
[40] Ibid.
[41] Ingrid Mignon and Anna Bergek, "System- and Actor-Level Challenges for Diffusion of Renewable Electricity Technologies: An International Comparison," *Journal of Cleaner Production* 128 (August 1, 2016): 107.
[42] J.P. Painuly, "Barriers to Renewable Energy Penetration; a Framework for Analysis," *Renewable Energy* 24 (2001): 73–89.

defined as a "radical, structural change of a societal (sub)system that is the result of a co-evolution of economic, cultural, technological, ecological and institutional developments at different scale-levels."[43] Transitions are required to address persistent problems "related to systemic failures that have crept into our societal systems, which, contrary to market failures, cannot be corrected by the market or conventional policies."[44] Due to the fact that "[t]ransitions involve mutually coherent changes in practices and structures," the nature of transitions is both complex and comprehensive.[45] Literature on sustainability transitions has increased as efforts to identify the best pathways towards addressing social, economic, and ecological challenges have increased. The multi-faceted nature of these challenges requires an approach that fully takes into account all parts of the existing systems that society seeks to change. Moreover, these systems themselves are complex—transitions aim to uproot existing structures related to energy, healthcare, education, food, mobility, and more.[46]

The complexity of transition processes has led to the development of many approaches to describe the interrelated parts of transitions. A commonly-used overarching framework to describe transitions is the multi-phase concept, which is derived from complex adaptive systems theory.[47] This framework describes transitions in four phases—predevelopment, take-off, acceleration, and stabilization (Figure 2). In the predevelopment phase, the status quo does not change visibly but there are changes in the background to the former state of equilibrium. The take-off phase occurs when the "state

[43] John Grin, Jan Rotmans, and Johan Schot, *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change* (New York: Routledge, 2010), 108.
[44] Ibid., 108.
[45] Ibid., 3.
[46] Johan Schot and Laur Kanger, "Deep Transitions: Emergence, Acceleration, Stabilization and Directionality," *Research Policy* 47, no. 6 (July 1, 2018): 1045.
[47] Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 4.

of the system begins to shift."[48] In the breakthrough phase, change to the system begins to be visible; these changes can be socio-cultural, economic, ecological, and institutional. This phase involves learning, diffusion, and embedding processes as well. Finally, the stabilization phase occurs when "the speed of social change decreases and a new dynamic equilibrium is reached."[49]

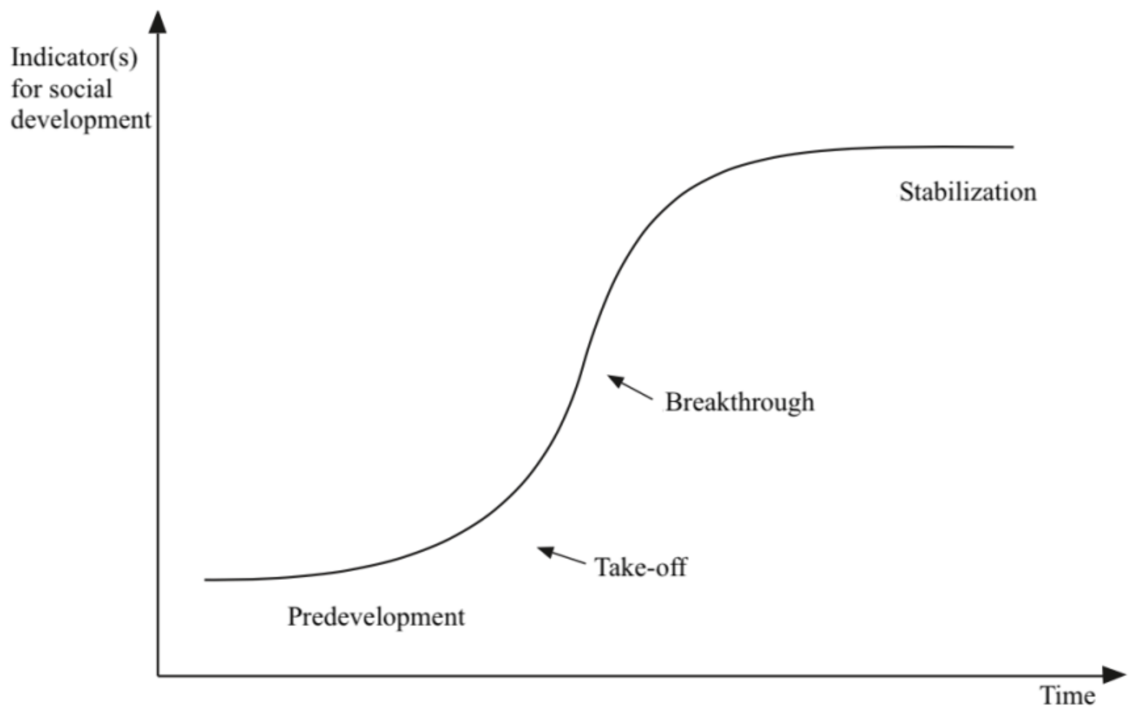

Fig. 2. The different phases of a transition (Adapted from Rotmans et al., 2001:17).

In addition to the multi-phase concept, socio-technical theory has also been applied to explain transitions. The concept of a socio-technical system has been used by many since at least the mid-twentieth century to describe systems, such as those aforementioned, whose operation relies on more than purely technology: "technologies do not fulfil societal functions on their own . . . Only in association with human agency, social

[48] Jan Rotmans, René Kemp, and Marjolein van Asselt, "More Evolution than Revolution: Transition Management in Public Policy," *Foresight* 3, no. 1 (February 1, 2001): 17.
[49] Ibid.

structures and organisations do artefacts fulfil functions."[50] Socio-technical systems are those that, in addition to technology, also take into account socioware, or how societal elements factor into the development of a technology. Socio-technical systems consider both technology and the institutions necessary to facilitate successful diffusion and use of said technology.[51] Sustainability transitions are often discussed as a subset of socio-technical transitions, as they describe the processes through which established socio-technical systems either evolve or are replaced by more sustainable systems.[52]

Energy systems are considered socio-technical due to the fact that while energy infrastructure is, at its core, a technological system, energy infrastructure does not operate autonomously, and requires constant oversight and maintenance from government and industry.[53] Due to the unsustainability of historically-utilized fossil-fuel energy systems, energy is often at the forefront of many conversations regarding sustainability transitions. In the case of a socio-technical transition from a fossil-fuel reliant energy system to a renewable energy system, the persistent problem to be addressed is society's reliance on fossil fuel-driven energy systems.

Theory on socio-technical transitions is rooted historically in concepts from evolutionary economics, sociology, and science and technology studies (STS).[54] Socio-technical transitions are co-evolving (innovative technologies must be developed, put into

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[50] F. W. Geels, *Technological Transitions and System Innovations: A Co-Evolutionary and Socio-Technical Analysis* (Cheltenham, UK: Edward Elgar, 2005), 1.

[51] Thomas Parke Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore and London: Johns Hopkins University Press, 1983), 465; Arie Rip and René Kemp, "Technological change," in *Human choice and climate change. Vol. II, Resources and Technology*, 1998, 331.

[52] Jochen Markard, Rob Raven, and Bernhard Truffer, "Sustainability Transitions: An Emerging Field of Research and Its Prospects," *Research Policy* 41, no. 6, Special Section on Sustainability Transitions (July 1, 2012): 956.

[53] Sugathan and Mani, "The Role of Trade and Investment in Accelerating Clean Energy Diffusion: Private-Sector Views from South Asia," 10.

[54] Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 29.

use, adopted, and ultimately societally embedded), multi-actor, radical (in terms of the innovation required, not the speed of the transition), long-term, and macroscopic.[55]

Socio-technical theory is predicated on historical descriptions detailing the interaction between technology and society, established through STS.[56] The process in which technology is developed is also multi-faceted, and was described by Bruno Latour as "heterogeneous engineering": not only must technology be physically developed, but the process also involves mobilizing resources, creating social networks, constructing markets and necessary regulatory regimes, and developing visions.[57] A similar term, coined by Thomas Hughes, is "seamless web," used to further establish that the evolution processes for society and technology are not separable—the process is one of coevolution.[58]

Beyond socio-technical theories, other disciplines have contributed to the field of energy transitions by proposing alternative frameworks. In addition to socio-technical, frameworks are also categorized as techno-economic or political.[59] The main differences between these frameworks revolve around the academic disciplines that ground each—for techno-economic, this is economics, Earth sciences, and engineering; for socio-technical, this is evolutionary economics, history, and sociology; for political, this is

[55] Ibid., 12–13.
[56] Ibid., 13.
[57] Bruno Latour, *Science in Action: How to Follow Scientists and Engineers Through Society* (Cambridge, MA: Harvard University Press, 1987).
[58] Rip and Kemp, "Technological change," 337; Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 11–12; Thomas P. Hughes, "The Seamless Web: Technology, Science, Etcetera, Etcetera," *Social Studies of Science* 16, no. 2 (1986): 281–292.
[59] These three categories are unique to Cherp et al.'s analysis; other articles analyzing energy transition frameworks utilize different (albeit sharing similarities) categorizations.
Cherp et al., "Integrating Techno-Economic, Socio-Technical and Political Perspectives on National Energy Transitions."

political science.[60] Others advocate for examining energy transitions as other processes (such as a geographical process), yet the main domains through which energy transitions have been examined are those aforementioned.[61]

I.2 Socio-Technical Heuristic Frameworks

Within socio-technical frameworks, four are primarily studied in the context of socio-technical transitions: the multi-level perspective (MLP), strategic niche management (SNM), technological innovation systems (TIS), and transition management (TM).[62] Across these four frameworks, a central concept is that of the socio-technical regime and presence of niche developments.[63]

I.2.1 Multi-Level Perspective

The MLP was developed in the latter half of the twentieth century by scholars seeking to form a bridge between STS and evolutionary economics.[64] The framework describes interactions between three levels—the "niche" level, "regime" level, and "landscape" level—and aims to explain "how incumbent (and unsustainable) technological regimes can be 'destabilised' through 'niche' developments."[65] Levels of the MLP constitute a nested hierarchy: niches are embedded in regimes, which are embedded in the landscapes

[60] Ibid., 179–181.
[61] Gavin Bridge et al., "Geographies of Energy Transition: Space, Place and the Low-Carbon Economy," *Energy Policy* 53 (February 1, 2013): 331–340.
[62] Markard, Raven, and Truffer, "Sustainability Transitions," 958–959; Derk Loorbach, Niki Frantzeskaki, and Flor Avelino, "Sustainability Transitions Research: Transforming Science and Practice for Societal Change," *Annual Review of Environment and Resources* 42, no. 1 (October 17, 2017): 601.
[63] Markard, Raven, and Truffer, "Sustainability Transitions," 957.
[64] Frank W. Geels, "Technological Transitions as Evolutionary Reconfiguration Processes: A Multi-Level Perspective and a Case-Study," *Research Policy* 31, no. 8–9 (2002): 1273; Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 18.
[65] Phil Johnstone and Peter Newell, "Sustainability Transitions and the State," *Environmental Innovation and Societal Transitions* 27 (June 1, 2018): 73.

(Figure 3).

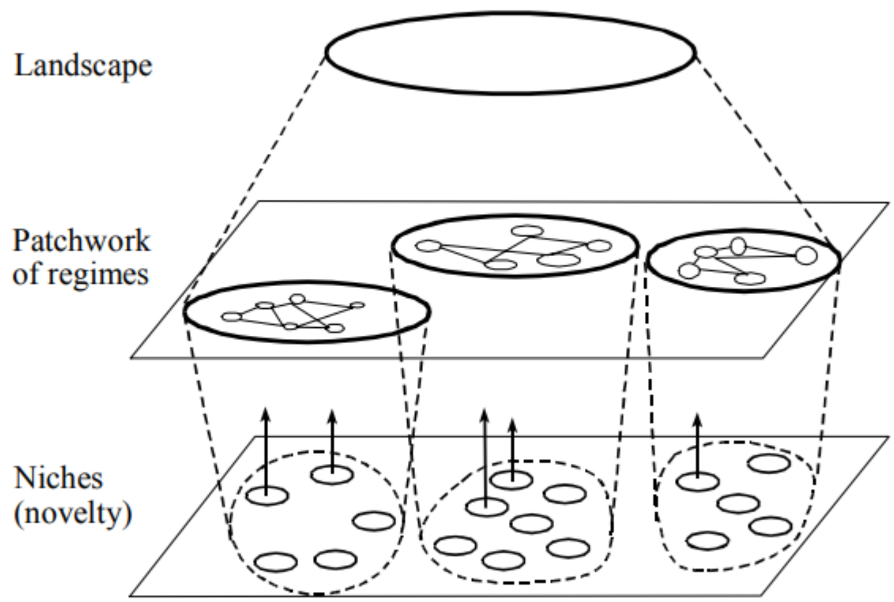

Fig. 3. Multiple levels in a nested hierarchy (Geels, 2002:1261).

In order for niche innovations to break through, changes in the landscape often exert pressure on existing regimes, eventually opening up the regime (Figure 4). This can happen as a result of multiple scenarios, such as a change in user preferences, increased negative externalities from the expansion of existing regimes, society perceiving existing regimes as threatening, internal technical problems within a regime, or if firms invest in innovation as a competitive strategy.[66]

[66] Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 25–27.

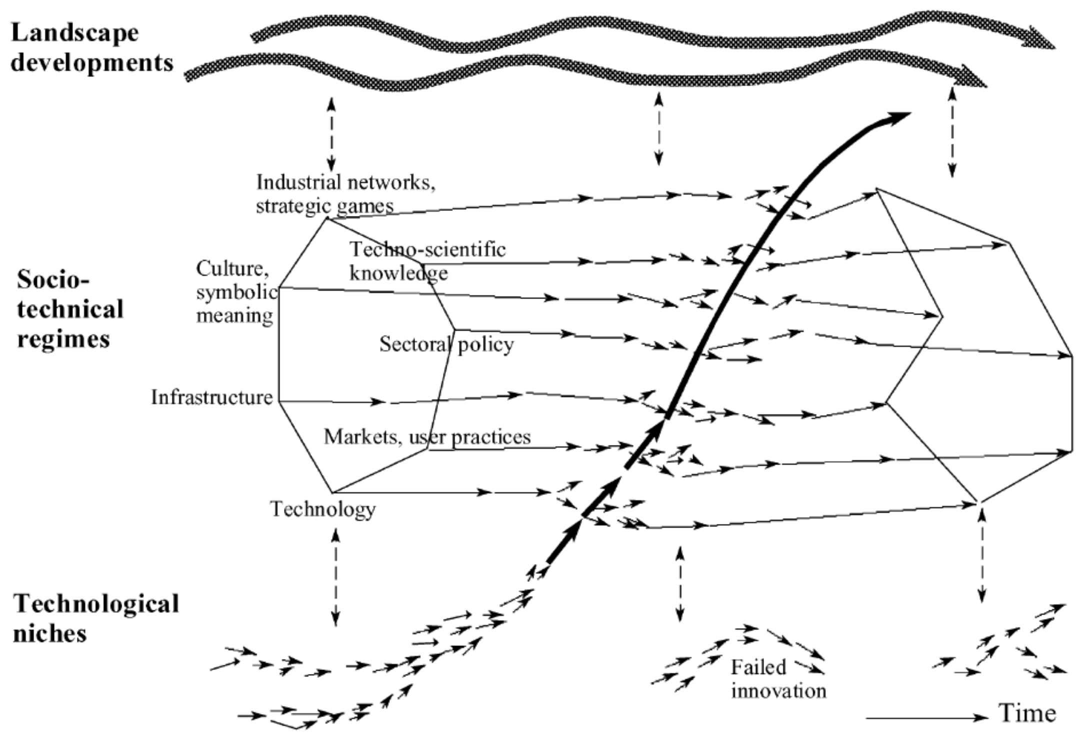

Fig. 4. A dynamic multi-level perspective on transitions (Geels, 2002:1263).

I.2.2 Strategic Niche Management

Strategic niche management is "a concentrated effort to develop protected spaces for certain applications of a new technology."[67] Protected spaces allow technologies to evolve from simply being ideas or suggestions into usable and fully-developed entities. SNM advocates for three internal processes that must occur for the successful development of a technological innovation: articulation of necessary technological and institutional changes, learning processes (including assessing economic, social, and technical feasibility; anticipated gains; alignment with existing systems; anticipated effects), and the building of social networks to constitute a constituency of supporters for the product who are able to facilitate necessary systematic shifts. A fourth external

[67] René Kemp, Johan Schot, and Remco Hoogma, "Regime Shifts to Sustainability through Processes of Niche Formation: The Approach of Strategic Niche Management," *Technology Analysis & Strategic Management* 10, no. 2 (January 1, 1998): 186.

process includes stimulating further development of the niche technology, as well as of complementary technologies and policies necessary to support the niche innovation.[68] The utility of SNM arises from its ability to assess the state of niches to subsequently inform policymaking, and the framework has been found useful for analyzing the dynamics of technological cases.[69] Considering the highly technical nature of energy systems, SNM is frequently applied in energy transition analysis.[70]

I.2.3 Technological Innovation Systems

The Technological innovation systems (TIS) framework is one subset of the larger group of frameworks on innovation systems. The first of these was the concept of national systems of innovations, rooted in theory on evolutionary economics.[71] The concept of innovation systems refers to all factors involved in innovation processes; "all important economic, social, political, organizational, institutional, and other factors that influence the development, diffusion, and use of innovations."[72] The efficacy of technology transfer is largely influenced by national systems of innovation, or "networks of institutions that initiate, modify, import, and diffuse new technologies."[73] Technological innovation systems differ from national systems in that, rather than referring to the entirety of the national system, they refer to "specific techno-industrial

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[68] Ibid.; Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 82.
[69] Wieczorek, "Sustainability Transitions in Developing Countries," 205.
[70] Ibid., 211.
[71] Jochen Markard and Bernhard Truffer, "Technological Innovation Systems and the Multi-Level Perspective: Towards an Integrated Framework," *Research Policy* 37, no. 4 (May 1, 2008): 598.
[72] Charles Edquist, "Systems of Innovation: Perspectives and Challenges," in *The Oxford Handbook of Innovation*, ed. Jan Fagerberg, David C. Mowery, and Richard R. Nelson (New York: Oxford University Press, 2006), 182.
[73] *Methodological and Technological Issues in Technology Transfer* (Cambridge University Press: Intergovernmental Panel on Climate Change, 2000), 110.

areas."[74] Technological systems both foster the development of niche innovations and support existing technologies.[75] Rather than being used to describe the overarching and broad nature of transitions, TIS has traditionally focused on analyzing specific technological systems for the purpose of informing policymaking.[76]

I.2.4 Transition Management

The transition management (TM) framework is used to further structure the governance processes of ongoing transitions with a long-term normative goal of sustainable development.[77] The MLP serves as the underlying theory that TM further builds on in order to formulate a comprehensive management strategy. It is a "process-oriented philosophy that balances coherence with uncertainty and complexity" born out of insights from governance approaches and complex systems theory.[78] Rather than providing an explanation for a transition, transition management aims to provide tools to work towards a transition more generally, with the assumption that the transition will eventually offer collective benefits. The process involves regular re-evaluation of the goals and practices fueling the transition.[79] In addition to the MLP, transition management utilizes the multi-phase concept describing four phases of transitions: predevelopment, take-off, breakthrough, and stabilization.[80] TM was introduced in 2001

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[74] B. Carlsson and R. Stankiewicz, "On the Nature, Function and Composition of Technological Systems," *Journal of Evolutionary Economics* 1, no. 2 (June 1, 1991): 112.

[75] Markard and Truffer, "Technological Innovation Systems and the Multi-Level Perspective," 599.

[76] Markard, Raven, and Truffer, "Sustainability Transitions," 959; Wieczorek, "Sustainability Transitions in Developing Countries," 205.

[77] Derk Loorbach, "Transition Management for Sustainable Development: A Prescriptive, Complexity-Based Governance Framework," *Governance* 23, no. 1 (2010): 163.

[78] Rotmans, Kemp, and van Asselt, "More Evolution than Revolution: Transition Management in Public Policy," 22; Markard, Raven, and Truffer, "Sustainability Transitions," 958.

[79] Rotmans, Kemp, and van Asselt, "More Evolution than Revolution: Transition Management in Public Policy," 22–23.

[80] Ibid., 17.

in the fourth Dutch National Environmental Policy Plan (NMP4) as official government policy. Rather than set explicit goals, the NMP4 outlined sweeping societal ambitions, recognizing that achieving these ambitions would require fundamental system changes and transitions.[81] The plan utilized the TM cycle (Figure 5), which details four governance arenas: strategic, tactical, operational, and reflexive.[82]

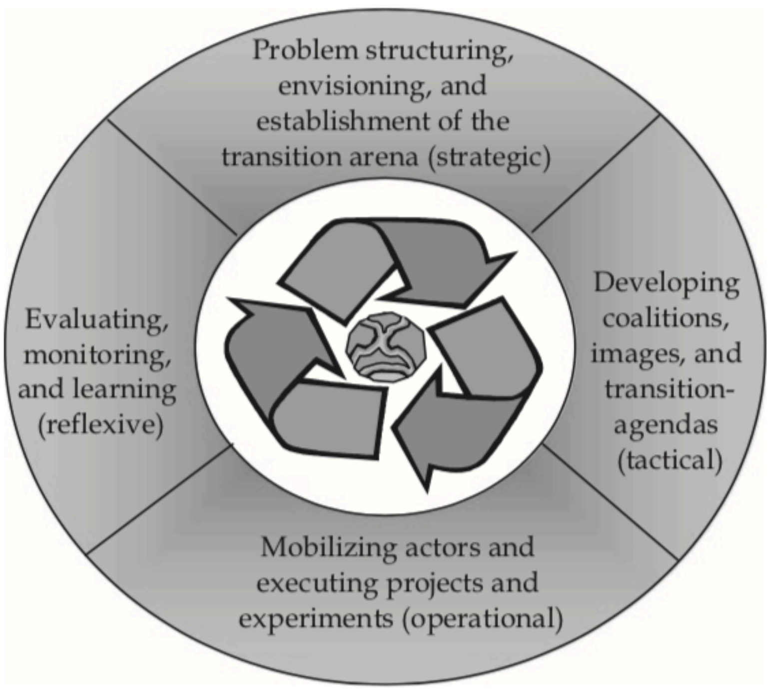

Fig. 5. Transition management cycle (Loorbach, 2010:173).

I.3 Multi-Level Perspective

Out of the four aforementioned socio-technical frameworks, the MLP will be used to examine Mongolia's ongoing energy transition. This selection is apt because in contrast to TIS and SNM, the MLP does not place heightened emphasis on the development of niche innovations; in a similar vein, the specific bottom-up development of niche

[81] Derk Loorbach and Jan Rotmans, "The Practice of Transition Management: Examples and Lessons from Four Distinct Cases," *Futures* 42, no. 3 (April 1, 2010): 238.
[82] Loorbach, "Transition Management for Sustainable Development," 172.

technologies is not an integral part of Mongolia's transition. The MLP was also chosen given that many more studies use the MLP than transition management, which has been additionally criticized for its Eurocentric slant and subsequent incompatibility with factors common in developing contexts.[83]

Rather than focusing solely on a singular aspect of society and its contribution to transitions, the MLP reflects the diversity and multidisciplinarity of structures within socio-technical systems. Transitions are both brought about and hindered by techno-economic, business, political, social, and cultural factors. The MLP has been utilized to analyze historical and ongoing transitions across many socio-technical systems, such as the British transition from sailing ships to steamships and America's transitions from piston engine aircraft to jetliners as well as from horse-drawn carriages to automobiles.[84]

I.3.1 Landscape Level

The first level of the MLP is the landscape level, "an external structure or context for interactions of actors."[85] Due to the exogenous and overarching structure of the landscape, it is "beyond the direct influence of regime and niche actors."[86] The landscape encompasses both literal landscape traits—such as physical geography, available resources, and climate—as well as more theoretical components, such as broad societal

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[83] It is important to note that similar criticism has been leveraged against all of the aforementioned socio-technical frameworks, which will be explored in later chapters.
Wieczorek, "Sustainability Transitions in Developing Countries," 210; Mara J. van Welie and Henny A. Romijn, "NGOs Fostering Transitions towards Sustainable Urban Sanitation in Low-Income Countries: Insights from Transition Management and Development Studies," *Environmental Science & Policy* 84 (June 1, 2018): 253.

[84] Geels, *Technological Transitions and System Innovations*.

[85] Geels, "Technological Transitions as Evolutionary Reconfiguration Processes," 1260.

[86] Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 23.

trends, economic cycles, and political constellations.[87] There are no actors unique to the landscape level; rather, landscape changes arise as a result of either independent occurrences or actions by regime and niche actors.[88]

Considering the scope of the landscape, it undergoes change at a much slower pace than regimes.[89] Often, factors that contribute to landscape shifts are described temporally. There are factors that change either slowly or not at all (i.e. the climate), factors that change in the long-term (i.e. German industrialization), and rapid exogenous shocks (i.e. oil price fluctuations, wars). Altogether, these factors cannot be influenced in the short-term; rather, they combine to make up a larger external context that is the landscape level.[90]

I.3.2 Regime Level

A technological regime is "the rule-set or grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artifacts and persons, ways of defining problems—all of them embedded in institutions and infrastructures."[91] Socio-technical regimes, specifically, refer to the rules that various social groups abide by, and are responsible for the stability of a sociotechnical system.[92] Regimes describe the institutions, paradigms, practices, economics, and dominant structures specific to a technology, as well as to a

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[87] Geert Verbong and Derk Loorbach, eds., *Governing the Energy Transition: Reality, Illusion or Necessity?* (Routledge, 2012), 9.
[88] Lisa-Britt Fischer and Jens Newig, "Importance of Actors and Agency in Sustainability Transitions: A Systematic Exploration of the Literature," *Sustainability* 8, no. 5 (2016): 6.
[89] Geels, "Technological Transitions as Evolutionary Reconfiguration Processes," 1260.
[90] Hugo Van Driel and Johan Schot, "Radical Innovation as a Multilevel Process: Introducing Floating Grain Elevators in the Port of Rotterdam," *Technology and Culture* 46, no. 1 (2005): 54.
[91] Rip and Kemp, "Technological change," 338.
[92] Ibid., 1260.

societal function or ecosystem.[93] At the regime level is where incumbent[94] actors, technologies, and systems operate. The regime can be influenced by changes both at the niche level or the landscape level. Socio-technical regimes make up the more intangible components of an overarching incumbent socio-technical system, which additionally includes tangible components such as “technologies, industries, supply chains, consumption patterns, policies, and infrastructures.”[95]

Regime change is driven by multiple factors at a time interacting with one another. While each of these factors change relatively autonomously, their collective evolution results in changes in the existing regime (Figure 6).[96] Table 1 further explains potential drivers of regime

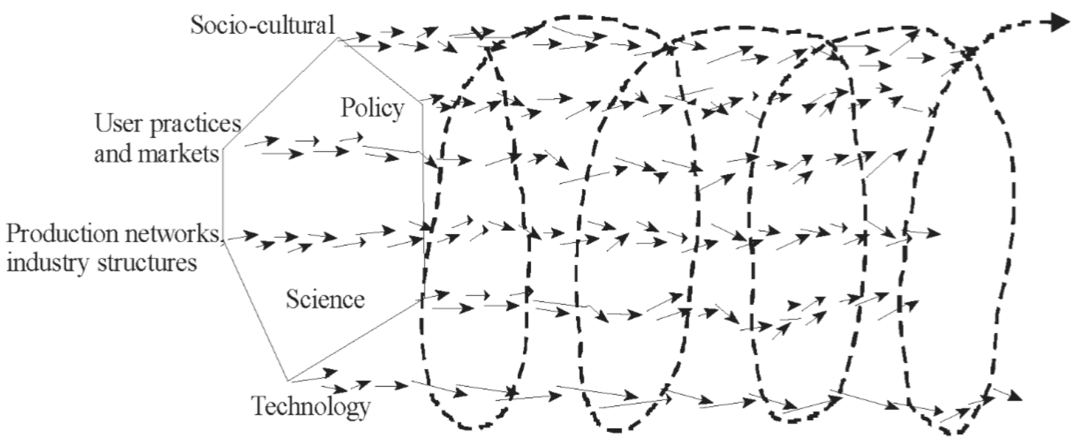

Fig. 6. Co-evolution between regime components (Grin, Rotmans, & Schot, 2011:21 [adapted from Geels, 2004: 912]).

[93] Verbong and Loorbach, *Governing the Energy Transition*, 9.
[94] An incumbent firm is defined by the Oxford Dictionary of Economics as “[a] firm which is already operating in a market.”
John Black, Nigar Hashimzade, and Gareth Myles, “Incumbent Firm,” in *A Dictionary of Economics* (Oxford University Press, 2017).
[95] Frank W. Geels et al., “Reducing Energy Demand through Low Carbon Innovation: A Sociotechnical Transitions Perspective and Thirteen Research Debates,” *Energy Research & Social Science* 40 (June 1, 2018): 26.
[96] Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 21.

tensions, demonstrating how these tensions can arise from any part of society. Existing regimes may begin to fracture if, alongside the exacerbation of regime tensions, niche-innovations are sufficiently developed to the point where they are able to compete with incumbent structures.[97]

Table 1
Drivers of regime tensions (Adapted from Geels et al., 2017:467).

Societal sphere	Drivers of regime tensions
Techno-economic	technical failures, disruption of infrastructures, accumulating negative externalities (e.g., CO2 emissions)
Business	shrinking markets, economic difficulties in incumbent industries, loss of confidence in existing technologies and business models, reorientation toward alternatives
Social	disagreement and fracturing of social networks, defection of key social groups from the regime
Political	eroding political influence of incumbent industries, declining political support, removal of supportive policies, introduction of disruptive policies
Cultural	negative cultural discourses undermine the legitimacy of existing regimes (e.g., coal and climate change, diesel cars, and air quality)

Barriers to change. That regimes are upheld by numerous interlocking rules means that niche innovations are only able to break through incumbent structures if these rules are either weakened or altered. These rules can be separated into three categories: regulative, normative, and cognitive.[98] Examples of regulative rules include regulations, laws, and standards; normative rules include behavioral norms, values, and role relationships; cognitive rules include guiding principles, user practices, market perceptions, goals, and problem definitions. These rules interlock and reinforce one another, accounting for what is classified as "lock-in" of socio-technical systems.[99] For example, engineers and designers are bound by cognitive rules and routines towards

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[97] Geels et al., "The Socio-Technical Dynamics of Low-Carbon Transitions," 465.
[98] Frank W. Geels, "From Sectoral Systems of Innovation to Socio-Technical Systems: Insights about Dynamics and Change from Sociology and Institutional Theory," *Research Policy* 33, no. 6 (September 1, 2004): 906.
[99] Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 20.

existing directions, causing them to ignore extraneous developments.[100] Similarly, organizations resist changes because of developing “webs of interdependent relationships with buyers, suppliers, and financial backers . . . and patterns of culture, norms, and ideology.”[101] These dynamics can contribute to path dependence, wherein the outcomes of future and current states depends on previous states’ paths.[102]

I.3.3 Niche Level

Innovations at the niche level are characterized by their deviation from the incumbent system; examples include “a new behavioural practice (e.g. car sharing), a new technology (e.g. battery-electric vehicles), a new business model (e.g. energy service companies, or a combination of these.”[103] Innovation that occurs at the niche level is of a different nature than innovation within an existing regime. Rather than the incremental innovation that may take place within existing energy regimes, niche level developments are often talked about in terms of necessitating “radical” or “breakthrough” innovations.[104] Niches allow these radical innovations to be protected from existing market structures while they are still being developed.[105] Niche innovations “gain a foothold in particular applications, geographical areas, or markets (e.g., the military), or with the help of targeted policy support.”[106] Developments at the niche level can be

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[100] Ibid.
[101] M. Tushman and E. Romanelli, “Organizational Evolution: A Metamorphosis Model of Convergence and Reorientation,” *Research in Organizational Behavior* 7 (January 1, 1985): 177.
[102] Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 116.
[103] Geels et al., “Reducing Energy Demand through Low Carbon Innovation,” 26.
[104] Martin Bell, “International Technology Transfer, Innovation Capabilities and Sustainable Directions of Development,” in *Low-Carbon Technology Transfer: From Rhetoric to Reality*, ed. David Ockwell and Alexandra Mallett, First. (London: Routledge, 2012), 21.
[105] Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 22.
[106] Geels et al., “The Socio-Technical Dynamics of Low-Carbon Transitions,” 465.

technological, but may also include novel policies implemented with the purpose of nurturing niche technologies.

At the niche level, much of the structure that the regime level is characterized by is absent. The makeup of actors is constantly in flux, resulting in unstable networks where rules are imprecise and opaque. The maintenance of niches thus requires sustained effort from the actors involved to upkeep niche development.[107]

Radical innovations, or novelties, can remain in niches for any duration of time depending on the existing regimes and landscapes; novelties often remain in niches for long periods of time. This can be for multiple reasons related to the existing regimes: novelties may require extensive technological development, dragging out the period of time until they are ready to be brought into the regime, the regime may be incompatible with the novelty, or "existing regime actors actively oppose niche-innovations," leading to the imposition of barriers to prevent novelties from breaking through. The stability of existing regimes is also relevant—the more stable existing regimes are, the less likely novelties will be able to break through. All levels are important; "it is the alignment of developments—successful processes within the niche reinforced by changes at regime level and at the level of the sociotechnical landscape—which determine if a regime shift will occur."[108]

Similar to the number of potential pathways that can contribute to the formation of regime tensions, niche developments can gain momentum through many different avenues (Table 2).

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[107] Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 27.
[108] René Kemp, Arie Rip, and Johan Schot, "Constructing Transition Paths Through the Management of Niches," in *Path Dependence and Creation*, ed. Raghu Garud and Peter Karnoe (New York: Psychology Press, 2001), 276–277.

Table 2
Drivers of niche momentum (Geels et al., 2017:467).

Societal sphere	Drivers of endogenous niche momentum
Techno-economic	price/performance improvements as a result of R&D, learning by doing, scale economies, complementary technologies, and network externalities
Business	new entrants or incumbents from other sectors are more likely to drive radical innovation than traditional incumbents. Their success may lead to "innovation races" when other firms follow a first mover
Social	growing support coalitions and constituencies improve available skills, finance, and political clout
Political	advocacy coalitions lobby for policy changes that support the niche innovation such as subsidies and supportive regulations
Cultural	positive discourses and visions attract attention, create cultural enthusiasm, and increase socio-political legitimacy

Barriers to change. Niche-innovations often face resistance from the existing regime structures, and their ability to break through is dependent largely on circumstances surrounding the regime, which is in turn dependent on landscape conditions. It is also possible that circumstances may position the regime to be open to the introduction of niche technologies; however, if niche-innovations are not fully developed, they will not be able to capitalize on this opening. The relationship between niche developments and existing regime structures can also inhibit break through. If niche-innovations are able to be incorporated into the incumbent structure, existing symbiotically, then they are able to be adopted regardless of a distinct opening in the regime.[109] Niche-innovations can also be stunted if their development is not supported, either financially or ideologically, by champion actors.

I.3.4 Typology of Transitions

Recognizing that transitions arise from many different circumstances as a result of variation within regimes and niche actors, as well as contextual landscape factors, Frank Geels and Johan Schot developed four pathways for socio-technical transitions:

[109] Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 55.

transformation, technological substitution, reconfiguration, and de-alignment and re-alignment.[110] These pathways differ based on timing and the nature of interactions between the levels of the MLP. Each has different main actors, and pressure for change manifests at different levels depending on the involvement of these actors.

In order to further delineate the dynamics of change that occur within each pathway, Geels and Schot utilize the typology for environmental change that Fernando Suarez and Rogelio Oliva propose. Using the attributes of frequency, amplitude, speed, and scope, five different classifications for environmental change are identified (Table 3). Geels and Schot use this typology to apply to the MLP; each pathway exhibits one or more of the types of change, which can occur at any level.

Table 3
Attributes of change and resulting typology (Suarez & Oliva, 2005:1022).

Frequency	Amplitude	Speed	Scope	Type of environmental change
Low	Low	Low	Low	Regular
High	Low	High	Low	Hyperturbulence
Low	High	High	Low	Specific shock
Low	High	Low	Low	Disruptive
Low	High	High	High	Avalanche

Transformation. In the transformation pathway, moderate landscape changes (disruptive change) apply pressure to existing regime systems; however, niche-innovations are not sufficiently developed to be able to take advantage of potential regime openings as a result of landscape pressure. Regime changes are initiated by incumbent actors responding to criticism voiced by outside groups.[111]

Technological substitution. In this pathway, niche-innovations are developed sufficiently so that when enough landscape pressure is applied to the existing regime,

[110] Frank W. Geels and Johan Schot, "Typology of Sociotechnical Transition Pathways," *Research Policy* 36, no. 3 (April 1, 2007): 414.
[111] Ibid., 406.

niche developments are able to penetrate and replace incumbent systems. This breakthrough is not possible without sufficient landscape changes—which typically occurs in the form of a specific shock, avalanche change, or disruptive change—and resulting pressure due to highly entrenched regime structures. Rather than being developed by actors in the incumbent regime, niche-innovations are developed by outsiders, and receive minimal attention from incumbent actors, who do not feel threatened by the presence of niche-innovations.[112]

Reconfiguration. In the reconfiguration pathway, niche-innovations do not necessarily clash with the existing regime. Instead, niche-innovations are symbiotic; the regime adopts these innovations to solve existing problems. Eventually, this adoption continues until the incumbent regime is reconfigured to account for the presence and utilization of the symbiotic innovations.[113]

De-alignment and re-alignment. This pathway involves the collapse and erosion of the existing regime as a result of significant landscape change, to the point that actors lose faith in the incumbent systems. Niche-innovations are not necessarily sufficiently developed at the point of erosion; thus, multiple niche technologies may compete until one is identified as dominant. This dominant niche-innovation will eventually become the foundation that allows for the re-alignment of a new regime.[114]

[112] Ibid., 409.
[113] Ibid., 411.
[114] Ibid., 408.

Chapter II: Application of the MLP to Energy Transitions in the Global South

The MLP has been consistently applied as a heuristic framework for socio-technical transitions, in particular, energy and low-carbon transitions, such as the German and Dutch electricity transition to renewables.[115] Thus, as the impetus on developing countries to undertake energy transitions has grown, scholars have identified the MLP as a useful tool for analysis. Using the MLP as a guide, components of energy transitions in select case studies of developing countries will be discussed, as well as the applicability of the MLP to these transitions. Discrepancies between the application of the MLP to developed versus developing countries will also be identified and discussed.

II.1 Landscape Level

Whereas regime and niche developments in developed countries have historically contributed to patterns and circumstances at the landscape level, similar developments in the global South have been less present. Thus, the landscape context framing many developing countries' energy transitions has been formed by actors and actions outside of the developing country's direct sphere of influence. While the landscape level has traditionally been described as beyond the direct influence of actors, niche and regime actors involved in developing countries' transitions are often motivated by deliberate efforts by international organizations to reconfigure normative policy priorities. In the 1990s, for example, multilateral development agencies such as the World Bank pushed for developing countries to implement reforms for the liberalization of their energy

[115] Geels et al., "The Socio-Technical Dynamics of Low-Carbon Transitions"; Geert Verbong and Frank Geels, "The Ongoing Energy Transition: Lessons from a Socio-Technical, Multi-Level Analysis of the Dutch Electricity System (1960–2004)," *Energy Policy* 35, no. 2 (February 1, 2007): 1025–1037.

sectors.[116] Similar dynamics are the result of other international efforts by organizations such as the UN and the Intergovernmental Panel on Climate Change, both of which have undertaken concerted efforts to educate and equip the public with information about climate change and sustainable development. Energy transitions may also be driven by landscape shifts that result from price fluctuations of particular energy sources, such as rising oil or coal prices.[117]

II.2 Regime Level

II.2.1 Drivers of Regime Tension

Reflecting the holistic nature of socio-technical systems, regime change can be initiated by developments across any aspect of society. It is important to note that the characterization of incumbent regimes in the MLP is biased towards developing countries— often, these regimes have been in place for numerous decades at a minimum, and are therefore highly integrated not only within directly relevant aspects of society but society as a whole. Reliance on these regimes leads to entrenchment, resulting in path dependency and lock-in, and making it more challenging for niches to break through. Regimes in developed countries most often evolved from knowledge and capacity already present in said countries, or in countries with societally similar circumstances. The seminal MLP diagram (Figure 3) presents regimes as uniform systems.

However, this presentation of regimes is inapplicable in many ways to developing countries. Regimes in developing countries are often composed of technologies diffused

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[116] Ulrich Elmer Hansen and Ivan Nygaard, "Sustainable Energy Transitions in Emerging Economies: The Formation of a Palm Oil Biomass Waste-to-Energy Niche in Malaysia 1990–2011," *Energy Policy* 66 (March 1, 2014): 668.

[117] Ibid., 669.

not from the developing countries themselves, but rather developed countries. This diffusion results in widespread variations in the nature of these regimes depending on an individual country's own domestic landscape context.[118] As a result, regimes are often non-uniform, and are more likely to experience internal tensions. This non-uniformity also contributes to a different standard of regime stability:[119] "The presupposition of a 'universal infrastructure ideal' in [large technical systems] and [multi-level transitions] theories can help to explain their lack of traction for studies focused on the [global] South, where infrastructure is often characterized by 'archipelagoes' and disrepair or even dilapidation.[120]

II.2.1.1 Technological

Incumbent systems may experience technical difficulties as a result of aging technology or demand limitations, resulting in the need to pursue alternative system.[121]

II.2.1.2 Markets and Finances

Given rapid population growth and industrialization in developing countries, many are driven to explore renewable or sustainable energy systems as a result of increasing energy demand.[122] Moreover, having a healthy economy allows a developing country

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[118] Frans Berkhout, David Angel, and Anna J. Wieczorek, "Asian Development Pathways and Sustainable Socio-Technical Regimes," *Technological Forecasting and Social Change* 76, no. 2, Sustainability Transitions in Developing Asia: Are Alternative Development Pathways Likely? (February 1, 2009): 225.
[119] Wieczorek, "Sustainability Transitions in Developing Countries," 208.
[120] Kathryn Furlong, "STS beyond the 'Modern Infrastructure Ideal': Extending Theory by Engaging with Infrastructure Challenges in the South," *Technology in Society* 38 (August 1, 2014): 142.
[121] Peter Newell and Jon Phillips, "Neoliberal Energy Transitions in the South: Kenyan Experiences," *Geoforum* 74 (August 1, 2016): 42.
[122] Linda M. Kamp and Lynn F. I. Vanheule, "Review of the Small Wind Turbine Sector in Kenya: Status and Bottlenecks for Growth," *Renewable and Sustainable Energy Reviews* 49 (September 1, 2015): 476; Latif Amars et al., "The Transformational Potential of Nationally Appropriate Mitigation Actions in Tanzania: Assessing the Concept's Cultural Legitimacy among Stakeholders in the Solar Energy Sector," *Local Environment* 22, no. 1 (January 2, 2017): 95; Hansen and Nygaard, "Sustainable Energy Transitions in Emerging Economies," 668; Enayat A. Moallemi et al., "India's on-Grid Solar Power Development:

with may be appealing to international investors, paving the way for actors such as development banks or other countries to invest in alternative energy sources.[123]

II.2.1.3 Political

Domestic governments play a large role in incentivizing firms to produce renewable energy technology. Incentives can be multi-faceted and cultivated either directly or indirectly. Examples of government involvement are domestic renewable energy policies, subsidies, declaring a renewable energy target, trade-related incentives, and more.[124] Policies incentivizing the use of low-carbon technologies "can play a strong role in overcoming cost barriers and developing markets for new low carbon technologies."[125] Governments can encourage a clean energy market in three ways: implementing policies that either directly or indirectly encourage the purchase of clean energy, as well as purchasing renewable energy directly.[126]

II.2.1.4 Socio-Cultural

Co-benefits—such as climate change mitigation and reduced air pollution—from utilizing sustainable energy sources can further incentivize governments to undertake energy transitions.[127] Governments may seek to initiate energy transitions to address

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Historical Transitions, Present Status and Future Driving Forces," *Renewable and Sustainable Energy Reviews* 69 (March 1, 2017): 246.

[123] Verena Streitferdt, Surapong Chirarattananon, and Peter Du Pont, "Lessons Learned from Studying Public Initiatives to Support Energy Efficiency Finance in Thailand from 1992 to 2014," *Energy Efficiency; Dordrecht* 10, no. 4 (August 2017): 912.

[124] Sugathan and Mani, "The Role of Trade and Investment in Accelerating Clean Energy Diffusion: Private-Sector Views from South Asia," 265.

[125] David G. Ockwell et al., "Key Policy Considerations for Facilitating Low Carbon Technology Transfer to Developing Countries," *Energy Policy* 36, no. 11, Transition towards Sustainable Energy Systems (November 1, 2008): 4114.

[126] Sugathan and Mani, "The Role of Trade and Investment in Accelerating Clean Energy Diffusion: Private-Sector Views from South Asia," 267.

[127] Linda Manon Kamp and Esteban Bermúdez Forn, "Ethiopia's Emerging Domestic Biogas Sector: Current Status, Bottlenecks and Drivers," *Renewable and Sustainable Energy Reviews* 60 (July 1, 2016):

systemic societal challenges, such as endemic poverty or widespread lack of access to electricity.[128]

Also relevant are pre-existing relations between developing countries and the international community. A documented history of being open to international actors can prime a developing country to receive financial assistance from donors for further reforms and development projects: "Kenya's adoption of neoliberal reforms in the energy sector has been rewarded by support from bilateral and multilateral donors, opening up opportunities for foreign capital to meet the shortfall in energy supply."[129]

The public's increased ability to obtain information about new technologies and global trends has also contributed to the weakening of regimes. For instance, in Kenya, increased media attention on climate change has allowed the public to become more knowledgeable about the availability and benefits of clean technologies.[130]

II.2.2 Barriers to Regime Change

II.2.2.1 Political

Because the MLP was initially criticized for failing to account for state autonomy and agency, the state as an autonomous actor has increasingly received attention through applications of the MLP. Yet this attention must be carefully applied to developing contexts, where states are often limited by institutional capacity and highly dependent on foreign aid. While these states are not powerless—in many cases they are still responsible for controlling electricity systems—"state capacity and autonomy to chart and pursue

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477; Laurence L. Delina, *Accelerating Sustainable Energy Transition(s) in Developing Countries: The Challenges of Climate Change and Sustainable Development* (Routledge, 2017), 7.

[128] Delina, *Accelerating Sustainable Energy Transition(s) in Developing Countries*.

[129] Newell and Phillips, "Neoliberal Energy Transitions in the South," 43.

[130] Kamp and Vanheule, "Review of the Small Wind Turbine Sector in Kenya," 474.

lower-carbon pathways is shaped by their relations with various other actors and is unevenly distributed."[131]

Policymakers are also limited in their ability to affect change as a result of competing agenda priorities. Especially in developing countries, the prospect of sustainability is just one of many areas for societal growth. Policymakers' primary motivation for implementing policies that accomplish climate change mitigation is rarely simply mitigation; rather, these actors are primarily driven by goals such as bolstering energy security, creating jobs, fostering new green industries, or increasing public revenue. Climate change mitigation is, at best, merely a co-benefit.[132]

Even in countries with liberalized energy markets, regulations at the regime level can still act as barriers to burgeoning RE producers. Large electric utility companies will act to further enforce or regulate existing barriers to prevent RE producers from entering the market. In general, little research has been done on the effects of various regulatory regimes for developing countries' RE industries.[133]

The political climate of developing countries can also hinder regime change from taking place. For instance, in Ethiopia, geopolitical conflicts with bordering nations as well as internal political instability further perpetuates low levels of competition.[134]

II.2.3.2 Socio-Cultural

Incumbent regimes are also protected by existing societal attitudes, including society's acceptance (or lack of) towards a new or emerging technology. Many barriers to

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[131] Peter Newell and Harriet Bulkeley, "Landscape for Change? International Climate Policy and Energy Transitions: Evidence from Sub-Saharan Africa," *Climate Policy* 17, no. 5 (July 4, 2017): 656.
[132] Hubert Schmitz, "Who Drives Climate-Relevant Policies in the Rising Powers?," *New Political Economy* 22, no. 5 (September 3, 2017): 521.
[133] Sanya Carley et al., "Global Expansion of Renewable Energy Generation: An Analysis of Policy Instruments," *Environmental and Resource Economics* 68, no. 2 (October 1, 2017): 401.
[134] Kamp and Bermúdez Forn, "Ethiopia's Emerging Domestic Biogas Sector," 485.

the successful incorporation of niche developments into the existing regime "can be considered as a manifestation of lack of social acceptance."[135] Increasingly, studies have been done on the role that social acceptance plays in diffusion. Studies in the 1980s showed that support at any level—be it from the public or crucial stakeholders—could not be taken for granted.[136]

Social acceptance can be broken down into further categories, namely, socio-political acceptance, community acceptance, and market acceptance (Figure 7).

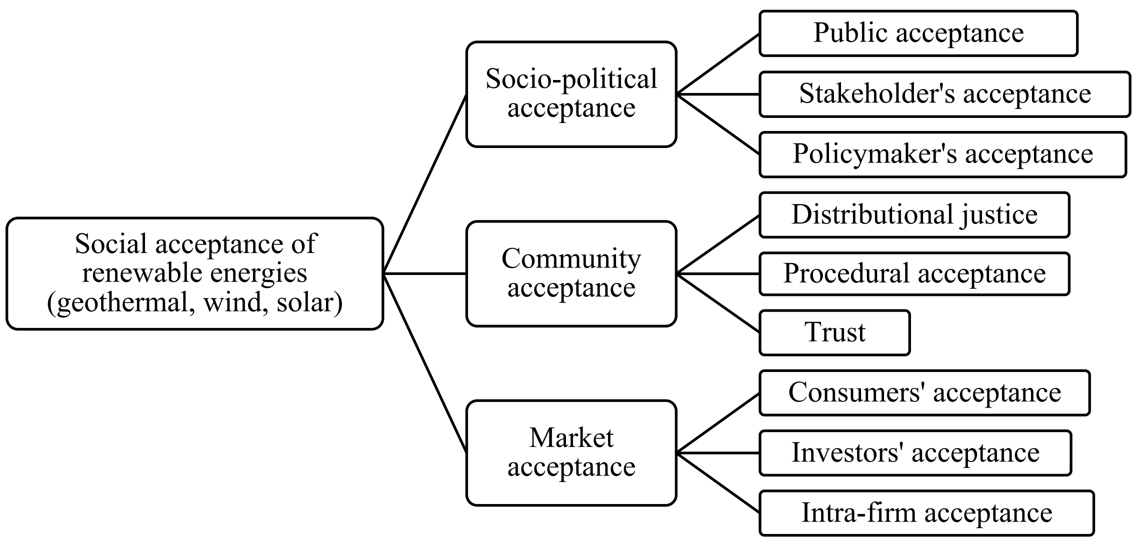

Fig. 7. Diagram of social acceptance dimensions (Adapted from Hosseini, 2018).

Socio-political acceptance refers to the broadest level of social acceptance and includes acceptance of technologies and policies by the public, key stakeholders, and policymakers. Results from years of opinion polls indicate that the majority of the public agrees with renewable energy concepts, leading many to think that worldwide social

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[135] Rolf Wüstenhagen, Maarten Wolsink, and Mary Jean Bürer, "Social Acceptance of Renewable Energy Innovation: An Introduction to the Concept," *Energy Policy* 35, no. 5 (May 1, 2007): 2685.
[136] Ibid., 2684.

acceptance of renewables is subsequently high. However, this is not the case; "[t]his positive overall picture for renewable energy has (mis)led policy makers to believe that social acceptance is not an issue."[137]

Community acceptance relates to how local stakeholders and community members accept renewable energy decisions. There are three components within community acceptance: procedural justice, distributional justice, and trust. Procedural justice concerns whether or not the decision-making process allows equal access to participation for all stakeholders, distributional justice concerns the distribution of costs and benefits among stakeholders, and trust is in terms of whether or not the local community trusts information regarding the implementation of renewable energy.[138] The concept of trust is critical to the successful implementation of renewable energy projects.[139] Within community acceptance is the concept of NIMBY-ism, which stands for "not in my backyard" and refers to the phenomenon that occurs when individuals support renewable energy on principle as long as it isn't present in their own backyard.[140] Theory on community acceptance also describes a U-shape pattern regarding individuals' perceptions of renewable energy projects—acceptance is high during proposal and lead up stages, then dips once the logistical components are being carried out, and finally increases again once the project is fully in operation.[141]

Market acceptance refers to how the market adopts an innovation. Market acceptance considers consumer, investor, and intra-firm acceptance, and is related to socio-political

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[137] Ibid., 2685.
[138] Ibid.
[139] Ibid., 2687.
[140] Ibid., 2685; Michael O'Hare, "'Not on My Block You Don't': Facilities Siting and the Strategic Importance of Compensation," *Public Policy* 25 (March 1977): 407–458.
[141] Wüstenhagen, Wolsink, and Bürer, "Social Acceptance of Renewable Energy Innovation."

acceptance due to the fact that as stakeholders, firms can influence the political process and political decisions made regarding renewable energy.[142]

Cultivating public appeal for low-carbon technology transitions can also be challenging, as there is not always an obvious constituent base to support such transitions. Whereas other political policies can be associated with clearly defined benefits, the benefits of low-carbon transitions "are displaced in space and time from those who pay for them."[143] Roberts discusses the need to form coalitions to support low-carbon transitions, considering that, as Newell and Paterson note, successful transitions "will have to be supported (financially and politically) by powerful fractions of capital with a stake in the success of such a project."[144]

II.3 Niche Level

II.3.1 Drivers of Niche Momentum

While the conceptual nature of operations at the niche level are unchanged for developing countries, a significant disparity arises in the actors who are primarily responsible for developing and nurturing niche-innovations. Within developing countries' energy transitions, the niche level in particular is characterized by significant levels of involvement from exogenous and international actors.

II.3.1.1 Technological

For many developing countries, rather than being developed domestically from the ground up, niche technologies are often both fully developed and successfully operating

[142] Ibid., 2686.
[143] Cameron Roberts et al., "The Politics of Accelerating Low-Carbon Transitions: Towards a New Research Agenda," *Energy Research & Social Science* 44 (October 1, 2018): 305.
[144] Peter Newell and Matthew Paterson, "Climate Capitalism," in *After Cancun: Climate Governance or Climate Conflicts*, ed. Elmar Altvater and Achim Brunnengräber (Berlin: VS Verlag, 2011), 23–44.

in developed countries at the time of transition, making traditional niche development obsolete. Instead, niche technologies are introduced and nurtured through processes such as technology transfer. According to the Intergovernmental Panel on Climate Change (IPCC), technology transfer is defined as

> the broad set of processes covering the flows of knowledge, experience and equipment amongst different stakeholders such as governments, private sector entities, financial institutions, NGOs and research/educational institutions. The broad and inclusive term "transfer" encompasses diffusion of technologies and technology cooperation across and within countries. It comprises the process of learning to understand, utilize, and replicate the technology, including the capacity to choose it and adapt it to local conditions.[145]

Technological learning refers to individuals' and organizations' accumulation of "technological knowledge and experience," and results in the accumulation of technological capabilities.[146] Technological learning is "not an automatic by-product of investments," and can only occur under the right conditions, which must be facilitated by both the government and domestic firms.[147] Looking at Thailand, it was found that "technological learning can, in the near future, reduce the cost of renewable electricity in emerging economics to a level that is close to competitiveness with fossil fuels," and additionally, "the major potential for cost reductions through learning lies in the build-up of *local* technological capabilities" (emphasis in original).[148]

Technology transfer is primarily understood to occur between developing and developed countries, where the conventional development paradigm utilized by those

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[145] *Methodological and Technological Issues in Technology Transfer*, 19.
[146] Joern Huenteler, Christian Niebuhr, and Tobias S. Schmidt, "The Effect of Local and Global Learning on the Cost of Renewable Energy in Developing Countries," *Journal of Cleaner Production* 128, New approaches for transitions to low fossil carbon societies: promoting opportunities for effective development, diffusion andimplementation of technologies, policies and strategies (August 1, 2016): 7.
[147] Ibid.
[148] Ibid., 17.

studying transitions in developing countries asserts that "innovations originate from the North and need to be absorbed by the South."[149]

In order to catalyze technology transfer processes, international actors have developed various mechanisms and tools to expedite and incentivize technology transfer. One of the most well-known methods for facilitating low-carbon technology transfer is the Clean Development Mechanism (CDM), established under the Kyoto Protocol. Through the CDM, "a country with an emission-reduction or emission limitation commitment under the Kyoto Protocol," referred to as an Annex B Party, can implement emission-reduction projects in developing countries and earn certified emission reduction (CER) credits. Each CER is equivalent to one ton of CO_2, and can be traded and sold by industrialized countries to count towards their own emission reduction targets set by the Kyoto Protocol.[150]

Similar to the CDM, the joint implementation mechanism allows Annex B countries to implement emission-reduction projects in other Annex B countries. Countries then earn emission reduction units, also equivalent to one ton of CO_2, which can be counted towards their own Kyoto emission reduction target.[151]

International organizations have been paramount in the movement to facilitate low-carbon technology transfer in developing countries. Technology transfer encompasses many different processes, such as capacity building, technical training and technological learning, and transfer of intellectual property. Most technology transfer takes place in the

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[149] Wieczorek, "Sustainability Transitions in Developing Countries," 207.
[150] "The Clean Development Mechanism," *United Nations Framework Convention on Climate Change*, accessed October 14, 2018, https://unfccc.int/process-and-meetings/the-kyoto-protocol/mechanisms-under-the-kyoto-protocol/the-clean-development-mechanism.
[151] "Joint Implementation," *United Nations Framework Convention on Climate Change*, accessed November 2, 2018, https://unfccc.int/process/the-kyoto-protocol/mechanisms/joint-implementation.

private sector.[152] In order to promote the development of climate technologies, the UN in particular has overseen the establishment of multiple mechanisms and frameworks. These include the Technology Mechanism (2010), the Technology Executive Committee (policy arm of the Technology Mechanism), the Climate Technology Centre and Network (implementation arm of the TM), Technology Framework (established in the Paris Agreement to "provide overarching guidance to the work of the Technology Mechanism"), and technology needs assessments (established in 2001).[153]

Another critical aspect of technology transfer is intellectual property. In 1995, the Trade-Related Aspects of Intellectual Property (TRIPS) Agreement as part of the World Trade Organization (WTO) Agreement was entered into force. The TRIPS Agreement details issues related to intellectual property rights (IPRs), "establishes standards of protection as well as rules on administration and enforcement of intellectual property rights," and "provides for the application of the WTO dispute settlement mechanism to resolve disputes" related to topics discussed in TRIPS.[154]

II.3.1.2 Markets and Finances

Given that many developing countries experience rapid population growth, energy demand is rarely stagnant. Fluctuations in energy demand and subsequent government

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[152] Ockwell et al., "Key Policy Considerations for Facilitating Low Carbon Technology Transfer to Developing Countries," 4113.

[153] David Ockwell, Ambuj Sagar, and Heleen de Coninck, "Collaborative Research and Development (R&D) for Climate Technology Transfer and Uptake in Developing Countries: Towards a Needs Driven Approach," *Climatic Change* 131, no. 3 (August 1, 2015): 412; "Climate Technology Centre and Network," *UN Environment*, accessed April 29, 2019, http://www.unenvironment.org/explore-topics/climate-change/what-we-do/climate-technology-centre-and-network.

[154] "Introduction to the TRIPS Agreement" (World Trade Organization, n.d.), 6–7, accessed November 11, 2018, https://www.wto.org/english/tratop_e/trips_e/ta_docs_e/modules1_e.pdf.

action to shift the makeup of energy systems can lead to increased incentives to explore alternative energy sources.[155]

The political and economic structure required for the facilitation of low-carbon technologies varies; "[e]vidence is mixed on whether coordinated market economies are better at accelerating low-carbon transitions."[156] Those successful at promulgating low-carbon technologies do not strictly adhere to principles of capitalism that emphasize "interrelationships between labour markets, welfare, electoral systems and types of innovation."[157]

Financing for the implementation of renewable energy systems in developing countries has primarily come from developed countries and international organizations. Bilateral financial assistance from developed to developing countries often manifests in the forms of official development assistance (ODA), direct loans, or foreign-direct investment (FDI). The OECD Development Assistance Committee defines ODA as "government aid that promotes and specifically targets the economic development and welfare of developing countries."[158] ODA must be both "provided by official agencies" and "concessional . . . and administered with the promotion of the economic development and welfare of developing countries as the main objective."[159] Governments can also receive loans from either governments or multilateral funding institutions.[160] FDI

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[155] Kamp and Vanheule, "Review of the Small Wind Turbine Sector in Kenya," 474; Hansen and Nygaard, "Sustainable Energy Transitions in Emerging Economies," 668.
[156] Roberts et al., "The Politics of Accelerating Low-Carbon Transitions," 308.
[157] Ibid.
[158] "Official Development Assistance," *OECD*, last modified April 2018, accessed November 11, 2018, http://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/What-is-ODA.pdf.
[159] Ibid.
[160] *Methodological and Technological Issues in Technology Transfer*, 72.

"involves direct investment in physical plant and equipment in one country by business interests from a foreign country."[161]

International organizations are also highly involved in funding projects and processes as a part of energy transitions. Multiple MDBs have historically driven the provision of mitigation financing. In 2014, the African Development Bank reported that mitigation financing was divided between seven different MDBs totaling $23.3 billion, with the majority (26%) coming from the World Bank.[162] Assistance from MDBs can come in multiple forms, such as loans, grants, technical assistance, or a combination of multiple or all of the three.[163] Aside from MDBs, multiple international organizations operate under mandates to provide financing for environmental or sustainable projects; the concept of sustainable financing has rapidly grown as more countries seek to implement environmentally sustainable projects. The Global Environment Facility (GEF) was founded in 1992 at the Rio Earth Summit to provide funds for "developing countries and countries with economies in transition to meet the objectives of the international environmental conventions and agreements."[164] In a similar vein, the Green Climate Fund (GCF) was established at the Conference of Parties (COP) 16 in 2010 by UNFCCC parties to serve as part of the Convention's financial arm. The GCF aims to direct climate finance for the purposes of adaptation and mitigation actions taken in developing countries. Importantly, the GCF places specific emphasis on the ownership of developing

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[161] Ibid., 71.
[162] Delina, "Multilateral Development Banking in a Fragmented Climate System," 76.
[163] Ibid.
[164] "Funding," *Global Environment Facility*, last modified April 4, 2016, accessed March 4, 2019, https://www.thegef.org/about/funding.

countries in projects, and requires countries to designate an individual to liaise between the GCF and the country's government.[165]

In addition to the aforementioned mechanisms to reduce emissions, the Kyoto Protocol also initiated the Adaptation Fund, established in 2001 for the establishment of adaptation projects "in developing country parties to the Kyoto Protocol that are particularly vulnerable to the adverse effects of climate change."[166]

II.3.1.3 Political

Considering that many countries lack established policy to address renewable energy, many of the policies to govern renewable energy sectors are developed at the niche level. Regarding options for the implementation of RE policies, two of the most common are feed-in tariffs (FITs) and renewable portfolio standards (RPSs). Both are aimed at creating a renewable energy market—thus, their implementation is indicative of a country's goal to include RE in its long-term energy regime. By creating long-term markets for RE, both policies are able to reduce the risk to investors. RPSs and FITs have been adopted at both the national and subnational level. Multiple actors, including international donors, businesses, and NGOs have been active in pushing developing countries to implement both policies. Even with this wide support, each option's relative effectiveness is contested. Studies done across OECD and non-OECD countries reach a variety of conclusions on the results of FIT implementation.[167] Feed-in tariffs "provide RE producers with a preferential price per unit of generation (e.g., kWh) over a set period

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[165] "About the Fund," *Green Climate Fund*, accessed March 4, 2019, https://www.greenclimate.fund/who-we-are/about-the-fund.

[166] "Adaptation Fund," *United Nations Framework Convention on Climate Change*, accessed November 2, 2018, https://unfccc.int/process/bodies/funds-and-financial-entities/adaptation-fund.

[167] Carley et al., "Global Expansion of Renewable Energy Generation," 398–99.

of time (e.g., 10 to 15 years), designed to enable investors to recover their investments over time."[168] RPSs, also referred to as "quota systems," "are mandates rather than financial incentives," and "require utilities to procure a specified percentage of electricity generation or sales from renewable sources."[169]

II.3.1.4 Socio-Cultural

The globalization of actors involved in producing clean technologies necessitates the occurrence of both global and local learning processes in order for the successful diffusion of clean technologies. Regarding the implementation and dissemination of technologies on the ground, local learning occurs as it does in traditional investment projects, where local firms are responsible for driving the local market and, in many cases, producing at least a component of the goods and services. Global learning processes are incorporated as companies located abroad become increasingly responsible for the production of necessary components. Thus, the investment conditions present in developing countries pursuing clean technologies are contingent upon both "global and local learning processes, which, in turn, depend on domestic and international regulatory, institutional, and industrial contexts."[170]

II.3.2 Barriers to Niche Breakthrough

II.3.2.1 Technological

Whether a country is able to successfully absorb technology through technology transfer depends on its absorptive capacity, or its ability to assimilate and apply new information received from external sources. This ultimately depends largely on a

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[168] Ibid., 399.
[169] Ibid., 400.
[170] Huenteler, Niebuhr, and Schmidt, "The Effect of Local and Global Learning on the Cost of Renewable Energy in Developing Countries," 7.

country's prior related knowledge.[171] Absorptive capacity is also highly indicative of a country or organization's innovative capabilities.[172]

The IPCC describes 10 different policy tools governments can employ to create enabling environments for technology transfer. These include national systems of innovation; social infrastructure and participatory approaches; human and institutional capacities; macroeconomic policy frameworks; sustainable markets; national legal institutions; codes, standards, and certification; equity considerations; rights to productive resources; and research and technology development.[173] Rather than efficacy, the main challenge facing developing countries' ability to employ these tools is limited institutional capacity.

While multiple international initiatives have been launched to facilitate technology transfer in developing countries similar to the CDM, their effectiveness is debatable. The cost of funding activities such as R&D or bolstering institutional capacity and innovation capabilities has precluded such initiatives from making a sustained impact on countries where they are implemented.[174]

A unique challenge to technology transfer in developing countries through collaborative research and development (R&D) stems from the fact that traditionally, private firms have been the subject of collaborative R&D specifically in industries of commercial interest to said firms—thus, collaboration between private firms and developing countries "for the purposes of delivering a public good . . . or specific

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[171] Wesley M. Cohen and Daniel A. Levinthal, "Absorptive Capacity: A New Perspective on Learning and Innovation," *Administrative Science Quarterly* 35, no. 1 (1990): 128.
[172] Sugathan and Mani, "The Role of Trade and Investment in Accelerating Clean Energy Diffusion: Private-Sector Views from South Asia," 263.
[173] *Methodological and Technological Issues in Technology Transfer*, 107.
[174] Heleen de Coninck and Daniel Puig, "Assessing Climate Change Mitigation Technology Interventions by International Institutions," *Climatic Change* 131, no. 3 (August 1, 2015): 431.

considerations relating to climate technology R&D" has not occurred on the same level.[175] "[C]ollaborative climate technology R&D needs to involve a range of private, public and not-for-profit actors, but can require involvement of developing country actors that have limited innovation capacities and are therefore of little strategic interest to international technology leading firms."[176]

There is additionally an ongoing ideological debate regarding whether or not IPRs act as a barrier to technology transfer. In 2013, Ecuador introduced the idea that climate change technology may run into barriers with the TRIPS agreement.[177] Views span from IPRs most certainly acting as a barrier to technology transfer, to IPRs being a problem yet not a relevant one, to IPRs not being a barrier at all.[178] In the past, international climate negotiations stalemated because of countries' differing perspectives on IPRs and their role in technology transfer.[179] This debate has also taken the form of the North-South debate, with more developed countries arguing for a lack of IPRs as a barrier to technology transfer and developed countries taking the opposite position. The two sides of this debate contest the importance of IPRs in technology transfer, with one arguing that IPRs, primarily in the form of patents, prohibit access to new technologies. In

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[175] Ockwell, Sagar, and de Coninck, "Collaborative Research and Development (R&D) for Climate Technology Transfer and Uptake in Developing Countries," 403.
[176] Ibid.
[177] "Climate Change and the WTO Intellectual Property (TRIPS) Agreement," accessed November 11, 2018, https://www.wto.org/english/tratop_e/trips_e/cchange_e.htm.
[178] Krishna Ravi Srinivas, "Technology Transfer, IPRs, and Climate Change," in *Low-Carbon Technology Transfer: From Rhetoric to Reality*, ed. David G. Ockwell and Alexandra Mallett, First. (London: Routledge, 2012), 107.
[179] David G. Ockwell et al., "Intellectual Property Rights and Low Carbon Technology Transfer: Conflicting Discourses of Diffusion and Development," *Global Environmental Change* 20, no. 4, 20th Anniversary Special Issue (October 1, 2010): 730.

contrast, other countries argue that the main barrier to technology transfer in developing countries is a lack of IPR law—IPRs are seen as a catalyst.[180]

Limited institutional and productive capacity also hinders countries' ability to produce niche technologies. Many developing countries lack either sufficient raw materials or the production lines to assemble materials, necessitating the import of resources and making countries vulnerable to consistency of supply and price fluctuations. These vulnerabilities impede manufacturing and eventual implementation of niche developments.[181]

II.3.2.2 Markets and Finances

Due to the limited financial resources of many developing countries, energy transitions are often financed by outside actors, such as multilateral development banks or international NGOs. Donor interventions are often heavily present. These interventions are "planned development programs and projects that are funded either by multilateral organizations, such as the World Bank and agencies of the United Nations, or by bilateral donor agencies that distribute aid between countries."[182] Donor interventions can affect both the regime and niche levels. At the regime level, interventions may include policy advising, institutional support and technical training, capacity-building for government agencies and other regime actors.[183]

In the event that donor countries provide RE subsidies for developing countries, these subsidies "can actually undermine nascent markets for RE by creating an expectation

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[180] Ockwell, Sagar, and de Coninck, "Collaborative Research and Development (R&D) for Climate Technology Transfer and Uptake in Developing Countries," 730.
[181] Kamp and Vanheule, "Review of the Small Wind Turbine Sector in Kenya," 478.
[182] Ulrich Elmer Hansen and Ivan Nygaard, "Transnational Linkages and Sustainable Transitions in Emerging Countries: Exploring the Role of Donor Interventions in Niche Development," *Environmental Innovation and Societal Transitions* 8 (September 1, 2013): 3.
[183] Ibid.

among customers that such products should be free or subsidized.[184]Moreover, “direct donor investment as a type of subsidization does little to catalyze private investment” in the RE sector.[185] Instead of donor support going towards subsidization, better outcomes would likely result if support is channeled towards policy and market reforms.[186]

Developing countries may also face challenges attracting investment if project developers perceive the uncertainties or risks of an investment to outweigh the potential profits, as seen in Malaysia.[187]

II.3.2.3 Political

While helpful in many respects, the presence of transnational actors, specifically in the form of donor interventions, may present additional challenges to the uptake of niche innovations in developing countries. The necessitation of holistic support, in addition to mere project development, is a key measure of whether or not a niche experiment will succeed. Rather than the technology itself, political and institutional aspects are the main barriers to successful upscaling of niche technologies. Projects designed with support from strong vertical linkages (such as complementary policies at the regime level) lead to successful upscaling, whereas projects initiated by international development agencies,

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[184] Carley et al., “Global Expansion of Renewable Energy Generation,” 401; Eric Martinot et al., “Renewable Energy Markets in Developing Countries,” *Annu. Rev. Energy Environ* 27 (2002): 309–48.
[185] Carley et al., “Global Expansion of Renewable Energy Generation,” 401; Mark T. Buntaine and William A. Pizer, “Encouraging Clean Energy Investment in Developing Countries: What Role for Aid?,” *Climate Policy* 15, no. 5 (September 3, 2015): 543–564.
[186] Carley et al., “Global Expansion of Renewable Energy Generation,” 401.
[187] Hansen and Nygaard, “Sustainable Energy Transitions in Emerging Economies,” 670; S. M. Shafie et al., “A Review on Electricity Generation Based on Biomass Residue in Malaysia,” *Renewable and Sustainable Energy Reviews* 16, no. 8 (October 1, 2012): 5879–5889.

hich often lack these same linkages, "are seldom diffused" and rarely lead to overarching shifts in practices.[188]

Although foreign direct investment (FDI) is often utilized in projects to increase RE diffusion in developing countries, the efficacy of FDI in contributing to a robust domestic RE industry is questionable. Using two different two-stage estimation methods, Pfeiffer and Mulder modeled 108 developing countries' choices (between 1980 and 2019) regarding both whether or not to adopt renewable energy technologies and "the amount of electricity to produce from renewable energy sources."[189] As Pfeiffer and Mulder explain, domestic institutions are much more indicative of the probability that renewable energy, specifically non-hydro RE (NHRE), is successfully adopted. Ultimately, they find that "donor-driven investment and attention given to NHRE adoption are insufficient in themselves to compensate for the fragile institutional environment in these countries."[190] Thus, rather than bolster the uptake of NHRE, the presence of ODA "reduces the probability of NHRE adoption"; increasing FDI has been shown to lower the probability of NHRE adoption.[191]

II.3.2.4 Socio-Cultural

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[188] Wieczorek, "Sustainability Transitions in Developing Countries," 206; Xuemei Bai, Brian Roberts, and Jing Chen, "Urban Sustainability Experiments in Asia: Patterns and Pathways," *Environmental Science & Policy* 13, no. 4, Socio-technical experiments in Asia – a driver for sustainability transition? (June 1, 2010): 312.
[189] Birte Pfeiffer and Peter Mulder, "Explaining the Diffusion of Renewable Energy Technology in Developing Countries," *Energy Economics* 40 (2013): 286. The dataset of countries that Pfeiffer and Mulder analyze does include Mongolia.
[190] Ibid., 293.
[191] Ibid.

In many developing countries, underlying societal problems often eclipse conversations about renewable energy and existential moral issues such as Western notions of environmentalism and sustainability.[192]

The hindrance of niche development by donor presence is further documented. Rather than providing the stability, predictability, and clarity that many donors advertise, it has been shown that donor interventions "create new arenas for struggle over resources, interests, meaning, interpretations and rationalities between various actors."[193]

Ultimately, renewable energy technology development and reliance on RE are driven by different factors; "simply increasing RE generation does not necessarily decrease reliance on fossil fuels nor help countries make the transition to a clean energy economy."[194]

II.4 Suitability of the MLP for developing countries

Upon analyzing relevant factors of developing countries' energy transitions, it is apparent that many of the same factors present in developed countries' transitions are present. However, given that the MLP was developed for and initially applied to transitions in developed countries, it has become increasingly apparent that the MLP does not, in many ways, account for factors that are at the forefront of energy transitions in the global South. This incompatibility is evident both in analyzing individual transitions and in efforts to apply models utilizing the MLP to these transitions; none of the four pathways described by Schot and Geels in their typology of transition pathways accounts for the presence of transnational or intermediary actors.

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[192] Wieczorek, "Sustainability Transitions in Developing Countries."
[193] Hansen and Nygaard, "Transnational Linkages and Sustainable Transitions in Emerging Countries," 16.
[194] Carley et al., "Global Expansion of Renewable Energy Generation," 399.

Anna Wieczorek's systematic review of 115 publications about sustainability transitions in developing countries provides a useful starting point for discussing the shortcomings of traditional socio-technical frameworks (Table 4).[195]

Table 4
Summary of insights regarding developing countries' sustainability transitions (Adapted from Wieczorek, 2018:212).

Major theme	Insights
Experiments and upscaling	There emerge transnational sustainability experiments that embody novel sources of capability-formation other than industrialised firms which challenges convergence theories. Vertical and horizontal linkages are important for upscaling of experiments. Definition of sustainability experiments is useful but needs further specification to create an effective design for developing countries.
Transnational linkages	Regime and niche actors are increasingly transnationally connected and there are technology, capital and knowledge flows. However, local assets and policies still play an important role. Regimes in developing countries are less uniform than in the Western world. Old technologies exist alongside new ones, providing the same service.
Stability and change	Stability does not necessarily obstruct regime transformation in developing countries. Many systems are absent or highly dysfunctional.
Path-dependence	Some aspects of path-dependence in developing countries (colonial past) form barriers to sustainability transitions, while underdeveloped or absent fossil fuel-based infrastructures provide opportunities. Institutional contexts are place specific.
Contextual factors	Landscape forces are not as exogenous as theory predicts and can have a direct impact or be deliberately mobilised by niche actors.
Normative orientation	Sustainability perception differs across societies, causing disagreements about problems and their solutions.

Within the themes that Wieczorek identifies, transnational linkages, contextual factors, and normative orientation are especially useful in cataloging how the MLP can be augmented by other disciplines to better apply to transitions in developing countries. Intermediaries, which she does not explicitly mention but are often mentioned in conjunction with transnational linkages, are also relevant.

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[195] Pfeiffer and Mulder, "Explaining the Diffusion of Renewable Energy Technology in Developing Countries," 294.

Transnational linkages are "the cross-border relationships, infrastructures and interactions that enable flows and circulations of resources including people (actors), knowledge, technologies, institutions and finance."[196] Fields outside of socio-technical theory are particularly relevant for providing insight on transnational linkages, such as geography and political economy. Transnational linkages allow for "actors to complement lacking resources," thus further enabling innovation.[197] These linkages are especially common in the form of donor interventions, which as discussed, occur frequently at both the regime and niche levels with Donor interventions at the niche level may include direct financial support for the development of niche-level experiments.[198]

Moreover, the role of intermediaries in sustainability transitions has received increasing attention. While intermediaries have been defined in a myriad of ways, specifically in relation to transitions, "transition intermediaries" are

> actors and platforms that positively influence sustainability transition processes by linking actors and activities, and their related skills and resources, or by connecting transition visions and demands of networks of actors with existing regimes in order to create momentum for socio-technical system change, to create new collaborations within and across niche technologies, ideas and markets, and to disrupt dominant unsustainable socio-technical configurations.[199]

This definition reflects numerous definitions for intermediaries present in a number of processes, where intermediaries are present at the niche, regime, and systemic levels, and can assume their role as intermediaries intentionally or unintentionally.[200] Increased

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[196] Anna J. Wieczorek, Rob Raven, and Frans Berkhout, "Transnational Linkages in Sustainability Experiments: A Typology and the Case of Solar Photovoltaic Energy in India," *Environmental Innovation and Societal Transitions* 17 (December 1, 2015): 152.
[197] Wieczorek, "Sustainability Transitions in Developing Countries," 207.
[198] Hansen and Nygaard, "Transnational Linkages and Sustainable Transitions in Emerging Countries," 3.
[199] Paula Kivimaa et al., "Towards a Typology of Intermediaries in Sustainability Transitions: A Systematic Review and a Research Agenda," *Research Policy* 48, no. 4, New Frontiers in Science, Technology and Innovation Research from SPRU's 50th Anniversary Conference (May 1, 2019): 1072.
[200] Ibid., 1066–1067.

attention to intermediaries reflects the increased focus on transnational linkages, in which intermediaries are critical to facilitate cross-border dynamics.

Discussions on intermediaries and transnational actors reflect a lack of clarity on who might be considered an actor at each level of the MLP. Specifically for the landscape level, seeing as it is considered merely "background" wherein no activities happen within it, any landscape change is either independent of any actors or results from actors operating at the niche and regime levels."[201] However, as Wieczorek notes, the landscape level has been found to be affected by action at the niche and regime levels, calling into question the assumption that the landscape level is unable to be affected directly.[202]

There has been little consideration given to the normative aspects of transitions, resulting in many highlighting that there is a lack of consensus regarding what "sustainability" even is. Specifically in relation to the global South, environmental issues in the form of existential, as opposed to concrete and definable, problems will be dominated by issues such as a lack of access to electricity, widespread poverty, or general social inequalities.[203] Moreover, technologies or practices that Western nations see as "sustainable," such as renewable energy systems, are often perceived through different normative lenses in developing countries. A statement by an interviewee in Tanzania regarding incentives for solar energy stated: "It doesn't have anything to do with climate change; it is driven by rural electrification and people wanting electricity."[204]

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[201] Fischer and Newig, "Importance of Actors and Agency in Sustainability Transitions: A Systematic Exploration of the Literature," 475.
[202] Wieczorek, "Sustainability Transitions in Developing Countries," 212.
[203] Ibid., 209.
[204] Amars et al., "The Transformational Potential of Nationally Appropriate Mitigation Actions in Tanzania," 95.

Chapter III: Landscape Level

The landscape level describes the exogenous structure within which regime and niche actors operate, and while "beyond the direct influence of regime and niche actors," the level is affected by both external events and broad, societal shifts that arise as a result of actions by niche and regime actors.[205] Relevant landscape factors for Mongolia's energy transition include the international community's recognition of anthropogenic climate change, attitude towards sustainable development, the nature of relationships between developed and developing countries and the acceptance, promulgation of renewable energy technologies, and normative framing. Relevant domestic landscape conditions include Mongolia's historic ties with the international community.

III.1 International Factors

III.1.1 Attribution of Global Warming to Anthropogenic Causes

Reports from the Intergovernmental Panel on Climate Change (IPCC) are published periodically to inform the general public about the latest findings regarding climate change as agreed to by the global scientific community. With every publication, the IPCC has ratcheted up its attribution of the increase in global temperatures, and subsequent changes in the global climate, to human activity. The IPCC's 1990 First Assessment Report did not confirm human responsibility for observed worldwide warming, stating instead that:

> The size of this warming is broadly consistent with predictions of climate models, but it is also of the same magnitude as natural climate variability. Thus the observed increase could be largely due to this natural variability, alternatively this variability

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[205] Grin, Rotmans, and Schot, *Transitions to Sustainable Development*, 23.

> and other human factors could have offset a still larger human-induced greenhouse warming.[206]

The IPCC's 1995 Second Assessment Report states that "The balance of evidence suggests that there is a discernible human influence on global climate."[207] The attribution of increase in global temperature to anthropogenic causes is more forceful with every report: in 2001, warming is "likely" due to increases in GHG concentrations, in 2007, "very likely," and in 2014, the IPCC writes that "[i]t is extremely likely that more than half of the observed increase in global average temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together."[208]

Coupled with the heightened assignment of climate change to human activity is a plea for society to undertake a fundamental shift away from unsustainable fuel sources. The IPCC goes on to write in 2014 that "[t]he stabilization of greenhouse gas concentrations at low levels requires a fundamental transformation of the energy supply system, including the long-term phase-out of unabated fossil fuel conversion technologies and their substitution by low-GHG alternatives."[209] This conclusion is reiterated in a 2018 IPCC report, which affirms "Pathways limiting global warming to 1.5˚C with no or

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[206] J.T. Houghton, G.J. Jenkins, and J.J. Ephraums, *Climate Change: The IPCC Scientific Assessment. Report Prepared for IPCC by Working Group 1* (Cambridge, UK: IPCC, 1990), xii.
[207] J.T. Houghton et al., eds., *Climate Change 1995: The Science of Climate Change. Contribution of WGI to the Second Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, UK: IPCC, 1996), 5.
[208] IPCC, *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, ed. Core Writing Team, R.K. Pachauri, and A. Reisinger (Geneva, Switzerland: IPCC, 2007), 5; IPCC, *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, ed. Core Writing Team, R.K. Pachauri, and L.A. Meyer (Geneva, Switzerland: IPCC, 2014), 5.
[209] Ottmar Edenhofer et al., "2014: Technical Summary," in *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press, 2014), 69.

limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (*high confidence*)."[210]

III.1.2 Conceptions of Development

Following the publication of the Brundtland Report in 1987, the international community began to confront what a future in which sustainable development was prioritized might look like. This reckoning began in the 1990s, particularly when the United Nations Framework Convention on Climate Change (UNFCCC, FCCC) was adopted in 1992 at the Rio Earth Summit. The Convention still reflected the attitude at the time that development (e.g., economic and social development and poverty eradication) should be developing countries' main priority, and that the achievements of development and environmental policies were, to a certain extent, mutually exclusive. Ultimately, developing countries should fully develop first, and then focus on sustainable development. Article 4.7 of the FCCC states:

> The extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology and will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties.[211]

These commitments, which are to be undertaken by all Parties to the Convention, include tasks such as periodically reporting national emissions, implementing climate change

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[210] IPCC, "Summary for Policymakers," in *Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty*, ed. V. Masson-Delmotte et al. (Geneva, Switzerland: World Meteorological Organization, 2018), 17.
[211] "United Nations Framework Convention on Climate Change" (United Nations, 1992), Article 4.7.

mitigation programs, promoting sustainable management, developing mechanisms for adapting to climate change, considering climate change in all policy formulation, and participating in ongoing efforts to further understand climate change—practices widely in line with the principles grounding sustainable development.[212]

As the international community sought to determine what processes would need to be undertaken to achieve development, countries defined development through broad ideals such as the eight Millennium Development Goals (MDGs) formed in 2000. Whereas "ensure environmental sustainability" was a single MDG, it is now recognized that when properly implemented, sustainable development practices, and renewable energy systems in particular, are potential solutions to many other aspects of development, such as the eradication of extreme poverty and social inequality. Seven of the UN's 17 Sustainable Development Goals (SDGs), adopted in 2015, explicitly mention "sustainability" or "climate."[213] Utilizing renewable energy sources or cleaner fuels immediately improves indoor air quality and resulting health outcomes. The provision of energy access through renewable sources can allow communities to be more productive, increasing economic activity and spurring traditional development goals such as poverty eradication.[214] Renewable energy is also increasingly looked to as an ideal solution to addressing the widespread lack of energy access customary in many developing countries. Whereas fossil-fuel-based electricity systems are "poorly suited to rural areas" given challenges that arise with grid connectivity and infrastructure, distributed renewable energy systems

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[212] Ibid., Article 4.1.
[213] United Nations, "Sustainable Development Goals."
[214] Delina, *Accelerating Sustainable Energy Transition(s) in Developing Countries*, 7–8.

have been proven to be very effective in providing electricity to these formerly unconnected areas.[215]

Landscape pressure to shift away from unsustainable energy sources is driven by more than a desire to mitigate warming temperatures; in addition to contributing significantly to GHG concentrations, emissions from fossil-fuel-based energy sources are detrimental for human health, specifically by contributing to air pollution. The International Energy Agency (IEA) writes in the 2016 World Energy Outlook that "Energy production and use, mostly from unregulated, poorly regulated or inefficient fuel combustion, are the single most important man-made sources of air pollutant emissions."[216] Many premature deaths are attributable to outdoor air pollution, and this number continues to rise despite efforts to expand renewable energy use. Due to demographic trends and circumstances such as the increase of urbanization and rising energy use, in particular for developing countries in Asia (including Mongolia), the IEA predicts that these deaths will increase from 3 million in 2016 to 4.5 million in 2040.[217]

III.1.3 Commitments of Developed Countries to Developing Countries

The extent to which developed countries are obligated to assist in the development of countries in the global South has been a contentious issue for decades. The international community has been mired in an ideological debate over who should absorb the majority of costs for mitigating climate change. The two areas in which developed countries have

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[215] Douglas Arent et al., eds., *The Political Economy of Clean Energy Transitions* (Oxford: Oxford University Press, 2017), 10.
[216] International Energy Agency (IEA), *World Energy Outlook 2016 Special Report: Energy and Air Pollution* (Paris: IEA/OECD, 2016), 13.
[217] Ibid., 14.

increasingly agreed to assist developing countries are technology transfer and sustainable financing.

III.1.3.1 Technology Transfer

The UNFCCC was the first international agreement to establish that developed countries were obligated to help developing countries; in particular, a commitment to initiating technology transfer was highlighted. The Convention clarifies 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. In this process, the developed country Parties shall support the development and enhancement of endogenous capacities and technologies of developing country Parties.[218]

The theme of technology transfer is prominent in additional agreements adopted by the UN. Agenda 21 was also adopted by countries at the 1992 Rio Earth Summit as a comprehensive action plan to address society's impact on the environment. Chapter 34, paragraph 34.4 of Agenda 21 specifically describes the need for "favourable access to and transfer of environmentally sound technologies, in particular to developing countries."[219] Agenda 21 highlights the need for long-term relationships to be cultivated in order to oversee the necessary "iterative processes" involved in technology transfer. Chapter 34, paragraph 34.10 of Agenda 21 states: "Consideration must be given to the role of patent protection and intellectual property rights along with an examination of their impact on the access to and transfer of environmentally sound technology."[220]

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[218] "United Nations Framework Convention on Climate Change," Article 4.5.
[219] "Agenda 21," *Sustainable Development Knowledge Platform*, last modified 1992, accessed November 11, 2018, https://sustainabledevelopment.un.org/outcomedocuments/agenda21.
[220] Ibid.

The Kyoto Protocol, adopted in 1998 as an agreement linked to the UNFCCC, both reiterates and expands on developed countries' obligations as stated in the FCCC. In addition to aiding in the transfer of environmentally sound technologies, developed countries are expected to contribute to the strengthening of human and institutional capacities in developing countries.[221] Technology transfer is re-emphasized in the Paris Agreement, the second agreement linked to the UNFCCC adopted in 2015; the Agreement implores Parties to "strengthen cooperative action on technology development and transfer."[222]

III.1.3.2 Sustainable Financing

In addition to fostering technology transfer, the provision of financing is an additional responsibility developed countries have shouldered in order to help facilitate developing countries. This financial support for renewable systems has enabled developing countries to adopt renewable energy technologies. Investment in renewable energy technologies continues to increase, and developing and emerging economies first surpassed developed countries in renewable energy investment in 2015.[223]

Using analogous language to that which is used to describe technology transfer, the UNFCCC and its linked agreements all elucidate the responsibility of developed countries to provide financial resources for developing countries.[224]

In addition to the mention of financial responsibilities in international agreements, various international institutions, such as the aforementioned Global Environment

[221] "Kyoto Protocol to the United Nations Framework Convention on Climate Change" (United Nations, 1998), Article 10(c), 10(e).
[222] "The Paris Agreement" (United Nations, 2015), Article 10.2.
[223] *Renewables 2018 Global Status Report*, 140.
[224] "United Nations Framework Convention on Climate Change," Article 4.3; "Kyoto Protocol to the United Nations Framework Convention on Climate Change," Article 11; "The Paris Agreement," Article 9.1.

Facility (GEF) in 1992 and the Green Climate Fund (GCF) in 2010, have been established with the distinct purpose of providing financial assistance to developing countries pursuing environmental goals.[225]

Specific shocks unrelated specifically to sustainability and energy further motivated countries to provide sustainable financing opportunities. The global financial crisis spurred the United Nations Environment Programme to propose a $3.1 economic stimulus package called the "Global Green New Deal," which outlined three objectives: reviving the global economy, reducing carbon dependency, and furthering the Millennium Development Goal of ending extreme world poverty.[226] This led countries such as China, the United States, South Korea, and France to allocate billions of dollars towards the development of green technologies.[227] Overall, the global market for clean technologies grew 31% between 2008 and 2011.[228]

III.1.4 Composition of Global Energy Sources

As the landscape level has slowly evolved to further incorporate principles and practices of sustainable development, energy as an overarching concept has subsequently transformed, further aligning with sustainable development practices. Fossil fuel energy sources continue to dominate the makeup of global energy systems, although the shares of each fossil-fuel source have shifted since the mid-twentieth century (Figure 8). While the percentage of energy use from oil, coal, and natural gas was the same in 2014 (81%)

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[225] "Funding"; "About the Fund."
[226] Edward B. Barbier, *Rethinking Economic Recovery: A Global Green New Deal* (United Nations Environment Programme, April 2009), 8.
[227] Ulrich Mans, "Tracking Geographies of Sustainability Transitions: Relational and Territorial Aspects of Urban Policies in Casablanca and Cape Town," *Geoforum* 57 (November 1, 2014): 153.
[228] Arnoud van der Slot and Ward van den Berg, *Clean Economy, Living Planet: The Race to the Top of Global Clean Energy Technology Manufacturing* (Roland Berger Strategy Consultants (Commissioned by WWF), 2012), 15.

as it was in 1986, within this 81%, oil has declined, whereas natural gas and coal have both increased (19% to 21% and 25% to 28%, respectively).[229]

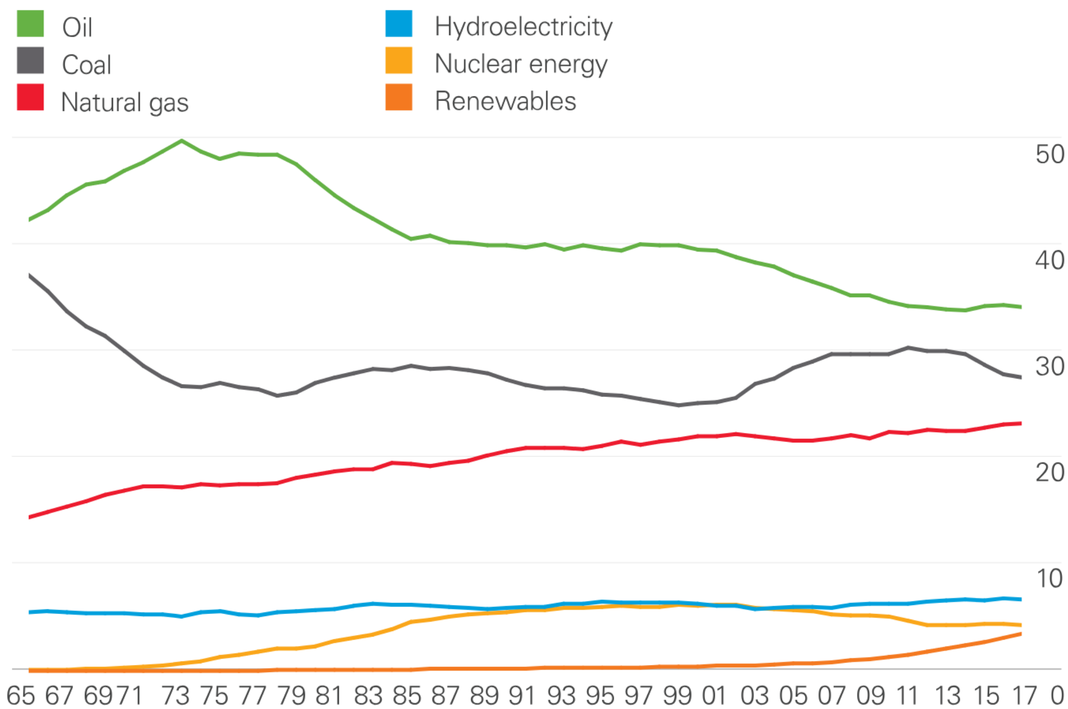

Fig. 8. Shares of primary energy sources (percentage) (BP, 2017).

The impacts of specific shocks at the landscape level are visible in Figure 8, specifically, the oil crises of 1973 and 1979. While each crisis arose out of different geopolitical and economic circumstances, both led to relatively immediate spikes in the price of oil, leading to the notable declines in oil's share of the world's energy supply.[230] While countries responded differently to these shocks, many European nations moved to reduce oil dependency.[231]

In addition to the oil industry, the nuclear energy sector has experienced similar specific shocks. These shocks often result in regional, as opposed to global, effects given

[229] International Energy Agency (IEA), *World Energy Outlook 2016 Special Report: Energy and Air Pollution*, 39.
[230] Fiona Venn, *The Oil Crisis* (London: Routledge, 2016), ix.
[231] Verbong and Geels, "The Ongoing Energy Transition," 1028.

individual countries' distinct relationships with varying energy sources. For example, in Germany's electricity transition, the 1986 Chernobyl nuclear accident (in which an explosion in one of the power plants reactors led to the release of radioactive debris) mobilized anti-nuclear activists, who began to promote the use of alternative energy sources.[232]

An additional landscape shock occurred in 2011 with the nuclear accident at the Fukushima Nuclear Power Plant in Japan. The accident prompted action from Japan that reverberated out to include many Asian countries, including Mongolia. Following the Fukushima accident, CEO and Chairman of Japan's SoftBank Corporation founded the Renewable Energy Institute (formerly Japan Renewable Energy Foundation) with the intent of accelerating renewable energy development in Japan and internationally. The concept of the Asia Super Grid (ASG) was introduced at the event establishing the Institute, which also included a presentation about Mongolia's eventual contribution to the Grid from the chairman of Newcom LLC, a Mongolian company.[233] The ASG would connect electricity grids across multiple Asian nations; currently, the concept is supported by China, Japan, South Korea, Russia, and Mongolia.[234]

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[232] Geels et al., "The Socio-Technical Dynamics of Low-Carbon Transitions," 467; "Chapter I The Site and Accident Sequence - Chernobyl: Assessment of Radiological and Health Impact," *Nuclear Energy Agency*, last modified 2002, accessed April 11, 2019, https://www.oecd-nea.org/rp/chernobyl/c01.html.
[233] "Celebration to Commemorate the Establishment of Japan Renewable Energy Foundation | Event," *Renewable Energy Institute*, last modified September 12, 2011, accessed October 31, 2018, https://www.renewable-ei.org/en/activities/events/20110912.html.
"About ASG | Asia Super Grid," *Renewable Energy Institute*, accessed October 31, 2018, https://www.renewable-ei.org/en/asg/about/.
[234] Charles Zhang, "An Asia Super Grid Would Be a Boon for Clean Energy—If It Gets Built," *Council on Foreign Relations*, last modified September 5, 2018, accessed October 31, 2018, https://www.cfr.org/blog/asia-super-grid-would-be-boon-clean-energy-if-it-gets-built.

III.1.5 Normative Framing

Gradual landscape changes have also been furthered by normative framing, such as the UN's Sustainable Development Goals (SDGs) set in 2015, as well as organizations that increasingly highlight achieving universal access to sustainable energy. SDG7 in particular is to "ensure access to affordable, reliable, sustainable and modern energy for all."[235] In 2011, former UN Secretary-General Ban Ki-moon launched the organization Sustainable Energy for All (SEforAll) to mobilize action around the three components of SDG7: "ensuring universal access to modern energy services," "doubling the share of renewable energy in the global energy mix," and "doubling the global rate of improvement in energy efficiency."[236] Following the creation of SEforAll, the UN General Assembly declared 2012 as the "International Year of Sustainable Energy for All," and the period 2014-2024 as the Decade of Sustainable Energy for All.[237] The UN has initiated efforts to promote renewable energy for decades, supporting the development of an international agency dedicated to renewable energy since 1981.[238] There is not one specific body within the UN to promote renewable energy; rather, efforts are spread across multiple UN agencies, such as the UN Environment Programme (UNEP), the General Assembly, and the UN Development Programme (UNDP). Outside of the UN, the International Renewable Energy Agency (IRENA) was founded in 2009

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[235] "Goal 7," *Sustainable Development Knowledge Platform*, accessed October 6, 2018, https://sustainabledevelopment.un.org/sdg7.

[236] "About Us," *Sustainable Energy for All (SEforALL)*, accessed October 17, 2018, https://www.seforall.org/about-us.

[237] "United Nations General Assembly Declares 2014-2024 Decade of Sustainable Energy for All," *United Nations*, last modified December 21, 2012, accessed April 23, 2019, https://www.un.org/press/en/2012/ga11333.doc.htm.

[238] "History," *International Renewable Energy Agency*, accessed November 2, 2018, http://irena.org/history.

with the mission of promoting “the widespread adoption and sustainable use of all forms of renewable energy.”[239]

III.2 Domestic Factors

In addition to favorable conditions shaped by the evolution of landscape factors at the international level, Mongolia’s energy transition has also been helped by unique domestic landscape conditions, such as Mongolia’s historic proclivity towards international participation.

III.2.1 Embrace of International Community

Mongolia’s good standing with the international community has catalyzed the ease with which Mongolia pursues development projects. While Mongolia has independently made progress on determining its development agenda and goals, much of the pressure for it to adopt policies towards a larger goal of sustainable development stems from international partners.

Mongolia’s geopolitical strategy is highly dependent on its physical placement between two authoritarian global powers, Russia and China. Mongolia’s National Security Concept clarifies its “third neighbor” strategy, which specifies that “bilateral and multilateral cooperation with highly developed democracies in political, economic, cultural, and humanitarian affairs shall be undertaken.”[240] Coined in 1990 by former United States Secretary of State James A. Baker, the term “third neighbor” was used to

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[239] “About IRENA,” *International Renewable Energy Agency*, accessed November 2, 2018, http://irena.org/aboutirena.
[240] “National Security Concept of Mongolia,” *National Security Council of Mongolia*, last modified 1994, http://www.nsc.gov.mn/sites/default/files/images/National Security Concept of Mongolia EN.pdf.

describe the U.S.'s relationship to Mongolia (with its other two neighbors being China and the former Soviet Union).[241]

Mongolia's proclivity towards international participation is evident in its diplomatic forays. Mongolia prides itself on being a diplomatic partner to many, even countries that others turn away from—it maintains diplomatic relations with both South and North Korea.[242] The country sent troops to Iraq to support the United States from 2003 to 2008, and still has troops in Afghanistan.[243] Additionally, Mongolia's presence among democratic international organizations is notable considering Mongolia's geopolitical status. Mongolia served as the chair of the Community of Democracies from 2011 to 2013.[244] Mongolia is also one of only nine NATO "partner" nations, with other Asian partner nations being Japan and the Republic of Korea.[245]

One of the most active international organizations in Mongolia is the UN; this activity is facilitated through multiple agencies and organizations, such as the UN Development Programme (UNDP) and the UN Environment Programme (UNEP), but also through the facilitation of Mongolia's participation in various UN treaties and agreements—Mongolia is party to 14 different UN conventions and treaties related to the environment.[246] While many of these conventions and treaties do not require parties to

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[241] Munkh-Ochir Dorjjugder, "Mongolia's 'Third Neighbor' Doctrine and North Korea," *Brookings Institution*, January 28, 2011, accessed March 18, 2019, https://www.brookings.edu/research/mongolias-third-neighbor-doctrine-and-north-korea/.
[242] Ibid.
[243] "Mongolia" (Congressional Research Service, July 10, 2018), accessed November 18, 2018, https://fas.org/sgp/crs/row/IF10926.pdf.
[244] "Remarks by Vice President Biden and Mongolian Prime Minister Batbold," *Whitehouse.Gov*, last modified August 22, 2011, accessed November 18, 2018, https://obamawhitehouse.archives.gov/the-press-office/2011/08/22/remarks-vice-president-biden-and-mongolian-prime-minister-batbold.
[245] "NATO - Topic: Relations with Partners across the Globe," *North Atlantic Treaty Organization*, last modified May 19, 2017, accessed November 20, 2018, https://www.nato.int/cps/en/natohq/topics_49188.htm.
[246] *Mongolia's Initial Biennial Update Report* (Ministry of Environment and Tourism, August 2017), 26.

take action, certain agreements require parties to complete various reports and progress updates. Mongolia ratified the UN Framework Convention on Climate Change UNFCCC in 1993 and has since signed on to both agreements linked to the Convention as well, the Kyoto Protocol and the Paris Agreement (ratified in 1999 and 2016, respectively).[247] The UNFCCC, Kyoto Protocol, and Paris Agreement all specify different reporting requirements that any party to the treaties must meet.

Even before Mongolia expressed an explicit interest in sustainable development as an overarching focus for its domestic policy agenda, external actors enabled the country to consider such a path: the seminal document that outlines Mongolia's wind energy potential was sponsored by two organizations in the United States—the Department of Energy and the U.S. Agency for International Development.[248] The agencies' exact motivation to undertake an assessment of Mongolia's wind energy resources is unclear; the only information available is that the agencies were, at the time, "sponsoring a program to help accelerate the use of wind energy technology in Mongolia."[249] Since the publication of Mongolia's Wind Energy Resource Atlas in 1998, international interest in Mongolia's renewable energy potential only continues to grow.

[247] "Mongolia," *UNFCCC*, accessed March 4, 2019, https://unfccc.int/node/61117.
[248] Elliott et al., *Wind Energy Resource Atlas of Mongolia*.
[249] D Elliott, M Legden, and L Natsagdorj, *Mongolia Wind Resource Assessment Project* (Ulaanbaatar, 1998), 3.

Chapter IV: Regime Level

IV.1 Incumbent Regime

The existing energy regime in Mongolia is characterized by a heavy reliance on coal and decentralized energy systems. The energy system in Mongolia is composed of five independent systems: the Central Energy System (CES), the Western Energy System (WES), the Altai-Uliastai Energy System (AUES), the Eastern Energy System (EES), and the South Gobi Region. Three are centralized power grids (CES, WES, EES), the latter two are isolated systems.[250] In total, these energy systems support nine combined heat and power (CHP) plants, 600 small diesel generators, 13 hydroelectric plants, and multiple solar and wind systems both off- and on-grid.[251] CHP plants are responsible for the vast majority of Mongolia's electricity capacity; in 2017 they accounted for about 88% of installed capacity.[252] However, Mongolia's renewable energy capacity has increased substantially since the first large-scale wind farm went into commission in 2013. Renewable energy accounted for 10.16% of installed capacity in 2017, and is set to increase to 21.79% by 2019.[253] Due to the fact that domestic capacity is unable to sufficiently meet energy demand, Mongolia imports about 20% of its electricity, coming mainly from Russia (and to a lesser extent, China).[254]

Many technologies currently operate within Mongolia's energy industry (Table 5).

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[250] *Mongolia's Initial Biennial Update Report*, 20.
[251] Ibid., 44.
[252] L. Jambaa, "National Renewable Energy Forum - 2018" (presented at the 9th Mongolian National Renewable Energy Forum, Ulaanbaatar, May 2018), 5.
[253] O. Bavuudorj, "Present Status and Challenges of Energy Sector in Mongolia" (presented at the 9th Mongolian National Renewable Energy Forum, Ulaanbaatar, May 2018).
[254] *Mongolia's Initial Biennial Update Report*, 44.

Table 5
Existing technologies in Mongolia's energy industry (Adapted from Technology Needs Assessment, Volume 2) (Ministry of Environment and Green Development, 2013a).

Service	Category	Technology	Description
Electricity supply	Fossil fuel	Combined heat and power, large-scale	Produces the majority of Mongolia's electricity and heat energy, there are 7 throughout the country
		Diesel for electricity generation	Supplies electricity to province centers not connected to central grid
	Renewable energy	Small-scale hydropower plant	Operates in capacities from 150kW to 12.0MW, 13 in total
		Small-scale solar PV	Generate electricity for herders using independent solar PV systems
		Solar and wind hybrid technologies	Built in some soum centers (wind power stations as well as combined solar-wind stations)
		Large-scale wind*	Supplies electricity to the central grid, began operating in 2013
		Large-scale solar PV*	Supplies electricity to the central grid, began operating in 2015
Heat supply	Fossil fuel	Combined heat and power, large scale	Produces the majority of Mongolia's electricity and heat energy, there are 7 throughout the country
		Heating stations for space heating and domestic hot water	Used in province centers

Energy use in Mongolia is governed by a compendium of laws addressing various components of the industry. Most important is the Law on Energy, passed in 2001 by Parliament to "regulate matters relating to energy generation, transmission, distribution, dispatching and supply activities, construction of energy facilities, and energy consumption."[255]

Energy consumption is dominated by the industry and construction sectors (Figure 9).

[255] "Law on Energy (Unofficial English Translation)," 2001, accessed October 3, 2018, http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/laws/1468%20English.pdf.

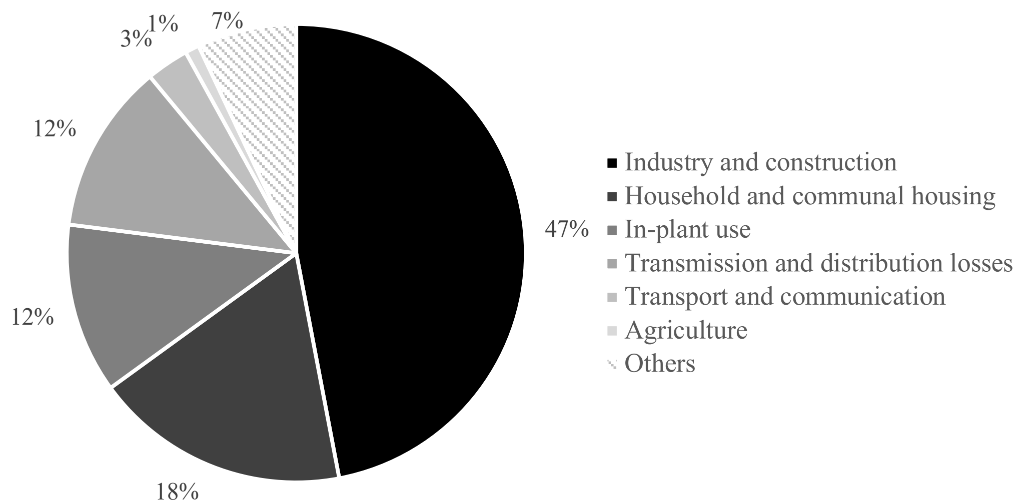

Fig. 9. Electricity consumption by sector (Ministry of Energy, 2014).

A CHP plant is a type of thermal power plant that uses waste heat as an input to generate more electricity and heat.[256] There is currently a proposal to construct CHP5 in Mongolia, financially backed by multiple MDBs and international organizations, including the Asian Development Bank, Engie (France), Nippon Export and Investment Insurance (Japan), and POSCO (South Korea).[257] Plants that are planned for construction include CHP5 in Ulaanbaatar, the Tavan Tolgoi thermal power plant, the Baganuur thermal power plant, and thermal power plants in western Mongolia, one for export (Shivee Ovoo), and one in eastern Mongolia (Dornod). Combined, these plants would add 1950MW for use in Mongolia, with 9240MW to be exported from Shivee Ovoo. Three additional projects not included in the six aforementioned plants are at varying steps in the approval process: the Chandgana Coal project (east of Ulaanbaatar) the

[256] "Types of Thermal Power Plant: Combined Heat and Power," *British Geological Survey (BGS)*, accessed November 20, 2018, http://www.bgs.ac.uk/discoveringGeology/climateChange/CCS/CombinedHeatAndPowerPlant.html.
[257] "Combined Heat and Power Plant Number 5 Project (CHP5)," *Asian Development Bank*, last modified November 20, 2018, accessed November 19, 2018, https://www.adb.org/projects/46915-014/main.

Tevshiin Gobi power station, and a 100MW expansion for power plant 4 in Ulaanbaatar. These would add another 1300 MW.[258]

Mongolia plans to build several thermal electric power stations near coal mines throughout the country in the next several years. There is currently a proposal to build a pulverized coal thermal supercritical power plant at the Tavan Tolgoi coal mine, with a capacity of 600MW.[259]

Mongolia also has a limited number of hydropower plants. Despite proposals to construct more than 70 large and mid-sized dams, only two have been built—Durgun (12 MW) and Taishir (11 MW). Additionally, there are 10 small plants that produce hydroelectricity. These plants have limited installed capacity and are unable to operate in winter due to freezing temperatures and resulting ice.[260]

The cement and lime industries are key manufacturing industries for Mongolia, and contribute significantly to Mongolia's GHG emissions.[261] Emissions in all sectors in Mongolia have dramatically increased from 1990 to 2014: emissions from the energy sector increased 55.69%, agriculture 58.02%, and waste 187.49%.[262]

IV.2 Drivers of Regime Tension

While coal has been the dominant energy source in Mongolia for decades, the incumbent system has been put under increasing pressure in recent years due to numerous tensions within the regime. These include economic uncertainty, technological

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[258] Ana-Maria Seman, *Mongolia's Energy Sector: Time for a Rethink* (CEE Bankwatch Network, 2017), 14.
[259] *Third National Communication of Mongolia Under the United Nations Framework Convention on Climate Change*.
[260] *Mongolia's Initial Biennial Update Report*, 21.
[261] Ibid., 12.
[262] Ibid., 14.

shortcomings, dissatisfaction with externalities from coal production (such as rising air pollution), and shifts in political agendas.

IV.2.1 Technological

The incumbent regime faces additional pressure from the technological limitations of existing infrastructure. Due to the fact that many of Mongolia's coal-fired TPPs were constructed between 1960 and 1980, they are likely to be retired in the near future; the average efficiency rate of these plants is below 30%.[263] A lack of management in the energy sector and poor incentives to increase the efficiency of heating systems results in significant energy loss during heat distribution, making heat supply costly and highly unreliable. Thus, there is enormous potential to improve the efficiency of Mongolia's heating systems.[264] However, there is little motivation for the public to conserve heat; rather than being billed for heating based on consumption, citizens are billed based on the area of their homes and apartments.[265]

As Mongolia's energy demand has increased, its reliance on imported energy has consequently increased. In order to stabilize the power system, Mongolia has turned to energy imported from Russia: imports increased to 1195.5 gigawatt-hours (GWh) in 2013, compared to a recorded 366 GWh in 2012.[266] The Government of Mongolia projects that annual energy demand will increase 500-600 megawatts (MW), or 3.5%, by

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[263] Chen, Gönül, and Tumenjargal, *Mongolia: Renewables Readiness Assessment*, 10; *Technology Needs Assessment: Volume 2 - Climate Change Mitigation in Mongolia* (Ministry of Environment and Green Development, 2013), 49.
[264] *Technology Needs Assessment: Volume 2 - Climate Change Mitigation in Mongolia*, 23.
[265] Anonymous (UNDP NAMA), interviewed by author, Ulaanbaatar, March 21, 2019.
[266] Chen, Gönül, and Tumenjargal, *Mongolia: Renewables Readiness Assessment*, 7.

2020.[267] Mongolia also imports electricity from China to supply towns along its southern border, as well as the Oyu Tolgoi mine.[268]

IV.2.2 Markets and Finances

With the guidance of various international partners, Mongolia continues to emphasize the expansion and utilization of sustainable financing practices. Initiated by the Dutch Development Bank (FMO), the International Financial Corporation (IFC), the Trade and Development Bank of Mongolia, the Mongolian Banker's Association, and the Banking and Finance Academy, the country's first Sustainable Financing Forum took place in 2013, and has been happening annually since.[269] The Forum is a chance for domestic and international actors to gather for the purpose of furthering Mongolia's sustainable financing goals, and is organized by both Mongolian and international actors.[270] Also established with the Forum was the Mongolian Sustainable Finance Initiative, which began as a tool to prioritize sustainable finance. All Mongolian banks committed to implementing the Initiative in 2013.[271] In order to further break down and address barriers that persist to Mongolia's pursuit of sustainable finance, the National Sustainable

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[267] Ibid., 8.

[268] *Mongolia's Initial Biennial Update Report*, 44.

[269] Mongolian Sustainble Finance Working Group, "Mongolian Sustainable Finance Initiative" (Lagos, Nigeria, March 3, 2014), accessed April 27, 2019, http://firstforsustainability.org/media/Badrakh-MongolianBankersAssoc-SBN2014.pdf.

[270] "ТоС Монголын Тогтвортой Санхүүжилтийн Холбоо," *Монголын Тогтвортой Санхүүгийн Холбоо - Mongolian Sustainable Finance Association*, accessed March 26, 2019, http://www.toc.mn/post/25.

[271] "Mongolian Sustainable Finance Initiative Brochure" (International Financial Corporation, n.d.), accessed April 27, 2019, https://www.ifc.org/wps/wcm/connect/bffbde00476d9f7885ecf5299ede9589/MBA_ToC_brochure.pdf?MOD=AJPERES.

Finance Roadmap of Mongolia was developed by the IFC, the Mongolian Sustainable Finance Association, and the UN Environment Programme.[272]

Mongolia's focus on sustainable finance has extended to the creation of a domestic fund to expand access to sustainable financing to previously under-addressed sectors of the economy.[273] The country also received support from international organizations, including multiple UN organizations, the IFC, and the Global Green Growth Institute (GGGI) to launch the Mongolia Green Credit Fund (MGCF). The MGCF is a national financing vehicle that will allow the government to meet targets set in various sustainable development policies.[274]

IV.2.3 Political

In order to support the construction and implementation of renewable energy projects, the Government of Mongolia has proposed and enacted laws and agendas that better align with a vision of sustainable energy. In addition to the Law on Energy, Mongolia's energy sector is governed by the Renewable Energy Law of Mongolia, adopted in 2007 and most recently amended in 2015. The Law defines relevant terms, clarifies apposite authorities, and outlines regulatory practices in regards to Mongolia's renewable energy sector.[275]

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[272] Iaian Henderson, Nomindari Enkhtur, and Tumurkhuu Davaakhuu, *National Sustainable Finance Roadmap of Mongolia* (UNEP Inquiry, International Finance Corporation, Mongolian Sustainable Finance Association, December 2018), 8, accessed December 21, 2018, http://unepinquiry.org/publication/national-sustainable-finance-roadmap-of-mongolia/.

[273] "Mongolian Green Credit Fund (MGCF)," *GGGI - Global Green Growth Institute*, accessed March 26, 2019, http://gggi.org/project/mongolian-green-credit-fund-mgcf/.

[274] Sodnomtseren Altatsetseg, "Mongolia Bankers Association Announces Next Steps Towards Mongolia Green Credit Fund | PAGE," *Partnership for Action on Green Economy*, last modified September 14, 2017, accessed April 27, 2019, https://www.un-page.org/mongolia-bankers-association-announces-next-steps-towards-mongolia-green-credit-fund; "Mongolian Green Credit Fund (MGCF)."

[275] "СЭРГЭЭГДЭХ ЭРЧИМ ХҮЧНИЙ ТУХАЙ," *Legal Info*, last modified 2015, accessed October 30, 2018, http://www.legalinfo.mn/law/details/465.

The Renewable Energy Law dictates responsibilities for various actors and levels of government with respect to renewable energy. Included are the state parliament, the cabinet, the Ministry of Energy, local governors of *aimags*, *soums*,[276] and Ulaanbaatar, and the Energy Regulatory Commission.[277] Each of these actors plays a prominent role in overseeing and enacting energy policy. Parliament approved the National Renewable Energy Program (NREP) in 2005, which put forth a plan for the renewable energy industry from 2005-2020.[278] In order to address the future of Mongolia's energy sector, Parliament approved the State Policy on Energy in 2015, which details plans to reform the sector from 2015-2030.[279] These reforms are to be implemented in two stages: 2015-2023 and 2023-2030. In the first phase, the government aims for construction of six coal power plants to be completed. Goals within this period also include doubling the installed capacity, meeting the 10% installed capacity target for hydropower with two hydropower plants, and increasing renewable energy to 20% of installed capacity.[280] In the second phase, renewable energy will be increased to 30%, smart energy systems will foster connection between regions with high-voltage transmission lines, and high-voltage transmission lines will export any excess energy to Northeast-Asian countries.[281]

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[276] Administrative unit of division for aimags (provinces); comparable to a county.
[277] Chen, Gönül, and Tumenjargal, *Mongolia: Renewables Readiness Assessment*, 28.
[278] "National Renewable Energy Programme (2005-2020)," *International Energy Agency*, last modified 2013, accessed October 30, 2018, https://www.iea.org/policiesandmeasures/pams/mongolia/name-37137-en.php.
[279] Yeren-Ulzii, Batmunkh, *Power Sector of Mongolia, Regional Cooperation Policies* (Ulaanbaatar: Ministry of Energy, 2015), 7, 10, http://www.unescap.org/sites/default/files/Mr. Yeren-Ulzii - Mongolia Presentation.pdf.
[280] *Third National Communication of Mongolia Under the United Nations Framework Convention on Climate Change*, 213.
[281] Ibid., 213, 253; "Төрөөс Эрчим Хүчний Талаар Баримтлах Бодлого /2015-2030/" (Parliament of Mongolia, 2015), http://www.parliament.mn/files/7959.

In 2015, the Law on Energy was amended with the goal of "strengthen[ing] public-private partnerships and creat[ing] a market-oriented framework for the energy sector."[282] With the passing of the Law on Energy was the creation of Mongolia's Energy Regulatory Commission, responsible for overall regulation of the energy sector, including the generation, transmission, distribution, dispatch, and supply of energy.[283] Amendments to the Law on Energy include goals of bringing electricity imports down to zero, yet this goal will come at the cost of constructing additional coal power plants and hydropower plants.[284]

The Government of Mongolia has also adopted numerous environmental policies in recognition of and to contribute to the ongoing regime shift. As Mongolia continues to prioritize sustainable development, multiple environmentally-oriented policies have been adopted (Table 6). These environmental policies are both the result of Mongolia-led initiatives, as well as collaborative efforts to further define how Mongolia pursues sustainable development.

Table 6
Environmental and sustainability policies implemented in Mongolia (Ministry of Environment and Tourism, 2017:25).

Name	Year Passed (Amended)	In Effect
Law on Environmental Protection	1995 (2007, 2012)	N/A
Water Law	1995 (2004, 2010, 2012)	N/A
Forest Law	1995 (2012, 2013)	N/A
Law on Air	1995 (2012)	N/A
National Action Programme on Climate Change	2000 (2011)	2011-2021
Law on Energy	2001 (2015)	N/A
Law on Renewable Energy	2007 (2015)	N/A
National Agriculture Development Policy	2010	2010-2021
Law on Waste	2012	N/A
Green Development Policy	2014	2014-2030

282 Chen, Gönül, and Tumenjargal, *Mongolia: Renewables Readiness Assessment*, XIV.
283 "Introduction," *Energy Regulatory Commission of Mongolia*, accessed October 30, 2018, http://erc.gov.mn/en/introduction.
284 Ana-Maria Seman, *Mongolia's Energy Sector*, 13.

State Policy on Industry	2015	2015-2030
State Policy on Energy	2015	2015-2030
State Policy on Forest	2015	2016-2030
Sustainable Development Vision, 2030	2016	2016-2030

Multiple third-party organizations have enabled the Government of Mongolia to introduce additional policy mechanisms to further codify sustainable development into law. Since Mongolia declared that green development would be the country's economic development strategy in 2012, GGGI has assisted the development of green growth plans for Mongolia's energy and transportation sectors. Out of this partnership resulted the Strategies for Development of Green Energy Systems in Mongolia, a project completed in 2014 that also included collaboration with the Stockholm Environment Institute – U.S. Center.[285] Green energy systems are defined by GGGI as "those that minimize carbon, local air pollution, and other environmental impacts."[286]

Additional disruptive policies have been born out of Mongolia's active participation in international fora; these policies have been illuminated as the result of reporting obligations under international agreements. Under the UNFCCC, countries are divided into Annex I, Annex II, and non-Annex I countries; as a developing country, Mongolia is labeled a non-Annex I party.[287] Non-Annex I parties are required to submit two documents regularly to the UNFCCC Secretariat: National Communications (NCs) and Biennial Update Reports (BURs). National Communications are submitted by countries

[285] *Mongolia's Initial Biennial Update Report*, 72; *Strategies for Development of Green Energy Systems in Mongolia: Final Report* (Ulaanbaatar: Global Green Growth Institute, March 2014), x.
[286] *Strategies for Development of Green Energy Systems in Mongolia: Final Report*, 25.
[287] Countries that are party to the UNFCCC are divided into Annex I and non-Annex I parties. Annex I parties include industrialized countries "that were members of the OECD . . . in 1992," as well as other countries that, at the time, were considered having economies in transition (e.g. Russia, the Baltic States, and select countries in Central and Eastern Europe).
"Parties & Observers," *UNFCCC*, accessed February 17, 2019, https://unfccc.int/parties-observers.

every four years after joining the Convention.[288] In 2017, at the Conference of Parties (COP) 17,[289] countries decided that non-Annex I countries would also submit BURs in addition to NCs. BURs contain updates of a nation's GHG inventories as well as "a national inventory report and information on mitigation actions, needs and support received."[290]

According to Mongolia's Biennial Update Report, submitted to the UNFCCC Secretariat in August 2017, if Mongolia fully implements the actions described in its national programs to mitigate GHG emissions, emissions could be reduced by about 25% by 2025 and about 28% by 2030. Two of Mongolia's main strategies to mitigate GHG emissions include increasing energy efficiency and the share of renewable energy, creating additional pressure on the regime to incorporate renewable energy technologies and phase out aging, inefficient systems.[291]

Mongolia's communications to the UNFCCC are coordinated and organized by the Ministry of Environment and Tourism (MET), including its NCs, BURs, and GHG inventory—all with the goal of incorporating issues related to climate change in all sectors.[292]

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[288] "National Communication Submissions from Non-Annex I Parties," *UNFCCC*, accessed March 7, 2019, https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/national-communications-and-biennial-update-reports-non-annex-i-parties/national-communication-submissions-from-non-annex-i-parties.

[289] The COP serves as the Convention's decision-making body, and meets annually to review progress and make further decisions relating to the Convention. "Conference of the Parties (COP)," *UNFCCC*, accessed March 7, 2019, https://unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-cop.

[290] "Biennial Update Reports," *UNFCCC*, accessed February 17, 2019, https://unfccc.int/process/transparency-and-reporting/reporting-and-review-under-the-convention/biennial-update-reports-and-international-consultation-and-analysis-non-annex-i-parties/biennial-update-reports.

[291] *Mongolia's Initial Biennial Update Report*, 14.

[292] Ibid., 13.

Due to the fact that the Kyoto Protocol targets the emissions of developed (rather than developing) countries, non-Annex I parties do not have reporting requirements under the Protocol.[293] In contrast to the Kyoto Protocol, the Paris Agreement requires all parties to submit reporting to the UNFCCC. As specified in Article 4, paragraph 2 of the Paris Agreement, each party to the Agreement is required to "prepare, communicate, and maintain successive nationally determined contributions," referred to as NDCs—countries' "post-2020 climate actions."[294] As a party to the Agreement, Mongolia submitted its Intended Nationally Determined Contribution (INDC) in September of 2015 to the Ad-Hoc Working Group on the Durban Platform for Enhanced Action.[295]

Following the conclusion of COP 18 in Doha in 2012, parties agreed that developing country parties will take Nationally Appropriate Mitigation Actions (NAMAs)—classified as "any action that that reduces emissions in developing countries and is prepared under the umbrella of a national governmental initiative."[296] Mongolia submitted its NAMAs to the UNFCCC Secretariat in 2010.[297] The NAMAs that Mongolia submitted proposed 22 different options (Appendix B) for mitigation actions in six sectors—energy supply, building, industry, transportation, agriculture, and forestry.[298]

The UN additionally oversees optional mechanisms and tools that countries can utilize in conjunction with mandatory reporting to further achieve sustainable

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[293] "Reporting and Review under Articles 5, 7 and 8 of the Kyoto Protocol," *UNFCCC*, accessed March 7, 2019, https://unfccc.int/process/transparency-and-reporting/reporting-and-review-under-the-kyoto-protocol/overview/reporting-and-review-under-articles-5-7-and-8-of-the-kyoto-protocol.
[294] "The Paris Agreement."
[295] "INDC - Submissions," *UNFCCC*, accessed September 24, 2018, http://www4.unfccc.int/Submissions/INDC/Submission%20Pages/submissions.aspx.
[296] "Nationally Appropriate Mitigation Actions (NAMAs)," *UNFCCC*, accessed February 17, 2019, https://unfccc.int/topics/mitigation/workstreams/nationally-appropriate-mitigation-actions.
[297] Chen, Gönül, and Tumenjargal, *Mongolia: Renewables Readiness Assessment*, 30–31.
[298] "Copenhagen Accord: Appendix II - Mongolia: Nationally Appropriate Mitigation Actions of Developing Country Parties" (UNFCCC, January 28, 2010).

development goals. An optional resource facilitated by the UNFCCC for developing countries is a Technology Needs Assessment (TNA). TNAs are undertaken by developing countries to determine their climate technology priorities. The process began in 2001 and has evolved to include multiple intergovernmental partners that provide technical and methodological support to countries, such as the UNEP Danish Technical University Partnership and the Global Environment Facility (GEF). One of the crucial outcomes of a TNA is the development of country-specific technology action plans (TAPs)—concise, technology-specific plans to facilitate the uptake and diffusion of technologies identified in the TNA that will assist in a country's actions towards climate change mitigation and adaptation.[299]

With the assistance of multiple international organizations, Mongolia completed a TNA in 2013 and credits funding of the document to the GEF. UNEP, the UNEP-Risoe Centre, and the Regional Centre Asian Institute of Technology, Bangkok, are additionally mentioned. The report does clarify that the project resulted from a "fully country-led process," overseen by Mongolia's Ministry of Environment and Green Development.[300] In Mongolia's TNA, the energy sector was identified as the primary contributor to the country's GHG emissions; thus, multiple technologies with the potential to decrease Mongolia's GHG emissions were identified. These technologies were presented to relevant stakeholders (Appendix A), who were asked to categorize each based on a score of variables. The three technologies prioritized following an assessment of each's costs

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[299] "What Is Technology Development and Transfer?," *UNFCCC*, accessed November 4, 2018, https://unfccc.int/topics/climate-technology/the-big-picture/what-is-technology-development-and-transfer.
[300] *Technology Needs Assessment: Volume 2 - Climate Change Mitigation in Mongolia*, II.

and benefits were large-scale hydropower plants, wind turbines, and pulverized coal combustion technologies.[301]

IV.2.4 Socio-Cultural

In addition to regime tensions arising from technological limitations of Mongolia's existing energy infrastructure, numerous social pressures have led the Mongolian Government to explore the implementation of alternative energy sources. Addressing social inequalities has historically driven the Government of Mongolia's (GoM) efforts to introduce sustainable energy technologies, specifically the issue of insufficient energy access. In 2001, the GoM approved the Sustainable Energy Sector Development Strategy Plan (2002-2010) to expand energy access to rural herding communities. The plan detailed the reform of *soum* electricity markets as well as the development of diesel-renewable energy hybrid systems.[302] The lack of feasibility of connecting rural herding families to centralized grid systems led the GoM to explore self-sustaining systems, specifically in the form of small-scale renewable energy systems.

Moreover, negative externalities arising as the result of an overreliance on coal has further pushed the GoM to explore sustainable energy options. Air pollution has grown rapidly in Mongolia, particularly in the capital Ulaanbaatar, as more people migrate from the countryside to the city. Many of these people elect to live in traditional Mongolian structures, *gers*, which are portable homes utilized by the nomadic population; over 60% of Ulaanbaatar's population live in the ger districts, neighborhoods composed of gers. Inside the gers, stoves burn fuel (coal, wood, dung) to provide heat; in the city, this fuel is

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[301] Ibid., 33.

[302] Benjamin K. Sovacool and Ira Martina Drupady, *Energy Access, Poverty, and Development: The Governance of Small-Scale Renewable Energy in Developing Asia* (London: Routledge, 2012), 125.

primarily coal for its longer-burning duration and lack of access to animals for the use of dung. It is these coal stoves that contribute primarily to Ulaanbaatar's air pollution.[303] Complications from air pollution are responsible for 10% of all deaths in Ulaanbaatar.[304]

In 2017, the Government of Mongolia approved the National Program on the Reduction of Air and Environmental Pollution.[305] In May 2019, a ban on burning raw coal, which is primarily used to heat gers, will go into place. This ban is part of the government's efforts to focus on improving, rather than unrealistically prohibiting, coal use in the ger districts; residents will be required to replace raw coal with refined coal.[306] The issue of air pollution has gained further traction with renewable energy proponents. In addition to the Government of Mongolia, various NGOs and CSOs actively advocate for increasing renewable energy use as a means of combatting air pollution.[307]

Civil society organizations (CSOs) and NGOs exist throughout Mongolia and are primarily located in Ulaanbaatar. According to Mongolians familiar with the energy industry and renewable energy development, NGOs and CSOs working specifically on the issue of citizen engagement with renewable energy are limited. In 2017, the Mongolian Wind Energy Association was renamed to become the Mongolian Renewables Industries Association (MRIA) with the purpose of generally supporting the

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[303] Sophie Cousins, "Air Pollution in Mongolia," *Bulletin of the World Health Organization* 97, no. 2 (February 1, 2019): 79–80.

[304] Henderson, Nomindari Enkhtur, and Tumurkhuu Davaakhuu, *National Sustainable Finance Roadmap of Mongolia*, 7.

[305] "АГААР, ОРЧНЫ БОХИРДЛЫГ БУУРУУЛАХ ҮНДЭСНИЙ ХӨТӨЛБӨР," *Legal Info*, 4, last modified 2017, accessed April 28, 2019, https://www.legalinfo.mn/annex/details/7779?lawid=12588.

[306] B. Ooluun, "Raw Coal Consumption to Be Banned," *MONTSAME News Agency*, last modified March 1, 2018, accessed April 28, 2019, https://montsame.mn/en/read/133813; "Better Air Quality in Ulaanbaatar Begins in Ger Areas," *World Bank*, last modified June 26, 2018, accessed April 11, 2019, http://www.worldbank.org/en/news/feature/2018/06/26/better-air-quality-in-ulaanbaatar-begins-in-ger-areas.

[307] Anonymous (GGGIa), interview by author, Ulaanbaatar, March 20, 2019.

growth of renewable energy (as opposed to solely promoting wind energy).[308] MRIA's members are comprised of numerous companies involved in the renewable energy industry, including both Mongolian companies as well as their international partners—as of March 2019, the page listed 34 such companies.[309] MRIA is now responsible for organizing Mongolia's National Renewable Energy Forum (NREF), which takes place every May. The NREF has been critical in expanding Mongolians' knowledge about ongoing and future renewable energy projects; being open to the public, the Forum grows in attendance with every year.[310]

Regarding education, Mongolia is working to increase public knowledge and awareness about its sustainable development agenda. Curricula for secondary schools in Mongolia are shifting to include a Sustainable Development Education program.[311] Public perceptions about renewable energy have evolved in conjunction with the makeup of Mongolia's renewable energy systems. Before the widespread construction of large-scale renewable facilities, renewable energy would evoke thoughts of small, single-household systems—a consequence of the 100,000 Solar Gers program. As publicity has grown showcasing the construction and implementation of large-scale systems, perceptions have shifted.[312]

GGGI has also been active in campaigns to increase the Mongolian public's knowledge about sustainable development issues. GGGI released a series of videos in

[308] "About Us," *Mongolian Renewables Industries Association*, accessed March 20, 2019, http://en.mria.mn/about-us-copy.
[309] "Members," *Mongolian Renewables Industries Association*, accessed March 20, 2019, http://en.mria.mn/membersen.
[310] Anonymous, multiple (ADB, GGGIa, GGGIb, Green Energy), interview by author, Ulaanbaatar, March 18-22, 2019.
[311] *Third National Communication of Mongolia Under the United Nations Framework Convention on Climate Change*, 51.
[312] Anonymous (ADB), interview by author, Ulaanbaatar, March 18, 2019.

2018 aimed at secondary school-aged children to educate them on issues such as air pollution and energy efficiency. GGGI partnered with the Mongolian Ministry of Environment and Tourism, as well as the Ulaanbaatar city government, to disseminate the videos to eco clubs in the country.[313]

IV.3 Barriers to Further Regime Change

IV.3.1 Technological

There are significant barriers at the regime level to successfully increasing Mongolia's renewable energy capacity. Despite Mongolia's recognition that electricity and energy will be critical in meeting GHG emission reduction goals, the electricity and heat sectors face problems of insufficient funding, low coal quality, and the use of obsolete technologies and techniques.[314]

IV.3.2 Markets and Finances

Although the government has worked diligently to adequately equip investors and project managers with laws to support renewable energy projects, there is still uncertainty. Because no criteria exist to reject applications for renewable energy licenses if renewable energy levels in an area are exceeded, it is possible for project developers to be granted a license but be unable to proceed with the project. Thus, developers may invest to secure a license only to be unable to recover their investments.[315]

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313 "Child-Friendly, Inclusive, and Green Lifestyle Videos Produced by the GGGI Mongolia Team Are Being Used at Assembly of Mongolian Children's Eco Clubs," *GGGI - Global Green Growth Institute*, last modified April 10, 2018, accessed March 26, 2019, http://gggi.org/child-friendly-inclusive-and-green-lifestyle-videos-produced-by-the-gggi-mongolia-team-are-being-used-at-assembly-of-mongolian-childrens-eco-clubs/.
314 *Mongolia's Initial Biennial Update Report*, 15.
315 *Scaling-Up Renewable Energy Programme (SREP): Invetsment Plan for Mongolia* (Ulaanbaatar: Ministry of Finance of Mongolia, 2015), 14.

Mongolia's economy has been rife with volatility since the country transitioned from a communist country to a democratic country with a market economy in 1990. Soviet assistance "disappeared almost overnight in 1990 and 1991," resulting in widespread economic and social chaos.[316] During the transition, there was

> scant concern for proper training in the rule of law, a solid banking system, appreciation of contracts, government officials' understanding of the need for a strict division between their public responsibilities and their private commercial gains, and stringent rules curtailing nepotism and favoritism, generated considerable profiteering and corruption.[317]

Many of these problems continue to persist in some form today. The current Government of Mongolia has "limited capacity to financially support investment projects in important sectors, most notably, energy, mining, and agriculture; and must rely on FDI [foreign direct investment] to support its broad economic and development agendas."[318]

Mongolia's economic conditions are highly reliant on the status of the country's mining sector. In 2016, the sector accounted for 85% of Mongolia's exports, 21% of its GDP, and over 30% of the national budget revenue. Two projects in the mining sector, the OT copper-gold project and the Tavan Tolgoi coking coal project, are expected to drive Mongolia's GDP for the next multiple decades. OT specifically is projected, at full capacity, to produce close to 3% of the world's copper output.[319] Between 2004 and 2008, GDP growth in Mongolia was around 9% on account of both gold production and

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316 "Mongolia."
317 Morris Rossabi, "Mongolia: Transmogrification of a Communist Party," *Pacific Affairs* 82, no. 2 (2009): 237.
318 "Mongolia Investment Climate Statement 2018," *U.S. Embassy in Mongolia*, last modified September 28, 2018, accessed November 18, 2018, https://mn.usembassy.gov/2018-investment-climate-statement-mongolia/.
319 "Mongolia - Mining," *Export.Gov*, last modified August 9, 2017, accessed November 2, 2018, https://www.export.gov/article?id=Mongolia-Mining.

global copper prices.[320] In 2009, despite passing legislation to develop the massive OT copper and gold mine with Anglo-Australian multinational mining company Rio Tinto, Mongolia's economy slowed significantly after investors lost confidence due to a "dispute with foreign investors."[321] While investor confidence was largely restored in 2015 after the country formalized an agreement with Rio Tinto to restart the development of OT, the economy has still faced struggled significantly. GDP growth in Mongolia peaked at 17.3% in 2011 and sharply fell in subsequent years as a result of the global recession and the resulting decline in commodity prices, reaching 1.2% in 2016 (Figure 10).[322]

Fig. 10. Annual GDP of Mongolia (1982-2017) (Data from World Bank, 2017).

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[320] "Mongolia."

[321] Ibid.

[322] "Mongolia and the IMF," *IMF*, accessed November 4, 2018, https://www.imf.org/en/Countries/MNG; Anna Reva et al., *The Impacts of Economic Crisis in Mongolia: Findings from Focus Group Discussions* (Washington, D.C.: World Bank, 2011), 1.

Due to the volatility of Mongolia's economic system and the reliance placed on its mining sector, Mongolia has received significant financial support from various international organizations. At the end of 2016, the Mongolian government prepared an "Economic Recovery Program," approaching the IMF for additional financial assistance. The Program aims to, among multiple objectives, promote economic diversification, "protect the most vulnerable in society," and strengthen the financial sector.[323] Since Mongolia's democratic transition, the country has received multiple funding packages from the International Monetary Fund (IMF), as well as financial assistance from allies. The IMF and Mongolia reached a $236 million Stand-by Arrangement (SBA) in 2009, helping Mongolia to strengthen its banking sector and fiscal management.[324] The IMF's SBA allows countries to receive financing from the IMF during an economic crisis, and allows for a quick response to address balance of payments problems. SBAs are typically distributed for short-term balance of payments problems, rather than longer-term.[325]

In April 2017, the IMF approved a three-year extended arrangement under the Extended Fund Facility (EFF) for Mongolia, with Mongolia's total financing package from the IMF, World Bank, ADB, Japan, and Korea totaling about $5.5 billion.[326] IMF assistance under an EFF is usually reserved for countries facing "medium-term balance of payments problems because of structural weaknesses." As opposed to SBAs, EFF assistance aims to address structural and pervasive underlying problems within a country's financing regime. Countries borrowing from the IMF under an EFF commit to

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[323] *Mongolia: 2017 Article IV Consultation and Request for an Extended Arrangement Under the Extended Fund Facility-Press Release: Staff Report; and Statement by the Executive Director for Mongolia* (International Monetary Fund, May 31, 2017), 2–3.
[324] "Mongolia."
[325] "IMF Stand-By Arrangement (SBA)," *IMF*, last modified March 8, 2018, accessed November 25, 2018, https://www.imf.org/en/About/Factsheets/Sheets/2016/08/01/20/33/Stand-By-Arrangement.
[326] *Mongolia*, 1.

implementing policies to ameliorate structural economic problems. In order to assure countries are on track with stated goals, the IMF regularly assesses countries' performance and is able to adjust the EFF as necessary.[327] Most recently, in October 2018, the IMF Executive Board conducted its Fifth Review of Mongolia's EFF.[328]

In addition to the IMF, the United States has been active in distributing financial assistance to Mongolia for decades. Notably, Mongolia received a $285 million aid package from the Millennium Challenge Corporation to be carried out from 2008-2013, "focused on property rights, vocational education, health, road infrastructure, and energy and the environment." Mongolia was approved to receive a second aid package from the MCC in December 2014 worth $345 million.[329]

IV.3.3 Political

Like many developing countries, the efficacy political system in Mongolia is hindered by public perceptions, corruption, and limited institutional capacity. After falling to the Manchu Qing dynasty in 1636, Mongolia declared independence in 1911. Yet even after this declaration, the government of China still considered present-day Mongolia, or "Outer Mongolia," part of China, invading the country in 1919. Mongolia became a socialist country in 1921 after expelling the Chinese with the aid of Russia's Red Army; from 1920 to 1990, Mongolia was under single-party communist rule. The democratic

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[327] "IMF Extended Fund Facility (EFF)," *IMF*, last modified April 20, 2018, accessed November 25, 2018, https://www.imf.org/en/About/Factsheets/Sheets/2016/08/01/20/56/Extended-Fund-Facility.
[328] "IMF Executive Board Completes Fifth Review under the Extended Arrangement for Mongolia and Approves US$ 36.22 Million Disbursement," *IMF*, last modified October 31, 2018, accessed November 25, 2018, https://www.imf.org/en/News/Articles/2018/10/31/pr18404-imf-executive-board-completes-fifth-review-under-the-extended-arrangement-for-mongolia.
[329] "Mongolia."

revolution that led to the political system Mongolia has now began in 1990. With this democratic transition also began Mongolia's transition to a market economy.[330]

There are three primary political parties in Mongolia—the Mongolian People's Revolutionary Party (MPRP), the Mongolian People's Party (MPP), and the Democratic Party (DP)—with self-professed orientations of left, center-left, and center-right. Despite these orientations, in practice, ideological distinctions are "practically indiscernible."[331] The MPRP was founded in 1924, and Article 82 of Mongolia's original constitution described the Party as a "guiding force" as well as the "vanguard of the working people" until the article was abolished in 1990.[332]

Mongolia's political system is plagued by rampant corruption, which remains a prominent problem for both foreigners conducting business in Mongolia and Mongolian citizens. Transparency International's 2017 Corruption Perceptions Index ranked Mongolia 103 out of 180 countries, with a score of 36 out of a possible 100—a decrease from its peak of 39 in 2015 and 2014.[333] The 2006 Anti-Corruption Law sets criminal penalties for official corruption, but the law continues to be poorly enforced, with contributing factors including "conflicts of interest, lack of transparency, lack of access to information, an inadequate civil service system, and weak government control of key institutions." A National Program to Combat Corruption was approved by Parliament in

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[330] "About Mongolia," *Embassy of Mongolia*, last modified May 21, 2013, accessed November 18, 2018, http://mongolianembassy.us/about-mongolia/.

[331] *Mongolia, Presidential Election, 26 June and 7 July 2017: Final Report* (Warsaw: OSCE Office for Democratic Institutions and Human Rights, October 2017), 11.

[332] Ian Jeffries, *Mongolia: A Guide to Economic and Political Developments* (London: Routledge, 2007), 6, 13, accessed March 18, 2019, http://www.taylorfrancis.com/books/9781134094684.

[333] "Corruption Perceptions Index 2017," *Transparency International*, last modified 2017, accessed November 21, 2018, https://www.transparency.org/news/feature/corruption_perceptions_index_2017.

2016, along with the initiation of Mongolia's second National Action Plan under the Open Government Partnership.[334]

Investigation of corruption cases is primarily conducted by Mongolia's Independent Authority Against Corruption, with assistance from the National Police Agency's Organized Crime Department.[335] As noted by the Department of State in its annual Human Rights Report, "Members of parliament are immune from prosecution during their tenures."[336]

Citizens' faith in the current government's ability to address corruption is limited; a report from the Asia Foundation found that only 11% of respondents believe the government elected in 2016 will improve on corruption while 21.3% think the administration will be worse than the previous.[337] The percentage of individuals who view corruption as a major problem increased to 11.8% in 2018 compared to 9.9% in 2017, although a majority of respondents view unemployment (33.2%) as a major problem.[338] The percentage of individuals who respond that they agree that "corruption is a common practice in our country" increased in 2018 to 75.8%, from 70.1% in 2017.[339] While it is not possible to directly link corruption to election turnout, turnout in Mongolia's presidential election has generally decreased since the country's first

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[334] "Mongolia - Corruption," *Export.Gov*, last modified August 4, 2017, accessed November 21, 2018, https://www.export.gov/article?id=Mongolia-Corruption.
[335] Ibid.
[336] "Mongolia 2017 Human Rights Report," *United States Department of State*, 12, last modified 2017, accessed November 21, 2018, https://www.state.gov/documents/organization/277345.pdf.
[337] Richard Batcheler, "Survey on Perceptions and Knowledge of Corruption 2017," *The Asia Foundation*, 2017, VIII, accessed November 21, 2018, https://asiafoundation.org/publication/survey-perceptions-knowledge-corruption-2017/.
[338] Richard Batcheler, "Survey on Perceptions and Knowledge of Corruption 2018," *The Asia Foundation*, 2018, 13, accessed November 21, 2018, https://asiafoundation.org/publication/survey-on-perceptions-and-knowledge-of-corruption-2018/.
[339] Ibid., 21.

democratic presidential election in 1993 (Figure 11).

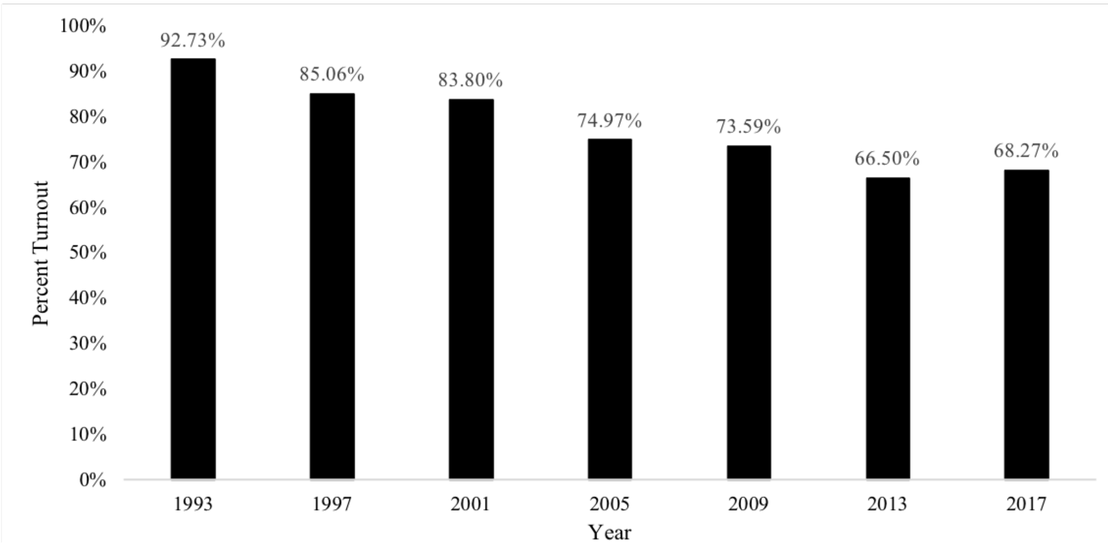

Fig. 11. Turnout in Mongolian presidential elections 1993-2017 (Data from Mongolian General Elections Commission, 2017).

Mongolia's most recent presidential election took place in 2017 and involved two rounds of voting after no candidate received a majority in the first round; a notable 8.23% of individuals cast blank ballots in the second round (compared to 1.37% in the first) as a form of protest.[340] Khaltmaa Battulga, candidate from the DP, won the 2017 presidential election with 50.61% of the vote.[341]

In addition to corruption, high turnover consistently impedes the efficacy of the Mongolian government (GoM). According to interviews with individuals working for organizations that partner with the GoM, this translates to slower progress on projects and unpredictability regarding who long-term government counterparts may be.[342] Despite rampant corruption and persistent bureaucratic challenges, Mongolia is still heralded as a

[340] *Mongolia, Presidential Election, 26 June and 7 July 2017: Final Report*, 23, 25.
[341] "Монгол Улсын Ерөнхийлөгчийн 2017 Оны Сонгуулийн 2 Дахь Санал Хураалтын Дүн," *Сонгуулийн Ерөнхий Хороо (Mongolian General Election Commission)*, last modified 2017, accessed March 18, 2019, http://gec.gov.mn/details/2188.
[342] Anonymous (Ministry of Construction and Development), interviewed by author, Ulaanbaatar, March 21, 2019.

democratic success story by many in the international community. In 2016, former U.S. Secretary of State John Kerry referred to Mongolia as an "oasis of democracy" given its two communist neighbors.[343]

An additional challenge is the separation between agencies tasked with implementing related policies. Within the Mongolian government, multiple agencies are responsible for formulating and implementing policies related to the environment. Regarding Mongolia's intended nationally determined contribution under the Paris Agreement, the various ministries listed include the MET, Ministry of Energy, Ministry of Industry, Ministry of Construction and Urban Development, Ministry of Road and Transport, and Ministry of Agriculture.[344] In 2012, the MET (formerly the Ministry of Environment and Green Development) was elevated to be one of the four core ministries within the government, signifying the ministry's increased importance.[345] Within ministries, various committees and offices have been established to address climate change adaptation; however, these smaller bodies have been subject to political volatility. For example, following the passage of the Law on Air in 2012, the government established a National Climate Committee to coordinate sectoral efforts on climate change as well as the Climate Change Coordination Office (CCCO), tasked with coordinating UNFCCC responsibilities and general oversight pertaining to laws and regulations, within the Ministry of Environment and Green Development. Due to political turnover, the CCCO was dissolved in 2015, only for the Ministry of Environment, Green Development, and

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[343] Yeganeh Torbati, "Kerry Hails Mongolia as 'oasis of Democracy' in Tough Neighborhood," *Reuters*, June 5, 2016, accessed February 20, 2019, https://www.reuters.com/article/us-usa-mongolia-idUSKCN0YR02T.
[344] "INDC - Submissions."
[345] *Third National Communication of Mongolia Under the United Nations Framework Convention on Climate Change*, 380.

Tourism to establish the Climate Change Project Implementing Unit based largely on former CCCO staff.[346]

IV.3.4 Socio-Cultural

Mongolia's climate produces unique challenges for energy technology production. Energy efficiency in Mongolia depends both on operating and technology practices as well as the country's climatic variation.[347]

Moreover, while public awareness of renewable energy projects has increased, knowledge is still limited. Given that renewable energy has been presented as an avenue for addressing a wide swath of societal issues, supporters are ideologically fragmented, necessitating multi-faceted campaigns that are often uncoordinated.[348]

IV.4 Divergence from the Multi-Level Perspective

The ways in which Mongolia's energy transition diverge from the traditional path outlined by the MLP are especially visible at the regime level. Most prominently, divergence occurs regarding the presence of transnational actors and donor interventions, the state of Mongolia's incumbent regime, and normative framing of the ongoing transition. Whereas energy transitions in developed countries have been and continue to be led by domestic agencies and actors, Mongolia's transition, in a similar manner to many in the global South, is highly dependent on transnational linkages and actors. Moreover, the presence of intermediaries has enabled the Government of Mongolia to both initiate and see to fruition projects that would be domestically unfeasible.

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[346] Ibid., 398.
[347] Chen, Gönül, and Tumenjargal, *Mongolia: Renewables Readiness Assessment*, 14.
[348] Anonymous (GGGIa), interviewed by author, Ulaanbaatar, March 20, 2019.

The current state of Mongolia's regime is similarly in line with that of other developing, rather than developed, countries. Mongolia's coal-fired power plants are far from highly functional, echoing the aforementioned state of disrepair and dilapidation that often applies to incumbent systems in the global South.[349]

Finally, the normative conversations driving Mongolia's energy transition occupy a starkly different space than is to be expected from developed countries' transitions.[350] Framing renewable energy as a potential mitigation technique for air pollution is reflective of the fact that developing countries often face much more pressing issues than being existentially environmental. Where "sustainability" as an abstract concept fails to gain traction as a primary motivator for the adoption of renewable energy systems, air pollution amelioration is a concrete and imaginable societal ideal.

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[349] Furlong, "STS beyond the 'Modern Infrastructure Ideal,'" 142.
[350] Wieczorek, "Sustainability Transitions in Developing Countries."

Chapter V: Niche Level

V.1 Drivers of Niche Momentum

V.1.1 Technological

Niche technologies, such as solar photovoltaic (PV) panels and wind turbines, were first introduced in Mongolia through the "100,000 Solar Gers" program. Small-scale PV systems were initially distributed throughout the Mongolian countryside to nomadic herder families in 2000, when the Government of Mongolia began the program with the aim of increasing the country's overall electricity access by providing 100,000 portable solar home systems to herder families. Prior to "100,000 Solar Gers," the vast majority of herders and Mongolia's rural population lacked access to electricity. This lack of access, according to the World Bank, was 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.[351]

By 2005, aided by grants from donor countries, the government had distributed over 30,000 solar home systems to herder families.[352] When the program began to plateau in 2005, the government looked to international sources for assistance; in 2006, the World Bank agreed to assist through the Renewable Energy for Rural Access Project (REAP).[353]

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[351] *Renewable Energy for Rural Access Project (REAP) - Project Information Document Appraisal Stage* (The World Bank, 2006), 2, http://documents.worldbank.org/curated/en/288521468273887512/Project0Inform1nt010Appraisal0Stage.doc.
[352] "Mongolia: Portable Solar Power for Nomadic Herders," last modified 2013, http://www.worldbank.org/en/results/2013/04/08/portable-solar-power-for-nomadic-herders.
[353] *Renewable Energy for Rural Access Project (REAP) - Project Information Document Appraisal Stage*.

The completion of Mongolia's Technology Needs Assessment in 2013, which outlines actions it can take to both mitigate and adapt to the effects of climate change, allowed for additional multiple niche technologies to be introduced and integrated into Mongolia's industries. Considering that the energy sector is the largest producer of GHG emissions, the TNA specifically identified technologies that could mitigate GHG and contribute to social, environmental, and economic development.

Mongolia's TNA identifies many potential technologies for the energy supply subsector. After stakeholders reviewed the presented technologies, a shortlist was compiled (Table 7).[354]

Table 7
Shortlist of potential technologies for energy subsector (italicized items are those ultimately selected) (Adapted from Technology Needs Assessment, Volume 2, 29) (Ministry of Environment and Green Development, 2013a).

Energy Service	Category	Technology
Electricity supply	Renewable energy	*Large-scale dam-based hydro for electricity supply (more than 100MW)*
		Medium-sized dam-based hydro for electricity supply (10-100MW)
		Pumped storage hydroelectricity
		Wind turbines – on-shore, large-scale
		Solar PV (off-grid, grid connected, solar home system)
		Solar thermal –CSP, central receiver tower, parabolic through collector and dish
		Carbon capture and storage
	Fossil fuels	Integrated coal gasification combined cycle
		Pulverized coal combustion with higher efficiency
Heat supply	Fossil fuel	Heat-only boilers for space heating and domestic hot water

In order to determine which technologies would be ideal for Mongolia to pursue, an assessment was created to score each technology based on its costs and expected economic, social, and environmental benefits. Costs included capital costs, operational and maintenance costs, and cost effectiveness of mitigation. Benefits included economic

[354] *Technology Needs Assessment: Volume 2 - Climate Change Mitigation in Mongolia*, 29.

(energy supply improvement, balance of payments), social (healthcare improvement), and environmental (reduced air pollution, GHG emission reduction by 2030). National consultants prepared Technological Fact Sheets (TFSs) for each of the shortlisted technologies that included information on the technology's potential for reducing GHG emissions, how it might impact Mongolia's development (economic, social, environmental, market) priorities, and costs. Using the information provided in the TFSs, identified stakeholders (Appendix A) scored each technology based on the aforementioned criteria. Any technology identified as the least preferred option for any category received a zero. Following the scoring process, each criterion was assigned a weighted value based on its importance.[355] After scoring the above technologies based on projected costs and benefits, the top three selected were large-scale hydropower, wind turbines, and pulverized coal (PC) combustion technologies.[356]

In order to facilitate the implementation of these three technologies, TAPs were developed for each technology. Each TAP outlines a description of the technology, the target for diffusion, current projects in progress, barriers to the technology's diffusion, and proposed steps to implement the technology, broken down into economic and financial, policy and regulatory, network, and market.[357]

Large-scale hydropower plants (HPPs) are classified as non-market public goods. They require immense investment and funding and are few in number. Approval for the construction of large-scale HPPs is granted by the government. The main barrier to implementing HPPs is Mongolia's low electricity tariff, as any electricity generated by

[355] Ibid., 29–31.
[356] Ibid., 4–5.
[357] Ibid., 157.

HPPs with capacity greater than 5MW is not covered by the feed in tariff specified under Mongolia's Renewable Energy Law. There are additional barriers to the development of large HPPs—politics being the main one.[358]

The second priority technology identified by the TNA is large-scale wind park projects. For large-scale wind park projects, the most significant barrier is the capacity limit of Mongolia's grid system.[359] Wind propellers with a capacity of 50-100 watts provide power to about 30,000 households.[360] Barriers defined in the TAP for large-scale wind turbines include economic and financial (high capital cost, inappropriate financial incentives, high transaction cost, lack of inadequate access to financial resources [sic]), technical (system constrain [sic]); network (weak connectivity between actors favoring the new technology, lack of involvement of stakeholders in decision-making); and policy, legal, and regulatory (policy intermittency and uncertainty, highly controlled energy sector, lack of professional institutions).[361]

The final priority technology identified by Mongolia's TNA for further development was pulverized coal (PC) thermal supercritical power plants. The inclusion of an option that utilizes coal is recognizant of the fact that while Mongolia's large coal reserves make continuing to utilize coal a pragmatic choice, in order to reduce the environmental pollution that existing plants produce, Mongolia must look for an option that reduces the current externalities resulting from existing coal power plants. Pulverized coal thermal supercritical (or ultra-supercritical) power plants are a more efficient, environmentally

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[358] Ibid., 72.
[359] Ibid.
[360] *Third National Communication of Mongolia Under the United Nations Framework Convention on Climate Change*, 349.
[361] *Technology Needs Assessment: Volume 2 - Climate Change Mitigation in Mongolia*, 175–176.

friendly alternative to Mongolia's existing coal-fired thermal power plants. Supercritical and ultra-supercritical plants allow for higher efficiency due to operating at higher steam temperatures and pressures—pollution levels are reduced as less coal per MWh produced is burned.[362] As opposed to conventional PC power plants with an efficiency of around 35%, ultra-supercritical plants can attain an efficiency level of 45%. This increase in efficiency is projected to decrease emissions of CO_2 about 33%.[363]

In addition to projects where only one renewable technology is developed, projects utilizing multiple renewable sources are also being explored. In September 2018, the Asian Development Bank approved a $40 million USD loan for the development of a 41MW distributed renewable energy system. The system, the first of its kind in Mongolia, will utilize a variety of renewable energy sources in order to provide power and heating to remote regions in the country's western regions. These regions currently rely on imported energy from Mongolia's neighboring countries, which is highly expensive and carbon-intensive.[364]

Mongolia's utilization of international financing opportunities reflects a larger trend of Mongolia partnering with both countries and international organizations to advance renewable energy priorities. Mongolia has also been active in partnering with the government of Japan to implement renewable energy projects. Under Japan's Joint Crediting Mechanism (JCM), inspired by the CDM and the Kyoto Protocol, Japan can implement projects in developing countries and receive credit towards its obligations

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[362] Ibid.
[363] Ibid., 49.
[364] "ADB Supports First Distributed Renewable Energy System in Mongolia," Text, *Asian Development Bank*, last modified September 21, 2018, accessed October 30, 2018, https://www.adb.org/news/adb-supports-first-distributed-renewable-energy-system-mongolia.

under the Kyoto Protocol. Mongolia was the first country to sign a JCM bilateral agreement with Japan in 2013; as of September 2018, there are 17 countries that have since signed JCM bilateral agreements. [365] There are five CDM-registered projects in Mongolia: the Salkhit wind farm, the Durgun hydropower project, the Taishir hydropower project, a retrofit program for heating stations, and MicroEnergy credits.[366]

V.1.2 Markets and Finances

One of the primary catalysts for Mongolia's renewable energy transition has been transnational support in the form of donor interventions. The Green Climate Fund (GCF) has been increasingly active in Mongolia, providing financing for projects addressing a wide swath of sustainable development priorities. In 2016, the GCF approved a project in order to enable Mongolian bank XacBank to better support loans sought by Mongolian businesses investing in renewable energy and energy efficiency projects. The project's impetus arose from the large majority of Mongolian businesses that rely on outdated and inefficient equipment and thus emit high levels of GHGs. Ultimately, the project seeks to foster the implementation of long-term low-carbon systems to allow businesses to lower financial costs and reduce their environmental impacts. Total investment for the project is $60 million USD, split between the GCF, the Global Climate Partnership Fund (GCPF), the European Bank for Reconstruction and Development (EBRD), and Developing World Markets (DWM). [367] The GCPF is a public-private partnership established in 2009 by the German Federal Ministry for the Environment, Nature Conservation, Building and

[365] "Introduction of the Joint Crediting Mechanism" (Ministry of Environment and Tourism, October 8, 2018), accessed November 4, 2018, http://www.mne.mn/wp-content/uploads/2018/10/20181012-Brief-Intro-JCM-Eng.pdf.
[366] *Mongolia's Initial Biennial Update Report*, 40.
[367] "FP028 Business Loan Programme for GHG Emissions Reduction," Text, *Green Climate Fund*, last modified April 28, 2018, accessed March 10, 2019, https://www.greenclimate.fund/projects/fp028.

Nuclear Safety as well as German bank KfW Entwicklungsbank; the Fund's goal is to mitigate climate change by supporting GHG reduction in emerging and developing markets.[368] Founded in 1994, DWM is an investment manager dedicated to emerging and frontier markets.[369]

Financing for Mongolia's renewable energy projects is increasingly shifting towards being locally, as opposed to internationally, driven. After becoming the first private entity in a developing country to receive accreditation from the GCF in 2016, Mongolian bank XacBank signed an agreement with the GCF in November 2017 to utilize GCF funds in order to become the first local bank to finance the construction of a large-scale solar plant within the country.[370] XacBank has since been approved by the GCF to finance two projects in Mongolia.[371]

In March 2018, the GCF approved a project to create eco-districts in Ulaanbaatar in order to form zones throughout the city that are climate resilient, low-carbon, and affordable. In a similar vein to the GCF's other projects, funding is also being provided by the Asian Development Bank (ADB). Total investment for the project is $544 million

[368] "ResponsAbility Takes over the Management of the Global Climate Partnership Fund," *Global Climate Partnership Fund*, last modified November 20, 2014, accessed March 10, 2019, https://www.gcpf.lu/press-release-detail/responsability-takes-over-the-management-of-the-global-climate-partnership-fund.html.

[369] "Our History," *Developing World Markets*, n.d., accessed March 10, 2019, https://www.dwmarkets.com/our-history/.

[370] "XacBank Proudly Becomes an Accredited Entity of the Green Climate Fund (GCF)," *XacBank*, last modified December 2016, accessed March 6, 2019, https://www.xacbank.mn/article/817?lang=en; "XacBank First Mongolian Bank to Finance Renewable Energy," Text, *Green Climate Fund*, last modified November 11, 2017, accessed February 21, 2019, https://www.greenclimate.fund/news/xacbank-first-mongolian-bank-to-finance-renewable-energy.

[371] "Mongolia Technology Review Opens Way to Cut Emissions," *UNFCCC*, last modified October 23, 2017, accessed March 1, 2019, https://unfccc.int/news/mongolia-technology-review-opens-way-to-cut-emissions.

USD.[372] Another GCF project was approved in October 2018 to provide loans to Mongolian households for the installation of energy efficient appliances and housing structures. With a total project investment of $21.5 million USD, co-financing for the project is also provided by XacBank, as well as through a grant from French NGO Groupe Energies Renouvelables, Environnement et Solidarités.[373] In addition to Mongolia-specific projects, other GCF projects encompassing a range of developing countries also involve Mongolia. These projects address various GCF target areas and involve countries sharing traits with Mongolia's own development.[374]

V.1.3 Political

The niche level is also characterized by the implementation of novel policies. Newell describes niche developments as including policies in addition to technologies if the policies are initiated by landscape-level actors—for instance, a donor-funded feed-in-tariff would be considered a niche policy.[375] As Mongolia continues to develop economically, niche policies have been implemented to better address issues such as investment and competition. A small number of these policies relate both directly and indirectly to the development of renewable energy technologies, such as Mongolia's feed-in-tariff (FiT). Mongolia implemented a FiT in 2014, but was unsuccessful. The

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[372] "FP077 Ulaanbaatar Green Affordable Housing and Resilient Urban Renewal Project (AHURP)," Text, *Green Climate Fund*, last modified June 27, 2018, accessed March 10, 2019, https://www.greenclimate.fund/projects/fp077.
[373] "SAP004 Energy Efficient Consumption Loan Programme," Text, *Green Climate Fund*, last modified January 30, 2019, accessed March 10, 2019, https://www.greenclimate.fund/projects/sap004; "Funding Proposal SAP004: Energy Efficient Consumption Loan Program" (Green Climate Fund, November 28, 2018), 3.
[374] Green Climate Fund, "Mongolia - Country Profiles," Text, *Green Climate Fund*, accessed March 10, 2019, https://www.greenclimate.fund/countries/mongolia.
[375] Newell and Phillips, "Neoliberal Energy Transitions in the South," 45.

amended Law on Renewable Energy, passed in 2015, sought to replace the FiT with a feed-in premium.[376]

In 2015, Mongolia's parliament passed a new Value-Added Tax (VAT) Act to replace the existing VAT law, which had been in effect since 2006. The Act aims to more accurately reflect the evolution of various sectors in Mongolia and economic development strides that the previous law did not adequately account for.[377] Within the act, a number of sectors and goods are named exempt from the VAT Act, including "equipment to be used for renewable energy surveying, research and production along with the accompanying devices and parts."[378] Interviewees credited the VAT law changes with drawing in critical actors necessary for funding and implementing large-scale renewable energy systems.[379]

A presentation from the head of Mongolia's Ministry of Energy's Investment and Production Division in October 2018 describes additional laws that the country has implemented or amended to promote the development of regional energy systems. These include the Concession Law (2010), Investment Law (2013), Amendment to the Law on Energy (2015), Amendment to the Law on Renewable Energy (2015), and Amendments to the Custom Law and Tariff Laws (2015).[380] Interviewees were unable to recall if the

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376 Emiliano Bellini, "Solar Gains Ground in Mongolia," *PV Magazine International*, last modified January 29, 2019, accessed February 21, 2019, https://www.pv-magazine.com/2019/01/29/solar-gains-ground-in-mongolia/.

377 "Mongolia Adopts New VAT Law," *EY*, last modified September 2, 2015, accessed March 6, 2019, https://www.ey.com/Publication/vwLUAssets/EY-mongolia-adopts-new-vat-law/$FILE/EY-mongolia-adopts-new-vat-law.pdf.

378 "Translation of Value-Added Tax (VAT) Act of 2015," *Deloitte*, last modified 2018, accessed March 6, 2019, https://www2.deloitte.com/mn/en/pages/tax/articles/value-added-tax-act.html; "Нэмэгдсэн Өртгийн Албан Татварын Тухай," *Legal Info*, last modified July 9, 2015, accessed March 6, 2019, https://www.legalinfo.mn/law/details/11227.

379 Anonymous, multiple (ADB, Green Energy), interviewed by author, Ulaanbaatar, March 19-22, 2019.

380 Batmunkh Yeren-Ulzii, "Role and Expectation of Mongolia in Promoting Energy Cooperation in North East Asia" (presented at the North-East Asia Regional Power Interconnection Forum , Ulaanbaatar31thOct

government initiated the passage of these laws, or if international organizations were responsible, but they did speak to the effectiveness of these amendments to bring an influx of foreign investment towards development of additional renewable energy systems.[381] Regarding the implementation of additional niche policy interventions, multiple interviewees spoke about the prospects of auctioning. Opinions differed on whether or not auctioning would be realistic. One interviewee did note that within the past year, Parliament had discussed the inclusion of amendments to the Renewable Energy Law but that these amendments were not approved.[382]

In addition to driving much of the momentum behind the development of projects utilizing niche technologies, international actors are also responsible for the realization and construction of these projects. Construction of Mongolia's large-scale renewable energy facilities, particularly solar and wind, has been initiated and overseen by various multinational corporations. There has so far been a pattern for the trajectory of large-scale renewable projects: international organizations or governments secure funding and resources necessary for the projects, a Mongolian partner company is identified (or established for the purpose of the project), and the project proceeds as a partnership between both Mongolian and external actors.

-1stNov 2018, Ulaanbaatar, October 31, 2018), accessed March 6, 2019, https://www.unescap.org/sites/default/files/Session%203-4.%20Mongolia-Ministry%20of%20Energy.pdf.

[381] Anonymous, multiple (ADB, Green Energy), interviewed by author, Ulaanbaatar, March 19-22, 2019.

[382] Anonymous, multiple (ADB, Ministry of Construction and Urban Development, Green Energy, GGGIa), interviewed by author, Ulaanbaatar, March 19-22, 2019.

In September 2018, President of Mongolia Khaltmaagiin Battulga urged the commencement of the Asia Super Grid's second phase, the East Asia Super Grid, which would connect across Japan as well as South Korea and China.[383]

V.1.4 Socio-Cultural

Regarding where Mongolia could potentially locate large-scale wind and solar energy production, the Gobi Desert—with high wind resources, low moisture and temperatures, and 300 days of sunshine per year—has been identified as an optimal location.[384] Compared to other desert areas, the Gobi Desert offers more efficient energy production.[385] Potential energy production from the Gobi desert area is five times greater than the annual world power demand in 2015.[386] The Gobi Desert's renewable energy potential has inspired the Gobitec concept, a proposal to connect the Gobi desert area with locations of high energy demand.[387] Eventually, the Gobitec project would be able to transmit energy produced through the ASG. Similar to the Gobitec project is the DESERTEC project, which would deploy renewable energy produced in the Middle East and North Africa to both meet domestic demand and, using any electricity surplus, supply electricity to Europe. [388]

In order for the full ASG to be realized, the cooperation of all countries involved as well as multiple intergovernmental organizations is critical. Intergovernmental

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[383] "President Kh.Battulga Proposes for Joint Organization of North East Asian Super Grid," *MONTSAME News Agency*, last modified September 13, 2018, accessed October 31, 2018, http://montsame.mn/en/read/136790.

[384] Chen, Gönül, and Tumenjargal, *Mongolia: Renewables Readiness Assessment*, 15.

[385] Ibid.

[386] Keiichi Komoto and Tomoki Ehara, *IEA-PVPS Task 8 - Energy from the Desert: Very Large Scale PV Power Plants for Shifting to Renewable Energy Future* (International Energy Agency, February 2015), 4.

[387] Chen, Gönül, and Tumenjargal, *Mongolia: Renewables Readiness Assessment*, 15.

[388] *Gobitec and Asian Super Grid for Renewable Energies in Northeast Asia* (Energy Charter Secretariat, January 2014), 10.

organizations will likely include: the Asia-Pacific Economic Cooperation forum (APEC), the Asian Development Bank, the UN Economic and Social Commission for Asia and the Pacific (ESCAP), the International Renewable Energy Agency, and the Energy Charter (EC). Existing challenges to the ASG include the need for an improved investment climate (due to the project's capital-intensive nature), regional electricity, stability, and improved property rights (on account of Mongolia and China's existing weak protection of intellectual property rights).[389]

In addition to the benefit of being able to sell electricity to other nations, Mongolia will be able to reap many tangible benefits from the creation of the ASG. These include economic benefits (job creation, diversification of the local economy), social benefits (poverty alleviation, improved infrastructure), and environmental benefits (reduced air pollution, protection of natural environment). It is estimated that between wind and solar technologies, the project will generate an income greater than nine billion USD over a 16-year period in Mongolia. Job diversification will come from the introduced renewable energy technologies industry, allowing for reduced dependency on Mongolia's mining industry for jobs.[390]

V.2 Existing Niche-Innovations

Figure 12 details renewable energy projects both in operation and planned throughout

[389] Ibid., 13–14.
[390] Ibid., 15.

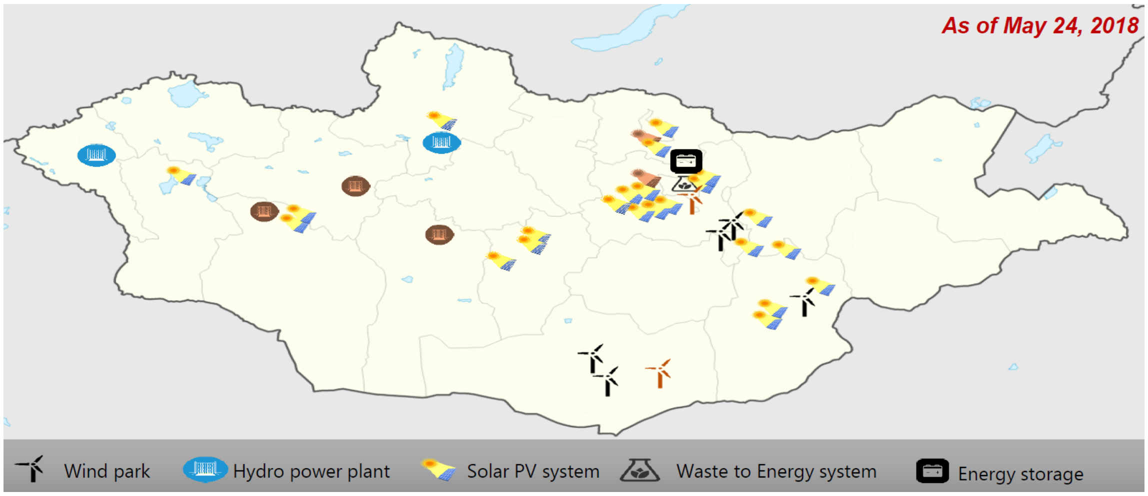

Fig. 12. Renewable energy projects in operation and planned (Jambaa, 2018).

Mongolia. As of July 2017, there were eight different renewable energy license holders: Sainshand Wind Park LLC, AB Solar Wind, Aidiner Global, Cleantech, Clean Energy Asia, Desert Solar Power Wind, Huduggiin tsahilgaan, and the Ulaanbaatar Usan tseneg power plant. The total capacity of these license holders is 642.4 MW.[391] Renewable energy in Mongolia exists in the form of hydropower plants, wind turbines, and photovoltaic (PV) systems.

V.2.1 Wind Energy Systems

Wind power systems have rapidly increased in Mongolia since the country's first large-scale non-hydro renewable energy facility, the Salkhit wind farm, became operational in 2013.[392] Multiple additional large-scale wind energy facilities are planned for construction across Mongolia, including a wind farm planned to supply 52 MW of electricity generation capacity, set to begin commission in 2017 and located in Sainshand, a town in the Gobi Desert.[393]

[391] D. Oyun, "Energy Sector of Mongolia, Policy and Challenges" (Government of Mongolia, Ministry of Energy, July 2017).
[392] Chen, Gönül, and Tumenjargal, *Mongolia: Renewables Readiness Assessment*, 7.
[393] Ibid.

Salkhit. The Salkhit wind farm was the first large-scale wind farm to be constructed in Mongolia. Financing for the wind farm was provided by multiple international organizations and governments. Debt and equity funding for the project was provided in part by the EBRD.[394] Clean Energy LLC, the Mongolian company that oversaw the construction of the Salkhit wind farm, was established in 2004. Owners of Clean Energy include Newcom LLC (51%, Mongolian), General Electric (21%, American), the EBRD (14%), and the Netherlands Development Finance Company (FMO, 14%).[395] Turbines powering the Salkhit wind farm were manufactured by GE.[396]

Sainshand. In 2009, the Mongolian company Sainshand Salkhin Park LLC was established for the construction of the Sainshand wind farm, in the Sainshand soum, Dornogovi aimag.[397] The Sainshand wind farm is sponsored by Ferrostaal (German project developer), ENGIE (French energy company), Danish Climate Investment Fund, and a Mongolian entrepreneur (Radnaabazar Davaanyam). The European Investment Bank (EIB) and the EBRD are providing long-term financing for the project. [398] On September 17, 2018, the Sainshand wind farm was connected to Mongolia's energy grid. Sponsors contributed $120 million to fund the project, which was completed by CMEC

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[394] Svitlana Pyrkalo, "Salkhit Wind Farm in Mongolia Starts Production; EBRD Ready to Double Funding for Wind," *European Bank for Reconstruction and Development*, last modified June 20, 2013, accessed February 1, 2019, //www.ebrd.com/news/2013/salkhit-wind-farm-in-mongolia-starts-production-ebrd-ready-to-double-funding-for-wind.html.
[395] *Scaling-Up Renewable Energy Programme (SREP): Invetsment Plan for Mongolia*, 34.
[396] "GE Taps Growth in Mongolia by Powering Nation's First Wind Farm Project," *GE Newsroom*, last modified November 17, 2011, accessed February 1, 2019, https://www.genewsroom.com/press-releases/ge-taps-growth-in-mongolia-by-powering-nations-first-wind-farm-project-220849.
[397] "Үйл Ажиллагаа - Сайншанд Салхин Парк," *Sainshand Wind Park*, accessed February 1, 2019, http://sainshandwindpark.mn/?page_id=2504&lang=mn.
[398] Svitlana Pyrkalo, "US$ 120 Million Deal for Sainshand Wind Farm in Mongolia Reaches Financial Close," *European Bank for Reconstruction and Development*, last modified August 23, 2017, accessed February 1, 2019, //www.ebrd.com/news/2017/us-120-million-deal-for-sainshand-wind-farm-in-mongolia-reaches-financial-close.html.

Corporation of China.[399] The company overseeing construction of the Sainshand wind farm, Clean Energy Asia (CEA) LLC, is a joint venture that was founded in 2012 by Newcom LLC and the renewable energy arm of Japan's SoftBank Group, SB Energy Corporation. CEA is 51% owned by Newcom, 49% owned by SB Energy Corp.[400] Mongolia's Technology Needs Assessment completed in 2013 reviews the possibility of constructing a wind farm in Sainshand, including the project's objectives, how it would align with Mongolia's sustainable development priorities, technical aspects, as well as potential challenges. Challenges include transportation of equipment, as well as incentivizing technology transfer and transaction costs. The Ministry of Energy is referenced as being responsible for coordinating and overseeing relationships with private companies and international financing organizations.[401] The turbines used in the Sainshand Wind Park are manufactured by Vestas, a Danish company.[402]

Tsetsii. A partnership between Japan and the EBRD, the Japan-EBRD Cooperation Fund, provided Mongolia with a $750,000 grant to modernize an electricity substation near the future site of the Tsetsii wind farm. In addition to Mongolian company Newcom, Japanese company SoftBank group is developing the Tsetsii wind farm. The EBRD,

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[399] "The Opening of the Sainshand Wind Farm Project Was Held on September 17, 2018," *National Renewable Energy Center of Mongolia*, last modified September 18, 2018, accessed February 1, 2019, http://nrec.mn/?p=1059.
[400] "Clean Energy Asia," *Newcom Group*, accessed February 1, 2019, http://www.newcom.mn/en/company/55.
[401] *Technology Needs Assessment: Volume 2 - Climate Change Mitigation in Mongolia*, 208.
[402] "Order for Mongolia's Largest Wind Park Underlines Vestas' Experience in Providing Solutions to Developing Markets," *Vestas*, last modified August 31, 2017, accessed March 1, 2019, https://www.vestas.com/~/media/vestas/media/news%20and%20announcements/news/2017/170831_nr_uk_asp.pdf.

along with Japan International Cooperation Agency (JICA) is planning to co-finance the project.[403]

Choir. The Choir wind farm is being overseen by the Aydiner Group, a Turkish company.[404]

V.2.2 Solar Energy Systems

In addition to wind energy systems, both small- and large-scale solar photovoltaic (PV) systems exist in Mongolia. Since the initiation of 100,000 Solar Gers, the focus on solar PV in Mongolia has shifted to large-scale systems, as foreign governments and investors have begun initiating and developing large-scale projects.

Darkhan: Mongolia's first large-scale solar farm is located in Darkhan, a city north of Ulaanbaatar. The solar farm has a capacity of 10MW, and went into operation on January 1, 2017. Solar modules for the plant were provided by the Japanese company SHARP Corporation.[405] In addition to PV modules provided by SHARP, German companies supplied additional equipment to ensure the plant would function in Mongolia's extreme temperatures reaching -40˚C.[406] The plant was jointly pursued by two Japanese companies—SHARP Corporation and Shigemitsu Shoji Co., Ltd.—and Mongolian

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[403] Svitlana Pyrkalo, "Japan, EBRD Support Infrastructure for Renewables in Mongolia," *European Bank for Reconstruction and Development*, last modified September 28, 2016, accessed February 1, 2019, //www.ebrd.com/news/2016/japan-ebrd-support-infrastructure-for-renewables-in-mongolia.html.
[404] "Establish a Wind Farm with a 50 Megawatt Capacity in Choibalsur Aimag Choir Soum," *National Renewable Energy Center of Mongolia*, last modified May 7, 2017, accessed February 1, 2019, http://nrec.mn/?p=529.
[405] "First Large-Scale Solar Power Plant to Be Commissioned This Year," *JCM-MONGOLIA*, accessed March 17, 2019, http://www.jcm-mongolia.com/?p=14887&lang=en.
[406] Oyundelger B., "Largest Solar Power Plant to Open Officially," *MONTSAME News Agency*, last modified January 18, 2017, accessed March 18, 2019, https://montsame.mn/en/read/128372.

company Solar Power International.[407] The project was registered under the JCM.[408] Solar Power International was founded in October 2015.[409]

Monnaran: An additional project under the JCM is the Monnaran Project, a combination 10MW solar plant-agriculture system (referred to as Solar Farm® technology).[410] Power generation, as well as operations and maintenance of the solar farm are overseen by Everyday Farm LLC, a joint venture pursued by Mongolian company Bridge Corporation and Japan company Farmdo LLC, established in 2012.[411] Operations commenced on November 25, 2017, with construction beginning in 2015.[412]

New Airport: The solar plant near Mongolia's new international airport was financed partially by a loan from the Asian Development Bank (ADB), the ADB's first renewable energy loan with a company in Mongolia's private sector.[413] The New Airport project is a JCM project.[414] Additional technical oversight and project sponsorship is being provided by Thai company Sermsang Power Corporation.[415] Mongolian company Tenuun

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[407] "Completion of Mongolia's First Ever Large-Scale Solar Power Plant!," *SHARP Blog*, last modified January 19, 2017, accessed March 17, 2019, http://www.sharp-world.com/blog/2017/01/19/9838/.
[408] "10MW Solar Power Project in Darkhan City," *The Joint Crediting Mechanism*, accessed March 17, 2019, http://gec.jp/jcm/projects/15pro_mgl_01/.
[409] "Түүхэн Замнал," *Solar Power International Inc*, accessed March 17, 2019, https://solarpowerinternational.mn/%d1%82%d2%af%d2%af%d1%85%d1%8d%d0%bd-%d0%b7%d0%b0%d0%bc%d0%bd%d0%b0%d0%bb/.
[410] R. Jigjid, "JCM's Contribution to Paradigm Shift (Solar Farm® Project in Mongolia)" (presented at the UNFCCC Subsidiary Body, Bonn, Germany, May 7, 2018), https://www.carbon-markets.go.jp/wp-content/uploads/2018/06/5_EverydayFarm.pdf.
[411] "Everyday Farm LLC," *Бридж Групп | Bridge Group*, accessed April 15, 2019, http://www.bridgecorporation.mn/page/2229.shtml?sel=3713&subsel=3719&subid=3720.
[412] B. Batchimeg, "New 10 MW Solar Power Plant Commissions," *MONTSAME News Agency*, last modified November 27, 2017, accessed April 15, 2019, https://montsame.mn/en/read/132534.
[413] Dulguun, "New Solar Power Project Sets Example to Draw Investors' Attention," *The UB Post*, last modified April 2, 2019, accessed April 15, 2019, http://theubposts.com/post/11671/.
[414] Sharp Energy Solutions Corporation, "Mega Solar Projects in Mongolia Under JCM Program" (presented at the Bilateral Business Matchmaking Event for the Joint Crediting Mechanism, Ulaanbaatar, November 7, 2018), accessed March 20, 2019, http://www.jcm-mongolia.com/wp-content/uploads/2015/11/Sharp.pdf.
[415] "Sermsang Khushig Khundii Solar Project - Project Data Sheet," Text, *Asian Development Bank*, last modified January 28, 2019, accessed April 15, 2019, https://www.adb.org/projects/52127-001/main.

Construction LLC is owned by Sermsang, Sharp Energy Solutions (Japan), AMOE Solar LLC (Mongolia), and SH Energy Solution LLC (Mongolia).[416]

Sumber: The Sumber solar project was financed by Mongolian bank XacBank with assistance from the GCF.[417] The Sumber solar plant is operated by Mongolian power company ESB, with technological input for the project provided by Japanese firm Sankou Seiki. The plant has a total of 31,000 solar panels and went into commission in January 2019.[418]

Other solar projects that are being pursued include a 10MW SPP in Choir, as well as a 15MW SPP in Zaminuud.[419]

The Mongolian Government continues to expand its ability to initiate and implement projects related to sustainable development. Whereas projects coordinated through the UNDP were once solely direct implementation, increasingly projects are nationally implemented—the difference being UNDP versus GoM led, respectively.[420]

V.3 Barriers to Further Niche Developments

V.3.1 Technological

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[416] "ADB Supports Private Sector Solar Power Development in Mongolia," Text, *Asian Development Bank*, last modified March 20, 2019, accessed April 15, 2019, https://www.adb.org/news/adb-supports-private-sector-solar-power-development-mongolia.
[417] "XacBank First Mongolian Bank to Finance Renewable Energy."
[418] "GCF Helps XacBank Become First Mongolian Bank to Finance Large-Scale Solar," Text, *Green Climate Fund*, last modified January 28, 2019, accessed February 28, 2019, https://www.greenclimate.fund/news/gcf-helps-xacbank-become-first-mongolian-bank-to-finance-large-scale-solar; Batchimeg B., "Solar Power Plant in Sumber Soum Puts into Operation," *MONTSAME News Agency*, last modified January 30, 2019, accessed February 28, 2019, https://www.montsame.mn/en/read/178921.
[419] Wakana Eriguchi, "The JCM Project Development by OECC" (presented at the Bilateral Business Matchmaking Event for the Joint Crediting Mechanism, Ulaanbaatar, November 7, 2018), accessed March 20, 2019, http://www.jcm-mongolia.com/wp-content/uploads/2015/11/OECC.pdf.
[420] Anonymous (UNDPa), interviewed by author, Ulaanbaatar, March 19, 2019.

The IPCC lists three main barriers to technology transfer: "inadequate technical expertise and know-how", "the absence of professionals in the country able to negotiate a suitable transfer agreement," and "the willingness of the technology owner to transfer the technology."[421] Regarding overcoming the first two barriers, the necessary solution is training and education; for the third, financial support in addition to encouragement from either the originating or recipient country or international bodies may be necessary.

Even though Mongolia has received technical support for the construction and deployment of niche technologies for its existing large-scale renewable systems, there is substantial room for additional assistance at the regime level. According to Mongolia's Third National Communication under the UNFCCC:

> "There is a strong need to provide technical capacity for certain issues of climate change namely MRV [measurement, reporting, and verification], NAMA, the readiness of climate finance, climate change adaptation, and vulnerability and M&E [monitoring and evaluation], GHG inventory, reporting, research, and technology transfer."[422]

Mongolia's most pressing technical problem is the lack of institutional knowledge and appropriate technologies.[423]

V.3.2 Markets and Finances

Moreover, additional barriers include "a lack of support by financial institutions for renewable energy investments (particularly hydro power plants)."[424] Rather than official development assistance, "the implementation of economic and regulatory instruments,

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[421] *Methodological and Technological Issues in Technology Transfer*, 98.
[422] *Third National Communication of Mongolia Under the United Nations Framework Convention on Climate Change*, 388.
[423] *Mongolia's Initial Biennial Update Report*, 16.
[424] *Ibid.*

higher per capita income and schooling levels and with stable, democratic regimes" is correlated with an acceleration of NHRE diffusion.[425]

V.3.3 Political

There are additional barriers that arise as a result of unanticipated political and economic circumstances. Even given the detail, thought, and intention put into Mongolia's TNA, the reality on the ground six years later presents a slightly different picture of actions Mongolia has taken to mitigate the effects of climate change through energy sector reforms. Hydropower, while present, is not responsible for the majority of renewable energy sources in Mongolia. Construction of large-scale PV plants continues to expand rapidly in Mongolia, despite their exclusion in Mongolia's TNA as a priority technology. This exclusion appears to be the result of consultants' analysis on the associated capital costs for large-scale PV; in comparison to wind's estimated capital cost of $5 million USD/year, solar was estimated to have an associated capital cost of $16m USD/year. Similarly, operational and maintenance costs for solar were calculated to be $23m USD/year, compared to wind's $5.5m USD/year. The cost of solar eclipsed all of the other shortlisted technologies as well, leading it to score a zero in the assessment category for capital costs. Considering that capital costs were more heavily weighted than any other category in the assessment, solar was not selected as a priority technology, despite scoring more highly than other selected technologies in categories such as reduced air pollution, healthcare improvement, and energy supply improvement.[426]

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[425] Pfeiffer and Mulder, "Explaining the Diffusion of Renewable Energy Technology in Developing Countries," 287.

[426] *Technology Needs Assessment: Volume 1 - Climate Change Adaptation in Mongolia* (Ministry of Environment and Green Development, 2013), 54, accessed November 4, 2018, http://www.tech-action.org/Participating-Countries/Phase-1-Asia-and-CIS/Mongolia.

This disparity between the TNA recommendations and the reality in Mongolia is likely due to unforeseen financial opportunities. While solar continues to necessitate high capital costs, financing for large-scale solar has been readily available from international organizations and donor countries. At Mongolia's 9th National Renewable Energy Forum, which took place in 2018, a representative from the Ministry of Energy presented that more special licenses have been issued for photovoltaic plants than any other category of renewable energy system—29 compared to five for wind and three for hydropower. The total capacity from these 29 licenses is stated to be 727 MW.[427] This expansion can be attributed to immense investments. According to a data from the country's Energy Regulatory Commission, total investments in planned solar PV projects since 2013 equal $1,221 million USD, compared to only $582m for wind parks and $533m for hydropower.[428]

Regarding domestic political capacity, the ability to implement further niche policies will likely be hindered by political instability as mentioned in reference to Mongolia's existing regime. When asked about the inefficacy of the Mongolian Government due to high turnover and shifting political agendas, interviewees responded that while the current situation impeded progress, they did not foresee the initiation of substantial institutional changes to ameliorate current conditions; rather, people have become accustomed to the challenges and recognize that they are a part of the policy process.[429]

V.4 Divergence from the Multi-Level Perspective

[427] O. Bavuudorj, "Present Status and Challenges of Energy Sector in Mongolia."
[428] Jambaa, "National Renewable Energy Forum - 2018."
[429] Anonymous, multiple (GGGIa, UNDPb), interviewed by author, Ulaanbaatar, March 19-22, 2019.

Similarly to Mongolia's divergence from the MLP at the regime level, the presence of intermediaries, transnational actors, and donor interventions also contributes to discrepancies at the niche level. The ability for niche technologies and policies to be introduced and implemented in Mongolia is highly dependent on Mongolia's partnerships with international organizations and its relationships with donor countries. As a result of these organizations and countries seeking to shift the overall status quo of energy regimes worldwide, they were highly receptive to engaging in programs and projects in Mongolia.

While niche technologies have been built in and brought to Mongolia from third-party organizations and countries, technology transfer to domestic industries has been limited so far. Domestic production of niche technologies in Mongolia is limited; for Mongolia's large-scale wind farm in Salkhit, the turbines were manufactured by GE and imported.[430] While by MLP standards this lack of transfer to domestic production may be seen as indicative of a lack of development and institutional capacity, interviewees importantly pointed out that the lack of domestic production is simply a matter of cost-effectiveness—regardless of Mongolia's role in initiating its energy transition, it is far cheaper to import renewable energy infrastructure from companies in other countries.[431] This speaks to the argument that the "phasing-in of green technologies in developing countries is less about discovering new technological niches and more about *utilizing the opportunities already present that coincide with development objectives*" (emphasis in original).[432]

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[430] "GE Taps Growth in Mongolia by Powering Nation's First Wind Farm Project."
[431] Anonymous (ADB), interview by author, Ulaanbaatar, March 18, 2019.
[432] René Kemp and Babette Never, "Green Transition, Industrial Policy, and Economic Development," *Oxford Review of Economic Policy* 33, no. 1 (February 7, 2017): 67. (Emphasis in original).

Chapter VI: Survey and Interview Data

Due to limited external resources on the status of Mongolia's renewable energy development, research included conducting in-person surveys and interviews in Ulaanbaatar and additional sites in Mongolia. Survey and interview data were collected during two separate phases: May 2017 and March 2019. In May of 2017, the research focused on Mongolians' perceptions of renewable energy, including the government's agenda and attitudes towards existing infrastructure. This research involved surveying and interviewing citizens of Mongolia, including those residing near large-scale renewable energy projects, those living in Ulaanbaatar, and individuals working directly on issues relating to renewable energy, whether it be policy or development.

VI.1 Methodology

VI.1.1 Location

Surveys were disseminated during May 2017 in Darkhan, Salkhit, Hatgal, and Ulaanbaatar (Figure 13). Due to the fact that the first survey was distributed prior to

Fig. 13. Survey locations (Esri, HERE, Garmin, NGA, USGS, 2019).

significant research, an additional survey was developed following interviews with professionals in the development and renewable energy fields. Survey sites were selected based on both available travel opportunities and the presence of large-scale renewable energy facilities—Darkhan being the site of Mongolia's first large-scale solar farm and Salkhit the site of the first large-scale wind park.

VI.1.2 Participants

A total of 94 individuals were surveyed (Table 8).

Table 8
Logistics for each survey.

Survey	Sites	Respondents	Questions	Dates
I	Darkhan	35	8	May 10-11, 2017
	Salkhit	21		May 14, 2017
II	Hatgal	8	10	May 21, 2017
	Ulaanbaatar	30		May 24, 2017

The first survey was distributed to individuals residing in the vicinity of large-scale renewable energy facilities in the city of Darkhan and town of Salkhit, both living directly next to and slightly removed from the facilities (Figure 14). Survey II was distributed to individuals not residing near large-scale renewable energy facilities, in the town of Hatgal and city of Ulaanbaatar (Figure 15). No individual completed both Survey I and Survey II. Refer to the appendices for copies of each survey in English and Mongolian.

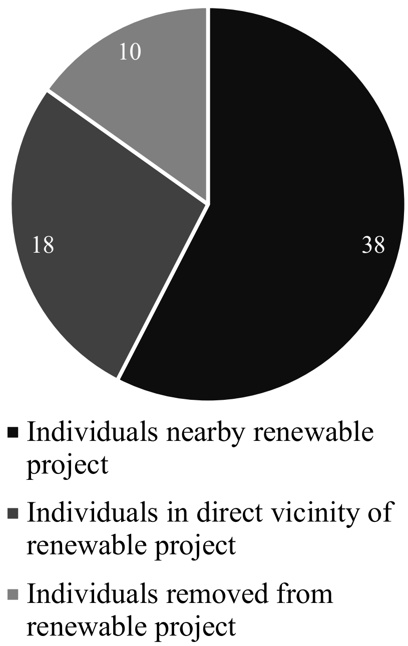

Fig. 14. Survey I: Makeup of respondents' residences.

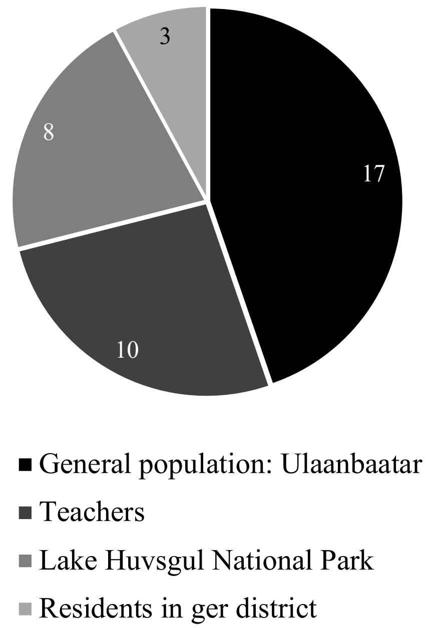

Fig. 15. Survey II: Makeup of respondents.

The majority of survey respondents were between the ages of 30-49 (Figure 16).

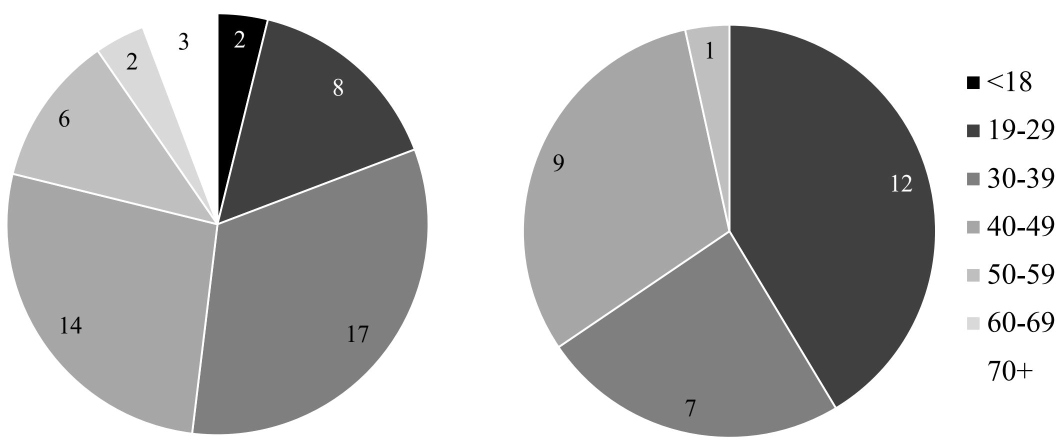

Fig. 16. Age demographics of Survey I (left) & II (right) respondents.

Survey respondents were asked about their perceptions of renewable energy, as well as if and how renewable energy has impacted their lives. Translators were utilized in all survey locations to maximize the survey's accessibility and number of respondents.

VI.2 Limitations

VI.2.1 Surveys

Rather than a single survey, two surveys were developed as a result of incomplete information prior to dissemination of Survey I. After Survey I was distributed, additional interviews were undertaken with renewable energy and development experts; information gleaned from these interviews directly informed the revised questions in Survey II. The only questions replicated from Survey I were "What do you think of the government's goal to have 30% of its energy sourced renewably by 2030?" and "Have you received any education about renewable energy?".

This revision meant that Survey I respondents were unable to answer questions from Survey II that are critical to this research, such as how respondents thought public awareness about renewable energy should be improved. Alternatively, Survey II eliminated relevant questions from Survey I, such as if respondents would be open to installing a renewable energy system in their own homes. Survey II was not distributed to anyone living in the direct vicinity of large-scale renewable projects, thus, it was not possible to compare individuals' knowledge about Mongolia's renewable energy policy between those directly next to versus removed from large-scale RE systems.

VI.2.2 Interviews

The primary limitations for conducting interviews in March 2019 were the language barrier and limited availability of interviewees. While it is possible to use translators throughout Ulaanbaatar, due to the increased logistical challenges posed by coordinating translators and securing Mongolian-speaking interviewees, this option was not pursued. This is tied to the second limitation of limited availability; the allocation of a single week towards visiting Mongolia in-person. Thus, if interviewees were unavailable during the single week, interviews were not conducted.

VI.3 Data Analysis

Surveys were reviewed and common themes were identified within answers where respondents either elaborated or provided extraneous information. All answers from both Survey I and Survey II were entered into a single spreadsheet.

Notes were typed during interviews and reviewed after to ensure accuracy of information. Common themes were identified from interview answers, which were then combined onto a single document organized by theme and interviewee.

VI.4 Results

VI.4.1 Lack of Information

In response to the questions "How much do you know about the electricity grid in Mongolia?" and "How much do you know about renewable energy policy in Mongolia" on Survey II, rates of response were similar, with fewer than 10% indicating that they knew a lot about the existing electricity grid (Figure 17). Only one individual responded that they knew a lot about Mongolia's renewable energy policy.

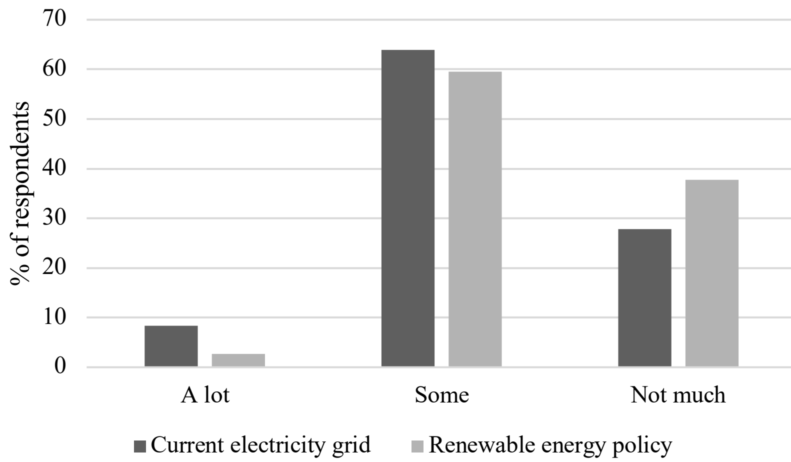

Fig. 17. Survey II: Comparison of respondents' knowledge of Mongolia's existing electricity grid and renewable energy policy.

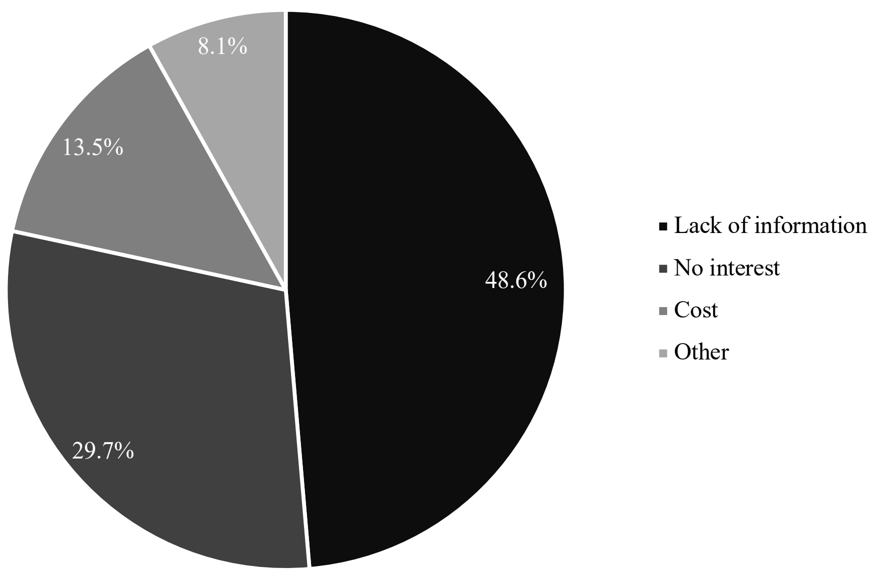

Fig. 18. Survey I: Motivation for not wanting to install residential renewable energy system.

The majority of respondents attributed a lack of information as the primary reason they answered no to the question "Would you ever be open to installing a renewable energy system (i.e. solar panels) for your own home?" (Figure 18).

Survey II respondents additionally reported minimally discussing renewable energy with their family, friends, and coworkers. When asked, "How often do you talk about renewable energy with people (family, friends, coworkers, etc.)?", 47.4% responded "infrequently," 44.7% responded "never," and just 7.9% responded "frequently."

Survey II respondents were also asked about if they thought the public should know more about renewable energy, and if so, how public awareness about renewable energy should be improved. The majority of respondents believed that the government and civil society should primarily be responsible for increasing public awareness (Figure 19).

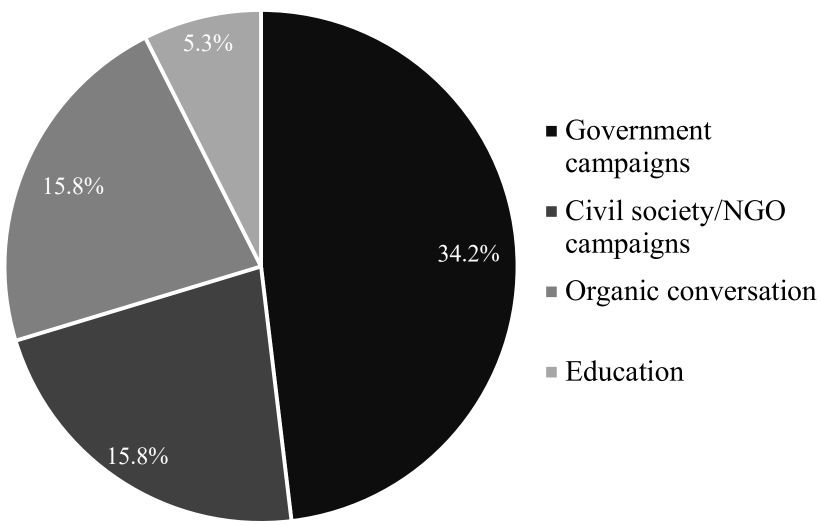

Fig. 19. Survey II: How public awareness about renewable energy should be improved.

There appears to be a potential disconnect between public expectations of the government's role regarding renewable energy and ministries' own expectations. What is interesting is that although most respondents in Survey II thought the government should be responsible for increasing public awareness about renewable energy, the government has largely stayed away from championing public awareness campaigns, instead, delegating this task to NGOs and civil society groups, as well as those organizations involved in development.[433]

VI.4.1 Normative Perceptions

[433] Anonymous (GGGIa), interview by author, Ulaanbaatar, March 20, 2019.

Survey I answers obtained from individuals residing near turbines of the Salkhit wind farm reflected trends identified with social acceptance of renewable energy projects. Specifically, two respondents expressed feeling initially skeptical towards the construction and implementation of the turbines, specifically in reference to uncertainty over their effect on birds and their own herds. Two respondents did say that representatives from the company visited in-person to describe the project and its environmental impacts.[434] One respondent living in the direct vicinity of the turbines stated that they thought the turbines had led to more storms, leading him to move his winter herding site as a result of the changes in weather.[435]

At least one respondent spoke directly to the differentiation that has been previously noted regarding how individuals developing countries perceive normative reasoning for installing renewable energy systems. When asked if she would be interested in installing her own solar energy system, one respondent replied "No, because I already have electricity."[436] This is strikingly similar to the aforementioned statement by an individual in Tanzania who was asked about incentives for installing renewable energy systems: "It doesn't have anything to do with climate change; it is driven by rural electrification and people wanting electricity."[437]

Despite a lack of knowledge about renewable energy systems, very few Survey I respondents expressed negative views of renewable projects. 52.8% responded they had a

[434] Survey I responses: IS-WF1, IS-WF5
[435] Survey I response: IS-WF2
[436] Survey I response: IS-N1
[437] Amars et al., "The Transformational Potential of Nationally Appropriate Mitigation Actions in Tanzania," 95.

"positive" perception of renewable energy projects, 41.5% responded "neutral," and 5.7% responded "negative."

Conclusion

Mongolia's ongoing energy transition speaks to what others have found regarding the limitations of the MLP's applicability to developing countries. Originally developed as a framework meant to explain historical energy transitions in developed European nations, the MLP is insufficient to explain many of the nuances unique to energy and sustainability transitions in developing countries. Thus, many authors have argued for the inclusion of additional frameworks and variables beyond the MLP in order to adequately explain ongoing transitions.

Specifically for Mongolia, the role of transnational linkages, in the forms of intermediaries and donor interventions, has been paramount. Mongolia's transition is characterized by niche technologies (wind turbines, PV panels) and policies (feed-in-tariff, value-added tax exemption) that have been fully developed for other contexts and are being introduced into Mongolia's unique environment. The transfer of these technologies has been successful largely due to partnerships Mongolia has fostered with international actors and its allies; projects are built according to long-term plans rather than singular and isolated ambitions. Mongolia has effectively involved the private sector in renewable energy project processes through the founding of private Mongolian companies to partner with international organizations and governments in order to see projects to fruition.

The majority of barriers affecting the development of renewable energy in Mongolia stem from the regime and niche level. Mongolia's incumbent regime is entrenched not only due to reliance on existing systems, but limited domestic political and economic capacity to initiate change, despite the government's ideological prioritization of sustainable development. Fortunately for Mongolia, it has been able to capitalize on its pre-existing relationships with the international community to foster long-term investment in renewable energy projects. This has resulted in limited cases seen in other countries where isolated transition projects do not lead to large-scale regime change. Consideration should continue to be given to the normative aspects of Mongolia's transition; specifically, the diffusion of renewable energy for purposes other than the Western notion of existential environmentalism rooted in an appeal to morality.

In the future, Mongolia should continue to draw on these relationships to ensure that future growth aligns with the government's long-term priorities. Ensuring that any development projects are suitable for factors unique to Mongolia will continue to be crucial, as sustainable development continues to expand as a primary tool to combat the effects of climate change.

Appendix A

Stakeholders Identified in Mongolia’s Technology Needs Assessment[438]

Stakeholders	Interest in TNA Project			Influence of Stakeholder		
	Low	***Medium***	***High***	***Low***	***Medium***	***High***
Ministries and President’ s Office						
Ministry of Mineral Resources and Energy		✓				✓
Ministry of Food, Agriculture and Light Industry	✓				✓	
Ministry of Roads, Transportation, Construction,		✓				✓
Ministry of Nature, Environment and Tourism			✓			✓
President’ s Office		✓			✓	
Government Agencies						
National Development and Innovation Committee			✓			✓
Energy Authority		✓			✓	
Energy Regulatory Authority	✓				✓	
Academy of Sciences and Universities						
Mongolian Academy of Sciences		✓		✓		
Mongolian University of Science and Technology		✓			✓	
Mongolian National University	✓				✓	
Mongolian State University of Agriculture	✓			✓		
Mongolian Development Institute	✓				✓	
International organizations and projects						
UNDP Office in Mongolia		✓			✓	
Local Governments						
The Municipal Government of Ulaanbaatar City		✓			✓	
NGOs						
Mongolian Chamber of Commerce and Industry	✓			✓		
Mongolian Energy Association		✓				✓
Private Companies						
Mon-Energy LLC	✓				✓	
MCS Group		✓			✓	
Clean Energy LLC		✓			✓	

[438]Adapted from *Technology Needs Assessment: Volume 2 - Climate Change Mitigation in Mongolia*, 10.

Appendix B

Mongolia's Nationally Appropriate Mitigation Actions[439]

Sector	Subsector	Action
Energy supply	Renewable options	PV and solar heating
		Wind power
		Hydropower
	Coal quality	Coal beneficiation
		Coal briquetting
	Heating boiler efficiency	Improve efficiency of existing HOBs and install boilers with new design and high efficiency
		Convert hot water boilers into small capacity thermal power plants
	Household stoves & furnaces	Change fuels for household stoves and furnaces
		Modernize existing and implement new design for household stoves & furnaces
	CHP plants	Improve efficiency and reduce internal use
	Electricity use for local heating	Use of electricity from grid for individual households in cities
Building	Improve energy efficiency	Improve district heating systems in buildings
		Install heat and hot water meters in apartments
		Improve insulation for existing buildings and implement new energy efficiency standards in new buildings
		Improve lighting efficiency in buildings
Industry	Improve energy efficiency	Improve housekeeping practices
		Implement motor efficiency improvements
		Introduce dry-processing in cement industry
Transport		Use more fuel-efficient vehicles
Agriculture		Limit the increase of the total number of livestock by increasing the productivity of each type of animal, especially cattle
Forestry		Improve forest management

[439] Adapted from "Copenhagen Accord: Appendix II - Mongolia: Nationally Appropriate Mitigation Actions of Developing Country Parties."

Appendix C

Survey I (English)

Renewable Energy Policy Survey

Name:
Age:
Area of residence:
Number of people in household:
For the following questions, please check all boxes that apply to you. Thank you!
1. What is your perception of renewable energy projects? ☐ Positive ☐ Negative ☐ Neutral ☐ Other (please explain below):
2. What do you see as the future of renewable energy in Mongolia? ☐ More projects from the government and foreign companies ☐ More projects from private companies ☐ Fewer projects overall ☐ 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? ☐ Realistic ☐ Unrealistic ☐ Other (please explain below):
4. Have you received any education about renewable energy? ☐ Yes (please explain below) ☐ No *If yes, please explain the details of your education:*
5. Have you been personally affected by the presence of renewable energy projects? ☐ Yes (please explain below) ☐ 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) ☐ Large-scale installation (able to serve many households) ☐ Small-scale installation (serves single household) ☐ Other (please explain below):
7. Would you ever be open to installing a renewable energy system (i.e. solar panels) for your own home? ☐ Yes ☐ No ☐ 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? ☐ Cost

☐ Lack of information ☐ No interest ☐ Other (please explain below):
Please include any additional comments below:
Thank you for taking this survey!

Appendix D

Survey I (Mongolian)

Сайн байна уу? Та доорх судалгааг хичээнгүйлэн бөглөж өгнө үү.

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 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 (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 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
Results: Survey I

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?	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	16	Gers outside of Darkhan Solar Plant	10 May 2017	73	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-GD2	Darkhan	17	Gers outside of Darkhan Solar Plant	10 May 2017	59	A) Positive	–	A) Realistic	Б) Yes	–	A) Large-scale installation (able to serve many households)	A) Yes	Д) N/A
ID-GD3	Darkhan	19	Gers outside of Darkhan Solar Plant	10 May 2017	77	–	–	A) Realistic	A) No	A) No	–	Б) No	B) No interest
ID-GD4	Darkhan	20	Gers outside of Darkhan Solar Plant	10 May 2017	76	–	–	A) Realistic	–	A) No	A) Large-scale installation (able to serve many households)	A) Yes	Д) N/A
ID-GD5	Darkhan	18	Gers outside of Darkhan Solar Plant	10 May 2017	52	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-BG1	Darkhan	8	Bag offices	11 May 2017	31	B) Neutral	B) Fewer projects overall	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	B) No interest
ID-BG2	Darkhan	9	Bag offices	11 May 2017	53	Б) Negative	Б) More projects from private companies	A) Realistic	Yes w/explanation	A) No	Б) Small-scale installation (serves single household)	Б) No	Б) Lack of information
ID-BG3	Darkhan	7	Bag offices	11 May 2017	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	B) No interest
ID-BG4	Darkhan	6	Bag offices	11 May 2017	35	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-BG5	Darkhan	5	Bag offices	11 May 2017	32	A) Positive	Б) More projects from private companies	A) Realistic	Б) Yes	A) No	A) Large-scale installation (able to serve many households)	A) Yes	Д) N/A
ID-BG6	Darkhan	4	Bag offices	11 May 2017	46	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	A) Cost
ID-BG7	Darkhan	3	Bag offices	11 May 2017	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	11	Ministry of Environment and Tourism	11 May 2017	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	13	Ministry of Environment and Tourism	11 May 2017	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	14	Ministry of Environment and Tourism	11 May 2017	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	15	Ministry of Environment and Tourism	11 May 2017	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	10	Ministry of Environment and Tourism	11 May 2017	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	12	Ministry of Environment and Tourism	11 May 2017	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	29	Market	11 May 2017	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	28	Market	11 May 2017	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	1	Market	11 May 2017	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	22	Market	11 May 2017	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	2	Market	11 May 2017	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	23	Market	11 May 2017	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	24	Market	11 May 2017		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)	Б) No	Г) Other (please explain below):
ID-M8	Darkhan	25	Market	11 May 2017	29	B) Neutral	B) Fewer projects overall	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	Г) Other (please explain below):
ID-M9	Darkhan	32	Market	11 May 2017	46	A) Positive	A) More projects from the government and foreign companies	A) Realistic	A) No	A) No	B) Other (please explain below):	Б) No	B) No interest
ID-M10	Darkhan	26	Market	11 May 2017	49	B) Neutral	A) More projects from the government and foreign companies	B) Other (please explain below):	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
ID-M11	Darkhan	27	Market	11 May 2017	52	B) Neutral	Б) More projects from private companies	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	B) No interest
ID-M12	Darkhan	36	Market	11 May 2017	43	B) Neutral	A) More projects from the government and foreign companies	A) Realistic	Б) Yes	A) No	B) Other (please explain below):	Б) No	Б) Lack of information
ID-M13	Darkhan	35	Market	11 May 2017	39	A) Positive	Б) More projects from private companies	A) Realistic	Б) Yes	A) No	A) Large-scale installation (able to serve many households)	Б) No	B) No interest
ID-M14	Darkhan	34	Market	11 May 2017	30	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	B) No interest
ID-M15	Darkhan	31	Market	11 May 2017	39	B) Neutral	Б) More projects from private companies	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
ID-M16	Darkhan	30	Market	11 May 2017	37	A) Positive	Б) More projects from private companies	A) Realistic	Б) Yes	A) No	Б) Small-scale installation (serves single household)	A) Yes	Д) N/A
ID-M17	Darkhan	33	Market	11 May 2017	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	Б) Lack of information
IS-N1	Salkhit	37	Surrounding gers	14 May 2017	49	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	Г) Other (please explain below):
IS-N2	Salkhit	38	Surrounding gers	14 May 2017		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
IS-N3	Salkhit	39	Surrounding gers	14 May 2017	46	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)	A) Yes	Д) N/A
IS-N4	Salkhit	40	Surrounding gers	14 May 2017	54	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	A) Cost
IS-N5	Salkhit	43	Surrounding gers	14 May 2017	41	A) Positive	Б) More projects from private companies	A) Realistic	A) No	Б) Yes	A) Large-scale installation (able to serve many households)	A) Yes	B) No interest
IS-N6	Salkhit	44	Surrounding gers	14 May 2017	46	Б) Negative	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	A) Cost

IS-N7	Salkhit	45	Surrounding gers	14 May 2017	19	A) Positive	Б) More projects from private companies	A) Realistic	Б) Yes	A) No	A) Large-scale installation (able to serve many households)	Б) No	–
IS-N8	Salkhit	46	Surrounding gers	14 May 2017	24	B) Neutral	B) Fewer projects overall	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	A) Yes	Г) Other (please explain below):
IS-WF1	Salkhit	41	Lives at base of wind farm	14 May 2017		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
IS-WF2	Salkhit	47	Lives at base of wind farm	14 May 2017		A) Positive	B) Fewer projects overall	A) Realistic	A) No	A) No	B) Other (please explain below):	A) Yes	A) Cost
IS-WF3	Salkhit	42	Lives at base of wind farm	14 May 2017	33	B) Neutral	Г) Other (please explain below):	B) Other (please explain below):	A) No	A) No	–	A) Yes	Б) Lack of information
IS-WF4	Salkhit	48	Lives at base of wind farm	14 May 2017	28	B) Neutral	Б) More projects from private companies	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information
IS-WF5	Salkhit	49	Lives at base of wind farm	14 May 2017	66	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
IS-WF6	Salkhit	50	Lives at base of wind farm	14 May 2017	41	B) Neutral	A) More projects from the government and foreign companies	A) Realistic	A) No	A) No	Б) Small-scale installation (serves single household)	A) Yes	Б) Lack of information
IS-WF7	Salkhit	51	Lives at base of wind farm	14 May 2017	60	A) Positive	A) More projects from the government and foreign companies	A) Realistic	A) No	A) No	B) Other (please explain below):	A) Yes	Д) N/A
IS-WF8	Salkhit	53	Lives at base of wind farm	14 May 2017	41	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	B) No interest
IS-WF9	Salkhit	52	Lives at base of wind farm	14 May 2017	37	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)	A) Yes	Д) N/A
IS-WF10	Salkhit	54	Lives at base of wind farm	14 May 2017	17	Б) Negative	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	B) No interest
IS-WF11	Salkhit	55	Lives at base of wind farm	14 May 2017	17	A) Positive	Б) More projects from private companies	A) Realistic	A) No	A) No	Б) Small-scale installation (serves single household)	A) Yes	Д) N/A
IS-WF12	Salkhit	56	Lives at base of wind farm	14 May 2017	42	–	Б) More projects from private companies	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	B) No interest
IS-WF13	Salkhit	57	Lives at base of wind farm	14 May 2017	24	B) Neutral	Б) More projects from private companies	A) Realistic	A) No	A) No	A) Large-scale installation (able to serve many households)	Б) No	Б) Lack of information

Appendix I

Results: Survey II

Code	City	Context	Survey date	Gender	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 answered yes to #6, how do you think public awareness about renewable energy should be improved?	8. What do you think of the government's goal to have 30% of its energy sourced renewably by 2030?	9. Have you received any education about renewable energy?	10. Have you ever utilized renewable energy in your own life?
IIH-NP1	Hatgal	ADB/ Ministry of Environ. offices	22 May 2017	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	a/г	a. Realistic	a. No	a. No
IIH-NP2	Hatgal	ADB/ Ministry of Environ. offices	22 May 2017	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 from NGOs/civil society	a. Realistic	a. No	a. No
IIH-NP3	Hatgal	ADB/ Ministry of Environ. offices	22 May 2017	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. Government campaigns	a. Realistic	a. No	a. No
IIH-NP4	Hatgal	ADB/ Ministry of Environ. offices	22 May 2017	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	a/б	a. Realistic	a. No	a. No

IH-NP5	Hatgal	ADB/ Ministry of Environ. offices	22 May 2017	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 from NGOs/civil society	a. Realistic	a. No	a. No
IIH-NP6	Hatgal	ADB/ Ministry of Environ. offices	22 May 2017	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 within the past year)	a. Yes	в. Organic conversations between people	a. Realistic	a. No	a. No
IIH-NP7	Hatgal	ADB/ Ministry of Environ. offices	22 May 2017	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. Government campaigns	в. Other	a. No	a. No
IIH-NP8	Hatgal	ADB/ Ministry of Environ. offices	22 May 2017	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	a/б/в/г	a. Realistic	б. Yes (if yes, please explain how)	a. No
IIU-1	UB	Park	24 May 2017	–	–	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. Government campaigns	a. Realistic	a. No	a. No
IIU-2	UB	Park	24 May 2017	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. Government campaigns	a. Realistic	a. No	a. No

IIU-3	UB	Park	24 May 2017	–	–	–	–	a. Satisfied	б. Some (somewhat aware of renewable energy policy)	a. Never (no conversations within the past year)	a. Yes	в. Organic conversations between people	a. Realistic	a. No	a. No
IIU-4	UB	Park	24 May 2017	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/curr icula in schools	в. Other	a. No	a. No
IIU-5	UB	Park	24 May 2017	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. Government campaigns	в. Other	a. No	a. No
IIU-6	UB	Man on bus	24 May 2017	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	a/r	б. Unrealistic	a. No	a. No
IIU-7	UB	Taxi driver	24 May 2017	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	a/б/r	a. Realistic	б. Yes (if yes, please explain how)	a. No
IIU-8	UB	Taxi driver	24 May 2017	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/curr icula in schools	a. Realistic	a. No	a. No

IIU-9	UB	Library	24 May 2017	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 from NGOs/civil society	a. Realistic		a. No
IIU-10	UB	Library	24 May 2017	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 conversations between people	б. Unrealistic	a. No	a. No
IIU-11	UB	Outside school	24 May 2017	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 from NGOs/civil society	a. Realistic	a. No	a. No
IIU-12	UB	Outside school	24 May 2017	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	a/г	a. Realistic	б. Yes (if yes, please explain how)	б. Yes (if yes, please explain how)
IIU-15	UB	Outside school	24 May 2017	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. Government campaigns	б. Unrealistic	a. No	a. No
IIU-16	UB	Outside school	24 May 2017	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	a/б/в/г	a. Realistic	a. No	a. No

IIU-17	UB	Outside school	24 May 2017	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 from NGOs/civil society	a. Realistic	a. No	a. No
IIU-GD1	UB	Ger district	24 May 2017	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	a/б/в/г	a. Realistic	б. Yes (if yes, please explain how)	б. Yes (if yes, please explain how)
IIU-GD2	UB	Ger district	24 May 2017	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 conversations between people	a. Realistic	a. No	a. No
IIU-GD3	UB	Ger district	24 May 2017	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	a/б	a. Realistic	б. Yes (if yes, please explain how)	a. No
IIU-S1	UB	School	24 May 2017	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	a/б/в/г	в. Other	б. Yes (if yes, please explain how)	a. No
IIU-S2	UB	School	24 May 2017	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 from NGOs/civil society	в. Other	a. No	a. No

IIU-S3	UB	School	24 May 2017	–	–	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. Government campaigns	б. Unrealistic	a. No	a. No
IIU-S5	UB	School	24 May 2017	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. Government campaigns	a. Realistic	a. No	a. No
IIU-S6	UB	School	24 May 2017	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. Government campaigns	a. Realistic	a. No	б. Yes (if yes, please explain how)
IIU-S7	UB	School	24 May 2017	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. Government campaigns	a. Realistic	б. Yes (if yes, please explain how)	б. Yes (if yes, please explain how)
IIU-S8	UB	School	24 May 2017	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	a/б	a. Realistic	a. No	a. No
IIU-S9	UB	School	24 May 2017	–	–	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	a. Government campaigns	a. Realistic	б. Yes (if yes, please explain how)	б. Yes (if yes, please explain how)

IIU-S10	UB	School	24 May 2017	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	a. Government campaigns	a. Realistic	a. No	a. No
IIU-13	UB	Outside school	24 May 2017	–	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	a. Government campaigns	в. Other	a. No	a. No
IIU-14	UB	Outside school	24 May 2017	–	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 conversations between people	a. Realistic	a. No	a. No
IIU-S4	UB	School	24 May 2017	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 conversations between people	б. Unrealistic	б. Yes (if yes, please explain how)	a. No

Appendix J

Interview Questions (March 2019)

General questions

1. What is your name?
2. Where do you work?
3. What is your position within where you work?

Renewable energy-specific questions

4. Have you ever studied renewable energy or development in a formal academic setting?
5. What are your thoughts on current governmental plans to increase renewable energy use in Mongolia?
    a. Do you think that Mongolia's goal of increasing renewable energy capacity to 20% by 2030 is realistic?
6. What barriers do you feel exist to more widespread diffusion of renewable energy technologies in Mongolia?
    a. Do you believe Mongolia is adequately equipped to address these barriers? If not, what would need to change for Mongolia to address these barriers?
7. What do you think are the best ways to increase the use of renewable energy?
8. What are your thoughts on the role of international organizations and other countries in Mongolia's renewable energy development?
9. Do you think Mongolia will be able to eventually have a domestic renewable energy industry?
    a. If so, what do you believe needs to happen for a domestic energy to take form?
10. Do you believe civil society will play a role in spreading renewable energy technologies?
11. What is your perception of the public's knowledge regarding renewable energy technologies in Mongolia?
12. How has Mongolia attempted to overcome challenges to renewable energy diffusion?
13. Was the implementation and amendment of laws to bolster renewable energy investment (i.e. the VAT law, customs law, etc.) driven by domestic or international actors?

Development-specific questions

14. How would you describe public awareness of UNDP and similar programs in Mongolia?
15. What would you say is the biggest impediment to development in Mongolia?
    a. How do you think these barriers can be addressed?
16. Do you think public support could be leveraged to increase development programs in Mongolia?
17. Are there civil society organizations working to raise awareness about environmental development programs in Mongolia?

18. How would you describe the relationship between government ministries and your team at UNDP?
    a. How supportive has the government been of your project, and has this support changed at all since you started working?
19. What is the biggest challenge you've faced in furthering the projects you work on?
20. What progress have you seen since starting at the UNDP on your projects?
21. What is the nature of the dialogue between different individuals/agencies/groups pursuing different sustainable development projects?
22. Do you foresee projects like BIOFIN ever being run independently by the Mongolian government?
23. Have you run into challenges pursuing programs due to industry (i.e. mining) interests?
24. Does the political system in Mongolia ever pose efficacy problems?

Appendix K
Description of Transition Management

Transition management describes four governance domains where activities during transitions take place—strategic, tactical, operational, and reflexive. Each of these domains details different processes necessary for a transition to be planned and take place.

Strategic: Activities in the strategic domain include "vision development, strategic discussions, long-term goal formulation, collective goal and norm setting, and long-term anticipation."[440]

The tactical domain is where "steering activities" take place—including actions such as "negotiations, planning and control, financial support, programming." Activities include "agenda building, negotiating, networking and coalition building."[441]

Operational activities are short-term and often pertain to innovation. These activities are carried out in specific programs for innovation, as well as existing business and industry, political, and civil society spheres. Innovation is not limited to technological advances, and also includes "all societal, technological, institutional, and behavioral *practices* that introduce or operationalize new structures, culture, routines, or actors."[442]

The scope and timeline of each domain varies (Table 9).

Table 9
Characteristics of transition management levels.[443]

Transition Management Levels	Focus	Problem scope	Time scale	Level of activities
Strategic	Culture	Abstract/societal system	Long-term (30 years)	System

[440] Loorbach, "Transition Management for Sustainable Development," 168–9.
[441] van Welie and Romijn, "NGOs Fostering Transitions towards Sustainable Urban Sanitation in Low-Income Countries," 252.
[442] Loorbach, "Transition Management for Sustainable Development," 170.
[443] Ibid., 171.

Tactical	Structures	Institutions/regime	Mid-term (5-15 years)	Subsystem
Operational	Practices	Concrete/project	Short-term (0-5 years)	Concrete

Appendix L

Partial lists of large-scale solar and wind projects in Mongolia

List of Wind Projects

Name of Wind Park	**Capacity**	**Owner**	**Status**	**Location**	**Annual generation**
Salkhit	50 MW	Clean Energy	In operation	Sergelen Soum, Tuv aimag	--
--	50 MW	Aydiner Global	Short-term project (2014-2017)	Choir city, Govisumber province	123 mil kWh
--	102 MW	"Qleantech" LLC	Short-term project (2014-2017)	Khanbogd soum, Umnugovi province	300 mil kWh
Sainshand Wind Park	50 MW	Sainshand Wind Park LLC	In operation Short-term project (2014-2017)	Sainshand city, Dornogovi province	130 mil kWh
--	100 MW	Clean Energy Asia LLC	Long-term project (2018-2025)	Bulgan soum, Umnugovi province	--
Tsetsii Wind Park	50 MW	Clean Energy Asia LLC	Long-term project (2018-2025)	Tsogttsetsii soum, Umnugovi province	--
--	50 MW	Khiimori salkhi LLC	Long-term project (2018-2025)	Argalant soum, Tuv province	--
--	100	AB Solar Wind	Completed feasibility study and license[444]	Dalanjargalan soum,	--
--	50	TBF International Group	Completed feasibility study and license[445]	Bayan-Ovoo soum	--

[444] Angarag Myagmar, "Mongolia Wind Development Status" (Ulaanbaatar, 2016).
[445] Ibid.

List of Solar Projects

Name of Solar Farm	Capacity	Operator	Status	Location	International Involvement
Darkhan Solar Farm	10 MW	Solar Power International, LLC	In operation	Darkhan	JCM
Monnaran solar/agriculture	10 MW	Everyday Farm LLC	In operation		JCM
Darkhan II	20 MW		Completion November 2019	Darkhan	--
New Airport	15 MW, CES	Tenuun Gerel Construction LLC	Completion November 2018	Khushig Khundii	ADB, JCM
Bayanchandmani	21 MW		Completion December 2019	Bayanchandmani	JCM
Sumber	--	--	--	--	GCF
Choir	10 MW	--	--	--	--
Zaminuud	15 MW	--	--	--	--

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Anonymous (Green Energy), interviewed by author, Ulaanbaatar, March 19, 2019.

Anonymous (Ministry of Construction and Urban Development), interviewed by author, Ulaanbaatar, March 21, 2019.

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