Comparative analysis of renewable energy development in the Republic of Buryatia (Russia) and Mongolia

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Abstract. The constantly growing demand for electricity and relatively small energy capacities are forcing the Republic of Buryatia (to a greater extent) and Mongolia, which are limited in some types of economic activity, to look for new sources of energy. One of these restrictions is the ban on the construction of hydroelectric power plants on rivers of the Lake Baikal basin. Therefore, Buryatia and Mongolia have taken the path of building environmentally friendly power plants and have succeeded in many ways. Despite the high costs of setting up clean power plants, infrastructure investments in alternative energy are long-term and expected to be profitable. Investors (including foreign ones) placing their money in a seemingly low-profit project, having long-term expectations. Competent investors do not run after “quick money”, realising that the return period of the constructed power plants will be long, as at the moment of development they have a relatively low efficiency. Despite the criticism of some researchers [1], they invest in green energy, modern infrastructure and a future without emissions (CO₂, NO₂, SO₂ and other gases) from burning coal, fuel oil and firewood. Other experts see in the development of alternative energy a great potential [2-5], refuting arguments of critics about high cost of electricity [6].

1. Introduction

The geographical proximity of Buryatia and Mongolia determines the similarity of natural conditions for energy development. Their energy capacities are approximately equal, both territories generate roughly the same amount of electricity, besides, the Buryat and Mongolian power systems are interconnected, which makes the comparison even more interesting. Mongolia has three times the population of Buryatia, so Mongolia imports some of its electricity from Russia. Gusinoozyorsk thermal power plant (TPP) in Buryatia exports electricity to the central part of Mongolia, Kharanor TPP (Zabaikalsky Krai) – to the eastern part, and Sayano-Shushenskaya hydro power plant (HPP) in Krasnoyarsk Krai – to the western part. Both territories benefit from the legacy of the Soviet past – thermal power plants that use coal and fuel oil.

In recent years, the need to develop renewable energy sources has arisen in connection with the UN Sustainable Development Goals on infrastructure for affordable and clean energy (Goal 7). One of the priority areas for the development of renewable, including alternative, energy in Buryatia and Mongolia is solar, wind, hydro- and geothermal energy.
2. Power generation’s situation

2.1. Current state of Power generation in Buryatia

The territory of Buryatia is divided into two unconnected energy districts: Northern and Southern. The Republic of Buryatia has an energy industry based mainly on TPPs: three combined heat and power plants and one state district power plant (GRES), which were put into operation from 1936 to 1976 (Table 1) and are the main sources of electricity in the southern energy district of Buryatia. In the Republic, an energy industry has developed, based mainly on thermal power plants: three thermal power plants and one state district power station, which were commissioned from 1936 to 1976 (Table 1). They are the main sources of electricity for the southern energy district of Buryatia. In general, 92.5% of the electricity in Buryatia is generated by combined heat and power plants (CHPs) and diesel power plants (DPPs).

The largest power plant is the Gusinoozoryorsk TPP (79.7% of the total capacity of Buryatia), which exports part of its electricity to Mongolia. The northern energy district of Buryatia is a transit one, is connected to the power system of the Irkutsk region, from where is supplied with electricity as it does not have its own power generation capacities. In addition, there are small isolated diesel power plants (DPP) in the settlements of the Severo-Baikalsky district (Table 1, Figure 1).

![Diagram of Buryatia's power facilities](image)

**Figure 1.** Buryatia’s power facilities (compiled by author).

The republic would have enough electricity if Ulan-Ude’s TPP-2 were completed. CHP-2, commissioned in 1991, operates as a large boiler house, although according to the project it should have an electricity capacity of 840 MW and a heat capacity of 1,840 Gcal. In March 2019, the project for the reconstruction of CHP-2 in Ulan-Ude was included in the Development Strategy of Buryatia until 2035. It is planned to commission two power units with the plant reaching an electric capacity of 230 MW and a thermal capacity of 360 Gcal/hour [16]. Recently, Buryatia has been experiencing a shortage of electricity.
Table 1. Operating power generation facilities in the Republic of Buryatia (as of 2021).

| Company Generating facility | Installed capacity, MW | Share of total capacity, % | Location | Launch year (date) |
|-----------------------------|------------------------|-----------------------------|----------|-------------------|
| Conventional sources of electricity |                         |                            |          |                   |
| Thermal power plants (TPPs) |                         |                            |          |                   |
| JSC “TGK-14” Ulan-Ude TPP-1 [7] | 148.77                | 9.72                        | Ulan-Ude | 1936              |
| Timlyui TPP [8]              | 22                     | 1.44                        | Kabansky District, Kamensk | 1953 |
| OJSC “Selenginsk pulp and cardboard mill” TPP at OJSC “Selenginsk pulp and cardboard mill” | 36                     | 2.35                        | Kabansky District, Selenginsk | 1971 |
| JSC “Inter RAO – Electrogeneratsia” Gusinoozyorsk TPP [9] | 1,190                 | 77.76                       | Selenginsky District, Gusinoozyorsk | 1976 |
| PJSC “MRSK of Siberia” – “Buryatenergo” DPP [7] | 18.62                 | 1.22                        | Severo-Baikalsky district: Davsha, Khakusy and Kotelnikovsky [10] | – |
| Total of conventional sources of electricity: | 1,415.39              | 92.49                       |          |                   |

| Renewable sources of electricity |                         |                            |          |                   |
| Solar power plants (SPPs) |                         |                            |          |                   |
| LLC “Avelar Solar Technology” Bichura SPP [11] | 10                     | 0.65                        | Bichura District, Bichura | 13.11.17 |
| LLC “Complex Industry” Kabansk SPP [12] | 15                     | 0.98                        | Kabans District, Kabans | 29.10.19 |
| Tarbatatai SPP [12] | 15                     | 0.98                        | Tarbagatai District, Tarbagatai | 29.10.19 |
| “BVS” SPP [12] | 15                     | 0.98                        | Kyakhta District, Kyakhta city | 29.10.19 |
| LLC “Avelar Solar Technology” Khorinsk SPP [13] | 15                     | 0.98                        | Khorinsk district, Khorinsk | 08.12.19 |
| Torey SPPa [14, 15] | 45                     | 2.94                        | Dzida District, Nizhny Torey | 21.12.20 |
| Total of renewable sources of electricity: | 115                    | 7.51                        |          |                   |
| Total: | 1,530.39              | 100.00                      |          |                   |

a Biggest solar power plant in Buryatia.

Given the environmental constraints in the Baikal natural area, the republic is experiencing difficulties with the development of the economy and infrastructure, including power generation. According to the reported data for 2019, the generation of electricity by the power plants of the operational zone of the Buryat Regional Dispatching Office amounted to 5,263.53 million kWh, electricity consumption – 5,549.72 million kWh [17]. The deficit of electricity for the year was 286.19 million kWh.

Most of Buryatia’s power generation facilities are located and constructed in the central and southern parts of the republic, except for three autonomous diesel power plants in the Severo-Baikalsky District.
2.2. Current state of Power generation in Mongolia

The Mongolian power system is divided into 4 regional power systems (in addition, the country has many isolated small power systems):

- Central Power System (CPS);
- Altai-Ulaistai Power System (AUPS);
- Eastern Power System (EPS);
- Western Power System (WPS).

More than 82% of Mongolia’s electricity is generated by CHPs, and DPPs, which were commissioned from 1961 to 2017. The largest of them is Ulaanbaatar TPP-4 (789 MW) [18] (Table 2; Figure 2). In 2019, electricity production in Mongolia reached 6,900.4 million kWh, electricity consumption – 6,846.4 million kWh [19]. The balance for the year amounted to +54 million kWh. However, the country still imports another 1,722.7 million kWh.

| Company Generating facility | Installed capacity, MW | Location | Launch year |
|----------------------------|-------------------------|----------|-------------|
| **Conventional sources of electricity** | | | |
| Thermal Power Plant-2 SSH Co | Ulaanbaatar TPP-2 | 24 | Ulaanbaatar city | 1961 |
| Engie, POSCO Energy, Sojitz Corp., Newcom Group [21] | Ulaanbaatar TPP-3 | 198 | Ulaanbaatar city | 1968 |
| Thermal Power Plant-3 SSH Co. [18] | Ulaanbaatar TPP-4 | 789 | Ulaanbaatar city | 1983 |
| JSC “Darkhan TPP”, Mongolian Central Energy System [22] | Darkhan TPP | 83 | Darkhan-Uul aimag, Darkhan town | 1966 |
| JSC “Dornod busin erchim khuchnii system” | Choibalsan (Dornod) TPP | 36 | Dornod aimag, Choibalsan town | 1982 |
| Hunan Ind. Equipment Instal-lation, MMRE of Mongolia [23] | Erdenet TPP | 50 | Orkhon aimag, Erdenet town | 1987 |
| Dalanzadgad Heat & Power Station SSH Co | Dalanzadgad TPP | 6 | Umnugovi aimag, Dalanzadgad town | 2000 |
| LLC “MCS International” | Ukhaa Khudag TPP | 18 | Umnugovi aimag, Tsogtseetsii sum | 2011 |
| “Mining and processing plant Erdenet” | TPP at Erdenet GOK | 48 | Orkhon aimag, Erdenet town | 2017 |
| Diesel power stations | | 43 | | |
| **Total of conventional sources of electricity:** | | **1,295** | | |

**Renewable sources of electricity**

- Solar power plants (SPP) (Table 4) 93.033
- Wind power plants (WPP) (Table 5) 154.86
- Hydro power plants (HPP) and Small hydro power plants (HPP) (Table 6) 27.19
- Hybrid solar and wind plants (HSWP) [24] 1.475

| Total HSWP: | **1.475** |
| **Total of renewable sources of electricity:** | **276.558** |
| **Total:** | **1,571.558** |
The shortage of electricity has forced Mongolia to plan various projects, including the construction of HPP on the Selenga River and its tributaries. In recent years, there have been ongoing discussions between the Russian authorities and their Mongolian counterparts about their big hydropower plans. Despite Mongolia’s promises not to harm the Baikal ecosystem, Russian scientists and the public, on the contrary, are seriously concerned. They consider the environmental risks that will arise after the construction of the HPP on the Selenga River and its tributaries to be unacceptably high. The Russian authorities have proposed various ways out to the neighbouring country: building the Mokskaya HPP (1,200 MW) on the Vitim River and exporting electricity to Mongolia; constructing the Russia-Mongolia-China gas pipeline (’Power of Siberia 2’), and helping with alternatives such as construction of TPP or nuclear power plant [25].

Figure 2 shows the power plants in Mongolia with a capacity of more than 5 MW. Most of them are located along the Mongolian Railway. The rest are located in Erdenet (two CHPs), in Choibalsan (in the east of the country) and in the Umnugovi coal mining aimag in the south of the country. There are two HPPs in the comparatively more water-secured west of the country.

3. Renewable energy development

3.1. Development of renewable energy in Buryatia

On 08 January 2009 the Government of the Russian Federation issued Order No. 1-R “On the main directions of state policy in the sphere of increasing energy efficiency of electric power industry based on the use of renewable energy sources (RES)”. In order to implement this Order, the Ministry of Transport, Energy and Road Sector Development of Buryatia is working on the involvement of renewable energy sources in the republic’s energy sector [26].

Despite the large hydropower, wind and geothermal potential, only solar energy has been developed in Buryatia so far. This is facilitated by climatic characteristics – there are up to 300 sunny days per year in Buryatia, and the duration of sunshine is more than 2,000 hours per year (Fig. 3). The amount of solar radiation in Buryatia is 4-5 kWh per m²/day.
In Buryatia, the first solar power plant (SPP) appeared in 2017, but over 3 years the production of solar energy in the republic has taken a large share, thus contributing to the reduction of greenhouse gas emissions. Three investment companies are currently operating in Buryatia: ‘Avelar Solar Technology’ LLC, ‘Complex Industry’ LLC, and ‘Green Energy Rus’ LLC (Table 3), which in the period 2017-2020 have already built 6 SPPs with a total capacity of 115 MW and a total cost of 12.7 billion roubles. To date, the share of SPP of in the total capacity of Buryatia is 7.51%. At the end of 2020, the Torey SPP with a capacity of 45 MW was commissioned. At the time of commissioning, the Torey SPP is one of the ten most powerful solar power plants in Russia and is the most powerful in the Asian part of Russia. All SPP capacities are being introduced into the general power system of the southern energy district of Buryatia, and will not be isolated energy systems.

From an investor’s point of view, locating SES in relatively densely populated areas in the south and centre of Buryatia, is more profitable, providing a higher return on investment (Figure 1). Private investment is good, but at the same time, we consider it is necessary to develop energy in the remote areas of the north, west and east of Buryatia. The state should help to ensure that the population of sparsely populated areas is provided with uninterrupted and high-quality power supply through construction of various types of power plants. The development of clean energy is especially necessary in the Central Ecological Zone of the Baikal Natural Territory (CEZ BNT), which still lacks relatively large or medium-sized power generation facilities, and with the development of tourism the load on the power networks has been increasing every year [10].

### 3.2. Development of renewable energy in Mongolia

Unlike Buryatia, Mongolia for more than 15 years has been actively building renewable energy mini power plants that are autonomous and isolated from the country’s national energy system. Mongolia’s first large HPP appeared in 2008, the first large wind power plant (WPP) – in 2013, and the first large SPP – in 2016. Today, in some aimags, renewable energy is used to generate 80% of the energy in the aimag and supply it to the central energy system.

In Mongolia, 270-300 days (2,250-3,300 hours) per year are solar, the specific power of solar energy is 1,200-1,600 kW/m2 (Figure 4) [20]. In Mongolia there are currently six large (built in 2016-2019) and 13 mini and micro SPPs (Table 4) with a total capacity of 93.03 MW.

Foreign investment companies, as well as the World Bank, the European Bank for Reconstruction and Development, the Asian Development Bank, the UN Green Climate Fund and others are active in constructing SPP in Mongolia, along with Mongolian companies.
Table 3. Operating and planned solar power plants of the Republic of Buryatia (as of 2021).

| Organisation managing the investment project | Generating facility | Volume of investments in the project, million RUB | Installed capacity, MW | Location | Launch year (date) |
|---------------------------------------------|---------------------|--------------------------------------------------|-----------------------|----------|-------------------|
| LLC “Avelar Solar Technology”                | Bichura [11]        | 1,200                                            | 10                    | Bichura District, Bichura | 13.11.17 |
| LLC “Complex Industry”                       | Kabansk [12]        | 2,000                                            | 15                    | Kabansk District, Kabansk | 29.10.19 |
|                                            | Tarbagatai [12]     | 2,000                                            | 15                    | Tarbagatai District, Tarbagatai | 29.10.19 |
|                                            | BVS [12]            | 2,000                                            | 15                    | Kyakhta District, Kyakhta town | 29.10.19 |
| LLC “Avelar Solar Technology”                | Khorinsk [13]       | 1,500                                            | 15                    | Khorinsk District, Khorinsk | 08.12.19 |
|                                            | Torey [14, 15]      | 4,000                                            | 45                    | Dzhida District, Nizhny Torey | 21.12.20 |

| Total of operating plants: | 12,700 | 115 |

| Planned and under construction |
|--------------------------------|--------|------|
| LLC “Complex Industry”          | Mukhorshibir | 15 | Mukhorshibir District, Mukhorshibir | 2021 |
| LLC “Green Energy Rus”           | Okino-Klyuchi | 20 | Bichura District, Okino-Klyuchi | 2021 |
|                                  | Uda-1    | 15 | Khorinsk District | 2021 |
|                                  | Uda-2    | 15 | Khorinsk District | 2021 |
| LLC “Avelar Solar Technology”    | Dzida    | 30 | Dzhidinsky District, Dyrestui | 2022 |

Total of planned and being constructed: 95

Total: 12,700 210

Mongolia, in contrast to Buryatia, has succeeded in developing WPP (Table 5). In 2004-2008, further 3 micro-WPP with a total capacity of 0.26 MW were commissioned. From 2013 to 2018, 3 WPPs with a total capacity of 154.6 MW have been jointly built: Salkhit, Tsetsii and Sainshand, and the total capacity of the Mongolian WPPs was 154.86 MW.

There is a network of mini-HPPS in the north and west of Mongolia, the largest of which are Durgun (2008) and Taishir (2010), with 12 MW and 11 MW capacity, respectively (Table 6). Together with another 7 mini-HPPs, the country’s hydropower capacity is 27.19 MW. In addition, Mongolia has another eight hybrid (solar-wind and solar-diesel) small power plants with a small total capacity of 1.475 MW (Table 2).

4. Prospects for renewable energy development in Buryatia and Mongolia

4.1. Buryatia

A balanced development of generating and network capacities is essential for the sustainable development of the Buryatia’s economy. Therefore, it is only possible to solve the problem of power shortages without a heavy burden on the environment by developing alternative energy (renewable
energy sources). In 2010, a project was developed in Buryatia to build 7 small HPPs on the Barguzin River and its tributaries in the Kurumkansky and Barguzinsky districts. A potential investor, CJSC TDF Ecotech, was found, but the project remained on paper [31]. Along with the development of small HPPs, it is potentially possible to develop damless HPPs, WPPs, and, especially, geothermal power plants (GPPs), which can be built in the Baikal rift zone rich in geothermal sources – from the Tunkinsky to the Bauntovsky districts. Plans for the Mokskaya HPP (1,200 MW) are unclear and require significant funds for the project.

The construction of the HPP is considered as a source of power supply to the northern settlements of Buryatia and Zabaikalsky Krai, as well as for the development of large mineral deposits and electrification of BAM. In August 2021, the project to build a 15 MW Gusinoozyorsk SPS was discontinued. The project of LLC Matraevskaya Solar Power Plant was estimated at over 1 billion roubles [32].

By 2022, it is planned to commission 5 more SPS with a total capacity of 95 MW, thus increasing the total capacity to 210 MW (Table 3) and the share in the total energy system of Buryatia from 7.5% to 13%.

4.2. Mongolia
Mongolia has plans with foreign partners to build 22 HPPs of varying capacity, 17 of which (the largest) are planned in the Selenga basin (Table 6). But the development of the hydropower system in the Selenga basin will also depend on the influence of the Russian side, as investors are not planning to give money for projects that are not settled with Russia. Therefore, for the time being, Mongolia has to solve the electricity capacity shortage by building alternative energy sources. In the coming years, Mongolia plans to build 11 more hydropower plants with a total capacity of about 132.8 MW (Table 4), and a project to build seven wind power plants with a total capacity of about 565.4 MW (Table 5). In addition, the World Bank and the Government of Mongolia are launching a national programme “100,000 Solar Yurts” and a project “Access to Renewable Energy and Rural Electricity” [33].

![Figure 4. Photovoltaic power generation potential in Mongolia [28.](image)]
Table 4. Operating and planned solar power plants of Mongolia (as of 2021).

| Generating facility         | Installed capacity, MW | Location                             | Launch year |
|-----------------------------|------------------------|--------------------------------------|-------------|
| Darkhan                    | 10                     | Darkhan-Uul aimag, Khongor sum       | 2016        |
| Monnaran                    | 10                     | Ulaanbaatar city, Songinokhairkhan District | 2017        |
| Gegeen (Naran teeg)        | 15                     | Dornogovi aimag, Zamyn-Uud sum       | 2018        |
| Bukhug (Sergelen)          | 16.4                   | Tov aimag, Sergelen sum              | 2019        |
| Sainshand\(^a\)            | 30                     | Dornogovi aimag, Sainshand town      | 2019        |
| Sumber                      | 10                     | Govi-Sumber aimag, Sumber sum        | 2019        |

**Including operating mini-SPPs [24]**

| Generating facility         | Installed capacity, MW | Location                             | Launch year |
|-----------------------------|------------------------|--------------------------------------|-------------|
| Tsetseg                     | 0.1                    | Khovd aimag, Tsetseg sum             | 2008        |
| Bayantsagaan                | 0.06                   | Bayankhongor aimag, Bayantsagaan sum | 2008        |
| Bugai                       | 0.14                   | Govi-Altai aimag, Bugat sum          | 2009        |
| Altai                       | 0.01                   | Bayan-Olgii aimag, Altai sum         | 2010        |
| Altai                       | 0.3                    | Govi-Altai aimag, Altai sum          | 2010        |
| Bayantooroi (Tsogt)         | 0.1                    | Govi-Altai aimag, Tsogt sum          | 2010        |
| Buyant                      | 0.01                   | Bayan-Olgii aimag, Buyant sum        | 2010        |
| Dorvoljin                   | 0.15                   | Zavkhan aimag, Dorvoljin sum         | 2010        |
| Urgamal                     | 0.15                   | Zavkhan aimag, Urgamal sum           | 2010        |
| Tsengel                     | 0.01                   | Bayan-Olgii aimag, Tsetseg sum       | 2010        |
| Chinggis Khaan              | 0.44                   | Ulaanbaatar city, Chinggis Khaan International Airport | 2010 |
| Khiliin tsereg 0214         | 0.1                    | Govi-Altai aimag, Border troops, military unit 0214 | 2014 |
| Takhiiin tal                | 0.06                   | Govi-Altai aimag, Bugat sum          | 2015        |

**Total of operating plants:** 93.033

| Generating facility         | Installed capacity, MW | Location                             | Launch year |
|-----------------------------|------------------------|--------------------------------------|-------------|
| Khurmen                     | 30                     | Umnugovi aimag, Khurmen sum          | –           |
| Airag                       | 20                     | Dornogovi aimag, Airag sum           | –           |
| Dalanzadgad                | 10-20                  | Umnugovi aimag, Dalanzadgad town     | –           |
| Khovd                       | 10                     | Khovd aimag, Myangad sum             | –           |
| Durgun                      | 10                     | Khovd aimag, Durgun sum              | –           |
| Muren                       | 10                     | Khocsugl aimag, Muren town           | –           |
| Taishir                     | 7.8-10                 | Govi-Altai aimag, Taishir sum        | –           |
| Altai                       | 10                     | Govi-Altai aimag, Altai sum          | –           |
| Bayantseeg                  | 7.8                    | Ovorkhangai aimag, Nariinteel sum    | –           |
| Ulaistai                    | 5                      | Zavkhan aimag, Ulaistai sum          | –           |
| Bayan-Undur                | no data                | Orkhan aimag, Undur sum              | –           |

**Total of planned plants:** 120.6-132.8

\(^a\) Biggest solar power plant in Mongolia
Table 5. Operating and planned wind power plants of Mongolia (as of 2021).

| Generating facility | Installed capacity, MW | Location | Launch year |
|---------------------|------------------------|----------|-------------|
| **Operating**       |                        |          |             |
| Salkhit             | 49.6                   | Tov aimag, Sergelen sum | 2013 |
| Tsetsii             | 50                     | Umnugovi aimag, Tsogtsetsii sum | 2017 |
| Sainshand<sup>a</sup> | 55                    | Dornogovi aimag, Sainshand town | 2018 |
| **Including operating mini-WPPs** | | | |
| Erdenetsagaan       | 0.1                    | Sukhbaatar aimag, Erdenetsagaan sum | 2004 |
| Bogd                | 0.08                   | Ovorkhangai aimag, Bogd sum | 2008 |
| Sevrei              | 0.08                   | Umnugovi aimag, Sevrei sum | 2008 |
| **Total of operating plants:** | 154.86 | | |

| Planned [29] | |
|--------------|--------------------------------------------------|
| Oyu-Tolgoi   | 102-250 Umnugovi aimag, Khanbogd sum | - |
| AB Solar Wind | 100 Govisumber aimag, Choir town | - |
| Bulgan       | 100 Umnugovi aimag, Bulgan sum | - |
| Choir        | 50.4 Govisumber aimag, Choir town | - |
| Argalant     | 50 Tov aimag, Argalant sum | - |
| Taishir      | 10 Govi-Altai aimag, Taishir sum | - |
| Telmen       | 5 Zavkhan aimag, Telmen sum | - |
| **Total of planned plants:** | 417.4-565.4 | |

<sup>a</sup> Biggest wind power plant in Mongolia

Figure 5. Dynamics of total capacity by types of renewable energy sources in the Republic of Buryatia and Mongolia (2011-2020), MW.
### Table 6. Operating, inoperative and planned hydro power plants of Mongolia (as of 2021).

| Generating facility | Installed capacity, MW | Location | Launch year |
|---------------------|------------------------|----------|-------------|
| **Operating**       |                        |          |             |
| Durgun              | 12                     | Khovd aimag, Durgun sum (Chono-Kharaikh r.) | 2008 |
| Taishir             | 11                     | Govi-Altai aimag, Taishir sum (Zavkan r.) | 2010 |
| **Including operating mini-power plants [24]** | | | |
| Bogdyn gol          | 2                      | Zavkhan aimag, Uliastai sum (Bogd r.) | 1997 |
| Guulın              | 0.4                    | Govi-Altai aimag, Delger sum (Zavkan r.) | 1999 |
| Ider                | 0.38                   | Zavkhan aimag, Tosontsengel sum (Ider r.) | 2006 |
| Uench               | 0.96                   | Khovd aimag, Uench sum (Uench r.) | 2006 |
| Erdenebulgan        | 0.15                   | Khovsgol aimag, Erdenebulag sum (Uure r.) | 2006 |
| Galuat (Tsetsen-Uul)| 0.15                   | Zavkhan aimag, Tsetsen-Uul (Galuut r.) | 2008 |
| Khunguin gol (Zavkhanmandal) | 0.15 | Zavkhan aimag, Zavkhanmandal sum (Khunguin-Gol r.) | 2010 |
| **Total of operating plants:** | 27.19 |
| **Inoperative**     |                        |          |             |
| Kharkhorin          | 0.528                  | Ovorkhangai aimag, Kharkhorin sum | 1959 |
| Ondorkhangai (Jigjiin gol) | 0.2            | Uvs aimag, Ondorkhangai sum | 1989 |
| Mankhan             | 0.15                   | Khovd aimag, Mankhan sum | 1998 |
| Monkhhairkhan       | 0.15                   | Khovd aimag, Monkhhairkhan sum | 2003 |
| **Total of inoperative plants:** | 1.028 |
| **Planned [29, 30]** |                        |          |             |
| Eg gol              | 200-315                | Bulgan aimag, Khutag-Ondor sum (Egiin Gol r.) | - |
| Shuren              | 245-300                | Selenge aimag, Tsagaan-nuur and Zuunburen sums | - |
| Buren               | 161                    | Selenge r. | - |
| Artsat              | 118                    | Selenge aimag (Artsat r.) | - |
| Orkhon              | 100-110                | Orkhon aimag, Orkhontuul sum (Orkhon r.) | - |
| Erdenet             | 100                    | Orkhon aimag, Erdenet town (Orkhon r.) | - |
| Tuul                | 50-100                 | Tuul r. | - |
| Tavaltai            | 93                     | Khovd r. | - |
| Terelj              | 90                     | Terelj r. | - |
| Erdeneburen         | 60-90                  | Khovd aimag, Erdeneburen and Bayan-Ulgii sums | - |
| Bayannuur           | 58                     | Bulgan aimag, Bayannuur sum (Tuul r.) | - |
| Tsambyn khiid       | 50                     | Egiin Gol r. | - |
| Khantai             | 40                     | Egiin Gol r. | - |
| Elstei              | 40                     | Egiin Gol r. | - |
| Orkhon-Govi         | 33                     | Orkhon-Gobi canal | - |
| Chargait            | 23-25                  | Delger-Muren r. | - |
| Tosontsengel        | 24                     | Khovsgol aimag, Tosontsengel sum (Delger-Muren r.) | - |
| Maikhan Tolgoi      | 12-21                  | Khovd r. | - |
| Kherlen-Govi        | 20                     | Kherlen r. | - |
| Khurst aral         | 15                     | No data | - |
| Khenkhert           | 5                      | Egiin Gol r. | - |
| Khatgal             | 3                      | Egiin Gol r. | - |
| **Total of planned plants:** | 1598–1811 |

*a Biggest hydro power plant in Mongolia*
5. Conclusion
In this article we have shown the current state of affairs in the energy system of Buryatia and Mongolia and identified problems and prospects for development. On a large scale, both Buryatia and Mongolia began to develop alternative energy relatively recently. The surge began 5 years ago (Figure 3). Buryatia is 2.4 times behind Mongolia in terms of renewable energy sources, and judging by the big plans of the Mongolian authorities and business, this gap will widen. One thing is certain: the share of renewable energy capacity in both Buryatia and Mongolia will grow every year.

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