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‘Geodrawphy’ of Bhutan: A Nature-based Holistic Society in the Himalayas

Abstract

In this paper, we discuss Bhutan’s geography that particularly deals with its energy resources, energy production and supply. But beyond this challenge, there is a more effective silhouette of the advantage for publishing this paper originally in Hungarian language (BOKOR, L. – SZELESI, T. 2011). At that time, we believed it was a stop-gap for our academic profession, especially in Hungary. Now, we have realised that the internationally available information about Bhutan’s geography of energy is generally too vague. Therefore, for this revised version, we have updated all the relevant data and written a comprehensive guide to Bhutan, this time in English. Our work is meant to present a little bit of this Asian kingdom, but also introduce an example of the sustainable and competitive holistic economy and its social progress. As these are kind of key fields for the further development in Bhutan, our aim is also to demonstrate their importance and provide examples that could also be adopted locally anywhere else on the planet.

Key words

Holistic society; Blue economy; Sustainable local development; Geodrawphy

Introduction

This study has been written as more of a reform experiment. With it, we would like to call the attention of the professional geographer's audience and also reach the average reader and introduce *Bhutan*, by using comprehensive and up-to-date international literature and resources. Our goal is, moreover, to observe —by using physical geographical bases and specific human geographical spectrums (energetic at present)—and also to introduce unusual examples of nature and environmental awareness to the *Western World* in the instance of the *World's* most spiritual country.

Situated within the eastern chains of the *Himalayas*, the *Vajrayana Buddhist Bhutan*—in *Dzongkha* it means the *Land of Thunder Dragon (Druk Yul)*—is among the *Earth's* relatively small and young democratic countries. Its territory covers 38,394 km² (14,824 mi²), and its total population between 1998 and 2002 was estimated to 1.8–2.3 million by the *United Nations* (SZEGEDI, N. 1998; BROWN, C. E. 2002). However, the official *Bhutanese Census* in 2005 exposed that the total number of inhabitants was as little as only 634,983 (BROWN, L. *et al.* 2007; NSB, 2009). (According to the CIA WORLD FACTBOOK [2013], the total population is now growing and is estimated to 725,926.) In Asian dimension, primarily spatially and population-wise, it is doubtlessly a small political entity; and as a landlocked country, it is wedged between two bordering giants. Its neighbours (*China* and *India*) like joiner's clamp vice it by their sizes (e.g. by areas and by populations) and also by the dynamics of their economic growth (WILHELM, Z. 2010). As a *Himalayan* country, it is located at high altitude where the young arcs of mountain contours fall apart from the great alluvial plains of *Brahmaputra*.

1. The basis of the Bhutanese society

There has not remained much and known about *Bhutan's* early history because in the old capital, *Punakha*, a fire devastated the city in 1827, and the ancient records had all been perished. In the 17–18th century, the country broke into several feudal states, but the anarchic condi-

tions had only ended when *Ugyen Wangchuck*, the governor (Penlop) of *Trongsa*, defeated his political enemies and united the country, following the civil wars of 1882–1885. In 1907, he was unanimously chosen and elected as the hereditary king (inherited) of the country. From this moment, *Bhutan*—like *India*—slowly went under British control, but was only dependent on its foreign affairs. By the 1960s, the country itself developed independently and—even then and after the *Indian independency* was achieved—remained an isolated state. Its opening to the world—especially to *India*—began by the Chinese occupation of *Tibet*, when, in 1959, *China* claimed the part of the *Bhutanese Kingdom* (JACOBS, D. 2005).

By the end of the second millennia, it had functioned as a hermit state, as an absolute monarchy. The end of that era was official by the abdication of King *Jigme Singye Wangchuck* on 14 December, 2006 in his son, *Jigme Khesar Namgyel Wangchuck's* favour. *Bhutan's* political system developed from an absolute monarchy to a constitutional monarchy. By this step, the country moved onto the path of modern democracy with the adumbration of conscious goals placed on natural bases and holistic approach of economic growth (GALL, T. L. 2004).

Bhutan's economic activity, with regard to the *Western World's* concept (GDP), belongs to one of the *Earth's* underdeveloped regions. The present estimated data of GDP (purchasing power parity) is circa 6,500 USD per capita, 47% for literacy, 35% for urbanised population, and 44% for agrarian workers (CIA, 2013). These data present *Bhutan* as a poor and an economically backward, agrarian country; however, in their own interpretations, their country is an independent and sovereign and, when it comes to its natural and historical treasures, it is infinitely rich and in human spirituality it is one of the *Earth's* most colourful and blissful formations of society. As the local inhabitants emphasise: *Bhutan* is the “Country of Happiness” which they put in opposition to the *Western World's* GDP and measure their life with the GNH index (Gross National Happiness). The latter shows the quality of life and the non-economy-based standard of life (NORBU, U. P. 2012). They intend to preserve this by not copying the wrongly structured

“Western” economic models and consumer habits and they do not place into trade their traditional values into trade (for example, the country’s first TV programme supply started just in 1999 with quite a few resistance against it). As a protection of the country’s natural treasures, the number of tourist visitors allowed to enter the country is maximised at an annual rate (LAMA, M. P. 1998; SZEGEDI, N. – WILHELM, Z. 2008). It is the *Earth’s* first country which has fully adopted *Gunter Pauli’s* concept of *Blue Economy* (transpose purpose of maximum efficiency and self-regulating processes of nature into the economy) and highlighted its future’s economic development by the guidance of that (PAULI, G. 2010a; 2010b).

2. The natural environment as one of the most important pillars of culture and energy economy

The employment of energy resources forms inherent components in today’s social–economic systems. Its main nature is that the *Western World’s* economic–material–financial society—by the aims of profit-orientation and the subordination of nature—pursues only a continuous economic growth (HAJNAL, K. 2010). This system is, however, sensitive to energy (just as to the energy resources)—primarily to electricity or heat—which are the most important components of all producing equipment, like water to a fish. Therefore, it is not a miracle and it is not even surprising that the *European* and *North American* statistical publications find *Bhutan* as an underdeveloped and backward agrarian country (SZEGEDI, N. 1998; BROWN, C. E. 2002). However, this Himalayan state is also identified as the land of secrets and mysteries (HAGGETT, P. 2002). In the *Western World*, if anything appears in this relation (thus, by its economic-development measurer, based on the GDP, is ‘underdeveloped’), assuming that on one’s mental map, it is marked by white, thus, it is *terra incognita* (which is an undiscovered territory) from what—like a mediaeval curse—everyone has to be feared of, or, at least, be kept refrained from.



Figure 1 – Bhutan's shaded relief conditions
 Edited by SZELESI, T. - BOKOR, L. (2013): Meteorological stations are according to NHMS (2013)

However, the blank white spots of the mental map can be coloured, thus, Bhutan can be re-drawn and re-characterised by, principally, four distinct shades similarly to the classically defined environmental zones by KARAN, P. P. (1987). The technic can now be called geodrawphy:

grey, white, blue and green. These are 'elements', from which the chains in our brains can slowly be broken: sedimentary rock formed young mountain ranges (grey; e.g. *Great Himalayan Range* – *Figure 1*);

- their snow-capped summits that go above 7,000 metres (23,000 feet) in heights (white; e.g. the official top of the country *Gankhar Puensum* [7,570 m/24,835 ft]);
- from those, melt waters born huge rivers (blue; e.g. rivers in the *Brahmaputra's* catchment area [for example *Manas Chhu*, also known as *Lhobrak*]);
- the southern barriers of all of the above mentioned ones, as low-level mountains, sub *Himalayan foothills* (e.g. *Siwalik*), basins and alluvial plains (e.g. *Duārs*) which are the main sources of the 70.5% forestation of *Bhutan* (green).

From the point of view of geography of energy, the most important is to exploit those energy resources which are locally available in a particular area and can be compatibly used by the aim of today's sustainable development. This is the philosophy of *Blue Economy*, too (PAULI, G. 2010a). In the world, there is everywhere at least one such type of source, but their majority differs in their employable amount of quantity and quality. In some countries—especially there where the basis of the economy is established on conventional fossil energy sources and the locally exploitable natural energy sources are small in their available amount—a tight dependency has developed on the import of energy sources. In these countries (like *Hungary* or the *United Kingdom*), the new and sometimes expensive energy production methods and equipment are not easily adoptable. On the contrary, in those countries where nature provides *Canaan* of exploitable energy resources (for example hydropower in *Austria*, in *Norway*, or in *Switzerland*), the occasional struggle from financial or energy crises, their dependency and import sensitivity are only affected by the pursuit of their constant economic growth. Nevertheless, the so-called renewable and sensitively renewable energy sources (e.g. solar, wind, water biomass and geothermal energy—see pp. 14–29) could maximally be able

to contribute to their electric energy production and partly also to their primary energy supply.

Two of the above mentioned three *European* countries are *Alpen* and one is mountainous *Scandinavian*. All of them bear huge amount of renewables and relatively small amount of fossil resources (yet this does not apply to *Norway*). *Bhutan* is part of the *Himalayas*. If we started our analysis by having mentioned and known this fact only, it would already be highlighted that this relatively small *South Asian* country owns the *World's* largest amount of energy resources and reserves. Luckily, this type of energy sources is not fossil-based ...

3. Primary energy structure

... because *Bhutan* has no known *hydrocarbon resources* (neither crude oil nor natural gas). Therefore, there has not been installed any assisting infrastructure either (e.g. oil refineries) (FRASER, N. *et al.* 2001; TSHEWANG, K. 2007). The ready-to-use raw materials (such as oil products) are imported principally from *India* (CIA, 2013; IEEJ, 2009).

The country's *coal* properties are having the same limitations as the hydrocarbons. However, in opposite to those, there is a small hard coal reserve exploitable in *Southeast Bhutan* (*Bangtar*, *Chenangri* and *Deo-thang*) where mines are still in operation. The size of the entire coal reserves is estimated to 1.96 million tons. This potential, however, is relatively small and to cover its needs, *Bhutan* imports coal from *India*. Regardless of the size of the reserve, sometimes coal is also exported mainly to *Bangladesh*. However—according to their bilateral agreements—it is then exported back to *India* (FRASER, N. *et al.* 2001). The minor amount of coal is used in the local factories (e.g. in the areas of chemical industry and used as coke in iron making and steel production). As opposed to SZEGEDI, N. – WILHELM, Z. (2008), they never use coal for electricity production.

There is no support of *nuclear energy* in *Bhutan*, therefore, there has been no power station installed either.

The three paragraphs earlier mentioned “ready-to-use import energy resources”, according to TSHEWANG, K. (2007), mean primarily *hy-*

drocarbon products, such as diesel oil, petrol, kerosene, liquefied petroleum gas (LPG) and specific greases. Diesel oil and petrol are used in transportation, whereas kerosene is majorly used for domestic purposes to heat in the urban areas and to produce a small amount of electricity for lighting houses in the rural households. LPG is also normally used in homes in gas cylinders. Imports of petroleum products have been gradually increasing in recent years, because the continuously improving quality of paving brings more vehicles onto the roads. (According to NSB [2009; 2012], in 2004, there were altogether 26,740 (governmental and privately) owned vehicles in the country, whose number went up to 40,659 by 2008, and at the end of 2011 the total number reached 62,697.) This is the only major issue that makes the country dependent on import of crude oil (100%) (Figure 2).

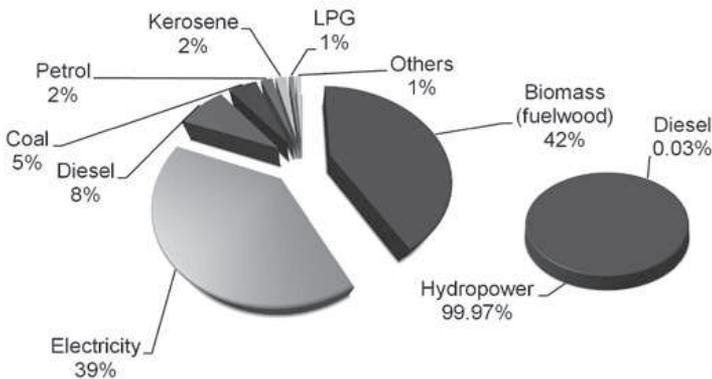


Figure 2 – The overview of Bhutan’s primary energy supply in 2005 (left) and its electricity production (right) in 2012

According to TSHEWANG, K. (2007) and NSB (2012), edited by BOKOR, L. (2013)

Moreover, *Bhutan* also endeavours to do free of fossil fuels in transportation, for which it tries to contribute by developing and using biologically and locally produced energy sources (PAULL, G. 2010b).

Biomass is not yet supported as an energy source for electricity production. There are no biomass power stations in operation either. Biomass has no role in the structure of electricity production; however, its share is significant in primary energy supply due to the high per-

centage of forestation (70.5%) in the country. The traditional biomass utilisation is majorly represented by the burning of wood (and animal roughage similarly to *Nepal* [Wilhelm, Z. *et al.* 2010]) which is primarily used for domestic purposes (approx. 90%), e.g. in cooking and heating of homes.) The annual firewood is the largest use of energy derived from a solid fuel and it has the highest rate in *Bhutan* among the *Earth's* countries (725 thousand tons/year). The estimations show, however, that this amount will probably increase in the future (IEEJ, 2009). The majority of the country's woodland is protected. At the moment, the total per cent of land covered by Protected Areas, Biological Corridors and Conservation Areas sum up to 51.44% of *Bhutan* (MOAF, 2013). In case of a further success of the *Blue Economy*, the currently separate areas might turn into a country-wide national park.

As everywhere else on *Earth*, biomass is primarily used for heating purposes, and the hydro power is utilised for electricity production. *Bhutan's* hydro energy potential is huge, thus, it is one of the most consistent energy sources that guarantees continuous supply for the entire country and even beyond its borders.

4. A strong relationship between the electricity production and renewable energy resources

Electricity occupies 39% of primary energy forms in *Bhutan*. According to data from the *2005 Census* and the *Statistical Yearbook of Bhutan 2012 (Figure 2)*, 99.97% of electric energy was obtained from domestic resources that make *Bhutan* a unique state in the world. Its top ranking is due to the fact that the country is situated among the chains of the *Himalayas* providing inexhaustible supply of hydropower which has become part and parcel of its culture through centuries and it is now the basis of the *Bhutanese* economic growth (ZÜRCHER, D. – CHODEN, K. 2004). The amount of hydropower is enormous, but its utilisation is still low. Therefore, the country has its own necessary energy resources available for an economic boom right away; sources can be regarded as the precursors of an environmentally conscious process of industrialisation (WILHELM, Z. 2010).

grants from *India* and *Japan*, and the country also had diesel power stations and low-powered hydroelectric power plants for domestic production. Between 1986 and 1988, two turbines of the *Chhukha* power station (with 336 MW installed capacity) started to operate. This was the only hydroelectric power station until 1990 providing 82% of all Bhutanese electric energy. In the spotlight of an economic boom after 1990, more hydroelectric power plants were planned; however, projects were carried out only after 2000 with faster installations: *Kurichhu* (2001, with 60 MW installed capacity) → *Basochhu I.* (2002, 24 MW) → *Basochhu II* (2004, 40 MW) → and *Tala* (2006, 1,020 MW) (*Figure 3*) (TSHEWANG, K. 2007; IEEJ, 2009; NSB, 2012).

As a result of the instalments, by the end of 2011 the total installed capacity of hydroelectric power stations had reached 1,488.1 MW (a total of 1,497.29 MW with other plants like diesel generators); however, according to TSHEWANG, K. (2007), there is still an estimated 23,500–30,000 MW of theoretical potential which could be exploited from the country's hydro reserves. Until 2020, experts have agreed to increase the total installed capacity by hydroelectric power plants up to 10,000 MW as the currently developing *India's* needs for energy means a perfect opportunity for energy export. Hydroelectric power seems to be the basis of an oncoming and future Bhutanese economic growth and development which will fundamentally move the country from a backward position to a highly developed state.

The total amount of *Bhutan's* electric energy is generated by hydroelectric power stations, which is sufficient for domestic needs, so that, a significant amount of power is exported to *India* (*Figure 4*). In 2011, 7.1 billion kWh of electric energy was generated in *Bhutan*, and 5.3 billion kWh was exported, mainly to *India*. This amount of energy is equal to 74.7% of all the domestic production (NSB, 2012). The distribution of electricity supply was designed according to the establishment of power plants, the efficacy of production and the needs of buyers' markets. The distribution in 2011 included transmission lines of 400 kV (74 kilometres), 220 kV (219 kilometres), 132 kV (345 kilometres), and 66 kV (311 kilometres) (*Figure 3*). The fast process of devel-

opment is obvious: in 2004, 40 cities and 1,064 remote villages were electrified. In addition, 71 cities and 1,934 remote villages were provided with electricity in 2008. Currently, there are altogether 3,194 settlements where electricity is distributed to (IEE), 2009; NSB, 2012). However, the country is not lagging behind and is not in poverty regarding its domestic consumer needs. The country has recently embarked on the drive to provide “electricity to all by 2013” with the taking charge by the first democratically elected government in 2008.

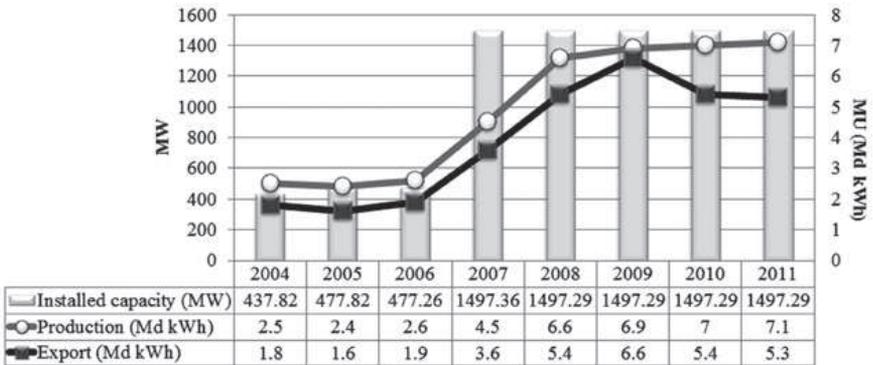


Figure 4: Indices in Bhutanese energy production between 2004 and 2011

Edited by BOKOR, L. (2013) based on data obtained from National Statistics Bureau (2009 and 2012)

The system of the electricity supply distribution will certainly be further developed as *India’s* rapidly increasing need for electric energy consumes a growing amount of hydroelectric power. As a consequence, experts are already planning further establishment and development of hydroelectric power plants, and the expansion of the electricity supply distribution is in question (*Figure 3*).

5. ... beyond forests and rivers

In energetic systems, the two (biomass and hydroelectric energy) mentioned forms of renewable energy sources play an important role. Although, they have been proven to be indispensable for the develop-

ment; according to UDDIN, S. N. *et al.* (2007), they have also been found vulnerable due to climate change and environmental degradation. Bearing this in mind, it is worth investing in other renewable possibilities, since *Bhutan* has more energy sources such as solar energy, wind power and some other types of bioenergy.

Making use of energy of the *Sun* in *Bhutan* is significant considering the country's traditions (it means the passive utilisation: suitably orientated houses or preserving food such as fruits and meat products). There are some already installed solar cells which are now able to generate sufficient power for low-energy buildings and institutions (schools, buildings of monastic orders and transmission towers of radio stations) in remote villages (FRASER, N. *et al.* 2001). In 2009, 0.3 MW of power was generated by installed solar cells (IEEJ, 2009).

Although, *Bhutan* has wind power plants in the neighbourhood of *Jakar* (*Bumthang* region) and *Wangdiphodrang* (*Wangdue* region) (*Figure 1*), there have not been prominent attempts to make use of wind power for energetic purposes so far. Relying on wind energy in the future, higher altitude areas give fruitful prospects. These elevations are in connection with the current major meteorological stations in operation (NHMS, 2013. – *Figure 1*) which constantly convey weather information. Regarding windy conditions, these areas in *Bhutan* are the best choices for building wind power plants. There is no accurate and detailed mariners' card available for these areas, because professionals plan to create them experientially with the newest technological innovations by taking land conditions and natural relations into consideration (PAULI, G. 2010b).

Facilities for the production of biogas (one of the forms of biomass) are proper all over the country and there are some established industrial units. The vast majority of these units are situated in the southern, above the sea level areas of lower heights including *Sarbhong* (*Sarpang*). In addition, there are also some units in the region *Punakha* (*Figures 1*). On a daily basis, units produce only 2–9 m³ (70.6–317.8 ft³) of gas sufficient for basic public purposes such as illumination (instead of using kerosene) in predominantly remote villages. As the produc-

tion of biogas gradually expands, a significant decrease in the import of hydrocarbon is expected.

Despite the fact that the country has appropriate natural endowments, the use opportunities for geothermal energy are not so good and the methodology is still unknown.

6. Conclusion

We have, limitedly, showed *Bhutan* from its energetic possibilities. We really think that all the fields well reflect how inhabitants of the *Kingdoms of South Asia* try to live in harmony with nature which clearly appears in their everyday life and activities. Conditions for the development of energetic systems are defined by surrounding mountain chains that can be considered as the basis of Bhutanese culture and its attraction to nature. Characteristics of Bhutanese society and economic structures are in a strong relationship with the country's mountainous site. The latter is regarded to have an important natural value and is the ground of Bhutanese culture, as well. Also, geographical conditions provide the essentials for joining the international economy.

Bhutan can, with good reason, be proud of its self-reliance and its practically total independence. The country makes every effort to maintain these values with all kinds of economy-boosting political measures which are effectuated through environmentally conscious and viable strategies. Nevertheless, *Bhutan* does not give out its natural and cultural values; all the economy-boosting measures are carried out in the light of remaining the happiest country in the world with its ever-smiling population. All these features are, in our view, exemplary, and *Bhutan* is determined to demonstrate them to the *Western World* countries that think that *Bhutan* is situated in a poor and underdeveloped region (*Kingdoms of South Asia*) according to local GDP information. However, the opposite is true: *Bhutan* is a developing country.

Bhutan is probably not an economic great power in the sense that western countries are, but can be famous for its pure way of thinking and circumspection. *Bhutan* is also the *World's* last paradise whose population demonstrates societal development relying on its natural

values. We can, frankly, say that *WesternWorld Countries* should take *Bhutan* and its development as an example ...

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