100% Renewable Energy Based Electricity Production in the Philippines: A Real Possibility or a Political Pipe Dream?

Stefan Thiesen

Europa Universität Flensburg (EUF), Department of Energy and Environmental Management, Flensburg, Germany
Author contact: Werner Str. 203, D-59379 Selm, Germany

E-mail: thiesen@uni-muenster.de

ABSTRACT

The following paper is the first of an intended series of papers on the prospects for a sustainable future of the Republic of the Philippines. The reason for choosing the Philippines as a subject of study is the country's unique and precarious situation as an archipelago experiencing many of the world's key economic and environmental problem circles in a concentrated and interconnected form, including over-population, energy dependence, tropical storms, climate change, land degradation, lack of garbage management, coral reef degradation and over-fishing, domestic terrorism and war with resulting considerable numbers of domestic refugees, to name a few. This first paper discusses the prospects of sustainable energy development of the Philippines in the foreseeable future, focusing on renewable energy electricity production.

(Keywords: energy transition, renewable energy, sustainability, development economics, country studies, regional studies, environmental policy)

INTRODUCTION

The well-known definition of sustainability that has been proposed by the famed Brundtland Commission back in the late 1980s is to meet the needs of the present generation without compromising the needs of future generations (Brundtland, 1987). This broad definition is certainly adequate when we look at the planet at large, since we obviously cannot import meaningful quantities of resources and economic goods from other planets in even the more distant foreseeable future, and the carrying capacity and resilience of the Earth are clearly limited.

The situation is different, at least in degree, when we look at individual countries, since the lack of one resource can be made up for by a surplus of another, and hence the needs of current and future generations may be met by economic exchange transcending physical limitations. On a country-level immaterial goods, such as technical and scientific expertise, or various services can be traded for material goods. A financially positive trade balance in such cases can make up for a negative physical resource balance. This is a typical situation for developed industrial nations, as well as for resource rich nations, such as Saudi Arabia.

However, in many developing countries both financial and resource balances are negative and lead to mounting deficits and debt burdens of these nations and their institutions. It seems reasonable in this context to propose a development paradigm that runs contrary to that promoted by international institutions that are led and controlled by industrialized nations. Many developing nations did not benefit from globalization, trade and financial liberalization, if we define as such the benefit of the average individual of the current generation as well as of future generations.

Such a development paradigm would focus on the far reaching self-sufficiency of a given nation, at least when it comes to basic goods and services, such as food, medicine and infrastructure, including energy supplies. Since every nation is also part of the global commons, the economic activities of all nations also should not compromise these commons and hence strive to minimize their contribution to critical loads and levels of the global bio-geosphere. One of these is the

emission of CO_2 and other radiation forcing gases to the atmosphere, augmenting global climate change, and here the power sector plays a pivotal role.

GENERAL GEOGRAPHICAL AND SOCIO-POLITICAL BACKGROUND

The Philippines is a geographically and culturally diverse country with a predominantly Catholic population. The geography is dominated by its fragmentation into more than 7,100 mostly mountainous volcanic islands, which in itself poses an enormous challenge for nation-wide infrastructure development, especially ground-based transportation and an integrated power grid with centrally balanced high, middle and low voltage sub-grids.

Politically, the Philippines is a nominal democracy with a nominal market society, but both are shaped by corruption, cleptocracy and influential political families dominating the economic as well as political spheres on practically all geographic levels and all hierarchies within society (Miranda, et al., 2011).

Another aspect of the Filipino economy is its heavy reliance on money remittances from overseas workers to balance the country's trade deficits. As of 2012, more than 1.3 million land-based and over 330,000 sea-based Filipino overseas workers were officially registered, with an additional unknown number of unregistered workers (Mediana and Pulumbarit, 2012). Together with an estimated 15 million expatriate Filipinos, their officially accounted for total remittance to the Philippines amounted to just under US$ 30 billion, or approximately 12% of GDP. According to the World Bank, the real numbers are much higher since many money transfers take unofficial routes among families (Torres 2015).

The enormous dependence of the Filipino economy on remittances is a direct result of the economic policy that began during the autocratic rule of Ferdinand Marcos during the 1970s, in particular Presidential Decree 442 and the 1974 Labor Code (Mediana and Pulumbarit, 2012). The resulting encouragement and formalization of an overseas workers market was intended to temporarily address unemployment and ease domestic budget deficits, but it turned into a permanent institution with numerous negative side effects, including a permanent "brain drain", dependence on remittances and foreign investments for large scale projects and an immense burden on families who often are separated for months, even years.

Another aspect playing a crucial part when looking at Filipino political, economic and cultural development is the very unique set of Filipino cultural, ethical and moral values. This topic is not within the scope of this paper, and at this point it shall be sufficient to say that the complex interwoven system of traditional values at the core of Filipino society often is at odds with the requirements of a "dog-eats-dog" and "winner-takes-all capitalist society". Filipino culture traditionally developed around concepts of harmony, reciprocity and keeping face. By and large there is a tendency to avoid conflict and confrontation as well as unpleasant truths.

Unfortunately this also leads to a suppression of aggression on both – individual and societal levels, which, when breaking out, become the very cause of the violent conflicts that were meant to be avoided (Roces and Roces, 2009). At the same time such individuals who shamelessly take advantage of the majority's desire for harmony and reciprocity are able to reap tremendous material benefits from their fellow countrymen. The result is a country operated as a system of mutually supportive political and economic cronies at a cost to the majority (Bello and Docena, 2005).

ENERGY POLICY IN THE PHILIPPINES

In June 2013, the government of the Philippines announced a roadmap towards a transition to 100% renewable energy for the country within a record 10 years, under the auspices of the climate change commission (Galvez, 2013). The main part of this paper will examine the likelihood and possibility of achieving this goal in the power sector on a national level.

From the outset, the Philippines are indeed in a unique position to achieve a high proportion of carbon emission-free power generation. Owing to its tropical location and volcanic island geology, principally non-polluting natural energy resources are abundant, ranging from geothermal energy, wind, solar

energy, hydro energy and considerable potentials for wave energy development on the country's Pacific Ocean shores.

METHODOLOGY

When studying the prospects of a country's economic development in any area, it is tempting to either resort to the rather artificial realms of standard economic theory or to get lost in the murky waters of complex real world socio-cultural, political and psychological affairs. In some cases those complexities cannot be avoided to obtain answers to the research questions at hand, but in this particular case, this author considers a semi-quantitative plausibility assessment inspired by Bayesian thinking to be sufficient. The following analysis hence completely ignores economic theory and policies, regional disparities, social aspects, the roles of the various market participants, etc., and instead draws on a simple comparison of prior power generation data timelines.

RECENT HISTORY OF POWER GENERATION IN THE PHILIPPINES

This section looks at the power generation history of the Philippines from 1991 to 2014. It explores the development of total electricity generation, the fraction of the various generation methods, as well as their relation to the efficiency and related losses in the total system. The underlying data were extracted from the publicly available power market statistics, published by the Philippine Department of Energy in 2010 and 2014, respectively (Philippine Department of Energy, 2014).

Visual Analysis of Power Generation Trends in the Philippines

Figure 1 shows the total electricity generation of the Philippines and generation separated by sector in GWh, in linear scale. The steady increase of total generation roughly follows increased demand caused by GDP growth. GDP grows exponentially while demand rises linearly, owing to increasing efficiency on the demand side. The following trends and facts can be directly derived visually without further statistic trend analysis:

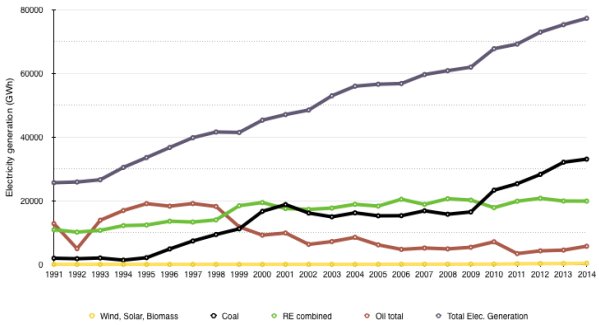

Figure 1: Total Electricity Generation and By Compounded Generation Method from 1991 to 2014.

- Total electricity demand has grown continuously at roughly the same rate for 23 years. Insight from around the world suggests that the direct correlation between GDP growth and electricity demand will remain strong, despite demand side efficiency improvements. It is hence a robust prediction that demand will continue linearly at very similar absolute increases in the foreseeable future. To give an example from the industrialized world: Although compared to the Philippines relative increasing rates are low in Germany, the total increase of power generation in the same period in this country amounts to 100,000 GWh per year (German Ministry of the Environment, 2014). At the end of the day absolute values count rather than relative comparisons.

- The only production trend-line showing a clear increase over the observation period is coal. Coal generation, in fact, has surpassed all other production methods with a 17-fold increase over the report period.

- Total renewable energy (green line on Figure 1) is the sum total of all technically CO_2-free electricity that was generated. In the Philippines this sector traditionally is dominated by hydro-energy and geothermal energy. Over the 15 years from 1999 to 2014, this sector is flat-lined, showing no trend to increase, despite efforts and announcements to further expand the proportion of renewable energies.

- In contrast to coal, the trend for oil-based electricity production has been negative since the late 1990's. Oil-based is represented here as the sum total of thermal generation, diesel generators and gas turbines. The decrease mainly is owing to phasing out inefficient old thermal oil power plants. Diesel and gas turbine generation figures tend to be quite variable since these generation methods typically are employed as rapid reaction generators to meet peak and emergency demands.

- Finally, we come to the sector that is the main topic in this paper. In this linear scaling, the combined total generation from wind, solar energy and biomass (yellow line, also included in the green line) is so insignificant as to basically become invisible. No visual trend can be derived and no first statement made other than that, to date, the sector simply makes no contribution to total power production that is worth mentioning.

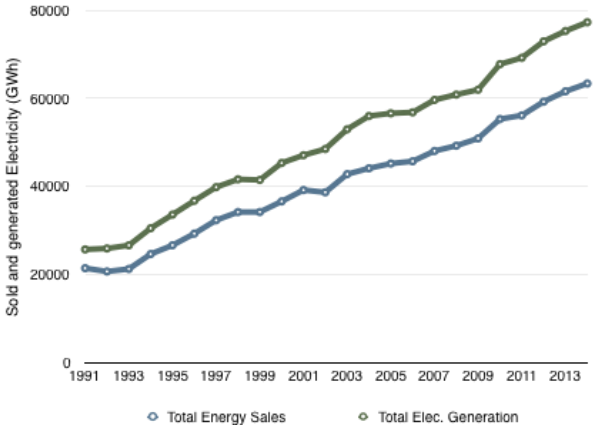

Figure 2: Total Electricity Generation vs. Total Energy Sales from 1991 to 2014.

Figure 2 shows total electric energy generation (upper line) and total energy sales (lower line), which brings us to the question of total system inefficiencies. The gap between both lines obviously is increasing, so at least the integrated system loss defined as total generation power minus sold power surely has increased. It is not clear at first sight whether relative supply-side system efficiency was improved over the report period, to which Figure 3 gives an answer.

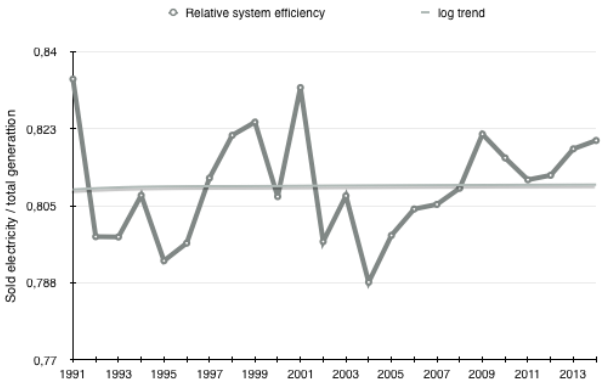

Figure 3: Relative Supply-Side Generation Efficiency from 1991 to 2014.

The purpose of electricity production is to sell electricity and meet market demands, so it should be in the interest of all involved parties to optimize system efficiency by minimizing losses. I am applying a very simple indicator for system efficiency here by dividing power sold by power generated. Clearly this figure can never meet 1.0, but all efforts should be made to come as close as possible.

Unfortunately, the system efficiency is low in the country, fluctuating around 0.8 with no visible trend for improvement, with the lowest efficiency observed in 2004. Since inefficiencies remain at roughly the same level, total system losses increase at the same rate as total generation. Approximately 20% of all generated energy never makes it to the market.

Figure 4 compares total power generation by method as well as total system losses in GWh (dashed red line). Again we can see the massive increase in coal power generation, especially since 2009, while total "new" renewable energy production methods (wind, solar, biomass) pale into insignificance in comparison to all other sectors. Moreover, both major natural energy generation methods – geothermal and hydro – do not even make up for the power losses from system inefficiencies.

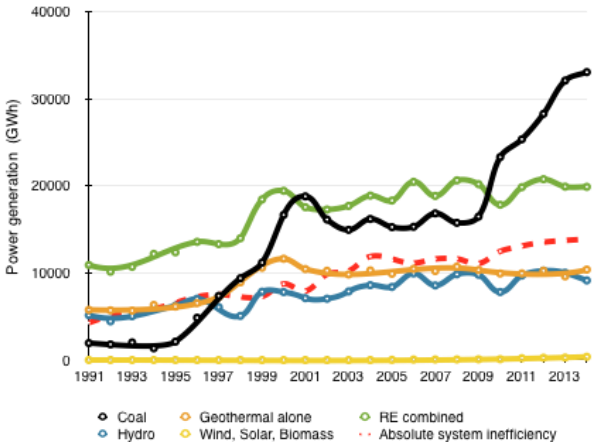

Figure 4: Power Generation vs. Losses from Total System Inefficiency 1991 to 2014.

The most recent visible as well as the long term polynomial trends even suggest the possibility that the gap between total CO_2-free energy production and system efficiencies is closing (Figure 5). As a result, it is possible that in the future all CO_2-free natural electric energy generation in the Philippines will not only not increase but might not even make up for losses in the production and distribution system.

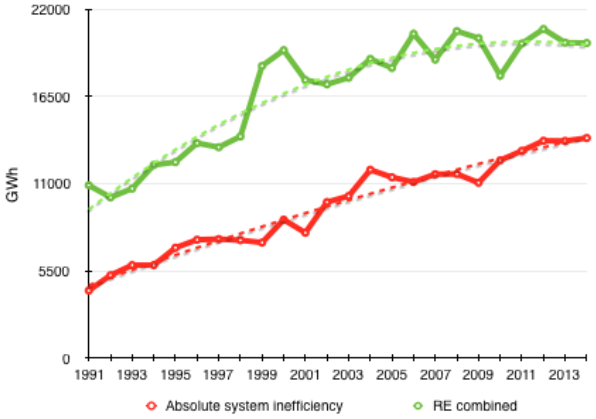

Figure 5: CO_2-Free Power Generation vs. Losses from Total System Inefficiency 1991 to 2014; with Polynomial Trend Lines.

Priors from the Developed World

As said in the beginning of this paper, the aim of this research is to analyze the plausibility of the politically stated goal to reach 100% renewable energy in the power sector within ten years from 2013 onwards. Other more cautious statements aim at 2050 or at 40% in 2030.

It is helpful to look at the past development in a country that embraced the energy transition at a much earlier time. Germany was well prepared for such an undertaking, considering its industrial and scientific know how, highly skilled engineering work force, diverse industry and financial prowess and a general consensus in society to support this development. Despite towering difficulties and various setbacks, the country was successful implementing the world's largest renewable energy based electricity generation capacities, but if the goal was CO_2 reduction, the performance turns out to be less than convincing (Figure 6).

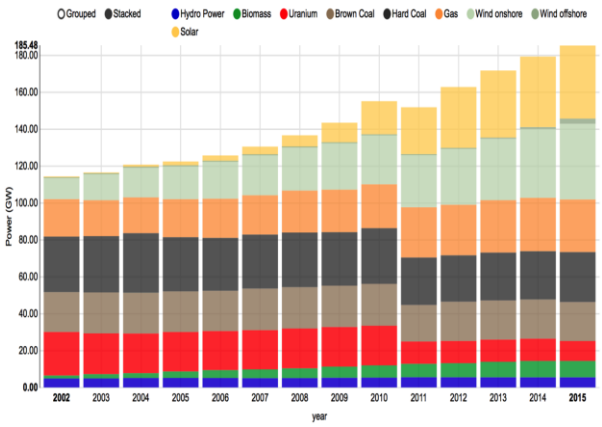

Figure 6: CO_2-Free Power Generation vs. Losses from Total System Inefficiency 1991 to 2014 (Fraunhofer ISE, 2016).

Despite rapid growth of renewable generation capacities (solar, wind and biomass, with hydro stagnating) the fossil fuel-based generation capacities could not be reduced in the shown period from 2002 to 2015. Although hard-coal capacities were decreased, the particularly dirty brown coal capacities remained the same, and fast reaction gas turbine power plant capacities were heavily expanded, partly to pitch in to make up for intermittent fluctuations of renewable energy based capacities, especially wind and solar, partly also simply owing to availability of natural gas. Total fossil fuel based capacities increased, and since gas is more efficient, per se emits less CO_2 per energy unit and also because newly installed coal capacities are

more efficient, the overall CO_2 emissions from the power sector roughly remained the same.

CONCLUSION

Based upon existing data and previous experiences from other countries (example Germany) and considering the general political and economic conditions in the Philippines, it can be deduced that the high goal of 100% renewable energy will not be achievable for the Philippines in the foreseeable future. In fact, based upon previous and current trends, it has to be doubted whether renewable energy in the mid-term will even match losses through system inefficiencies.

This unfortunate conclusion is strengthened by the fact that several major coal power stations currently (2016) are under development or recently were connected to the grid, each of them individually dwarfing all new solar and wind developments within the same period (Rivera, 2015; IBP Staff, 2015; Bello and Docena, 2005). In addition, the Philippines currently heavily supports oil and gas explorations of multi-national corporations in their territories.

Technologically, it is well known that 100% renewable energy for the power sector is a real possibility for a given time and market demand, but in my view, the political statements of the Filipino government have to be considered as out of touch with reality – even more so than similar claims and promises in other countries. It is also this author's firm opinion that, despite immense improvements in demand side efficiency, the free market incentives and the perpetual economic growth paradigm are nearly insurmountable obstacles to a complete environmentally benign energy transition.

Countries like the Philippines are on their way towards fully developed consumer societies. Consumption and material possessions are becoming the main normative goals around the globe, and without opening a debate about the meaning of this lifestyle, one fact is unchallenged: it requires enormous amounts of energy. Since fossil fuels will eventually run out, renewable energy for mainly political reasons will not be able to fill the rapidly growing gap fast enough and nuclear energy carries unacceptable risks, from our current vantage point it is likely that the future will see a series of energy crises of proportions we cannot yet fully comprehend.

REFERENCES

1. Bello, W.F. and H. Docena. 2005. *The Anti-Development State: The Political Economy of Permanent Crisis in the Philippines*. Zed Books: London, UK.

2. Brundtland, G.H. (ed.) 1987. *Report of the World Commission on Environment and Development: Our Common Future*. World Commission on Environment and Development, United Nations: New York, NY.

3. Fraunhofer ISE. 2016. "Installierte Leistung in Deutschland". https://www.energy-charts.de/power_inst_de.htm edn. Fraunhofer-Institut für Solare Energiesysteme ISE: Freiburg, Germany.

4. Galvez, J.C. 2013. "100% Renewable Energy Eyed in 10 Years". http://www.manilatimes.net/100-renewable-energy-eyed-in-10-years/12319/ edn. *The Manila Times*: Manila, Republic of the Philippines.

5. IBP Saff. 2015. *Philippines Energy Policy, Laws and Regulations Handbook*. International Business Publications, Global Investment & Business Center: Washington, DC.

6. Mediana, A. and V. Pulumbarit. 2012. "How Martial Law helped Create the OFW Phenomenon". http://www.gmanetwork.com/news/story/275011/news/pinoyabroad/how-martial-law-helped-create-the-ofw-phenomenon edn. *GMA News Online*: Manila, Republic of the Philippines.

7. Miranda, F.B., et al. (ed.). 2011. *Chasing the Wind - Assessing Philippine Democracy.* 1st Edition. Commission on Human Rights of the Philippines (CHRP): Manila, Republic of the Philippines.

8. Philippine Department of Energy. 2014. "2014 Philippine Power Statistics". http://www.doe.gov.ph/electric-power-statistics/philippine-power-statistics edn. Dept. of Energy: Manila: Republic of the Philippines.

9. Rivera, D.O. 2015. "Sarangani Energy Starts Commissioning 210-MW Power Plant". http://www.manilatimes.net/100-renewable-energy-eyed-in-10-years/12319/ edn. *The Manila Times*: Republic of the Philippines.

10. Roces, A.R. and G. Roces. 2009. *Cultureshock! Philippines: A Survival Guide to Customs and Etiquette*. 7th Edition. Marshall Cavendish Editions: Tarrytown, NY.

11. Torres, T.P. 2015. "Third Highest Worldwide, OFW Remittances seen to hit $29.7 B in 2015". http://www.philstar.com/business/2015/12/27/1536499/third-highest-worlwide-ofw-remittances-seen-hit-29.7-b-2015 edn. *The Philippine Star*: Republic of the Philippines.

ACKNOWLEDGEMENT

I owe a debt of gratitude to Professor Dr. Olav Hohmeyer at the European University of Flensburg and his encouragement to publish this first summary of some of my insights about the renewable energy situation in the Philippines. Prof. Olav and his team tirelessly work towards the tremendously difficult, but at the same time, immensely important goal of a global energy transition. Given the real world political and economic conditions, this can seem like a daunting task, but ultimately it is a matter of planetary survival. I surely hope the mission will succeed. The technology, the concepts and the experts who can make it happen all are there. Let's make it happen!

ABOUT THE AUTHOR

Stefan Thiesen, Ph.D., studied Astronomy, Geography and Physics and is an independent science writer and environmental consultant currently involved with the Europa Universität Flensburg's, Dept. of Energy and Environmental Management and their research efforts into the possibility of a world with 100% renewable energy.

SUGGESTED CITATION

Thiesen, S. 2016. "100% Renewable Energy Based Electricity Production in the Philippines: A Real Possibility or a Political Pipe Dream?". *Pacific Journal of Science and Technology*. 17(1):23-29.