The resistance of the large technical network model: Questioning the relevance of the electricity delivery system in Metro Manila, the Philippines

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Abstract

This presentation seeks to interrogate the resistance of the large technical network model of electricity delivery in a context where very high tariffs might provide a temptation for the newly formed middle classes to adopt decentralised electricity production units in order to reduce their dependency on the grid. The dominant model of service delivery is characterised by large production units delivering electricity through transportation and interconnected distribution grids. It has been considered the most efficient way to provide electricity to a large number of customers for a long time, but the high tariffs in Metro Manila, the Philippines, can lead to a reconsideration of this premise.

In order to answer this question, the presentation first focuses on middle classes — which are often considered as the engines of a change in the energy landscape of emerging countries. Their coherence as a social group is debated, and their electricity uses and practices are described. When it appears that no movement towards a weakening of the large technical network model can be observed, the presentation investigates the reasons that can account for this inertia of the energy system.

What energy is for: the making and dynamics of demand
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Service delivery in urban areas is largely organised along the lines of 'large technical network' (Hughes, 1983) characterised by the uniqueness and the centrality of a network that provides the same access to service to all. The electricity sector is no exception, and this industry is characterised by large-scale production units that are able to provide reliable and continual power at a reasonable cost, which transits through large transportation and interconnected distribution networks. This model, as dominant as it is, does not remain unchallenged. The environmental concerns that have led to the acknowledgement of a need for an « energy transition », understood as the shift towards a new socio-technical system characterised by a lesser dependency to carbon resources, by a more diversified energy mix relying more extensively on renewable energy (Jaglin & Verdeil, 2013). One of the most notable example is this regard is that of Germany, where the ongoing *energiewende* has had major impacts on the energy sector and utilities (Defeuilley, 2014). A number of studies has been focusing on the conditions of emergence of energy transitions (Geels, 2002, Bulkeley *et al*., 2014), and attention has also been paid to how large technical networks may be challenged, reshaped or hybridised by such evolutions (Coutard & Rutherford, 2015).

The relevance of the large technical network model is usually questioned if 1) the existing network is not capable of reaching the entire population, as in many countries of the South (Furlong, 2014 ; Jaglin, 2015) and therefore alternative service delivery systems are experimented, or if 2) the implementation of policies seeking to trigger an energy transition endanger the existing energy system.

Metro Manila[1] does not match either of these configurations. The electricity grid has been spreading and now connects the vast majority of the population, and the policies addressing climate change are timid at best. However, the weakening of the network could come from another way. This presentation starts from the assessment that electricity prices in the Philippines are amongst the highest in the world, and it investigates how this matter of fact can endanger the traditional model of service delivery, encouraging alternative systems to emerge and end-users to reduce their dependency to the grid. In short, it seeks to ask the following question: can the (mal)functioning of the large technical network in the Metro Manila foster the development of an alternative model of service provision? This interrogation is becoming more pressing in a context of economic growth that sees the strengthening of a middle class population that could favour alternative models of service provision.

This paper first discusses the propagation of the large technical network model and its adoption by the Philippines (1). It then focuses on how end-users react and cope with this situation, paying particular attention to their practices in terms of electricity consumption (2). Finally, it seeks to identify the obstacles to the emergence of alternatives to the large technical network that could endanger the current model of service provision in the Philippine capital region (3).

[1] This expression designates the Philippine national capital region (NCR), composed of 17 local government units and home to an estimated 12 million inhabitants.

1. Whose model is it anyway?

The first part of this presentation seeks to retrace the adoption of the large technical network model in the Philippines. It first discusses its emergence in Europe and the United State, and the way it was used as a template in countries of the global South (1.1). It then seeks to identify the main characteristics of this model in order to question their applicability to the Philippine context (1.2).

1.1. The large technical network: an expansion-based model?

The birth and extension of large technical networks in general, and electricity networks in particular, has been well documented (Hughes, 1983; Bijker *et al*., 1987; Tarr & Dupuy, 1988; Coutard 1999). This phenomenon occurred in Europe and in the United States between 1850 and 1960, and was driven by what S. Graham and S. Marvin (2001) termed the 'modern ideal' of infrastructure: a belief in science and technology, in rational urban planning, the integration of networks within the homes of residents and the increasing role taken by infrastructure in municipalities' but also nation states' agendas.

This model has not been static since its birth, and in fact it underwent a number of transformations. In particular, liberalisation reforms were carried out. The electricity sector was unbundled, State assets were privatised, regulatory agencies were created and attempts were made to foster competition in electricity production (Victor & Heller, 2007 ; MacDonald, 2009). However, as important as such reforms were, they did not challenge the material organisation of the network and still relied on a centralised grid.

The large technical network model therefore remains dominant, and is thought of as ever-expanding (Florentin, 2015). The growth the networks is intrinsically linked to the growth of cities, and as the network connects more and more users, it acquires momentum and benefits from economies of scale (Lorrain, 2002 & 2008). As a consequence, an important number consumers leaving the « club » of the network would endanger its existence.

1.2. The Philippine context

It is in 1903 that the first power utility was established in the Philippines, with the American-owned Manila Electric and Railroad and Light Company (Meralco). Since then, the company was transferred into Philippine hands, and gradually covered an area that extends to a large portion of the Luzon Island, the largest of the archipelago and the one where the capital city is located. While electrification is still a major issue at the national scale, notably given the difficulty of bringing electric power to all of the 2,000 inhabited islands that are part of the country, it is nearing completion in the national capital region. A vast majority of households are connected to the grid, including informal settlements, which were targeted by large-scale electrification programs (Mouton, 2015).

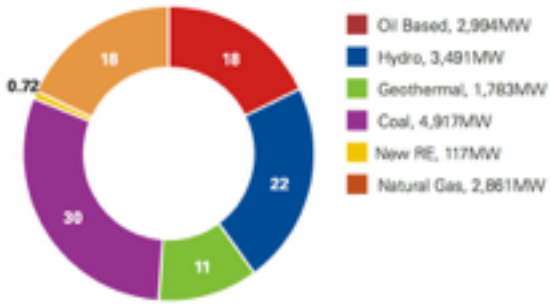

Figure 1: Philippines installed generation capacity by fuel type
Source: KPMG (2013).

The customer base of the distributor is expanding[2], thus indicating that the electricity grid is reinforced.The model of the large technical network seems stronger than ever. Why, then, do we raise the question of the challenges and dangers that such a well-established model faces? This paper identifies the cost of electricity as a potential threat to the model of the single and centralised power grid. Several explanatory factors can be identified in this regard. First, an element of geography: the Philippines is an archipelago and therefore cannot interconnect its

[2] From 2010 to 2014, the customer base in the Meralco franchise area went from 4,847,238 to 5,574,776 (a 15% increase in the span of these 4 years). 91% of these customers were residential users in 2015, and they accounted for 30% of total electricity consumption in the franchise. Source: *Meralco Annual Report 2014*, pp. 16-17.

electrical grid with a neighbouring country. It cannot buy electricity from another grid in order to satisfy a peak in consumption, and must therefore have a production that exceeds demand by an important margin. Second, the country does not have a lot of resources when it comes to energy production, and most of the coal and oil used to produce electricity has to be imported. Third, the regulation of the Philippine electricity sector is often pointed as a cause for the high tariffs. Since the aftermath of the liberalisation reform of the beginning of the 2000's, electricity has gotten more and more expensive (IBON, 2010) and some of the actors of this industry, notably the distributor Meralco, have been accused of colluding in order to jack up the prices (IBON, 2014). More generally, the domination of the electricity production market by a low number of powerful business actors is also pointed as a factor accounting for the high tariffs in the Philippines.

2. Electricity users: a force of disruption?

This section discusses how the different categories of users might challenge the current model of electricity provision in the Philippines. In particular, it questions the idea that the Philippine society is increasingly characterised by a strong middle class that could reduce the disparities in consumption in the part of end-users (2.1). Instead it shows that income levels, and consequently consumption practices, are highly unequal even within the groups of population commonly identified as constituents of middle classes (2.2). The last sub-section (2.3) shows that the cost of electricity is a constraint that could potentially put into question the dominant model of service delivery.

2.1. An apparent consolidation of middle classes…

Middle classes in the global South are among the topics that have gained considerable visibility in the last few years, notably among international funding agencies (e.g., ADB, 2010) or businesses actors (e.g., McKinsey, 2014). The Philippines is no exception to this, and it is indeed possible to identify a part of the population that emerged after WWII as a group of skilled professionals (managers, white collars, etc.) (Shiraishi & Phongpaichit, 2013) and that was reinforced more recently in the aftermath of the EDSA revolution at the end of the 1980s (Goodman & Robison, 2013) with the development of a strong service-oriented economy. Another important element that fuels the rise of middle classes is the number of Oversea Foreign Workers (OFWs)[3] that send remittances to their families and eventually come back with an increased wealth (Ang *et al*., 2009).

This change in the economy has a considerable impact on the energy landscape. With the construction of high-rise buildings where the middle classes work and sleep, and the mushrooming of shopping malls where they spend leisure time and consume (Connell, 1999 ; Garrido, 2013) comes a higher electricity consumption, notably through the use of air-conditioning (Sahakian, 2011 & 2014 ; Shove *et al*., 2014). Increased consumption levels multiply the number of electrical appliances owned by middle class households, and also drive urban Philippines to a more energy-intensive model. Beyond the Philippines, these tendencies have been well-documented for emerging countries (Lange & Meier, 2009). Does this mean that energy consumption levels in Metro Manila are going to be increasingly polarised around an « average » level, and that disparities will diminish in the near future? This paper argues that it is not necessarily so.

Statistical surveys (Virola *et al*., 2007, 2010 & 2013) have in fact shown that the « rise » of middle classes in the Philippines is a debatable fact. The population in Metro Manila remains, contrary to what a

[3] They are expatriates who, since the 1970s left their country in order to temporarily work in the US, in Gulf countries or in the neighbouring Hong Kong, Taiwan and Singapore. This phenomenon was organised by the Philippine State and has reached a massive extent : in 2008 it was estimated that 8.2 million workers were in this situation, roughly 25% of active population (World Bank, 2008). The consequences for the economy are significant, since their remittances were equivalent to 9% of the GDP in 2002 (Burgess & Haksar, 2005).

review of the literature produced by international funding agencies might lead to believe, a highly unequal one. Some social groups are indeed getting more affluent in the national capital region, but one cannot speak of a homogenous middle class. The next sub-section will therefore make an attempt at un-blackboxing this category in order to draw conclusions on the trends at work when it comes to energy consumption in Metro Manila.

2.2. … Hiding a diversity of social conditions…

The definition of middle classes is a blurred one: every author uses their own indicators (income, property, etc.) and their own thresholds. And these statistical elements hardly give us a sense of what it means to belong to the middle classes. As a consequence, in order to give a more concrete description of the « middle class way of life », this sub-section makes an attempt to depict the different social realities that lie behind this category. In order to do so, it draws on a household survey carried out in four different neighbourhoods selected because they each reflect a different aspect of middle classes : Barangka, Commonwealth (Ideal Residences), Bali Oasis and Blue Ridge A (see pictures at the end of this document). The average per capita income varies significantly between them (see figure 2): the first three neighbourhoods (Barangka, Commonwealth and Bali Oasis) are located within the range of middle classes as they are defined by the ADB (2 to 20 US dollars per capita and per day) while the more affluent residents of Blue Ridge A belong to what Kharas (2010) termed the « global middle class » (10 to 100 US dollars per capita and per day).

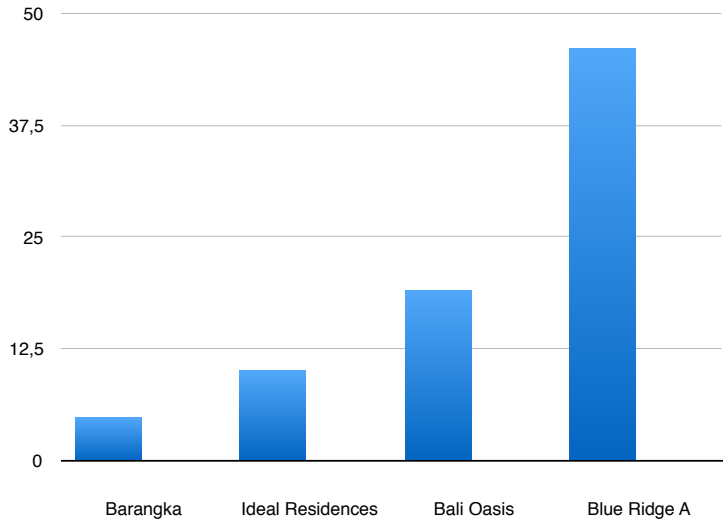

Figure 2: Average daily per capita income in the selected neighbourhoods (in USD/day).
Source: Survey carried out by the author (September - October 2015). N = 49.

The disparities in terms of number of appliances and electricity consumption reflect the disparities in income:

- Barangka: in this lower-middle class neighbourhood, households seem to have a number of electrical appliances (an average of 1.5 TV, one computer, one refrigerator, an air-conditioning unit, 0.9 for washing machines), but they have to limit their use because of the cost of electricity. The situation is

comparable to that of households that have a car, as explained by a respondent[4] : « They buy a car, but then they can't afford it. [...] You have to pay gas, it's very expensive. I wouldn't want a car ».

- Ideal Residences (Commonwealth): this part of the survey was conducted in a gated community[5] where households have access to significantly more appliances (2.5 TVs on average, almost two computers, 1.5 air-conditioning units). As a consequence, their level of electricity consumption — estimated on the basis of their electricity bill and verified in some cases with the help of a receipt — is higher: almost two times that of Barangka.
- Bali Oasis: in this condominium, the practices in terms of electricity consumption are comparable to that of Ideal residences, with some variations that can be attributed to the disparities when it comes to the age of the respondents — Bali Oasis residents are substantially younger than the people in Commonwealth and then to have fewer TV sets and a larger number of computers per household.
- Blue Ridge A: this gated community is harbouring wealthier households, and the respondents tended not to hold salaried positions but rather to run their own business or to be liberal professionals. Their larger individual houses were filled with a more important number of electrical appliances, compared to the previous case-studies: 4.4 TVs, 4.4 computers, 2.2 refrigerators and 4.3 air-conditioning units. Their power consumption is consequently much higher than other neighbourhoods: more than two times that of Ideal residences or Bali Oasis.

In light of this survey, the conclusion is that within what is generally acknowledged as the middle classes, there are significant disparities when it comes to energy consumption and practices.

2.3. … Which are hardly taken into consideration by the tariff structure

Tariff issues were at the centre of the debates at the time of electricity reform in the Philippines (Mouton, 2015), and still are a major concern for the country. The cost of electricity is high in the Philippines: it has been considered as the highest in Southeast Asia for a long time (Joint Foreign Chambers of the Philippines, 2010), and it is regularly pointed as one of the highest in the world. As a comparison, the price for domestic consumption per kWh was 23.7 euro cents in Metro Manila, 19.7 euro cents in London and 14.4 euro cents in Paris in July 2015.[6] As a consequence, energy represents a high percentage of households' income. In France, this share is evaluated at below 5%[7], while it ranges from 7 to 11% in the neighbourhoods selected for the survey (the wealthiest areas being characterised by the lowest percentage of income dedicated to electricity).

Electricity prices being such a financial burden, the question of tariff structure arises. Prices are not subsidised by the Philippine State, and the actors of the electricity sector operate on a cost-recovery basis, making the accessibility of the service to the poorest a difficult equation to solve. One mechanism is in place

The lifeline subsidy scheme in the Meralco franchise area.

kWh Consumption	Lifeline discount (% of charge)
1–20	100
21–50	50
51–70	35
71–100	20

[4] Quotation extracted from an interview with an inhabitant of Barangka, Sept. 26th.

[5] Gated communities are numerous in Metro Manila and can be inhabited by various social groups (including, as is the case here, by intermediate social groups).

[6] Numbers obtained respectively on a Meralco bill, from the UK Government statistics (« Average annual domestic electricity bills for selected towns and cities in the UK and average unit costs (QEP 2.2.3) ») and from the EDF website (« tarif bleu »). Exchange rates for July 22nd: 1 euro = 52.0776 Philippine peso = 0.7245 British pound.

[7] 4.8%: figure obtained from the French National Institute of Statistics and Economic studies (INSEE, http://www.insee.fr/fr/themes/document.asp?ref_id=ip1315). Note should be taken that this figure includes other residential energy sources (e.g., LPG) that are not integrated in the figures provided for the Philippine case studies: the difference between the two national contexts is all the more significant.

in order to provide a form of redistribution: a system of cross subsidy, the « lifeline rates ». This tariff scheme is targeted at the poorest end-users, and is based on consumption — with the (debatable)[8] premise that poorer households consume less than their wealthier counterparts. All consumers, residential, commercial or industrial, finance it collectively, but its benefits are limited to residential users. As a consequence, poorer households do receive a discount for their energy bill. It should be noted that in the survey carried out in Barangka, the least affluent community of our case studies, only one household benefitted from lifeline rates.

The cross-subsidies also raise the question of their acceptability. Worried about such acceptability in the part of its better-off consumers, Meralco was indeed opposed to lifeline rates, and renewed its opposition to this scheme in 2012 when this measure was extended for another 12 years.[9] In addition to te high tariffs, this element could trigger exit-strategies on the part of the users that have the investment capacity to produce their own power. Yet, no such movement can be observed on a significant scale, which shows that the model of the large technical network is still relevant in Metro Manila — an assessment that the next section will focus on.

3. The resistance of the traditional model of service delivery

Given the disparities in consumption levels in Metro Manila and the high tariffs that characterise Metro Manila's electricity network, it could be expected to observe exit strategies on the part of at least a portion of end-users. This section shows how consumers manage to cope with tariffs (3.1), and how obstacles to alternative service delivery systems explain this absence of challenge to the existing system (3.2 and 3.3).

3.1. An extreme adaptability on the part of users

One of the main results of the households survey has to do with the practices of end-users when they are faced with the financial burden of their electricity bill. First, one has to emphasise the close monitoring that households have of their consumption: the overwhelming majority of them knew the amount of their average electricity bill with a good degree of precision.

Second, one can observe the flexibility of their electricity consumption. Depending on the comfort of their current financial position, they adapt their consumption. What differs depending on the affluence of households is the extent of these efforts. For the poorest of the respondents (in Barangka notably), it is current to unplug their refrigerator at night, or even for longer periods in some instances. A respondent stated for instance that he tries not to store meat at home so that he can leave his refrigerator unplugged as long as possible, even if it means buying some ice from a local store at times. For all of the households which own one, air-conditioning units are an important adjustment variable. It is by far, for most households, the most energy-intensive device that they possess, and its use has important financial implications. For most households, air-conditioning use is restricted to certain rooms and certain time-slots — usually before bedtime — for most households, while the wealthiest are able to cool their entire habitation during extended periods of time.

Third, while poorer households manage to cope with their electricity expenses by unplugging certain devices, the wealthier ones have an additional tool they can use in order to improve their comfort while

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[8] This subsidy does not, as the law states it, target exclusively the "marginalised end-users". Wealthy households, for instance, have secondary residences that they seldom use, and which often benefit from lifeline rates. On the contrary, in some cases poorer households have a consumption that is above the limit of the lifeline. The size of their household is not taken into account, and therefore a family with ten members living under the same roof will consume more than a couple with no children. In addition, the appliances owned by low-income earning families tend to be older, and can be less energy-efficient.

[9] Interview with a Meralco executive from the Home and Micro Business Marketing (April 8, 2013, Pasig City).

limiting their costs: replacing their appliances with newer, more energy-efficient ones (e.g., air-conditioning units and refrigerators with inverters). This attention to the energy-efficiency characteristics of their appliances was most visible in the neighbourhoods of Bali Oasis and Blue Ridge A, where households have the financial means to invest in these more expensive equipment.

3.2. The limited alternatives

It has now been established that households manage to keep their electricity consumption in line with their financial capabilities, even in the context of a very expensive service. The question that arises is therefore the following one: if the large technical network model is very expensive, why do they not try to experiment alternative models, and in particular decentralised power production through the use of photo-voltaic panels? Given the cost of electricity in the Philippines and the high potential for solar production in this country located close to the level of the Equator, one would imagine that such practices would start spreading. While being completely autonomous and rely completely on off-grid electricity generation would undoubtedly go against the convenience and comfort that middle classes in emerging countries have been shown to seek (Lange & Meier, 2009), using PV on top of the conventional network could reduce significantly users' electricity bill. Fieldwork carried out in Metro Manila in fall 2015 show that such a movement towards more decentralised energy production cannot be observed.

Figure 4: Solar panels sold in a hardware store at the SM Marikina shopping mall, December2015.

The most obvious reason for this lock-in has to do with the cost of such equipment, which is still too high for the overwhelming majority of the population. The average cost lies around 100,000 Philippine pesos (almost 2,000 euros) for one kW, and it is estimated that the return on investment is made after 5 to 7 years of use for a 4 kW installation, while the lifespan of these panels is around 25 years, after which the output decreases gradually.[10] More affordable options exist (see figure 4), but their reliability, durability and overall quality are questionnable[11], and their wattage is much lower. As a consequence, even with appropriate financing schemes — which have yet to be designed and spread — it is too much of a burden for households to be able to reduce their dependency to the grid.

3.3. Strong vested interests against a challenge of the dominant system

The second set of reasons for this attachment to the large technical network has to do with the balance of power between the actors of the dominant model and its challengers. The Philippine public authorities have embraced the global discourse over the need to lower carbon emissions, and have included in their agenda the goal of increasing the share of renewables in their energy mix (DoE, 2012). The Government has set an objective of increasing the solar generation capacity to 500 MW, and heavy investments are indeed being made. The growth of solar power production is estimated at 12% per year. However this growth is borne by the traditional actors of the energy sector, and translated into the construction of solar

[10] Number obtained from a member of the organisation Solar Solutions, and confirmed by other actors of this sector, Quezon City, October 9, 2015.

[11] In particular, critiques were voiced by actors from the solar energy sector, by executives of the electricity distributor (Meralco) and by NGOs working on the development of solar energy in off-grid areas.

farms.[12] Incentives have been put in place by the Government, in the form of feed-in-tariffs, but they concern big production units rather than individuals choosing to invest in decentralised energy production units. This choice to encourage centralised renewables rather than in micro-units is understandable if one considers the balance of power in the energy sector. The utility, Meralco, has little to gain in the development at a large scale of household level production units that would diminish its sales of electricity. And with a technology which is largely held and distributed by foreign companies, local conglomerates — which are highly influential in Philippine politics — engaged in the energy market can profit more easily from the construction and operation of solar farms than from decentralised energy production.

4. Conclusion

The aim of this paper was to interrogate the capacity of the large technical network model to resist when one of its main sources of legitimacy, the affordability of its service, is endangered by the high tariffs of the utility. The danger, for the model, would be that a significant number of end-users would have the financial means to set up decentralised electricity production units and reduce their dependency on the grid: they would leave the « club » and consequently cast doubts on its future. Middle classes, which are often viewed as the « engine » for energy transitions in emerging countries, are however not in a position to initiate such a movement. First, they are very diverse, with a majority of them barely standing above the poverty level and unable to invest in electricity production technologies. They cope with the high tariffs by adapting and fine-tuning their consumption practices. Those who could have the financial means to reduce their dependency on the grid constitute a very small group, and they are not encouraged to do so by public authorities: the system of incentives put in place in order to promote renewables encourages large production units rather than household level systems.

[12] Interview carried out with an executive from the equipment supplier Schneider Electric, Taguig City, 14/10/2015.

A glance at the neighbourhoods selected for the survey

Barangka:

Ideal Residence (Commonwealth):

Bali Oasis:

Blue Ridge A:

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