

Spring 2015

The Role of Productive Uses of Electricity in Rural Development: A Case Study of Xẻo Trâm and Hoà Đức Hamlets of Hoà An village, Vietnam

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Recommended Citation

Short, Gabrielle, "The Role of Productive Uses of Electricity in Rural Development: A Case Study of Xẻo Trâm and Hoà Đức Hamlets of Hoà An village, Vietnam" (2015). *Independent Study Project (ISP) Collection*. 2099.
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The Role of Productive Uses of Electricity in Rural Development:
A Case Study of Xẻo Trâm and Hòa Đức Hamlets of Hòa An village, Vietnam

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World Learning, SIT Study Abroad, Vietnam: Culture, Social Change and Development

Spring 2015

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Abstract

Vietnam's economy has grown extensively over the past twenty years; however, 68% of the population still lives in rural areas. The government of Vietnam has taken huge steps in the growth of rural infrastructure, specifically electricity. According to the World Bank 95% of the rural population had access to electricity as of 2010. This paper discusses how this electricity is being used in rural areas and whether the uses are aiding in the national growth of Vietnam. Productive uses, those which result in production of income, or value, are compared with solely economic uses. A case study comprised of surveys, and in depth interviews, in the Xèo Trâm and Hòa Đức hamlets of Hòa An village, explore this concept further. Findings conclude that although electricity is being used productively, in most cases it is not being utilized economically. Data analysis revealed two main obstacles keeping rural villagers from using electricity economically. The first was lack of knowledge of potential electricity uses that would increase production of income. The second was affordability and sustainable affordability of electricity. Suggestions of rural electrification implementation programs which would promote economic uses in rural areas are shared in the conclusion.

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ACKNOWLEDGEMENTS

There were many people who made my Independent Study Project (ISP) possible. I would like to begin by thanking the academic director of the School of International Training (SIT) program in Vietnam, Dr. Duong Van Thanh. Co Thanh guided me through the first steps of this project and connected me with my two wonderful advisors. She has encouraged me along the way and supported me as my topic and research methods shifted focuses. I would also like to thank Phat Nguyễn our wonderful program assistant who helped me navigate through tough situations. He was more than willing to translate over the phone for me when the language barrier proved too much alone in Can Tho, and assisted me in translating two sets of interview questions. In addition to all of the ISP help that Phat provided, he was always a source of encouragement and a friend who helped all of the students thrive here in Vietnam. Giang-Linh Tran was another constant source of encouragement that I appreciate greatly.

My two wonderful advisors Mr. Tran Duy Phat, and Dr. Can, the Dean of the College of Rural Development, also aided in my success. They welcomed me into the Hòa An campus where I was able to use the facilities. Mr. Phat was always willing to discuss my research with me and was extremely helpful in setting up interviews with villagers to meet my research needs.

I would also like to thank my two main translators Ngọc Phạm and Nguyễn Trang from the Rural Development College. They were unbelievably generous to assist me in conducting my surveys and interviews in the village. In addition to these two, I had help from a handful of other students from the English club that also generously gave their time to help in conducting my survey. With a limited time schedule I could not possibly have collected the depth of data I did without all of the people listed above.

In conclusion I would like to thank all of the other people I met along my journey and the ways in which they helped me grow.

1. Introduction

Rural areas need reliable, affordable access to electricity in order to improve incomes and quality of life for the people. As Vietnam expands the electricity grid into more and more rural areas, are the people equipped to use electricity productively to meet these goals?

The definition of a productive use of energy is commonly debated. For the purpose of this research we will use definition developed by the Food and Agriculture Organization (FAO) in conjunction with the Global Environment Facility (GEF), “in the context of providing modern energy services in rural areas, a productive use of energy is one that involves the application of energy derived mainly from renewable resources to create goods and/or services either directly or indirectly for the production of income or value” (White, 2002). This definition is originally meant to consider only renewable energy, but we will apply it in this study to all forms of energy in Vietnam.

Productive uses of energy therefore are considered anything from using it to irrigate a farmer’s field, to powering a television which leads to female empowerment, “any use that results in the production of *income* or *value*”. Value can be considered economic value, or social value. Female empowerment and gender equality is an important social value that electricity can influence. For the purpose of this research we will refer to any use resulting in the production of income as an economic use of electricity.

Vietnam has a considerably high level of access to electricity in rural areas. World Bank data began reporting rural electricity access in 1990 when 84% of the rural population had access. In 2010 95% of rural areas in Vietnam had access to electricity. This places them right below Thailand, and Malaysia who report 97% and 98% respectively. All other Southeast Asian countries have lower electrification rates in rural areas.

With so much importance placed on access to electricity it is necessary to assess whether access truly leads to better lives and national growth. Access does not guarantee affordability or productive uses.

This case study of two hamlets in Hòa An village explores the relationship between electricity access, cost, and uses. It will consider electricity uses with the previously given definition of a productive use of energy. The report will assess the current situation in this rural village, the challenges of productive uses and conclude with suggestions to improve productivity. The findings of this research may not be generalizable to all rural areas in Vietnam, however it will be an example of what many villages most likely go through after gaining access to electricity.

1.1 Background

Vietnam has seen unprecedented growth in the past 20 years since Doi Moi economic reform which was implemented in 1986. Prior to Doi Moi, Vietnam had a centrally planned economy, the reform transitioned it into a socialist-oriented market economy. This allowed Vietnamese people to own their own businesses and began a shift away from state owned enterprises. It is accepted that private firms have been more successful in creating jobs than state owned enterprises (World Bank). This newfound freedom in the domestic private sector accelerated the growth of the economy immediately. The GDP growth rate fluctuated around 7% from 1990-2012 (World Bank, databank), representing a very impressive amount of growth. In 2012 however, the growth rate dropped to 5.2% per year. Since then it has gradually risen up to 6%.

In 2010 the World Bank reported that 68% of the Vietnamese population lived in rural areas. Rural development is a natural step for a country which has seen huge growth and still has

such a large portion of the population living in rural areas. However, the process is not possible without strong infrastructure.

It is important to note that “a strong positive correlation is apparent between infrastructure accumulation and growth performance” (Calderon, Serven, 2004), however this does not necessarily reflect causation. Once we recognize that infrastructure accumulation and development is necessary for a growing economy, we must understand how it will benefit Vietnam.

One of the main challenges Vietnam has faced, and continues to face is that with such fast increase in GDP and production, infrastructure has not been able to keep up. Foreign direct investors (necessary for continued growth within the world market) have basic expectations of infrastructure. “Lack of adequate infrastructure services results in lower productivity and higher production costs for private producers... the reduced profitability in turn discourages private investment” (Calderon, Serven, 2004). Because of these higher costs, lack of adequate infrastructure “is usually seen as a bottleneck that can harm prospects for investment and therefore, growth” (Lopez, 2003).

One of the most important infrastructure factors for foreign investors looking to do work in Vietnam is having reliable power accessibility. Without power, nothing can get done. The power sector is a great example of how infrastructure is necessary for development. Research found that “in the technological world of the late 20th century, economic development occurred ‘hand in hand’ with electricity consumption” (Ferguson et al, 2000). A paper discussing economic reform in India touches on the issue of sufficient power infrastructure. “Indian industry will not only need adequate power supply, but also high quality power, free of interruptions and voltage fluctuations” (Ahluwalia, 1998). Vietnam faces the same challenge and requires

improvements to their power sector in the near future to be able to maintain expectations of foreign direct investors.

Since its establishment in 1994, Vietnam's state owned electricity provider, EVN, has been working to provide electricity to a higher percent of the population. Access to electricity and physically being "on the grid" are two different things and will be discussed later. For over 25 years, EVN has been working to expand the grid into rural areas of the country. In 1990, 88% of the country was on the grid, including 84% of the population in rural areas. By 2010, 96% of the population of Vietnam was on the grid, including 95% of people in rural areas (World Bank, databank).

Although a large percentage of people in Vietnam are technically on the electricity grid, they do not always have access to electricity. The US Energy Information Administration found that in Vietnam "with electricity consumption nearly matching generation in recent years and insufficient investment in new power plants, the electricity grid is under constant strain by the growing economy" (EIA, 2013). Similarly to what was found in the study in India quoted above, electricity especially in rural areas faces interruptions and voltage fluctuations. Considering that 68% of Vietnam's population lives in rural areas, it is extremely important to consider growth ability and development outside of urban centers.

Economic development of rural areas is Vietnam's next step, and it will be a complicated one. Currently, 30.8% of EVN's power is generated through hydro power plants, a number they are hoping to decrease to 19% by 2020 (EVN, 2014). Hydro power is clean energy and overall quite cheap to produce when you consider that there is no cost of the input (water). This form of energy, however, is not reliable during the dry season. They have limited reservoir capacities

leading to a huge decrease in electricity production during the dry season (Dapice, 2009). This increases the strain on the electricity grid.

Large changes to the energy sector have to take place in order to provide rural areas of Vietnam with reliable electricity. The first change is obvious, more electricity needs to be generated. This requires building new infrastructure and redistributing the types of energy used to create electricity to be more efficient. The reason this has yet to be done, and the challenge in doing so, is that the government controlled electricity cost (to the consumer) is locked in at a price too low to justify the costs of new facilities. In other words, EVN cannot make a profit from building more power infrastructure due to the extremely low return on investment. A study in India recognized that “as expectations of quality increase, with corresponding willingness to pay for better services, it is appropriate to shift to private sector suppliers” (Ahluwalia, 1998). Clearly this is a complicated situation for the Socialist Republic of Vietnam who currently only allows EVN, a state owned enterprise, to provide power to the nation.

Lopez explains that development of infrastructure has the ability to negatively, or positively affect income distribution. For example, if infrastructure investment is focused on areas which have already shown economic progress it can negatively affect income equality. Whereas, if it is directed towards poor areas and the areas are able to take advantage of the new opportunities, it can reduce inequality. Reducing income inequality is another key factor in development.

An OECD study found that “countries where income inequality is decreasing grow faster than those with rising inequality” (OECD, 2014). Income inequality and economic growth are two quality of life indicators which are very closely related. Findings in a paper suggest that “there would be inequality convergence; that growth, as such, would not affect inequality and

that inequality, as such, may negatively affect growth” (Lopez, 2003). Growing Vietnam’s economy will not improve income inequality on its own. That being said, income inequality, if not addressed, may negatively affect economic growth.

According to the World Bank, in 2012, Vietnam had a Gini Coefficient of 35.6. A Gini Coefficient is used to measure income inequality. A measure of 0 would represent perfect equality and 100 would represent perfect inequality. Per capita household income in rural areas is roughly one half of that in urban areas (Van Cao, 2008). This confirms that infrastructure development in rural areas would benefit the poor Vietnamese people as well as promote the country’s GDP and overall development.

1.2 Literature Review

In Cabraal 2005 there is a detailed discussion of the definition of productive uses of energy and how it has transformed over time. Traditionally there have been two uses of energy, residential and productive. Residential uses included anything which improved the quality of life of a household- fans, TV, cooking devices, etc. Productive uses were viewed as uses which improved the economic situation- increased production, higher employment, etc. leading to higher incomes.

More recently however, the views on productive uses of energy have expanded to align more closely with the Millennium Development Goals. The following 8 goals were set by the United Nations in 2002 as an international development standard (UN).

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality

5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Global partnership for development

A paper titled “Energy for the Poor” by the department for international development concluded that improvement in energy services is necessary in order to achieve the Millennium development goals (Department for International Development, 2002). Cabraal discusses the change in definition of productive uses of energy due to the new emphasis on the importance of energy for international development.

Members of the FAO and GEF developed a new working definition of productive uses of energy which is as follows, “in the context of providing modern energy services in rural areas, a productive use of energy is one that involves the application of energy derived mainly from renewable resources to create goods and/or services either directly or indirectly for the production of income or value” (White, 2002). Cabraal notes that this definition is specifically for renewable energy but can be applied to all forms as well.

Cabraal goes on to show examples of situations in which energy indirectly contributes to the success of millennium development goals. The relationship between electricity in households and education is discussed at length. Studies have found that access to electricity in a household results in higher education levels. It is also commonly accepted that higher education levels result in high income later in life. So this example shows how energy is used in a traditionally unproductive way to promote a millennium development goal, and later in life pays off through improved income which is a traditional productive outcome. Examples like electricity’s relationship with education goes to show how the new definition of productive energy use is more accurate.

Cabraal discusses two studies on the introduction of electricity to rural areas, one conducted in India and one in Bangladesh. In India, the electrification program focused on the traditional sense of productive use of energy and introduced electricity to the agriculture sector. Unfortunately, the introduction of electricity into households did not happen. In Bangladesh the electrification project was more balanced and was introduced into both the economic sector as well as households. This balanced approach resulted in relatively more success in all aspects of life.

These studies show the importance of a balanced electrification implementation program in order to use electricity productively to aid in accomplishing the millennium development goals. Fishbein, Sanghvi, and Unit, (2003) discusses the challenges of productive uses of energy in rural areas. Fishbein's paper focuses on a more traditional definition of productive use of energy as an income generating use. It suggests that a precondition to productive use is that "energy must be understood as an input to income-generating activities". This understanding combined with other conditions such as knowledge and skill of the people on how to use electricity to make a profit, technical and financial management capacity, an institutional environment willing to promote decentralized services, access to markets, and availability of other infrastructure services, are all necessary in order to use energy in a productive way.

Fishbein's paper explains that without these preconditions, it is nearly impossible for a rural area to develop after getting access to electricity. The single act of electrification is not sufficient for improved quality of life or increases in income. The Energy sector Management Assistance Program released a report on methodologies for "Maximizing the productive uses of electricity to increase the impact of rural electrification programs" (De Gouvello, Durix, 2003). This report has an in depth discussion about traditional productive uses of energy and how

electrification programs can better achieve this goal. It lays out a five step, systematic approach for electrification of rural areas.

- i. Identify the productive activities and the sectors in which they currently take place in the project area.
- ii. Carefully analyze the production processes involved within the region of interest. Identification of the existing limitations and areas of possible improvement of these processes.
- iii. Analyze the role electricity can play and what equipment is required.
- iv. Analyze the technical feasibility and economic and social viability of the electrically based solution proposed.
- v. Implement a promotion campaign to communicate the gains that can be obtained. Based on the results of the earlier analysis, the campaign should target specific energy users and promote a specific use of electricity that can provide them with clear benefits.

This framework addresses many of the obstacles to productive electricity uses discussed by Fishbein. It is a method that reaches across sectors and places importance on livelihood factors of rural villagers when considering electrification projects.

2. Methodology

With the goal of collecting quantitative and qualitative data in this case study, a mixed methodology structure was chosen. Surveys were utilized to reach a large sample size while in depth interviews were used to supplement the survey with more detailed information. Key informant interviews were then conducted with villagers and experts with a unique perspective on rural electrification. This mixed methodology provided detailed information while still reaching a large enough sample size to draw some conclusions about electricity uses in Hòa An village.

2.1 Stage One: Survey

The survey was developed and revised over a period of two weeks in which a literature review, and meetings with advisors were conducted. The end result was a 14 question survey, 11 of these were multiple choice and 3 were fill in the blank or short answer. The survey was then translated into Vietnamese by a volunteer student. In addition to the survey, an introduction letter about the purpose of the study and informing participants of the voluntary nature of participation was also translated into Vietnamese.

Given time restraints of the student volunteers (which will be discussed in section 2.4), it was decided that 30 surveys and roughly 15 interviews would be conducted over two days. The morning of the first day myself, Mr. Phat, 5 Vietnamese volunteer students, and a local guide went to Xèo Trâm hamlet of Hòa An village. The volunteer students walked around with the local guide and were introduced to households where they could conduct the survey. I spent the morning with one student conducting in depth interviews. A total of 15 surveys and 6 interviews were conducted in Xèo Trâm hamlet.

In the afternoon of the same day myself, Mr. Phat, 7 Vietnamese volunteer students, and a local guide went to Hòa Đức hamlet of Hòa An village. The students again went around the hamlet with the local guide and conducted surveys with households. I spend the afternoon with a different student conducting in depth interviews. A total of 15 surveys and 4 interviews were conducted in Hòa Đức hamlet.

2.2 Stage Two: Key Informant Interviews

Returning to Hòa An later in the week I conducted two key informant interviews. The first was with the local village leader. He was chosen for an interview due to his unique knowledge and understanding of the village. The second key informant interview was with a family who owns and runs a rice factory out of their home in Xèo Trâm hamlet. This interview was set up in order to understand more about how electricity is being used in an economic manner in the village. Both key informant interviews were conducted with the help of local volunteer students and guided with interview questions specific to the interviewee.

Later on, two more interviews were conducted over e-mail. The purpose of these last two interviews was to better understand the subsidy program, and to discover if there were any other rural electrification education programs. Mr. Phat sent two sets of questions to the appropriate people over e-mail. Due to busy schedules and holidays these interviews could not be conducted in person; however, it would have been beneficial if possible to ask follow up questions.

2.3 Stage Three: Data Analysis

The final stage of my research was analyzing results and drawing conclusions from the surveys and interviews conducted in the field. It is important to note that throughout this research

I have attempted to create unbiased surveys and interview guides. I continue to make this effort throughout the data analysis and process of drawing conclusions.

Survey data was coded and entered into SPSS (a statistical analysis software). It was then analyzed through methods such as descriptive statistical analysis. Graphs, tables, and other helpful statistical visuals were produced in SPSS.

Interview data was not included with survey results in SPSS, but rather was analyzed separately. The interview data is much more qualitative and therefore the results will be best represented in a discussion format as opposed to graphs and tables.

2.4 Limitations

As with all primary research it is important to acknowledge limitations to data and analysis. The most obvious, and important limitation to this research is the language barrier. None of the villagers I spoke with throughout data collection spoke English. All communication was done through student volunteers translating. Unfortunately with any translation, certain thoughts and ideas can get lost in the process. Another challenge is that throughout the interview process, the translator changed. This causes inconsistencies in the quality and quantity of the data collected due to proficiency of English.

A second limitation which had a large effect on the data collected, was the availability of the student volunteers. This research is not possible without their help translating and unfortunately the original two weeks I planned to collect data in Hòa An was not realistic. The students were dealing with their own school work, final theses, and prepping for a class trip to Da Lat. This resulted in the mindset of getting the data collection done as fast as possible.

Ideally I would have been present for all data collection but this was unfortunately not possible. The survey had been designed with mostly multiple choice questions so it worked fine to have the students conduct the surveys even if I wasn't present. However, I was only able to collect a total of five in depth interviews in the time available. While it was helpful that the other students conducted interviews at the same time with different households, it greatly limited the information I received. I was able to still collect a total of 10 in depth interviews with the students' help but without follow up questions, and limited English translation, the interviews I was not present for did not provide the same depth of information.

3. Results

3.1 Access to electricity

For the purpose of this question, access is meant in terms of the house being connected to the grid. This is when the family chose to be connected, the infrastructure was available in the hamlets earlier on. During the interview with the local leader, he stated that electrification infrastructure began to be built in the village in 1994. Some hamlets were added after that. Families have to pay 500,000-600,000 VND in order to be connected to the grid. Due to this cost, “access” years differ by household.

Only 53% of survey respondents were able to recall what year they first received access to electricity in their home (8 respondents from each hamlet). Although the sample size for this question is small, a pattern was apparent. The median year in which households received access to electricity in their home in Xẻo Trâm hamlet was 2008, and in Hòa Đức hamlet it was 2002. These findings are consistent with the information given by the local leader in terms of electrification timetables by hamlet.

Table 1

Median Year of Connection of Household to Electricity Grid

Hamlet	Year
Xẻo Trâm	2008
Hòa Đức	2002

3.2 Do households use electricity in economic ways?

For clarification purposes, this question is regarding specifically economic uses of electricity, not all productive uses. Economic uses are those which result in higher productivity and therefore income.

Only 20% of all 30 surveyed households use electricity economically. Of the respondents who do use it economically, 2 of them live in Xẻo Trâm hamlet, and 4 live in Hòa Đức hamlet. The most common use was for raising pigs (total of 3 households). These households explained that they use a water pump to fill the pig troughs. This use saves time, energy, and poses fewer challenges to raising pigs. The pigs are then used for a biogas system in the households. The next common use was for field irrigation (2 households), and lastly for sewing (1 household).

Table 2

In what ways does your household use electricity economically?

Uses	Frequency	%
None	24	80
Raising Pigs	3	10
Field Irrigation	2	6.7
Sewing	1	3.3

3.3 Rice Factory example

Rice Factory

The family who owns the rice production factory uses electricity economically in their production. After opening their operation in 1998 they used oil powered machinery until 2008. That's when they connected to the grid and switched over to electricity powered machines. In the first few years after starting to use electricity, their profit increased a lot. However, in recent years as electricity price have risen, their profits have taken a hit. They explained that at this point in time, the cost of using electricity or oil, is roughly the same. They continue to use electricity due to its convenience. The factory is a family operation and run by the mother and father. They have no plans to expand in the future, even if electricity prices were more affordable. They feel that there isn't enough demand in the area and find themselves sometimes now without enough supply.

Factories like these require a large amount of expensive machinery. These owners explained that they were unable to secure a large enough loan to begin on their own. Luckily they had parents who owned property and were able to take out a loan for them. They felt that initial investment is the main challenge facing rural villagers in beginning operations such as theirs.

3.4 In what other ways do households use electricity?

Fans and lights were the most common uses of electricity in households. 100% of survey respondents use fans, and 97% use lights. Water pumping was also a common use. Households pump water from the river, treat it and can store it for up to 3 days to use with cooking and other household needs. Pumped water was not used for drinking, most households either bought drinking water or collecting rainwater. A few households in Hòa Đức hamlet had access to running water which they drank.

Table 3

In what ways do you use electricity in your household?

Uses	%
Light	97
Cooking	80
Water collection	43
Fan	100
Refrigerator	17

3.5 Blackouts

Pre 2010, 68% of survey respondents stated that electricity blackouts happened on average, once a week. Post 2010, 70% of respondents said they happen only once a month. Mr. Phat advised that 2010 be used as the cutoff point through his observations and experiences in the Hòa An village. 67% of respondents stated that blackouts last an average of 6-12 hours. Many of the households who participated in the in-depth interviews shared that blackouts often happen on the weekends (usually Sunday) and can last anywhere from a few hours to the entire day. Many commented that blackouts never happen at night, only during daytime hours. When asked about warning given for blackouts not related to weather, the majority of respondents explained that they didn't get any warning. A few however, shared that 2-3 days before there would be a warning on television.

Table 4

How often were there blackouts before 2010, how often are they since 2010?

Frequency	% responses pre 2010	% responses post 2010
2+ times a week	14.3	0
Once a week	67.9	6.7
2 times a month	7.1	16.7
Once a month	10.7	70
Never	0	6.7

Table 5

What is the average length of blackouts?

Length in hours	Frequency	Percent
<1	2	6.7
1-6	7	23.3
6-12	20	66.7
12-18	1	3.3

Blackout effect on households

Households were asked how blackouts effect many different variables from day to day task, to income generation. One variable stood out in this analysis and that was dealing with heat. 87% of households listed heat as an inconvenience during blackouts (the most common variable). Meal preparation was the next most common variable affecting 50% of respondents. Water pumping ability affected a few households. Variables having to do with attending work, losing income, or affecting schoolwork, were all found to not be affected by blackouts. Interviewees shared similar thoughts on the issue. Many of them stated that although they were uncomfortable during blackouts due to the heat, it did not affect their life drastically. There was also no significant differences between effects on life due to blackouts between the two hamlets.

Table 5

In what ways do blackouts affect your daily routine?

	% respondents affected
Spend time collecting and cleaning water	20
More time required for preparing meals	50
Decreased activity due to heat and no power for fans	87
Business must close or cannot function as normal	10
Cannot work	0
Loss of Income	0
Children cannot attend school	0
No effect	13

3.6 Affordability of electricity

50% of households surveyed spend 10-15% of monthly income on electricity. The other 50% are roughly split between less than 10% and between 15-20%. No household reported paying more than 20%. Only one respondent felt that electricity was unaffordable, and another 3 felt neutral on the topic.

Table 6

What percentage of your monthly income do you spend on electricity?

% of Income	Frequency	%
<10	8	26.7
10-15	15	50.0
15-20	7	23.3

Table 7

Electricity is very affordable

	Frequency	Percent
Strongly agree	9	30.0
Agree	17	56.7
Neutral	3	10.0
Disagree	1	3.3
Strongly disagree	0	0.0

3.7 Future use

Although the majority of respondents feel that electricity is affordable, only 26.6% would consider using it in more ways in the future. The goal of this question was to determine whether or not affordability of electricity is a main deterrent in using it in economic ways. Of the 8 respondents who said they would consider increased uses, 3 of them had previously reported that they already use electricity in economic ways. None of the survey respondents gave examples of what ways they would use it in the future. Through the in-depth interview, one family was interested in beginning to raise fish in the future with the help of electricity for pumps and lighting (to prevent thieves). She explained that she would do this sooner if electricity was cheaper or if she had enough money saved for the initial investment. Overall the majority of those surveyed and interviewed expressed that they have no plans to use electricity in the future beyond daily household needs.

4. Discussion

4.1 Uses

Electricity's role in improving quality of life in rural areas is quite clear. Electricity is "essential for the provision of clean water, sanitation and healthcare" (World Energy Outlook). It also provides lighting for extended working and studying hours, higher education rates, the ability to use household appliances to save time and effort, cooking methods which can reduce exposure to harmful cooking fumes, the ability to refrigerate medicines and food, etc. (World Energy Outlook). A much safer, and more comfortable life is offered with access to electricity in a home.

Electricity also has the ability to transform rural economies. According to World Bank data, 35% of land in Vietnam is used for agriculture production. Electricity can be used to "power farm machinery, such as water pumps, fodder choppers, threshers, grinders, and dryers. That would result in the modernization of agricultural production" (Cabral, 2005). In addition to the agriculture sector electricity can improve productiveness of manufacturing. It also can be used in many ways for small enterprises, such as internet cafes, or karaoke bars.

The results of the survey and in depth interviews show a consistent pattern across the village. It seems as though people enjoy having access to electricity for household uses and a more comfortable lifestyle. Very few people have begun to use electricity in ways to increase income and better their household's financial situation. Not only have they not started utilizing it in this way, but many of them stated that they simply have no additional uses in mind. This suggests that knowledge of how electricity can be used economically is severely lacking in this rural village.

Of the 6 households surveyed who said they use electricity economically, 3 use it for raising pigs. The electricity helps to pump water from the river, to the trough. This is the only use of electricity in the process. It's a time, and effort saving measure but not always required for the process.

The local leader and student volunteers explained that in the village there are a few rice factories, blacksmiths, an internet café, and a karaoke café which utilize electricity.

A vast majority of rural people work in agriculture, however only two survey respondents reported using irrigation pumps in the fields they work in. This number may be higher in reality due to the sample population not representing farmers but rather their wives. As discussed previously, irrigation in fields leads to higher agriculture yields, which benefits the farmers and local rice factories.

Although many of those surveyed and interviewed don't use electricity economically, I would argue they still use it productively. The previously given definition of a productive use of energy states that any use leading to "production of income, or value" is productive. A few in depth interviews touched on the fact that children have more time to study since gaining access to electricity due to lighting after sunset. Access to electricity can result in higher education rates due to less time necessary for daily household tasks such as collecting wood for cooking, and meal preparation.

Electricity also saves time for meal preparation in many households. One of the most common electrical appliances discussed in Hòa An were rice cookers. Women repeatedly emphasized how convenient they are and how much time they save them on a day to day basis. This is time that can be used in other ways to produce income.

Although the survey did not specifically ask about television use, from my observations, the majority of households in Hòa An village had televisions. One woman who was interviewed works on a farm. She shared that she watches shows on agriculture and that she has learned a lot about farming from it. In this sense electricity leading to television access improves productive knowledge and can lead to improved production of income.

4.2 Affordability

From data collected through this research it is apparent that there are two aspects to affordability regarding productive uses of electricity. The first is the affordability of the actual electricity. The second is the affordability of initial investments needed to use the electricity economically.

The first aspect, affordability of the actual electricity has two pieces. Firstly, according to the local leader, in order for a home to be connected to the electricity grid, they have to pay 500,000-600,000 VND. This is a substantial amount of money to invest in electricity for only household uses. Household uses may improve quality of life but will prove more challenging to make the initial payment back.

The second piece is the cost per KW/h to the households. Even though 86.7% of survey respondents reported that they agreed, or strongly agreed, with the statement “Electricity is very affordable”, 73.3% of people are still paying over 10% of their monthly income on electricity. This is a high cost for solely household uses- which is the case for the majority of survey respondents.

Electricity costs in Vietnam have been increasing recently, and will continue to as EVN attempts to attract foreign investors. “We need to recognize that for over a decade, not a single

foreign company has been willing to invest in Vietnam's energy sector, because our present electricity tariffs are too low to make an investment profitable" (Am Cham, 2010). As these prices continue to increase, households who are already stretching their resources in order to afford electricity could lose that ability. The affordability of household uses is not sustainable without economic uses.

One home interviewed identified an electricity subsidy that some families in the village are able to receive. After following up on this topic with the local leader and a government official, there was a bit of confusion on details of the subsidy. The local leader explained that the provincial government (whether it is the provincial, or national government was questioned), provides an electricity subsidy for very poor households. The government official said these households qualify if they make less than 400,000 VND per person per month (In Xẻo Trâm 112 out of 183 households qualify, and in Hòa Đức 72 out of 362 households qualify). The local leader was also under the impression that poor households cannot use more than 50 KW per month to receive the subsidy. According to the government official the subsidy began in January 2011 and households were given 30,000 VND per month. However, since July 2014 households now receive 42,500 per month. This subsidy is only for household electricity uses and there are currently no subsidy programs for small enterprises. The government official also shared that there are no future plans to raise the subsidy if electricity prices continue to rise.

Although an electricity subsidy for the very poor may help in some aspects, it also discourages them from increasing the amount used in order to use it economically. For example, a household who is receiving this subsidy may consider buying an ice breaking machine to start selling drinks. However it would be risky to try this because although the economic use of

electricity could pay off in increased income, the additional KW/h used would disqualify the household from the subsidy.

The second aspect of affordability is the initial investment necessary to use electricity economically. In order for rural villagers to begin most medium sized enterprises they need to secure a loan. However, loans are only given out to people if there is property that can be signed as collateral. Without a wealthy family member who can provide collateral, rural villagers don't have the opportunity to open a factory or other enterprise which would use electricity economically.

4.3 Support programs

The interview questions sent to an expert in rural development revealed that there are currently no government programs helping rural villagers use electricity economically. They do not provide workshops or information on electricity uses in the agriculture sector, or for small enterprises. There are however "loans with preferential interest rates (low interest rate) for the establishment of small and medium enterprises in rural areas". Interviews with local people though suggested these loans were not very accessible. This expert explained that the government is more concerned with getting electricity access to all people for daily uses rather than investing time and energy into programs promoting economic uses. The biggest challenge for rural development currently is investment in poor infrastructure in rural areas.

5. Conclusion

The research conducted in Hòa An village concludes that although electricity is being used productively, it is not being used economically. Quality of life of villagers has improved through access to fans, lighting, water pumping, and rice cookers. Incomes however, have not improved with the introduction of electricity. The research emphasized the disconnect in knowledge of ways to use electricity economically. The main challenges faced in this village include lack of knowledge, and affordability. There are currently no government programs to aid rural people in utilizing electricity economically which would lead to an improved local economy, and eventually help the national economy. The five step systematic approach for rural electrification by the Energy Sector Management Assistance Program would be a very beneficial framework to use in Hòa An.

- i. Identify the productive activities and the sectors in which they currently take place in the project area.
- ii. Carefully analyze the production processes involved within the region of interest. Identification of the existing limitations and areas of possible improvement of these processes.
- iii. Analyze the role electricity can play and what equipment is required.
- iv. Analyze the technical feasibility and economic and social viability of the electrically based solution proposed.
- v. Implement a promotion campaign to communicate the gains that can be obtained. Based on the results of the earlier analysis, the campaign should target specific energy users and promote a specific use of electricity that can provide them with clear benefits.

The implementation of these steps would address the main challenges faced by the people in Hòa An village. It would assess the needs of the people and productive local sectors. After

developing a comprehensive plan a promotional campaign would communicate all the benefits of productive electricity uses to the people.

A program like this would benefit from an incentive program given by the provincial or national government level. An incentive program comprised of subsidies, loans, etc. would work to combat the issue of initial enterprise investment. The program should promote increased use of electricity, which the government has worked so hard to share with the whole rural population.

If programs like these could be implemented in Vietnam it would lead to higher quality of life in rural areas, increased economic activity, decreased income inequality, and overall, national economic growth.

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7. Appendices

Appendix 1: Survey in English

ISP questionnaire

1. What year did your home first have access to electricity, “on the grid”?
 - a. _____
 - b. We still don’t have electricity
 - c. Don’t know
2. In what ways do you use electricity in daily life?
 - a. Lights
 - b. Cooking
 - c. Water collection
 - d. Fans
 - e. Other _____
3. In what ways do you use electricity for economic purposes (for your job, production, etc.)?
 - a. Please explain
4. How often did you experience electricity blackouts before 2010 (if your home had access to electricity)?
 - a. 2+ times a week
 - b. Once a week
 - c. 2 times a month
 - d. Once a month
 - e. Never
 - f. Other _____
5. How often do you experience electricity blackouts now?
 - a. 2+ times a week
 - b. Once a week
 - c. 2 times a month
 - d. Once a month
 - e. Never
 - f. Other _____
6. On average, how long do the blackouts last?
 - a. Less than an hour
 - b. 1-6 hours
 - c. 6-12 hours
 - d. 12-18 hours
 - e. 18-24 hours
 - f. 24+ hours
7. In what ways do blackouts affect your family’s daily routine? (select all that apply and please specify which family members are affected by each)
 - a. Spend time collecting and cleaning water
 - b. More time required for preparing meals
 - c. Decreased activity due to heat and no power for fans
 - d. Business must close or cannot function as normal
 - e. Can’t work
 - f. Loss of income

- g. Children cannot attend school
 - h. No effects
 - i. Other _____
8. On average, how much do you pay for electricity each month?
 - a. less than 50,000 VND
 - b. 50,000 - 100,000 VND
 - c. 100,000 - 150,000 VND
 - d. 150,000 - 200,000 VND
 - e. more than 200,000 VND
 9. To compare with family income per month, what proportion of electricity cost to income by month?
 - a. Less than 10%
 - b. 10-15%
 - c. 15-20%
 - d. 20-25%
 - e. 25-30%
 - f. More than 30%
 10. Electricity is very affordable
 - a. Strongly agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly disagree
 11. Would you use electricity in additional ways/ more often if it was more affordable? (please explain)
 - a. Yes
 - b. No
 - c. Maybe
 12. Would you consider using another supplementary form of energy? (circle all that apply)
 - a. Bio-gas
 - b. Wind
 - c. Solar
 - d. None of the above
 - e. Other: _____
 13. How many people live in your household?
 14. What is the main occupation of your household?

Appendix 2: English survey translated to Vietnamese

ISP questionnaire

1. Gia đình ông/bà đã được tiếp cận với mạng lưới điện từ năm nào?
 - a. _____
 - b. Chúng tôi vẫn chưa có điện để sử dụng
 - c. Không nhớ rõ

2. Ông/bà sử dụng điện thông qua những phương tiện nào?
 - a. Đèn điện
 - b. Nấu ăn
 - c. Lấy nước (bơm nước)
 - d. Quạt gió
 - e. Khác _____

15. Có/chưa có sử dụng điện cho kinh doanh, sản xuất không?
16. Sử dụng điện như thế nào?
 - a. Hãy giải thích

4. Trước năm 2010, ở gia đình mình mất điện bao nhiêu lần? (trong trường hợp gia đình đã có điện sử dụng)
 - a. Hơn 2 lần 1 tuần
 - b. Một lần một tuần
 - c. 2 lần một tháng
 - d. Một lần một tháng
 - e. Chưa bao giờ bị mất điện
 - a. Khác _____

5. Hiện tại thì bao nhiêu lần gia đình mình bị mất điện?
 - a. Hơn 2 lần 1 tuần
 - b. Một lần một tuần
 - c. 2 lần một tháng
 - d. Một lần một tháng
 - e. Chưa bao giờ bị mất điện
 - f. Khác _____

6. Trung bình thì mỗi lần cúp điện kéo dài bao lâu?
 - a. Ít hơn một tiếng
 - b. 1-6 tiếng
 - c. 6-12 tiếng
 - d. 12-18 tiếng
 - e. 18-24 tiếng
 - f. Trên 24 tiếng

7. Mất điện ảnh hưởng đến những hoạt động thường ngày như thế nào? (có thể chọn tất cả các đáp án và nêu rõ thành viên nào chịu ảnh hưởng bởi yếu tố nào?)

- a. Mất thời gian để lấy và làm sạch nước
 - b. Mất thời gian để chuẩn bị bữa ăn
 - c. Các hoạt động thường ngày bị giảm lại do nóng nực và không có điện để sử dụng quạt gió
 - d. Các hoạt động kinh doanh sản xuất bị ngưng lại hoặc không thể hoạt động như bình thường
 - e. Không thể làm việc
 - f. Mất đi thu nhập
- b. Con trẻ không đi học được
 - c. Không có ảnh hưởng gì
 - d. Khác _____
8. Trung bình thì tháng vừa rồi, tiền điện của gia đình mình là bao nhiêu?
- a. Nhỏ hơn 50,000 VND
 - b. 50,000 - 100,000 VND
 - c. 100,000 - 150,000 VND
 - d. 150,000 – 200,000 VND
 - e. Nhiều hơn 200,000 VND
9. So với thu nhập của gia đình mỗi tháng thì chi phí trả cho điện sử dụng chiếm khoảng bao nhiêu phần trăm?
- a. Ít hơn 10%
 - b. 10-15%
 - c. 15-20%
 - d. 20-25%
 - e. 25-30%
 - f. Nhiều hơn 30%
10. Chi phí cho tiền điện là rất hợp lí
- a. Rất đồng ý
 - b. Đồng ý
 - c. Không có ý kiến
 - d. Không đồng ý
 - e. Rất không đồng ý
11. Ông/bà có sử dụng điện nhiều hơn, thường xuyên hơn nếu giá cả điện hợp lí hơn không?(Hãy giải thích)
- e. Có
 - f. Không
 - g. Có thể
12. Gia đình có ý định sẽ sử dụng thêm loại năng lượng nào khác nữa không? (có thể khoanh tròn tất cả các đáp án)
- a. Biogas
 - b. Năng lượng gió
 - c. Năng lượng mặt trời
 - d. Không sử dụng nguồn năng lượng nào phía trên cả

e. Khác: _____

13. Gia đình có/ chưa có bao nhiêu thành viên?

14. Nghề nghiệp chính?

Appendix 3: In depth interview guide for households, English

1. Has your job/ methods of making a living, changed since having access to electricity?
2. Are you better off financially since having access to electricity?
3. Do you feel your daily life is easier/ more enjoyable since having access to electricity?
 - a. What has changed in your daily life? (cooking methods, water, lights at night extending hours to do work)
4. Have you noticed any changes in the community since getting electricity? (social changes, economic changes, environmental changes)
5. Are there additional ways you would like to use electricity?
 - a. Why have you not yet done this?
6. Do you feel that electricity is affordable?
7. How has your access to water/ clean water, changed since getting electricity?
8. Did you ever experience blackouts after getting electricity?
9. How did these blackouts affect your life?
10. Are you still experiences blackouts?
11. Do you use any other forms of energy to supplement your electricity?
12. Do you have future plans to use electricity (or other forms of electricity), to change your lifestyle or methods of making a living?

Appendix 4: In depth interview guide for households, translated to Vietnamese

1. Công ăn việc làm của gia đình có sự thay đổi nào không khi có điện sử dụng?
2. Từ khi có điện, tình hình kinh tế của gia đình có tốt hơn không?
 - a. Ông/bà có cảm thấy cuộc sống thường ngày của gia đình mình trở nên dễ dàng hơn/ thoải mái hơn khi có điện hay không?
3. Trong cuộc sống hằng ngày, những thứ gì đã thay đổi? (cách để gia đình nấu ăn, nước sử dụng, có đèn vào buổi tối sẽ có nhiều thời gian làm việc hơn)
4. Ông/bà có nhận thấy từ khi có điện, trong ấp mình có sự thay đổi nào không? (thay đổi về mặt xã hội, kinh tế, môi trường)

5. Còn có phương thức nào khác ông/bà có thể có điện để sử dụng không?
 - a. Tại sao ông/bà vẫn chưa sử dụng nó?
6. Ông/bà có cảm thấy giá điện là hợp lí/ phải chăng?
7. Từ khi có điện, cách ông/bà sử dụng nước/nước sạch thay đổi như thế nào?
8. Từ khi có điện trong gia đình đến nay, ở gia đình mình có xảy ra tình trạng mất điện hay không?
9. Việc mất điện ảnh hưởng như thế nào đến cuộc sống của ông/bà?
10. Hiện tại thì mất điện vẫn còn xảy ra?
11. Ông/bà có sử dụng nguồn năng lượng nào khác để bổ sung điện sử dụng cho gia đình mình hay không?
12. Trong tương lai, ông/bà có dự định sẽ sử dụng điện (hoặc các hình thức khác của điện) để thay đổi cách sống hoặc phương pháp để kiếm sống hay không?

Appendix 5: Interview question guide for rice factory owner

1. What year did your factory open?
2. Did you have electricity access before opening? If not, what year did you first get electricity?
3. How many people do you employ? Are they family members or villagers?
4. How has your business profit improved with access to electricity?
5. Does it allow you to produce more rice?
6. Has the size of your business grown in recent years?
7. Have you hired more employees in recent years?
8. Do you feel the price of electricity is reasonable?
9. Do you plan to expand your business in the future?
10. Do your employees make more money working here than harvesting/ farming?
11. Do you use electricity in any other ways to make money?
12. When opening your factory, how did you make the money to initially invest?

Appendix 6: Interview question guide for local leader

1. How long have you lived in this village?
2. How long have you been a leader in this village?
3. What responsibilities do you have as the leader?
4. Were you involved with bringing electricity to the village?
5. Do you know what year the village received electricity, or did different hamlets receive it at different times?
6. Many people we surveys said that their life is more comfortable since getting electricity, do you feel as though people are utilizing it in ways to better their financial situation? (for economic purposes)
 - a. If not, do you think they know of ways to use electricity to help make money/ make their jobs more efficient?

- b. What do you feel is the main obstacle for families to start using electricity for production and making money? (Initial investment in machinery and appliances, education on ways to use electricity to make money, etc.)
 - c. Are there any plans in the village to help families make the change from using electricity for only daily needs, to using it to develop and grow?
7. How many factories do you know of in the village that use electricity for production?
 8. Overall do you think villagers are better off since getting electricity? (Financially, standard of living, etc.)
 9. One villager mentioned a 30,000 VND payment they receive every month from local authorities to help pay for electricity. Do you know about this subsidy?
 - a. Who pays for it?
 - b. Who receives it/ how does someone qualify for it?
 - c. Do you think it's enough of a subsidy to help the people?
 - d. What are the future plans with subsidies if electricity prices rise?

Appendix 7: Interview question guide for rural development expert

1. What are the main goals of rural development in Vietnam?
Những mục tiêu chính của phát triển nông thôn tại Việt Nam là gì?
2. Electricity access has been given to a large amount of rural areas, are there any government programs that educate people of these villages as to ways they can use the electricity for economic growth? (agriculture sector and non-agriculture)
Nguồn điện đã được cung cấp đến phần đông người dân tại các vùng nông thôn, vậy thì hiện nay có Chương trình nào của nhà nước hướng dẫn người dân ở khu vực làng này sử dụng điện để giúp tăng trưởng kinh tế không? (cả trong lĩnh vực nông nghiệp và phi nông nghiệp)
3. Are there any electricity subsidy programs for rural people beginning small enterprises?
Có Chương trình hỗ trợ điện cho người dân vùng quê thực hiện những dự án kinh doanh nhỏ?
4. Are there any government programs that assist rural people in getting loans to begin small enterprises?
Nhà nước có Chương trình nào hỗ trợ vốn cho người dân quê để thiết lập các doanh nghiệp nhỏ?
5. Are there any plans in place for future programs to help shift the use of electricity in rural areas from only daily uses to productive economic purposes?
Hiện nay nhà nước có kế hoạch gì cho tương lai nhằm giúp chuyển đổi việc sử dụng điện của người dân tại vùng quê từ việc sử dụng hàng ngày sang việc sử dụng mang tính hiệu quả kinh tế?
6. What do you feel are the next steps in rural development for areas who have recently gotten access to electricity?
Theo Anh/Chị, những bước cần giải quyết tiếp theo tại những khu vực nông thôn nơi mà nguồn được vừa mới được cung cấp là gì?
 - a. What are the biggest challenges facing further rural development?
Thử thách lớn nhất đối với việc phát triển nông thôn là gì?

Appendix 8: Interview question guide for government official

Through interviewing people of the Hoa An rural village, I was told about an electricity subsidy given to very poor people.

Thông qua việc phỏng vấn với người dân tại Hòa An, em có được nghe nói về chính sách trợ giá điện cho người nghèo.

1. How much is this subsidy for and how often is it given?
Tổng mức giá trị của việc trợ giá là bao nhiêu và việc trợ giá diễn ra bao lâu một lần?
2. Who can receive the subsidy? (how do they qualify)
Đối tượng nhận trợ giá là ai? (bằng cách nào mà họ được xác nhận là nhận được trợ giá)
 - a. If they qualify by income, how does the government have this information?
Nếu xác nhận để được trợ giá bằng thu nhập, thì bằng cách nào nhà nước có được thông tin này?
3. How long has this program been going on for?
Chương trình trợ giá đã được thực hiện bao lâu?
4. Has the subsidy always been the same amount?
Mức trợ giá luôn luôn duy trì hay sao?
5. As electricity prices in the country increase, are there plans for the subsidy to increase proportionally?
Theo như em được biết, giá điện tăng, vậy thì nhà nước có kế hoạch gì để tăng việc trợ giá không?
 - a. If yes, where will the increased budget come from?
Nếu có, nguồn ngân sách tăng đó lấy từ đâu?
6. Are there any subsidies for rural villagers doing small scale production (such as a family rice production factory)?
Có Chương trình trợ giá nào dành cho người dân vùng nông thôn thực hiện sản xuất quy mô nhỏ không (ví dụ hộ gia đình sản xuất gạo)?
7. Do you have any statistics you can share on percentage of rural people who receive the subsidy, how much overall is given each period, etc.?
Anh/Chị có số liệu thống kê (theo phần trăm) tỷ lệ người dân nhận được trợ giá, và giá trị tổng thể một năm họ nhận được là bao nhiêu?