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Energy Management Analysis in Oriental Mindoro: A Basis for a Prepaid Electricity

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Abstract:

The researcher became interested in this study because Philippines is one of the countries that has high rates on electric energy consumption. As cited in Manila Bulletin (2011), Philippines has the most expensive electricity in the whole of Asia because it privatized its electric power sector and has no state subsidy on rates. Energy consumption is one of the concerns of those people below middle class bracket. This renders monitoring of energy consumption as an urgent factor for costumers with limited budget to address. According to Dr. Romulo A. Virola of National Statistical Coordination Board (2011, slide 10), "the magnitude of subsistence poor population is 9.4 million in 2009." For those people belonging to this status, a prepaid retail electric service would be highly beneficial to them to avoid disconnection of electric supply from the distribution company.

This study aims to analyze the level of supply of electricity and the consumers related concerns along with the extent of energy management effectiveness. The quantitative research employing descriptive-correlational method was chosen by the researcher to give appropriate answers to the questions.

Findings revealed that ORMECO's Power Suppliers met the monthly contracted energy. ORMECO prevented power outage through a maintenance plan. However, results indicate that high energy consumptions occur during summer hence the rotating brownouts are not completely eliminated due to slight shortage of energy supply during dry season. Further analysis revealed that ORMECO manages and controls the system losses reducing the operational cost.

Innovations relative to measurement system was adapted and ensure high security features in the use of electric gadgets.

Based on the findings and conclusions, the researcher recommends that ORMECO needs to continuously develop a program that would totally eliminate power interruptions due to insufficient supply of energy. Moreover, ORMECO needs to provide public awareness on conservation of energy by giving free seminar and/or posting it on their website. The SMS Reporting System numbers is also suggested to be included in the bill of statement so that costumer can immediately verify their queries. And lastly, consider the proposed Prepaid Electricity system for energy consumption management.

Key words: Prepaid electricity, energy management, energy consumption, rotating brownouts, conservation of energy

I. INTRODUCTION

Republic Act No.9136 also known as "Electric Power Industry Reform Act of 2001" explicitly states the need *"to encourage the efficient use of energy and other modalities of demand side management."* Through this act, consumers can regulate the use of electric energy according to their needs and affordability to pay the consumption. Energy should also be conserved considering that fuels are becoming increasingly limited in supply [1].

The supply of electric energy is basic to all business establishments, hospitals, and residential areas. All of these sectors are very dependent on normal distribution of electricity from utility companies to continue services to its customers, patients, and to manage all household activities.

As a matter of fact, energy consumption is one of the concerns of those people below middle class bracket. This renders monitoring of energy consumption as an urgent factor for costumers with limited budget to address. According to Dr. Romulo A. Virola of National Statistical Coordination Board

(2011, slide 10), "*the magnitude of subsistence poor population is 9.4 million in 2009"* [2]. For those people belonging to this status, a prepaid retail electric service would be highly beneficial to them to avoid disconnection of electric supply from the distribution company. When disconnection has been served to the consumer, the distribution company asks for additional charges due to late payment and reconnection fee settlement of which adds additional burden to the consumers. It also gives a lot of inconvenience to the end-users when supply of electricity is disrupted. But monitoring of the energy consumption which needs to be done regularly is a problem as well for the customers since the electric meter is installed in the electric pole which is about six (6) feet and above from the ground. This renders the end-users to be out of control as to the usage of electricity.

The uncontrolled usage of electricity is an added problem of those family with limited income. For one thing, even the usage of electric fans becomes inevitable because of temperature rise due to climate change. Electric fans for that matter have become regular amenity even in ordinary households since they are considered a necessity. The well-off families use air conditioning units. These two electric devices and other high power equipment consume much energy that could result in rotating brownout when energy to be supplied by the distribution company is not sufficient. Given this situation everybody is encouraged to conserve energy to prevent power interruption.

The above-cited problems are common to all consumers in Oriental Mindoro in particular, the ORMECO clienteles belonging to the middle low-income groups. There is difficulty in coping with the charges from consumption, aggravated by the increase that accrues from the generation charges. Added to this is the discomfort due to power interruption either due to rotating brownout or disconnection. Both have compounded the existing problems on electricity.

As cited in Manila Bulletin (2011), our country has gained a new record, that of having the most expensive electricity in the whole of Asia. It is said that this is because the Philippines is the only country in the region that has privatized its electric power sector and has no state subsidy on rates. Furthermore, the International Energy Consultant has traced the high cost of electricity from all costs - from producing power to distribution and taxes that are passed on to consumers. These are the main reasons why consumers cannot avail of low rates for energy consumption. The study also found out that household consumers in the Philippines pay the highest at an average of P10 per kilowatt-hour, shouldering the biggest burden of high electric rates. This is different from other Asian countries, where rates for commercial establishments are highest [3].

System loss is one of the factors that cause the increase of electric bill. The two forms of system losses are technical loss and non-technical loss.

Technical losses comprise mainly of power dissipation in electricity system components such as transmission and distribution lines, transformers, and measurement systems (Antmann, 2009) [4]. But these technical losses are being charged by the Distribution Company to the consumers since it is allowed by the Energy Regulatory Commission; hence there is no possibility for the consumer to control these charges.

Non-technical losses are caused by external factors that consist primarily of electricity theft, unsettled accounts of customers, and errors in accounting and record-keeping (Antmann, 2009) [4]. The non-technical losses are determined by subtracting the technical losses from the total losses.

It is clear that controlling of electric usage is not easy hence, the household consumers must be aware of the types of light being used and its wattage; the wattage of different home appliances and devices, the frequency of its usage; the appliances and devices that can be controlled when limited energy arises; and their financial plan for energy consumption.

Research Locale

Oriental Mindoro is one of the developing provinces in the Philippines. At present, a daily minimum income per capita in Calapan City and Puerto Galera is Php270, Php260 for first class municipalities, and Php255 for the rest of the province based on provincial rate for establishments with more than 10 employees (MIMAROPA-DOLE Website) [5]. This income has to be scrutinized to support daily needs and to pay monthly bills for water, electricity, cable television, etc.

The Oriental Mindoro Electric Cooperative (ORMECO) is non-stock, non-profit and service-oriented rural electric cooperative that uses diesel fuel for power generation (ORMECO Website). ORMECO is a sub-station company that supplies electricity in Oriental Mindoro which is located at Sta. Isabel, Calapan City [6].

Water and electricity are basic energy needs which have no fixed charge; it is being paid according to monthly consumption. Thus, the electricity consumption every month varies and usually increases since cost of electricity rises indiscriminately.

At present, there are some houses in the remote areas of Oriental Mindoro that are not yet connected to the power lines of ORMECO due to some reasons: there is no right of way to erect a post for transmission lines, the houses are far from one another, and there are no requests or permit from the barangay officials.

Theoretical Framework

This study was anchored on Design-Based Research Method (DBR) that seeks to bridge theory and practice in education to uncover the relationships between educational theory, designed artifact, and practice. Because of the combined experimental educational research and theory-driven design in learning

environment, DBR is considered a significant approach to know how, when, and why educational innovations work in practice [7].

The foregoing theory lends support to the current study which focused on the introduction of a new innovation in the form of prepaid electricity to monitor electric consumption. After all the study deals on the implications to the consumers monitoring of electric consumption for economy and financial viability. The theory provided a design or foundation that could be applicable to the settings under study.

This study was also anchored on Ohm's Law (Education Portal, 2015) which states that the current (I) is directly proportional to the voltage (v) and inversely proportional to the resistance (R) [8]. The greater the current that draws from a line, the greater the power. The power consumption increases as the time of using electric devices becomes longer and also when consumer uses devices with high power rating. The cost of electric bill is proportionate to the energy consumed by the end-user.

Still another theory that lends credence to the study is the law of conservation of energy (Serway & Jewett, 2004) which states that energy is neither created nor destroyed, it is merely transformed from one form to another. Windmills changes the wind's energy into mechanical energy to turn turbines, which then produce electricity. Another is solar cells, it changes sunlight known as radiant energy into electrical energy [9].

Primary energy sources take many forms, including nuclear energy, fossil energy -- like oil, coal and natural gas -- and renewable sources like wind, solar and hydropower. These primary sources are converted to electricity, a secondary energy source, which flows through power lines and other transmission infrastructure to your home and business (Energy sources, 2014).

Conceptual Framework

The conceptual framework is shown below:

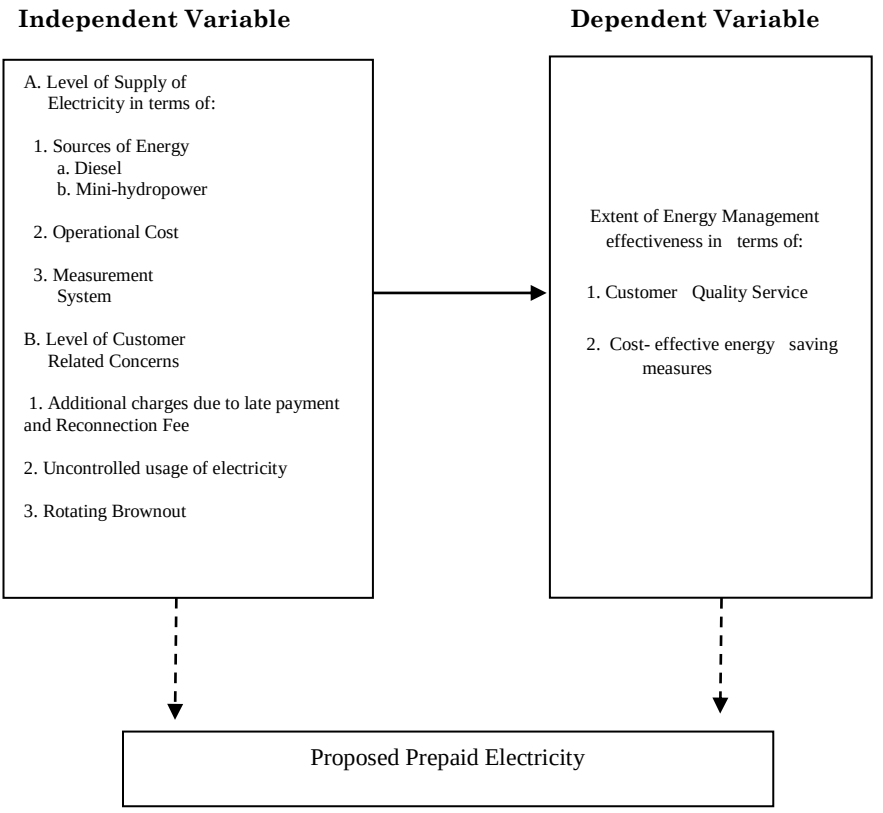

Figure 2: Conceptual Framework

The independent variable (IV) is the level of supply of electricity in terms of sources of energy: diesel and hydropower; operational cost and measurement system. This will be correlated with the level of customer related concerns (DV) and to the extent of energy management in terms of customer quality service and cost-effective energy saving (DV).

The level of customer related concerns in terms of: additional charges due to late payment, reconnection fee,

uncontrolled usage of electricity and rotating brownouts will be correlated also with the extent of energy management (DV).

The researcher will propose a prepaid electricity program.

Statement of the Problem

This study analyzed the level of supply of electricity and the consumers related concerns along with the extent of energy management effectiveness.

Specifically, the study answered the following questions:

1. What is the level of supply of electricity in terms of:
    a. sources of Energy
        - Diesel fuel
        - Mini-hydro power plant
    b. operational cost
    c. measurement system
2. What is the level of customer related concerns in terms of:
    a. additional charges due to late payment and reconnection fee
    b. uncontrolled usage of electricity
    c. rotating Brownout
3. What is the extent of energy management effectiveness in terms of:
    a. customer quality service
    b. cost-effective energy saving measures
4. Is there a relationship between level of supply of electricity in terms of the mentioned indicators and extent of energy management effectiveness such as customer quality service and cost-effective energy saving measures.
5. Is there a relationship between level of customer related concerns in terms of additional charges due to late payment and reconnection fee, uncontrolled usage of electricity and rotating brownout and the extent of energy management effectiveness in

terms of customer quality service and cost-effective energy saving measures.
6. What proposed Prepaid Electricity program can be endorsed to the consumers of Oriental Mindoro?

Statement of the Hypotheses

There is no relationship between:
1. level of supply of electricity in terms of the mentioned indicators and extent of energy management effectiveness such as customer quality service and cost-effective energy saving measures.
2. level of customer related concerns in terms of additional charges due to late payment and reconnection fee, uncontrolled usage of electricity and rotating brownout and the extent of energy management effectiveness in terms of customer quality service and cost-effective energy saving measures.

Scope and Delimitations of the Study

This study covered the analysis of the energy management system of ORMECO in Oriental Mindoro for three years, 2011, 2012, and 2013.
It focused on the level of supply of electricity in terms of: sources of energy – diesel and hydropower; operational cost and measurement system.
It also focused on the level of customer related concerns in terms of: additional charges due to late payment, reconnection fee, uncontrolled usage of electricity and rotating brownout.
Based on the results of the study, a prepaid plan for electric consumption charges was proposed.

Significance of the Study

This study aimed at achieving a commendable analysis of energy management in households that would lower the power consumption. Specifically, this study would be beneficial to the following:

Consumers. The consumers would be able to manage energy and to reduce cost of electrical charges. This would also introduce a new concept of technology which can give better option for consumers.

Distribution Company. This study would work to the advantage of the distribution company since they would be able to address the problem on unpaid bills of consumers and solve other cost related problems and assure quality service and offer cost-saving means for the consumers.

Future Researchers. This study would hopefully help the future researcher to determine the benefits of energy management. This would help researchers to know the advantages and disadvantages of employing prepaid meter to the customers.

Reconnection fee. The fee that must be paid to the office so the service could be reinstalled.

Rotating Brownout. The cessation of supply of electricity especially experienced during unholy hours.

Technical Workers. The ORMECO Employees who have technical know-how of the company's operation.

Uncontrolled usage of electricity. This is the excessive use of gadgets, computer, lamps, dispenser, electric fans, air conditioning unit and refrigerator and other equipment that need electricity.

II. REVIEW OF RELATED LITERATURE

Alternative energy encompasses (Conserve Energy Future, 2014) all those things that do not consume fossil fuel. They are widely available and environment friendly. They cause little or almost no pollution. There have been several alternative energy projects running in various countries to reduce dependence on traditional fossil fuels.

Solar is the first energy source in the world. It was in use much earlier before humans even learn how to light a fire. Many living things are dependent on solar energy from plants, aquatic life and the animals. The solar is mostly used in generating light and heat. The solar energy coming down to the planet is affected by the orbital path of the sun and its variations within the galaxy. In addition, it is affected by activity taking place in space and on the sun. It was this energy that is believed to have been responsible for the breaking of ice during the ice age, which creates the separation of lands and sea.

Solar energy is one alternative energy source that is used most widely across the globe. About 70% of the sunlight gets reflected back into the space and we have only 30% of sunlight to meet up our energy demands. Solar energy is used for drying clothes, used by plants during the process of photosynthesis and also used by human beings during winter seasons to make their body temperature warm. Solar energy can be extracted either by their solar thermal or using Photovoltaic (PV) cells.

There are two kinds of solar energy, the active solar energy and the passive solar energy. Passive solar energy basically uses duration, position and sun's rays intensity to its advantage in heating a particular area. It is also used to induce airflow from an area to the next. Active solar energy uses electrical technology and mechanical technology like collection

panels in capturing, converting and storing of energy for future use.

Moreover, solar energy is widely used by many countries since it is pollution free. It is renewable source of power since sun will continue to produce sunlight all the years. Solar panels, which are required to harness this energy can be used for long time and require little or no maintenance. However, solar energy proves to be ineffective in colder regions which don't receive good sunlight. It cannot also be used during night time since not all the light from sun can be trapped by solar panels. It is to be noted though that solar energy advantages are much more than its disadvantages and it remains a viable source of producing alternative energy (Conserve Energy Future, 2014) [10].

The next indicator is the quality of customer service. The quality of customer service is the key differentiator between good and bad in different companies. Good quality customer service keeps customers coming back; bad customer service drives customers away, taking their friends, family and workmates with them.

All else being equal, good quality customer service gives the edge over competitors. Regardless of industry, there are the 9 key principles of good customer service that always make business sense (Swinston, 2009)

First principle is attracting new customers' costs more than retaining existing customers. A satisfied customer stays with a company longer, spends more and may deepen the relationship. For example a happy credit card customer may enlist the company's financial services and later take travel insurance. This is an easy "sell", and is more advantageous compared to direct marketing campaigns, television advertisements and other sophisticated and expensive approaches to attract new customers.

The second principle pertains to customer service that costs real money. Real costs are associated with providing

customer service and companies spend in line with a customer's value. A high value customer or one with the potential of being high value, will be serviced more carefully. In some companies cost of customer service is reduced by using telephone voice response systems, outsourcing call centers to cheaper locations, and self-servicing on the internet. However companies risk alienating customers through providing an impersonal service.

Third principle is to understand the customers' needs and address them. To understand your customer's needs, the company should listen to the "voice of the customer" and take action accordingly. Customer listening can be done in many ways, such as: feedback forms, mystery shopping, and satisfaction surveys. Some companies resort to involving senior employees in customer listening to ensure decisions benefit the customer as much as the company.

The fourth principle is good process and product design is important. Good quality customer service is only one factor in meeting customer needs. Well-designed products and processes will meet customers' needs more often. Quality movements, such as Six Sigma, consider the "cost of quality" resulting from broken processes or products. Is it better to service the customer well than to eradicate the reason for them to contact you in the first instance?

The fifth principle is Customer-service must be consistent. Customers expect consistency in quality of customer service like a visit to an expensive hairdressing saloon may include a friendly welcome, a refreshing drink and a warm accommodation. These are done in branches outside of the main.

The sixth principle is to treat employees as customers too. The quality management movement brought the concept of internal and external customers. Traditionally the focus was on external customers with little thought given to how internal departments interacted. Improving relationships with internal customers and suppliers assists delivery of better customer

service to external customers, through reduced lead-times, increased quality and better communication.

The "Service-Profit Chain" model developed by Harvard University emphasizes the circular relationship between employees, customers and shareholders. Under-staffed, under-trained employees will not deliver good quality customer service, driving customers away. Equal efforts must be exerted to attract, motivate and retain employees as customers, to ultimately deliver improved shareholder returns. Better shareholder returns mean more money and is available to invest in employees and so the circle continues.

Principle seven is open all communications channels. The customer establishes contact in many ways – face to face, by mail, phone, fax, and email - and expects all of these communication channels to be open and easily inter-mingled.

This presents a technical challenge, as it requires an integrated, streamlined solution providing the employee with the information they need to effectively service the customer.

The eight principle is every customer contact is a chance to shine. If a customer contact concerns a broken process, then empowered employees will be able to resolve the complaint swiftly, possibly enhancing the customer's perception of the company. Feeding back this information allows corrective action, eliminates further occurrences of the same nature.

If customers are informed about new products or services when they establish contact, a valuable sale is made turning the cost center into a profit center. This is only possible when there is a good relationship with the customer, where their specific needs are met. A targeted sales pitch will have a good chance of success, as the customer is pre-sold on the company's reputation.

The last principle is people expect good customer service everywhere. On an average day, whether one travels on a train, buys coffee, or simply works, the train is expected to be on time, clean and at a reasonable cost. One expects the coffee

to be hot and delivered quickly and work mates work with each other to get the job done.

People become frustrated when their expectations are not met, and increasingly demand higher service quality in more areas of their lives.

Providing outstanding customer service at the right price is the holy grail of most companies. It is worth remembering that everybody experiences customer service everyday. The quality of customer service will make one stand out from his competitors – make sure it's for the right reasons! (Swinton, 2009) [11].

Another literature is about energy efficiency that is widely perceived to be cost-effective, and is frequently portrayed as the lowest-cost utility resource available. Many states in the U.S. are currently establishing aggressive energy efficiency goals that are likely to require significant increases in funding. The success of these programs relies in part on the assurance that programs are indeed being run cost-effectively.

In 2004, American Council for Energy Efficient Economy (ACEEE) reviewed the cost-effectiveness results from nine leading states. On the costs of "saving" kilowatt-hours (kWh) through utility ratepayer-funded energy efficiency programs, the reported utility costs of saved energy (CSE) ranged from $0.023 to $0.044 per kWh (with a median value of 3.0 cents/kWh).

This report pointed to an energy efficiency programs from recent years in 14 states that have utility CSEs ranging from $0.016 to $0.033 per kWh, with an average cost of $0.025 per kWh. The six natural gas efficiency programs covered in this report also saved energy cost-effectively – spending $0.27 to $0.55 per therm, with an average of $0.37 per therm.

At these costs of saved energy (CSE), energy efficiency is by far the least costly energy resource option available for utility resource portfolios. Saving a kilowatt-hour through energy efficiency improvements is easily one-third or less the

cost of any new source of electricity supply, whether conventional fossil fuel or renewable energy source. In addition, the results of this research suggested that the cost of energy efficiency would remain very consistent across states and over time. Given these strong results, and the many other environmental and job creation benefits, states have supported the creation and expansion of energy efficiency programs, and increasingly viewed energy efficiency as their "first fuel" of choice (Friedrich, Eldridge, York, Witte & Kushler, 2009) [12].

There are many cost-effective ways on saving lighting energy bill by applying the following:

Replace standard incandescent with reduced wattage. For example, replace a standard 100 Watt with an energy saving 90 Watt lamp since this gives an almost similar light output.

Replace standard incandescent with Halogen. Halogen lamps are much brighter and more focused light so it can be used to replace a high wattage incandescent lamp.

Replace incandescent lamp with compact fluorescent lamp (CFL). Replacing incandescent lamp with CFL reduces almost 75% of energy since a standard 75 Watt down light can be replaced with only about 20 Watts.

Fluorescent replacement or removal. Lamps with ballast can be removed and replaced with lamps that still have excellent light quality.

Replace magnetic ballasts with electronic. Use high-efficiency electronic ballasts instead of magnetic ballasts which are inefficient and considered hazardous waste to prevent emission of carbon dioxide to the environment.

Replace incandescent exit signs with CFL or LED. Incandescent exit signs consume about 40 Watts while CFL signs consume about only 7 Watts and LED signs only about 1 Watt.

Install occupancy sensors. This detects the presence of people and turn lights off when unoccupied that saves energy of 25 to 75%.

Install daylighting controls. This determines the need to light on when there is insufficient light provided by skylights. This can reduce energy about 40% or more when properly designed and installed, and also an excellent means of reducing peak loads on the building's electric system (Energy Answers for Business) [13].

The National Resources Defense Council (2004) mentioned ways on how to reduce energy consumption:

Unplug appliances that are seldom-used; chargers of cell phones and other personal gadgets when not in use; use power strips to switch off television, home theater equipment; and stereo's because the standby mode still consumes electricity which is equivalent to 75 or 100 watt light bulb running continuously.

Set computers to sleep and hibernate. Enable the "sleep mode" and configure "hibernate" after 30 minutes to consume less power during periods of inactivity. These modes will reload everything when the user switches it back on.

Take control of the thermometer. Set the thermostat according to climate condition but always remember that lower temperature can save more energy.

Turn out the lights. Always switch off the light when leaving the room. Work by daylight when possible [14].

As cited in the Electrical Engineer Magazine (2010), Meralco suggested that appliances will operate more efficiently and use less energy when it is in good working condition. The power service provider also added that since summer months are vacation time for children, the appliance usage is expected to go up. Consumers are also expected to maintain their household appliances in order to cope the expected increase in its usage [15].

Energy management is very important to all consumers because energy sources are limited. Consumers must be aware on how to use energy wisely. A few of the energy saving tips provided by ORMECO in their flyers to consumers consist of the following: 1) avoid frequent washing with only few pieces of clothes instead maximize the washing machine's capacity, 2) soak dirty clothes for several hours to minimize the rinse time, 3) go with traditional way of drying clothes under the sun instead of using electric dryer, 3) iron clothes during off-peak hours to reduce from the peak hours demand (before 9am and after 9pm), 4) iron clothes once a weak, 5) turn off air conditioning unit when leaving out the room, 6) switch off lights and other electric devices that emit heat when air conditioning unit is turned on, 7) use small fan to diffuse the cool air inside the room coming from the air condition unit, 8) choose air conditioning unit with higher Energy Efficiency Ratio (EER) because it consumes less energy, 9) always defrost the refrigerators and freezers because having more than ¼ inch thick of ice adds up to the load of the compressor motor, and 10) set the thermostat to a lower level to control the ice build-up.

Another appropriate literature is on Prepaid Retail Electric Service. As cited in Manila Bulletin (2012), Meralco emphasized that the implementation of the Prepaid Retail Electric Service (PRES) should generally be no different from postpaid service. Customers are already familiar with the old system or the postpaid scheme hence the implementation of the new scheme should not deviate from where the customers are familiar with. The concept of prepaid electricity is similar to prepaid phones offered by telecommunications companies that the amount of consumption is differentiated from the credits. Meralco further specified that prepaid credits for electricity to be consumed should be differentiated from prepaid credits bought for other product/services, such as for telecommunications. This refers to the prepaid cards that customers are not allowed to buy in bulk cards since the

Distribution Company has to set limit of kilowatt-hour per household [16].

The prepayment energy metering system provides the following benefits: cancels billing dispute and mistakes; consumer has full control on usage of electricity; improves accelerated cash flow; lowers administrative costs, theft avoidance, no meter reading and billing statement is needed; and provides cost-effective solution with equitable benefits to both tenants and landlords.

Related Studies

In the study of Idalina Baptista (2013) titled Everyday Practices of Prepaid Electricity, it was found out that prepaid systems were increasingly popular in the delivery of urban services in Sub-Saharan Africa, but remain under-theorized. Some scholars highlight the advantages of prepayment to consumers and service providers in the face of weak governments, scant infrastructure planning, unclear land tenure, and persistent poverty. Urban scholars scrutinize the inequality and social controls imposed by prepayment on low-income citizens whose social life rests on a sense of provisionality and uncertainty.

This paper uses the case study of prepaid electricity in Maputo, Mozambique to investigate the dynamics of prepaid electricity in peri-urban areas in terms of access to energy, autonomy of electricity use and divisibility of energy purchases. By paying attention to the everyday practices of electricity use across these three themes, the paper suggested that prepayment would enable and facilitate forms of sociability and social ordering that are not exclusively economic, but also political, familial and technological.

The study has made a contribution to expand theorizations of prepayment in the context of mainstream theories and policies of utility service delivery in poorly

resourced and highly informalized urban areas of Sub-Saharan Africa.

Urban dwellers in Maputo were used to experiencing much uncertainty while using electricity with a conventional post-paid meter. Many of those who connected to the grid prior to the mid-1990s (and even well into the early 2000s) were fitted with conventional meters. They reported receiving electricity bills with unexpected sums to pay, either because the billing covered two or three months of service or because it accounted for an unexpected amount of electricity consumption. Households would soon have their electricity account in arrears, because bills could amount to as much as what the breadwinner could make in a month. If the household wished to contest the bill, it would have to do so after paying it or risk being fined, disconnected, and then they have to pay to be reconnected again. Moreover, setting the record straight could involve several trips to EDM (Electricidade de Mozambique), complicated paperwork and procedures that many could not follow, and, more importantly, hours of work and income foregone. In sum, the conventional post-paid meter was a headache to many families.

It is in this context that prepaid meters appear to electricity users in the peri-urban areas of Maputo as a welcome change to their relationship with EDM [17].

When asked what they thought of the prepaid system CREDELEC, most people expressed some form of satisfaction, especially when compared with the earlier dealings with the post-paid billing system. People often expressed their satisfaction with prepayment in terms of 'autonomy' or 'control' over spending and consumption. For instance, people would favor this system because they would have unmediated control over how much they spent on electricity and when. The opportunity for 'unmediated control' –i.e. by getting EDM out of the equation – seemed to be the important aspect of prepayment. People no longer depended on the uncertain

performance of EDM regarding billing in order to know how much they would have to pay for electricity. It also allowed them to avoid debt and that was welcomed too.

People consumed what they could afford and that gave them a sense of autonomy and empowerment, even if consumption was judicious. With CREDELEC one can control spending. With the old [post-paid meter], consumers used energy thinking you used 300, 400 [Meticais] with a bill of 500! Knowing how to use energy (saber como usar) electricity often meant that members of the household had to discipline themselves–individually and each other –about how much they could use each day or over the course of a week or month. In line with existing ethnographic accounts of prepayment, the disciplining took place through controlling, for instance, when the lights would be on or which appliances were plugged in and in use at any given time.

In a few of the households studied, the lights would be turned on at sunset and switched off right after the novella was over, around 9 or 9.30pm. An engineer who works for an international aid agency, asserted this was a very common practice at Mozambican households. That was the reason why one could see many people lining up at vending posts at the end of the workday: "For the Mozambican all that matters is that you go home and you can watch your novella, then the telejornal (the news), and after that another novella. At 5pm one could see people lining up at a coin slot prepayment system for household electricity.

A technical research titled "Development of a coin slot prepayment system for household electricity" was presented to the faculty of Computer Engineering Department at University of Mindanao by Joebert S. Arquiola Ismael M. Dampac Dijie S. Osnan, August, 2012.

The purpose of the study was to develop prepayment system electricity by coin slot machine and notifies the daily usage of electricity. In addition, this study provides paperless so

the end users may pay as much as they want as long as they have a positive balance and also this prepayment system will be particularly implemented in a boarding house.

Electricity is most needed and has become more important because almost everything is dependent on electricity in our world today. It depends on having the power to keep them running and electricity services are essential for meeting all the basic human needs.

The study provided the customer with convenient method of paying for the electricity, particularly the low income group or those who find it difficult to pay the electric bill as a whole. Nowadays, a number of apartments are into a mastered-metered form of billing in which allocation of the payment is divided by the number of apartment units. With this kind of setup, all consumers pay an exactly the same amount regardless of the consumer's income, capability to pay and level of consumption. With then coin slot payment system, there will be no arrears to collect and the tenant can control their budget for they can manage the use of electricity according to their needs [18].

According to Robins (2010), more than half of all low-income families with a mortgage have struggled to pay their electricity. Between 9 per cent and 11 per cent of households in the middle-income groups were similarly struggling to pay their electricity bills. It was also found that low-income households were more likely to seek help from their power supplier, as were households with three or more occupants, since they used more electricity and thus faced higher bills, or were renting or faced larger proportionate mortgage repayments [19].

The tribunal's chief executive, Jim Cox, said it was clear low-income households with financial commitments such as a mortgage were finding it hard to keep up. House Deputy Speaker Lorenzo Tañada said that the Philippines now holds the unenviable record of having the highest cost of electricity in Asia, beating Japan, Singapore and its more developed

neighbors. In addition, at P8.14 per kilowatt-hour, the price of electricity in the country is now the highest in Asia that is why millions of Filipinos have been suffering from spiraling costs of electricity and 14 million Filipino families have no electricity in their homes (Diaz, 2011) [20].

In a Meralco-GE survey about prepaid electricity on October 27, 2011 1:58pm it was found out that more consumers in Meralco's franchise would rather use prepaid electricity, citing the need to manage their appliance use and match the timing of their household expenses with income.

Results of a recent joint survey conducted by Meralco and global conglomerate General Electric showed just that, Alfredo Panlilio, Meralco senior vice president said in a statement Thursday [21].

"Prepaid and buying *tingi* or sachet is ingrained in the Filipino lifestyle. Many wage earners receive daily or weekly pay, so they would prefer that their expenses from mobile to Internet and — yes — to electricity be also on a *tingi* basis," Panlilio said.

"This enables them to bridge the timing of their cash outflows," the Meralco official noted.

Consumer interest in the prepaid system as a budget tool revolve on the need to teach other household members to save and share expenses, according to the survey.

"If this can be made possible, [consumers] will avoid the monthly experience of having to pay a one-time big amount. With the prepaid scheme, electricity, thus, becomes more *abot kaya* for some segments of our customers," Panlilio said.

Meralco customers believe that an effective management of electricity consumption using the prepaid system can actually lead to savings, according to the official.

The pulse of customers "This prepaid innovation is meant to give our customers power of choice. That is why we wanted them to be involved from the beginning of this undertaking," the he noted.

The consumer study was implemented as part of the distribution utility's desire to monitor the pulse of its customers. The research involved focus group discussions and in-depth interviews with respondents from Meralco's franchise areas.

The Meralco prepaid electricity is similar to the system of loading mobile phone credits that can be bought at the nearest *sari-sari* store or prepaid outlet. Using the consumer's subscriber information number, the amount of prepaid credits is loaded via text message.

Prepaid electricity is already in place in South Africa and Indonesia, and more recently in India, Australia, and New Zealand. In South Africa and Indonesia, consumers use tokens and a meter with numbered keys where a code is punched in to load credits, according to Meralco.

"What will make Meralco's implementation different from those countries is our leveraging on the strength of prepaid telecoms in the Philippines," Panlilio said.

"The Filipino's love affair with his prepaid mobile is a powerful vehicle we will ride on, making the Philippine implementation somewhat unique versus the early adopters of the service," Panlilio said.

Publicly listed Meralco is majority controlled by Philippine Long Distance Telephone Co., with San Miguel Corp., First Philippine Holdings Corp. and other investors as minority shareholders in the power utility (VS, GMA News, 2011) [22].

Customers who enroll in prepay electric service reduce their energy usage from 5.5 to 14 percent as a result of changes in behavior due to more real-time information and awareness around their energy usage, according to a study conducted by Distributed Energy Financial Group (DEFG, 2014). Three out of four customers who were part of the study indicated they had changed their electric usage behavior to lower their electric bill since switching to prepay. In addition, the study indicated that

customers had high levels of satisfaction with their prepay service as 92 percent of the surveyed customers indicated they were "very satisfied" or "somewhat satisfied" with their prepay service.

"The findings from the prepay study indicate that customers change behavior as a result of voluntarily switching to a prepay electric service. Customers become more proactive in looking for ways to reduce their energy usage and lower their electric bill," said Darren Brady, DEFG's executive vice president. "Prepay service can enhance the relationship between the utility and its customers by not only making the payment process more convenient, but by providing real-time information to the customer about their daily cost which is changing how they think about and manage their electricity."

"The results from the study confirmed what was seen in recent prepay savings study and national consumer surveys conducted through our Prepay Energy Working Group," said Darren Brady, "Customers enrolled in voluntary prepay programs on average are reducing their energy usage at a very meaningful level, higher than most traditional energy conservation measures. While at the same time prepay services are generating high satisfaction levels from customers across all income levels, helping utilities enhance the value of a traditional payment transaction with their customer base."

The study asked questions related to the actions customers had taken since enrolling in a prepay service. The goal was to try and better understand customer behavior and the specific steps that customers may take to reduce their energy usage as a result of prepayment.

"Overall, the results from this study indicate that prepay brings greater awareness of energy usage to the customer, encouraging them to take both basic actions—such as turning off the lights and turning down the thermostat—to making investments in energy efficient lighting, insulation, and HVAC systems," said Darren Brady. "Customers indicated they

switched to prepay to have greater control over their energy usage and bill, as well enabling better budgeting of energy costs and allocation of available funds to pay for electricity." Distributed Energy Financial Group (DEFG) is a management consulting firm specializing in energy (DEFG, 2014) [23].

III. RESEARCH METHODOLOGY

Research Design

This study used the quantitative research employing descriptive-correlational method. This particular method was chosen because of its appropriateness to answer the problem. According to Ariola (2006), it is used to determine whether or not there is a relationship that exists between two or more quantifiable variables, and if there is, to what extent or degree the relationship is [24].

Quantitative research involves gathering of data that is absolute, such as numerical data, so that it can be examined in as unbiased a manner as possible (wisegeek.com) [25].

Quantitative research is classified as social research that is based on empirical data/statements. An empirical statement is a descriptive statement about what "is" the case in the real world rather than what "ought" to be the case. Empirical statements are expressed in numerical terms (Cohen, 1980 as cited by Acero, Javier & Morilla, 2014) [26].

Descriptive research is used to obtain the pertinent information concerning the present status of the phenomena to describe the existing conditions with respect to the variables selected. According to Best and Kahn (1998) as cited by Acero and Leuterio (2006), descriptive research deals with the relationships between variables, the testing of hypotheses, and the development of the generalizations, principles, or theories that have universal validity; and is concerned with functional relationships [27]. Specifically, the study uses the descriptive-correlational research method which investigates the energy

management analysis. This particular method is chosen because of its appropriateness to answer the problem.

Research Respondents

The researcher's respondents in this study were the 80 employees of the ORMECO who belong to the non-technical and technical group of workers. The researcher used two types of purposive sampling such as homogeneous and expert sampling to determine the number of respondents. Respondents with similar nature of work and expertise answered the same questions.

Research Instrument

This study utilized self-made and semi-structured questionnaire. This was chosen by the researcher for the reason that the method will acquire better quality of study in the analysis of energy management.

Reliability of the Instruments

To determine the reliability of the instrument, the researcher administered twice over a span of one week the questionnaire to 80 ORMECO personnel. The next step is to compute the reliability of the instrument using the Pearson's r. The questionnaire is said to be reliable if the same measurement can produce similar results in similar circumstances.

After conducting the test-re-test, all the raw scores were statistically treated using Pearson's Product Moment Correlation (Pearson's r). The formula below was used.

$$r = \frac{n \sum XY - (\sum X)(\sum Y)}{\sqrt{(n \sum X^2 - (\sum X)^2)(n \sum Y^2 - (\sum Y)^2)}}$$

where: r – the Pearson's r
n - total number of respondents

$\sum X$ – sum of all X values
$\sum Y$ – sum of all Y values
$\sum X^2$ – square of the sum of all the X's
$\sum Y^2$- square of the sum of all the Y's
$(\sum X)^2$ - sum of all squares of the X's
$(\sum Y)^2$ – sum of all the squares of the Y's
$\sum XY$ – sum of the products of X and Y
$n\sum XY$ – the number of cases (n) multiplied by the sum of the products XYs

Table 1
Reliability of the Questionnaire

Variables	R value	Interpretation
Sources of energy in terms of diesel fuel and mini-hydropower plant	0.99997	Reliable
Customer related concerns in terms of a) additional charges due to late payment and reconnection fee b)uncontrolled usage of electricity and c) rotating brownout	0.99998	Reliable
Extent of energy management in terms of a) customer quality service and b) cost-effective energy saving	0.99997	Reliable

Validity of the Instrument/s

The panel members headed by the Graduate School Dean including the adviser of the candidate of the proposal oral defense served as experts to validate the questionnaire after a careful study and analysis of the instrument.

Data Gathering Procedure

The first step was to seek permission from the General Manager of ORMECO to conduct the study and administered the self-made questionnaire and the semi-structured questionnaire to the respondents by using two types of purposive sampling namely: homogeneous sampling and expert sampling. Homogeneous sampling is selecting participants who have very similar experience, perspective, and outlook. According to Palys, expert sampling is about looking for

individuals who have particular expertise that is most likely to be able to advance the researcher's interests and potentially open new doors [28].

Names of the respondents were taken from the list of employees of ORMECO.

Statistical Treatment of Data Gathered

After the retrieval of the respondents' questionnaire, the researcher tabulated the raw data.

The researcher employed both the descriptive and inferential statistics in the study.

To answer problems 1, 2 and 3, mean and ranking was employed.

To answer problem 4 inferential statistics specifically Pearson's r was used to determine the relationship between the variables.

According to Becker (1970) as cited by Ratcliff (n.d.), *quasi-statistics* count the number of times something is mentioned in the field notes. The quasi-statistics method was used in this study for the treatment of interviewed/gathered data and for its data analysis [29].

Scaling and Quantification

Table 2 which is presented on the next page shows the numerical scale, statistical limits and verbal descriptions/interpretations of the study.

Table 2: Numerical scale, statistical limits and verbal descriptions/interpretations

Scale	Limits	Verbal Interpretations	
5	4.50–5.00	VHL	VHE
4	3.50-4.49	HL	HE
3	2.50-3.49	ML	ME
2	1.50-2.49	LL	ME
1	1.00-1.49	VLL	VLE

Legend:
Questions #1 and #2

VHL	-	Very high level
HL	-	High level
ML	-	Moderate level
LL	-	Low level
VLL	-	Very low level

Question #3

VHE	-	Very high extent
HE	-	High extent
ME	-	Moderate extent
LE	-	Low extent
VLE	-	Very low extent

IV. RESULTS AND DISCUSSIONS

The presentation, analysis and interpretation of data are presented according to chronological order of the statement of the problem.

1. What is the level of supply of electricity in terms of:

a. sources of energy
- Diesel fuel
- Mini hydro power plant

b. operational cost

c. measurement system

Table 3: Mean perception of the respondents on the level of supply of electricity in terms of Diesel Fuel

	Statements	Mean	Rank	Description
1	Power Supplier meets the monthly contracted energy by ORMECO	4.00	2	High Level
2	ORMECO provides steady supply of electricity to all consumers.	3.89	3	High Level
3	There is maintenance plan to avoid power outage	4.32	1	High Level
4	There is a standby bunker in case the demands get higher	3.05	5	Moderate Level
5	Industrial and commercial areas are prioritized than residential areas in case of limited supply	3.42	4	Moderate Level
Overall Mean		3.71		High Level

Table 3 shows the mean perception of the respondents in terms of diesel fuel as source of energy with an overall mean of 3.71 which means that the generated needed supply of electricity is of high level.

The distribution company has a high level of providing steady supply of electricity to all consumers as revealed by item number 2. This would not be possible if and when the power supplier cannot meet the monthly contracted energy of ORMECO. With this, item number 1 also reveals that power suppliers meet the contract at high level. This shows that ORMECO depends on the supplied energy coming from different energy suppliers. Power suppliers that use diesel fuel are Mindoro Grid Corporation (MGC) at Calapan and Bongabong, Ormin Power, Power One Corp., and GBH Power Resources Inc.

Meanwhile, item number 3 which relates to the distribution company as having a very good maintenance plan to avoid power outage garners a mean score of 4.32 also described to a high level. To make it achievable ORMECO places a maintenance group that operates 24 hours a day. In some instances wherein an area experiences either an overload, line fault, and line to ground problems that cause the transformer to blow up, the maintenance group responds immediately upon notice.

Item number 4 pertains to availability of standby bunker in case the demands get higher which is perceived to a moderate level. ORMECO has contracted energy from different suppliers hence the suppliers are responsible for standby bunkers. However, the distribution company which is the ORMECO knows well that the maximum demand usually occurs during summer season because the clients need to run almost all home appliances hence it is indicative of the suppliers attending to the needs of ORMECO.

Industrial and commercial areas are prioritized than residential areas in case of limited supply which is item number

5 and is also of moderate level which indicates that ORMECO is still fair to all its clients in terms of supplying electricity. The substation is aware that electricity is for everybody hence industrial and commercial establishments are also experiencing rotating brownout along with residentials when supply of electricity is limited.

Results imply that ORMECO shows dedication to manage supply of electricity. The company is doing its best to meet the demands in Oriental Mindoro. As it is, there will be more incoming power suppliers that will deliver additional energy to fully accomplish the electrification program and to minimize the rotating brownout if cannot totally eliminated. Results further imply that the power suppliers have been effective in so far as maintaining/sustaining the steady power supply as proven by the long years of partnership with ORMECO.

Table 4a: Mean perception of the respondents on the level of supply of electricity in terms of Mini Hydro Power Plant

	Statements	Mean	Rank	Description
1	Capacity requirement of the mini-hydro is met	4.40	2	High Level
2	There is a water quality control for level, flow, and velocity	4.30	3	High Level
3	Turbine is of good condition	4.80	1	Very High Level
4	Power house is safe from soil erosion	4.10	4	High Level
5	There is pumped storage for storing more energy	3.50	5	High Level
Overall Mean		4.38		High Level

As shown in Table 4a the overall mean which pertains to the level of supply of electricity in terms of mini hydropower is 4.38 described as high level.

To a high level, item number 1 which relates to meet the capacity requirement of the mini-hydro has a mean of 4.40. This is due to ORMECO's sustainability plan through the continuous conduct of tree planting activities to hold more water which is reflected in 2013 Annual Report of ORMECO. Having more water will mean greater amount of water to flow

into the weir intake, thus, the higher the energy generated the more able the power plant can continuously supply electricity to its consumers.

Heavy rains and strong winds are unavoidable circumstances that could hit the places of ORMECO's hydropower plants. These phenomena have effects on water control device of the power plant. Thus, the presence of good design of water quality control for level, flow, and velocity is really important and this appears to a high level with a mean score of 4.30 as stated under item number 2.

To a very high level, item number 3 which pertains to the condition of turbine gets a mean score of 4.80. This indicates that the power plants value the importance of brand new machines with good quality to easily manage its operation. The turbine and other equipment in the power house are constantly maintained by on-duty engineers and technicians.

Item number 4 pertains to safety of power house from soil erosion and obtains a mean score of 4.10 described as high level. The company has a compliance certificate from the Department of Environment and Natural Resources which suggests that the power house is safe. To intensify protection on the power house, ORMECO conducts continuous tree planting programs to control soil erosion and landslide in all places where there are Mini-Hydro Power Plant.

Likewise, item number 5 has a mean score of 3.50 described as high level which pertains to the existence of pumped storage for storing more energy. Actually, power plants use water stocker or forebay as a counterpart of pumped storage. This helps holding more water during low demands and releasing it during peak periods. Having more water to flow into the weir intake the greater the energy generated.

Results imply that ORMECO acknowledges the advantages of using hydropower plants as a good alternative energy source. Hydropower is renewable, constant, predictable and controllable source of energy. It emits no greenhouse gases

and are environment friendly. However, it could have an adverse effect on aquatic life and can also reduce flow of water which may affect agriculture (EDF, 2014).

Table 4b: Summary table on the mean perception of the respondents on the level of supply of electricity in terms of Sources of Energy

	Statements	Mean	Rank	Description
1	Diesel fuel	3.71	2	High level
2	Mini-Hydro Power Plant	4.38	1	High level
Overall Mean		4.04		High Level

The mean score of 3.71 described to a high level the supply of electricity in terms of diesel power.

Results imply the steady supply of electricity to all consumers since power suppliers are able to meet and sustain the contracted energy of ORMECO. This is attributed to a very good maintenance plan to avoid power outage, availability of standby bunkers when demands get high and the fair treatment to all consumers through prioritization in the distribution of energy when supply is limited.

Findings further imply that ORMECO show dedication to manage electricity.

The mean of 4.38 described as high level signified the capability of ORMECO to maintain and meet the capacity requirement of the mini-hydro. ORMECO has a sustainability plan to address concerns about change in water supply due to climate change like heavy rains and strong winds.

Further, to a very high level, the turbine is in good condition, being consistently maintained including other brand new machines in the power plants which are of high quality.

There are also storage pumps for storing energy and water stocker as counter part of the pump storage. Results imply that hydro-power is a good alternative source.

Table 5: Mean perception of the respondents on the level of supply of electricity in terms of Operational Cost

	Statements	Mean	Rank	Description
1	Hires an expert engineer when serious technical problem occur	4.32	1.5	High Level
2	There are sufficient manpower for repairs and maintenance	4.32	1.5	High Level
3	There are available equipment, spare parts, and transformers	4.03	4	High Level
4	Store more diesel when its price is cheaper	3.24	5	Moderate Level
5	Manage system loss to reduce operational cost	4.27	3	High Level
Overall Mean		4.04		High Level

Table 5 shows the mean perception on the level of supply of electricity in terms of operational cost with an overall mean of 4.04, described as high level.

Item number 1 and item number 2 which pertain to hiring an expert engineer when serious technical problem occur and assuring sufficient manpower for repairs are both perceived as high level with mean score of 4.32. ORMECO employs highly qualified engineers and technicians that can satisfactorily perform the job. Fortunately, the company is not yet experiencing very serious problems that would require hiring an expert engineer but they are open to hire if ever the situation happens. This only indicates that ORMECO has employees that are already considered as expert engineers who can troubleshoot the overall technical operations of the company. Similarly, item numbers 3 and 5 are also perceived as high level. They relate to availability of equipment, spare parts, and transformers and managing system loss to reduce operational cost. ORMECO furnishes to all needed supplies for operation to accomplish all job orders.

On the other hand, item number 4 which pertains to storing more diesel when the price is lower is perceived to a moderate level. This is because ORMECO has a contracted energy from different suppliers which means that it is the choice of the power supplier whether they will store fuel or not. There is a possibility that power suppliers still have a stocked

fuel hence they can no longer store more fuel even if the price lowers. When this happens, the cost of energy cannot be reduced.

With regard to item number 5 relating to reduction of operational cost through management of system loss, ORMECO has a continuous upgrading program to reduce the system losses to a single digit. In fact based on Annual Reports in 2011, 2012, and 2013 the company was able to get 9.72%, 9.67%, and 9.86%, respectively. These records show that the company tries to improve its services. Technical group and maintenance group work hand in hand to make it happen which could be attributed to the strong leadership and motivation of the general manager. System losses have high effect on the cost of electric utilities and consequently on the high cost of electricity. Hence, the reduction of system losses is of paramount importance because of its financial, economic and socio-economic values to the utility company, and customers. The company does the following measures to manage system losses: balancing of feeder, upgrading of undersized lines and underrated transformers, retightening of jumper, thermal scanning, centering of load, strict implementation of anti-pilferage campaign, and replacing rotten poles. Balancing of feeder refers to balancing of a power line that carries power from a generating station to a substation, undersized lines refers to inability to cater higher voltages, underrated transformers refers to a rating which is lower than required, retightening of jumper means to compress the loose wire connection using AMPAK tools, centering of load means placing the transformer on the most populated area to balance the load.

Results imply that ORMECO has been able to manage well all operating costs subject to proper accounting and auditing rules in the Philippines. Summary of Key Performance Standards (KPS) Rating of ORMECO in 2012 and 2013 as reflected in its Annual Report reveals that the company obtains perfect scores equivalent to 30 points on Financial

Aspect. These records are strong evidence that ORMECO which is classified as Mega Large electric cooperative is financially sound. Further evidence are the 30 different achievements/awards received by ORMECO as reflected in the 2013 Annual Report, page 33 hence it really deserves to receive an adjectival rating of AAA or Triple A on KPS.

Table 6a: Mean perception of the respondents in terms of Measurement System

	Statements	Mean	Rank	Description
1	Ensures security feature of electric meter	4.36	3	High Level
2	Analog and digital meter measure the same amount of energy for the same energy consumption	4.30	4	High Level
3	Electric bill calculator generates accurate billing system	4.41	2	High Level
4	ORMECO inspects distribution lines relative to illegal connection	4.45	1	High Level
5	Technical losses are managed and controlled	4.01	5	High Level
Overall Mean		4.31		High Level

Table 6a shows the mean perception of respondents for measurement system with an overall mean of 4.31 described as high level.

To a high level, all items under table 6 are perceived as high level. ORMECO ensures security feature of electric meter, uses analog and digital meter, generates accurate billing system, inspects distribution lines relative to illegal connection, and manages and controls technical losses.

ORMECO has been able to manage all undertakings relative to measurement system specifically on KWh or electric meter, read and bill gadget, preventive measures on technical losses and illegal connections.

Kilowatt-hour (kWh) meter has a seal that if damaged will mean it is tampered. Regular inspections in electric meter are done to safeguard possible pilferage of electricity. Employees of ORMECO who are working relative to meter reading and billing were given training on kWh Meter Reading Accuracy and Competency to intensify their level of awareness.

There were 87 persons who attended this training as reflected in 2011 Annual Report page 24.

The traditional way of computing electric consumption and the current scheme gives the same billing computation. The current scheme uses the so called Read and Bill gadget. It is called Read and Bill because the meter reader has to read and key in the consumer's consumption to generate the bill.

Based on data gathered using semi-structured questionnaire, analog kWh meter has the same reading in comparison with digital kWh meter for the same amount of power consumption. The new meter should have ±0.5% tolerance and ±2% for the old meter. Tolerance refers to deviation in measurement which is either added or subtracted from the standard value, i.e. for old meter with ±2% will have an acceptable reading in the range of 98-102 kWh for a 100 kWh consumption. In 2012 and 2013 Annual Report, records show that ORMECO is doing sampling test of kWh meter to find out if troubleshooting is needed.

Findings imply that ORMECO further improves its measurement system and facilities to give quality service to its consumers. Using digital kWh meter instead of analog and the Read and Bill gadget indicate that ORMECO promotes system innovation. There are also some preventive measures that are taken by ORMECO to control and manage the system losses. These actions symbolize concern and commitment to all its stakeholders.

Table 6b: Summary table on the mean perception of the respondents on the level of Supply of Electricity

	Statements	Mean	Description	Interpretation
1	Sources of energy	4.04	Often	High Level
2	Operational cost	4.04	Often	High Level
3	Measurement system	4.31	Often	High Level
Overall Mean		4.13	Often	High Level

In terms of operational cost, it garners an overall mean of 4.13, described as high level, implying the capability of ORMECO to

manage all operating cost, subject to proper accounting and auditing rules.

ORMECO is manned with highly qualified engineers and technicians thus helping contribute to a highly satisfactory performance in terms of cost reduction.

With regard to the level of measurement system, with a mean of 4.31 described as high, ORMECO ensures security features of electric meters, generates accurate billing system and inspects distribution lines relative to illegal connections to prevent technical losses.

There are also preventive measures to control and manage the system losses as part of ORMECO's commitment to consumers.

2. What is the level of customer related concerns in terms of:

a. additional charges and reconnection fee?
b. usage Uncontrolled of Electricity
c. rotating brownout

Table 7: Mean perception of the respondents on the level of customer related concerns in terms of Additional Charges and Reconnection Fee

	Statements	Mean	Rank	Description
1	Consumers are given grace period to settle their accounts	4.63	1	Very High Level
2	Consumers are given notice of disconnection when accounts are not yet paid after the grace period	4.56	2	Very High Level
3	There is receipt of notice of disconnection from the consumer	4.45	3	High Level
4	Service is back immediately after paying reconnection fee	3.47	5	Moderate Level
5	ORMECO accepts promissory note to avoid disconnection	4.34	4	High Level
Overall Mean		4.29		High Level

Table 7 presents the mean perception of the respondents in terms of additional charges obtaining an overall mean of 4.29 described as high level.

To a very high level consumers are given grace period to settle their accounts, item number 1 with a mean score of 4.63. Likewise, consumers are given notice of disconnection when accounts are not yet paid after the grace period, item number with mean score of 4.56. The notice of disconnection with mean score of 4.45, which is item number 3, is often accompanied by a receipt. This is perceived to a high level as well as item number 5 that points to acceptance of promissory notes to avoid disconnection, registering a mean score of 4.34.

After the electric bill has been generated using the ORMECO's read and bill gadget, it will be given to the consumer. From the generation date of bill, consumers will be given nine (9) days to pay their electric consumption. Due date is specified in the electric bill and after this, a notice of disconnection will be served. If consumers do not yet respond to settle their accounts within two (2) days which is free from surcharge, ORMECO will schedule the power disconnection. Surcharge with different rates which based on the range of amount of electric bill is imposed after 11 days of not paying the consumers account. However, if they have been disconnected from the power lines, consumers are required to pay the surcharge together with the reconnection fee and the power bill.

Consumers are allowed to have one (1) promissory note every year except during December because ORMECO needs to finish the year-end report. No surcharge is imposed if and when the consumer has been able to pay the bill within the promised date of payment.

Response time to reconnection of service due to disconnection is within 24 hours based on the KPS-Institutional Parameters. ORMECO has a perfect grade on this aspect hence it only indicates that ORMECO immediately returns the electric service except when there is calamity that might harm the linemen.

Results imply that ORMECO shows dedication to attend to all needed services of their customers. ORMECO has

consideration to its consumers relative to settling accounts and serving back the electric connection. Moreover, ORMECO wants to maintain a good customer relationship because they both benefit from one another and they need each other.

Table 8: Mean perception of the respondents on the level of customer related concerns in terms of Uncontrolled Usage of Electricity

	Statements	Mean	Rank	Description
1	Consumers are given seminar on how to conserve energy	4.44	2	High Level
2	Faulty energy meter (i.e. not regulated hence it takes more energy than normal) are inspected and replaced	4.19	3	High Level
3	Poor location (far from household) of energy meter makes consumer unaware of their energy consumption	3.85	4	High Level
4	Transmission and distribution losses are higher than normal technical standards	3.19	5	Moderate Level
5	Illegal connection is prohibited before and after the energy meter of a legitimate member	4.60	1	Very High Level
Overall Mean		4.06		High Level

Table 8 shows the mean perception on the level of customer related concerns in terms of uncontrolled usage of electricity with an overall mean of 4.06 described as high level.

As gleaned from the table, item number 5 which relates to illegal connection as deemed prohibited after the energy meter of a legitimate member, registers a mean score of 4.60, described as very high level indicating that ORMECO strictly implements the Anti-Pilferage Campaign. The company encourages member-consumers to report suspicious line connection to reduce the system loss and also to give the necessary action on part of the violator. ORMECO ensures the confidentiality of the informer. Aside from that, ORMECO gives reward to the informer after which the information has been proven true.

Meanwhile, to a high level as reflected by mean scores of 4.44, 4.19 and 3.85 for items 1, 2, and 3. Item number 1 pertains to consumers are given seminar on how to conserve energy. In fact, consumer is required to attend seminar before

he/she can apply for new electric connection. Part of the seminar is about energy saving tips and sample computation for electricity consumption. Moreover, ORMECO has flyers stating the same topics and other important reminders like the requirements for new electric connection and its corresponding fees, electricity theft or anti-pilferage campaign, and explanation for the proceeds of the electric bill.

Faulty meters are inspected, regulated or calibrated, and replaced if needed. Some problems that have been encountered as to results of semi-structured questionnaire are burnt meter, either slow or fast oscillation, stopped, or very old. Records show that ORMECO is doing sampling test of kWh meter as reflected in 2012 and 2013 Annual Report. This further improves services to their customers. On the other hand, the transfer of electric meter to the electric post makes the consumers unaware of their latest consumption, thus it causes the consumers to poorly manage the usage of electricity. However, the transfer of electric meter to electric post is one of the solutions on illegal connection because lineman or meter reader can easily notice the wire tapped before the kWh meter.

Item number 4 on transmission and distribution losses as higher than normal technical standards is perceived to a moderate level suggesting that the acquired losses of ORMECO is not higher than standard. Energy Regulatory Commission allows to charge the consumers of up to 13% which means that it is within the system loss cap as reflected in the 2012 and 2013 Annual Reports, p.35 and p.34, respectively. Fortunately, ORMECO has been consistent to have below 13% which indicates that ORMECO has good or efficient transmission and distribution lines. Furthermore, lower losses give less surcharge on part of the member-consumers.

Results imply that ORMECO takes so much efforts to address uncontrolled usage of electricity. This also indicates that ORMECO has good management system and facilities that enable them to receive Triple A in Key Performance Standards

(KPS) rating through the good governance of their general manager as reflected in their Annual Report 2013. This further implies that ORMECO is true to its vision which is provide members and consumers with an affordable, reliable and excellent quality of electric service with the total support of a committed, competent and dynamic workforce and mission which is to be one of the most efficient, stable and service-oriented electric cooperatives in the Philippines.

Table 9a: Mean perception of the respondents on customer related concerns in terms of Rotating Brownout

	Statements	Mean	Rank	Description
1	Supply of energy is sufficient during wet season than dry season	3.89	1	High Level
2	Rotating brownouts are normally scheduled during daytime	3.42	4	Moderate Level
3	Rural areas experience less rotating brownouts than remote areas	3.74	2	High Level
4	Rotating brownouts are resorted to store energy	3.37	5	Moderate Level
5	Rotating brownouts accrue from diminished supply of energy	3.47	3	Moderate Level
Overall Mean		3.58		High Level

Table 9a shows the mean perception on the level of customer related concerns in terms of rotating brownout garnering an overall mean score of 3.58, described as high level.

As presented, items number 1 and 3 with mean scores of 3.89 and 3.74 on supply of energy as sufficient during wet season than dry season, and rural areas experience less rotating brownouts than remote areas are perceived to a high level indicating that season somewhat affects the usage of energy. From the graph in ORMECO Annual Report of 2103 p. 39 which is the status of power supply and demand, it shows that during wet season the actual peak load of 33.102 MW which is below the supply capacity (36MW) occurs around pass 7:00pm while during dry season it occurs before 2:00pm that gives a slight power shortage and around pass 7:00pm with a power shortage of 3.81MW. The power shortage affects the supply of electricity to all consumers thus ORMECO takes

action to minimize if not totally eliminate the rotating brownout by appealing to the mall owners/general managers to use generators from around 6pm onwards and to the rice millers not to operate from 6:00pm to 10:00pm. Energy sales are on-peak during the months of April, May, and June as reflected in the Annual Report 2013 p. 23. Meanwhile, energy sales are lower in the months of January to March.

Respondents perceive to a moderate level items 2, 4, and 5 signified by mean scores of 3.42, 3.37, and 3.47 which points to rotating brownouts are normally scheduled during daytime, that accrue from diminished energy supply, and they are resorted to store energy. Rotating brownouts happen when there is a need for maintenance of the lines and also when there is power shortage. Schedule of rotational brownout depends on the situation, time is considered during maintenance period. In case of power shortage, the area that would possibly be affected by the rotational brownouts are the feeders that need supply equivalent to the deficit energy. Results imply that one way to eliminate rotating brownout is the need for ORMECO to encourage Independent Power Provider (IPP) to put up power plants here in Oriental Mindoro to meet the needed demands. However, ORMECO has foreseen this problem years back hence it has contracted energy from different IPP's.

Table 9b: Summary table on the mean perception of the respondents on the level of Customer Related Concerns

	Statements	Mean	Rank	Description
1	Additional charges due to late payment and reconnection fee	4.29	1	High Level
2	Uncontrolled usage of electricity	4.06	2	High Level
3	Rotating brownout	3.58	3	High Level
Overall Mean		4.13		High Level

Customer related concerns has an overall mean of 4.13 described as high level. The additional charges and reconnection fee with a mean of 4.29 described as high level implies that ORMECO attends to all needed services of their

consumers shows consideration in the matter of settling accounts and serving back electric connection. Further, there are measures instituted relative to notice of disconnection, grant of grace period and issuance of promissory notes.

The uncontrolled usage of electricity gets 4.06 as mean also described as high level. Such concerns are addressed through seminars on energy conservation, energy saving tips, and even sample computation for electric consumption. There is also regular inspection of faulty meters which are regulated, calibrated, and replaced if needed.

Results imply that ORMECO exerts effort to address uncontrolled usage of electricity.

On the aspect of rotating brownouts with mean score of 3.58 described as high level, ORMECO addresses this specific concern through maintenance of transmission lines when there is power shortage. There is also a schedule of rotation brownouts as the need arises in some areas.

Findings also imply that the mini supply of energy could be due to increase consumer demands.

3. What is the extent of energy management effectiveness in terms of:

a. customer quality service

b. cost-effective energy saving

Table 10: Mean perception of the respondents on the extent of energy management service in terms of Customer Quality Service

	Statements	Mean	Rank	Description
1	Approach with well-strategized customer centered plans	4.39	2	High Extent
2	Efforts are taken to reduce non-technical losses such as electricity theft, unsettled accounts of customers, accounting and record-keeping errors	4.33	3	High Extent
3	Efforts are taken to reduce technical losses such as transmission and distribution, and measurement systems	4.44	1	High Extent
4	There is efficient energy supply which means power for all at all times	3.41	4	Moderate Extent
5	Power utility is open to Prepaid System	3.08	5	Moderate Extent
Overall Mean		3.95		High Extent

Table 10 shows the mean perception of respondents on the extent of energy management service in terms of customer quality service registering an overall mean score of 3.95, described as high extent.

As reflected in the table, item number 3 with mean score of 4.44 that relates to efforts as taken to reduce technical losses such as transmission and distribution, and measurement system is perceived to a high extent. This is indicative of the efforts done by ORMECO, in particular their continuous activities relative to replacement of undersized lines, transformer load management, thermal scanning, compression of loose connection using AMPAK tools, close monitoring on load balancing of all feeders, reinstallation of adequate groundings, and replacing defective kWh meters.

Similarly, items number 1 and 2 are perceived to a high extent evidenced by mean scores of 4.39 and 4.33, respectively. ORMECO has a well-strategized customer centered plan and efforts are taken to reduce non-technical losses in terms of electricity theft, unsettled accounts of customers, accounting and record-keeping errors. ORMECO strictly implements the electricity theft or Anti-Pilferage Campaign to reduce system losses by ensuring the confidentiality of the informer. Aside from that, ORMECO gives reward to the informer after which the information has been proven true. The company has also designated Customer Welfare Desk Officer (CWDO) who will cater to all the customer complaints and will then forward the information to the concerned department. Customers can also send messages through SMS Reporting System by sending at 0908-815-5648 if Smart/Sun and 0917-656-6436 if Globe. ORMECO also assigned two hotline numbers: 286-9424 and 286-9375.

Electricity is a basic need of all people hence the company experiences very rare cases of totally unsettled accounts. Though there are cases of disconnections, customers still settle their accounts to return the electricity service.

Accounting and record-keeping are considered errors-free as evidenced by the Summary of Key Performance Standards that the area on Financial aspect got perfect 30 points as reflected in the Annual Report 2013 p. 21. The company has internal and independent auditors who verify the accounting records.

As seen on the table, to a moderate extent there is efficient energy supply which means power for all at all times, item number 4 has a mean score of 3.41. Based on the response to the semi-structured questionnaire, Roxas, Mansalay, and Bulalacao are the municipalities that are experiencing most frequent brownouts due to unstable/unreliable 69kV line of National Power Corporation (NPC) hence power for all at all times is not yet happening as of the moment. Roxas, Mansalay, and Bulalacao are connected to feeder line R8B thus, if R8B will be affected by electricity supply, these three (3) municipalities will suffer from power interruption.

ORMECO might consider the possibility of having prepaid electricity but implementation of this needs thorough study because of its pros and cons effect both to the company and the stakeholders.

Findings imply that ORMECO passes the standards of costumer quality-service. All efforts to this effect, have been successful and have worked to the advantage of both the company and the consumers.

Table 11a: Mean perception of the respondents on the extent of energy management effectiveness in terms of Cost Effective Energy Saving Measures

	Statements	Mean	Rank	Description
1	Elimination of illegal connections	4.34	1	High Extent
2	Over aged meters are replaced by digital meters	4.12	2	High Extent
3	Conduct of seminars for energy management (ex. use of LED lights, low-power equipment and device)	3.84	3	High Extent
4	Close monitoring of amount of energy consumed for gadgets, appliances and other home devices	3.81	5	High Extent
5	Control of electric usage through wattage monitoring	3.83	4	High Extent
Overall Mean		3.99		High Extent

Table 11a presents the mean perception of the respondents on the extent of energy management effectiveness in terms of cost effective energy saving measures, obtaining an overall mean of 3.93 described as high extent.

As seen, to a high extent there is elimination of illegal connections, item number 1, 4.34; over aged meters are replaced by digital meters, item number 2, 4.12; there is conduct of seminars for energy management, specific to use of LED lights, low power equipment and device, item 3, 3.84; with close monitoring of amount of energy gadgets, appliances, and other home devices, item 4, 3.81; and control of electric usage through wattage monitoring.

Total elimination of illegal connections is one of the targets of ORMECO to improve the efficiency of power system management. As a matter of fact, energy consumption caused by illegal connections is part of the system losses. ORMECO continues its campaign against illegal connections and rewards awaits to the sincere informer. The transfer of the kWh meter to the electric post helps the company to lessen if not totally eliminate the illegal connections. Record shows that the company replaces defective kWh meters including old aged meters. A total number of 1862, 2114, and 2090 meters were replaced in 2011, 2012, and 2013, respectively as reflected in ORMECO Annual Reports.

ORMECO requires consumers to attend seminar before they can apply for new electric connection. Part of the seminar is about energy saving tips and sample computation for electricity consumption. There are also flyers stating how to compute electricity consumption. Included also in the flyers is list of different appliances and fixture at home have corresponding estimated electricity consumption which is used to guide the consumers to decide which among the appliances and fixture are best to use.

A few of the energy saving tips provided by ORMECO in their flyers to consumers consist of the following: 1) avoid

frequent washing with only few pieces of clothes instead maximize the washing machine's capacity, 2) soak dirty clothes for several hours to minimize the rinse time, 3) go with traditional way of drying clothes under the sun instead of using electric dryer, 3) iron clothes during off-peak hours to reduce from the peak hours demand (before 9am and after 9pm), 4) iron clothes once a weak, 5) turn off air conditioning unit when leaving out the room, 6) switch off lights and other electric devices that emit heat when air conditioning unit is turned on, 7) use small fan to diffuse the cool air inside the room coming from the air condition unit, 8) choose air conditioning unit with higher Energy Efficiency Ratio (EER) because it consumes less energy, 9) always defrost the refrigerators and freezers because having more than ¼ inch thick of ice adds up to the load of the compressor motor, and 10) set the thermostat to a lower level to control the ice build-up.

The energy tips given by ORMECO could help the consumers to monitor and to be aware of the amount of energy consumed by different gadgets, appliances and other home devices. These could also control the electric usage because consumers can get an idea about the type of devices or appliances can be effectively used.

Results imply that ORMECO being the electric distributor proves that they work both to the advantage of the company and the consumer. They also give sufficient information about electric usage that could increase the level of awareness of the stakeholders. This could be the advantage of ORMECO as a non-stock, non-profit, and service-oriented electric cooperative.

Table 11b: Summary table on the mean perception of the respondents on the extent of Energy Management Effectiveness

	Statements	Mean	Rank	Description
1	Customer quality service	3.95	2	High Extent
2	Cost effective energy saving measures	3.99	1	High Extent
Overall Mean		3.97		High Extent

The extent of energy management effectiveness in terms of customer quality service has an overall mean of 3.97 described as high extent.

Customer quality service has a mean of 3.95 described as high extent. Efforts are exerted to implement a well-strategized customer centered plans to reduce non-technical losses. Moreover, customers/ consumers are assured of an efficient energy supply that has worked to the advantage of both the company and the consumers.

The energy saving measures with a mean of 3.99 described as high extent implies the efficiency of the power system management reflected in the elimination of illegal connection, conduct of seminars on energy management like use of LED lights and other low power equipment devices. Moreover, ORMECO issues energy saving tips to help consumers monitor the amount of energy consumed and subsequently control electric usage.

4. Is there a relationship between supply of electricity and extent of energy management?

Table 12
Summary Table of r and p-values
DV: Extent of Energy Management

IV: Status of Supply of Electricity	Customer Quality Service		Cost Effective Energy Saving	
	r	p-value	r	p-value
Diesel	0.6922*	0.000721	0.6384*	0.002454
Mini Hydro	0.7652*	0.009910	0.8400*	0.002355
Operational Cost	0.3831*	0.019257	0.5436*	0.000507
Measurement System	0.4102*	0.000464	0.5114*	0.000007

* significant at 5% level

The above table shows that there is a low to high degree of relationship between the level of supply of electricity in terms of sources of energy (diesel and mini-hydro), operational cost and measurement system and the extent of energy

management effectiveness in terms of customer quality service and cost-effective energy saving measures. The computed r – values ranging from 0.3831 to 0.8400 are significant at 5% level. This could mean that the level of supply of electricity could really affect the extent of energy management effectiveness. The null hypothesis for this cannot be accepted. When the supply is steady, ORMECO can sustain the supply requirement. In case of hydropower, climate change, strong winds, drought, and natural phenomena can affect the quality of service.

The higher the operation cost, the higher the quality. Operation cost related to training for expertise will afford avoidances of future problems. Moreover, more investment on related aspects of management of energy consumption like purchase of brand new equipment/devices will add to more cost but will give assurance of better service on the part of the consumers considering the efficiency and utility involved.

The higher the measurement system the higher the quality. It's because there is provided security features of electric meters that can generate accurate electric consumption. The technical losses are also managed and controlled.

5. Is there a relationship between level of customer service and extent of energy management?

Table 13
Summary Table of r and p-values
DV: Extent of Energy Management

IV: Level of Customer Related Concerns	Customer Quality Service		Cost Effective Energy Saving	
	r	p-value	r	p-value
Additional Charges	0.6227*	0.000141	0.6692*	0.000028
Uncontrolled Usage	0.6206*	0.000000	0.7187*	0.000000
Rotating Brownouts	0.5786*	0.0075200	0.3537	0.125995

* significant at 5% level

A moderate to a high degree of relationship can be observed between the level of customer related concerns in terms of

additional charges, uncontrolled usage and rotating brownouts and the extent of energy management effectiveness in terms of customer quality service and cost-effective energy saving measures. This is revealed by the computed r – values of 0.6227, 0.6206, 0.5786, 0.6692 and 0.7187. These r values are significant at 5% level. This means that the level of customer related concerns are determining factors of the extent of energy management effectiveness. The null hypothesis for this cannot be accepted.

On one hand, no significant relationship can be observed between rotating brownouts and cost effective energy saving. The computed r – value of 0.3537 is not significant at 5% level. The null hypothesis for this cannot be rejected.

The higher the supply of energy, the higher quality in terms of service. When the supply is steady, consumers are relieved of rotating brownouts or power outage. Supply during the summer period could cause brownouts because of the increased demand for energy which will be difficult to meet considering the change in climate.

It can be concluded that quality service is dependent upon these aforementioned variables.

6. What proposed prepaid electricity program can be endorsed to the customers of Oriental Mindoro?

The proposed electricity program is as follows:

Rationale

This proposal would like to present the benefits of using Prepaid Electricity System. The new metering system will be advantageous to both consumers and the distribution company. On the part of consumers there are no disconnection or reconnection, no need to queue up to settle accounts, electric consumption and budget are both manageable, there is automated record keeping, and no minimum charge.

Furthermore, the landlord has no problem with regard to the electric consumption of their tenants. For the distribution company, some benefits are payments will be done in advance, non-technical losses are reduced (error-free from meter reading and encoding), provides revenue increases, there is reduced non-technical losses since no meter reader is needed to key in the energy consumption. Added to these will be better cash flow because the company is free from outstanding balance, aside from better customer services, better load management, and developed energy saving attitude to the end-users.

Prepaid metering system has two types: a) keypad-based prepayment meter and b) smart card type.

The Prepaid metering has special features such as standardized data exchange mechanism, smartcard or key code credit load carries the same scheme of charging the energy consumed, the distribution company provides Master Database and Information Center that will cater all important records regarding data exchange from the utility to meter and send back the data from meter to utility, consumer enjoys user-friendly loading scheme to add credits to the meter, tamper detector, warning alarm for low credits, automatic cut-off of power supply when load has been fully consumed, and automatic power on when meter receives minimum credits.

The keypad-based prepayment meter is proposed in consideration of being more economical than smart card type prepayment meter. It is suggested that ORMECO use the keypad-based prepayment meter due to economic consideration. This proposal will also be beneficial to clienteles who are under and will be under the Barangay Power Association (BAPA) because of the following reasons: there will be no line disconnection, members will not be charged the reconnection fee, BAPA collector will be worry-free from members who cannot settle their accounts on-time, there will be an advanced collection of payment, and a marked increased revenue both for BAPA and ORMECO.

Barangay Power Association (BAPA) is an association which has been created in order to fortify institutional consciousness in the grassroots level (Sanchez, 1994). At present, there are 21 existing BAPA's in Oriental Mindoro. Each BAPA receives 3% from the collected payment if all members pay their energy consumption on-time. However, if one member fails to settle his/her account on-time, the reconnection fee will be given to the association in lieu of 3% income from the total collection [30].

The consideration of the proposed keypad-based prepayment meter will work to the advantage of the BAPA clienteles since they will be relieved of the current charges on disconnection, reconnection, and late payments.

V. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions were drawn based on the findings in this study: there is a steady supply of diesel fuel, achieved through an effective maintenance plan executed by ORMECO and the Power Suppliers; hydropower Plant is able to supply the needed electricity and meets the capacity requirement through the good condition of the turbine; ORMECO manages and controls the system losses through with the assistance of technical experts thus, reducing operational cost; the company adapts innovations related to measurement system and ensures security features in the use of electric gadgets; rotating brownouts are not completely eliminated due to slight shortage of energy supply during dry season; the well-strategized centered plan contributes to customer quality service and characterized by deduction of system losses and efficient energy supply; and there were effective energy-saving measures provided by ORMECO for the benefit of the company and the end-users.

The following are the recommendations based on the findings and conclusions of the study: ORMECO needs to continuously develop a program for steady supply of electricity in the whole province of Oriental Mindoro to eliminate power interruptions due to lack of supply. Renewable sources of energy are much better choice because these sources do not contribute harmful effect to the atmosphere; keep on having reforestation activity to have continuous water supply for Mini-Hydropower Plant to consistently meet the needed demands; continue to manage the system losses so that customers can enjoy the much less surcharge; provide information on ORMECO's website about conservation of energy; address the problem on 69KV line to make it stable and reliable so that rotating brownouts will be minimized; include the SMS Reporting System numbers in the bill of statement so that costumer can immediately verify their queries; and consider the proposed Prepaid Electricity system for energy consumption management.

VI. REFERENCES

[1] http://lia.erc.gov.ph/documents/65
[2] Virola, R. A. (2011). National Statistical Coordination Board. Retrieved from: http://www.nscb.gov.ph/poverty/2009/Presentation_RAVirola.pdf(slide 10)
[3] Manila Bulletin. February 23, 2011. Retrieved from: http://www.mb.com.ph/node/305841/philippine
[4] Antmann, P. (2009). Retrieved from p.4 of: http://siteresources.worldbank.org/INTESC/Resources/ReducingTechnicalAndNonTechnicalLossesBackgroundPaper.pdf
[5] MIMAROPA-DOLE Website. Retrieved from http://mimaropa.dole.gov.ph/default.php?retsamlakygee=25&resource=28dd376c5a44acc92e450ee338260c56

[6] Retrieved from http://www.geocities.ws/ormeco_coop/index_files/ORMECO_Profile.htm

[7] Design-Based Research Collective. (2003). Design-based research: An emerging paradigm for educational inquiry. Educational Researcher, 32(1): 5-8. Retrieved from: http://www.learning-theories.com/design-based-research-methods.html

[8] Education Portal. Retrieved from: metermate.co.za/types_of_prepaid_electric_meters_and_prices.php

[9] Serway, R.; Jewett Jr., J. (2006). *Physics for Scientists and Engineers with Modern Physics. 6th Edition.* Thomson Brooks/Cole.

[10] Retrieved from: http://www.conserve-energy-future.com/AlternativeEnergySources.php#sthash.SIDoiypV.dpuf

[11] Swinton, L. (2009). Retrieved from The 9 Principles of Quality Customer Services www.mftrou.com

[12] Friedrich, K., Eldridge, M., York, D., Witte, P. & Kushler, M. (2009). Cost saving energy.

[13] Energy Answers for Business. (N.D.). Energy-Efficient Lighting Retrieved from:http://www.aps.com/main/_files/services/BusWaysToSave/Lighting.pdf

[14] Natural Resources Defense Council. (2004). How to Reduce Your Energy Consumption. Retrieved from: http://www.nrdc.org/air/energy/genergy.asp

[15] Milan, F. D. (2010). *The Electrical Engineer Magazine of the Institute of Integrated Electrical Engineers of the Philippines. Volume XXXIX No.* 3 Third Quarter.

[16] Manila Bulletin. January 2, 2012. Retrieved from: http://mb.com.ph/node/346704/rate

[17] Baptista, I. (2013). Everyday Practices of Prepaid Electricity in Maputo, Mozambique. Retrieved from:

http://www.insis.ox.ac.uk/fileadmin/InSIS/Publications/Baptista_InSIS_WorkingPaper.pdf
[18] Arquila, J.; Dampac, I.; Osnan, D. (2012) Retrieved from:http://www.slideshare.net/harharcaparida/a-development-of-a-coin-slot-prepayment-system-for-household-electricity
[19] Robins, B. (2010). Low-income families, especially home buyers, struggle to pay power bills. Retrieved on January 14,2012,from http://www.smh.com.au/lifestyle life/lowincome-families-especially-homebuyers-struggle-to-pay-power-bills-20101216-18zqr.html
[20] Diaz, J. (2011). Phl power cost now highest in Asia. Retrieved on January 14, 2012, from http://www.philstar.com/Article.aspx?publicationSubCategoryId=66&article Id=710471
[21] Meralco-GE Survey (2011). Retrieved from: http://www.gmanetwork.com/news/story/236744/economy/consumers-want-prepaid-electricity-meralco-ge-survery
[22]http://www.gmanetwork.com/news/money/content/236744/consumers-want-prepaid-electricity-meralco-ge-survery/story/
[23] DEFG (2014). Retrieved from: http://webcache.googleusercontent.com/search?q=cache:PDllMGtPRPUJ:www.alonovo.com/aggregator/www.treehugger.com/files/2009/06/creativecommons.org/licenses/by/www.flickr.com/photos/jimkiernan/sets/creativecommons.org/licenses/by/2.0/tinyurl.com/9jtybwg%3Fpage%3D254+&cd=3&hl=en&ct=clnk&gl=ph
[24] Ariola, M. M. (2006). *Principles and Methods of Research*. Quezon City: Rex Book Store.
[25] http://www.wisegeek.com/what-is-the-difference-between-quantitative-and-qualitative-research.htm
[26] Acero, V. O., Javier, E. S. & Morilla, C.S. (2014). *Educational Research. Applications of different research methods.* Germany: Lap Lambert Academic Publishing.
[27] Acero, V. O.; Leuterio, F. C. (2006). *Methods of research*. Quezon City: Rex Book Store.

[28] Palys, T. (no date). Retrieved from: http://www.sfu.ca/~palys/Purposive%20sampling.pdf
[29] Ratcliff, Donald. 15 Methods of Data Analysis in Qualitative Research. Retrieved from http://qualitativeresearch.ratcliffs.net/15methods.pdf
[30] Sanchez, T. (1994). Retrieved from: Barangay-Power-Association-Conceptual-and-Implementation-Guidelines/revbapa.pdf