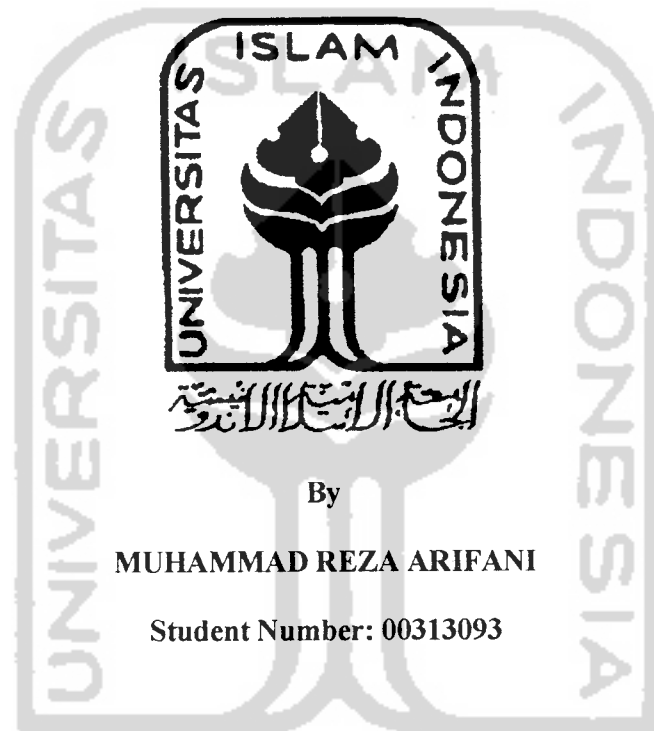


**DEMAND FOR ELECTRICITY IN INDONESIA
THE CASE OF QUANTITY DEMANDED FOR ELECTRICITY
IN PT PLN (PERSERO) 1982-2002**

A THESIS

**Presented as Partial Fulfillment of the Requirements
To Obtain the Bachelor Degree in Economics Department**



By

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YOGYAKARTA
2004**

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PLN (PERSERO) YEAR 1982-2002**

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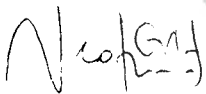
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Defended before the Board of Examiners
On August 27, 2004
and Declared Acceptable

Board of Examiners

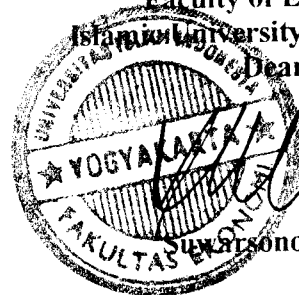
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The writer hopes that this thesis can give contributions and benefits for others.

Yogyakarta, 15 Augustus 2004

Muhammad Reza A

TABLE OF CONTENTS

| | |
|---------------------------------|---|
| PAGE OF TITLE | i |
| APPROVAL PAGE | ii |
| LEGALIZATION PAGE | iii |
| ACKNOWLEDGEMENTS | iv |
| TABLE OF CONTENTS | v |
| LIST OF TABLES | viii |
| LIST OF FIGURES | ix |
| LIST OF APPENDICES | x |
| ABSTRACTS (In English) | xi |
| ABSTRACTS (In Indonesian) | xii |
| | |
| CHAPTER I | INTRODUCTION |
| | 1 |
| | 1.1. Background Of The Study |
| | 1 |
| | 1.2. Problem Formulation |
| | 5 |
| | 1.3. Problem Limitation |
| | 6 |
| | 1.4. Research Objectives |
| | 7 |
| | 1.5. Research Contribution |
| | 7 |
| | 1.6. Definition of Terms |
| | 8 |
| CHAPTER II | REVIEW OF RELATED LITERATURE |
| | 9 |
| | 2.1. Literature Review |
| | 9 |
| | 2.1.1. Faried Wijaya Mansure |
| | 9 |
| | 2.1.2. Amarulla M |
| | 10 |
| | 2.1.3. Article from listrik watch journal |
| | 11 |
| CHAPTER III | THEORETICAL BACKGROUND AND HYPOTHESIS |
| | 13 |
| | 3.1. Theoretical Background |
| | 13 |
| | 3.1.1. Quantity Demand Theory |
| | 13 |
| | 3.1.2. Elasticity of Demand |
| | 16 |
| | 3.1.3. The Theory of Consumer Choice |
| | 19 |
| | 3.1.3.1. The effect of Income on the Consumer's Choice |
| | 20 |
| | 3.1.3.2. The effect of price on Consumer's Choices |
| | 22 |
| | 3.1.3.3. Income and Substitution Effect |
| | 23 |
| | 3.2. Hypothesis Formulation |
| | 25 |

| | | |
|------------|--|----|
| CHAPTER IV | RESEARCH METHOD | 26 |
| | 4.1. Research Method | 26 |
| | 4.2. Research Subject | 26 |
| | 4.3. Research Setting | 26 |
| | 4.4. Research Variables | 27 |
| | 4.4.1. Dependent variable | 27 |
| | 4.4.2. Independent variable | 27 |
| | 4.5. Types and Sources of Data | 27 |
| | 4.5.1. Data Source | 27 |
| | 4.5.2. Data Needed | 28 |
| | 4.5.3. Population | 28 |
| | 4.5.4. Sampling method | 28 |
| | 4.6. Method of Data Compilation | 29 |
| | 4.7. Technique of Data Analysis | 30 |
| | 4.7.1. T Test | 32 |
| | 4.7.2. F Test | 33 |
| | 4.7.3. Goodness of Fit (R^2) | 33 |
| | 4.7.4. Classical Assumption | 34 |
| | 4.7.4.1. Multicollinearity | 34 |
| | 4.7.4.2. Autocorrelation | 35 |
| | 4.7.4.3. Heterocedasticity | 35 |
| | 4.7.4.4. Specification error test | 37 |
| CHAPTER V | GENERAL DESCRIPTION OF PLN | 39 |
| | 5.1. PT PLN (PERSERO) in brief | 39 |
| | 5.1.1. PLN corporate legal basis | 40 |
| | 5.2. PT PLN (PERSERO) Vision & Mission | 40 |
| | 5.3. PT PLN (PERSERO) Organizational Development | 41 |
| | 5.3.1. PLN Subsidiaries | 41 |
| | 5.3.2. PLN Supporting Units | 42 |
| | 5.4. PT PLN (PERSERO) Human Resources | 44 |
| | 5.5. PT PLN (PERSERO) Business Activities | 47 |
| | 5.5.1. Generation | 47 |
| | 5.5.2. Financing | 47 |
| | 5.6. PT PLN (PERSERO) Transmission and Distribution | 50 |
| | 5.7. PT PLN (PERSERO) Production | 51 |
| | 5.8. PT PLN (PERSERO) Supervisory and Control system | 52 |
| | 5.9. Horizon of Opportunities | 53 |
| CHAPTER VI | RESEARCH FINDINGS AND DISCUSSION | 54 |
| | 6.1. Research Description | 54 |
| | 6.1.1. Choosing Regression Model | 56 |
| | 6.2. Research Findings | 56 |
| | 6.2.1. Regression Result Analysis | 56 |

LIST OF TABLES

| | |
|---|----|
| 1.1. Consumer data in PT PLN (PERSERO) | 2 |
| 5.1. Number of PT PLN employee | 44 |
| 5.2. Number of PT PLN employee base on group of employee | 45 |
| 5.3. University that work with PT PLN..... | 46 |
| 5.4. PT PLN fund from Valas, APBN, and APLN | 48 |
| 5.5. PT PLN project from foreign aid | 49 |
| 5.6. Transmission and Distribution line | 50 |
| 5.7. PT PLN production | 51 |
| 6.1. Research Data | 55 |
| 6.2. The Comparison Value of t-statistic and t-table | 59 |
| 6.3. Multicollinearity Test | 63 |
| 6.4. The Comparison Value of χ^2 computed and χ^2 table | 65 |
| 6.5. The Comparison Value of χ^2 computed and χ^2 table | 67 |
| 6.6. The Comparison computed F value and F table..... | 69 |
| 6.7. Energy Sold | 74 |

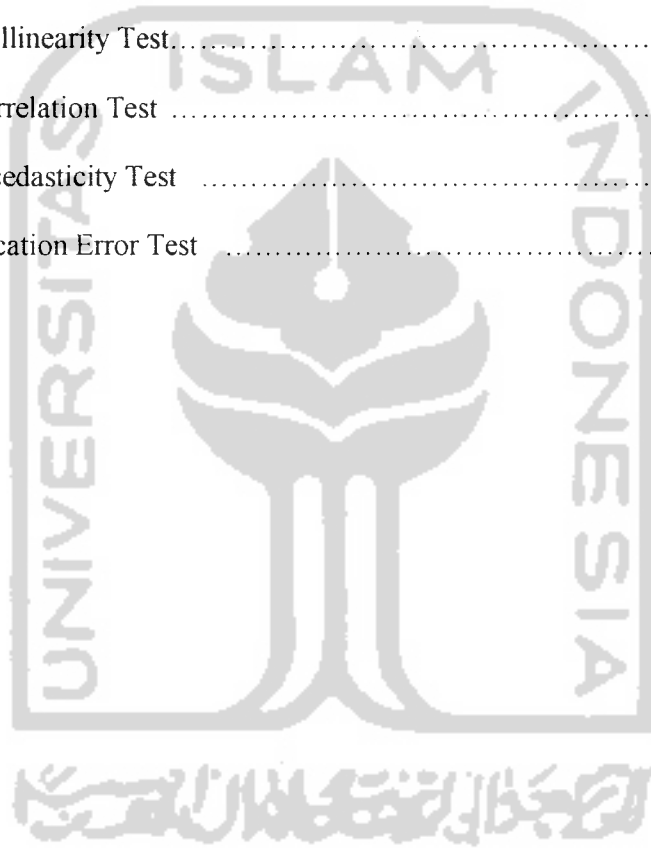
LIST OF GRAPH

| | |
|---|----|
| 3.1. Income effect on the Normal good | 21 |
| 3.2. Income effect on the Inferior good | 21 |
| 3.3. Price effect on the consumer's choices | 22 |
| 3.4. Income and Substitution effect | 24 |



LIST OF APPENDICES

| | |
|-----------------------------------|----|
| 1. Research Data | 83 |
| 2. Other Supporting Data | 84 |
| 3. Regression Result | 85 |
| 4. MWD Test | 86 |
| 5. Multicollinearity Test..... | 87 |
| 6. Autocorrelation Test | 88 |
| 7. Heterocedasticity Test | 89 |
| 8. Specification Error Test | 90 |



ABSTRACT

Muhammad Reza Arifani (2004), "Demand For Electricity In Indonesia The Case of Quantity Demanded For Electricity In PT PLN (PERSERO) 1982-2002". Economics Faculty, Economics Department, International Program, Universitas Islam Indonesia, Yogyakarta.

More advances in the community social welfare creates more demand in a certain product. Nowadays, every body uses electronic tools to make their life become easier. Therefore, electricity becomes the commodity that is needed by many sectors. Every people need electricity in their daily life because in this modern era, most activities need electricity. Because the electricity is very useful in every activity, it would create a demand for electricity. Electricity in Indonesia was provided by PT PLN as the only state-owned company that has the authorities in electricity business over the country. Based on the PLN data, the quantity demand for electricity in Indonesia is increasing from time to time. It reflects that electricity is needed more and more by the Indonesia citizen. Nowadays, the condition of demand for electricity in Indonesia is high, thus PT PLN as the supplier of electricity cannot cover all of the demand. PT PLN can only cover about 60% from the total demand of electricity.

This research was conducted in order to know the demand for electricity in Indonesia and to identify the factors that influencing to the quantity demand for electricity in Indonesia. The research only deals with the demand of electricity in PT PLN because most of the demand of electricity in Indonesia comes from PT PLN and the other demand electricity is shared with so many private companies, therefore it is difficult to collect the accurate data. This research was using time series data from 1982 to 2002. The research used per capita income and per capita demand in measuring the quantity demand for electricity.

This research summarizes the determination of the quantity demand for electricity per capita on PT PLN (PERSERO); they are Indonesian Gross Domestic Product per capita, Prices of Oil, and the amount of PT PLN customer. The coefficient determination R-square is 0.996247. Here, the price of oil is the dominant factor influencing the quantity demand for electricity per capita in PT PLN. Therefore, the price of oil variable is needed to get more attention. PT PLN should have more consideration in determining the electricity prices respect to the price of oil because if PLN does not do so, it will lose some of their potential demand for electricity.

ABSTRAK

Muhammad Reza Arifani (2004), "Demand For Electricity In Indonesia The Case Of Quantity Demanded For Electricity In PT PLN (PERSERO) 1982-2002". Fakultas Ekonomi, Jurusan Ilmu Ekonomi Studi Pembangunan, Program International. Universitas Islam Indonesia, Yogyakarta.

Perkembangan gaya hidup masyarakat yang semakin meningkat menciptakan permintaan yang meningkat terhadap suatu produk tertentu. situasi yang terjadi sekarang ini adalah setiap orang menggunakan alat-alat elektronik untuk memudahkan mereka dalam kehidupan sehari-hari. Sehingga ini membuat listrik menjadi komoditas utama yang dibutuhkan diberbagai bidang. Setiap orang membutuhkan listrik di kehidupan sehari-hari dikarenakan diera moderen seperti sekarang ini listrik sangat dibutuhkan disetiap kegiatan. Karena sangat dibutuhkan maka terjadi permintaan terhadap listrik. Listrik di Indonesia disediakan oleh PLN sebagai satu-satunya perusahaan negara yang diberikan wewenang khusus untuk menangani bisnis listrik dinegara ini. Berdasarkan data dari PLN permintaan listrik dari waktu ke waktu cenderung meningkat, ini mencerminkan bahwa listrik makin dibutuhkan oleh setiap warga negara Indonesia. Kondisi yang terjadi sekarang ini adalah jumlah permintaan listrik di Indonesia sudah cukup tinggi sehingga membuat PT PLN tidak dapat memenuhi semua permintaan akan listrik. PT PLN hanya dapat memenuhi sebanyak 60% dari keseluruhan permintaan listrik yang ada.

Penelitian ini dilaksanakan untuk mengetahui permintaan listrik di Indonesia dan untuk mengetahui faktor-faktor apa saja yang mempengaruhi jumlah permintaan listrik di Indonesia. Penelitian ini hanya mempengaruhi permintaan listrik di PT PLN saja dikarenakan hampir semua permintaan listrik di Indonesia datangnya dari PT PLN. Dan permintaan-permintaan listrik yang itu datangnya dari berbagai perusahaan-perusahaan swasta, sehingga sangatlah susah untuk mendapatkan suatu data yang akurat. Penelitian ini menggunakan data deret waktu dari tahun 1982 hingga 2002. Penelitian ini juga menggunakan pendapatan per kapita dan permintaan per kapita untuk mendapatkan jumlah permintaan listrik.

Kesimpulan dari pada penelitian ini adalah faktor-faktor yang mempengaruhi permintaan listrik per kapita di PT PLN adalah Indonesia Gross Domestic Product, harga minyak dan jumlah pelanggan PT PLN itu sendiri. Dari regresi total didapat R-kuadrat = 0.996247. Disini juga dinyatakan bahwa harga minyak adalah faktor yang dominan yang mempengaruhi jumlah permintaan listrik per kapita di PT PLN.

Oleh karena itu variable harga minyak perlu mendapat perhatian lebih. PT PLN harus lebih memperhatikan dalam memberikan harga listrik mengingat akan harga minyak sehingga PT PLN tidak akan kehilangan permintaan listrik yang potensial.

CHAPTER I

INTRODUCTION

1.1. Background of the Study

If we talk about electricity, it is about the commodity needed by many sector. Every people need electricity in their daily life because in this modern era, most activities activity needs electricity. In the form of economic, electricity was needed in the term of production, consumption and distribution activity.

Electricity in Indonesia was began on the 19th century when some of Dutch companies established power unit for their own supplier which later on developed its core business into a public supply of electricity. In October 1945, President Soekarno inaugurated the National Electricity and Gas Corporation. In January 1965, two state-owned companies were established. The National Electricity Company ran the electricity supply and the National Gas Company catered for the demand for gas. In 1972, the Indonesia government declared the status of this National Electricity Company as the state-owned Public Electricity Company (Perusahaan Umum Listrik Negara). With a Government declaration number 17 issued in 1990, this company was appointed to hold the authority for electricity business. In 1992, the government offered the opportunities for the private sector to participate in the electricity business. In line with policy in June

| | | |
|------|------------|------|
| 1998 | 26,433,489 | 7.8 |
| 1999 | 27,524,552 | 4.13 |
| 2000 | 28,595,405 | 3.89 |
| 2001 | 29,827,728 | 4.31 |
| 2002 | 30,586,479 | 3.47 |

Source: Statistik PLN 2001

So based on the costumer data in PT PLN, the quantity demanded for electricity in Indonesia is always increasing from time to time. It reflects that electricity is needed more and more by the Indonesian citizen. The changing of percentage on the third row shows the number of change of the total costumer from time to time. It shows various numbers and instability. If we look in 1997 to 1998, it shows a significant drop to the total costumer because during that time Indonesia experienced monetary crisis.

Despite of the monetary crisis, the increasing number of costumer using electricity in Indonesia on PT PLN (PERSERO) means the growth for electricity demand is estimated to be 10 – 11 % per year this is an indication that electricity market is tremendously potential.

Nowadays, the demand of electricity in Indonesia is high, so that PT PLN as the supplier of electricity cannot cover all of the demand. According to the data, PT PLN can only cover about 60% from the total demand of electricity. This condition happens because PLN doesn't have the capability to produce electricity, so the remaining 40% demand for electricity gone to the private company, for example most of the Multinational companies that

run their business in Indonesia like PT Freeport in Papua, PT Exxon in Aceh, PT Caltex in Borneo provide their own electricity. Also the demand for electricity in the area surrounding the factory is provided by the company it's self. This is an example why PT PLN had lost their opportunities in providing electricity. However PT PLN doesn't give up and let the remaining 40 % demand for electricity gone to the private company. PT PLN use investment strategies to try to cover the remaining demand. Because PLN have the right from the government to provide electricity, PLN have the first authorities to decide how much the demand they want to cover. PLN use private investment to invest their capital in PT PLN so that PLN can build some more generators to increase their supply of electricity and can meet the demand that PLN has to cover. The purpose of this strategy is that some day PT PLN can cover all the demand of electricity throughout Indonesia.

It is interesting to know why it happens and what factors influence the quantity demand of electricity in Indonesia that makes state company like PT PLN (PERSERO) cannot cover all the demand of electricity in Indonesia. The research only deal with the demand of electricity in PT PLN because most of the demand of electricity in Indonesia comes from PT PLN and the other demand for electricity is shared with so many private companies, therefore it is difficult to collect the accurate data. Hopefully from the quantity demand of the electricity analysis, we might know what factor that influence the most to the quantity demand of electricity in

In Indonesia by PT PLN (PERSERO). This research will be limited to the year of 1982 to 2002.

1.2. Problem Formulation

Based on the study background and the significant of analysis on factors influencing the quantity demand for electricity per capita in PT PLN (PERSERO) Indonesia, the writer formulates the following problems:

1. What are the factors affecting the quantity demand for electricity per capita in Indonesia?
2. What are the effects Indonesian Gross Domestic Product per capita have on the quantity of demand for electricity per capita in PT PLN?
3. What are the effects of oil price upon the quantity of demand for electricity per capita in PT PLN?
4. What are the effects of the amount of customer upon the quantity of demand for electricity per capita in PT PLN?
5. What are the factors that influence dominantly to the quantity of demand for electricity per capita in Indonesia that provided by PT PLN?

1.3. Problem Limitation

The studies will focus on the demand of electricity in Indonesia provided by PT PLN (PERSERO). The reason is because PT PLN (PERSERO) is the only provider of electricity in Indonesia that has legal authority by the Indonesia government to supply, distribute and sell the electricity. PLN controls a large portion of the electricity supply such as, its generation, transmission and distribution. However it does not imply that PLN has a pure monopoly over the industry. PLN provide 80 % from the total of electricity used in Indonesia, the remaining 20 % is comes from the private company like Freeport. They provide their own electricity with their own generator and also supply the electricity in the area surrounding the company. Usually the other electricity provider like multinational company such as Exxon, Caltex, Freeport and other, they only provide electricity for the internal use and industrial purpose. So the other supply of electricity beside PLN are relatively small and scattered in isolated location (usually in other island outside java), making difficult to draw any general conclusion.

According to the difficulties to observe the demand for electricity by those companies, we only focuses on the demand for electricity produced by PT PLN (PERSERO) and still get general picture of the whole demand over the country.

1.4. Research Objectives

1. To examine the factors that affecting the quantity demanded of electricity per capita in Indonesia from the PT PLN (PERSERO) in the year 1982 – 2002.
2. To explore and measure factors that influence dominantly to the quantity demand of electricity in Indonesia.

1.5. Research Contribution

1. Company

Hopefully the research can give useful benefits for PT PLN management, mainly concerning to the demand of electricity in Indonesia. The research might also be able to give some supporting data for PT PLN (PERSERO) about the quantity demand of electricity in Indonesia so that PT PLN can cover all the demand for electricity in Indonesia.

2. Writer

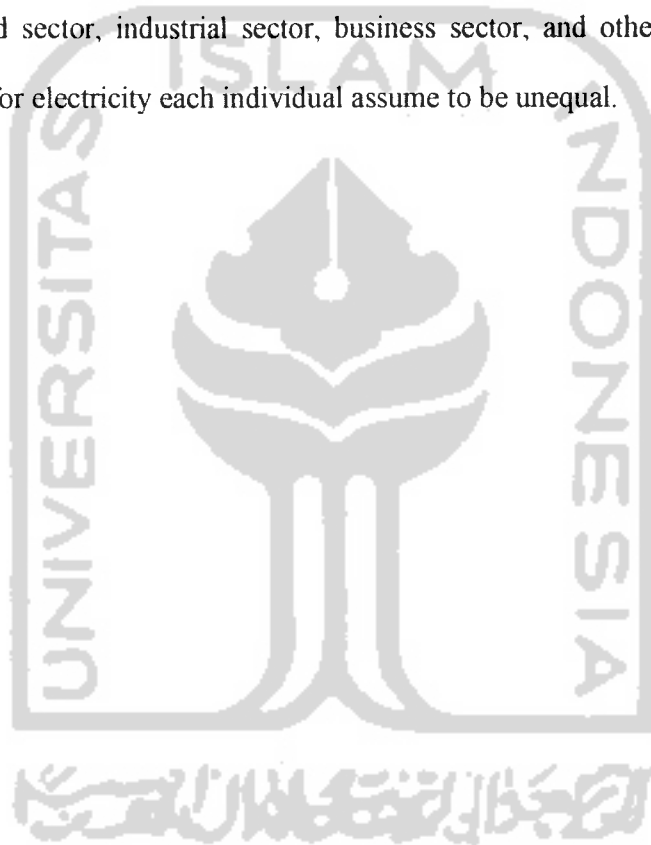
The research can give so many positive contributions for the writer, mainly concerning to the demand where in this case it deals with the demand of electricity in Indonesia that provide by PLN. The research is also to practice writer's ability in systematical analytic thought.

3. Other Parties

The research might also give contribution for other parties who want to make similar report. It can be a reference for them in making their report.

1.6. Definition of Terms

Demand for electricity means demand from Indonesia people for electricity that comes to PT PLN as the company in Indonesia that provide the electricity. The demand of electricity included people that already use the electricity. The demand of electricity data base on the PT PLN data about PT PLN customer, its cover all of PT PLN customer including household sector, industrial sector, business sector, and other. Where the demand for electricity each individual assume to be unequal.



CHAPTER II

REVIEW OF RELATED LITERATURE

2.1. Literature Review

2.1.1. Faried Wijaya Mansure (1986)

The former researcher that already research about electricity condition in Indonesia was done by *Faried Wijaya Mansure* (1986), his research entitles *Electricity Pricing and Investment under government policy constraints: the case of the Java Indonesia Interconnected supply system*. This research purpose is to review and analyze PLN pricing and investment under the government policy constraint. Its covers mostly in the period that begin in the late 1970's up to 1986 because in all of this period a non economic distributional objective dominates the price setting policy. The research study tries to analyze the industries optimization under such constraint. The mythology applied basically analytical and empirical simple a general overview of the industry and its relation with government role and policy is explored and the hypothesis is that electricity power has been almost always under priced due to general distributional objective. The similarities with the former research are related to the electricity in PT PLN. The different with this former research are this research is analyzing the factor that affecting to the quantity demand for electricity in Indonesia on the PT PLN.

2.1.2. Amarullah M (1983)

Another research that studies about electricity in Indonesia is done by *Amarullah, M.* (1983). His research's title is *Pricing of electricity in Indonesia*. The subject of this research is on the Energy Planning & Policy; electric power prices; electric power rate, rate structure ; Indonesia electric power; Mathematical models ; And power demand. The objectives of this study are 1) to establish a sound theoretical basis for the determinants of electricity demand in Indonesia, 2) to measure the welfare losses of existing electricity pricing, and 3) to suggest a method of reducing these welfare losses. An econometric model for electricity demand is estimated using pooled time-series of fifteen regions in Indonesia covering the period 1970-1979. The short run price elasticity for both residential and industrial/business sectors are found to be inelastic, while the long run price elasticity for these sectors is found to be quite elastic with a value of -0.61 for the residential sector and of -1.1 for the industrial/business sector. Income elasticity is 0.8 in the short run and around 1.00 for the long run. The exposure variable that captures the accessibility of electricity has long run elasticity of 1.00 for the residential sector and less than 1.00 for the industrial/business sector. Due to distributional considerations, the 1980's electricity rate was set below its efficient level, and has created a welfare loss of Rp.8273.23 million per month. This accounts for 36.03% of the

monthly electricity revenue. A rebate mechanism is recommended in this study, which provides a way to mitigate conflicting aspects of efficiency and equity.

2.1.3. Article from *listrik watch journal* (February – March 2004)

An article written in *Listrik Watch Journal* on February – March 2004 talk about the demand of electricity in India. The article describes the situation of electricity in India. The problem is almost similar to the problem of electricity in Indonesia, where the demand of electricity in India is bigger to the supply of the electricity itself. In India, the total population is about 1 billion people it places India country as the second biggest population in the world. Based from this total population makes the demand for electricity in India is huge the India states electricity company can not cover all the demand for electricity, the second reason is in India there also not enough resource as the fuel of the electricity. But India managed to deal with this problem. India government managed to develop renewable resource thru India Ministry of non-Conventional Energy Sources. This department set the national policy and regulation that not limited to the development and research about the renewable resource for electricity. For example India developed Biogas plant technology and wind power technology to produce energy for electricity. India also develops Solar Photovoltaic energy. Because of

the development of technology in renewable resource it attracts many private investors to invest in India. According to the data total private investors reach 82% from the total investment of 250 million rupee or similar to 46,23 trillion rupiah with 1 rupee = 184,918 rupiah, and the total capacity around 4 Giga Watt.



1994, the status of this company was changed into a state-owned Limited Company.

Based on the brief history of electricity in Indonesia, it can tell that most of electricity in Indonesia was provided by PT PLN (PERSERO), so the research will based on the PT PLN.

Based on its use, the electricity was needed in many sectors such as household, transportation, industrial, commercial, and business sector according to the data of PT PLN costumer. Because the electricity is very useful in every activity, it would create a demand for electricity. The demand for electricity is measured in quantity. Based on the economic theory, if a commodity is useful, it means that this commodity has more value, and then it would create more demand for this commodity. It can be seen from the increasing quantity of demand for this commodity from time to time. The example same as the quantity demanded for electricity in Indonesia.

Table 1.1
Consumer data in PT PLN (PERSERO)

| Year | Total Costumer | Percentage Change |
|------|----------------|-------------------|
| 1992 | 14,543,907 | 11.56 |
| 1993 | 15,157,409 | 12.39 |
| 1994 | 16,936,613 | 11.74 |
| 1995 | 19,471,647 | 14.97 |
| 1996 | 21,980,325 | 12.88 |
| 1997 | 24,640,587 | 12.10 |

CHAPTER III

THEORITICAL BACKGROUND AND HYPOTHESIS

3.1. Theoretical Background

3.1.1. Quantity Demand Theory

Demands are determined by quantity demanded of product, are the total amount of any particular goods and services that an economy's consumers wish to purchase in some time period. It is important to notice three things about this concept: (Richard G. Lipsey(1996: 63))

First, quantity demanded is a *desire* quantity. It is the amount that consumers wish to purchase that the price of the other product is assumed to be constant.

Second, *effective demand*. Are the amounts that people are willing to buy, given the price they must pay for the product.

Third, quantity demand refers to a continuous *flow* of purchase. The amount of some product that all costumers wish to buy in a given time period is influence by the following important variable (Richard G. Lipsey (1996: 65)):

1. Product's own price

A basic economic hypothesis is that the price of a product and the quantity that will demand are related negatively, while other thing is equal. That is, the lower the price, the higher

the quantity demanded, and the higher the price, the lower the quantity demanded. (Alfred Marshall (1842-1924)) this fundamental concept is called "Law of Demand." On the case of demand for electricity related to the prices of electricity is when the prices of electricity is increasing the quantity demand for electricity will decreasing.

2. Average Consumer Income

If consumers receive more income on average, they can be expected to purchase more of most products even though product prices remain the same. In the case of demand for electricity related to the income is when the National income or GDP is increasing the quantity demand for electricity will also increasing.

3. Other Price

It means other product prices or substitutes, A rise in the prices of substitute for a product its will make the quantity demanded for the product increase. It will make the demand curve shift to the right. In this case the price of gasoline is the substitution product for the electricity, when the price of gasoline is increasing the quantity demand for electricity is increasing or otherwise.

4. Taste

Tastes have an effect on people's desire to purchase. A change in the taste maybe long-lasting or short- lasting, a change in the tastes in favor of a product shift the demand curve to the right. In the case of demand for electricity we don't talk about the taste because every person have different taste and electricity is a commodity that needed by every individual.

5. Population

An increase in population will shift the demand curves for most products to the right, indicating that more will be bought at each price. It means that the increase of the population will increase the quantity demand for electricity because more people need more electricity in their daily lives.

Other economist, Gregory Mankiw (2001: 67) determines that quantity demand is *the amount of good that buyers are willing and able to purchase*. According to him the quantity of every individual demand are determine by,

1. Price, if the price of good is increasing the quantity of demand will decreasing.
2. Income, if the income is increasing the quantity demand is also increasing but this theory is happen on the normal

quantity and price each rise or fall; it is also important to know *how much, the change*. This is what the concept of *elasticity* does.

Elasticity is a term in economics to denote the responsiveness of one variable to change another, for example the elasticity of X with respect to the Y means the percentage of change in X for every 1 percent change in Y. In the term of demanding one good, the elasticity of demand will be showed by the percentage change price as the independent variable (X) and percentage change in quantity demand of good as the dependent variable (Y).

In economic there are several concept of elasticity (Gregory Mankiw, 2001: 75),

1. *Price elasticity of demand*, a measure of how much the quantity demanded of a good responds to a change in price to that good, computed as the percentage change in quantity demanded divided by the percentage change in prices.

$$\text{Prices elasticity of demand} = \frac{\% \text{ change in quantity of demanded}}{\% \text{ change in price}}$$

2. *Income elasticity of demand*, a measure of how much the quantity demanded of a good responds to a change in costumers income, computed as the percentage change in quantity demanded divided by the percentage change in income.

Cross-price elasticity of demand = $\frac{\% \text{ change in quantity demanded of good 1}}{\% \text{ change in the price of good 2}}$

Whether the cross price elasticity is a positive or negative number depends on whether the two goods are substitute or complements. Substitute goods if increasing in one price makes the demand for another price is increasing it had positive cross price elasticity and complement goods if prices of one good increasing the demand for another goods is decreasing it had negative cross price elasticity.

If the result are higher ($>$) than 1 means that elastic

Less ($<$) than 1 means that inelastic

Equal ($=$) than 1 means that Unitary

3.1.3. The Theory of Consumer Choice

Examine the trade off that people face in their role as costumer.

When a costumer buys more of one goods, he can afford less of other goods. When he spends more time enjoying leisure and less time working, he has lower income and can afford less consumption. So these theories examine how consumer facing these tradeoffs makes decision and they respond to change in their environment.

The Consumer Budget Constraint, the budget constraint shows the various bundles of goods that the consumer can afford for a given income.

Indifference curve, a curve that shows consumption bundles that give the consumer the same level of satisfaction. Four properties of indifference curve:

- Higher indifference curve are preferred to lower ones.
- Indifference curve are downward sloping.
- Indifference curve do not cross.
- Indifference curve are bowed inward, means the slope are marginal rate of substitution.

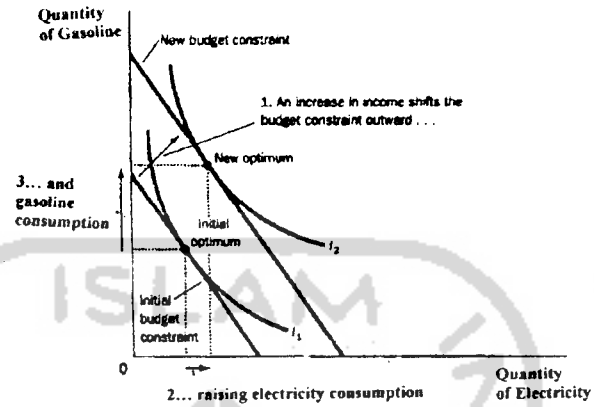
Marginal rate of substitution, is the rate at which a consumer is willing to trade one good for another.

The Consumer Optimal Choices, The consumer choose the point on his budget constraint that lies on the highest indifferent curve. At this point, called optimum, the marginal rate of substitution equals the relative prices of two goods.

3.1.3.1. The effect of income on the Consumer's Choices

An increase on the consumer income raises the budget constraint shift to the right. If both goods are *normal goods*, the consumer responds to increasing in income by buying more of both of them. In this case the writer use electricity and gasoline as the example, graphical example show the

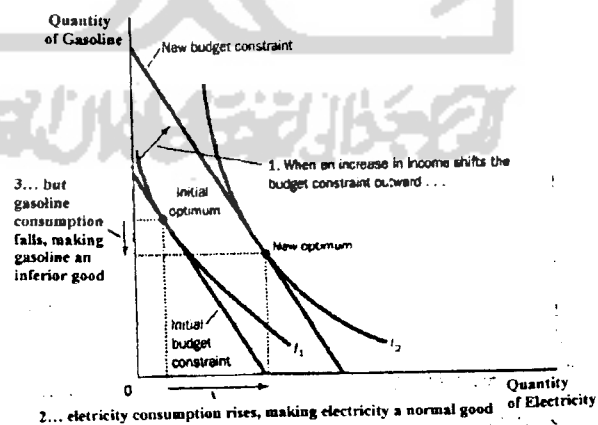
consumer buys more electricity and more gasoline when their income is increasing. In **Graph 3.1**



Normal good, a good for which an increasing in income raises the quantity demanded.

If the good are *Inferior good*, a good for which an increasing in income reduces the quantity demanded. The graph is like in the below.

Graph 3.2

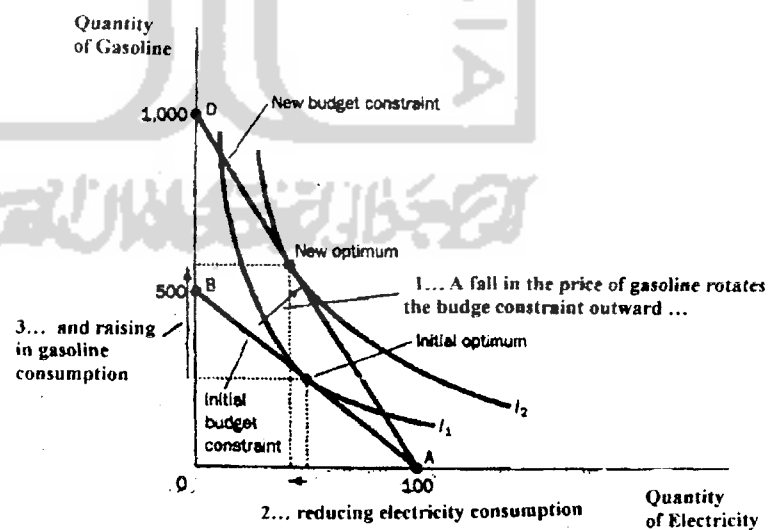


In this graph gasoline is the inferior good, when the consumer's income increases and the budget constraint shift outward; the consumer buys more electricity but less gasoline.

3.1.3.2. The effect of price on Consumer's Choices

When the prices of one good falls in this case the prices of gasoline, the consumer's budget constraint shift outward and change the slope. The consumer moves from initial optimum to the new optimum, which changes his purchase of both gasoline and electricity. In this case, the quantity of gasoline consumed rises, and the quantity of electricity consumed falls.

Graph 3.3



3.1.3.3. Income and Substitution Effect

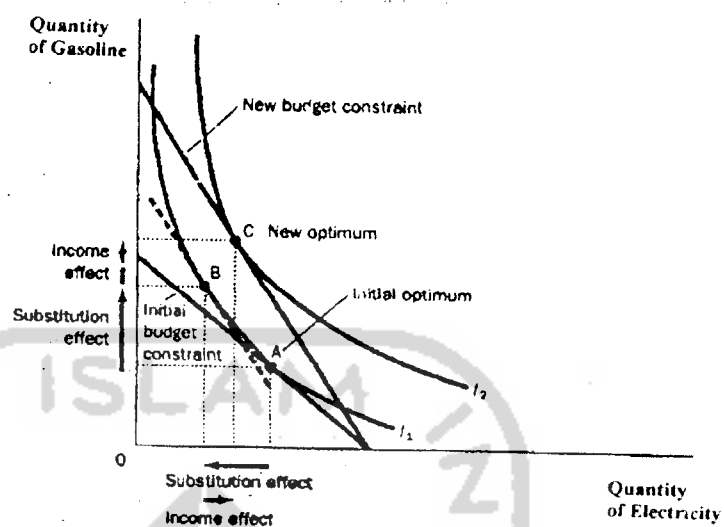
The impact of a change in the price of a good on consumption can be decomposed into two effects: an income effect and substitution effect. We use the example of electricity and gasoline. The situation maybe like this:

- “Great news! Now that price of gasoline is cheaper, my income has greater purchasing power. I am, in effect, richer than I was. Because I am richer, I can buy both more gasoline and electricity. (this is the income effect)
- “Now that the price of gasoline has fallen, I get more pints of gasoline for every electricity that I give up. Because electricity is now relatively more expensive, I should buy less electricity and more gasoline. (This is the substitution effect).

Income effect is the change in the consumption that result when a price is change moves the consumer to a higher or lower indifferent curve.

Substitution effect is the change in consumption that results when a price change moves the consumer along a given indifference curve to a point with a new marginal rate of substitution.

Graph 3.4



The effect of a change in price can be broken down into an income effect and substitution effect. The substitution effect is the movement along an indifference curve to a point with a different marginal rate of substitution, as shown here as the change from point A to point B along indifference curve I_1 . The income effect is the shift to a higher indifference curve, as shown here as the change from point B on indifference curve I_1 to point C on indifference curve I_2 .

CHAPTER IV

RESEARCH METHOD

4.1. Research Method

The research method used in this research was quantitative analysis. The quantitative analysis is a characteristic of variables where the mark stated on the numerical form. The characteristics of the measurement variable make the mark being placed in an interval.

The writer also used literature study. Literature study is meant to get theory to help in solving the problem in the research by learning the literatures and books related to the analysis and problems of research.

4.2. Research Subject

This research concentrates on the demand for electricity in Indonesia. The case study of quantity demand for electricity in PT PLN (PERSERO) became the subject in this thesis

4.3. Research Setting

The study of this thesis takes place on Economics Faculty of Islamic University of Indonesia, PT PLN (PERSERO) head office Jl Trunojoyo 135 Kebayoran Baru, Jakarta and also in BPS (Badan Pusat Statistik) Yogyakarta. The writer does the research through literature and data analysis

that available on the library and reference room in economics faculty of Islamic University of Indonesia and also from PT PLN office at Jakarta.

4.4. Research Variables

Based on the data used in this research, the variables in this thesis are categorized into two variables; dependent variable and independent variables. Both variables are described as follows:

4.4.1. Dependent variable

The dependent variable in this research is the Quantity demand for electricity per capita in Indonesia (Q).

4.4.2. Independent variable

The independent variables in this research consist of four variables, they are:

4.4.2.1 The Indonesian GDP per capita (GDP).

4.4.2.2 The Price of oil (Po).

4.4.2.3 The Number of PT PLN customer (Customer).

4.5. Types and Sources of Data

4.5.1. Data Source

➤ Primary Data

Data that obtain straightly from the authorization that comes from interview with the PT PLN officer or whom it may concern and employee.

➤ Secondary Data

Secondary data is the data taken from the literatures related to the research topic.

4.5.2. Data Needed

➤ General Data

- The Quantity demand for electricity in Indonesia
- Indonesia population
- Indonesia GDP
- Indonesia price of oil
- Number of PT PLN customer

4.5.3. Population

Population is the whole or individual unit becoming the suggestion or the research subject, which the characteristics will be supposed. In this research, the population is all of Indonesian citizen.

4.5.4. Sampling method

In this research, the researcher prefers to use selected sampling method, which means the researcher will choose several units from the population independently. The sample will be the customers at PT PLN (PERSERO) who use electricity. The method of sample collection for this research will collect accurate data from PT PLN (PERSERO):

Based on the data of PT PLN customer that already use electricity, according to PLN, the customer who use electricity is divided into four groups: residential, industrial, business and social.

4.6. Method of Data Compilation

The writer uses method of data compilation to obtain the prices of electricity and oil in Indonesia because the prices of both commodities, the electricity and the oil, have different prices for different use and function.

In this research the writer do not include the prices of electricity in the regression model because prices of electricity is determine by the company together with central government as the supplier, not from the market it self. Based on the research, the prices of electricity and prices of oil get multicorrelation it means that prices of oil and prices of electricity have strong correlations. The reason not to include prices of electricity and only based on the prices of oil as the substitution goods because whenever the prices of oil is increasing as the result of decreasing in subsidies to the oil prices, the government also increase TDL (Tarif Dasar Listrik) in Indonesia so makes the prices of electricity in PT PLN increasing. From this analysis we can see that prices of oil and prices of electricity have a strong relationship.

Other reason not to include prices of electricity because nowadays electricity just likes necessities goods whenever the price is increasing the

Function of Quantity demand for electricity per capita in Indonesia can be formed as follows:

$$Q = f \{GDP, Po, Customer\}$$

Where:

Q : Quantity Demand for electricity per capita in Indonesia (GWh).

GDP : The Value of Indonesia's Gross Domestic Products per capita (in Rupiah).

Po : The Price of oil (Rp/litter).

Customer: The amount of PT PLN customer (people)

Writer uses linear regression model in this research in the form of the following econometric model:

$$Q = \beta_0 + \beta_1 GDP + \beta_2 Po + \beta_3 Customer + u$$

Where;

β_0 : Constant

β_1, \dots, β_4 : Regression coefficient of each variable.

Q : The Quantity demanded for electricity per capita in Indonesia (GWh)

GDP : The Indonesia's Gross Domestic Products per capita (Rupiah)

Po : Prices of oil (Rupiah/litter).

Customer: Amount of PT PLN Customer

u : disturbance error

The writer also applies statistical test which include testing about individual partial regression coefficient and testing the overall significance of

4.7.2 F – test

This test is used to detect the correlation between dependent variable and independent variables jointly. The testing of F test is the same as the testing for t test. Hypothesis is formulated as follows:

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$: hence the independent variables do not affect the dependent variable jointly.

$H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$: hence the independent variables affect the dependent variable together.

4.7.3 Goodness of Fit (R^2)

It is an important property of R^2 that a non decreasing function of the number of explanatory variables or independent variables presents in the model; as the number of independent variables increase. R^2 almost invariably increases and never decreases. R^2 is used to detect how far the independent variable influences the dependent variable in the model (Gujarati, 1995: 207). R^2 is being a measure of the goodness of fit of a sample least squares linear regression in a body of data. The number of R^2 is between 0 – 1. The closer the number of R^2 to 1 the better the model explain about relationship between dependent variable and independent variables.

4.7.4 Classical Assumption

Basically this test is used to know whether the model in this research is a valid model or not. We can say the model is a valid model if there is no correlation, autocorrelation, and heteroscedasticity in the model.

4.7.4.1 Multicollinearity

Multicollinearity means the existence of a perfect or exact linear relationship among some or all explanatory variables of a regression model (Gujarati, 1995: 320). The consequences of multicollinearity are as follows: if there is perfect collinearity between the X 's, their regression coefficients are indeterminate and their standard errors are not defined. If collinearity is high but not perfect, estimation of regression coefficients is possible but their standard errors tend to be large. As a result, the population values of coefficients cannot be estimated precisely. However, if the objective is to estimate linear combination of these coefficients, the *estimable function*, this can be done even in the presence of perfect multicollinearity (Gujarati, 1995: 345).

To detect multicollinearity, we can use the correlation method as the best one. The multicollinearity is predicted happens when R^2 is high, say in excess of 0.8. If R^2 is high,

the F test in most cases will reject the hypothesis that the partial slope coefficients are simultaneously equal to zero.

4.7.4.2. Autocorrelation

The term autocorrelation may be defined as correlation between members of series of observations ordered in time (as in time series data) or space (as in cross-sectional data) (Gujarati, 1995: 400). If there is autocorrelation in the model, it will raise the value of residual and the impact is the number of t-test, f-test and R^2 will decline.

The tool of analysis is used to detect autocorrelation is using LM test (Lagrange Multiplier Test). This test uses the level of degree (χ^2) in which the expressing that there is no autocorrelation, with the guidance if χ^2 statistic bigger than the value of χ^2 table, hence H_0 denied and also on the contrary.

4.7.4.3. Heteroscedasticity

An important assumption of heteroscedasticity shows the conditional of X increasing as Y increasing. Here the variances of X are not the same. The writer used White Test that provided by the Eviews 3.0 program to detect heterocedasticity.

The White Model is:

$$E^2 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \delta_1 X_1^2 + \delta_2 X_2^2 + \delta_3 X_3^2 + \delta_4 X_1 X_2 + \delta_5 X_1 X_3 + \delta_6 X_2 X_3 + \varepsilon \quad (4.7.4.3.a)$$

That is, the squared residual from the original regression are regressed on the original X variable, their squared values, and the cross product of the regressors.

Under the null hypothesis that there is no heteroscedasticity, it can be shown that sample size (n) times the R^2 obtained from the auxiliary regression asymptotically follows the chi-square distribution with df equal to the number of independent variables (excluding the constant term) in the auxiliary regression. That is,

$$n \cdot R^2 \underset{asy}{\sim} \chi^2_{df} \quad (4.7.4.3.b)$$

If the chi-square value obtained in (4.7.4.3.b) exceeds the critical chi-squared value at the chosen level of significance, the conclusion is that there is heteroscedasticity. If it does not exceed the critical chi-square value, there is no heteroscedasticity, which is to say that in the auxiliary regression (5.7.4.3.a), $\alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$.

omitted variable, the test can be regarded as a general one for the omission of one or more relevant variable.

The RESET test of this subsection can be regarded as a test of general mis-specification. When we apply it, the null hypothesis is that of a correct specification but we have no definite alternative hypothesis in mind. Rejection of the null hypothesis merely indicates that the equation has been mis-specification in some way or other.



CHAPTER V

GENERAL DESCRIPTION OF PLN

5.1. PT PLN (PERSERO) in brief

The history of PT PLN dates back to the end of 19th Century when some of Dutch companies established some power unit for their own supply, which later on developed its core business into public supply of electricity.

In October 1945, Indonesian first president, Soekarno, inaugurate the National Electricity and Gas Corporation. At the time being, the generation capacity was only 157.5 MW.

In January 1965, two state-own companies were established. The National Electricity Company that ran the electricity supply and the National Gas Company catered for the demand for gas. The installed Capacity was around 300 MW.

In 1972, the Indonesian government declared the status of this Electricity Company as the State-owned Public Electricity Company (Perusahaan Listrik Negara). With a Government Declare number 17 issued in 1990, this company was appointed to hold the authority for electricity business.

In 1992, the government offered the opportunities for the private sector to participate in the electricity business. In line with this policy, in June 1994, the status of this company changes into a State-Owned Limited Company (PERSERO).

- PT pelayanan Listrik Nasional Batam (PT PLN Batam) with business in Electric Power supply for public in Batam Island region, established on October 3rd, 2000.
- PT Indonesia Connets Plus (PT ICON+) with business in Telecommunication, established on October 3rd, 2000.

In addition to these activities, to anticipate a regional autonomy policy, PLN has also established Strategic Business Units in regard to regions, a similar entity with wider managerial autonomy.

5.3.2. PLN Supporting Units:

- PT PLN (PERSERO) Jasa Pendidikan dan Latihan (PLN Jasdik)
PLN educational and training center has conducted various educational activities and training in fields such as technical, management, finance, and general administration in 10 location spread out in many region in Indonesia and prepared to serve for the needs of education and training within PLN or outside PLN.
- PT PLN (PERSERO) Jasa Enjiniring (PLN Jaseng)
PLN engineering Service has several experts knowledgeable in various fields of technology who have wide experience working with International Consultants.
- PT PLN (PERSERO) Unit Bisnis Jasa Teknik Kelistrikan (PLN Jastek)

The research and development unit business provides support in standardization, calibration as well as test for electrical appliances and other instruments.

The Low Voltage Laboratory has been accredited nationally by KAN-BSN and internationally by Raad voor Acreditatie (RvA – the Netherlands)

The Medium & High Voltage Laboratory as well as the Calibration Laboratory has received the national accreditation form KAN-BSN and international accreditation from RvA – the Netherlands is currently on the assessment process.

- PT PLN (PERSERO) Unit Bisnis Jasa dan Produksi (PLN-JP)

The Service and Production Business Unit of PLN give supports in field of Production, Construction and Repair Services, particularly in the electricity sector. PLN – JP is a consolidation of 4 Production Unit and 2 Sub-Production Units spread all over Java.

5.4. PT PLN (PERSERO) Human Resources

PLN currently employs 50.310 staff across the country with 7.4 % of them are having graduated and post graduate. In order to improve individual skill and competence as required by the constantly developing technology, the company conduct various educational and training activities though in-house training, universities, and other local and overseas institutional. Table 5.1 and table 5.2 below show the number of employee that work in PT PLN according their major field of study and group of employee in PT PLN (PERSERO).

Table 5.1, source 50 year PLN dedication book

| Jurusan | 77/78 | 78/79 | 79/80 | 80/81 | 81/82 | 82/83 | 83/84 | 84/85 | 85/86 | 86/87 | 87/88 | 88/89 | 89/90 | 90/91 | 91/92 | 92/93 | 93/94 | 1994 |
|---------------------|------------|------------|------------|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Sarjana | 509 | 591 | 667 | 779 | 913 | 1.095 | 1.466 | 1.716 | 2.003 | 2.116 | 2.188 | 2.304 | 2.376 | 2.552 | 2.712 | 3.164 | 3.669 | 3.961 |
| Teknik | | | | | | | | | | | | | | | | | | |
| Listrik | 227 | 268 | 289 | 338 | 404 | 483 | 605 | 718 | 859 | 904 | 932 | 959 | 946 | 1.011 | 1.021 | 1.214 | 1.351 | 1.453 |
| Mesin | 101 | 120 | 147 | 163 | 191 | 211 | 292 | 292 | 340 | 359 | 374 | 383 | 404 | 422 | 435 | 513 | 594 | 646 |
| Sipil | 42 | 55 | 69 | 83 | 110 | 139 | 201 | 241 | 267 | 263 | 263 | 291 | 290 | 298 | 310 | 318 | 330 | 345 |
| Lain-lain | 19 | 21 | 25 | 26 | 26 | 32 | 60 | 85 | 82 | 85 | 86 | 58 | 56 | 58 | 67 | 115 | 159 | 197 |
| Bukan Teknik | | | | | | | | | | | | | | | | | | |
| Ekonomi | 46 | 43 | 46 | 62 | 66 | 95 | 128 | 177 | 219 | 241 | 243 | 275 | 297 | 338 | 389 | 448 | 544 | 616 |
| Hukum | 21 | 25 | 25 | 30 | 28 | 45 | 55 | 72 | 83 | 100 | 104 | 120 | 131 | 140 | 152 | 169 | 206 | 211 |
| Administrasi | 45 | 46 | 48 | 60 | 51 | 69 | 72 | 76 | 90 | 100 | 112 | 147 | 165 | 192 | 235 | 280 | 339 | 343 |
| Lain-lain | 8 | 13 | 18 | 17 | 37 | 21 | 53 | 55 | 63 | 64 | 74 | 71 | 87 | 93 | 103 | 107 | 146 | 150 |
| Sarjana Muda | 639 | 696 | 767 | 870 | 1.029 | 1.140 | 1.466 | 1.704 | 1.985 | 2.070 | 2.092 | 2.119 | 2.235 | 2.294 | 2.376 | 2.551 | 2.717 | 2.750 |
| Teknik | | | | | | | | | | | | | | | | | | |
| Listrik | 265 | 282 | 294 | 340 | 401 | 433 | 537 | 637 | 718 | 745 | 761 | 758 | 841 | 872 | 889 | 970 | 1.070 | 1.101 |
| Mesin | 107 | 121 | 148 | 160 | 197 | 221 | 281 | 307 | 351 | 349 | 354 | 374 | 388 | 377 | 388 | 412 | 460 | 482 |
| Sipil | 38 | 41 | 51 | 56 | 68 | 91 | 135 | 159 | 189 | 197 | 196 | 192 | 197 | 196 | 202 | 202 | 203 | 171 |
| Lain-lain | 11 | 15 | 21 | 18 | 23 | 25 | 41 | 50 | 48 | 46 | 51 | 52 | 52 | 52 | 58 | 67 | 62 | 63 |
| Bukan Teknik | | | | | | | | | | | | | | | | | | |
| Ekonomi | 69 | 72 | 80 | 99 | 76 | 129 | 182 | 217 | 283 | 299 | 304 | 314 | 313 | 336 | 386 | 426 | 431 | 449 |
| Hukum | 29 | 27 | 33 | 42 | 50 | 47 | 61 | 66 | 71 | 65 | 61 | 50 | 46 | 54 | 44 | 49 | 51 | 42 |
| Administrasi | 79 | 85 | 75 | 90 | 99 | 130 | 145 | 142 | 160 | 190 | 169 | 200 | 200 | 197 | 198 | 203 | 210 | 211 |
| Lain-lain | 41 | 63 | 65 | 65 | 115 | 64 | 104 | 126 | 165 | 179 | 96 | 179 | 198 | 210 | 211 | 225 | 230 | 231 |

Table 5.2, show the worker in PT PLN based on there group of employee.

| Tahun Anggaran | Golongan | | | | Calon Pegawai | Tenaga Harian | Jumlah |
|----------------|----------|--------|-------|-----|---------------|---------------|--------|
| | I | II | III | IV | | | |
| 1969 | | | | | | | 18.100 |
| 1970 | | | | | | | 18.282 |
| 1971 | | | | | | | 20.083 |
| 1972 | | | | | | | 21.100 |
| 1973 | | | | | | | 21.530 |
| 1974 | | | | | | | 19.509 |
| 1974/75 | | | | | | | 20.308 |
| 1975/76 | | | | | | | 21.299 |
| 1976/77 | | | | | | | 25.015 |
| 1977/78 | 10.490 | 6.389 | 845 | 150 | 600 | 9.315 | 27.789 |
| 1978/79 | 10.703 | 7.349 | 940 | 160 | 474 | 9.719 | 28.385 |
| 1979/80 | 10.663 | 7.342 | 1.013 | 171 | 764 | 10.177 | 30.130 |
| 1980/81 | 10.631 | 8.231 | 1.187 | 182 | 682 | 12.038 | 32.951 |
| 1981/82 | 10.481 | 9.886 | 1.337 | 181 | 1.240 | 12.666 | 35.791 |
| 1982/83 | 10.729 | 11.445 | 1.640 | 193 | 1.718 | 14.237 | 39.962 |
| 1983/84 | 10.854 | 12.751 | 1.934 | 196 | 3.048 | 16.126 | 44.909 |
| 1984/85 | 11.736 | 14.208 | 2.274 | 202 | 4.231 | 17.045 | 49.696 |
| 1985/86 | 12.496 | 17.016 | 2.629 | 206 | 4.475 | 14.468 | 51.290 |
| 1986/87 | 12.776 | 19.287 | 2.956 | 200 | 2.204 | 14.148 | 51.571 |
| 1987/88 | 12.487 | 20.815 | 3.161 | 220 | 1.566 | 12.954 | 51.203 |
| 1988/89 | 12.080 | 21.686 | 3.321 | 236 | 2.136 | 11.778 | 51.237 |
| 1989/90 | 11.446 | 23.339 | 3.595 | 263 | 2.537 | 10.673 | 51.853 |
| 1990/91 | 11.307 | 25.632 | 3.827 | 261 | 3.827 | 7.958 | 52.812 |
| 1991/92 | 10.932 | 27.089 | 3.759 | 414 | 4.559 | 7.129 | 53.882 |
| 1992/93 | 11.008 | 29.805 | 4.061 | 420 | 4.909 | 5.534 | 55.737 |
| 1993/94 | 9.731 | 33.292 | 4.319 | 521 | 5.898 | 4.145 | 57.906 |
| 1994 | 9.525 | 35.694 | 4.632 | 583 | 4.353 | 3.209 | 57.996 |

Source: 50 year PLN dedication

5.5. PT PLN (PERSERO) Business Activities

5.5.1. Generation

At the end of 2000 the installed capacity of PLN has reached 20,762 MW, coming from all generation units across Indonesia.

The generation capacity respectively is given below:

| | |
|---|------------|
| - Hydro Power Plants | : 3.015 MW |
| - Oil-fired Diesel Power Plants | : 2.550 MW |
| - Steam Power Plants | : 6.770 MW |
| - Gas Turbine Power Plant | : 1.203 MW |
| - Combined Cycle Gas Turbine Power Plants | : 6.873 MW |
| - Geothermal Power Plants | : 360 MW |

5.5.2. Financing

PT PLN financing sector is comes from many sectors

1. Foreign aid, this aid comes from multilateral source such as: World Bank, Asian Development Bank. And Bilateral source such as: KfW-German, France, Austria, and Japan. And also from Export Credit.
2. Grant, commonly this help in form of training to the employee, scholarship, etc.
3. Domestic fund, this domestic fund comes from the entire fund in Rupiah that help PT PLN to finis all PT PLN project beside foreign aid.

4. APBN (Anggaran Pendapatan Belanja Negara).
5. Government Saving.
6. APLN (Anggaran PLN), from 1982/83 PT PLN have to provide its own source of fund.
7. Obligation, since year 1992/1993 PT PLN had already issue an obligation to the society to finance their project.
8. Banking sector means that PT PLN must loan fund from the banking sector.

Table 5.4, show how much funds that PT PLN get from Valas, APBN and APLN.

| Tahun | Valas | APBN | APLN | APBN+APLN | Total | Total Repelita |
|---------|---------------|-------------|---------------|---------------|---------------|-------------------|
| 1969/70 | 1.039.847 | 3.987.100 | | 3.987.100 | 5.026.947 | |
| 1970/71 | 2.511.954 | 7.098.189 | | 7.098.189 | 9.610.143 | |
| 1971/72 | 11.127.545 | 8.756.874 | | 8.756.874 | 19.884.419 | |
| 1972/73 | 6.571.848 | 13.870.873 | | 13.870.873 | 20.442.721 | |
| 1973/74 | 9.498.765 | 15.563.735 | | 15.563.735 | 25.062.500 | 80.026.730 |
| 1974/75 | 39.470.272 | 44.879.882 | | 44.879.882 | 84.350.154 | |
| 1975/76 | 78.953.763 | 45.934.965 | | 45.934.965 | 124.888.728 | |
| 1976/77 | 113.966.750 | 57.904.588 | | 57.904.588 | 171.871.338 | |
| 1977/78 | 110.050.560 | 64.609.574 | | 64.609.574 | 174.660.134 | |
| 1978/79 | 90.953.343 | 65.197.758 | | 65.197.758 | 156.151.101 | 711.921.455 |
| 1979/80 | 208.477.410 | 72.739.368 | | 72.739.368 | 281.216.778 | |
| 1980/81 | 323.838.704 | 111.429.773 | | 111.429.773 | 435.268.477 | |
| 1981/82 | 313.218.787 | 151.582.833 | | 151.582.833 | 464.801.620 | |
| 1982/83 | 580.650.582 | 182.873.847 | 183.424.445 | 366.298.292 | 946.948.874 | |
| 1983/84 | 540.093.742 | 149.778.121 | 74.368.224 | 224.146.345 | 764.240.087 | 2.892.475.836 |
| 1984/85 | 638.141.000 | 182.094.017 | 181.030.123 | 363.124.140 | 999.265.140 | |
| 1985/86 | 877.992.000 | 199.319.215 | 76.293.000 | 275.612.215 | 1.153.604.215 | |
| 1986/87 | 767.725.000 | 96.297.437 | 316.525.011 | 412.822.448 | 1.180.547.448 | |
| 1987/88 | 1.270.454.000 | 187.377.000 | 577.068.000 | 764.445.000 | 2.034.899.000 | |
| 1988/89 | 1.157.831.000 | 638.812.868 | 127.046.793 | 765.859.661 | 1.923.690.661 | 7.292.006.464 |
| 1989/90 | 685.037.508 | 405.747.471 | 465.189.000 | 870.936.471 | 1.555.973.979 | |
| 1990/91 | 671.635.305 | 522.541.956 | 607.950.772 | 1.130.492.728 | 1.802.128.033 | |
| 1991/92 | 1.785.768.580 | 618.169.869 | 786.463.000 | 1.404.632.869 | 3.190.399.449 | |
| 1992/93 | 2.934.717.000 | 725.803.233 | 1.616.745.000 | 2.342.548.233 | 5.277.265.233 | |
| 1993/94 | 2.540.951.580 | 818.439.497 | 2.089.778.000 | 2.908.217.497 | 5.449.169.077 | 17.274.935.771 |

Source: 50 year PLN dedication book

Table 5.5, show number of PLN project that had help from foreign country.

Source from: *50 year PLN dedication book*

| Tahun kontrak | Proyek | Negara Donor | Bantuan (juta US\$ eq) |
|---------------|---------------------------------|-----------------|------------------------|
| 1957 | PLTA Jatiluhur | Perancis | 9,7 |
| | PLTD Tersebar | Amerika Serikat | 7 |
| 1958 | PLTA Timo | Cekoslovakia | 0,45 |
| 1959 | PLTA Jatiluhur | Perancis | 6,9 |
| 1960 | PLTA Jatiluhur | Perancis | 5,5 |
| | PLTU Tanjung Priok | Jerman | 7,7 |
| | PLTD Tersebar | Cekoslovakia | 1,85 |
| | PLTD Kebayoran | Jerman | 1,6 |
| | PLTU Tanjung Perak | Amerika Serikat | 14,35 |
| 1961 | PLTU Tanjung Priok | Jerman | 4 |
| 1962 | PLTA Jatiluhur | Perancis | 5,5 |
| 1963 | PLTA Jatiluhur | Perancis | 23 |
| | PLTA Jatiluhur | Perancis | 10,2 |
| | Transmisi Jawa Barat | Hungaria | 0,7 |
| | PLTU Tello (Ujung Pandang) | Yugoslavia | 9,95 |
| | PLTU Keramasan (Palembang) | Yugoslavia | 9 |
| 1964 | PLTA Jatiluhur | Perancis | 0,8 |
| | PLTA Jatiluhur | Perancis | 3,2 |
| | PLTA Jatiluhur | Perancis | 6,3 |
| | PLTU Tg. Priok | Jerman | 1,1 |
| | Transmisi Jawa Barat | Perancis | 1,2 |
| | PLTD Tersebar | Cekoslovakia | 0,2 |
| 1965 | PLTA Jatiluhur | Perancis | 5 |
| | Transmisi Jawa Barat | Perancis | 2,2 |
| | Transmisi Jawa Barat | Perancis | 2,2 |
| | PLTG Medan, Palembang, Semarang | Jerman | 4 |
| | Transmisi Jawa Timur | Yugoslavia | 2,5 |
| 1966 | PLTA Jatiluhur | Perancis | 6,05 |
| | Transmisi Jawa Timur | Yugoslavia | 1,5 |
| 1968 | Transmisi Jawa Barat | Perancis | 2,1 |
| | PLTA Asahan | Rusia | 2,7 |
| Total | | | 173,45 |

Sumber : *Tenaga Listrik, Profil dan Anatomi Hasil Pembangunan Dua Puluh Lima Tahun Bambang Pumomo - PT Gramedia Pustaka Utama 1994*

5.6. PT PLN (PERSERO) Transmission and Distribution

For Java-Bali PLN has an Interconnected Transmission System of 500 kV and 150 kV, while for outside Java-Bali the System used is the separated transmission system 150 kV and 70 kV. The transmission and distribution line show in the table 5.6 below.

Table 5.6, Transmission and Distribution line

| YEAR | Transmission Line (kms) | Distribution line Medium voltage (kms) | Distribution line Lower voltage (kms) | Distribution pos MVA |
|------|-------------------------|--|---------------------------------------|----------------------|
| 1969 | - | - | - | - |
| 1970 | - | - | - | - |
| 1971 | - | - | - | - |
| 1972 | - | - | - | - |
| 1973 | 1101 | 6349 | 17265 | 924 |
| 1974 | - | - | - | - |
| 1975 | - | - | - | - |
| 1976 | - | - | - | - |
| 1977 | - | - | - | - |
| 1978 | 6582 | 14715 | 28448 | 2839 |
| 1979 | 6731 | 16975 | 32028 | 3181 |
| 1980 | 8020 | 18788 | 36571 | 3736 |
| 1981 | 8740 | 20315 | 39703 | 4183 |
| 1982 | 9608 | 22602 | 43724 | 4726 |
| 1983 | 10641 | 27627 | 50673 | 5649 |
| 1984 | 11416 | 31876 | 54914 | 6360 |
| 1985 | 12320 | 37438 | 64936 | 7166 |
| 1986 | 13774 | 42821 | 74101 | 8145 |
| 1987 | 14505 | 55602 | 92637 | 9915 |
| 1988 | 14983 | 63455 | 103694 | 10720 |
| 1989 | 15426 | 70666 | 114225 | 12285 |
| 1990 | 16563 | 77346 | 120919 | 13108 |
| 1991 | 18509 | 84776 | 126919 | 13609 |
| 1992 | 18874 | 101037 | 141138 | 14737 |
| 1993 | 18997 | 106506 | 160935 | 15266 |
| 1994 | 19514 | 116804 | 177258 | 16937 |

Source: 50 year PLN dedication book

5.7. PT PLN (PERSERO) Production

Electricity in Indonesia mostly comes from PT PLN but not all of it. PT PLN also does not produce total of electricity. Some of electricity in PLN comes from private company. It means PT PLN buy electricity form private electricity company in Indonesia. Example of the private electricity companies are:

- NV.EMTO (Electricity Maatschappij Timor en Omstreken).
- S.W. YOUNGE (Electricity Maatschappij S.W.Younge), in Tanjung Pinang.
- NV. MEPB to provide electricity in Prapat, Balige, Sidikalang, and Penuh River Celebes Island.
- NV. MEPB (Maatschappij tot Exploitatie van Plaatselijke Bedrijven) provide electricity in Celebes Island and outside Makasar.

Table 5.7 below shows how much electricity that is produced by PT PLN and how much electricity that PT PLN must buy in providing electricity in Indonesia.

Table 5.7, PLN Own Production and PLN buy electricity

| YEAR | Own Production GWh | Buying Electricity GWh |
|------|-----------------------|---------------------------|
| 1969 | 1429 | 486 |
| 1970 | 1626 | 525 |
| 1971 | 1756 | 677 |
| 1972 | 1997 | 566 |
| 1973 | 2369 | 637 |
| 1974 | 2631 | 714 |
| 1975 | 2989 | 781 |
| 1976 | 3428 | 700 |
| 1977 | 4055 | 685 |

CHAPTER VI

RESEARCH FINDINGS AND DISCUSSION

6.1. Research Description

The research aims to analyze factors affecting the quantity demand for electricity in PT PLN (PERSERO). This research used quantity demand for electricity per capita in order to have a better in measure in average person demand. The factors that affect the quantity demand for electricity per capita in PT PLN that are examined in this research consist of Indonesian gross domestic product per capita, prices of oil and number of PT PLN customer.

The type of data being observed and examined in this research is time series data. The data used in this research annually are the data from 1982 until 2002. It cover the total value of quantity demand for electricity per capita in PT PLN (Q) measure in Giga Watt hours, Indonesian gross domestic product per capita (GDP) measure in million rupiah, prices of oil (P_Oil) measure in rupiah/litter and number of PT PLN customer (CUSTOMER) measure in people.

The data used in this research can be seen in the table 6.1 below:

Table 6.1
Research Data

| obs | Q | GDP | P_OIL | CUSTOMER |
|------|----------|----------|-------|----------|
| 1982 | 59.47321 | 80537.77 | 85 | 3802518 |
| 1983 | 63.91211 | 471065.5 | 145 | 4406077 |
| 1984 | 69.05798 | 488552.1 | 220 | 5133231 |
| 1985 | 77.76284 | 520732 | 242 | 5953293 |
| 1986 | 88.57398 | 539602.3 | 200 | 6965579 |
| 1987 | 99.28138 | 549496 | 200 | 8203349 |
| 1988 | 113.8668 | 569147.4 | 200 | 9275938 |
| 1989 | 130.8209 | 599091.8 | 200 | 10316945 |
| 1990 | 154.6355 | 686875.7 | 245 | 11463738 |
| 1991 | 169.1474 | 704839.9 | 300 | 12396716 |
| 1992 | 184.4585 | 1622127 | 300 | 13486556 |
| 1993 | 201.9493 | 1709303 | 380 | 15157409 |
| 1994 | 219.3681 | 1806627 | 380 | 16936613 |
| 1995 | 249.1798 | 1922326 | 380 | 19471647 |
| 1996 | 294.7249 | 2145358 | 380 | 21980325 |
| 1997 | 328.4384 | 2212583 | 380 | 24640587 |
| 1998 | 325.088 | 1873233 | 600 | 26433489 |
| 1999 | 351.684 | 1870298 | 650 | 27524552 |
| 2000 | 384.5939 | 1933623 | 800 | 28595405 |
| 2001 | 404.5973 | 1970412 | 1600 | 29827728 |
| 2002 | 410.7986 | 2011978 | 1980 | 30586479 |

Note

- Q = Demand for electricity per capita (Gwh)
- GDP = Indonesian GDP per capita (Million Rupiah)
- P_oil = Price of Oil (Rupiah/litter)
- Customer = Amount of PT PLN customer (people)

Where:

| | |
|----------|--|
| Q | = Demand for electricity per capita (Gwh) |
| GDP | = Indonesian GDP per capita (Million Rupiah) |
| P_oil | = Prices of Oil (Rupiah/litter) |
| Customer | = The amount of PT PLN customer (people) |

6.2.2. Statistical Result Analysis

6.2.2.1. Constant or Intercept

The constant value is 1.817533 indicate that the average level of Demand for electricity in Indonesia on PT PLN is 1.817533 when other variable is zero. The sign is positive, means that the demand for electricity in Indonesia tends to increase, keep other variables constant.

6.2.2.2. T Test

The t test is done to test the independent variables individually by t statistic. From the regression result gathered the value of computed t value for each independent variable in which will be compared to the value of t table. The way to find the value of t table is:

$$t \text{ table} = t_{\alpha \text{ df} (n-k)}$$

α : the level of significance

df : degree of freedom

n : the number of data

k : the number of parameter

This research estimates the t table with α 0.05 and df (21-4) that is 17. From the table found that the value of t table is 1.740.

If the value of t-statistic or computed t value $>$ t table value; the independent variables impact the dependent variable significantly. Likewise, if the computed t value $<$ t table value; means that the independent variables are not significant impact on the dependent variable.

From the regression result, the computed t value for each independent variables found and shown in the following table 6.2:

Table 6.2
The Comparison Value of t-statistic and t-table

| Variable | t-statistic | A | t-table | Result |
|----------|-------------|----|---------|---------------|
| GDP | 1.058896 | 5% | 1.740 | Insignificant |
| P OIL | 2.237513 | 5% | 1.740 | Significant |
| Customer | 18.52438 | 5% | 1.740 | Significant |

6.2.2.2.1. T – Test of Indonesian GDP per capita (GDP)

H_0 : $\beta_1 > 0$

H_i : $\beta_1 < 0$

The value of computed value is 1.058896

The value of t table with α 5% and df 21 is 1.740.

Since the value of computed t value is smaller than the t table, so the H_a is rejected or H_0 is accepted statistically. It means that the Indonesian GDP per capita does not impact the demand for electricity per capita in Indonesia significantly.

6.2.2.2.2. T – Test of Prices of Oil (P_OIL)

$$H_0 : \beta_1 > 0$$

$$H_i : \beta_1 < 0$$

The value of computed t value is 2.237513

The value of t table with α 5% and df 21 is 1.740

Since the value of computed t value is bigger than the t table, so the H_0 is rejected or H_a is accepted statistically. It means that the prices of oil have a positive affect on the demand of electricity per capita in Indonesia significantly.

6.2.2.2.3. T – Test of Number of Customer (Customer)

$$H_0 : \beta_1 > 0$$

$$H_i : \beta_1 < 0$$

The value of computed t value is 18.52438

The value of t table with α 5% and df 25 is 1.740

Since the value of computed t value is bigger than the t table, so the H_0 is rejected statistically. It

means that the number of customer have a positive affect on the demand for electricity per capita in Indonesia significantly.

6.2.2.3. F Test

This test is used to detect the correlation between dependent variable and independent variables jointly. The testing of F test is the same as the testing for t test. Hypothesis is formulated as follows:

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$: hence the independent variables do not affect the dependent variable jointly.

$H_i: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$: hence the independent variables affect the dependent variable together.

The decision will be made with the parameter (α) 5% based on the following rules:

- a. When the value of computed $F < F$ table value, the decision is accept H_0 . In this case the independent variables jointly do not impact on dependent variable significantly.
- b. When the value of computed $F > F$ table value, the decision is reject H_0 . In this case the independent variables jointly impacts on dependent variable significantly.

The way to run the F test is similar to t test in which comparing the value of computed value and table value. First thing to do is looking for the value of F table in the statistical table. The way to find the F table is by getting the degree of freedom for numerator (k-1) and degree of freedom for denominator (n-k)

With the level of α 5%, degree of freedom for numerator 3 (4-1) and the degree of freedom for denominator 17 (21-4), found that the value of F table for $F_{(3,17)}$ is 3.20. Meanwhile the value of computed F value from the regression result is 1504.347. Since the value of computed F value is much greater than the value of F table, it can be concluded that the independent variables impact on the dependent variable jointly. In other words, Indonesian Gross Domestic Product, Prices of Oil, and Number of customer were impact jointly and significantly on the demand for electricity per capita on PT PLN in Indonesia.

6.2.3. Goodness of Fit (R^2)

From the regression run by writer, resulted the value of coefficient determination (R^2) 0.996247. This value shows a high measure for independent variables to explain its impact on dependent variable in the model. It means that the variation of the dependent

variable can be explained by the independent variables about 99.6247%, while the rest 0.3753 % are explained by factors outside the model.

6.2.4. Classical-Assumption Test

6.2.4.1. Multicollinearity

In this research, the detection of multicollinearity is done by watching and comparing the correlation among independent variables shown in the following table 6.3.

Table 6.3
Multicollinearity Test

| | GDP | P_OIL | CUSTOMER |
|-----------------|------------|--------------|-----------------|
| GDP | 1 | 0.576172 | 0.905557 |
| P_OIL | 0.576172 | 1 | 0.766598 |
| CUSTOMER | 0.905557 | 0.766598 | 1 |

From the table above, it is clearly shown that the values of correlation among independent variables are relatively high. The correlation method states that when the correlation is $r < 0.99$ it can be said that there is no multicollinearity in the model. So based on the correlation matrix writer conclude that the model of this research does not involve multicollinearity.

6.2.4.2. Autocorrelation

The tool of analysis is used to detect autocorrelation in this research is using LM (Lagrange Multiplier) test. The result of LM test shown below:

Breusch-Godfrey Serial Correlation LM Test:

| | | | |
|---------------|----------|-------------|----------|
| F-statistic | 0.736245 | Probability | 0.403537 |
| Obs*R-squared | 0.923812 | Probability | 0.336476 |

Test Equation:
 Dependent Variable: RESID
 Method: Least Squares
 Date: 07/20/04 Time: 08:48

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|-----------|
| C | -0.19092 | 3.731093 | -0.051171 | 0.9598 |
| GDP | -2.11E-06 | 6.92E-06 | -0.304083 | 0.765 |
| P_OIL | -0.0031 | 0.007523 | -0.412396 | 0.6855 |
| CUSTOMER | 2.68E-07 | 7.28E-07 | 0.368126 | 0.7176 |
| RESID(-1) | 0.242957 | 0.283151 | 0.858047 | 0.4035 |
| R-squared | 0.043991 | Mean dependent var | | -3.27E-14 |
| Adjusted R-squared | -0.19501 | S.D. dependent var | | 7.428546 |
| S.E. of regression | 8.120632 | Akaike info criterion | | 7.23095 |
| Sum squared resid | 1055.115 | Schwarz criterion | | 7.479646 |
| Log likelihood | -70.925 | F-statistic | | 0.184061 |
| Durbin-Watson stat | 1.712459 | Prob(F-statistic) | | 0.943299 |

The guidance of decision which shows whether there is an autocorrelation or not in the model is by watching and comparing the value of χ^2 computed (Obs*R-square) and χ^2 table. When the value of χ^2 computed is greater than χ^2 table with α 5%,

so the hypothesis that stated there is no autocorrelation in the model is rejected, and the contrary.

From the LM test found that the value of χ^2 computed (Obs*R-square) is 0.923812 in which smaller than the value of χ^2 Table; in other words; there is no autocorrelation in the model because the value of χ^2 computed is smaller than the value of χ^2 table 6.4.

Table 6.4
The Comparison Value of χ^2 computed and χ^2 table

| χ^2 computed | χ^2 table | Decision |
|-------------------|----------------|--------------------|
| 0.923812 | 3.84146 | No Autocorrelation |

6.2.4.3. Heterocedasticity

An important assumption of heterocedasticity shows the conditional of X increasing as Y increasing. Here the variances of X are not the same. The writer using white test that provide by the eviews 3.0 program to detect heterocedasticity.

The white model is:

$$E^2 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \delta_1 X_1^2 + \delta_2 X_2^2 + \delta_3 X_3^2 + \delta_4 X_1 X_2 + \delta_5 X_1 X_3 + \delta_6 X_2 X_3 + \varepsilon$$

The result as follow

White Heteroskedasticity Test:

| | | | |
|---------------|----------|-------------|----------|
| F-statistic | 1.226478 | Probability | 0.368633 |
| Obs*R-squared | 10.51825 | Probability | 0.31018 |

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 07/20/04 Time: 08:39

Sample: 1982 2002

Included observations: 21

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|--------|
| C | 73.28449 | 102.6766 | 0.713741 | 0.4903 |
| GDP | -0.00026 | 0.000351 | -0.724876 | 0.4837 |
| GDP^2 | -2.73E-10 | 4.77E-10 | -0.572392 | 0.5786 |
| GDP*P_OIL | 1.74E-06 | 1.38E-06 | 1.266804 | 0.2314 |
| GDP*CUSTOMER | 2.14E-11 | 6.62E-11 | 0.323574 | 0.7523 |
| P_OIL | -0.4746 | 1.025871 | -0.462634 | 0.6526 |
| P_OIL^2 | 5.99E-05 | 0.000285 | 0.210032 | 0.8375 |
| P_OIL*CUSTOMER | -1.08E-07 | 1.01E-07 | -1.074597 | 0.3056 |
| CUSTOMER | 2.23E-05 | 2.29E-05 | 0.97084 | 0.3525 |
| CUSTOMER^2 | -1.44E-13 | 3.26E-12 | -0.04412 | 0.9656 |
| R-squared | 0.500869 | Mean dependent var | 52.55552 | |
| Adjusted R-squared | 0.092489 | S.D. dependent var | 70.45926 | |
| S.E. of regression | 67.12186 | Akaike info criterion | 11.55665 | |
| Sum squared resid | 49558.78 | Schwarz criterion | 12.05404 | |
| Log likelihood | -111.345 | F-statistic | 1.226478 | |
| Durbin-Watson stat | 2.825586 | Prob(F-statistic) | 0.368633 | |

The guidance of decision which shows whether there is heteroscedasticity or not in the model is by watching and comparing the value of χ^2 computed (Obs*R-square) or by times $n.R^2$ and the chi-square distribution with 9 df. The 5% critical chi-square value for 9 df is 16.91990. When the value of χ^2

computed is greater than critical chi-square with α 5%, so the hypothesis that stated there is no heterocedasticity in the model is rejected, and the contrary.

From the White test found that the value of χ^2 computed (Obs*R-square) is 10.51825 or $n.R^2 = 21 \times 0.500869 = 10.518249$ in which smaller than the value of χ^2 table (critical chi-square) with $df = 9$ and $\alpha = 5\%$ is 16.91990; in other words; there is no heterocedasticity in the model because the value of χ^2 computed is smaller than the value of χ^2 table 6.5.

Table 6.5
The Comparison Value of χ^2 computed and χ^2 table

| χ^2 computed | χ^2 table | Decision |
|-------------------|----------------|----------------------|
| 10.51825 | 16.9190 | No Heterocedasticity |

6.2.4.4. Specification error test

The writer using RESET (regression error specification test) based on the work of Ramsey (1969). This test is general set of test for mis-specification, which are not based directly on an examination of residuals. In this test we have to make assumption that the null hypothesis is the correct specification that is linear model. The result that provide by the Eviews 3.0 computer program as follow:

Ramsey RESET
Test:

| | | | |
|----------------------|----------|-------------|----------|
| F-statistic | 0.42281 | Probability | 0.524766 |
| Log likelihood ratio | 0.547733 | Probability | 0.459246 |

Test Equation:
Dependent Variable:
Q
Method: Least Squares
Date: 08/10/04 Time: 18:29
Sample: 1982 2002
Included observations: 21

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|----------|
| C | 7.42888 | 9.413158 | 0.789202 | 0.4415 |
| GDP | 8.74E-06 | 7.19E-06 | 1.216877 | 0.2413 |
| P_OIL | 0.010211 | 0.009532 | 1.071232 | 0.3 |
| CUSTOMER | 1.11E-05 | 1.69E-06 | 6.568864 | 0 |
| FITTED^2 | 0.000174 | 0.000268 | 0.650239 | 0.5248 |
| R-squared | 0.996344 | Mean dependent var | | 208.6387 |
| Adjusted R-squared | 0.99543 | S.D. dependent var | | 121.2636 |
| S.E. of regression | 8.197758 | Akaike info criterion | | 7.249855 |
| Sum squared resid | 1075.252 | Schwarz criterion | | 7.498551 |
| Log likelihood | -71.1235 | F-statistic | | 1090.059 |
| Durbin-Watson stat | 1.496148 | Prob(F-statistic) | | 0 |

The guidance of decision which shows whether there is a mis-specification or not in the model is by watching and comparing the value of computed F-statistic and the F-table. When the computed F value is less than the F table means we accept the null hypothesis that there is no mis-specification in this model.

With the level of α 5%, degree of freedom for numerator 3 (4-1) and the degree of freedom for denominator 17 (21-4),

found that the value of F table for $F_{(3;17)}$, is 3.20. And the computed F value is 0.42281 in which smaller than F-table 3.20; in other words; we accept the null hypothesis there is no mis-specification in this model.

Table 6.6
The Comparison computed F value and F-table

| F computed | F table | Decision |
|------------|---------|----------------------|
| 0.42281 | 3.20 | No mis-specification |

6.3. Research Discussion

The discussion in this part is meant to have a deep and advance discussion related to the model.

6.3.1. Gross Domestic Product

GDP or gross domestic product is the total value of a country's output. It is the market value of all final goods and services produces within a given period of time by factors of production located within a country. (Karl E. Case, 2002).

In this research GDP is one variable that affecting to the demand for electricity, cause GDP represent income, it is says from the method of calculating GDP, there are two method of calculating GDP, first expenditure approach, second income approach in this approach including all the income such as wages, rents, interest and profit.(Karl E. Case,2002)

industrial tools need electricity in order to be more faster and efficient in production. Another reason that might tell that increasing GDP can increase demand for electricity is according to consumption theory if customer have more income or money they tend to spent more on the consumption (Lipsey, 1996), based on this definition, in this modern era where every tools in our daily life is using electricity and PLN have the monopoly authorities to do that so, the demand for electricity in PLN also increase.

Meanwhile the insignificant number of T-test 1.058896 below the T-table, the effect of GDP per capita on the demand for electricity per capita the reason is because of electricity right now is just like necessities good that needed to our daily activity so when ever their income is increasing or decreasing people are still willingly to pay to purchase this commodity.

6.3.2. Prices of Oil

The other variable that affecting quantity demand for electricity per capita is prices of oil. In this research the prices of oil its self is the prices of diesel oil or call “solar” in Indonesia. The purpose of using these prices of oil is as the substitution goods for electricity.

The hypothesis for this variable is prices of oil impact on the quantity demand for electricity per capita positively. It means that an increase on the prices of oil will increase to the quantity demand for

second they also demand electricity from PT PLN. This situation happens because the electricity that produces from PT PLN sometimes does not good enough, according to the research, electricity in Indonesia that comes from PLN sometimes gets cut off suddenly or sometimes the energy power goes down or drops suddenly, this can make the production process not running well it can make the production become decreasing or may be stopped, the businesses or industries sector doesn't want that happen. So this makes the industries build their own generator as the other source of energy. The relation between electricity from PT PLN and prices of oil is relatively high, in Indonesia the prices of oil also monopolized by the state company that call PT PERTAMINA, is the state company that deal with producing, distributing and selling the oil in the country. This makes the prices for both goods get monopolized by the supplier. Because of that right now many industries sector commonly using both sources of energy that comes from electricity and also comes from generator together, it means, the industries using both goods at the same time, the industries as the consumer use a combination for using both goods electricity and oil, in economics term this situation can be represent on indifferent curve. The volume of using both sources is depended on the concept of efficiency and the Theory of Consumer Choice. (Gregory Mankiw, 2001), Examine the trade off that people face in their role as consumer. When a consumer buys more of one goods, he can afford less of other goods. When he spends more time enjoying

prices of oil in that year, the prices of oil increasing almost two times from 280 to 600 rupiah/liter or increasing 214.29 %. The situation also happen in the year 2001 where the number of energy sold in the industrial sector increasing a lot, in that time the prices of oil increasing from 600 to 1600 rupiah/liter or increasing 266.67%, although the prices of electricity is also increasing from year to year the percentage of change in prices of oil is still higher that percentage change in prices of electricity. This analysis is to provide stronger statistical hypothesis to the price of oil as the substitution goods for electricity.

6.3.3. Customer

Customer is one variable that most definitely affecting the quantity demand for electricity in PLN. In this case the customers are the total of PT PLN customer that is using electricity from PT PLN. In this research the customers are mention by people so that every individual have different demand for electricity.

The hypothesis for customer made by writer is a positive relationship between number of customers and the quantity demand for electricity per capita in PLN. It means that when the number of PT PLN customer increases, the quantity demand for electricity per capita in PT PLN also increases.

The hypothesis is corrected and supported by the value of coefficient for the number of customer variable as much 0.000021. It

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

From the examination and discussion of the previous chapter, several conclusions and recommendations are outlined as follow.

7.1. Conclusions

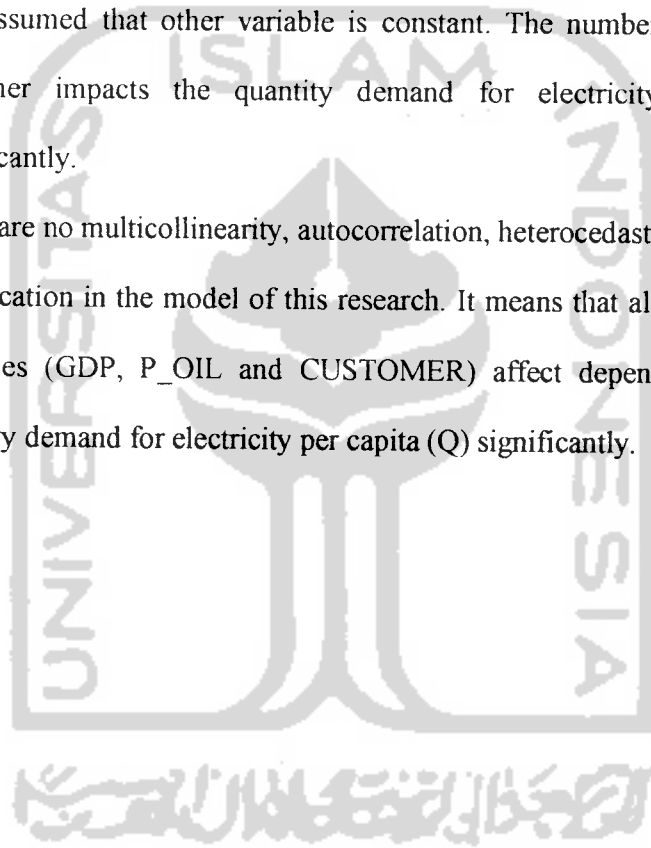
1. This research summarizes the determination of the quantity demand for electricity per capita on PT PLN (PERSERO); they are Indonesian Gross Domestic Product per capita, Prices of Oil, and the number of PT PLN customer.
2. Based on the research, the coefficient of determination R-squared is 0.996247. It means that about 99.66247% of variation in quantity demand for electricity per capita in PT PLN can be explained by variation in the explanatory variables. They are Indonesia Gross Domestic Product per capita, Prices of Oil and the amount of PT PLN customers. Meanwhile, the rest is around 0.33753% that explains the outside factors of this model.
3. According to the regression result, F test value of this research is greater than F table value; means that those independent variables (GDP per capita, Prices of Oil and Number of Customer) affect the quantity demand for electricity per capita in PT PLN in jointly.
4. The t test for Indonesian Gross Domestic Product per capita is statistically expresses that the relationship between Indonesian gross

domestic product per capita and the quantity demand for electricity in PT PLN is positive. It is proved with the coefficient value of Indonesia gross domestic product per capita variable 0.0000068. This coefficient value means that the increase of the gross domestic product per capita in Indonesia, as much as 1 Rupiah, will increase the quantity demand for electricity per capita on PT PLN by 0.0000068 GWh and other variables are assumed to be constant. The insignificant effect of the Indonesia gross domestic product per capita is caused electricity is a necessities commodities needed by every one or a basic need in this modern era. So whenever the income is increasing or decreasing, people still have willingness to purchase this commodity. This makes the gross domestic product per capita variable in the model become insignificant.

5. The t test for Prices of oil as the substitution goods explained by the coefficient value for prices of oil variable is as much as 0.014646. It means that when the prices of oil increases by 1 Rupiah/litter, the quantity demand for electricity per capita in PT PLN also increases by 0.014646 GWh while other variables are assumed to be constant. The prices of oil impacts to the quantity demand for electricity per capita in PT PLN are significant. Price of oil as the variable in this research affects the quantity of demand for electricity dominantly. It is the reason why, according to the PLN data in term of energy sold in PT PLN on the table 6.7, the most of the energy sold go to the industrial sector where

industrial sector is also using a lot of oil as the other source of energy beside electricity from PT PLN.

6. The t test for the amount of PT PLN customer by the coefficient value for customer variable is as much as 0.0000121. It means that when the amount of customer increases by 1 person, the quantity demand for electricity per capita in PT PLN also increases by 0.000021 GWh where it is assumed that other variable is constant. The number of PT PLN customer impacts the quantity demand for electricity per capita significantly.
7. There are no multicollinearity, autocorrelation, heterocedasticity and misspecification in the model of this research. It means that all independent variables (GDP, P_OIL and CUSTOMER) affect dependent variable quantity demand for electricity per capita (Q) significantly.



BIBLIOGRAPHY

- Abdulkadir, Ariono. (2000). Pedoman Hitungan Dampak Kenaikan Harga BBM & TDI. Tahun 2000. Indonesia: KADIN Indonesia & KLUB BIMASENA.
- Blanchard, Olivier (1997). Macroeconomics, 2nd ed., Massachusetts Institute of Technology, USA : Prentice-Hall, Inc.
- Case, Karl E., and Fair, Ray C. (2002). Principles of Economics, 6th ed., USA: Prentice-Hall, Inc.
- Dirjen LPE (2002). PT PLN (PERSERO) In Brief. Enclosure Paper, No 2769/04.1/2002 October 21, 2002.
- Gujarati, Damodar N. (1995). Basic Econometrics, 3rd edition., Singapore: McGraw-Hill.
- Hyman, David N. (1996). Microeconomics, 4th ed., North Carolina State University, USA : Irwin/McGraw-Hill.
- Lipsey, Richard G., and Paul N, Courant. (1996). Economics, 11th ed., New York, USA: HarperCollins Publisher Inc.
- Mankiw, Gregory. (2001). Principle of Microeconomics, 2nd ed., Harvard University, USA : Harcourt College Pub'ishers.
- Oxford University. (1995). Oxford Advance Learner's Dictionary. Britain. Oxford University press.
- Presiden Republik Indonesia. (2002). Undang-Undang Republik Indonesia No nor 20 Tentang Ketenagalistrikan. Indonesia: Dewan Pimpinan Serikat Pekerja PT PLN (PERSERO).
- PT PLN (PERSERO). (2000). Panduan Penjelasan Tarif Dasar Listrik 2000. Indonesia: PT PLN (PERSERO).
- PT PLN (PERSERO). (1997). 50 Tahun Pengabdian PLN. Indonesia: PT PLN (PERSERO).

PT PLN Statistics. (2001). Catalogue In Publication (2002), No 31.621.3 , PT PLN (PERSERO)

Samuelson, Paul A., and Nordhaus, William D. (1995). Economics, 15th ed., USA: Mc Graw Hill.

Tim Redaksi. (2004). Pengembangan Energi Terbarukan. Listrik Watch Journal. Vol. 6 Year II Edition, February – March 2004, pp 27-28.



APPENDIX

RESEARCH DATA

| obs Year | Quantity demand Per capita (GWh) | GDP Per capita MillionRupiah | P_OIL Rupiah/litter | CUSTOMER People |
|-------------|--|------------------------------------|------------------------|--------------------|
| 1982 | 59.47321 | 80537.77 | 85 | 3802518 |
| 1983 | 63.91211 | 471065.5 | 145 | 4406077 |
| 1984 | 69.05798 | 488552.1 | 220 | 5133231 |
| 1985 | 77.76284 | 520732 | 242 | 5953293 |
| 1986 | 88.57398 | 539602.3 | 200 | 6965579 |
| 1987 | 99.28138 | 549496 | 200 | 8203349 |
| 1988 | 113.8668 | 569147.4 | 200 | 9275938 |
| 1989 | 130.8209 | 599091.8 | 200 | 10316945 |
| 1990 | 154.6355 | 686875.7 | 245 | 11463738 |
| 1991 | 169.1474 | 704839.9 | 300 | 12396716 |
| 1992 | 184.4585 | 1622127 | 300 | 13486556 |
| 1993 | 201.9493 | 1709303 | 380 | 15157409 |
| 1994 | 219.3681 | 1806627 | 380 | 16936613 |
| 1995 | 249.1798 | 1922326 | 380 | 19471647 |
| 1996 | 294.7249 | 2145358 | 380 | 21980325 |
| 1997 | 328.4384 | 2212583 | 380 | 24640587 |
| 1998 | 325.088 | 1873233 | 600 | 26433489 |
| 1999 | 351.684 | 1870298 | 650 | 27524552 |
| 2000 | 384.5939 | 1933623 | 800 | 28595405 |
| 2001 | 404.5973 | 1970412 | 1600 | 29827728 |
| 2002 | 410.7986 | 2011978 | 1980 | 30586479 |

MWD TEST

Dependent Variable:
Q
Method: Least Squares
Date: 08/10/04 Time: 17:52
Sample: 1982 2002
Included observations: 21

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|--------|
| C | -1.06752 | 4.53332 | -0.235482 | 0.8168 |
| GDP | 1.66E-05 | 1.10E-05 | 1.503168 | 0.1523 |
| P_OIL | 0.018628 | 0.00747 | 2.493697 | 0.024 |
| CUSTOMER | 1.14E-05 | 9.33E-07 | 12.17945 | 0 |
| Z1 | -120.004 | 110.3615 | -1.087374 | 0.293 |
| R-squared | 0.996506 | Mean dependent var | 208.6387 | |
| Adjusted R-squared | 0.995632 | S.D. dependent var | 121.2636 | |
| S.E. of regression | 8.014513 | Akaike info criterion | 7.204642 | |
| Sum squared resid | 1027.719 | Schwarz criterion | 7.453338 | |
| Log likelihood | -70.6487 | F-statistic | 1140.66 | |
| Durbin-Watson stat | 1.612438 | Prob(F-statistic) | 0 | |

Dependent Variable: LOG_Q
Method: Least Squares
Date: 08/10/04 Time: 17:52
Sample: 1982
2002
Included observations: 21

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|--------|
| C | -10.851 | 0.424245 | -25.57712 | 0 |
| LOG_GDP | -0.11727 | 0.041358 | -2.83539 | 0.0119 |
| LOG_P_OIL | 0.008742 | 0.030161 | 0.289842 | 0.7757 |
| LOG_CUSTOMER | 1.071942 | 0.054782 | 19.56747 | 0 |
| Z2 | -0.01006 | 0.003959 | -2.541242 | 0.0218 |
| R-squared | 0.995645 | Mean dependent var | 5.153758 | |
| Adjusted R-squared | 0.994556 | S.D. dependent var | 0.654168 | |
| S.E. of regression | 0.048267 | Akaike info criterion | -3.01989 | |
| Sum squared resid | 0.037275 | Schwarz criterion | -2.77119 | |
| Log likelihood | 36.70884 | F-statistic | 914.4414 | |
| Durbin-Watson stat | 0.901535 | Prob(F-statistic) | 0 | |

MULTICOLLINEARITY

CORRELATION MATRIX

| | GDP | P_OIL | CUSTOMER |
|----------|----------|----------|----------|
| GDP | 1 | 0.576172 | 0.905557 |
| P_OIL | 0.576172 | 1 | 0.766598 |
| CUSTOMER | 0.905557 | 0.766598 | 1 |



AUTOCORRELATION

LAGRANGE MULTIPLIER TEST

Breusch-Godfrey Serial Correlation LM Test:

| | | | |
|---------------|----------|-------------|----------|
| F-statistic | 0.736245 | Probability | 0.403537 |
| Obs*R-squared | 0.923812 | Probability | 0.336476 |

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 07/20/04 Time: 08:48

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|--------|
| C | -0.19092 | 3.731093 | -0.051171 | 0.9598 |
| GDP | -2.11E-06 | 6.92E-06 | -0.304083 | 0.765 |
| P_OIL | -0.0031 | 0.007523 | -0.412396 | 0.6855 |
| CUSTOMER | 2.68E-07 | 7.28E-07 | 0.368126 | 0.7176 |
| RESID(-1) | 0.242957 | 0.283151 | 0.858047 | 0.4035 |
| R-squared | 0.043991 | Mean dependent var | -3.27E- | 14 |
| Adjusted R-squared | -0.19501 | S.D. dependent var | 7.428546 | |
| S.E. of regression | 8.120632 | Akaike info criterion | 7.23095 | |
| Sum squared resid | 1055.115 | Schwarz criterion | 7.479646 | |
| Log likelihood | -70.925 | F-statistic | 0.184061 | |
| Durbin-Watson stat | 1.712459 | Prob(F-statistic) | 0.943299 | |

SPECIFICATION ERROR TEST

RAMSEY RESET TEST

Ramsey RESET
Test:

| | | | |
|----------------------|----------|-------------|----------|
| F-statistic | 0.42281 | Probability | 0.524766 |
| Log likelihood ratio | 0.547733 | Probability | 0.459246 |

Test Equation:
Dependent Variable:
Q
Method: Least Squares
Date: 08/10/04 Time: 18:29
Sample: 1982 2002
Included observations: 21

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|----------|
| C | 7.42888 | 9.413158 | 0.789202 | 0.4415 |
| GDP | 8.74E-06 | 7.19E-06 | 1.216877 | 0.2413 |
| P_OIL | 0.010211 | 0.009532 | 1.071232 | 0.3 |
| CUSTOMER | 1.11E-05 | 1.69E-06 | 6.568864 | 0 |
| FITTED^2 | 0.000174 | 0.000268 | 0.650239 | 0.5248 |
| R-squared | 0.996344 | Mean dependent var | | 208.6387 |
| Adjusted R-squared | 0.99543 | S.D. dependent var | | 121.2636 |
| S.E. of regression | 8.197758 | Akaike info criterion | | 7.249855 |
| Sum squared resid | 1075.252 | Schwarz criterion | | 7.498551 |
| Log likelihood | -71.1235 | F-statistic | | 1090.059 |
| Durbin-Watson stat | 1.496148 | Prob(F-statistic) | | 0 |