goods, and for the inferior goods increasing to the income will lend to the decreasing to the quantity demand for that goods.

3. Prices of related goods, means that substitution and complement goods, substitution if two goods for which an increasing in the price of one leads to an increasing in the demand for the other. And complement if two goods for which an increasing in the prices of one leads to a decreasing in the demand for the other. In the case of electricity and gasoline is if the price of gasoline is increasing the demand for electricity is increasing so electricity and gasoline related to the substitution goods.
4. Taste, economists normally do not try to explain people's taste because tastes are based on historical and psychological forces that are beyond the realm of economists.
5. Expectation, expectation of every individual will affect to the quantity of demand in the future.

3.1.2. Elasticity of Demand

The laws of demand and supply predict the direction of changes in price and quantity in response to various shifts in demand and supply. However, it is usually not enough to know merely whether the

Income elasticity of demand = $\frac{\%\text{ change in quantity demanded}}{\%\text{ change in income}}$

For most goods, increasing in income can lead to increasing in the demand this happen on the *normal goods*. Goods for which consumption decreasing in response to a rise in income has negative income elastic ties and is called *inferior goods*. Even among normal goods, income elastic ties vary substantially in size. Necessities such as food and clothing, tend to have small elastic ties because consumer regardless of how low their incomes, choose to buy some of these goods. Luxuries, such as caviar and furs, tend to have large income elastic ties because consumer feels that they can do without these goods altogether if their income is too low. (Gregory Mankiw, 104). In the case of demand for electricity the electricity is the normal goods cause if people income is increasing the consumption of electronic tools also can increase so they demand more electricity.

3. *Cross-price elasticity of demand*, measure of how much the quantity demanded of one goods responds to a change in the price of another good, computed as the percentage change in quantity demanded of the first good divided by the percentage change in the price of the second good.

3.2. Hypothesis Formalization

This hypothesis defined as a right and temporarily argument to the behavior of model that it used and tested with the statistical test and econometric test. This hypothesis will be tested with the variable independent regression analysis that affects the demand of electricity in Indonesia on PT PLN (PERSERO). The hypotheses that are to be taste are:

1. The GDP of Indonesia individually has positive effect to the quantity of demand for electricity in Indonesia.
2. Price of oil in Indonesia individually has positive effect on the quantity of demand for electricity in Indonesia.
3. Number of PT PLN customer individually has positive effect on the quantity of demand for electricity in Indonesia
4. All the factor GDP, prices of gasoline, and number of customer is assume to be affecting the quantity demanded for electricity in Indonesia.

demand for electricity relatively not change. The research only based on the prices of oil as the substitution goods.

For the price of oil, because there is various kind of oil, so the price is also different. This oil its self can be divided into engine oil and diesel oil. Engine oil such as premium, petramax and petramax plus are sold in the market with different prices. And diesel oil is the only solar that is sold in the market and had different prices with engine oil. The writer will use the prices of solar as the price of oil in the analysis, the reason because the substitution goods for electricity is using generator. Solar used as the energy to run the generator that produce electricity. Many household and industries used generator as the replacement of electricity. The frequencies of using this alternative resource of electricity depend on the prices of electricity from PLN itself. So if the prices of electricity increase the demand of diesel oil (solar) also increasing.

4.7. Technique of Data Analysis

This research uses multiple regression model, in which involves the use of more than one independent variable to predict a dependent variable (Hanke and Rietsch, 1995:255). Meanwhile, in determining the parameter of α, the method being used is Ordinary Least Square (OLS). By using this method, it is expected that the Best Linear Unbiased Estimator (BLUE) will be get by the writer. Basically, the content of this method is normal determination through minimization of error square.

the sample regression. Beside this statistical test, writer also analyzes the R^2, classical assumptions that cover: multicollinearity, autocorrelation, and heterocedasticity.

4.7.1 T – test

This test is used to detect the correlation between dependent variable and independent variables individually. In this research, the writer uses one tail test since this research has a strong theoretical expectation.

The following hypothesis will be examined individually:

H_0: $\beta_i = 0$: means that the independent variable individually does not impact on dependent variables.

H_i: $\beta_i > 0$: means that the independent variable individually has positive impacts on dependent variables.

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

a. When the value of computed t < t table value, the decision is accept H0. In this case the independent variable individually does not impact the dependent variable significantly.

b. When the value of computed t > t table value, the decision is reject H0. In this case the independent variable individually impacts the dependent variable significantly.

4.7.4.4. Specification error test

A commonly used general set of tests for mis-specification, which are not based directly on an examination of residual, are the RESET tests (regression error specification test) based on the work of Ramsey (1969).

In the RESET test such proxies are based on the predicted value of Y, obtained from the OLS estimation. We first estimate.

$$Y = \beta + \beta_2 X_2 \qquad (4.7.4.4.a)$$

Ramsey suggests the use of various powers of the Ys retained from (4.7.4.4.a) as proxies for X_3, that is Y^2, Y^3 etc. Thus to carry out the RESET test, we next estimate equation such as.

$$Y = \beta_1 + \beta_2 X_2 + \delta_1 Y^2 + \delta_2 Y^3 + \varepsilon \qquad (4.7.4.4.b)$$

The significant of the δ coefficient on the proxy variable can then be tested using standard F test for additional explanatory variables. If only one proxy, Y^2, is included then the significance of its coefficient may be assessed by the normal t-test.

If one or more of the δ coefficient in (4.7.4.4.b) prove to be significantly different from zero then this is evidence of omitted variable error. Note, though, that, since the Y variables could be acting as proxies for more than one

5.1.1. PLN corporate legal basis

1. PLN Statuses 1998.
2. Government Decree No 23, 1994 on the transfer of the status from the State-owned Public company to State Owned Limited Company.
3. Government Decree No 12, 1998 on State Owned Limited Company.
4. Government Decree No 50, 1998 on the change of the reins of authorities.
5. Government Decree No 64, 2001 on transferring the reins of authority of State-Owned Limited Company from the Minister of Finance to the State Minister for State-Owned Enterprises.

5.2. PT PLN (PERSERO) Vision & Mission

The mission and vision of PT PLN Persero are:

1. To become a world class company with suitable growth, a prominent and a reliable company.
2. To conduct electricity business with orientation on customer, employee and owners satisfaction and to remain environmentally friendly.
3. To promote electricity as the means to improve the quality of living and to boost the economic growth.

5.3. PT PLN (PERSERO) Organizational Development

The operational coverage of PLN is very large, spreading across the entire nation with more than 13.000 islands.

In order to overcome the obstacle in management, to simply the procedure and to speed up the decision making, it is necessary to decentralize managerial authority.

During its growth, PT PLN (PERSERO) has established 4 subsidiaries. As the State-owned Limited Company, the subsidiaries are expected to be able to make more maneuvers, for instance, to establish a joint venture company, offers shares in the Stock Exchange, issues Obligation or other business venture.

5.3.1. PLN Subsidiaries:

- PT Indonesia Power with business in Electricity Power Generation and other related business established on October 3rd, 1995 under the name of PT PJB and changed its title into PT Indonesia Power in September 1st, 2000.
- PT Pembangkit Jawa Bali (PT PJB) with business in Electricity Generation and other related business. Established on October 1995 under the name of PT PJB II and change its title into PT PJB on September 22, 2000.

From the table 5.1 and table 5.2 it can be seen that the number of worker in PT PLN (PERSERO) is increasing each year, this is because each year PT PLN have to do different job in providing electricity and each year the task is more difficult.

In order to maintain PT PLN human resources well PT PLN (PERSERO) work together with several University in the country and also outside the country. The cooperation is in the form of education and short course program for S2 in foreign country. Table 5.3 show the University that work together with PT PLN (PERSERO).

Table 5.3, *Universities* that had work together with PT PLN

University of Westminster	3 Hoxton Street London N 1 6 HG
University of Dundee	Dundee, DDI 4 HN Scotland Telp. (01382) 223181
University of Sheffield	United Kingdom Flat 7, 36 Oakholme Road Sheffield S10
University of Leeds	3 DF - UK Woodhouse Lane Leeds LS 2 9 JT United Kingdom
University of Wollongong	Telp. (0532) 332207 Hortfields Avenue Wollongong, NSW 2609 Australia
University of Melbourne	Parville, Victoria 3052 Australia Tepl. 61. 3. 3447839
University of New South Wales	Sydney NSW 2063 Australia
University of Tasmania	GPO BOX 252 C Hobart Tasmania 7001 Australia
Edith Cowan University Perth	
Universitas Indonesia	
Institute Teknologi Bandung	
Institute Teknologi Surabaya	
Universitas Gajah Mada	
Universitas Diponegoro	
Universitas Syahkuala	
Universitas Hasanudin	
Universitas Sumatera Utara	

Source: 50 year PLN dedication

1978	4910	813
1979	6201	804
1980	7502	918
1981	8606	1532
1982	10571	1275
1983	12111	1281
1984	13622	1155
1985	15838	1061
1986	18202	1253
1987	21559	747
1988	24940	683
1989	28739	836
1990	34012	856
1991	37894	843
1992	40900	1058
1993	45469	1250
1994	50066	1412

Source:50 year PLN dedication book

5.8. PT PLN (PERSERO) Supervisory and Control system

The operation of the integrated electrical power system in the island of Java and Bali supervised and controlled by a Load Dispatch Center (LDC) located in Gandul, Southern Jakarta. The Java-Bali LDC in Gandul is conducting energy management and supervising 500 kV system. Switching operation of the 150 kV system is mainly managed by the second hierarchy which is called Area Control Centers (ACC). There are 4 Area Control Centers located at Jakarta & Banten Region, West Java Region, Central Java & Yogyakarta Region and East Java & Bali Region.

5.9. Horizon of Opportunities

The current electrification ratio in Indonesia is 52% with energy consumption of 375 kWh/capita. The growth for electricity demand is estimated to be 10-11% per year, an indication that electricity market is tremendously potential. To increase the electrification ratio and meet the demand for supply in the coming 10 year, an investment of US$ 28.5 billion is needed for additional generating capacity of up to 24,500 MW and additional Transmission lines of 11,600 kms. Up to 2003 there will be this investment opportunities amounting to US$ 3,73 billion for new Generator and Transmission, whereas for Distribution Lines with an additional connection to 2–3 million potential customers per year, an investment of US$ 3 billion is needed.

6.1.1. Choosing Regression Model

The reason of choosing the linear model in this research is because linear model gives a better estimation result than the log linear model. Beside that the writer also runs the MWD ((McKinnon, White, Davidson, (1983)) Test to choose the best model for this research. The MWD test suggests regressing in linear model was the best ways. After getting the result of estimation, the decision to choose the best model is shown by the value of Z in which provided through MWD test. In MWD test shows that the probability of Z value on the linear model shows statistically insignificant its means that we reject the null hypothesis that says rejected the linear model. The result of MWD test can be look on the appendix page.

6.2. Research Findings

6.2.1. Regression Result Analysis

The first step to analyze the data is by regress the data with the assistance of the supported computer package that competent and representative with the research. The writer uses Eviews 3.0 computer program in order to make the data estimation easier. Beside that Eviews 3.0 computer program helped the writer in avoiding the computation error.

The result of regression by using Eviews 3.0 program is as follows:

Dependent
Variable: Q
Method: Least Squares
Date: 07/19/04 Time: 21:08
Sample:
1982 2002
Included observations: 21

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.817533	3.695447	0.49183	0.6291
GDP	6.80E-06	6.42E-06	1.058896	0.3045
P_OIL	0.014646	0.006546	2.237513	0.0389
CUSTOMER	1.21E-05	6.53E-07	18.52438	0

R-squared	0.996247	Mean dependent var	208.6387
Adjusted R-squared	0.995585	S.D. dependent var	121.2636
S.E. of regression	8.05739	Akaike info criterion	7.1807
Sum squared resid	1103.666	Schwarz criterion	7.379656
Log likelihood	-71.3974	F-statistic	1504.347
Durbin-Watson stat	1.538435	Prob(F-statistic)	0

This result is using linear model.

Based on the result of regression, the regression models for quantity demand for electricity per capita (Q), Indonesian GDP per capita (GDP), prices of oil (P_oil), and number of customer (CUSTOMER), the writer gets the estimation equation for the quantity demand for electricity per capita in PT PLN, that is:

$$Q = 1.817533 + 0.0000068\ GDP + 0.014646\ P\_OIL + 0.0000121\ CUSTOMER + u$$

In this research data the writer used Per capita GDP. It means a country's GDP is divided by it population. The reason of using per capita GDP is a better measure of well-being for the average person than is the total GDP

Previously, the writer made hypothesis of relationship between per capita gross domestic product and per capita demand for electricity on PT PLN Indonesia is positive. It means that an increase of per capita gross domestic product will increase to the per capita demand for electricity.

According to statistical test, the coefficient value of per capita gross domestic product variable is 0.0000068. This value represents that when per capita GDP increase by 1 Rupiah, the demand for electricity per capita will also increase by 0.0000068 GWh holding all variable assume to be constant. It agrees with the previous hypothesis in this research about the positive relationship between both variables gross domestic product and the demand for electricity.

GDP represents the welfare of community in a country. The higher the number of a country's GDP the richer the community in that country. GDP can also present the county production based on its definition, where increasing a production can increase the GDP, the relationship with the demand for electricity is when the production is increase the demand for electricity also increase this is happen because in modern era the major input factor of production is electricity, many

electricity per capita. In other words, both variable prices of oil and quantity demand for electricity per capita has a positive relationship.

The statistical test supports hypothesis correctly. The resulted coefficient from regression for prices of oil variable is 0.014646. The value shows the impact of prices of oil on the quantity demand for electricity per capita in Indonesia. When the price of oil is increase by 1 rupiah/litter, the quantity demand for electricity per capita is also increase by 0.014646 GWh. This statistical result is fit with the previous hypothesis that stated a positive relationship between prices of oil and quantity demand for electricity per capita in Indonesia.

The statistical result show probability and t-statistic number that significant at 0.0389 and 2.237513, its means that when the prices of oil is increasing the customer tend to decreasing their volume of using oil and shifting to using more electricity immediately its would create an increasing to the quantity demand for electricity.

The statistical significant result for the prices of oil that shows the positive impact to the quantity demand for electricity in PLN can be supported by some reason. The significant number show customer immediately change from using oil to electricity it is because the concept of efficiency, in economics term concept of efficiency is to minimize the cost and maximizing the return or profit. In Indonesia many industries when they start doing their business commonly they already prepare their source of energy power ones they build their own generator and

leisure and less time working, he has lower income and can afford less consumption. These theories examine how consumer facing these tradeoffs makes decision and they respond to change in their environment. Consumer will choice the commodity that according to them more efficient. So when ever the prices of oil is increasing at the same times the consumer will decreasing their volume of using oil and shifting to use electricity form PLN, this is make the quantity demand for electricity is increasing.

The writer used industrial sector because according to the data from PT PLN, the volume of energy that had been sold most of it had sold to the industrial sector. It can be seen from the table 6.7 below.

Table 6.7

Energy sold (GWh)

Customer	End REPELITA 1 (1973/74)	End REPELITA 2 (1978/79)	End REPELITA 3 (1983/84)	End REPELITA 4 (1988/89)	End REPELITA 5 (1993/94)	End REPELITA 6 (.1998.)	Year 2001
Household	1077.3	1962.2	4219.5	7274.63	13140.74	24865.45	33339.78
Industry	596	1443.4	3435.9	9052.24	19560.98	27995.54	35593.25
Business	220.9	430.9	1002.5	1740.14	3774.97	8655.96	11395.35
Other	320.8	450.4	1269.8	1925.83	2485.34	3744.46	4192
Total	2215	4286.9	9999.7	19992.84	38962 03	65261.41	84520.38

source: PLN statistic 2001

The table shows that from REPELITA 4 in the year 1988/89 the number of energy sold to the industrial sector became the highest, and to the year of 1998 the number of energy sold to the industrial sector became increasing more sharply, and if we look on the

means that when the number of customer increases by 1 person the quantity demand for electricity per capita in PT PLN will also increase by 0.000021 GWh.

Actually the statistical test, clearly explain the logical thinking behind the hypothesis. The more the number of customer who using the electricity form PT PLN the higher the quantity demand for electricity per capita in PT PLN.

7.2. Implication

1. Based on the analysis in term of income per capita variable, it shows that the result is positive (+) insignificant to the quantity demand for electricity. This is because of electricity is necessities good in this modern era, so whenever the income is increasing they will buy more electricity from the PLN. This is a good sign for PT PLN as the only provider of electricity in Indonesia. Therefore, PT PLN should consider more the increasing of income because it may increase the quantity demand for electricity. PT PLN also has to give more attention to their customer in order not to make them disappointed by increasing the company performance.
2. According to the analysis result price of oil, price of oil has a positive significant effect to the quantity demand for electricity in PT PLN. It means that oil is a substitution good for electricity and the significant point show that whenever the price of oil decreases, people will shift their demand from electricity to oil immediately. Based on that PT PLN should consider more in determining the electricity prices because if it doesn't, PT PLN will lose some of their potential demand for electricity.