

REPORT EMERGY: CASE STUDY IN PROVINSI DAERAH ISTIMEWA YOGYAKARTA

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Abstract

This study is an effort to preparing the emergy balance sheet and the emergy surplus-deficit report and also presenting the results of emergy indices analysis to accommodate all the natural resources that produce energy that is owned and controlled by the Provincial Government of Provinsi Daerah Istimewa Yogyakarta in the period 2006-2010. Further development of the analysis method presented in this report will enable policy-makers, in this case the Provincial Government of Provinsi Daerah Istimewa Yogyakarta (DIY), as the first complete and worth examination between economic and environmental accounting data before making a decision regarding the policy on natural resources, energy, and the environment.

Keywords: emergy, the emergy balance sheet and the emergy surplus-deficit report, emergy index, natural resources.

Abstrak

Penelitian ini adalah sebuah usaha untuk menyiapkan neraca emergi dan laporan surplus-defisit emergi dan juga untuk menyajikan hasil analisis indeks emergi untuk mengakomodasi semua sumber daya alam yang menghasilkan energi yang dimiliki dan dikendalikan oleh Pemerintah Provinsi Daerah Istimewa Yogyakarta (DIY) periode 2006-2010. Pengembangan metode analisis berikutnya yang disajikan dalam laporan tersebut akan membantu pengambil kebijakan, dalam kasus ini adalah Pemerintah Provinsi Daerah Istimewa Yogyakarta, sebagai pengujian pertama yang lengkap dan berharga antara data akuntansi lingkungan dan ekonomi sebelum mengambil keputusan yang berkaitan dengan kebijakan sumber daya alam, energi, dan lingkungan.

Kata kunci: *Emergi, neraca emergi dan laporan surplus-defisit emergi, indeks emergi, sumber daya alam.*

INTRODUCTION

The financial statements of a public sector that is so far in Indonesia, never include natural resources as a source of energy but a wealth of natural resources to be reckoned with. The balance sheet produced by the Government only to dwell on the assets of the country and never talk about natural resources and energy are controlled by the Government. The balance sheet should include natural resources as a source of energy, so that The balance sheet can actually be used as a basis for decision making. Provide an important point to the existence of

natural resources and energy in the financial statements of a public sector are expected to be helpful to do a more definite plan in the management of natural resources and energy. Natural resources as a source of energy should be reckoned with in the financial statements of public sector, this is due to the natural resources and energy is the source of income or principal assets for the Government.

This study has two objectives: (1) an effort to prepare the emergy balance sheet and the emergy surplus-deficit report to accommodate all the natural resources that produce

energy that is owned and controlled by the Provincial Government of Provinsi Daerah Istimewa Yogyakarta (DIY) in the period 2006-2010, and (2) an effort presenting the results of energy indices analysis in Provinsi Daerah Istimewa Yogyakarta within the period 2006-2010, as a basis for policy in utilization of natural resource that produce energy and its impact on the environment and the system as a whole.

In this study, the authors apply it to analyze Provinsi Daerah Istimewa Yogyakarta. Besides practical reasons, this is also due to Yogyakarta, including areas that do not recognize the natural resources and energy as part of regional development assets.

Further development of the analysis method presented in this report will enable policy-makers in this case the Provincial Government of Provinsi Daerah Istimewa Yogyakarta for the first time examine complete and worth between economic and environmental accounting data before making a decision regarding the policy on natural resources, energy, and the environment. And this is the first step to implement the energy basis of the financial statements in other areas in Indonesia, especially in Indonesia itself.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Energy Reports

Energy report referred to in this study in the form of the energy balance sheet and the energy surplus-deficit report. The energy balance sheet and the energy surplus-deficit report that this refers to the explanation given Campbell and Meisch (2005) in *Environmental Accounting Using Emergy: Evaluation of the State of West Virginia*. In their study, Campbell and Meisch (2005) mentions the energy surplus-deficit report as a report that provides information regarding the increase or decrease in total energy flow generated and used by entities in each year. This report is available by comparing the total energy flow is generated and used in the current year with a total energy flow is generated and used in the previous year. The energy balance sheet according to Campbell and Meisch (2005) is a table that contains the current value of energy that is an asset of

the system. The depiction of an entity's financial position on Financial Assets, Non-Financial Assets, Financial Liabilities and Equity, and Non-Financial Liabilities & Equity on a certain date. Where the available energy for use in the category of Non-Financial Assets, while natural resources and energy used to produce energy into the Non-Financial Liabilities & Equity. The purpose of this report is to provide information related to energy use of energy from natural resources are used in an effort to advance the Government's economic growth in their area. The energy surplus-deficit report makes the local government will find information about the increase or decrease in total energy flow is generated and used in each year, which can later be used as a basis for sustainable use and management policies in an efficient and effective energy of natural resources, the future to support the sustainability of economic development.

Emergy

According to Campbell and Meisch (2005), earlier economists often have difficulty understanding the concept of energy and had to face so much trouble to document the economic and ecological flows and storage in these terms. The practical answer is that accounts for environmental systems can not be stored in units of currency, because the system is based on the work of both men are paid for by the current count in the currency, and the nature or ecosystem, where there is no money to be paid.

Odum et al. (2000) in *Handbook of Emergy Evaluation, Introduction and Global Budget* translate energy (spelled with a "m") as available energy (exergy) of a type that is needed in the transformation process, both directly and indirectly to produce goods or services. Further Odum et al. (2000) said, energy is a statement of all energy used in the process of the work to produce products or services within a unit of energy type. Emergy using thermodynamic basis of all forms of energy, resource and human services, and turn it into the equivalent of one form of energy, usually solar energy. Thermodynamic in Wikipedia (Greek: *thermos* = 'hot' and *dynamic* = 'change') is the physics of energy, heat, work, entropy and the spontaneity of processes.

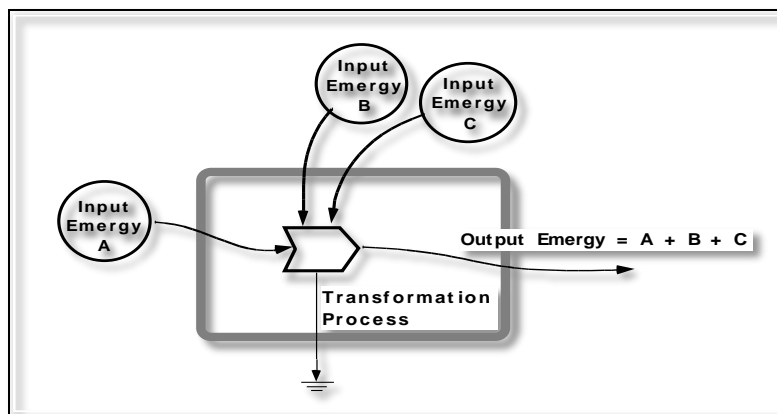


Figure 1: Energy Transformation Process (University of Florida, 2012a)

Odum et al. (2000) calls transformity as a kind of measure of efficiency, as it relates to all of the input to the output. The lower transformity, the conversion more efficient. It follows from the thermodynamic second law that there is some minimal transformity consistent with the maximum power operation. According to Odum et al. (2000), although we have no way to calculate it, but we can use the lowest transformity found in the operating system as a long-term approach. If transformity used to estimate the theoretical potential of some systems, it is appropriate to use transformity (lowest) best known.

Energy with Money Relationship

EmRupiah Value (abbreviated emRp) of a product or service is part of the total purchasing power in the system caused by a product or service from the economy or nature. This

ratio means that the average amount of energy purchased by spending a dollar. In other words, the ratio of energy/rupiah tell us the purchasing power of dollars in real wealth (energy) that can be purchased. The money is used to purchase products such as food, fuel, clothing, housing, electricity, information, etc. according to their market price. EmRp obtained by dividing the total energy with gross regional domestic product (GRDP). Thus, GRDP is an indicator to regulate the extent to which the success of the government in utilizing existing resources and can be used as a planning and decision-making. There are 2 types of GRDP used in this study, the GRDP at current prices that can be used to see the shift in economic structure, whereas the GRDP at constant prices in 2000, which can be used to determine the economic growth from year to year.

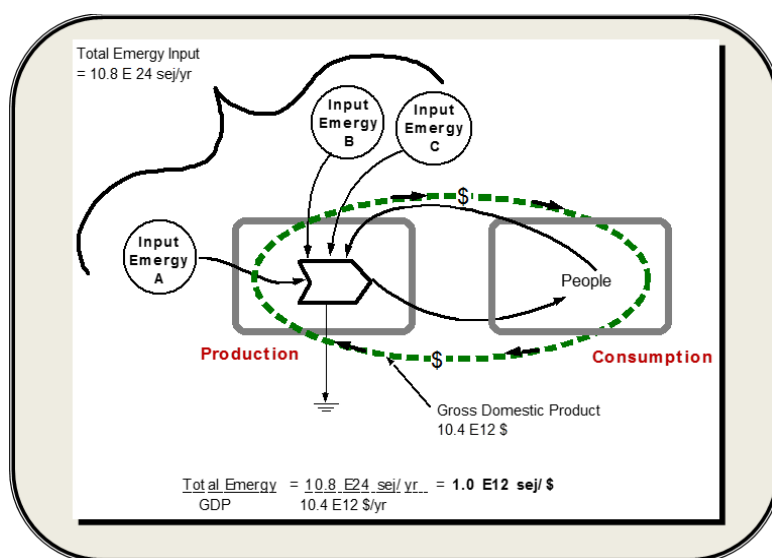


Figure 2: Sample Forms Relationship between Energy and Money (University of Florida, 2012a)

RESEARCH METHOD

The Data

Secondary data used in this study covers the objects of natural resources in Provinsi Daerah Istimewa Yogyakarta, such as agriculture, plantation, forestry, animal husbandry, fishery, fuels for industrial, minerals group C, water resources, water for consumption, sunlight, wind, rain, and air humidity and pressure. Data taken in the form of relevant information on the total amount of output of each object and the amount of production that the consumption of the population in the range of 2006-2010. For most of the data needed research, authors get through catalogues DIY in Figures published by the Central Statistics Agency (BPS) in each year. But there are few research data that must be the author via e-mail get from central ministries directly, such as the Ministry of Forestry, Ministry of Public Works, the Ministry of Energy and Mineral Resources, Ministry of Environment, the Ministry of Industry and Trade, Office of Water, and the Company National Electricity (PLN). For data on wind, rain, and air humidity and pressure, the authors get it through the help of the Meteorology, Climatology, and Geophysics. As for the data on intensity of sunlight, the authors obtain it through Florida University website (see University of Florida 2012b).

Emergy Accounting Cycle

Common methodology in the emergy accounting cycle as reported in University of Florida (2012a) is a "top-down" systems approach and includes 2 steps that are described in the following sections:

1. Making Left-right Energy Systems Diagram.

This is done to put the system out of the focus of attention in perspective, arranging idea and relationship between components and exchange lines and flow of resources occurs. A diagram such as this is a useful tool to determine the needs of the data, in which the relationship between the system and systems outside and among the parts themselves have been translated in the form

of energy and material flows. So it can be said that the purpose of the diagram system to perform critical inventory of the process, storage and flow are important as a driver of the system (all cross-border inflows system). This in turn points to the exact factors that need to be measured when the field work required.

2. Making of the emergy flow table, the emergy balance sheet and the emergy surplus-deficit report.

Flow paths that cross the boundaries of the system and the relevant pathways within the boundaries of the system put in currents emergy tables and calculations developed to evaluate the path of energy flow. The raw data and conversion factors were collected to complete the table. Conversion factors, such as energy content and transformity required to transform raw data into emergy units, the next step is to determine the overall value emRupiah for later to contribute value on each resource item. The end product of this phase are the emergy flow table, the emergy balance sheet and the emergy surplus-deficit report.

The Emergy Balance Sheet and The Emergy Surplus-Deficit Report Analysis

Emergy Index Calculation

The final step is emergy evaluation is the calculation of emergy index by first classifying the existing resource, a renewable resource (R), non-renewable resources (N), imported resources (F), and calculate the total emergy (U). Here is a description of emergy indices used in this study.

1. Environmental Loading Ratio

It's the ratio of emergy used from non-renewable resources and the resources of goods and services imported into renewable resources. Where it shows is the number of input emergy that are not renewable or locally available to the economy and shows the pressure on local ecosystems from imported energy and materials. The higher proportion of renewable emergy used by an economy, the lower the Environmental Loading Ratio. On the other hand, the

economy is highly dependent on external sources of emergy have high Environmental Loading Ratio. In general, is a measure of ecosystem stress due to economic activity (Haden in Skuladottir, 2005). $ELR = (\text{non-renewable resources} + \text{imported resources}) / \text{renewable resources}$.
Or: $(N + F) / R$.

2. Emergy Investment Ratio.

The ratio of emergy purchased from outside the system to emergy supplied by renewable energy sources and non-renewable of the system is called Emergy Investment Ratio because the ratio of emergy invested for residents. It shows the proportion of investment to economic resources native to the area and reflects the intensity of development (Campbell & Meisch, 2005). $EIR = \text{imported resources} / (\text{non-renewable resource} + \text{renewable resource})$. Or: $F / (N + R)$.

3. Empower Density.

Empower Density is the number of emergy flow for a certain time. Urban with industrial systems, commercial business and housing construction development of high-density has high entry emergy flow and this means high Empower Density compared to

rural areas. Empower Density Ratio is the amount of emergy used in the economy of a region's total land area. $ED = \text{total emergy} / \text{area}$. Or: U / area .

4. Emergy per person (EPP).

The ratio of total emergy by population. It shows how the consumption related to population and, in a sense, this index is the responsibility of every resident in the use of resources. $EPP = \text{total emergy} / \text{population}$. Or: $U / \text{population}$.

RESULTS AND DISCUSSION

Left-right Energy Systems Diagram

The first step in this phase is to determine there source points and main activity in the system. The process of a major transformation are the agriculture, plantation, forestry, animal husbandry, fishery and aquatic ecosystems. The process of a secondary transformation are manufacturing industrial, mining, services and trade, transportation and disposal. Subsystems such as people and household, government, and tourists are described as consumers (hexagons), which works as an attract orf or the flux through the existing transportation system in the region.

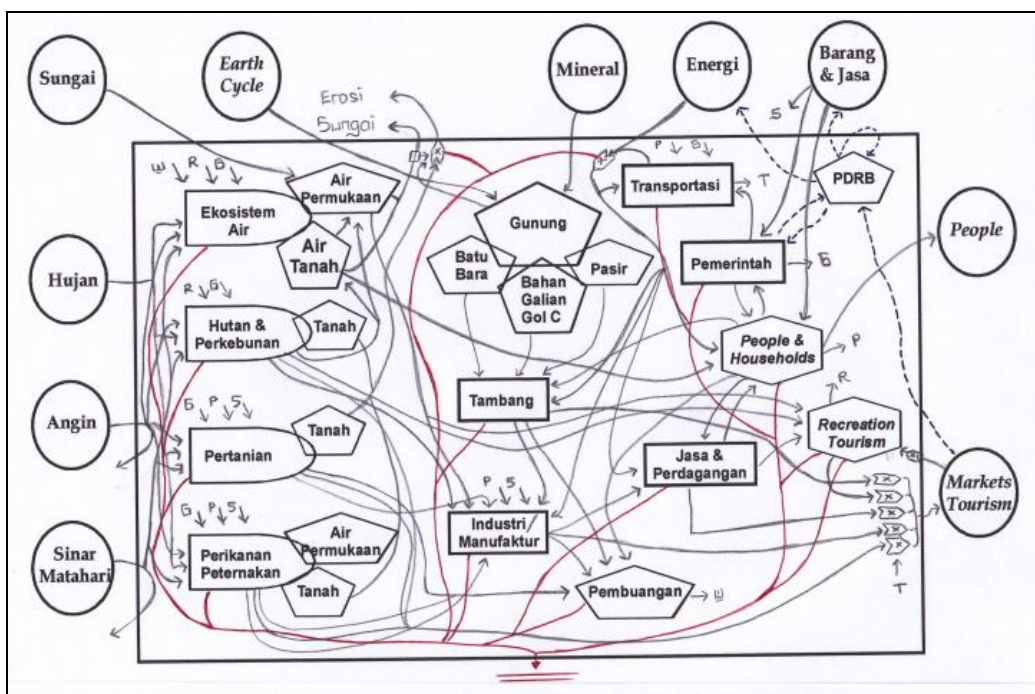


Figure 3: Left-right Energy Systems Diagram in Provinsi Daerah Istimewa Yogyakarta

The second step is to give the relationship between the components through the exchange and flow of resources going on, both inside and outside the system, as shown in Figure 3, a large square to define the boundaries of the system under study, Provinsi Daerah Istimewa Yogyakarta.

The Energy Flow Table

The first step in this phase is to collect data related to the natural resources that exist in the system (including external systems that affect the system). Second, perform unit conversions of existing resources data into units of joules. Third, perform transformity from emergy to joules. The next step is to determine the overall value emRupiah for later to contribute this value on each resource item.

The Emergy Balance Sheet

There are examples of the emergy balance sheet resulted of authors in this study (table 6 and table 7).

By including the available emergy for use in the category of Non-Financial Assets, while natural resources and energy used to produce emergy into the Non-Financial Liabilities & Equity in making the emergy balance sheet from Provincial Government of Provinsi Daerah Istimewa Yogyakarta, means the Government has to involve energy derived from the natural resources in the activities and economic growth in their area.

The Emergy Surplus-Deficit Report

There are examples of the emergy surplus-deficit report resulted of authors in this study (table 8 and table 9).

Table 6: The Emergy Balance Sheet in 2007
Using the emRupiah value of the Current Price GRDP

Asset		Liabilities and Equity	
Financial Assets	XXX	Liabilities and Equity	XXX
Non-Financial Assets	XXX	Non-Financial Liabilities & Equity	XXX
Emergy	41,500,000	SDA and Emergy	41,500,000
Total Assets	XXX	Total Liabilities and Equity	XXX

Table 7: The Emergy Balance Sheet in 2007
Using the emRupiah value of the Constant Price GRDP

Aktiva		Passiva	
Financial Assets	XXX	Liabilities and Equity	XXX
Non-Financial Assets	XXX	Non-Financial Liabilities & Equity	XXX
Emergy	23,100,000	SDA and Emergy	23,100,000
Total Aktiva	XXX	Total Passiva	XXX

Table 8: The Emergy Surplus-Deficit Report in 2007
Using the emRupiah value of the Current Price GRDP

Value of Emergy in 2007	41,500,000
Value of Emergy in 2006	(37,200,000)
Increase in the Value of Emergy	4,300,000

Table 9: The Emergy Surplus-Deficit Report in 2007
Using the emRupiah value of the Constant Price GRDP

Value of Emergy in 2007	23,100,000
Value of Emergy in 2006	(22,200,000)
Increase in the Value of Emergy	900,000

The emergy surplus-deficit report makes the local government will find information about the increase or decrease in total emergy flow is generated and used in each year. This report is important for the management and sustainable use of natural resources and energy more efficiently and effectively, given the continued increase in the number of inhabitants in Provinsi Daerah Istimewa Yogyakarta.

Emergy Index Calculation

To calculate the emergy indices, the available resources in Provinsi Daerah Istimewa Yogyakarta must first be classified as a renewable resource, non-renewable resources, and resources are imported. Materials and renewable energy used directly by the people in which the flow of material and energy used at a rate lower than the rate of their generation, such as the production of food crops, the production of vegetable crops, fruit crops production, production of plantation crops, production of forest products, livestock production and fisheries, water resources, as well as self-produced electricity at 2.505% of the total electricity supply in the province is treated as a renewable resource (labeled R). Material and non-renewable energy used by people to flow originating from the storage used at a rate faster than their regeneration such as: water for consumption (assumed to be non-renewable because of the risk of over-exploitation as a result of the level of the population continues to grow), land, minerals group C (labeled N). Fuel purchased for local transportation, industry, and electricity imported for 97.495% of the total electricity supply in the province is treated as a resource that is imported (labeled F).

Summary of Research Findings

The main source of flow for the entire region in the province of Yogyakarta has been calculated as follows:

1. Total emergy used in Provinsi Daerah Istimewa Yogyakarta in 2006 was $3.17E + 21$ sej/year, in 2007 was $3.59E + 21$ sej/year,

while in 2008, 2009 and 2010 are $5.88E + 21$ sej/year, $6.04E + 21$ sej/year, and $6.16E + 21$ sej/year, respectively. This value corresponds to the number of all emergy flow that supplies the entire region.

2. Total renewable emergy (R) in Provinsi Daerah Istimewa Yogyakarta in 2006 was $5.17E + 19$ sej/year, in 2007 was $5.19E + 19$ sej/year, while in 2008, 2009 and 2010, are $5.83E + 19$ sej/year, $5.63E + 19$ sej/year, and $8.74E + 19$ sej/year, respectively.
3. Total non-renewable emergy (N) in Provinsi Daerah Istimewa Yogyakarta in 2006 was $2.19E + 21$ sej/year, in 2007 was $2.50E + 21$ sej/year, while in 2008, 2009 and 2010 are $4.75E + 21$ sej/year, $4.80E + 21$ sej/year, and $4.83E + 21$ sej/year, respectively.
4. Total imported emergy (F) in Provinsi Daerah Istimewa Yogyakarta in 2006 was $9.27E + 20$ sej/year, in 2007 was $1.04E + 21$ sej/year, while in 2008, 2009 and 2010 are $1.07E + 21$ sej/year, $1.18E + 21$ sej/year, and $1.24E + 21$ sej/year, respectively.

As for the results of emergy indices in Provinsi Daerah Istimewa Yogyakarta has been calculated as follows:

1. Provinsi Daerah Istimewa Yogyakarta has fluctuated Environmental Loading Ratio (ELR) significantly. From 2006 were only 60.29, increased to 68.21 in 2007 and 99.83 in 2008. The highest increase was in the year 2009 ie 106.22, although in 2010, fell to 69.45. A sharp spike in 2009 suggests the utilization of non-renewable resources are more dominant than the renewable resources in the process of economic growth. These results lead to high stress on the ecosystem or "load" weight on environmental waste treatment capacity.
2. Empower Density is the number of emergy flow for a certain time. Urban with industrial systems, commercial business and housing construction development of high-density has high entry emergy flow

- and this means high Empower Density compared to rural areas. Empower Density Ratio is the amount of emergy used in the economy of a region's total land area. Provinsi Daerah Istimewa Yogyakarta in 2006 had ED amounted to $9.95E+11$ sej per m^2 , in 2007 amounted to $1.13E+12$ sej per m^2 , while in 2008, 2009, and 2010 are $1.85E+12$ sej per m^2 , $1.90E+12$ sej per m^2 , $1.93E+12$ sej per m^2 . The increase ratio in each year Provinsi Daerah Istimewa Yogyakarta showed a fairly good progress. There are always economic development in this area every year, such as the growth of new industries.
3. Emergy per Person (EpP) is the ratio of total emergy with the population. It shows how the consumption related to population and, in a sense, this index is the responsibility of every resident in the use of resources. Provinsi Daerah Istimewa Yogyakarta in 2006 had amounted to $9.32E+14$ sej per people, in 2007 sebesar $1.05E+15$ sej per people, while in 2008, 2009, dan 2010 are $1.70E+15$ sej per people, $1.72E+15$ sej per people, $1.78E+15$ sej per people. These results indicate an increase in the level of consumption of the emergy per one people in each year. The high ratio to be a good sign, because it means that people more prosperous. However, a bad sign, if the high ratio is not balanced with the management and utilization of energy resources more efficiently and effectively.
 4. Emergy Investment Ratio (EIR) is the ratio of the external input emergy purchased to support the system in conjunction with all local emergy, both renewable and non-renewable. It shows the proportion of investment to economic resources native to the area and reflects the intensity of development (Campbell & Meisch, 2005). A high level of EIR system is a kind of fragility because of its dependence on the input of other economic systems. Degree of dependence on other ecosystems showed weakness in competitive capacity (self-reliance and long-term sustainability) of the local system, because the availability of resources for the development and maintenance are not under the control of the system. Provinsi Daerah Istimewa Yogyakarta in 2006 and 2007 had the EIR by 0.41, while in 2008, 2009 and 2010 0.22, 0.24, and 0.09, respectively. These results indicate that relatively low intensities corresponding between economic emergy purchased from outside the region with emergy from renewable environmental resources and are not renewable in the region. This index shows that Provinsi Daerah Istimewa Yogyakarta a is still an interesting place to further economic investment.
 5. EmRupiah or emergy to money ratio is obtained by dividing the total emergy use of a region with a gross regional domestic product, the result is the average amount of emergy purchased by spending a dollar (sej/rupiah) termed emRupiah (abbreviated emRp). In other words, the ratio of emergy/rupiah tell us the purchasing power of dollars in real wealth (emergy) that can be purchased. A low emergy value of the rupiah does not mean that the emergy less in circulation. In fact, many areas with a low ratio of emergy to rupiah has emergy use value per capita is very high. It simply means that the region is more dependent on the use of environmental resources beyond the boundaries of their territory, and resulted in the use of money to acquire goods and services to support the economy. Using the GRDP at current prices, Provinsi Daerah Istimewa Yogyakarta in 2006 and 2007 had a value of $1,08E+8$ sej per rupiah dan $1,09E+8$ sej per rupiah, while in 2008, 2009, and 2010 respectively $1.54E+8$ sej per rupiah, $1.46E+8$ sej per rupiah and $1.36E+8$ sej per rupiah. From these results it can be seen that Provinsi Daerah Istimewa Yogyakarta in 2008 had a ratio of emergy to the rupiah higher than another 4 years, so it can be concluded that the purchasing power of the rupiah against real wealth (emergy) strongly dur-

ing the year. When using GDP at constant prices 2000, Provinsi Daerah Istimewa Yogyakarta in 2006 and 2007 had a value of 1.81E+8 sej per rupiah and 1.96E+8 sej per rupiah, while in 2008, 2009, and 2010 each amounted to 3.06E+8 sej per rupiah, 3.18E+8 sej per rupiah and 2.93E+8 sej per rupiah. From these results it can be seen that the Yogyakarta Special Region in 2008 and 2009 experienced the best growth than in 2006, 2007, and 2010.

CONCLUSION

The conclusions of research by the authors in this time are as follows:

1. Total energy used in Provinsi Daerah Istimewa Yogyakarta in 2006 was 3.17E+21 sej/year, in 2007 was 3.59E+21 sej/year, while in 2008, 2009 and 2010 are 5.88E+21 sej/year, 6.04E+21 sej/year, and 6.16E+21 sej/year, respectively. Total annual energy value is almost 70% is dominated by non-renewable energy (N). While renewable energy (R) and the imported energy (F) each contributed 2% and 27%.
2. Sharp spike Environmental Loading Ratio (ELR) in 2009 suggests the utilization of non-renewable resources are more dominant than the renewable resources in the process of economic growth. These results lead to high stress on the ecosystem or "load" weight on environmental waste treatment capacity.
3. Increasing the ratio of Empower Density (ED) in each year in Provinsi Daerah Istimewa Yogyakarta showed a fairly good progress. That means, there is always economic development in this area every year, such as the growth of new industries.
4. Results of Energy per Person (EPP) showed an increase in the level of consumption of the soul energy per population in each year. The ratio of high to be a good sign, because it means that people more prosperous. However, a bad sign, if the high ratio is not balanced with the

management and utilization of energy resources more efficiently and effectively.

5. Results of Energy Investment Ratio (EIR) showed relatively low intensities corresponding between economic energy purchased from outside the region with energy from renewable environmental resources and are not renewable in the region. This index shows that Provinsi Daerah Istimewa Yogyakarta is still an interesting place to further economic investment.
6. Results of emRupiah or the ratio of energy to money using GDP at current prices can be seen that Provinsi Daerah Istimewa Yogyakarta in 2008 had a ratio of energy to the rupiah higher than another 4 years, so it can be concluded that the purchasing power of the rupiah against real wealth (energy) strong during the year. While the results emRupiah or the ratio of energy to money using GDP at constant prices in 2000 can be seen that the Yogyakarta Special Region in 2008 and 2009 experienced the best growth than in 2006, 2007, and 2010.

So overall it can be concluded that the level of the economy in the province of Yogyakarta showed good results in 2009. This is indicated by the value of emRupiah or energy to money ratio using GDP at constant prices in 2000. Although the value of emRupiah or energy to money ratio using GDP at current prices fell from 2008, but in 2009 still show better results than in 2006, 2007 and 2010. Although the rate of the economy in the province of Yogyakarta Special Region in 2009 was pretty good, but economic growth is still dominated by the use of non-renewable resource that almost 70% of the total available energy. In light of this, the Government should Yogyakarta continue to improve the management and utilization of energy resources more efficiently and effectively, because in the future there will certainly still energy usage spikes that followed the population growth as economic growth.

Implication

By including the available energy for use in the category of Non-Financial Assets, while natural resources and energy used to produce energy into the Non-Financial Liabilities & Equity in making the energy balance sheet from Provincial Government of Provinsi Daerah Istimewa Yogyakarta, means the Government has to involve energy derived from the natural resources in the activities and economic growth in their area. The energy surplus-deficit report makes the local government will find information about the increase or decrease in total energy flow is generated and used in each year. This is an excellent first step in an effort to management and sustainable use of natural resources and energy more efficiently and effectively, given the continued increase in the number of inhabitants in Provinsi Daerah Istimewa Yogyakarta.

Limitation

Energy base complex to use, although it can be said that by using energy basis, all the details of the data and holistic frame of an area can be created by combining a lot of different sides of the economic and the environment system. Sustainability energy base is an issue transdisciplinary, which is necessary in a variety of perspectives from different disciplines to be able to measure energy a more accurate and reliable. To do energy basis, a researcher must collect raw data relating existing resources in a region as detail, and it takes a lot of time and cost as well as prudence. Because according to Campbell in Skuladottir (2005) the accuracy of energy evaluation depends on the overall accuracy of the calculation a variety of raw data collected.

In this thesis, where the resources in Provinsi Daerah Istimewa Yogyakarta which will be put into a renewable resource with a label R, turns out to be the hard part done in the analysis. In this study, the authors take to assume the production of food crops, the production of vegetable crops, the production of

fruit crops, the production of plantation crops, the production of forest, the production of livestock and fisheries as a renewable resource. The authors recognize the classification of the production of food crops, the production of vegetable crops, the production of fruit crops, the production of plantation crops, the production of forest, the production of livestock and fisheries in other areas may be different, especially in areas that may be barren and dry.

Future studies are expected to refine these results by conducting a more detailed study by the districts/cities in Provinsi Daerah Istimewa Yogyakarta. The study was to determine the economic growth in comparison to their respective districts/cities in the utilization and management of natural resources that produce energy. Results of research conducted by this author can be used as a comparison tool.

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