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THE DYNAMICS OF NATIONAL ENERGY RESILIENCE SYSTEM IN INDONESIA

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Abstract: *Uncertainty of energy in this globalized era, which is affected by Strategic Environment: local, national, regional and international has caused Indonesian Energy Resilience System is tangled; therefore a geostrategic model of comprehensive and interdisciplined energy planning is required. The model (Tenacity-Toughness) is a mixed model method that identifies the characters of external and internal factors qualitatively and quantitatively. This research aims to: 1) confirm contextual factors of model design (Tenacity-Toughness) in the dynamics of policy development on Indonesian energy resilience system within four input variables; 2) analyze the level of importance of Tenacity and Toughness on SKEN's Strategic Planning Indicator; and 3) apply the model (Tenacity and Toughness) through priority analysis of strategic planning of integrating the Indonesian energy resilience system planning in the development of ASEAN Grid Energy. The analysis results are: 1) mapping the contextual characteristics of the model (Tenacity and Toughness), 2) Finding priority of the importance level of Tenacity and Toughness factors to the three Indicators of Strategic Planning. Last, 3) recommending the importance of developing the ASEAN Grid Energy in strengthening Indonesian Energy Resilience System.*

Key Words: *ASEAN Grid Energy, Energy Resilience System, System Dynamics.*

1. INTRODUCTION

Energy resilience development is part of national development which aims to realize the prosperous and sustainable life for people according to the national goals as implemented in the 1945 Constitution, Article 33, and Clause 3. During three national leadership eras, issues on implementing the 7 Bills on energy sector have put dynamics in the Indonesian energy resilience system. So have the issues of implementing the partial models, (Yusgiantoro, 2000) which during New Order has caused a tangled management on national energy distribution and energy consumption pattern. Meanwhile, according to the policy of energy utilization, dualism of interest in managing Indonesian energimix resources, is, in one side, encouraged to obtain foreign exchange of energy export to fund the development within the Amended State Budget

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and, on the other side, is pushed to strengthen the system of energy resilience; and the importance of strategy planning of National Energy Resilience System during regional autonomy era by noticing the factors of Indonesian Strategic Environment (Sukanto, 1996), both external and internal.

According to Administration Science, the conceptual relationship between Public Administration and National Energy Resilience has a broad coverage. Therefore, in this research, it is limited to the dynamics of Indonesian Energy Resilience System during three national leadership eras. The theoretical review of National Energy Resilience System is a derivative of national resilience concept according to (Lemhanas, 1997) seen from strategic management of public sector. Epistemologically, the relationship between Management Strategic (*Nag, Hambrick and Chen, 2007) and National Energy Resilience is a combination of management development and strategic. On the other hand, according to Sunardi (1997),in methodology, national energy resilience is a development planning model called as development of national geostrategic (National Resilience).*

Along with the rapid development of public administration science, many paradigms and understandings emerged: traditional public administration, New Public Management, and good governance (Salomo, 2006). The conceptual framework of National Energy Resilience System developed in this research refers to the model of energy resiliencesystem developed by (APERC, 2007) and Energy Resilience according to Yusgiantoro (2010) in his book *Development of Energy Resilience*, as reported by Association of Alumni ITB, stating that the concept of energy resilience is the capability to anticipate dynamics of global energy change and to prepare domestic energy needs.

In addition to Yusgiantoro's, the definition stated by *International Energy Agency* (IEA-2007) in Nugroho (2014), states that Indonesia Energy Resilience covers the uninterrupted availability of energy sources at an affordable price, here the definition is described as efforts to provide energy sources which is nationally planned. Yusgiantoro (2000) noted that most energy planning models in Indonesia energy development were applied partially according to their commodity types during three decades of leadership and it has caused frail Indonesian energy resilience system.

During the New Order era, the policy on energy commercialization and trading, especially on oil and gas, has made Indonesia an OPEC member in which the production level (at that time) reached 1.2 million barrel per day and encouraged export-import strategies to gain additional value in energy export foreign exchange income. Development dependability on energy export foreign exchange income, specifically oil and gas, has caused interest dualism in employing the energy. Besides, revenue of the foreign exchange can be used as trade balance checker, and, as importantly, energy price as determined in the Amended State Budget has become the benchmark rate.

Starting from Reformation Era up to now, the impact of interest dualism in using energy sources has caused the export-import strategies and policies of Indonesian energy been maintained. Although the contribution to the state revenue is no longer dominant, in terms of macroeconomic, it is very important since it will affect the trade balance and national production. In addition to interest dualism in managing and developing energy resources is the high energy consumption during the New Order era without being controlled by any policies on development of national energy resources, specifically in electricity energy development. This is also important and is the major causes which worsen Indonesian Energy Resilience System, especially the electricity and oil. Empirical data describes that development of power plants is centralized on Java Island, whereas energy sources are mostly in Kalimantan and Sumatera.

According to five globalization mysteries proposed by Sachs(1998) and Huseini (1999), especially to answer the fifth mystery as revealed by Huseini (1999) on what a body or government institutions (State institutions) should do as a regulator in dealing with national constellation, which experience changes in all levels whereas demand from corporate in all sectors are more globalized while entering the third millennium era. In this case, Indonesia as the Central of Gravity ASEAN, especially on energy sector, needs to take steps on developing the energy resilience system that refers to the conditions of geographical location and variety of available energy sources as a strategy to develop National Energy Resilience System by integrating ASEAN Grid Energy, which consists of ASEAN Power Grid, Trans Gas Pipelines, and AFOC (ASEAN Forum On Coal). Conceptually, ASEAN Grid Energy could encourage growth of ASEAN industry.

Referring to aforementioned various backgrounds, this research aims to see the dynamic characteristics and importance level of tenacity and toughness factor in developing Indonesian Energy Resilience System related to the priority to develop ASEAN Grid Energy by analyzing three important factors as follows:

1. Characteristics of tenacity and toughness factors in the dynamics of Indonesian energy resilience policy system.
2. Importance level of tenacity and toughness factors toward indicators of strategic planning in National Energy Resilience System output.
3. Priority of strategic planning to integrate ASEAN Grid Energy planning to develop Indonesian energy resilience system?

2. LITERATURE REVIEW

In the context of Administration Science, the concept of National Energy Resilience in its development is considered as a pot, especially in Public Administration, (Huddleston 1984; Kieron. 1995; Salomo, 2006). National Energy Resilience System (SKEN) which is developed using (Tenacity and Toughness) Model, methodologically is applicable to various analysis level, both at the micro level (corporate) and macro level (planning and public policy). Furthermore, it is applicable at the trans-national level such as in inter-region of Southeast Asian nations (ASEAN), (Sunardi, 1997). At the regional level of ASEAN or United Nations of ASEAN economics it is referred as Regional Energy Resilience, or specifically ASEAN Grid Energy.

The conceptual basis of developed National Energy Resilience System is description of relationship between Wawasan Nusantara as the Indonesian geopolitics with National Resilience as the national development geostrategic according to strategic environment (Sunardi, 2000; Sukanto, 1996) and that puts energy geopolitics aspect, energy economics geostrategic aspect and energimix resources geostrategic aspect. Theoretical description of those relationships is in line with the Analysis of the Threats of Strategic Surprises in the Form of National Energy Crisis initiated by Yulianto and Wijaya (2015) and developed from APERC Studies (2007) in "Quest For Energy Resilience in The 21st Century," which is described into 4 (four) important factors: physical availability, accessibility to obtain the energy, affordability/ acceptability, and sustainability.

Since National Resilience is Indonesian development geostrategic, the National Energy Resilience System can be formulated as "*Dynamic condition of energy which consists of toughness and tenacity in effort to provide energy, both producing (and importing) energy in quantity, quality, price, region and time as needed.*" Based on the definition, the statement *dynamic condition of energy which consists of tenacity and toughness* can explain that National Energy Resilience System is a dynamic condition and affected by the dynamics of tenacity and toughness at all times.

The statement; "*in a strive to provide energy, both producing locally (and importing)*" indicates the importance of providing energy output which does not only rely on local energy sources, but also international energy such as oil by energy trading (export-import) through commercialization of energy policy in order to gain economic added values. This means energy resilience development policy, whenever possible, considers the dynamics of energy price at the international market which is affordable for Indonesian society.

Next, the statement "*energy in quantity, quality, price, region and time as needed*" signals the need of management and national energy consumption pattern with purpose for energy resilience is suitable with the needs by considering geographical location which is accessible every time for energy distribution. This surely requires national energy sources to be managed through a cross-sectoral planning which is integrated at all regions of Nusantara, without neglecting the influence of strategic environment, both at the national and regional (Southeast Asia) level.

Then, referring to the theoretical description of geopolitical and geostrategic relationships to develop the aforementioned energy resilience system and related to four variables stated by APERC, in the concept of model design (Tenacity and Toughness), there are four main variables need to observe:

1. Geostrategic of energimix output availability development within Indonesian energy sustainability politics.
2. Indonesian energimix commercialization politics in strive for developing the energy economic added value.
3. Geostrategic of national energy distribution management within national economic control
4. Geostrategic of national energy consumption pattern within energy utilization control.

The importance of (Tenacity and Toughness) model approach in conceptual design of National Energy Resilience System theory is a middle course that combines the role of market based strategy flow (Porter, 1990) and resources based strategy (Prahalad, 1993), in which, conceptually, elements of tenacity is put into analogy with the market based strategy approach that leads to the dynamic competitive advantages, whereas the elements of toughness is put into analogy with the resources based strategy that leads to the static comparative advantages. Therefore, conceptually, the dynamics of National Energy Resiliencesystem with (Tenacity and Toughness) model approach is a hypothesis that needs to data to prove.

A (Tenacity and Toughness) model of National Energy Resilience System that puts management of energy distribution and energy consumption pattern as the main variables, other than variable of energy output availability and commercialized energy, needs to be developed in purpose for Indonesian to experience the energy sovereignty in managing the energy sources. Meanwhile, the need of foreign exchange to fund the development from primary energy export product (coal and natural gas) carried out so far, should be replaced by final energy export (electricity), considering the existence of primary energy sources for power plant in Indonesia is abundant, such as: coal, geothermal and water.Methodologically, the (Tenacity and Toughness) model application is not only to measure the condition of National Energy resilience system through three strategic planning indicators: energy sustainability, improvement of added value, and energy/environment control but also to diagnose public policy in general.

3. RESEARCH METHOD

In this research, paradigm is defined as philosophical world view as reference for the researcher and perspective background to view the problem, find theoretical explanation and design the research and to answer the problem analyzed. As the philosophical world view in the search for science, Creswell (2009) categorized it into four courses: post-positivism, social constructivism, advocacy/participatory, and pragmatism. Since this research is quantitative and using mixed model research

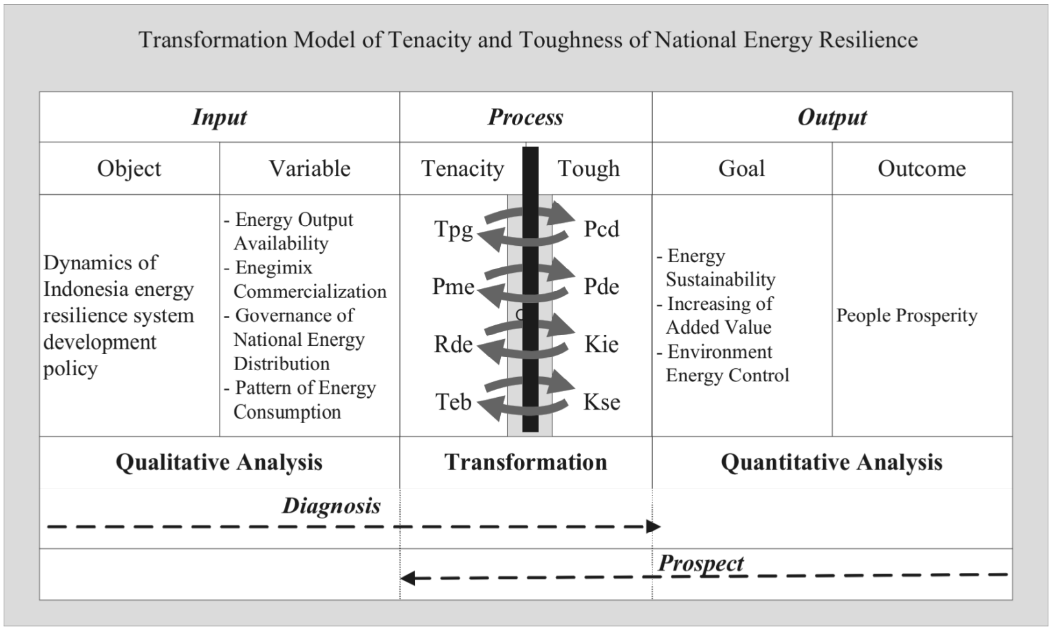

Figure 1: Transformation Matrix (Tenacity and Toughness) Design of National Energy Resilience System

approach, the philosophical world view chosen is post-positivism. Creswell explains that post-positivism as philosophical world view tends to maintain deterministic philosophy which considers that causative factors are possible to determine the result or outcome.

Therefore, the studied problems reflect the need to identify causes which affect the outcome as found in qualitative research in general. (Tenacity and Toughness) Modelin this research is the development of energy independence model (Yusgiantoro, 2010) and Asia Pacific Energy Resource Center (APERC) (2007) by putting three main indicators: energy sustainability, control and economics added value. Methodologically, the (Tenacity and Toughness) model is a mixed model of Systems Dynamic (Archetype Technique), developed by Flood and Jackson (1991) and Analytical Hierarchy Process (AHP) developed by Saaty (1986).

According to the theory of descriptive-prescriptive (Wahyudi, 2011), the stages and steps of this research is divided into two sequences: First stage of research is using system dynamics model (archetype technique) with purpose in mapping the characteristics of tenacity and toughness factors. The second stage of research is using Analytical Hierarchy Process model, which intends not only to figure out the importance level of observation parameter elements, but also to analyze the strategic planning priority of tenacity and toughness model related to the policy to develop the ASEAN Grid Energy within National Energy Resilience System.

The type of data used in the First Stage is a combination of primary data, which are interviews with three energy experts with different educational background, and secondary data collected from various literature related to energy. The data used in the Second Stage is data acquired from questionnaire.

There are 30 respondents: 4 respondents from National Energy Board (DEN); 1 respondent from Directorate General of Mineral and Coal (*Minerba*); 1 respondent from Directorate General of Oil and Gas; 1 respondent from Directorate General of New and Renewable Energy; 2 respondents are experts on coal and geothermal from ITB; 2 respondents are experts on oil from Universitas Trisakti; 4 respondents from Center for Energy Studies of Gajah Mada University; 2 respondents from Regulatory Agency for Downstream Oil and Gas (BPH-Migas); 2 respondents from Directorate General of Oil and Gas; 2 respondents from Directorate General of Electricity; 4 respondents from corporate (Private and State-owned Enterprises); 1 respondent is an energy analyst; 1 respondent is National Research Board; and 1 respondent is from National Land Authority (Wanhankamnas).

The dynamics of Indonesian Energy Resilience System could be seen from the analysis result on the influence of tenacity and toughness factors which are competed in pairs with three indicators of strategic planning model with support from graphic of tenacity and toughness transformation through axis X and Y (Figure 1).

4. ANALYSIS AND DISCUSSIONS

The discussion on Indonesian energy resilience system in this research adopting (Tenacity and Toughness) model approach aims to prove that methodologically the concept of National Energy Resilience System (SKEN) could be stated as an applied science theory. Thus, this discussion covers three parts:

1. The Dynamics of Indonesian Energy Resilience Policy System Development

The image below (Figure 2), displays the structure of systemic relationship between four input variables and three indicators of strategic planning in the (Tenacity and Toughness) model of National Energy Resilience System. The structure pattern of archetype formed on the four input variables (availability of energy output, energimix commercialization, governance of national energy distribution, and energy consumption pattern) describe the dynamics of systemic relationship between tenacity and toughness factors of energy resilience system which are projected as percentage in each indicator of National Energy Resilience System strategic planning.

The systemic relationship between four input variables and three indicators of strategic planning are as follows:

1. The output energy availability (*Ke*) with the indicator of energy sustainability (*K*), then the characteristics of tenacity and toughness factors are affected by the energimix sources geostrategic factor and energy geopolitical factor as

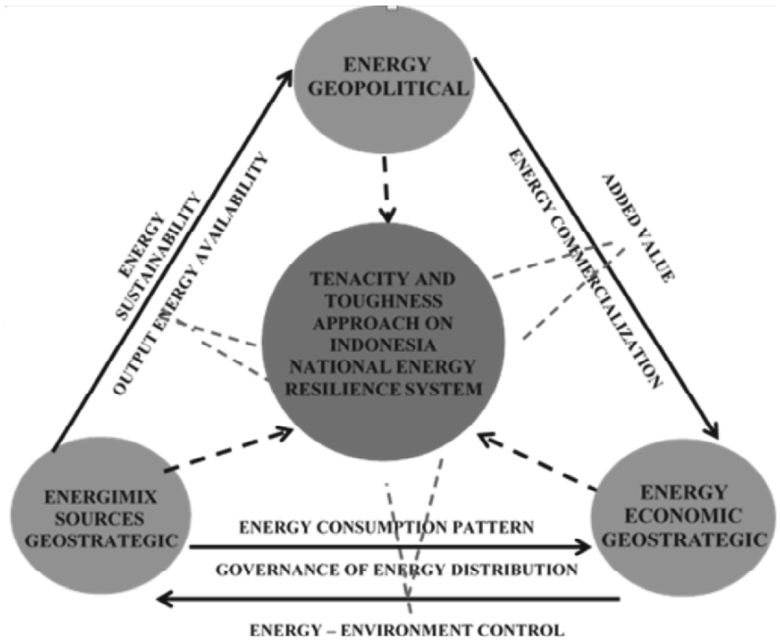

Figure 2: Relationship Structure of Variables in the (Tenacity and Toughness) Model Design

reflected in the dynamic relationship between the depletion rate versus energy reserves improvement. The finding on limit to growth structure on availability (provision) variables of energy output explains the factors which are able to leverage the sustainability of energy consumption through energy import. The interest to perform oil energy import could form balancing system toward the energy output availability subsystem aims for development on Indonesian Energy Resilience System Policy.

2. Commercializing energy sources (*Km*) with an indicator of energy economy added value improvement (*N*), then the characteristics of tenacity and toughness elements are influenced by energy geopolitics and energy geo-economics' factors reflected in the dynamics relationship between fulfilment of international energy market versus domestic energy market fulfilment. Findings of shifting the burden on the energy sources commercialization variables, specifically national energimix, explains factors capable to leverage the improvement of energy added value by energy export to international market. However, being cautious is needed as too large energy export could threaten the sustainability of domestic energy. The need of foreign exchange on oil and coal energy export could form a balancing system to subsystem of energy sources commercialization through the use of foreign exchange to import oil energy and develop energy industry with purpose Indonesian energy resilience policy development.

3. Governanceof national energy distribution (*Td*) with an indicator of national energy utilization control (*P*), then the characteristics of tenacity and toughness elements are influenced by energy sources geostrategic factor reflected in the dynamic relationship between energy distribution regulation (rules) and availability of energy distribution infrastructure. Finding of structure pattern limit to growth on the governance of national energy distribution, specifically the governance of energimix, explains the factors capable to leverage the worsening energy utilization control through infrastructure development policy of electricity distribution (transmition) performed by *PT*. Pusat Listrik Negara (Persero) – The Indonesia State Owned Electrical Company and *PT*. Pertamina (Persero) – The Indonesia State Owned Oil Company for oil and gas piping and shipping and capacity and competence improvement for supervisors conducted by BPH Migas (Indonesia Oil and Gas Regulation Agency). Improvement on supervisory capacity could form system balancing to the governance subsystem of national energy distribution with purpose to develop the Indonesian energy resilience policy.
4. National energy consumption pattern (*Pk*) in which control on environment impact is the indicator (*P*), the characteristics of tenacity and toughness elements are affected by the energy economic geostrategic factor and energy source geostrategic factor which are reflected in the dynamics relationship between clean energy technology use and natural characteristics of energy sources. Structure pattern of success to the successful that develops within the policy of national energy consumption pattern is able to leverage the control on environmental impact of energy use through the use of technology in using non-environmentally friendly energy sources, such as: oil and coal. Thus, balance between the uses of environmentally friendly and non-environmentally friendly energy leads to the balance of national energy pattern subsystem with purpose to develop the Indonesian energy resilience system.

2. Importance Level of Tenacity and Toughness Factor in the National Energy Resilience System

Related to the quantitative analysis on tenacity and toughness relationship in determining strategic planning indicators of Indonesian Energy Resilience System, then the discussion order is divided into five stages as the following:

1. **Synthesis and Determination on Element Value of Observation Variables and Strategic Indicator :** Referring to the comparison scale (Saaty, 1986), the synthesis process or balancing the value of influence on each observation variables and pairing the strategic indicators of National Energy Resilience System based on the questionnaire which are collected from 30 respondents, results in the following average:

(a) Analysis on The Importance Level of Observation Variable are:

Energy output availability versus energimix source commercialization = 4;

Energy output availability versus energy distribution governance = 2;

Energy output availability versus energy consumption pattern = 4;

Energimix sources commercialization versus energy distribution governance = 3;

Energimix sources commercialization versus energy consumption pattern = 3;

Energy distribution governance versus energy consumption pattern = 2

SKEN	Ke	Km	Td	Pk	EV (Priority)
Availability	1	4	1/2	4	0,352
Commercialization	1/4	1	3	1/3	0,210
Distribution Governance	2	1/3	1	2	0,271
Consumption Pattern	1/4	3	1/2	1	0,167
	14/4	25/3	5	22/3	

Output availability variable of primary energy is 35.20%;

Energy trading variable (commercialization) is 21.00%

National energy distribution governance variable is 27.10%; and

Energy consumption pattern variable (utilization) is 16.70%

(b) Analysis on The Importance Level of Parameter Observation are:

Energy reserve improvement (Pcd) = 3;

Energimix Depletion Rate (Tpg) = 4;

Domestic market share (Ppd) = 5;

Foreign export market (Ppm) = 4;

Infrastructure availability (Kid)= 3;

Energy distribution regulation (Rde) = 2;

Natural characteristics of energy (Kse) = 4; and

Energy technology use (Teb) = 2

2. **Calculation of Eigen Value of Parameter Observation :** By calculating (multiply) the eigen value calculation of eight observation parameter elements by eigen value calculation of three strategy indicators, as seen in Table 1below, therefore the distribution value differentiation of tenacity and toughness elements can be found:

Table 1
Multiplying Status Variable Eigen Value by Sub factor Element Eigen Value

KEN	(0,354) Ke	(0,210) Km	(0,271) Td	(0,167) Pk	Level of Importance
Pcd	0,525	-	-	-	0,185
Tpg	0,475	-	-	-	0,167
Ppd	-	0,483	-	-	0,100
Ppm	-	0,517	-	-	0,110
Kie	-	-	0,542	-	0,147
Rde	-	-	0,458	-	0,124
Kse	-	-	-	0,434	0,072
Teb	-	-	-	0,566	0,095
					1,000

Referring to the multiplication result eigen value of each sub factor element by eigen value of each status variable (input), therefore the importance level of sub factor element pairs on the input variable could be identified, that is: Energy output availability = (18.50% + 16.70%); Energimix commercialization = (10.00% + 10.10%); National energy distribution management = (14.70% + 12.40%), and energy consumption pattern (utilization) = (7.20% = 9.50%).

3. Distribution Calculation of Tenacity and Toughness Factor Value and Strategic Indicator of National Energy Resilience System
   (a) Reserve improvement, that is: (*K vs N*; = 3; *K vs* P = 4; and *N vs P* = 3)
   (b) Depletion Rate, that is: (*K vs N* = 4; *K vs P* = 2; and *N vs P* = 2)
   (c) Energy Domestic Market, that is: (*K vs N* = 3; *K vs P* = 2; and *N vs P* = 3)
   (d) Foreign Market, that is: (*K vs N*; = 4; *K vs P* = 2; dan *N vs P* = 5)
   (e) Energy Characteristics, that is: (*K vs* N; = 4; K *vs P* = 2; dan *N vs P* = 5)
   (f) Technology Use, that is: (*K vs N*; = 3; *K vs P* = 2; dan *N vs P* = 5)
   (g) Infrastructure Availability, that is: (*K vs N*; = 2; *K vs P* = 4; dan *N vs P* = 3)
   (h) Energy Distribution Regulation, that is: (K *vs N*; = 4; *K vs P* = 3; dan *N vs P* = 2)

By calculating (multiplying) the eigen value of eight observation parameter elements by value calculation of egien value of three strategic indicators, as seen in Table 2 below, the differentiation of distribution value on tenacity and toughness factor can be seen:

Table 2
Multiplication between Eigen Value of Observation Parameter Elements and Eigen Value of Strategic Planning Indicators

KEN	Pcd (0,185)	Tpg (0,167)	Ppd (0,100)	Pmn (0,110)	Kid (0,147)	Rde (0,124)	Kse (0,072)	Teb (0,095)
K	0,354	0,277	0,334	0,202	0,385	0,309	0,390	0,354
N	0,333	0,392	0,142	0,680	0,322	0,110	0,300	0,280
P	0,313	0,331	0,524	0,118	0,333	0,581	0,310	0,366

KEN	Pcd		Tpg		Ppd		Pmn		Kid		Rde		Kse		Teb		
K	0,066	+	0,046	+	0,033	+	0,022	+	0,056	+	0,038	+	0,028	+	0,033	=	0,322
N	0,062	+	0,065	+	0,014	+	0,074	+	0,047	+	0,014	+	0,021	+	0,027	=	0,324
P	0,057	+	0,055	+	0,052	+	0,013	+	0,048	+	0,072	+	0,022	+	0,035	=	0,354

Calculation (multiplication) as illustrated in Table 2 above shows the importance level of each observation parameter elements toward strategic planning indicator are distributed throughout percentage of multiplication between eigen value of observation parameter element pairs and eigen value of strategic planning indicators in the (Tenacity and Toughness) model. The values of distribution differentiation are as follows:

1. Sustainability of energy use, (*K*) is 32.20%
2. Enhancement of energy added value, (*N*) is 32.40%; and
3. Energy control and environmental impact: 35.40%
4. Projection of Tenacity and Toughness Value in SKEN

The mathematical calculation as seen in (Table 3) below results in percentage of tenacity and toughness condition in each strategic planning indicator of National Energy Resilience System by classifying each element of tenacity and toughness in pairs, as illustrated in Table 4 below. The percentage value on each sub factor elements as seen in Table 4 describes the dynamic condition of desired energy resilience system. Therefore, if the policy of strategic planning program changes, the values of each element will also change.

Dynamics value projection of Tenacity and Toughness factors in each strategic planning indicator in Indonesian Energy Resilience System could be transformed as the element of tenacity and toughness as seen in Image 3 below. Policy direction to develop Indonesia Energy Resilient System highly determines the dynamics of the system.

Table 3
Simulation Matrix of Distribution Transformation of Tenacity and Toughness Value toward Strategic Indicator (SKEN)

No.	*Percentage of Subfactor Element Value (Observation Parameter)*		*Percentage of Observation Parameter Influence on Strategic Indicator SKEN*		
	Subfactor	*Value (%)*	*K*	*N*	*P*
1.	Pcd	18,50	06,60	06,20	05,70
2.	Tpg	16,70	04,60	06,50	05,50
3.	Ppd	10,00	03,30	01,40	05,20
4.	Pmn	11,00	02,20	07,40	01,30
5.	Kie	14,70	05,60	04,70	04,90
6.	Rde	12,40	03,80	01,40	07,20
7.	Kse	07,20	02,80	02,10	02,20
8.	Teb	09,50	03,30	02,70	03,50

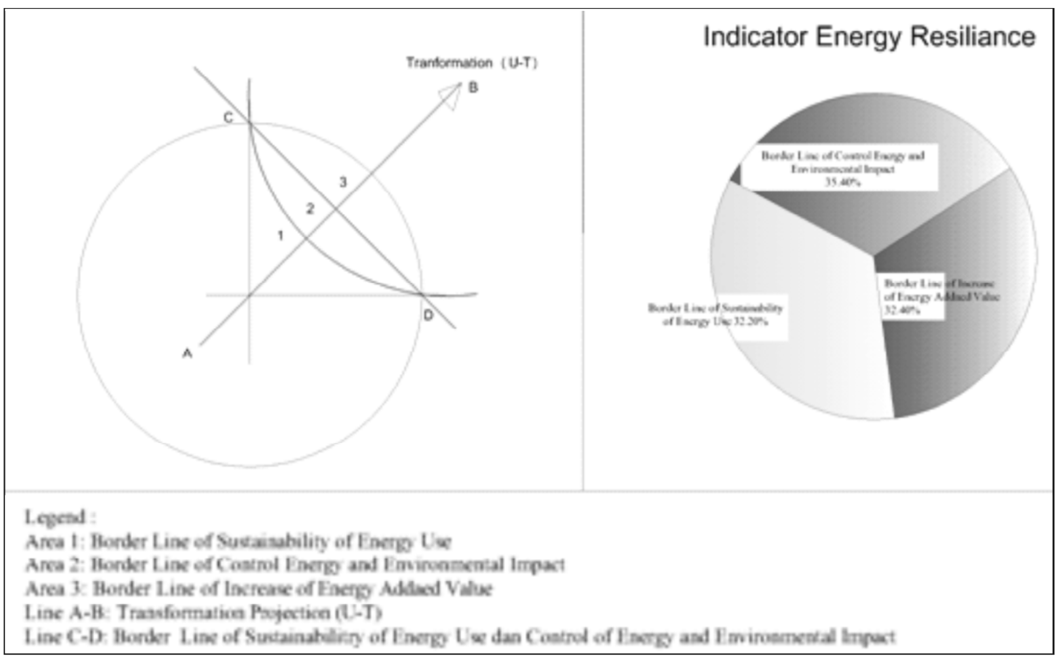

Figure 3: Transformation Projection (U-T) within Relationship of Strategic Planning Indicator of SKEN Development

If in a certain circumstances the isotanas line is approaching the tenacity elements, it means the toughness value tends to increase, and vice versa. Ideal condition happens when tenacity and toughness elements value are balanced, in which both are 50% of the SKEN tenacity and toughness total value. However, this ideal condition is rarely found in practice. Though, it does not mean tenacity and toughness condition can not be predicted or projected.

Tabel 4
Matrix of Transformation Projection of Importance Level Distribution of Observation Parameter Element to SKEN Elements (U-T)

U	*Observation Parameter*		*T*
16,70%	Tpg	Pcd	18,50%
11,00%	Pmn	Ppd	10,00%
12,40%	Rde	Kie	14,70%
9,50%	Teb	Kse	7,20%
49,60%	Total		50,40%

Conceptually, ideal value condition of tenacity and toughness elements on each strategic planning indicator within Indonesia Energy Resilience System currently is assumed that its development policy planning is to gain optimal result. Therefore, comparison percentage between three indicators of strategic planning is as follows:

1. The continuity of energy use (*K*) covers the overall areas of axis up to the hyperbole limit.
2. Energy added value increase (*N*) is the overall area of hyperbole up to the straight line A-B that intersects with the axis.
3. Effort of energy control or environment impact (*P*) is the overall areas of parabola up to the straight line *A-B* which intersects with the axis.

As described previously that systemic relationship (input-process-output) of tenacity and toughness model consists of three strategic outputs indicator in which the value are: energy sustainability 32.20%, added value increase 32.40%, and energy/ environmental control 35.40%. The three strategic planning indicator in constructing the development program of energy resilience system is sometimes difficult to be translated or implemented into the targets of development policy program. Mostly the policy makers and the development program formulator are not hand in hand in understanding the process of policy transformation that caused the difficulties in implementation.

3. Strategic Planning Priority of Integrating the Indonesia Energy Resilience System Planning in Development of ASEAN Grid Energy

Synthesis process (data synthesis) of strategic planning change in developing the Indonesia Energy Resilience System which is related to the development of ASEAN Grid Energy aims to measure how far the distribution transformation and differentiation of tenacity and toughness factor value is during the data simulation. The discussion on synthesis process and calculation of changes in strategic planning value in the development of ASEAN Grid Energy will cover:

1. New and renewable energy-based village energy development (*D*);
2. Energymix development for commercialization (*M*); and
3. Development of ASEAN Electricity Grid Distribution (*L*).

Then, by changing the strategic planning of National Energy Resilience Planning as in the Chapter 5 previously, the result of data synthesis on the relationship between tenacity and toughness factors and strategic planning indicators in the development of ASEAN Grid Energy, are as follows:

(a) Reserve improvement, that is: (*D vs M*; = 2; *D vs L* = 4; and *N vs L* = 2)

(b) Depletion Rate, that is: (*D vs N*; = 3; *D vs L* = 4 and *N vs L* = 2)

(c) Energy Domestic Market, that is: (*D vs N*; = 2; *D vs L* = 4; dan *N vs L* = 2)

(d) Foreign Market, that is: (*D vs N*; = 3; *D vs L* = 3; and *N vs L* = 2

(e) Infrastructure Availability, that is: (*D vs N*; = 3; *D vs L* = 2; and *N vs L* = 2)

(f) Energy Distribution Regulation, that is: (*D vs N*; = 3; *D vs L* = 4; and *N vs L* = 2)

(g) Energy Characteristics, that is: (*D vs N*; = 2*D vs L* = 4; and *N vs L* = 3)

(h) Technology Use, that is: (*D vs N*; = 2; *D vs L* = 3; and *N vs L* = 4)

By calculating (matrix multiplication) eigen value of square matrix by vectorial matrix similar to (Appendix V), it results in differentiation of value distribution from eight observation parameter elements of National Energy Resilience System on: new energy-based village energy development (D); energimix development for commercialization (M); and development of electricity grid distribution (L), as illustrated in Table 5 below:

In order to choose among three Strategic Planning Indicators in ASEAN Grid Energy development which has the main priority to develop at the moment, a questionnaire to find out the level of importance of each Indicator using simple matrix calculation is needed. Then, the value of Strategic Planning Indicator can be identified.

Table 5
Calculation Matrix of Differentiation SKEN Observation Parameter Value on Changes of Strategic Planning Indicator in ASEAN Grid Energy

SKEN	Pcd (0,185)	Tpg (0,167)	Ppd (0,100)	Pmn (0,110)	Kie (0,147)	Rde (0,124)	Kse (0,072)	Teb (0,095)
D	0,172	0,128	0,242	0,141	0,370	0,310	0,551	0,300
M	0,478	0,512	0,192	0,525	0,300	0,300	0,172	0,390
L	0,350	0,360	0,566	0,334	0,330	0,390	0,227	0,310

SKEN	Pcd		Tpg		Ppd		Pmn		Kse		Teb		Kie		Rde		
D	0,032	+	0,021	+	0,024	+	0,016	+	0,055	+	0,038	+	0,040	+	0,029	=	0,255
M	0,089	+	0,085	+	0,019	+	0,058	+	0,044	+	0,037	+	0,013	+	0,037	=	0,382
L	0,065	+	0,060	+	0,057	+	0,036	+	0,049	+	0,049	+	0,017	+	0,030	=	0,363

Based on the calculation as illustrated in (Table 5) above, it is seen that eight factor elements which influence Tenacity and Toughness change significantly and in line with the change of Strategic Planning Indicator of National Energy Resilience System Development. In other words, the change of value and the Strategic Planning Indicator change policy are correlated.

Distribution of the percentage value of the three strategic indicators of ASEAN Grid Energy (JEA) illustrates the condition of Indonesia energyresilience system management through four observation variables after a change (simulation) of strategic planning, in which the order or the main development importance are commercial energimix development to gain the energy added value as seen in the revenue of energy export foreign exchange, then the development of ASEAN Electricity Grid Distribution to control the electricity in a long term; and finally the new and renewable energy-based village energy development in order to maintain the energy output availability for longer term.

Based on the multiplication between eigen value of each observation parameter element and eigen value of strategic indicator of ASEAN Grid Energy development, the percentage distribution differentiation of tenacity and toughness value can be explained as in line with the characteristics of actual condition of each output strategic indicator in the National Energy Resilience System, which can be used as a reference or the goal of policy planning, as follows:

1. New energy-based village energy development, (*D*) as much as 25.50%;
2. Commercial energimix development, (*M*) as much as 38.20%; and
3. Development of electricity grid distribution, (*L*) as much as 36.30%.

THE PROSPECT OF ASEAN GRID ENERGY DEVELOPMENT

Assuming that during the development of National Energy Resilience System (SKEN) into ASEAN Grid Energy System by changing the three Strategic Planning Indicator, but still considering the development policy of Indonesia Energy Resilience System as discussed in Result and Discussion, then the value of influential factors of the three Strategic Planning Indicator in SKEN has changed significantly within the Strategic Planning Indicator of ASEAN Grid Energy development. The dynamics of changing rate of the observation parameter value is a value differentiation of tenacity and toughness factors in SKEN as illustrated in Table 6 below.

Data calculation of observation parameter value to strategic planning change during the development of ASEAN Grid Energy as discussed in (Table 6) basically is a transformation of tenacity and toughness value in SKEN. Therefore, if the element of tenacity and toughness becomes our focus in analyzing Development Integration Prospect of ASEAN Grid Energy, Table 7 will illustrate the simulation of change transformation of strategic planning indicator value in the Tenacity model (*U*) and Toughness (*T*), SKEN. Differentiation of strategic planning value change on the

Table 6
Matrix of Value Changing on Strategic Planning Indicator (SKEN) in the ASEAN Grid Energy Development (JEA)

No.	*Percentage of Observation Parameter Value*		*Calculation Result of Changes on Strategic Planning Value of Energy Resilience System*					
			Strategic Planning SKEN (%)			*Strategic Planning JEA (%)*		
	Sub factor	*Value (%)*	*K*	*N*	*P*	*D*	*M*	*L*
1.	Pcd	22,00	6,60	6,20	5,70	3,20	8,90	6,50
2.	Tpg	16,80	4,60	6,50	5,50	2,10	8,50	6,00
3.	Ppd	13,80	3,30	1,40	5,20	2,40	1,90	5,70
4.	Pmn	17,40	2,20	7,40	1,30	1,60	5,80	3,60
5.	Kie	11,20	5,60	4,70	4,80	5,50	4,40	4,90
6.	Rde	07,50	3,80	1,40	7,20	3,80	3,70	4,90
7.	Kse	07,30	2,80	2,10	2,20	4,00	1,30	1,70
8.	Teb	04,00	3,30	2,70	3,50	2,90	3,70	3,00

Table 7 reflects the dynamic condition of Tenacity and Toughness elements of SKEN in the development dynamics and energy resilience development policy in Indonesia with purpose for ASEAN Grid Energy Integration.

Table 7
Matrix of Simulation of ASEAN Grid Energy Development Prospect within Indonesia National Energy Resilience System

No.	*Development of Output Strategic Planning Indicator*		*Change of Output Indicator Value in (%)*				*Notes*
	RS-SKEN	*RS-JEA*	*RS-SKEN*		*RS-JEA*		
			U	*T*	*U*	*T*	
1	K	D	13,90	18,30	10,40	15,10	Decrease-Decrease
2	N	M	18,00	14,40	21,70	16,50	Increase-Increase
3	P	L	17,50	18,00	17,50	18,80	Stable-Increase
	Total Nilai		49,40	50,60	49,60	50,40	Increase-Decrease

Therefore, the impact value of each observation parameter element to each observation variable of national energy resilience is the value of tenacity (*U*) and toughness (*T*) factors which are transformed into a strategic planning of National Energy Resilience System (SKEN) with purpose to develop ASEAN Grid Energy (JEA). Since the projection of SKEN strategic planning development is related to the ASEAN Grid Energy Integration, there are three strategic goals, then the percentage of Tenacity and Toughness elements value to the three strategic planning can be determined by adding the value of tenacity and toughness elements.

Based on the calculation of tenacity and toughness value transformation toward the SKEN strategic planning indicator in the National Energy Resilience System Dynamics related to the development of ASEAN Grid Energy, then the review of the transformation dynamic characteristics of the three goals are as follows:

1. Energy sustainability versus new and renewable energy-based village energy development: a decrease in the value of tenacity element from 13.90% to 10.40%, indicates that the development of new and renewable energy-based village did not really support the sustainability of energy use in medium-term since the decrease value is under the average, which is (12.50%). This is inseparable from the influence of not-yet-good-regulation. Meanwhile, the toughness factor, despite the decrease has hope since the value is above average 12.50% and the reason is the variety of new and renewable energy sources. Hence, efforts to improve the sustainability of energy use through new and renewable energy, currently, could not be recommended.
2. The gain of added value versus energimix sources commercialization: an increase of tenacity value from (18% to 21.70%) and tenacity value from 14.40% to 16.50% indicates that policy of energimix sources commercialization could increase the added value of energy economy especially in the future. This process of commercialization should be executed selectively since in the development of energy sources not all factors could be applicable directly in their economic level. Currently, things need to develop into commercial energimix covers: hydropower energy (water), geothermal, coal, oil and natural gas. Those five energimix sources theoretically are in the commercialization level, so they do not need subsidy any longer. The most important thing in energy commercialization effort is the affordability of the society, especially households.
3. Energy use control versus development of electricity grid distribution: unmoving tenacity element at the value of 17.50% indicates the need of technology innovation in the energy sources use. Meanwhile, the toughness element which was 18.00% increased slightly into 18.80% indicates infrastructure increase although alarming for the long term. Related to the development planning of electricity grid distribution to various ASEAN nations, through a planning that is integrated to National Energy Resilience System, surely it will provide significant impact on the efforts to control the management system of Indonesia energy distribution, then Indonesia could also increase the control of energy consumption pattern through conversion of coal into electricity with purpose to reduce dependence on oil and gas in energimix.

5. CONCLUSIONS AND SUGGESTIONS

A. Conclusion of Research

Referring to the research problem and discussion result on three questions and the purpose of research discussed in previous chapter, there are three main conclusions:

1. Conclusion on the characteristics of tenacity and toughness factors in the dynamics of Indonesia energy resilience system development policy;

2. Conclusion on the importance of tenacity and toughness factors toward the strategic output indicator (energy sustainability, energy/environmental control, and added value increase) in the National Energy Resilience System; and lastly
3. Conclusion on priority of strategic planning of integrated Indonesia energy resilience system planning to develop ASEAN Grid Energy.

1. **Characteristics of Tenacity and Toughness Factors in the Dynamics of Indonesia Energy Resilience Policy System :** Based on deep interviews with several experts with various background and secondary data description from various literatures in viewing the actual condition as reviewed in details on Chapter 4, therefore the characteristics of tenacity and toughness factors of Indonesia energy resilience system could be described as follows:
   (a) In the four subsystems (input variable), the characteristics of tenacity and toughness factors are identified as the pairs of observation parameter that drive the dynamic condition of Indonesia energy resilience system development policy.
   (b) In the three indicators of strategic planning (system output), the characteristics of tenacity and toughness factors are identified as external and internal factors that affect the energy resilience system.
   (c) On the model design (input-process-output), the characteristics of tenacity and toughness factors are identified as a diagnosis tools (evaluation) for national energy resilience system development policy.

Based on those three findings on characteristics of tenacity and toughness factors, it can be concluded that methodologically, the conceptual design of National Energy Resilience System is quite relevant as a theory since it is supported by significant empirical data qualitatively.

2. **Importance Level of Tenacity and Toughness Factors in the National Energy Resilience System :** Based on the distribution differentiation calculation of importance level of tenacity and toughness factors in the National Energy Resilience System, as illustrated in (Table 5-3) in Chapter 5, then data from four input variables (subsystem) being observed are obtained, which are as follows:
   (a) Energy output availability subsystem is dominated by the sub factor of energy reserve increase compared to the sub factor of depletion rate. This condition describes the sustainability of energy use during three national development era is safe enough and supported by tenacity factors through oil exploration and importing activities, specifically exploration on energimix sources, such as: oil and natural gas, coal, geothermal, and water. This is seen from the comparison value of tenacity and toughness factors as the strategic planning indicator on energy use sustainability as much as (16.70% versus 18.50%).

(b) Commercialization subsystem of energy source is dominated by the basic sub factors of foreign energy market compliance compared to sub factors of domestic energy market compliance. This condition describes that the effort to increase the added value economic during three national leadership era was only supported by tenacity factors through primary energy export such as: coal, oil and natural gas. This can be seen in the comparison value of tenacity and toughness factors strategic planning indicators experience an increase of energy added value as much as 11.00% versus 10.00%).

(c) Subsystem governance of national energy distribution is dominated by infrastructure availability for energy distribution sub factor compared to energy distribution regulation sub factor. This condition explains that efforts to control the energy use during three national development era was only supported by toughness factors through the availability of energy infrastructure, while the regulation was in shambles. This can be seen on the comparison value of tenacity and toughness factors strategic planning indicator on controlling the energy use, which is as much as (12.40% versus 14.70%).

(d) Subsystem of national energy consumption pattern is dominated by clean energy technology use sub factor compared to the natural characteristics of energy sources sub factor. This condition describes the effort to control energy consumption pattern during three national leadership era is still highly dependable to the tenacity factors through technology application to clean energy use. This can be seen in the comparison value of tenacity and toughness factors strategic planning indicator to control environmental impact of energy use which is as much as 9.50% versus 7.2%).

In concept, the importance level of tenacity and toughness factors in the National Energy Resilience System can be identified based on the calculation between value percentage distribution of each pair of observation parameter element and the three model output strategic planning indicator which are transformed as elements of tenacity and toughness. The importance levels of these factors become the basic of planning and policy to develop four observation variables of National Energy Resilience System.

3. **Priority of Strategic Planning on Integrated Indonesia Energy Resilience System Planning in the ASEAN Grid Energy Development :** Based on the calculation and analysis conducted, the priority for strategic planning of ASEAN Grid Energy Integration in the Development of Indonesia Energy Resilience System using the approach of (Tenacity-Toughness) model, from three strategic planning being observed, one has a chance to follow up, which is development of ASEAN Grid Energy. The development of ASEAN Grid Energy, could leverage the Indonesia energy resilience system. Among those leverages are:

(a) Improving the added value of Indonesia energy sources economic, especially coal which are mostly exported to neighbouring countries.

(b) Boosting the industry economic growth at national and ASEAN level

(c) Providing workplace, worth noting that Indonesia has the largest population among ASEAN Nations.

(d) Strengthening the National Energy Resilience System, since in turn, coal will no longer be exported as a primary energy, but as a secondary energy or as electricity final energy.

(e) Strengthening the union and economic resilience of ASEAN Nations.

By performing application test of Tenacity and Toughness model through prospect study of National Resilience Energy Planning Integration in the ASEAN Grid Energy Development, then the conceptual formulation of National Energy Resilience System could be defined as an applied science theory, since it is supported by data and valid investigation technique and reliable methodology.

B. Recommendation and Suggestion

Based on the analysis result above, both conclusion on characteristics of tenacity and toughness factors in the dynamics of energy resilience development policy, and on the importance level of tenacity and toughness factors in SKEN, and also on the priority of strategic planning on Indonesia energy resilience system planning integration in the development of ASEAN Grid Energy, the following are the suggestions:

1. In the globalized era and Regional Autonomy, in which the influence of stronger strategic environment, the approach of (tenacity-toughness) model could become a solution for the planning strategy of Development and multi aspect National Energy Resilience System development policy, both at the national and regional level. Therefore, it is suggested:

   (a) Multidisciplinary researcher under Public Administration science at the doctoral level make Tenacity and Toughness model the grand model in analysing the planning and public policy, especially in the multiaspect energy field.

   (b) For National Defence Agency (Lemhanas): this research contributes to science to find the black box of theory development of the Indonesia National Resilience System which has been considered as development doctrine and not yet a theory in the national resilience system.

2. Related to the condition of National Energy Resilience System which is pretty alarming, specifically the condition of national energy consumption pattern and tangled energy sources commercialization, the Government through National Energy Board is suggested to revise among others:

(a) Act (Undang-Undang) no. 30 of 2007 on Energy by adding Chapter on management of national energy distribution and Indonesia energy consumption pattern.

(b) Act (Undang-Undang) no. 4 of 2009 on Mineral and Coal by adding the importance of technology application in order to increase the economic value of coal, including providing strategic position for State-Owned Enterprises in energy sector and mineral sources as the main actor who are directly assigned by the President.

3. In line with the goal of establishing ASEAN to prosper their people and the enactment of ASEAN free trade which began in 2015, it is suggested that the Government make the development of ASEAN Grid Energy as the main priority in the Indonesia resilience system development policy.

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