Crucial factors in shaping strategies for Thai energy business in the dynamic era

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Abstract. In an era of rapid change, adequate strategy formulation is crucial to an organization, not just to overcome obstacles but to thrive in the business sustainably. To survive in the dynamic environment of the energy business, strategy formulation for energy enterprise need to consider various potential factors, together with their impacts. This includes social factors, innovation and technology factors, economic factors, environmental factors, as well as government policies and directions. The strategy formulation must be based on accurate and sufficient data, which indicates a level of impact and their uncertainties that may occur in the future. This paper presents analytical sets of key challenges, drivers, and critical uncertainties, which are expected to have significant impacts on the Thailand energy business in the next 30 years. The research starts with examining the global energy situation and challenges for the Thai energy business. The sustainable development goal is defined as a key decision focus at this step. Next, the STEEP analysis is employed to evaluate the impacts of factors on the energy business ranging from social factors, technology factors, economic factors, environmental factors to political factors. Foresight workshop with stakeholders is arranged to identify critical uncertainties. The result will be beneficial to both government and private enterprises in designing appropriate energy strategies.

Keywords: Energy business strategy, Key challenges, Drivers, Crucial uncertainties

1. Introduction
The energy business is constantly changing due to several factors. Business leaders need to understand how each potential factor will affect their business and suitably prepare for them. Ignorance of doing so may result in serious damage to the business. Traditional utilities in Germany overlooked the potential of distributed photovoltaic (PV) generation. Not only they missed the opportunities to benefit from technology development, but they also lost 97 percent of the PV electricity generation market [1]. Thus, to sustain the business, an organization must carefully formulate strategies to deal with those changes. The strategy formulation must be based on accurate and sufficient data, which indicates a level of impact and their uncertainties that may occur in the future. However, the same factor may affect business in different countries at a different level.

The objective of this study is to analyze factors specifically influencing the future of the Thai energy business covering 5 main aspects which are economical, social, environmental, innovation and technological, and political. It results in the analytical sets of key challenges, drivers, and critical uncertainties.
uncertainties, which are expected to have significant impacts on Thailand energy business in the next 30 years. The results will be beneficial to the development of Thailand’s energy scenarios, which will lead to the formation of suitable energy strategies at both corporate and national levels.

2. Methodology
The methodology consists of 3 steps: identification of key decision, identification of drivers, and evaluation of importance and uncertainty of drivers

2.1. Identification of key decision
As the decision focus should be in line with global changes in various aspects, global and local trends of technology, environment, economy, and society are examined for their effects on future energy supply and consumption patterns. Consultation with stakeholders is arranged to finalize the key decision.

2.2. Identification of drivers
Defined as a tool to assess external factors that have influences on the business [2], the STEEP analysis provides a comprehensive view of ongoing and future circumstances impacting the business in 5 aspects, namely social, technological, economical, ecological and political (figure 1). Accordingly, its framework is employed to identify which and how various factors impact energy business in positive and/or negative ways. Both local and global issues & trends are mapped to each STEEP aspect correspondingly.

| Social          | Technological | Economical     | Ecological     | Political                  |
|-----------------|---------------|----------------|----------------|---------------------------|
| Social changes, such as demographic change, change of people behavior and lifestyle | Technological advance and integration such as innovations and product development trends | Economic environments such as overall economic growth, interest, income, market, and competitor | Ecological impacts of products and/or services, both physically and biologically | Political changes involving laws, regulations and policies such as development goals, incentives or policy burdens |

**Figure 1.** STEEP analysis framework.

2.3. Evaluation of importance and uncertainty of drivers
After influencing factors are obtained, the foresight workshop with stakeholders is arranged to evaluate the importance and future risks or uncertainties of such factors (figure 2). The critical uncertainties are defined at this step. The critical uncertainties are considered to have a critical role in determining future energy scenarios, while other factors are parts of the projections.
3. Results

3.1. Identification of key decision

3.1.1. Global situation and challenge. According to the Global Risk Report 2019 of the World Economic Forum [4], it is found that environment and digitalization are having a growing role in the development of both global economic development and energy businesses. At present, they have become part of economic and energy policies, which aim to pay more attention to the environment. All new and prospective technologies must be environmentally friendly. In other words, the concept of 3D – decarbonization, decentralization, and digitalization – has become the direction and goal of policy at a corporate level, national level, and international level.

Also, it is forecasted that the energy market will grow towards low-carbon energy options [5]. It is expected that renewable energy will have the highest growth rate and will become one of the world’s main energy sources within the next 10-20 years. The use of natural gas will still remain in the future. However, the uses of oil and coal are likely to be shrunk. Their growth will be only observed in emerging markets.

Accordingly, the IEA has proposed the sustainable development scenario (SDS) with the challenging greenhouse gas emissions mitigation target. This is following the sustainable development goals set by the United Nations as well as Shell’s sky scenario [6].

3.1.2. Challenges for Thailand. Several challenges are observed for the Thailand energy system. Energy security and stability are ranked as the top priority to continuously support the growing needs. The current energy management system also needs more players to encourage fair competition. Besides, there may be a need to stimulate new businesses that create higher value and provide more choices for consumers.

Environmental issues have become more important to Thailand, especially air pollution problems, as public awareness towards the impacts have been increased. The issues have been emphasized with the momentum from major international commitments and agreements e.g. greenhouse gas emissions mitigation targets, enforcement of low sulfur fuel oil measure. Thus, to avoid a negative impact on the national long term competitiveness, environmental issues must be taken into consideration of energy policy development.

Moreover, new high potential digital and energy technologies may rapidly cause changes in patterns of energy usage in Thailand so that the existing infrastructure and energy management system will be obsolete. This will negatively impact both energy price and supply, and will eventually affect national energy and economic security.

Considering the mentioned situations and challenges, it is certainly necessary for Thailand to consider a balance of economic development, energy security and access, and stakeholder engagement in the long-term energy development. Therefore, the challenge for Thailand’s energy business that
should be considered as a key decision is “to achieve the Sustainable Development Goals (SDG) by the year 2050”.

3.2. Identification of drivers
According to the STEEP analysis, factors that drive Thailand’s energy system towards the SDG are as follows.

3.2.1. Social factors. The changing lifestyle of Thai people towards more urban and sharing economy is the first influencing social factor that will impact the future of energy business. It is foreseen that mobility-as-a-service will become popular as it provides more choices of transport ranging from bus to car and bikes. And thanks to the digital technology advancement, there will be digital tools to facilitate the provision of this service. Also, e-commerce is becoming even more popular as people choose to do more financial transactions via electronic media.

The second social factor is demographic change. Although the population growth rate of Thailand is declining, it is more likely that people will move to urban areas [7]. This will lead to a high population density in specific areas. Moreover, Thailand has entered the aging society approximately since the year 2005. It is expected that Thailand will completely enter an aging society in the year 2021 with the population aged 60 accounting for more than 20 percent of the total population [8]. Accordingly, numbers of labor and consumer behavior will be inevitably affected leading to a negative impact on national economic growth.

Lastly, it is foreseen that there will be a shift towards urbanization. A vertical living will be on the rise. And, city development will be based on transit-oriented development (TOD) such as train and electric train, which provides benefits and conveniences for traveling and helps reduce dependence on personal cars.

3.2.2. Technological factors. Several technological factors are identified as influential to the Thailand energy business. The first one is efficiency improvement technology, which covers production efficiency, transportation efficiency, product efficiency, and energy efficiency. It also includes designs for zero energy use such as zero energy building and district cooling system.

The advancement of renewable and alternative energy technologies has pushed the price of renewable and alternative energy down so that they can compete with fossil fuels. Also, coupled with more advanced energy storage systems, it is expected that the demand for renewable and alternative energy will be increased.

Information technology will play a greater role in various aspects. First, it will efficiently help maximize resource management leading to the energy and environment conservation. Its application can be found in the smart grid, smart city, and smart farming. Next, the high-speed internet and internet of things (IOT) that connect devices and things will allow people to easily control and operate the device via the internet. Furthermore, blockchain technology, which enables safer and more powerful online transactions, will empower technology platforms for business development.

The electric vehicles and autonomous vehicles will be more popular as they have been greatly developed, resulting in the elimination of major limitations and the significant price reduction. Besides, the infrastructures for these vehicles have been continuously developed. Other transportation and logistics technologies such as high-speed trains and hyperloop will also play a greater role in the future.

Artificial intelligence and robotics, as well as advanced materials e.g. batteries for energy storage and building envelope, are also important technological factors in the energy system development.

3.2.3. Economic factors. Similar to technological factors, several economic factors have been identified for potential impacts on the energy business. The first one is national economic growth including government policies that aim to pull the economy out of the middle-income trap. Secondly, the reduction of renewable and alternative energy prices, as well as the reduction of energy storage system prices, have fostered the competitiveness of renewable and alternative energy against fossil fuels.
Geopolitics also have impacts on the Thailand energy business as it affects the amount and price of energy, especially those of crude oil and natural gas. International economic cooperation also plays role in energy supply management. Examples of international economic cooperation are the Association of Southeast Asian Nations or ASEAN, the framework of cooperation between ASEAN and the negotiating countries (ASEAN Plus), the Economic Cooperation Development Program in the Greater Mekong Sub-regional (GMS).

Furthermore, national economic structure and income distribution; sufficient economy philosophy; the amount of existing domestic natural resources; and economic crisis are also identified for their impacts on the Thailand energy business.

3.2.4. Ecological factors. International environmental policies and agreements, such as carbon policies, UN Framework Convention on Climate Change, and the Paris Agreement have provided great impacts on the greenhouse gas mitigation attempts. Regional and local pollution issues such as PM2.5 and nitrogen oxide (NOx) help increase the environmental awareness of the public. More importantly, all of them have helped foster the use of low-carbon fuels and renewable energy.

Life cycle thinking and the concept of the circular economy have gained in popularity over time. The life cycle thinking will lead to the appropriate approach to mitigate impacts of products and services throughout their life cycle, while the circular economy will affect demand for virgin materials as well as production patterns. The concept of bioeconomy and green economy are also received high attention in many organizations.

3.2.5. Political factors. Below are various policies, which are expected to have an impact on Thailand’s energy systems.

1) Policies that support renewable and alternative energy such as feed-in tariff policy and biofuel mandate
2) Disruptive technology supportive policies such as smart grid master plan
3) Energy efficiency policies such as building energy code
4) Energy pricing policies such as energy price structure, real-time pricing, subsidies for certain fuels
5) Clean cooking fuels policies based on sustainable development goals (SDG)
6) Policies to phase out carbon-intensive fossil fuels such as the new regulations of the International Maritime Organization (IMO), and the phase-out of old diesel vehicles

In addition to the above policies, structure and governance of energy businesses such as decentralization that encourage local power production and lessen demand from the central grid will also play an important role in the energy system.

Lastly, the economic corridors that aim to stimulate economic development will also have a major contribution to the energy development

3.3. Evaluation of importance and uncertainty of drivers
The drivers identified in 3.2 are prioritized and assessed for their impacts and uncertainties. The result is shown in figure 3.
Figure 3. Ranking of drivers of Thai energy business towards sustainable development goals.

From figure 3, drivers with high impact and high uncertainty or so-called “critical uncertainties” are carbon policies, people lifestyle, renewable energy (RE) policies, and renewable energy & energy storage (RE&ES) technologies. These four factors are expected to have a critical impact in the direction of Thailand’s energy business as they reflect the trends of energy demand and supply as well as the urge to achieve sustainable development goals. Accordingly, they should be taken into account in the development of a national energy roadmap or master plan.

With high impact and low uncertainty, efficiency technologies should be included in energy planning as well. The economic growth may be revisited periodically to observe their impacts on the energy business. Other factors can also be parts of future projection or may be disregarded.

4. Conclusion
To overcome obstacles and successfully thrive in the globally dynamic environment, the Thai energy sector must incorporate the sustainable development goal (SDG) into its strategic planning. Various factors are expected to have an impact on the Thai future energy system. However, there are 4 factors, namely carbon policies, renewable energy policies, people lifestyle and energy storage technologies are considered to have the greatest impacts and highest uncertainties. These factors are expected to strongly stimulate decarbonization and digitalization in the Thai energy business as they will escalate the demand for renewable and alternative energy, promote electrification, enhance efficiency improvement and foster the use of digital technologies. Therefore, these factors should be taken into consideration in strategic planning, at the corporate, national and international levels.

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