# *THE STRATEGY ANALYSIS OF LIQUEFIED NATURAL GAS SECURITY IN TAIWAN*

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## Overview

In 2016, the Taiwan government established a new national electricity structure for low-carbon energy transition. The proportion of power generation from renewable energy and natural gas are 20% and 50% respectively by 2025. As Taiwan is an island-based electric grid and 98% of the energy are imported, the role of natural gas is becoming more and more important in the energy transition. 80% of Taiwan's natural gas is used for power generation, which is not only to support the power-assisted dispatching for unstable power generation (solar or wind power), but also to maintain good air quality by reducing coal and increasing gas. The soundness of supply-chain between electricity and natural gas is an important factor in energy security. In order to cope with the interruption of sporadic gas sources and ensure the stability of power supply, the government revised the natural gas management law on August 27, 2018, gradually increasing the legal days for energy security stocks. The purpose of this study is to evaluate the impact of liquefied natural gas (LNG) policy on the energy security.

## Methods

This study establishes a system dynamic model of natural gas to identify the relevant risk-influencing factors and causal relationships in energy transition, and to assess the risk impact of policy implementation. The system dynamics model is a computer simulation methodology, developed by Professor Forrester of the Massachusetts Institute of Technology in 1956, which is based on a multi-dimensional and interactive analysis viewpoint. This model constructs a complete supply chain including demand and stock, with two main features. Firstly, this study integrated the inventory management theory into the system dynamics model and constructed the feedback logic between the influential factors to explore the systematic causal relationship. Secondly, a state of the art analysis method of risk indicators of energy security, based on 4A dimensions including Availability, Accessibility, Affordability, Acceptability. This study focuses on an ex-ante dynamic strategy analysis, which is different from the ex-post static key performance indicators (KPIs).

## Results

A situational difference analysis between the “risk management scenario” (the safety stock policy) and the “baseline scenario” (current state) to assess the impact of the legal safety stock of LNG in Taiwan. The study results reveal that the inventory level needs to increase by 6.4 times compared with 2018 and the total production cost will increase by 8.7 times to meet the LNG safety target to reach the 14-day stock by 2027. The resilience risk reduction caused by the energy security stock policy is greater than the increase in the risk of the tank capacity operation. Therefore, the total risk of natural gas accessibility index is significantly reduced, but the affordability risk will increase.

## Conclusions

The risk indicator of energy security stocks is like the concept of buying insurance. The more secure (stable supply), the higher the premium (affordability) that needs to be paid. Due to the implementation of LNG safety stock, the total production cost will increase by 8.7 times, but the effect of LNG stable supply is positive, the total energy security risk , which equals to accessibility risk plus affordability risk, is reduced. Energy transition is two-side of aspects (goal achievement and system vulnerability). The systematic energy security model could assist decision makers to evaluate the positive and negative impacts of energy transition and propose response strategies to increase public awareness on acceptability of energy transition.

## References

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