

# **COMPUTATION AND ANALYSIS ON TAIWAN INDEX OF ENERGY SECURITY RISK**

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## **Overview**

This study adopted the International Index of Energy Security Risk developed by U.S. Chamber of Commerce (USCC) and the Taiwan's domestic data to complete the localized energy security risk analysis for the past years. The result shows that, since 2012, the overall risk of energy security has declined, mainly due to the recent reduction of global crude oil prices and slowdown in crude oil prices volatility. In addition, Taiwan has been over-concentrated in a particular country for natural gas import in the past years, which induced high risk of exposure of energy import for a specific period of time. The issue has been adequately mitigated by means of increasing the importing countries to enhance diversity and to reduce the risk exposure.

In order to predict the future Taiwan's energy security risks under three proposed scenarios, this study integrates three tools: USCC International Energy Security Risk Index, TIMES Model and GEMEET Model.

The proposed scenarios include: Business As Usual (BAU), Optimistic Scenario and Moderate Scenario. In compliance with the government's carbon reduction policy, for Optimistic Scenario and Moderate Scenario, large scale renewable energy, gas-fired power generation, coal-fired power plants with carbon capture and storage (CCS) are used, and electricity demand is suppressed. The main differences between the two scenarios are: in Optimistic Scenario, the construction of renewable energy facilities is maximized. However, in Moderate Scenario, it is assumed that sufficient renewable energy facilities cannot be built. As a result, more gas-fired power generation and coal-fired power plants with CCS are used, and more electricity demand is suppressed to achieve the same carbon reduction requirement. Under these scenarios, the carbon dioxide emission continued to decline year by year. In BAU, carbon dioxide emission is not controlled. The fossil fuel power plants are massively used to replace the nuclear power generation. As a result, the scores of CO<sub>2</sub> related risk index of Optimistic Scenario and Moderate Scenario are significantly lower than those of BAU.

However, in Optimistic Scenario and Moderate Scenario, a large amount of fossil fuel is still need to be imported, and the fossil fuel prices will continue to rise. Therefore, the negative impact of importing fossil fuel combined with price rising has offset the positive impact of reducing carbon dioxide emissions. Therefore, for Optimistic Scenario and Moderate Scenario, the overall energy security risks of in 2050 are even higher than that in 2015.

## **Methods**

In order to predict future Taiwan's energy security risks under proposed scenarios, this study integrates three tools: USCC International Energy Security Risk Index, TIMES Model and GEMEET Model. The TIMES model predicts the basic data of the scenarios, and the GEMEET model calculates GDP based on the electricity demand from TIMES model. The resulting data is used to analyze the energy security risks of Taiwan's domestic energy security risks by USCC International Energy Security Risk Index.

## **Results**

The proposed scenarios include: Business As Usual (BAU), Optimistic Scenario and Moderate Scenario. In compliance with the government's carbon reduction policy, for Optimistic Scenario and Moderate Scenario, large scale renewable energy, gas-fired power generation, coal-fired power plants with carbon capture and storage (CCS) are used, and electricity demand is suppressed. The main differences between the two scenarios are: in Optimistic Scenario, the construction of renewable energy facilities is maximized. However, in Moderate Scenario, it is assumed that sufficient renewable energy facilities cannot be built. As a result, more gas-fired power generation and coal-fired power plants with CCS are used, and more electricity demand is suppressed to achieve the same carbon reduction requirement. Under these scenarios, the carbon dioxide emission continued to decline year by year. In BAU, carbon dioxide emission is not controlled. The fossil fuel power plants are massively used to replace the nuclear power generation. As a result, the scores of CO<sub>2</sub> related risk index of Optimistic Scenario and Moderate Scenario are significantly lower than those of BAU.

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## Conclusions

The paper combines the International Index of Energy Security Risk published by U.S. Chamber of Commerce (USCC) with TIMES Model and GEMEET Model to evaluate the future Taiwan's energy security risks under three proposed scenario, BAU, Optimistic Scenario and Moderate Scenario. Based on the preliminary results, the suggestion can be proposed: the energy policy with diversity consideration should be taken into account. The energy supply for economic development in a nation should not be focused on certain energy technology in order to alleviate the impact of fuel supply and the fluctuation of fuel price in the international on the economic development.

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