A SYSTEMATIC APPROACH TO EVALUATING THE COSTS AND BENEFITS OF HARMONIZING TRANSPORTATION FUEL QUALITY STANDARDS IN THE APEC ASIA AND OCEANIA REGION

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Overview

Exhaust gases emitted from vehicles, like carbon monoxide (CO), nitrogen oxides (NOx), and particulate matter (PM), harm human health as well as the environment. To alleviate the undesirable side effects of automobile utilization, every APEC economy has adopted fuel quality standards, which set emission limits for car pollutants. However, it is unavoidable that in different APEC economies, a vast variety of specifications have been adopted and utilized. At the same time, the APEC oil market, and particularly oil trade, finds itself in a state of uncertainty and flux because it is hampered by the differences in quality specifications. Among several key factors sustaining the APEC trade flows, the harmonization of APEC fuel quality standards stands out as one of the possible transitions to support the APEC oil trade market, minimize environmental emissions, and reduce unnecessary oil movement and its excessive logistics costs in the long term.

This paper seeks to highlight the emerging threat of vast differences of qualities among the petroleum products especially diesel and gasoline in APEC Asia and Oceania which have considerably limited trade among APEC economies and analyses the transition opportunities to harmonize the fuel quality standards in its oil market. This research also aims to help policymakers across APEC in improving the sustainability and security of their energy systems and to integrate these indications into policy strategies. This paper also compares the economic benefits of improving or harmonizing the quality standards with the investment cost to upgrade the quality standards to meet the specifications required by the government and industry.

Methods

The approach used in this research is Gap Analysis, SWOT Analysis (Strengths, S; Weaknesses, W; Opportunities, O; and Threats, T), and the Asia Pacific Energy Research Centre (APERC) Financial and Economic Model.

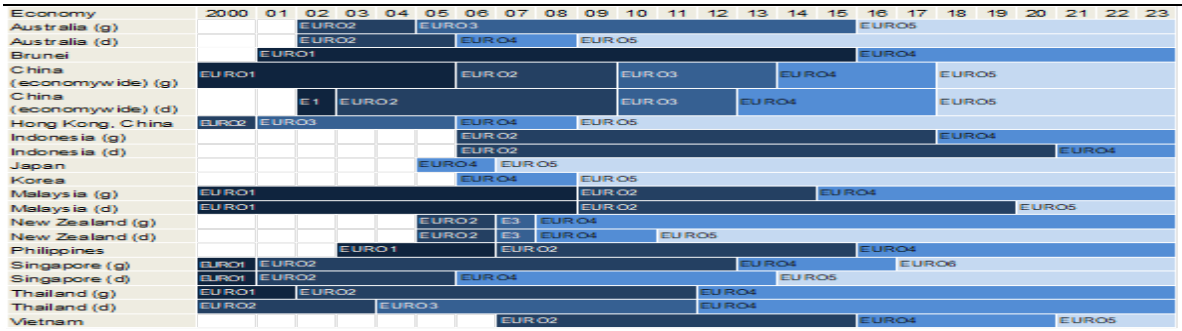
The data on transportation fuel standards of APEC Asia and Oceania is from the Expert Group on Energy Data and Analysis (EGEDA) and the inputs from economy representatives at APERC. The gap analysis is used to assess the differences of diesel and gasoline quality standards among APEC Asia and Oceania economies. The SWOT analysis identifies the key factors (both internal and external) associated with the harmonization and improvement of the product quality standards within APEC Asia and Oceania. Based on the results from the SWOT analysis, the APERC Financial and Economic Model is used to evaluate the economic costs and benefits for APEC Asia and Oceania in upgrading and harmonizing the product quality standards. Using Thailand as a case study, the APERC Financial and Economic Model calculates the economic costs and benefits of Thailand in changing the diesel and gasoline specifications from Euro 3 to Euro 4. The results obtained from the model are then evaluated to investigate whether Thailand's drive to Euro 4 quality is justifiable and beneficial to its economy.

Results

The gap analysis for fuel quality standards in APEC Asia and Oceania (Figure 1) summarizes the differences of fuel quality standards of the diesel and gasoline which are adopted and applied as transportation fuels in APEC Asia and Oceania region. The fuel quality standards adopted in some APEC economies are generally behind those in Europe and widely vary among economies. While passenger cars in Australia, China, Hong Kong, Japan, Korea, and Singapore are already subject to the Euro 5 standard, other southeast Asian economies have adopted only Euro 2, Euro 3, and Euro 4; for example, Indonesia progressed two levels from Euro 2 to Euro 4 for gasoline vehicles in October 2018 and plans for Euro 4 diesel in 2021 while Thailand shifted from Euro 3 to Euro 4 for both diesel and gasoline in early 2016 and plans to upgrade to Euro 5 in the 2021-2023 timeframe.

Utilizing fuels with common standards in APEC will contribute to more flexible product trades since the differences in their qualities may have hindered their active trades which can be translated into the extra costs incurred when developing the trade in the region. Should this barrier be resolved, more dynamic trades of fuels will strengthen APEC energy security. This is particularly true to southeast Asia, with significant intra-product trade and yet different quality standards in the region.

Figure 1: Gap analysis of fuel quality standards in APEC Asia and Oceania



Note: (g) represents gasoline, (d) refers to diesel. China imposes stricter regulations to cities such as Beijing, Shanghai, and Guangzhou.
Sources: PTIT (2016), European Environment Agency (2015), APERC Oil Report 2019 (2019)

The SWOT analysis on APEC Asia and Oceania economies shows that the market expansion (S), energy transition and security (S), and petroleum product trading (O) are advantages but the refinery investment (W), differences in car service life (T), and differences in environmental policies (T) are barriers to the attempt to harmonize the quality standards in APEC Asia and Oceania. The identified factors from the strengths and opportunity categories are used to evaluate the economic benefits while the factors from the weakness and threats categories are used to calculate the economic costs associated with the upgrading process of the fuel specifications. Using the APERC Financial and Economic Model to calculate Thailand's economic costs and benefits in the transportation fuel transition from Euro 3 to Euro 4 as a case study, the benefit to Thailand in implementing Euro 4 diesel oil was calculated to be US$756 million based on cleaner air with sulphur limits reduced from 350 ppm to 50 ppm. Besides, less CO, NOx, and PM emission have been realized in addition to the saving from health care cost reduction due to less respiratory health patients. On the other hand, the economic cost was derived from the refinery investment in its de-sulfurization units to remove sulphur in the diesel and was equivalent to US$74 million. The model was also applied to estimate the economic costs and benefits to upgrade the gasoline from Euro 3 (150 ppm sulphur) to Euro 4 (50 ppm sulphur). In this case, the economic benefit in implementing Euro 4 gasoline was calculated to be US$84 million and the cost in adopting the Euro 4 gasoline standard was equivalent to US$8 million. When comparing the costs (US$74 million for diesel and US$8 million for gasoline) to the benefits (US$756 million for diesel and US$84 million for gasoline), it was, therefore, justifiable for Thailand to advance to Euro 4.

This systematic economic costs and benefits evaluation technique can also be applied to the case of any economy that is preparing to upgrade its transportation fuel to a better quality standard such as in many APEC Asia and Oceania economies or any economy that prepares to upgrade its bunker oil quality to comply with the new tanker regulations to limit sulphur content (from 3.5% to 0.5%) on marine fuels to be enforced in 2020 by the International Maritime Organization (IMO) based on its recognition that tightening the emission standard is necessary to mitigate the environmental impact stemming from bunker fuel.

Conclusions

The evaluation of Thailand to upgrade its diesel quality standard from Euro 3 to Euro 4 shows that the economic benefit is worth US$756 million versus economic costs of US$74 million while the economic benefit of gasoline Euro 4 is US$84 million versus economic costs of US$8 million for gasoline. Following this systematic approach, the APERC Financial and Economic Model can be further applied to evaluate whether it is economical to harmonize the quality standards of APEC Asia and Oceania economies. The model can also be used to evaluate Thailand transition to Euro 5 during 2021-2023 timeframe. Besides, it is possible for any economies to apply this technique in evaluating its bunker oil quality to comply with the IMO regulation to be in effect on January 2020 by comparing the upgrading costs to produce 0.5% S versus 3.5% S bunker oil with the benefits of the improving environment and a more flexible trade flow of bunker oil. Last but not least, the technique can be applied to evaluate the economic costs and benefits of oil market transition, oil trading, transportation pipelines installation opportunity, and evaluate the supply security in crisis when supply disruption takes place.

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