



### Harmonizing Transportation Fuel Quality Standards to Resolve Oil Trade and Environmental Issues in APEC

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- Asia Pacific Energy Research Centre (APERC) Dr. Ruengsak Thitiratsakul, Research Fellow



### **Outline of presentation**

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- Vehicle population and pollution in APEC economies
- Harmonization of fuel standards in APEC economies
- SWOT analysis of the harmonization of fuel standards in APEC economies
- Case study: evaluation of cost and benefits to upgrade transportation fuel from Euro IV to Euro V in Thailand
- APEC analysis: evaluation of cost and benefits to upgrade transportation fuel from Euro IV to Euro V in APEC
- Conclusions



# APEC oil consumption has been growing strongly for the past decade

#### APEC oil demand, by region, 2008-2018



Source: APERC analysis and IEA (2021)

APEC high growth (1.5% p.a.) was mainly due to the contribution of China and southeast Asia.

# Transport sector has the largest share of APEC oil consumption

#### APEC oil demand, by sector, 2008-2018



Source: APERC analysis and IEA (2019)

Transportation has been the dominant sector in APEC and contributes to increasing the number of vehicles in the region.

### ...and maintains its growth towards 2050...

#### APEC transportation demand, by fuel, 2000-2050



Diesel shows stronger growth than gasoline and dominates transportation fuel over the projection period.



# Vehicle population and pollution in APEC economies



### The world vehicles increase strongly amid COVID-19 crisis

#### Number of cars sold worldwide between 2010 and 2021



Source: Statista (2021)

### Vehicle population in the world increased by 9% in 2021.



# APEC vehicles increase sharply with high transportation fuel demand

#### World automobile population, by region, 2010-2016



#### Vehicle population in APEC shows 11% growth.



# Vehicle pollution is an increasingly important challenge in APEC



Exhaust gases emitted from vehicles (CO, NO<sub>x</sub> and PM) harm human health and environment.





# Harmonization of fuel standards in APEC economies



### APEC economies have adopted fuel standards to set emission limits for cars for the past years

#### Fuel quality standards in APEC economies, 2000-2023

Economy 20	000	01	02	03	04	05	06	07	0	8 0	9 1	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Australia (g)			EUF	02		EUR	203		EL	JRO	4														
Australia (d)			EUF	02			EUR	RO4		EL	JRC	05													
Brunei		EUR	01															EUF	804						
China (g)	URO	1					EUF	208			E	UR	03			EUF	RO4			EUR	05				
China (d)		1	E1	EUI	ROZ						E	UR	03	- 1	EUF	804				EUR	05				
Hong Kong, China 🔤	2	EUR	03				EUF	RO4		EL	JRC	05													
Indonesia (g)							EUI	202												EUR	04				
Indonesia (d)							EUR	208															EUR	04	
Japan						EUF	204	EUF	RO	5															
Korea							EUF	RO4		EL	JRC	05													
Malaysia (g) 🔤	URO	1			101					EL	JRC	52				1	EUP	RO4							
Malaysia (d)	U RO	1								EL	JRC	D2										EUR	05		
Mexico (g)						EUF	802			E	JRC	24													
Mexico (d)						EUF	RO2			EL	JRC	04									EUF	205			
New Zealand (g)						EUF	302	E3	EL	JRO	4									EUR	05				
New Zealand (d)						EUF	802	E3	EL	JRO	4		EUR	105											
Peru (g)	URO	1		EUI	RO2			EUI	RO	63									EUF	804					
Peru (d)	URO	1		EUI	ROZ			EUI	RO	3								EUF	804						
Philippines				EUI	R(0)1			EU	RO	2							- 1	EUP	804						
Singapore (g)	1	EUR	02												EUP	RO4			EUF	605					
Singapore (d)	1	EUR	02				EUP	RO4								EUF	ROS								
Thailand (g)	URO	1	EUF	102										EUF	204										
Thailand (d)	URO	2			EUR	203								EUF	804										
Vietnam	Į.						Į	EUR	R(0)	2								EUF	804				EUR	05	

Source: APERC analysis and PTIT (2019)

A variety of specifications of gasoline and diesel have been utilized in APEC economies.

### ...but there are some adverse impacts of APEC economies adopting different fuel quality standards

#### Maximum gasoline sulfur limits, 2020



*Vast differences of qualities considerably limit trade among APEC economies.....* 

## APEC oil market is uncertain because it is hampered by different quality specifications

#### Maximum diesel sulfur limits, 2020



Source: Stratas Advisors (2020)

.....resulting in a need to harmonize the fuel quality standards to facilitate oil trade in APEC.



# Sustaining APEC trade flows is enabled by harmonizing fuel quality specifications



The harmonization of fuel quality standards in APEC economies not only supports oil trade market, but also minimizes environmental emissions and reduces excessive logistics cost.





# SWOT analysis of the harmonization of fuel standards in APEC economies



# SWOT analysis of the harmonization of fuel standards in APEC economies



Strengths	Weaknesses
Expansion of APEC's oil market	Investments are needed for some
	refineries to upgrade facilities
Better air quality, lower GHG	
emissions, and less health risk	
Opportunities	Threats
Fuel swap trading in APEC economies	Differential policy and quality
	standards of APEC economies
Optimization of regional production	A big gap in GDP and income per
capacity and consumption	capita in the region
Strengthened cooperation in	Increasing trade competition because
improving fuel standards in APEC	all economies focus on the same
economies	quality products
Increased security of supply in terms	Lack of public awareness of fuel
of Strategic Reserve	quality standards



### Case Study: Evaluation of cost and benefits to upgrade transportation fuel (diesel and gasoline) from Euro IV to Euro V in Thailand



### Case Study: Benefits of sulfur reduction in Euro V diesel vs Euro IV diesel in Thailand



Health benefit due to sulfur reduction in Euro V diesel vs Euro IV diesel

Health impact	S 350 ->	S 50 ->	S 350 ->
	50ppm	15ppm	15ppm
Decreased premature deaths	284-810	102-292	386-1,102
Decreased new cases of	1,215-	438-	1,653-
chronic respiratory disease	3,767	1,358	5,124
Decreased respiratory/	227-636	82-229	309-865
cardiovascular hospital admissions			
Economic potential benefits (billion baht)	23-57	8-20	31-77

Source: Pollution Control Department, Ministry of Natural Resources and Environment (2012)

Economic benefit from upgrading diesel from Euro IV was estimated to be USD 540 million

- Less CO, NOx, PM emissions
- Health care cost reduction
- Less lung disease and fewer respiratory health patients

### Case Study: Cost of sulfur reduction in Euro V diesel vs. Euro IV diesel



Economic cost of the refinery investment (de-sulfurization units) to upgrade diesel from Euro IV to Euro V was calculated to be USD 201 million



## Thailand's economic cost and benefits to upgrade diesel and gasoline from Euro IV to Euro V

	Cost (USD million)	Benefits (USD million)
Better air quality, lower GHG emission, and health risk reduction (diesel)		540
Investments needed to desulfurize diesel from 50 ppm to 10 ppm	201	
Better air quality, lower GHG emission, and health risk reduction (gasoline)		202
Investments needed to desulfurize gasoline from 150 ppm to 50 ppm	54	
Total	255	742

Source: APERC analysis (2020)

Comparison of economic benefits and costs to upgrade fuel from Euro IV to Euro V was justifiable for Thailand to advance to Euro V.



## APEC's economic cost and benefits to upgrade diesel and gasoline from Euro IV to Euro V

	Cost (USD billion)	Benefits (USD billion)
Better air quality, lower GHG emission, and		2.7
health risk reduction (diesel)		
Investments needed to desulfurize diesel from	1.0	
≥50 ppm to 10 ppm		
Better air quality, lower GHG emission, and		4.0
health risk reduction (gasoline)		
Investments needed to desulfurize gasoline	1.2	
from ≥50 ppm to 10 ppm		
Total	2.2	6.7

Source: APERC analysis (2020)

Comparison of economic benefits and costs to upgrade fuel from Euro IV to Euro V was justifiable for APEC to advance to Euro V.



### Conclusions

- It was justifiable for APEC economies to upgrade their fuel quality standard from Euro IV to Euro V, based on the economic evaluation that showed the economic benefit (USD 6.7 billion) higher than economic cost (USD 2.2 billion).
- *Potential application of using the systematic economic cost and benefits evaluation approach:* 
  - any economy that prepares to upgrade or standardize its transportation fuel to a better quality standard.
  - any economy that plans to evaluate the economic costs and benefits of oil market transition, oil trading, transportation pipelines, and oil supply disruptions.





### Thank you for your kind attention

#### ruengsak.t@aperc.or.jp

