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3-3. Oil and Gas Security Indexation

Izham Shukor
Researcher, APERC

Background

In 2001, APEC Leaders endorsed the Energy Security Initiative (ESI) in order to strengthen regional energy security, emphasizing on longer-term policy responses that address the broad challenges facing the region's energy supply by focusing on actions that are practical in a policy context and acceptable in a political context.

In 2014, the Energy Ministerial Meeting (EMM) officially recognised four elements that are vital for energy security and sustainable development in this region: diversified energy supply and stable demand; safe energy transportation routes; innovation in energy technologies; and effective fora to discuss energy policy.

In EWG 50 (14-18 December 2015), **Energy Security Indexation** was proposed as one of the topics under the Oil & Gas Security Studies (OGSS) research activities for 2016

Defining Energy Security

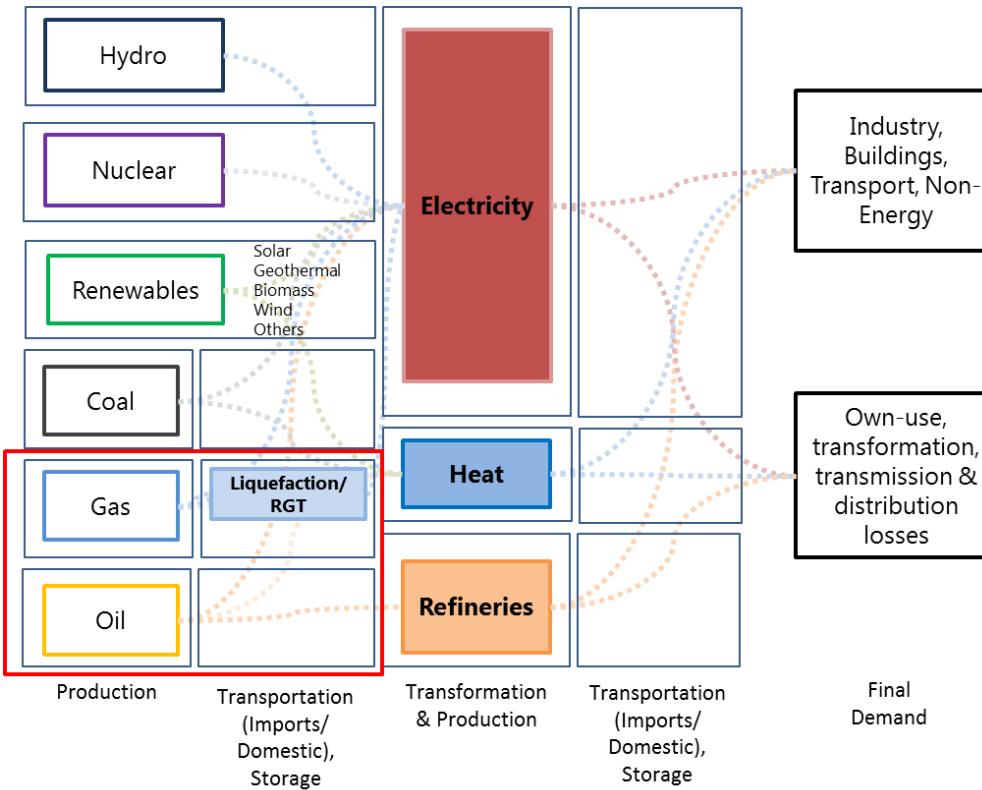
Definitions of energy security by organization around the world

Organization	Definition
International Energy Agency (IEA)	Uninterrupted physical availability of energy at a price that is affordable, while respecting environmental concerns.
Asia Pacific Energy Research Center (APERC)	Adequate energy supplies at reasonable and stable prices to sustain economic performance and growth. APERC assess energy security in terms of availability, accessibility, acceptability and affordability
World Bank	Sustainable production and use of energy at reasonable cost in order to facilitate economic growth and improve the quality of peoples' lives
United Nations Development Program (UNDP)	Continuous availability of energy in varied forms, in sufficient quantities and at reasonable prices
Institute of Energy Economics, Japan	Adequate energy at reasonable prices for economic and industrial activities of the country

Source: IEA 2011, APERC 2007, World Bank 2005, UNDP 2000, IEEJ 2012 and APERC analysis

Energy supply chain is very complex

Study focus

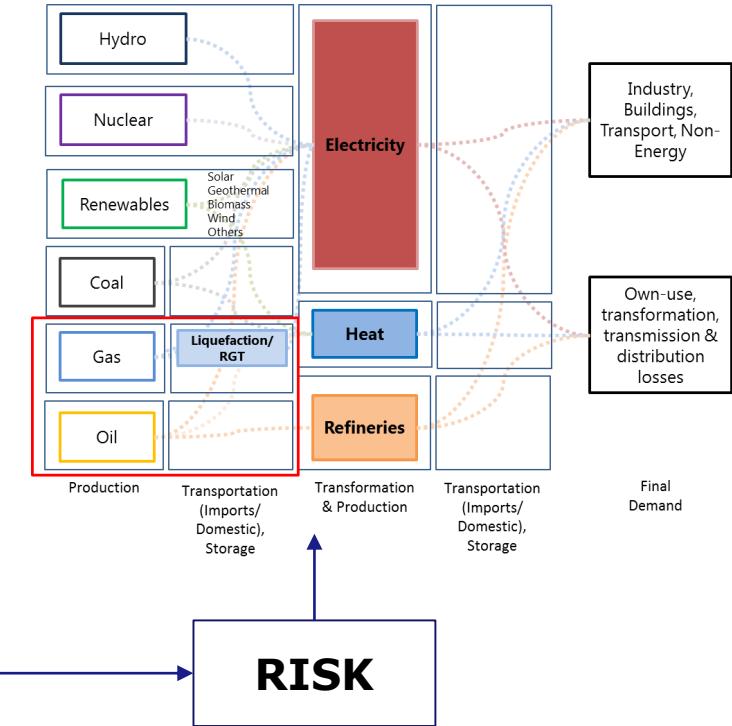
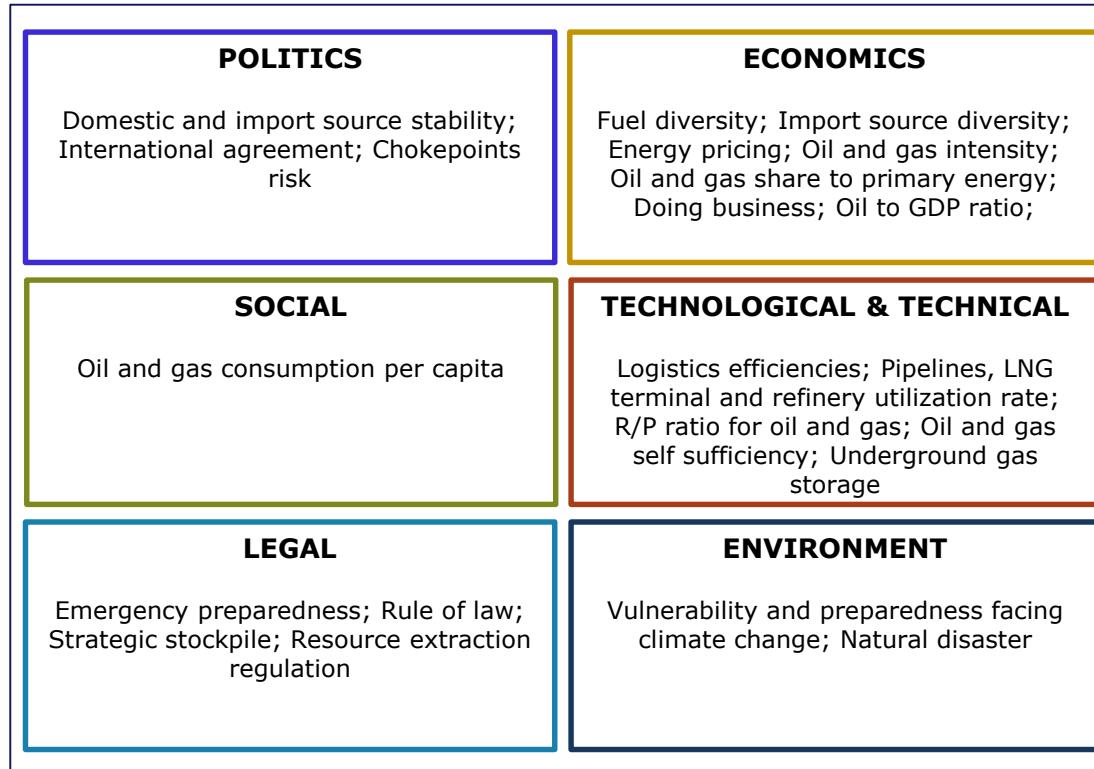


This study focusing on oil and gas sector, specifically in production and transportation, and to some extend, transformation

Source: APERC analysis

Many factors may contribute to supply interruptions

Identifying factors by using PESTLE methodology

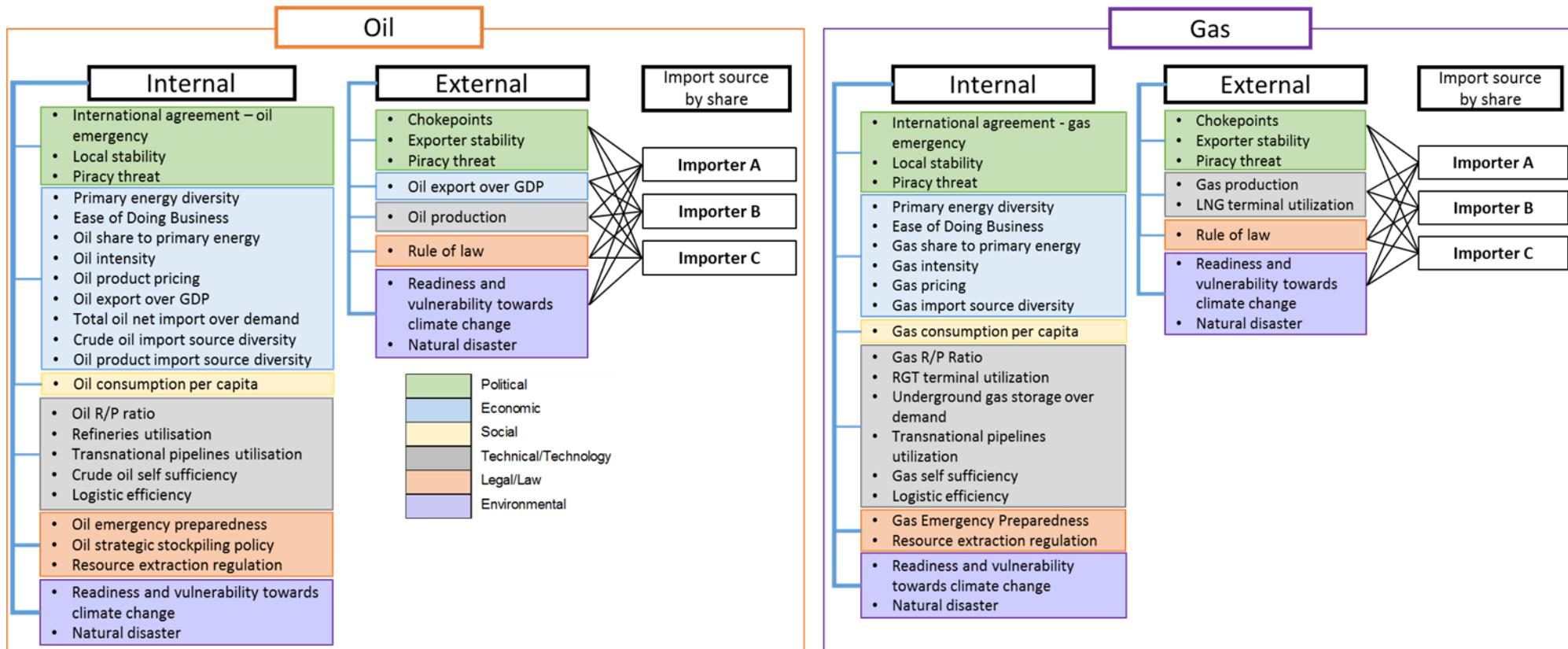


This study focuses on production, transportation and to some extent transformation in oil and gas. Each segment poses its own challenges and supply disruption risk.

Source: APERC analysis

Index Building Blocks

Oil and gas security indexation sub-indicators



Each segment poses its own challenges and supply disruption risk.

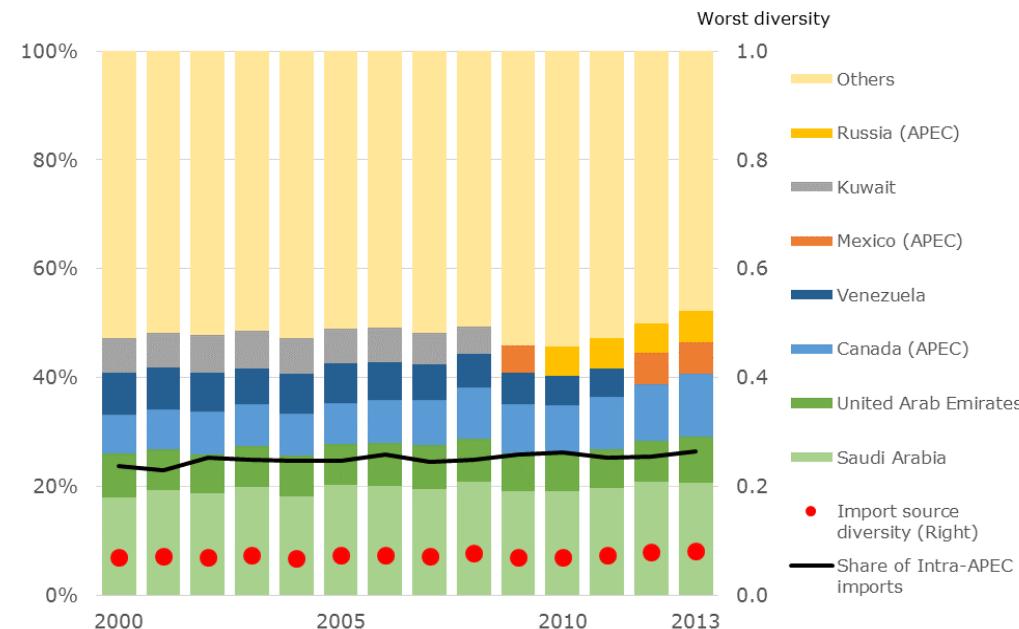
Source: APERC analysis

Notes: Oil includes crude and product. However, external risk for crude and product is calculated separately. Each import source was calculated separately

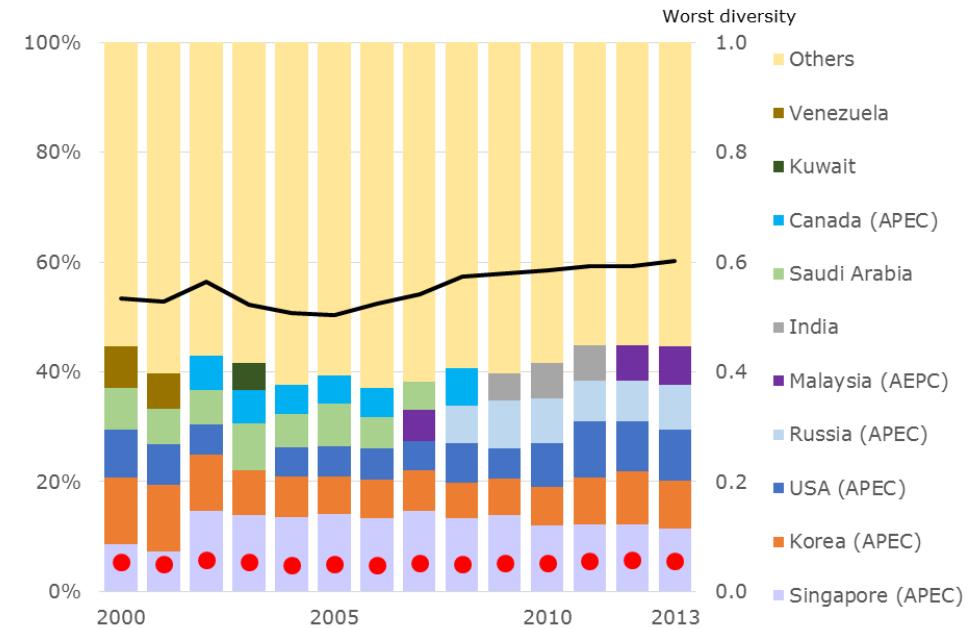
High intra-APEC import for oil products help to mitigate some of supply risk for oil

Crude and oil product import source

Crude oil



Oil product

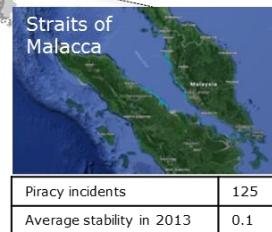
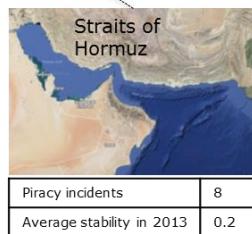
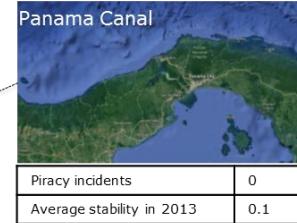
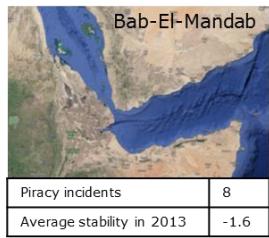
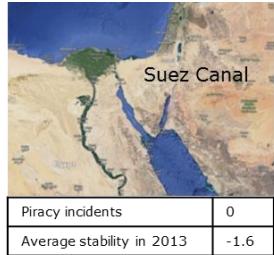


Although crude oil import among APEC members is low (~30%) because of limited resources, oil product import reached more than 50%

Sources: UN Comtrade and APERC analysis.

Chokepoints Risks

Chokepoint risk derived from surrounding economies stability and piracy incidents



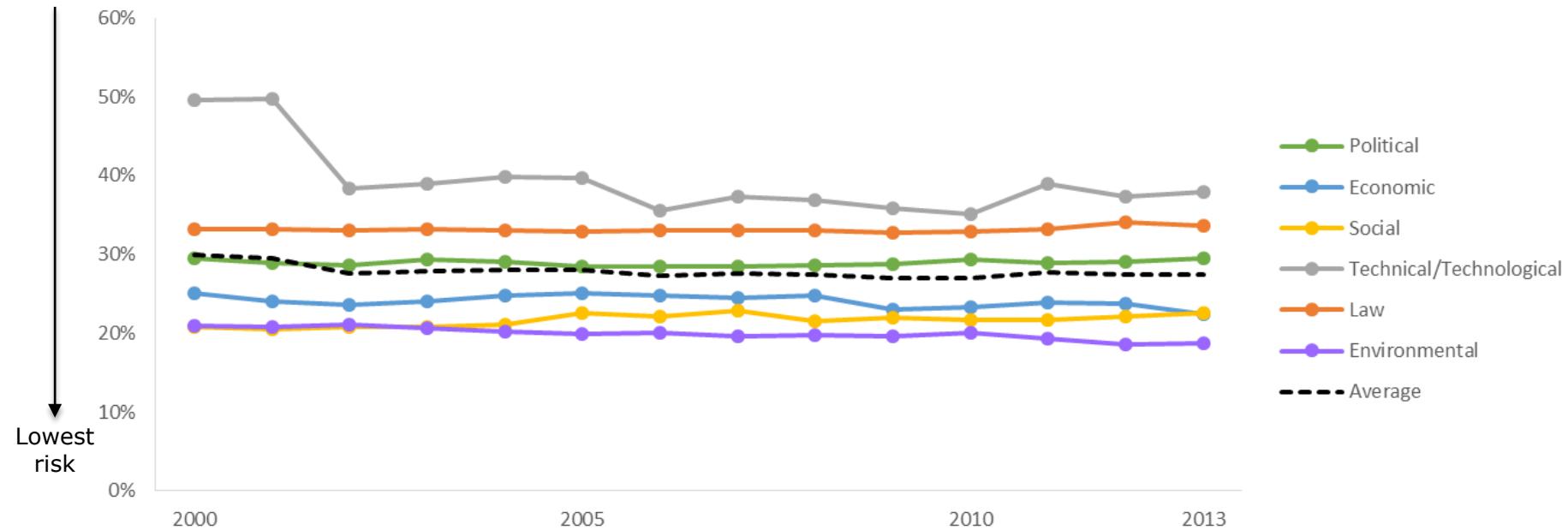
In 2013, two-third of crude oil and one-third of LNG imports to APEC members passed through at least one of these chokepoints

Sources: World Bank, ICC-IMB and APERC analysis.

Note: WGI consist of six sub-indices. The Study adopted the WGI's "Political Stability and Absence of Violence/Terrorism indicator" published by the World Bank in order to establish the local stability indicator. ICC-IMB recorded incidents that occurred in economy and international waters. The study assume that there is no chokepoint risk for intra-APEC oil and LNG trade.

Oil supply security index

PESTLE analysis on oil supply security



The average of APEC's oil security index improved because of new oil reserves in Canada. However, social indicator is expected to increase as oil consumption in developing APEC members will continue to grow.

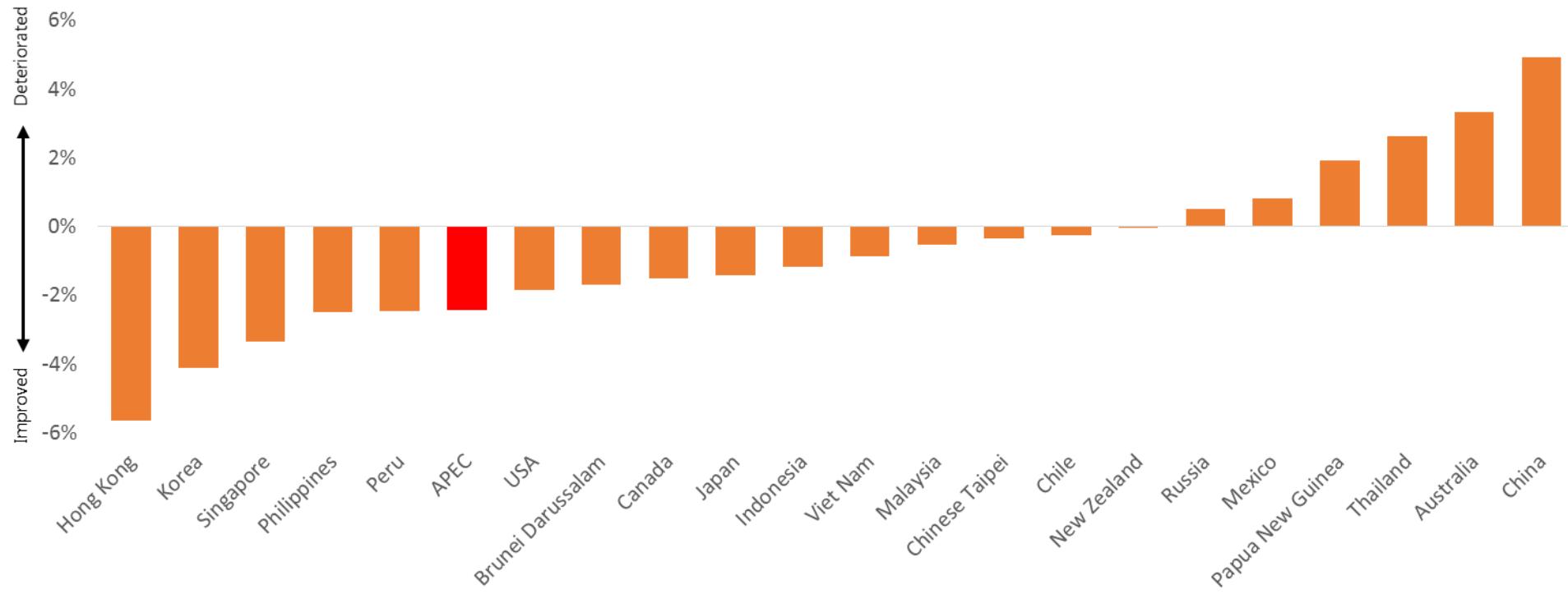
Source: APERC analysis

Note:

- In the oil security index (1.0% to 100.0%), a lower index means less vulnerability to any gas supply disruption/crisis. A security index of 20% and below is considered low exposure to supply disruption, 21%-40% is moderate-low exposure, 41%-60% mid-exposure, 61%-80% moderate-high exposure, and 81% and above is high exposure.
- Oil includes crude and product

Depleting reserves and increase in oil consumption pushed the index higher for some economies..

Changes in average of oil security index, 2000-13



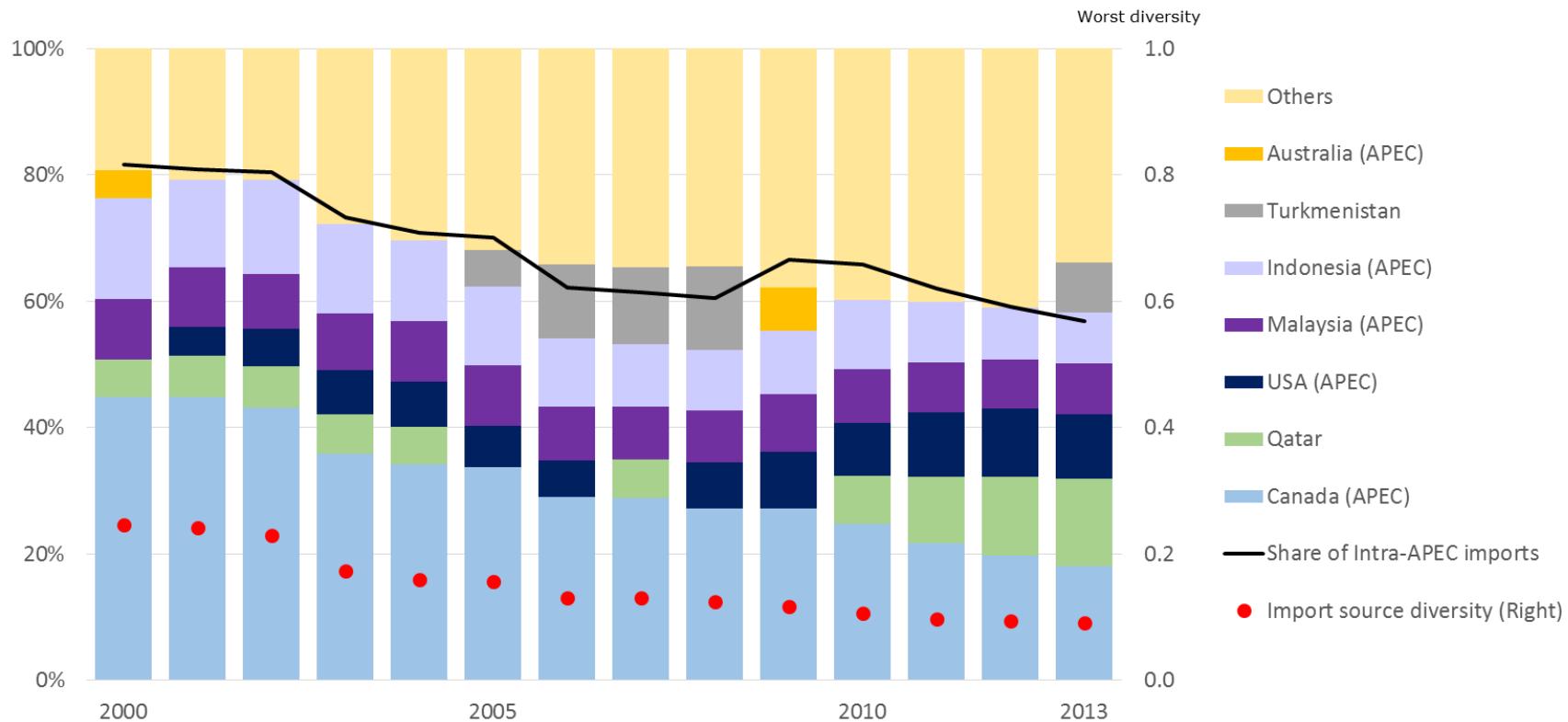
Most APEC members showed improvements because of lower oil consumption, improvement in oil reserves, lower risk from import sources and highly stable domestic situation

Source: APERC analysis

Note: Oil includes crude and product

Most of gas import came from APEC members

Gas import source of APEC



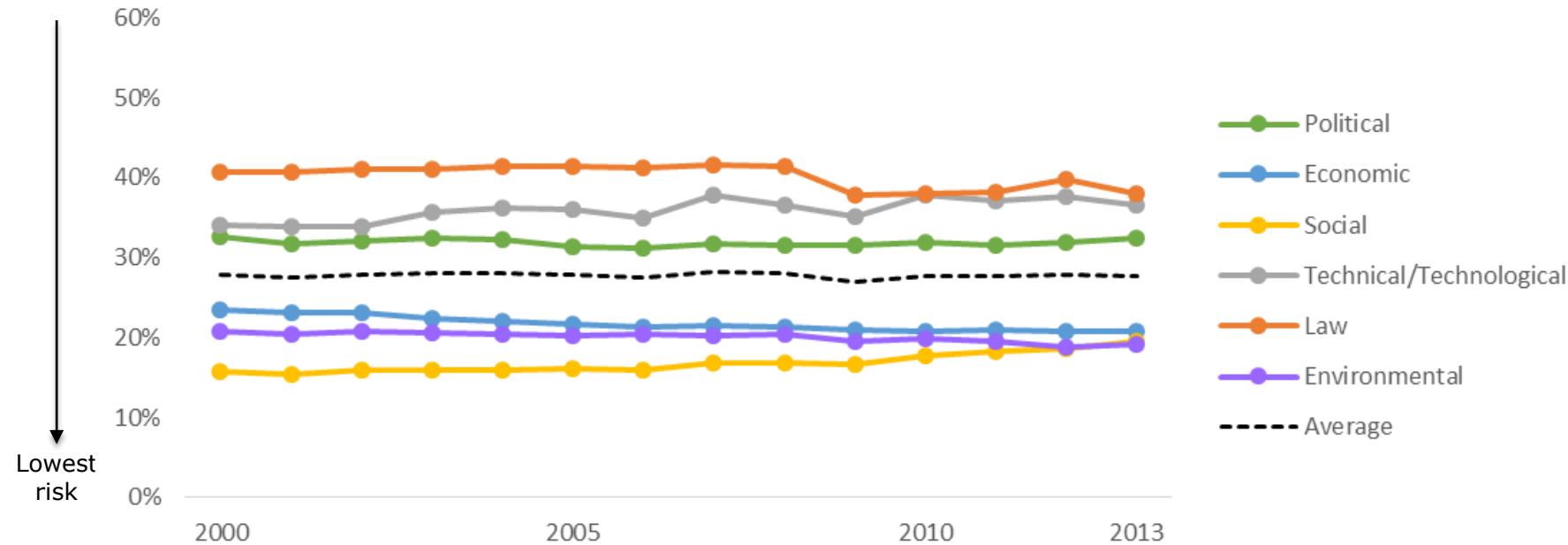
Share of intra-APEC imports reduced as importers trying to diversify their source (and subsequently the risk)

Source: Cedigaz and APERC analysis

Note: Gas import source covers pipelines and LNG

Gas supply security index

PESTLE analysis on gas supply security



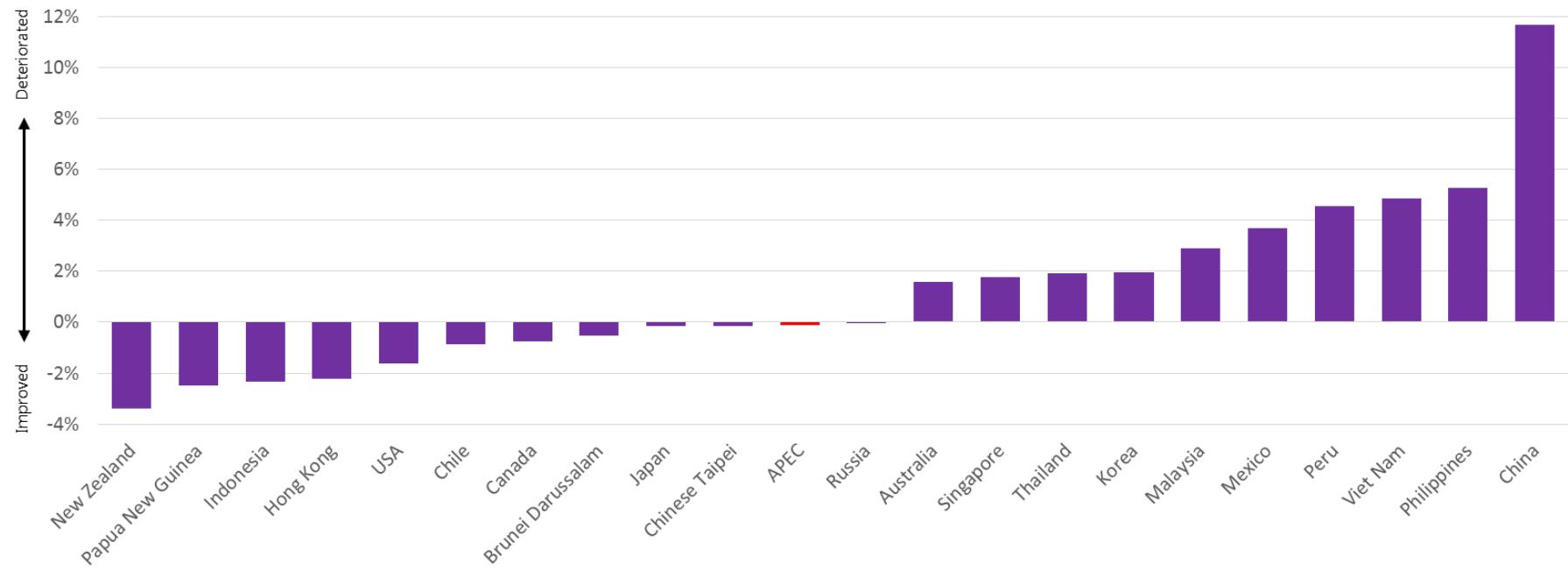
Law indicator provides the highest risk followed by technical /technology indicator. There are 14 APEC members does not have regional gas emergency agreement. Gas consumption per capita continue to increase in developing and gas producing economies.

Source: APERC analysis

Note: In the gas security index (1.0% to 100.0%), a lower index means less vulnerability to any gas supply disruption/crisis. A security index of 20% and below is considered low exposure to supply disruption, 21%-40% is moderate-low exposure, 41%-60% mid-exposure, 61%-80% moderate-high exposure, and 81% and above is high exposure.

Unconventional gas managed to improve gas security in North America..

Changes in average gas security index, 2000-13

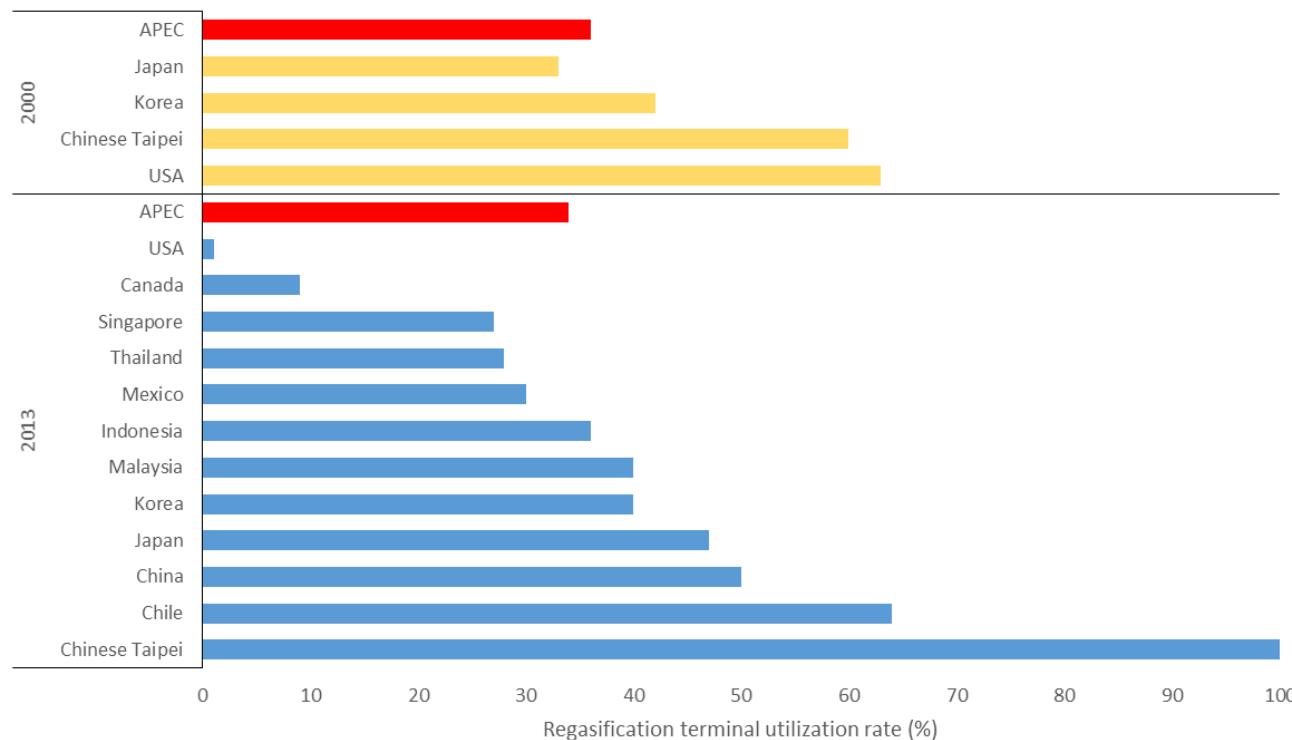


Nearly half of APEC members gas security index deteriorated because of the increase in gas consumption, higher dependency on imports and lack of infrastructure to meet demand

Source: APERC analysis

APEC LNG import increased by more than double

Annual regasification terminal utilization rate, 2000 and 2013



More than half of APEC members owned RGT in 2013, up from only 4 economies in 2000. This trend will continue in the future with new RGT expected in the Philippines and Viet Nam soon

Source: Cedigaz and APERC analysis

A regional agreement for emergency supply will help to improve supply security

International/regional emergency supply agreement

**International Energy Agency-
International Energy Program
(for oil emergency)**

Australia
Canada
Japan
Korea
New Zealand
USA

**ASEAN Petroleum Security
Agreement (APSA)
(for oil and gas emergency)**

Brunei Darussalam
Indonesia
Malaysia
Philippines
Singapore
Thailand
Viet Nam

**APEC members without
regional agreement**

Chile*
China
Hong Kong, China
Mexico*
Papua New Guinea
Peru
Russia
Chinese Taipei

A region-wide agreement will be able to lower risk of supply of disruption by 2 percentage point for oil and 3.5 percentage for gas

Source: IEA, ASCEAN and APERC analysis

Note: Chile and Mexico are currently candidate economies for IEA membership

Conclusions and policy implications

- APEC economies should try to expand intra-APEC energy trade as APEC members are politically stable
- Oil had a higher supply disruption risk than gas in 2013 because of lack of oil reserves in some APEC members with high oil share in their primary energy supply mix
- APEC could consider formulating a strategy for possible joint stockpiling among and between member economies, which could improve the region's overall risk on supply disruptions
- Reducing oil demand or oil intensity will help improve supply security, as demonstrated by some of the APEC economies (such as New Zealand)
- APEC may consider developing its own oil and gas security framework agreement covering supply sharing in the event of domestic or regional supply emergencies.



Thank you for your kind attention

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