

5<sup>th</sup> Oil and Gas Security Network Forum  
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# Emerging energy security risks in changing global energy landscape (OGSS)

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# Outline

1. Update of traditional energy security risk for oil and gas
2. Emerging risks
3. Risk analysis
4. Policy implications

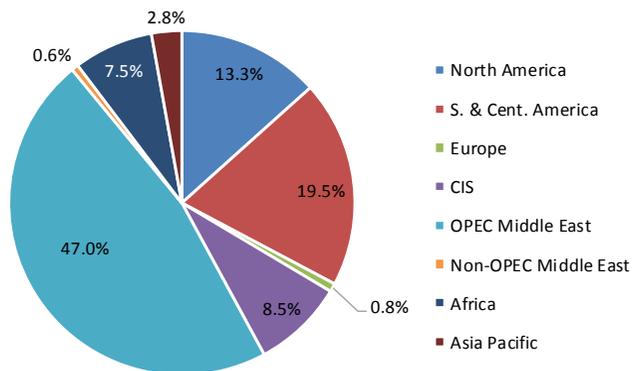
Risk	
<b>Traditional</b>	1-1. Geopolitical risk in the Middle East
	1-2. Honeymoon between OPEC and Russia
	1-3. Under investment and supply crunch risk due to oil price volatility
	1-4. Trade risk
	1-5. Potential risks in the LNG market
<b>Emerging</b>	2-1. Mismatch during transition period from conventional to new energy system
	2-2. Side-effect of increasing renewables in power supply
	2-3. Fixed cost recovery and under investment in liberalized electricity market
	2-4. Rising cyber threats in energy sector
	2-5. Effect of natural disaster by climate change on energy supply chain
	2-6. Uncertainty of the energy policy

# 1. Update of traditional energy security risk for oil and gas (1/5)

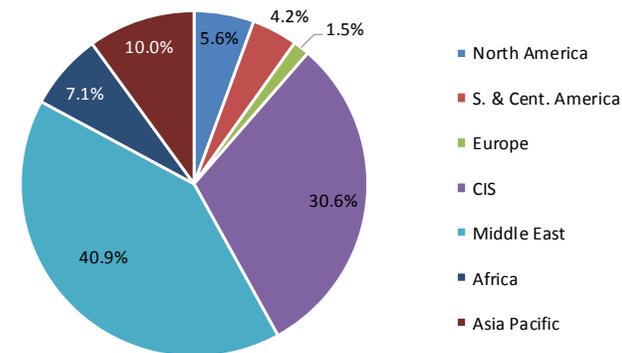
## 1-1 Geopolitical risk in the Middle East

- The uneven distribution of fossil fuel resources
- Traditional conflicts and rivalries (Arab-Israeli wars, Iranian revolution, Iran-Iraq war, Iraq's invasion of Kuwait, collapse of Saddam Hussein regime and the rise of extremist groups)
- The changing of the guard in the Middle East
  - US foreign policy for the Middle East
  - The active involvement of Russia and other economies in the Middle East

### The uneven distribution of crude oil reserves



### The uneven distribution of natural gas reserves



# 1. Update of traditional energy security risk for oil and gas (2/5)

## 1-2 Honeymoon between OPEC and Russia

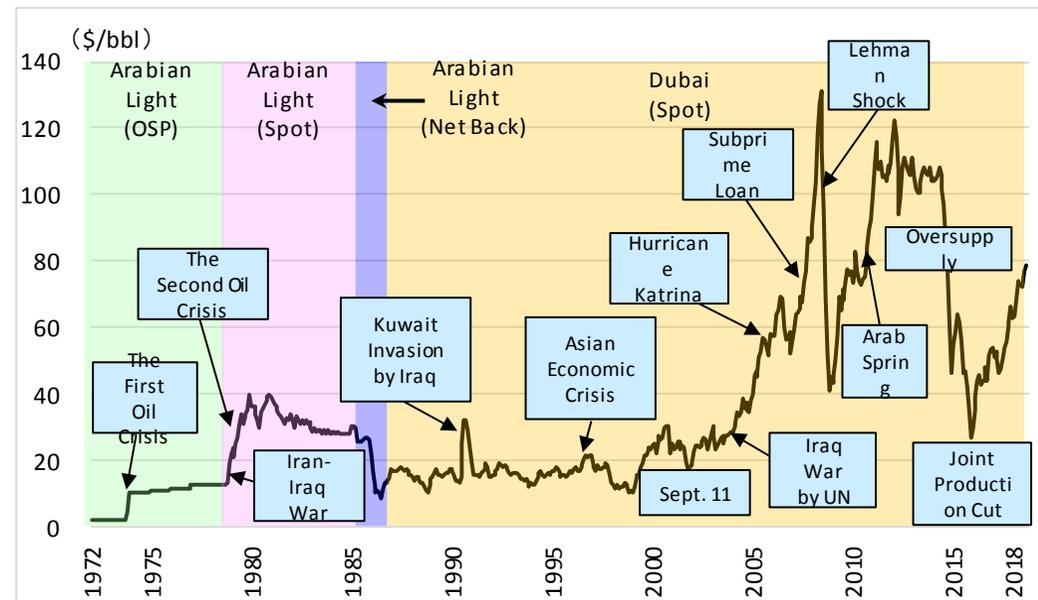
- History of production adjustment
- Joint production cut between OPEC and non-OPEC producers
  - December 2001 agreement
  - December 2016
- How long will the joint production cut between OPEC and Russia last?

# 1. Update of traditional energy security risk for oil and gas (3/5)

## 1-3 Under investment and supply crunch risk due to fluctuating oil price

- Oil price volatility
- Impact of oil price volatility
  - OPEC's concerns for underinvestment
  - IEA reported upstream investment collapse due to low oil prices
- Impact of underinvestment in oil and gas upstream
  - Potential supply crunch due to rising demand in the future
  - Both investment and management are needed to sustain upstream development

**Oil price trend, 1972-2018**



# 1. Update of traditional energy security risk for oil and gas (4/5)

## 1-4 Trade risks caused by choke points

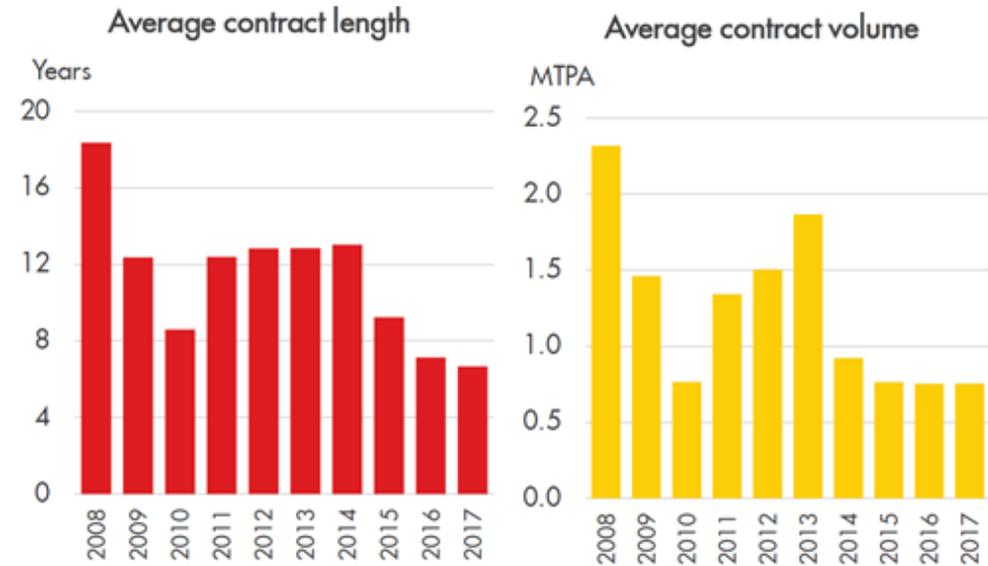
- The importance of choke points to oil trade
- Potential risks and threats to choke points
  - War
  - Piracy
- New choke points emerged as US exports surge
  - US oil production and exports increase significantly
  - Prospects for the change in global crude oil trade
  - Impact of changes in trade routes on maritime trade risk

# 1. Update of traditional energy security risk for oil and gas (5/5)

## 1-5 Potential risks in the LNG market

- LNG market development
  - Historical LNG market (1960s to 2000)
  - The growing LNG market (after mid 2000s)
  - Prospect of LNG market expansion
- Risks associated with expanding LNG market
  - The uncertain LNG market
  - The change in LNG contract types
  - Market barriers

### LNG trading volume, 2008-17

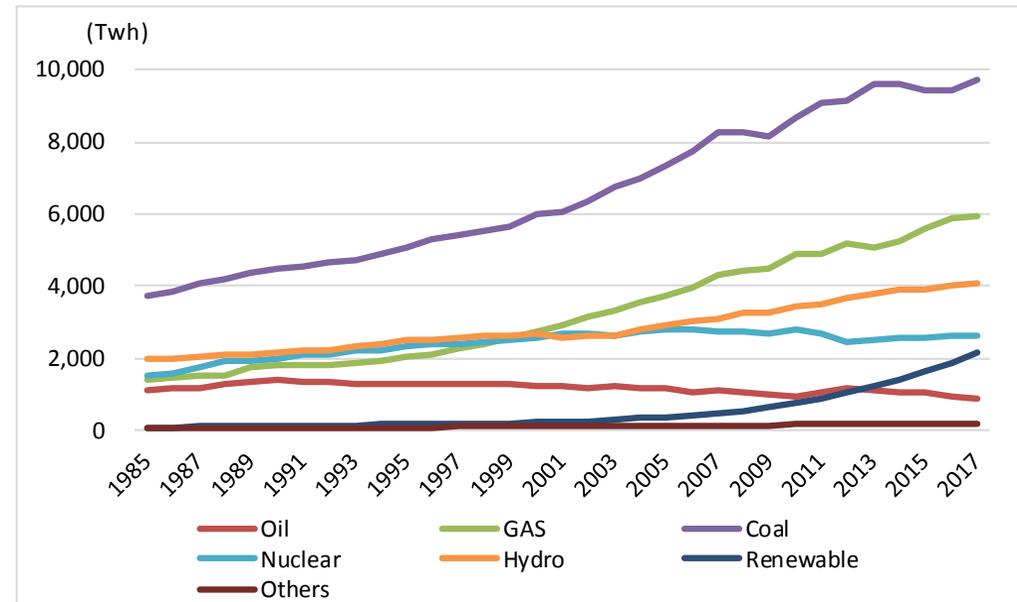


## 2. Emerging energy security risks in power supply market (1/6)

### 2-1 Mismatch during transition period between conventional energy and new energy

- Rapidly growing renewable energy
- Uncertainty in security on shifting to new energy
  - Impact on the development of existing energy sources
  - Impact on energy costs
  - Mass disruption of specific power sources due to aging of power plants
  - Risk of sudden power source conversion

**Electricity generation by fuel, 1985-2017**

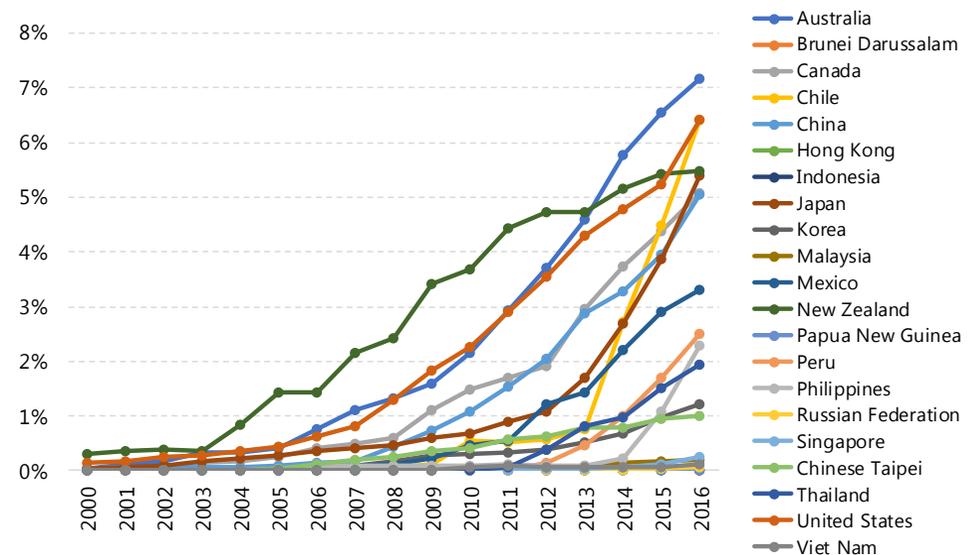


## 2. Emerging energy security risks in power supply market (2/6)

### 2-2 Effect of renewable electricity increase on electricity supply security

- New challenges arising from the introduction of renewable energy
  - Impact on power system operation
  - Characteristic phenomenon: Duck Curve
- Recent renewable energy developments in APEC
- Impact of VRE deployment in the APEC region
  - Status of APEC economies

### VRE share in power generation in APEC economies, 2000-16



## 2. Emerging energy security risks in power supply market (3/6)

### 2-3 Fixed cost recovery and under investment in liberalized electricity market

- Challenges for conventional thermal power plants
  - Decline in capacity factor of conventional thermal power plants
  - Decline in wholesale electricity price
- Capacity mechanisms in specific APEC economies
  - Canada
  - Japan

## 2. Emerging energy security risks in power supply market (4/6)

### 2-4 Rising cyber threats in energy sector

- What is cyber risk?
- Background of rising cyber risks
  - the ongoing digitization of energy sector raises its cyber vulnerability
  - the continuous evolution and sophistication of cyber-attacks present a highly dynamic threat
  - the deepening interconnection between energy sector and society and the potential cross-over between a cyber-attack and a physical event
- Cyber threats examples
- Impacts of cyber risks in energy sector (market disruption, physical infrastructure damage, national security, human harm, network effects, financial loss)

## 2. Emerging energy security risks in power supply market (5/6)

### 2-5 Impact of natural disasters on the energy supply-chain

- Natural disasters that threaten the lives of human beings
  - Disasters occur when hazards meet vulnerability
  - Classifications of natural hazards
- Security of energy supply and natural disasters
  - Hurricanes in the US
  - Forest fires in the US
  - Hydroelectric power generation during a drought in Brazil
  - Coal during torrential rains and flood in Australia
  - Energy supply-chain loss due to earthquake and tsunami in Japan
- Recognition of risks among power and public utility operators

## 2. Emerging energy security risks in power supply market (6/6)

### 2-6 Uncertainty of energy policies

- Review of energy policies through change in governing party
  - Australia, US
- Changes to the situation from the point when the policy is announced
  - Germany's nuclear power policy
- Opposing views among the citizens toward ongoing projects
  - Chinese Taipei's nuclear policy
  - Korea's nuclear power policy
  - Indonesia's construction of coal-fired power plant
  - Pipeline construction in the US

# 3. Risk analysis (1/3)

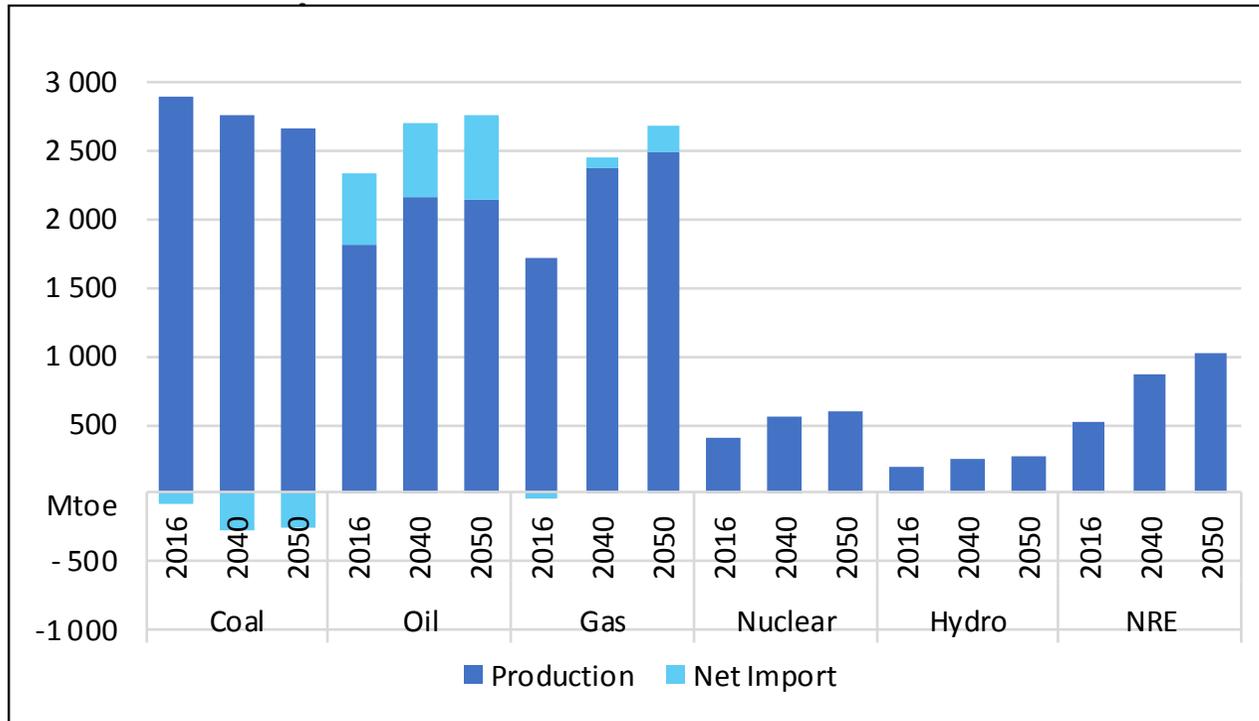
## 3-1 The characteristics of risks related to oil, natural gas/LNG and electricity

	Oil	Gas/LNG	Electricity
Substitution of supply	Middle	Low	High
Substitution of end use demand	Middle	High	Low
Geographical impact	Wide	Middle	Narrow
Risk exposure level	Decrease	Middle	Increase

# 3. Risk analysis (/6)

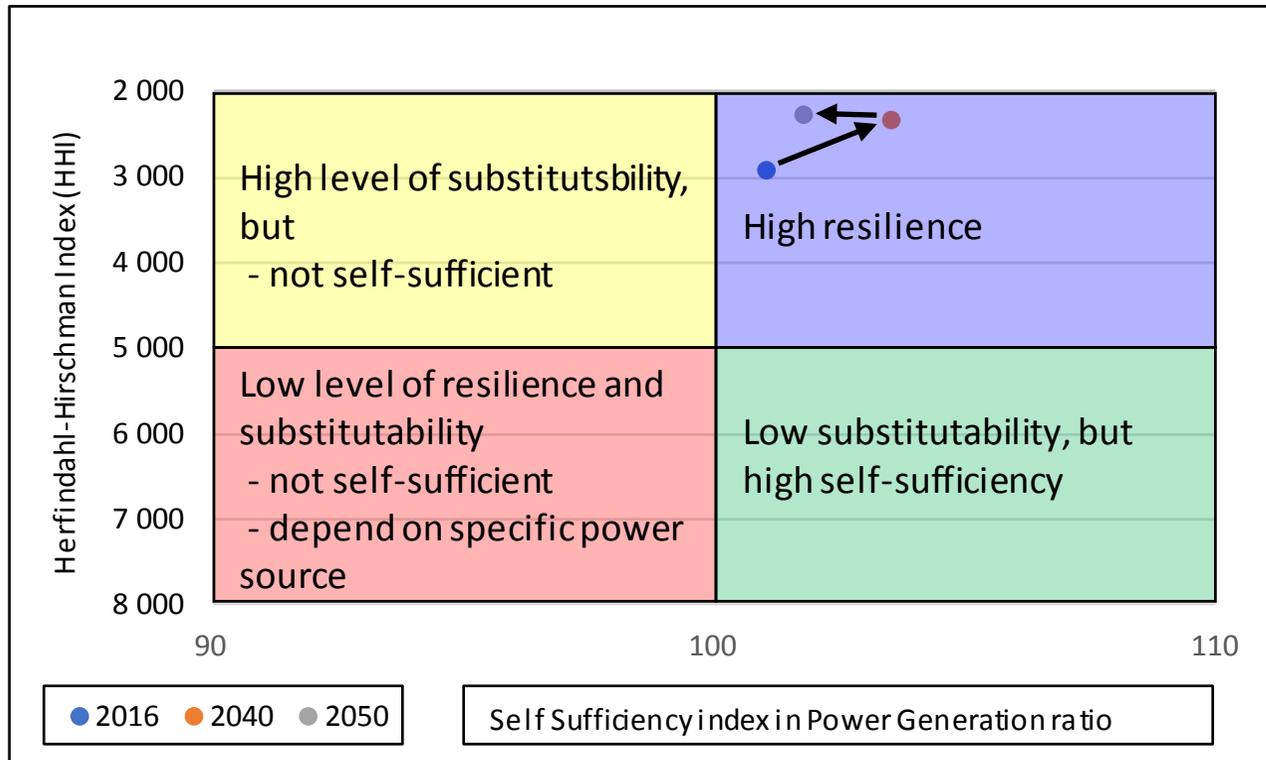
## 3-2 Risk exposure levels

**APEC's overall energy production and net**



# 3. Risk analysis (3/3)

## APEC's overall resilience for power supply disruption



## 4. Policy implications – comparison between traditional and emerging risks(1/2)

	Risk	Reason/cause	Effect	Likelihood	Impact
Traditional	Geopolitical risk in the Middle East	Traditional conflicts	Supply disruption	Frequent	Supply shortage, High price
	Honeymoon between OPEC and Russia	Change of market condition	Market control	Occasional or Remote	High price
	Under investment and supply crunch risk due to oil price volatility	Low predictability of market	Supply shortage	Probable	High price, Shift to other energies
	Trade risk	Geopolitical conflicts	Cost rise Unable to transport	Frequent	High price Supply disruption
	Potential risks in the LNG market	Rigid trade practice	Low liquidity of transaction	Probable	Supply-demand gap, Growth inhibition
Emerging	Mismatch during transition period from conventional to new energy system	Increase of renewable energy	Low profitability of fossil power plants	Occasional	Low reserve margin, blackout
	Side-effect of increasing renewables in power supply	Uncontrollable power output	Complicated grid operation	Frequent	Low-quality electricity, blackout
	Fixed cost recovery and under investment in liberalized electricity market	Decline of capacity factor and wholesale electricity price	Low profitability of fossil power plants and no new investments	Frequent	Weakened security of supply
	Rising cyber threats in energy sector	Act of terrorism	Collapse of energy production and supply activities	Probable	Supply shortage, High price
	Effect of natural disaster by climate change on energy supply chain	Natural hazard	Shredding of supply chain	Frequent	Crisis of life Discontinue of business operation
	Uncertainty of the energy policy	Regime change, public opinion	Stagnation of infrastructure construction	Probable	Supply shortage, High price, Blackout

## 4. Policy implications – recommendations for the identified risks (2/2)

Risk		Recommendations
Traditional	1. Geopolitical risk in the Middle East	As demand for fossil fuel continues to rise, energy security policy towards fossil fuel is still important.
	2. Honeymoon between OPEC and Russia	
	3. Under investment and supply crunch risk due to oil price volatility	
	4. Trade risk	
	5. Potential risks in the LNG market	Create a more transparent and liquid LNG market, as well as emergency response mechanism
Emerging	1. Mismatch during transition period from conventional to new energy system	Positive and clear investment signals are required
	2. Side-effect of increasing renewables in power supply	To control of renewable electricity and to promote R&D of necessary technologies.
	3. Fixed cost recovery and under investment in liberalized electricity market	To introduce new electricity market design such like capacity mechanism
	4. Rising cyber threats in energy sector	To develop cyber security program for energy system.
	5. Effect of natural disaster by climate change on energy supply chain	To develop climate adaption program
	6. Uncertainty of the energy policy	To build policy on scientific evidence and to involve stakeholders in policy making process.



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