



# U.S. shale revolution has changed global energy markets - Where shall we go?

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Jun, 2019

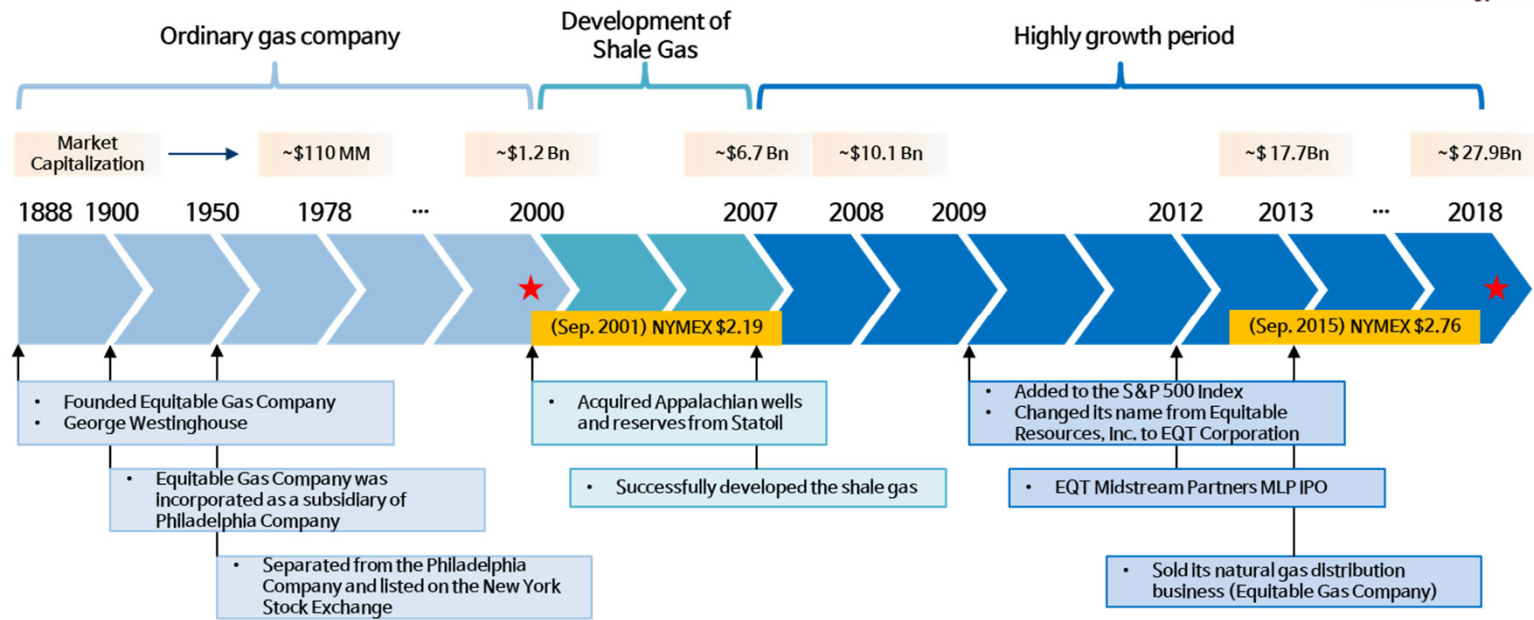
# Introduction - Speaker

## □ Heejun (June) Park & Energy Innovation Partners

- MBA from Carnegie Mellon University
- (2002~2013) EQT corporation (The largest energy company in the Eastern U.S., S&P 500)  
- Final Position: Vice president
- (2013~current) President & CEO of Energy Innovation Partners, Inc. (EIP)

## □ EQT Corporation Overview - What is EQT?

- EQT is leading energy company in the eastern U.S. over 130 years experience.



## What We Have Done - Deal base

Year	Project	Client	Service	Notes
2019.04	Blue Racer Midstream (Gathering Pipeline Midstream Asset)	SK Holdings	Technical and Investment Advisory	Acted as Project Lead
2018.01	Project Compass 1,202MW Starwood (CCGT) Senior Term Loan B	KB Kookmin Bank, KB Asset Management	Technical and Investment Advisory	Sourced the project and acted as Project Lead
2017.10	Eureka Midstream (Gathering Pipeline Midstream Asset)	SK Holdings	Technical and Investment Advisory	Sourced the project and acted as Project Lead
2017.09	Project Gridiron 3,510MW LS Power (Peaker & CCGT) Senior Notes	ABL Life, Lotte Non-life Insurance, Shinhan Life Insurance, MiraeAsset Life Insurance	Technical and Investment Advisory	Sourced the project and acted as Project Lead
2017.06	Project Helix 3,900MW LS Power (Peaker & CCGT, Wind Farm) Senior Term Loan B	KB Kookmin Bank	Technical and Investment Advisory	Sourced the project and acted as Project Lead
2017.04	CIT Secondary Term Loan Transaction: West Deptford Energy Center (WDE) CPV St. Charles (CPV)	CPV: JB Power Fund 7 WDE: JB Power Fund 8 (MiraeAsset Life, Lotte Insurance, etc.)	Technical and Investment Advisory	Sourced the project and acted as Project Lead
2017.02	Project RA: 1,453MW LS Power Peaker Plants Senior Secured Debt Global Syndication	NH Investment & Securities (Hyundai Fire & Marine)	Technical and Investment Advisory	Sourced the project and acted as Project Lead
2016.12	Project DSP: 423MW Dominion Solar Power Plant Senior Debt Global Syndication	JB Renewable Power Fund (Hana Bank, Hana Financial Investment, etc.)	Technical and Investment Advisory	Sourced the project and acted as Project Lead
2016.11	Project Cornerstone: 790MW Marcus Hook Combined Cycle Cogeneration Facility Senior Debt Syndication	KB Power Fund (KB Life, Korea Credit Union, etc.) Kookmin Bank	Technical and Investment Advisory	Sourced the project and acted as Project Lead
2016.05	Project Avalon: 694MW Newark Energy Center Senior Debt Syndication	JB Power Fund (NH Life, NACF, etc.), Kookmin Bank, IBK	Technical and Investment Advisory	Sourced the project and acted as Project Lead
2015.09	Project Half: 350MW Caithness Long Island Combined Cycle Senior Debt Syndication	Hanwha Asset Management, Hana Financial Group, NACF, Lotte Insurance	Technical and Investment Advisory	Sourced the project and acted as Project Lead

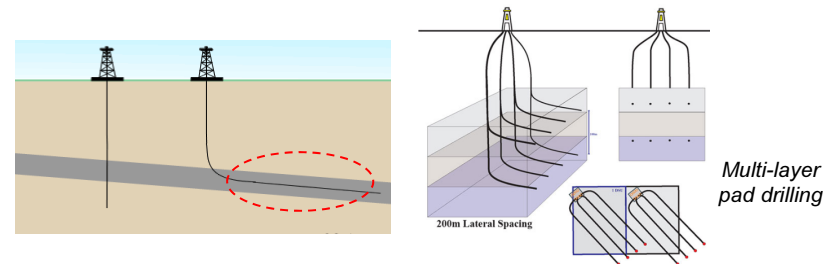
# Shale Gas Revolution is a Technological Revolution

Rapid growth in gas production and total production volume per well due to development in technology

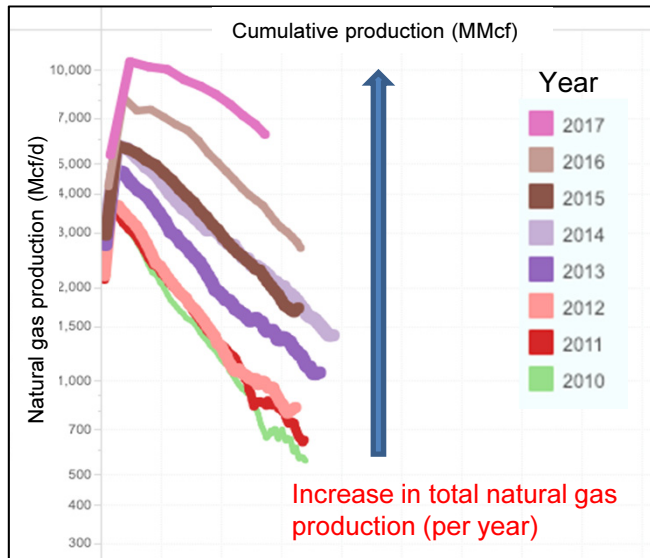
## Development of technology for shale gas production

- ❑ Drilling efficiency: Drilling time per well ↓
- ❑ Horizontal drilling length↑: Production volume per well ↑
- ❑ Improved efficiency of hydraulic fracturing

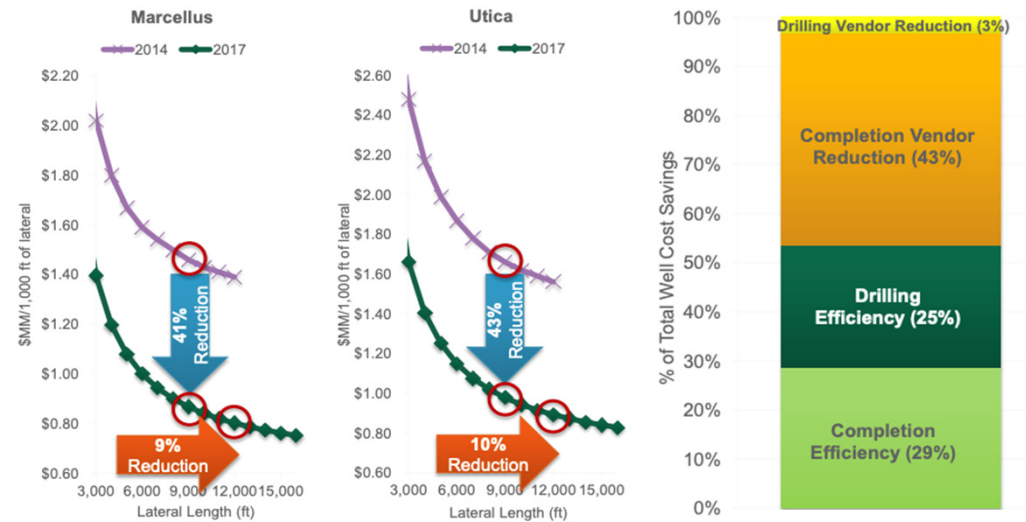
∴ Breakeven Price ↓



<Prospect of natural gas production by region>



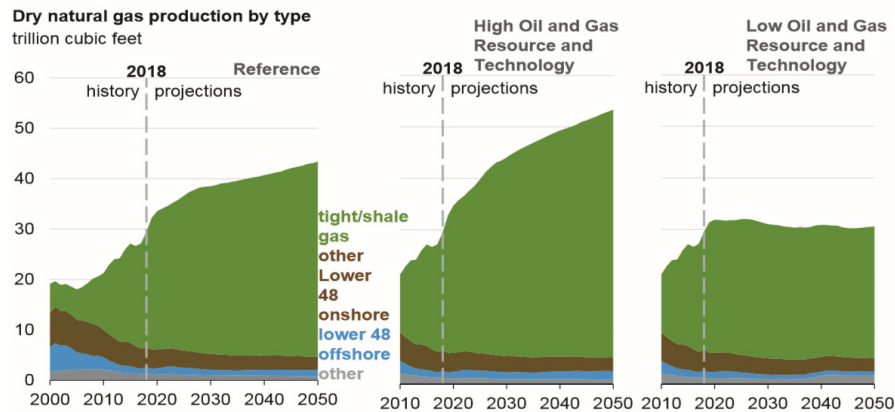
<Drilling cost reduction in Appalachian basin>



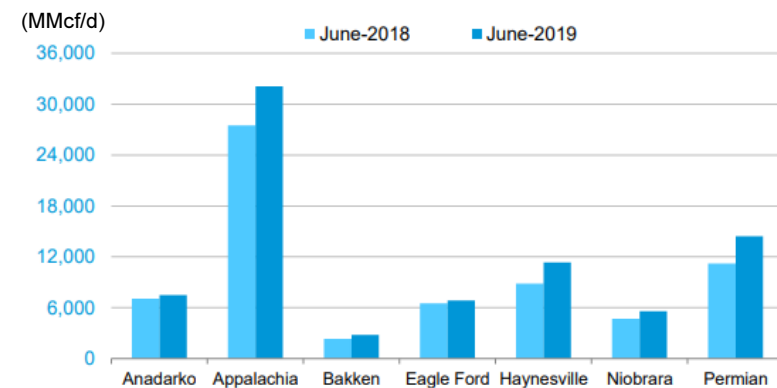
# U.S. Tight / Shale Gas Production - 1<sup>st</sup> Wave of Shale Revolution

Approximately 36% of total natural gas produced in U.S. was in the Appalachian Basin  
(2018 total natural gas production in U.S.: 89 Bcf/d)

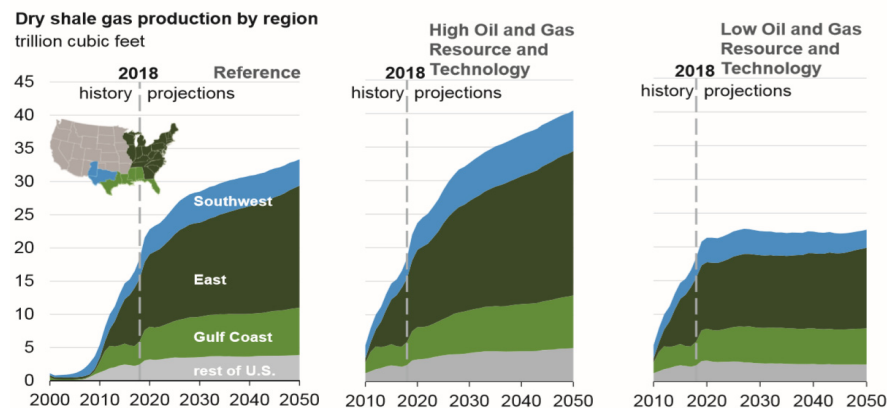
<U.S. natural gas production forecast by resources type>



<U.S. natural gas production by shale basin>



< U.S. natural gas production forecast by region >



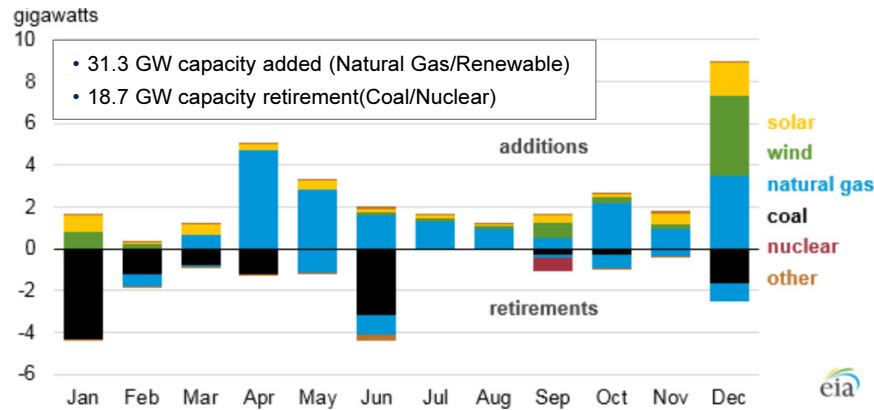
Basin	Natural gas production volume in June 2019(MMcf/d)	Portion of total gas production
Appalachia	32,108	36.1%
Permian	14,410	16.2%
Haynesville	11,358	12.8%
Anadarko	7,516	8.4%
Eagle Ford	6,881	7.7%
Niobrara	5,604	6.3%
Bakken	2,786	3.1%
<b>Total</b>	<b>80,663</b>	<b>90.6%</b>



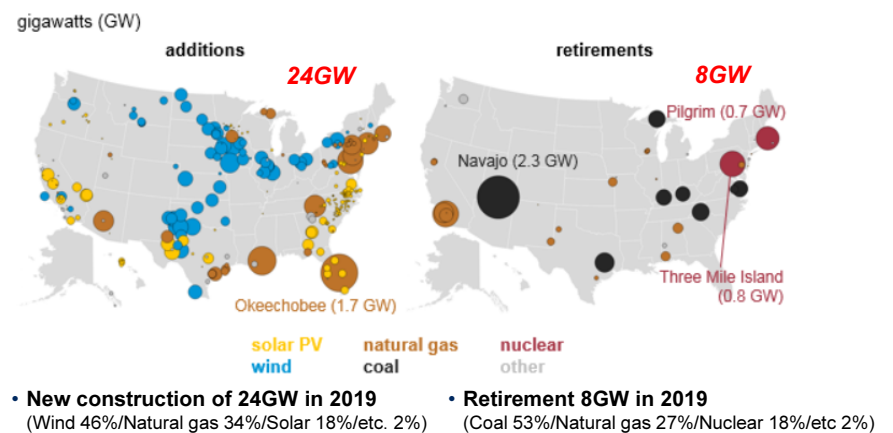
# Conversion of U.S. Power Energy Sources

Conversion of U.S. power sources from coal & nuclear power plants to natural gas & renewable energy  
 (~ 434GW of natural gas/renewable power plants will be built by 2050)

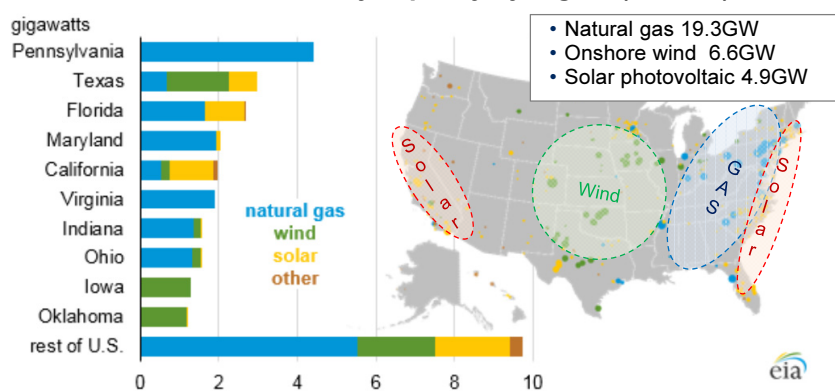
<U.S. electric capacity additions & retirements (2018)>



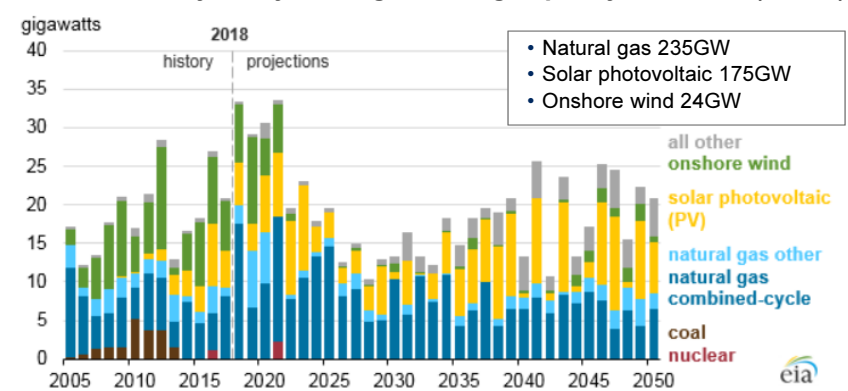
< U.S. electric capacity additions & retirements (2019)>



<Additional electricity capacity by region (FY2018)>



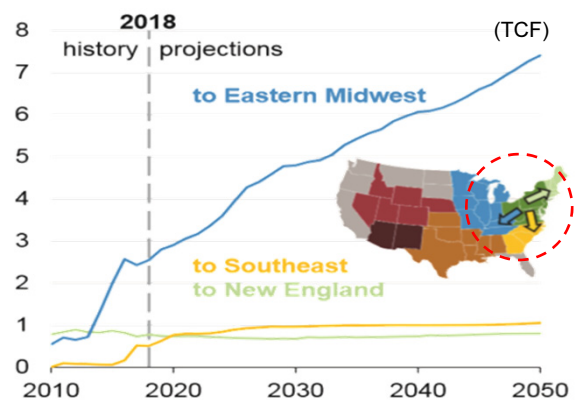
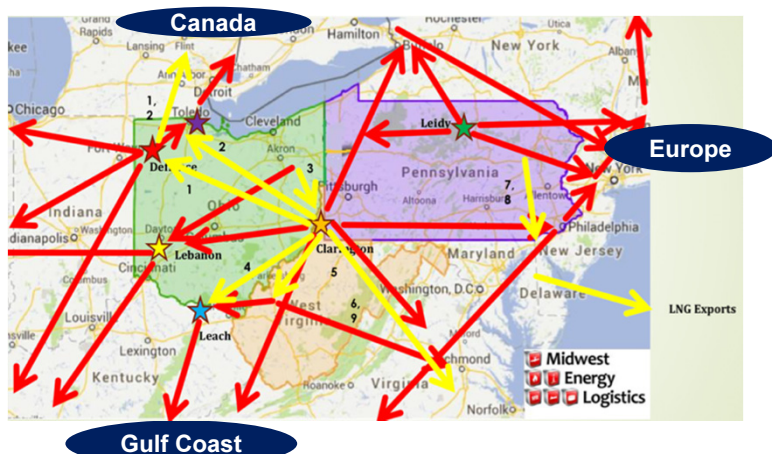
<Annual electricity utility-scale generating capacity additions (~2050)>



# Expansion of natural gas takeaway capacity

Construction of a number of interstate pipeline for natural gas transport  
(Midstream industry investment ↑)

## Natural gas transport volume and flow



## Status of interstate pipeline in Appalachian

- ❑ 8 Operational pipeline in Appalachian Basin (12Bcf/d)
- ❑ Under construction or permits approved pipeline (8Bcf/d)
- ❑ Awaiting regulatory approval (1Bcf/d)

### <Pipelines in Operation in Appalachian Basin>

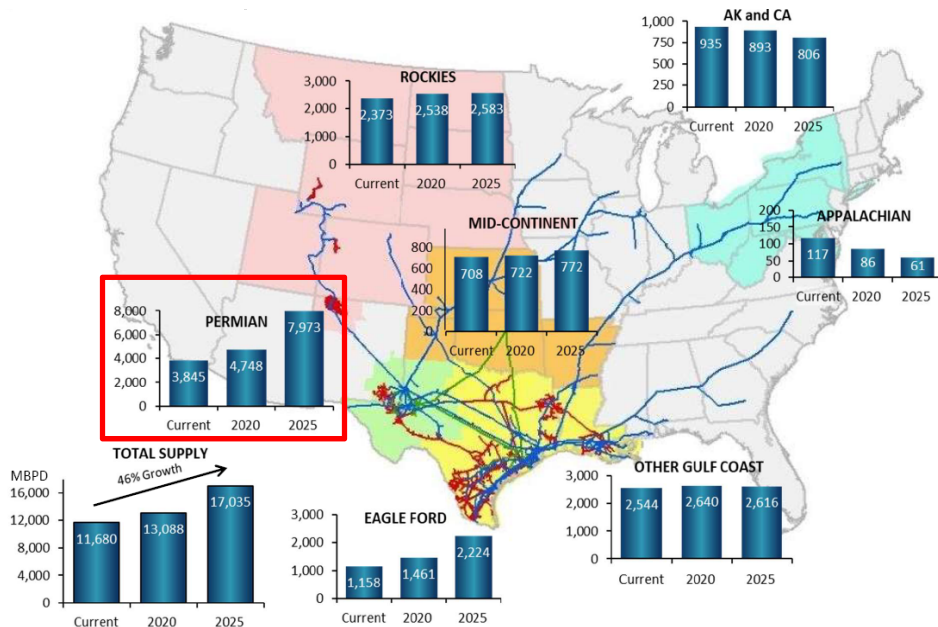
Pipeline company	Project	State	Investment (Millions)	Miles	MMcf/d	Status
Williams	Atlantic Sunrise	PA	\$2,100	183	650	Operational
Energy Transfer Partners	Rover	OH, MI	\$4,200	713	3,250	Operational
TransCanada	Leach Xpress	OH	\$1,600	160	1,500	Operational
Enbridge	NEXUS Gas Transmission Project	MI, OH	\$1,500	255.9	1,500	Operational
Tennessee Gas	Orion	PA	\$109	13	135	Operational
<b>Total Operational – 5 pipelines</b>			<b>\$9,509</b>	<b>1324.9</b>	<b>7,035</b>	
TC Energy (TransCanada)	Mountaineer Xpress	WV	\$2,000	170.1	2,700	Partially Operational
Enbridge	Texas Eastern Appalachian Lease Project (TEAL)	OH	\$183	4.7	950.2	Partially Operational
TC Energy (TransCanada)	WB Xpress	VA, WV	\$900	29.2	1,300	Partially Operational
<b>Total Partially Operational – 3 pipelines</b>			<b>\$3,083</b>	<b>204</b>	<b>4,950</b>	

# U.S. Tight/Shale Oil Export Continue to Grow - 2<sup>nd</sup> Wave

U.S. is expected to shift to a net exporter of energy  
 U.S. oil export has led to a major shift in the global oil market

## Prospects of U.S. Oil and Condensate Production

- Crude oil (also condensate) production growth is mostly due to production in Permian basin
  - In 2025, ~ 33% of total crude oil supply by Permian basin



## Construction of U.S. Oil Export Infrastructure

- Jupiter Offshore Loading Terminal (JOLT), a VLCC loading facility confirmed an EPC contractor (Texas 州)
  - 2 pipelines (24 inches) connect to a 10MMBbls storage facility & 1MMBbl/d load to the VLCC (1 VLCC loaded per 48 hours)
- 'Trafigura', Plans for the construction of offshore oil export terminal 15 miles from Corpus Christi
  - 400,000 bbl/d load carrying capacity, 1 VLCC loading every 5 days using single-point mooring buoyancy system
- 'Enterprise', Construction plan of new crude oil export terminal near Freeport and construction of a crude oil export terminal
- 'Tallgrass Energy', Construction plan for Plaquemines Liquids Terminal and Seahorse Pipeline which is linking Cushing – St.Cushing – St.James
  - Seahorse pipeline: 700 miles, 800,000bbl/d
- Louisiana Offshore Oil Port (LOOP) was built as an oil import terminal, but now converted to an oil export terminal



# Increased U.S. Influence in the Asia-Pacific Region(Natural Gas)

Oil exporters Competition: 'U.S. vs. Russia vs. Middle East'  
(U.S. accounts for 75% of global LNG trading growth over the next 5 years)

## Status of natural gas import (China)

- ❑ **China, the largest LNG importing country**
  - No.1 LNG import growth rate
  - In 2030, China will rise to No. 1 LNG importing country
- ❑ **浙江省 能源集团(Zhejiang Provincial Energy Group)**
  - **Exxon Mobil was sign the LNG supply contract for 20 years (1 MMTPA)**
  - Contracted date: 2019. 4. 22.
  - U.S. LNG portion will increase gradually in China
- ❑ **Exxon Mobil signed long-term LNG supply contract with Sinopec(China National Petroleum Company) and CNPC(China Petroleum Natural Gas Company)**

## Status of natural gas import (Korea)

- ❑ **The Korea government is seeking to reduce the LNG importing from the Middle East and increasing proportion of U.S. & Australia**
  - In 2018, Korea's total LNG import is ~2.03 Tcf
  - Qatar(32.4%), Australia(17.9%), U.S.(10.6%), Oman (9.7%), etc.
  - Compare to 2017, Korea's total LNG import increased by 17.3% ('17: ~1.72 Tcf)

	Natural gas imports from U.S.	Detail
KOGAS	0.13 Tcf	Signing a long-term LNG contract with Sabine Pass
SK E&S	0.10 Tcf	Signed a contract for the use of liquefied natural gas services & LNG import contract (LNG will be imported in 2020)
GS EPS	0.03 Tcf	-

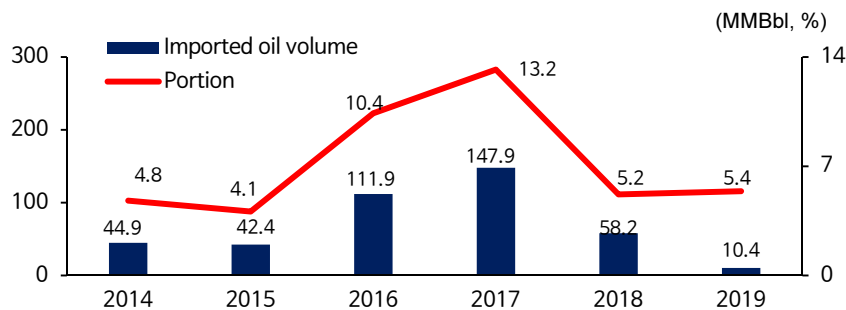
# Increased U.S. influence in the Asia-Pacific Region (Crude Oil)

Global Energy Market is Influenced by U.S. natural gas / crude oil exports  
Setting up the Energy Importing Strategies is crucial

## Prohibition of importing Iranian crude oil

- ❑ U.S. announces full blockade of oil export from Iran
  - After the withdrawal of the Iranian Nuclear Agreement (JCPOA), the United States prohibited Iranian crude oil and petrochemical product trade from 18th Nov. 2018.
- ❑ China and Turkey asked U.S. to reviewing the U.S.'s unilateral decision
- ❑ Korea could not import Iranian crude oil about 58 MMBbl per year  
→ Petrochemical Industry is hard to procure crude oil

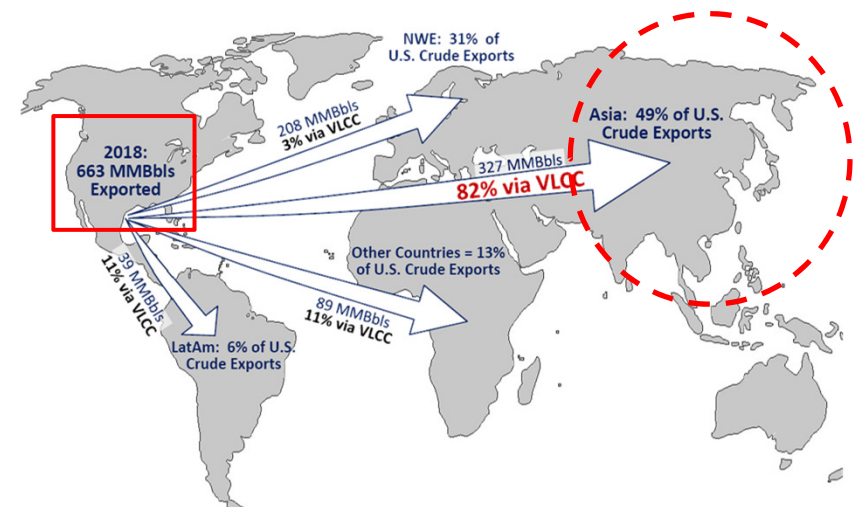
<Importing crude oil by Iran<sup>1)</sup>>



1) 2019 is calculated based on Jan.~Feb.

## Prospect of exporting crude oil by U.S.

- ❑ In 2018, U.S. was exported ~2MMBbl/d (663MMBbls)
- ❑ IEA is expected that U.S. will turned to net oil exporter in 2021
  - U.S. account for 70% of the rise in global oil production over the next 5 years

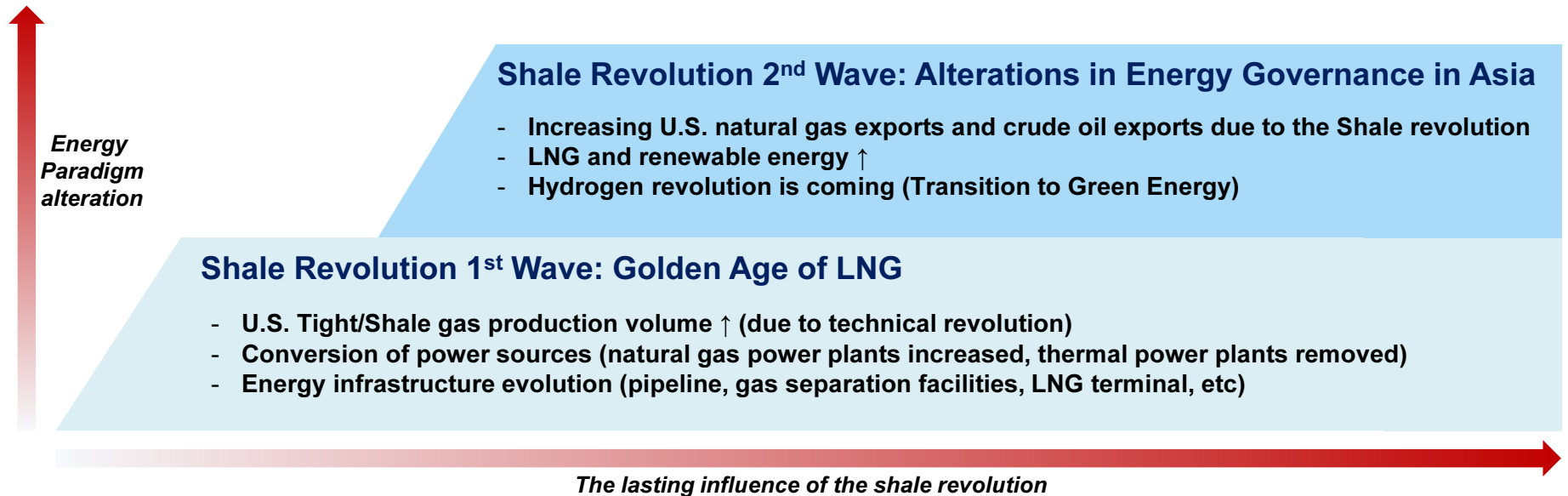


# Transition in Energy Industry

- ① Expansion of natural gas plants and gradual closure of nuclear power plants  
 ② 30~35% target for renewable energy (until 2040) ③ Diversification of crude oil / LNG import channels

## <Overview of the 3<sup>rd</sup> Energy Plan in Korea>

	Korea's Energy Strategy	Global Cooperation Initiative
<b>Sustainable Energy mix</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> <b>Coal, Natural gas, Crude oil, Nuclear etc. Energy Mix</b></li> <li>- Coal: Reduce role as energy source for power generation</li> <li>- Natural gas: Expanded role of energy source (base power generation)</li> <li>- Crude oil: Using as petrochemical raw material</li> <li>- Nuclear: Nuclear power plants are stepped down by extending the life of old nuclear power plants and not constructing new nuclear power plants</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> <b>Diversification of crude oil / LNG imports</b></li> <li>- Continued diversification of crude oil supply lines, construction of commercial storage facilities (Asia oil hub)</li> <li>- U.S. natural gas &amp; crude oil imports (The proportion of U.S. crude oil/gas will increase)</li> <li><input type="checkbox"/> <b>Asia Super Grid</b></li> <li>- Drive the "Korea-Russia" joint research(~2020),</li> <li>- Rail line construction until 2022 (Korea-China)</li> <li><input type="checkbox"/> <b>Cooperation regarding of natural gas</b></li> <li>- Improving rigid contract conditions, Take action together in case of gas supply emergency, expansion of swap transactions</li> </ul>
<b>Increasing supply stability by global cooperation</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> <b>Reconsidering of natural gas import portfolio</b></li> <li><input type="checkbox"/> <b>Diversification of crude oil exporter</b></li> </ul>	
<b>Creating a New Market for Renewable Energy &amp; Hydrogen Industries</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> <b>Demonstration of new service model in smart grid complex</b></li> <li><input type="checkbox"/> <b>Diversification of Hydrogen production methods, Strengthening safety standards</b></li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> <b>Generate secondary markets due to increased share of renewable energy</b></li> </ul>



## Where to go?

- **Secure the natural gas & oil portfolio**
  - Strategic alliance relationship with many countries
  - LNG is IMO's next generation marine fuel due to air pollution regulation (LNG carrier/bunker market is growing faster)
- **Strategic position is needed to project opportunities**
  - Creating a new energy system with energy cooperation



Q & A





# Appendix: LNG Industry in China

Increased needs for LNG ships and related facilities due to increased LNG demand

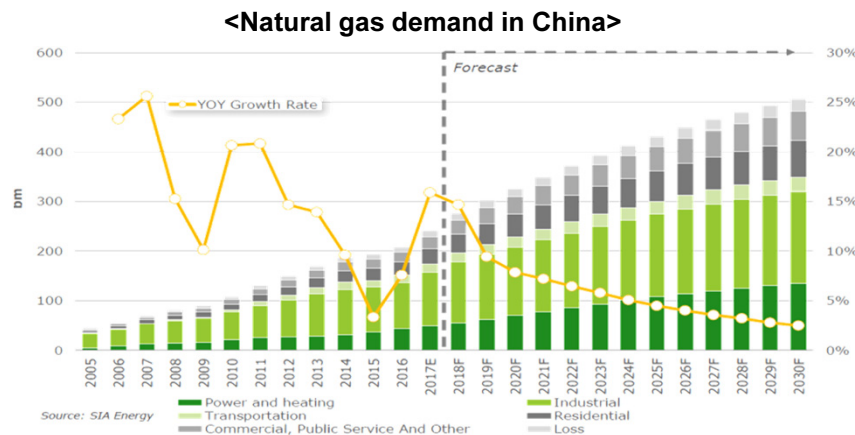
## Status of Chinese LNG Industry

### Multiple LNG-related infrastructure investment opportunities

- In 2030, China's gas demand and LNG imports are expected to double
- 10 LNG Import Terminals Authorized
- Facilities related LNG are needed due to increasing LNG import (FSRU, small LNG carriers/ terminals/ STS etc.)

### Plans to build LNG bunkering infrastructure (~2025)

- Providing LNG bunkering service to 10% of ships which are passing through the river



### <LNG Terminal in China>



\* 19 LNG Import terminals (68MMTPA(8.94Bcf/d) in 2018)

- Construction of 6 LNG import terminals

**End of Document**