Thailand's Energy Direction

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30 August 2018

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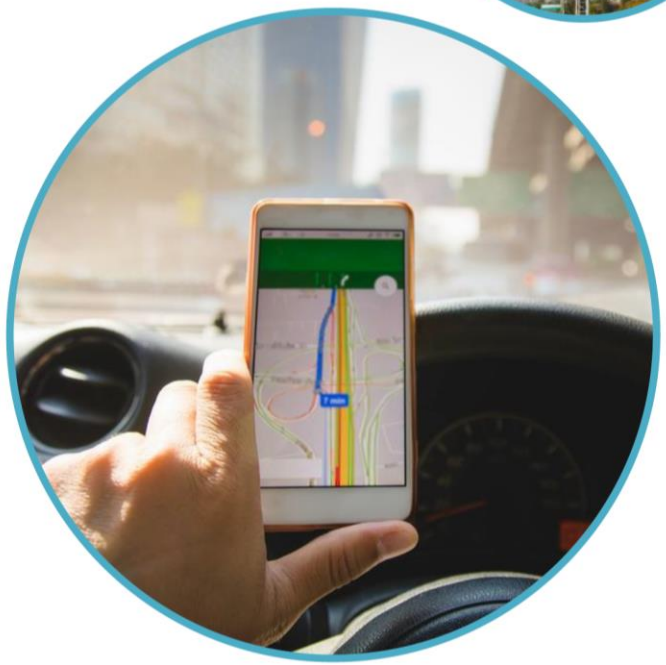
https://www.newshub.co.nz/home/new-zealand/2017/10/auckland-leads-significant-new-zealand-population-growth.html

http://www.un.org/en/development/desa/population/theme/urbanization/index.shtml

noaa.gov/explorations/16arctic/background/climate/climate.html



https://www.iea.org/media/workshops/2017/cop23/presentations/171116IETADigitalization.pdf

1 NO POVERTY

2 ZERO HUNGER

3 GOOD HEALTH AND WELL-BEING

4 QUALITY EDUCATION

5 GENDER EQUALITY

6 CLEAN WATER AND SANITATION

7 AFFORDABLE AND CLEAN ENERGY

8 DECENT WORK AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

10 REDUCED INEQUALITIES

11 SUSTAINABLE CITIES AND COMMUNITIES

THE GLOBAL GOALS

For Sustainable Development

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

15 LIFE ON LAND

16 PEACE AND JUSTICE STRONG INSTITUTIONS

17 PARTNERSHIPS FOR THE GOALS

1 NO POVERTY

2 ZERO HUNGER

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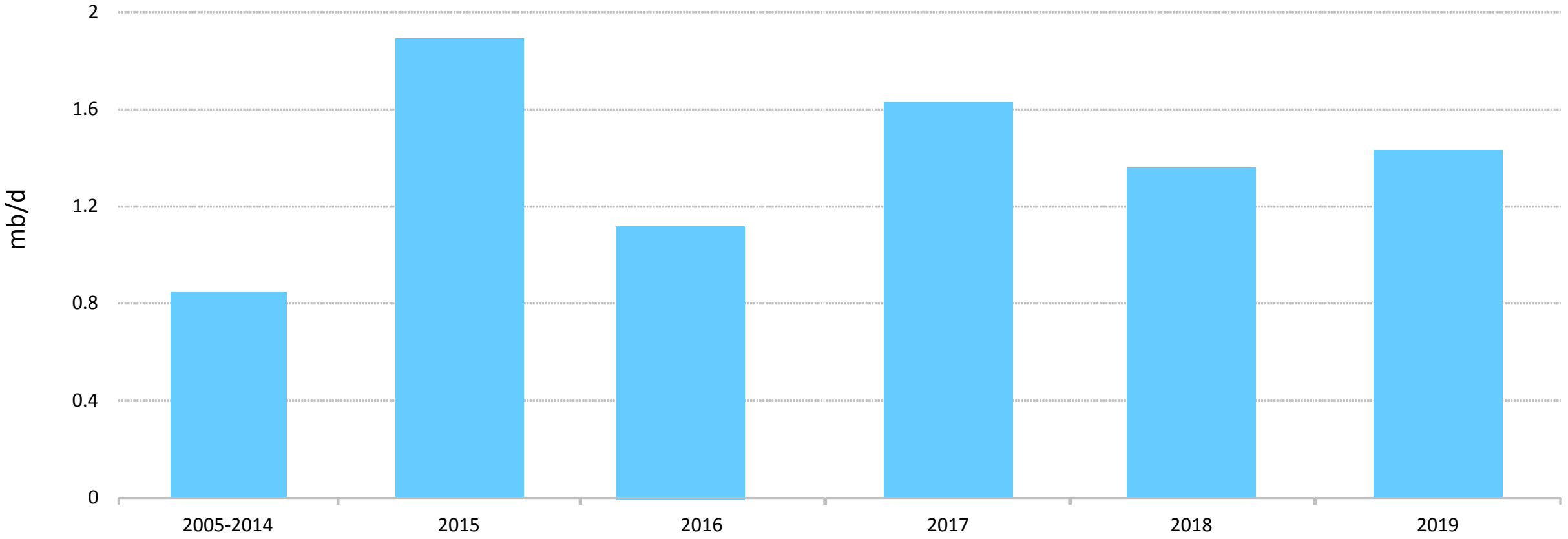
7 AFFORDABLE AND CLEAN ENERGY

World Energy Situation

Global oil demand remains robust

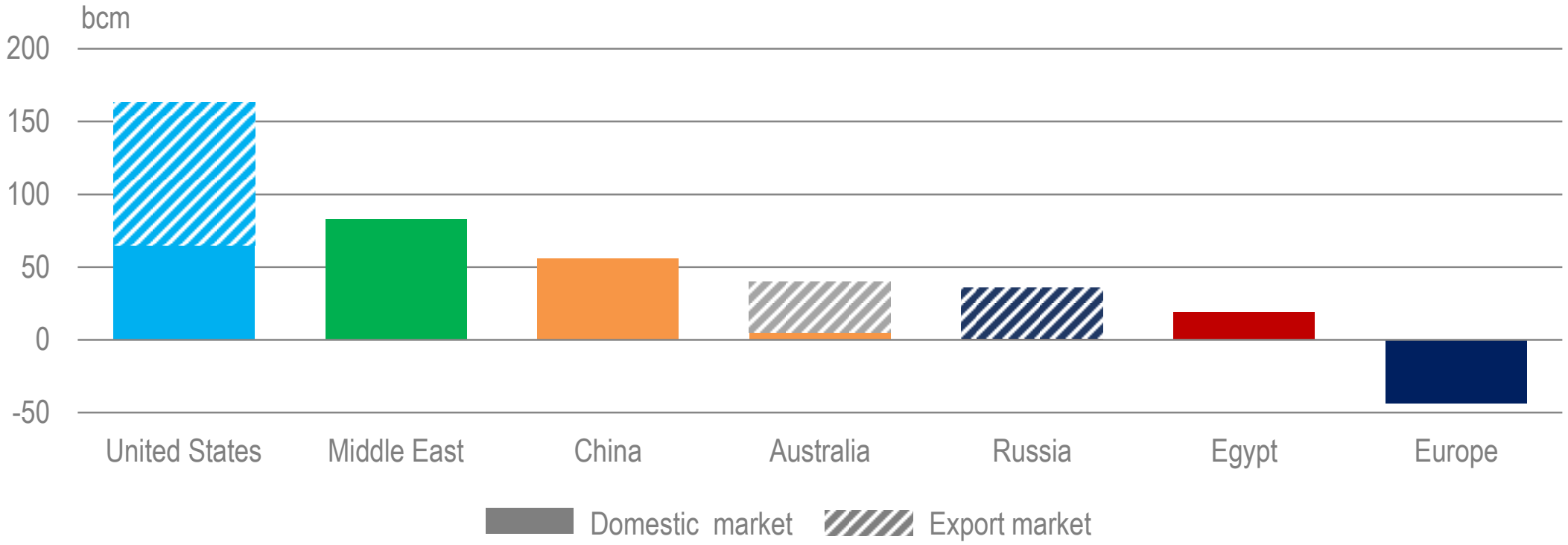


Global oil demand is set to rise by 1.4 mb/d in 2019, with Southeast Asia, China and India making up 60% of the increase; Southeast Asia is becoming increasingly dependent on oil imports, making energy security a pressing concern

Source: International Energy Agency (IEA)

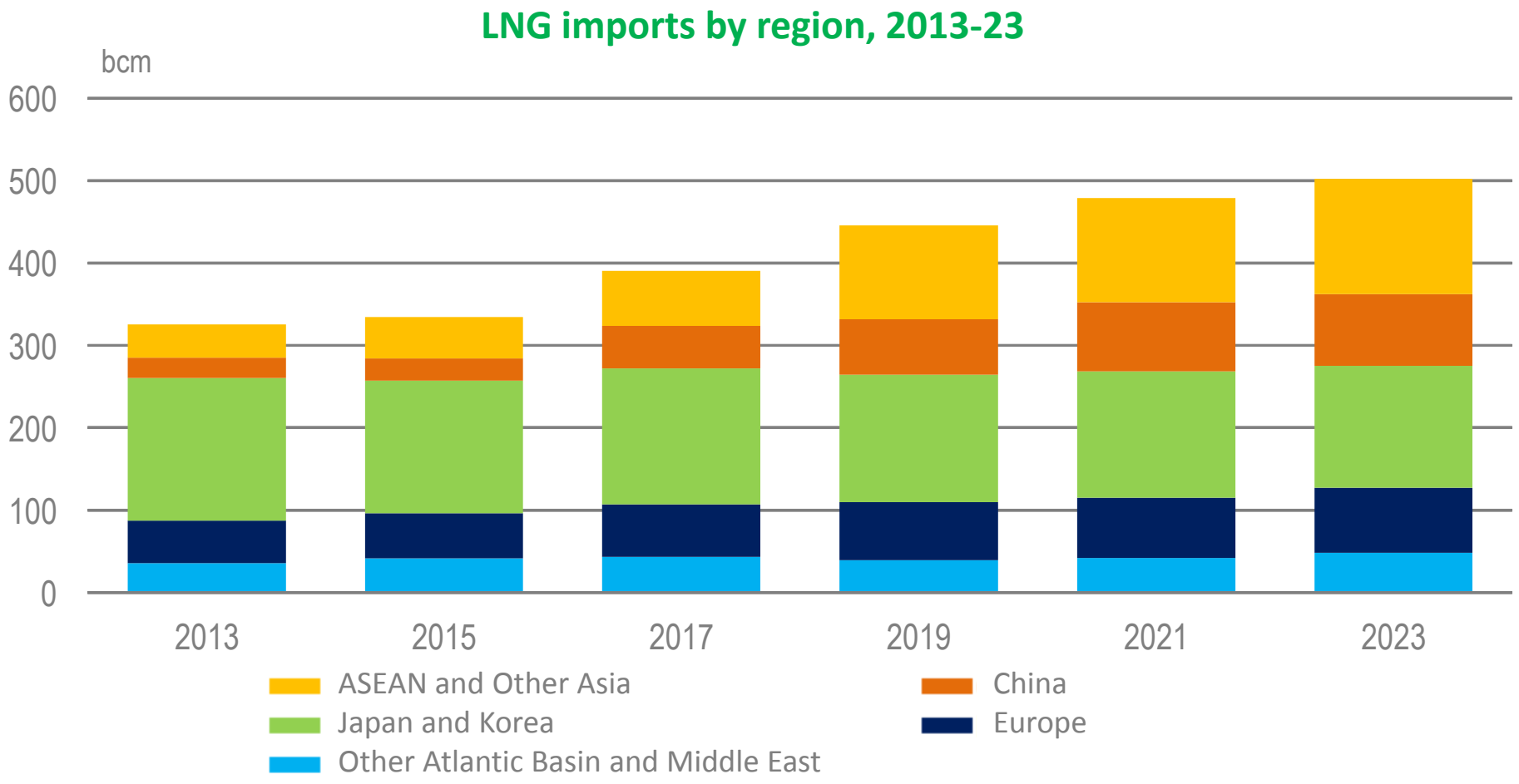
The global gas supply outlook

Natural gas production growth for selected countries and regions, 2017-23



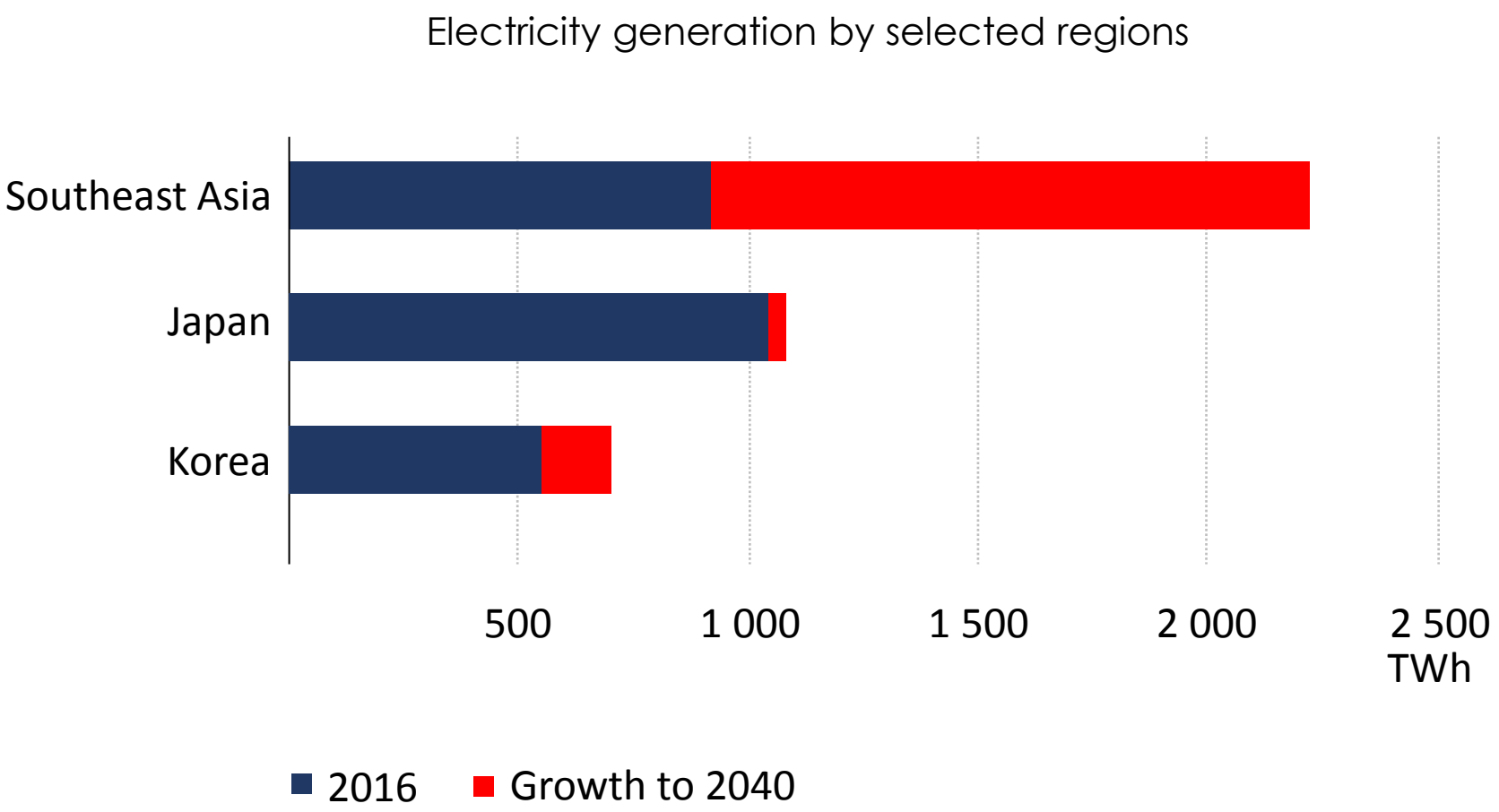
The US accounts for almost 75% of growth in global LNG exports to 2023; Southeast Asia will need to increasingly import LNG from Qatar, Australia & the US to meet growing demand

Global LNG market reaches 500 bcm mark by 2023



LNG trade passes 500 bcm mark by 2023, reaching almost 40% of global gas trade from around a third today; Developing Asian markets account for almost half of LNG market by 2023

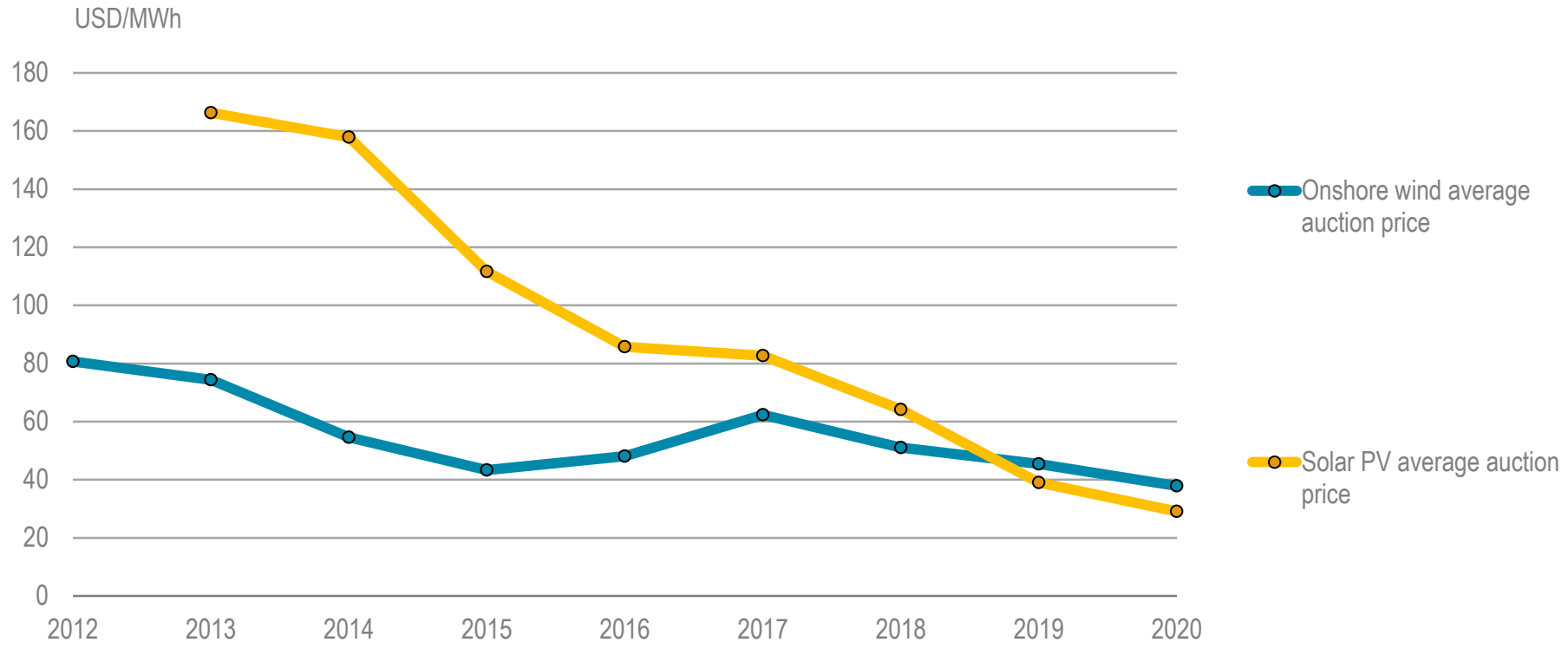
The future is electrifying



Southeast Asian electricity generation is set to more than double by 2040, requiring additions greater than Japan's current power capacity

Wind and solar PV costs falling rapidly

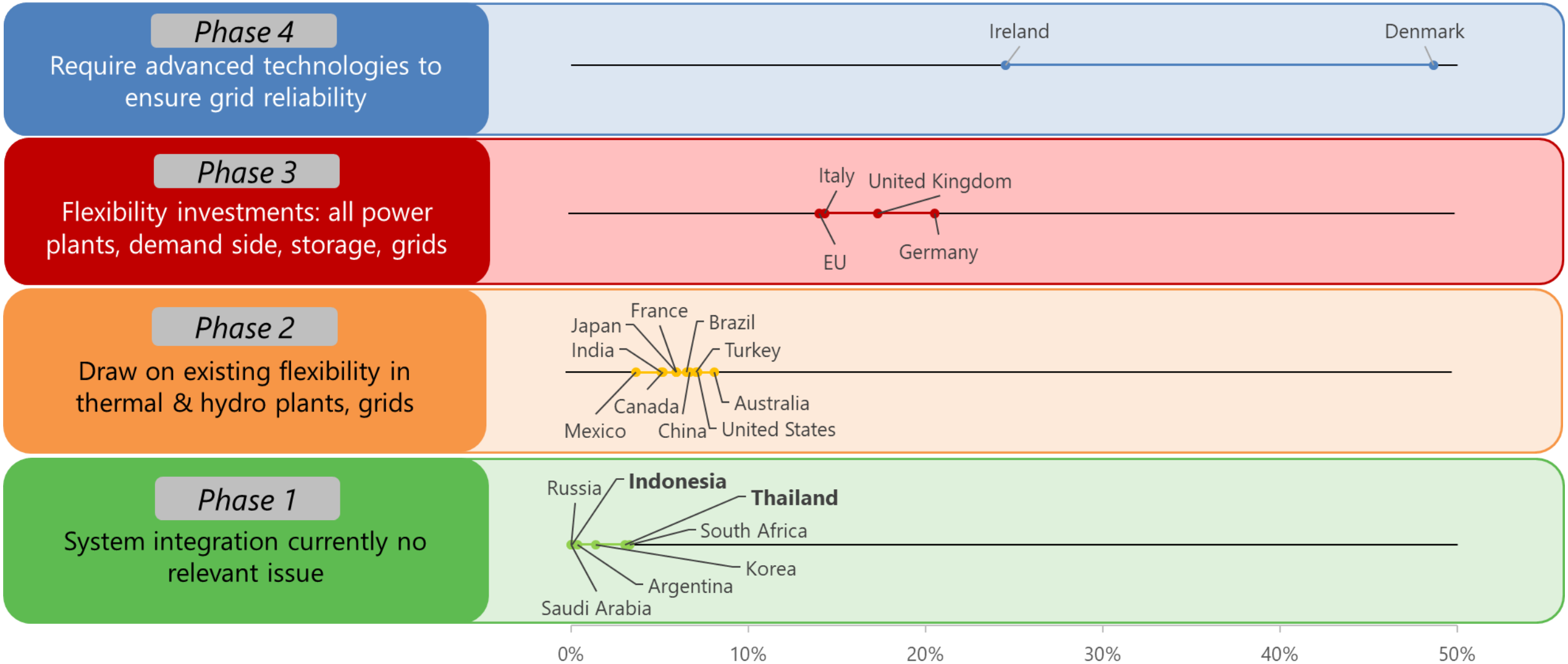
Announced wind and solar PV average auction prices by commissioning date



Technology progress and competition have driven down prices to record-low levels in countries with good renewable resources, transparent policies and well-designed auction schemes

Wind & solar making strong inroads, but new challenges may emerge

Four phases of wind and solar integration



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Natural Gas

ttps://energy.economictimes.indiatimes.com/news/oil-and-gas/algeria-launches-new-natural-gas-ipeline-from-southwestern-fields/62835202

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Thailand Natural Gas Situation

Jan-May 2018

Supply

4,889 MMSCFD ↓ **3.6%**

Domestic

73%

3,549 MMSCFD

↓ **2.8%**

Import

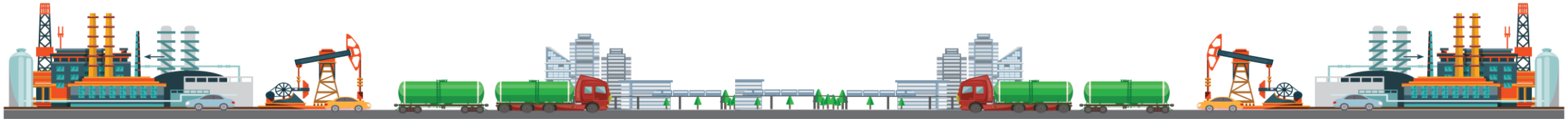
27%

1,340 MMSCFD

↓ **5.6%**

- Myanmar **16%**
- LNG **11%**

Decline natural gas supply including both domestic and import



4,665 MMSCFD ↓ **0.2%**

Demand

1 icon = 400 MMSCFD

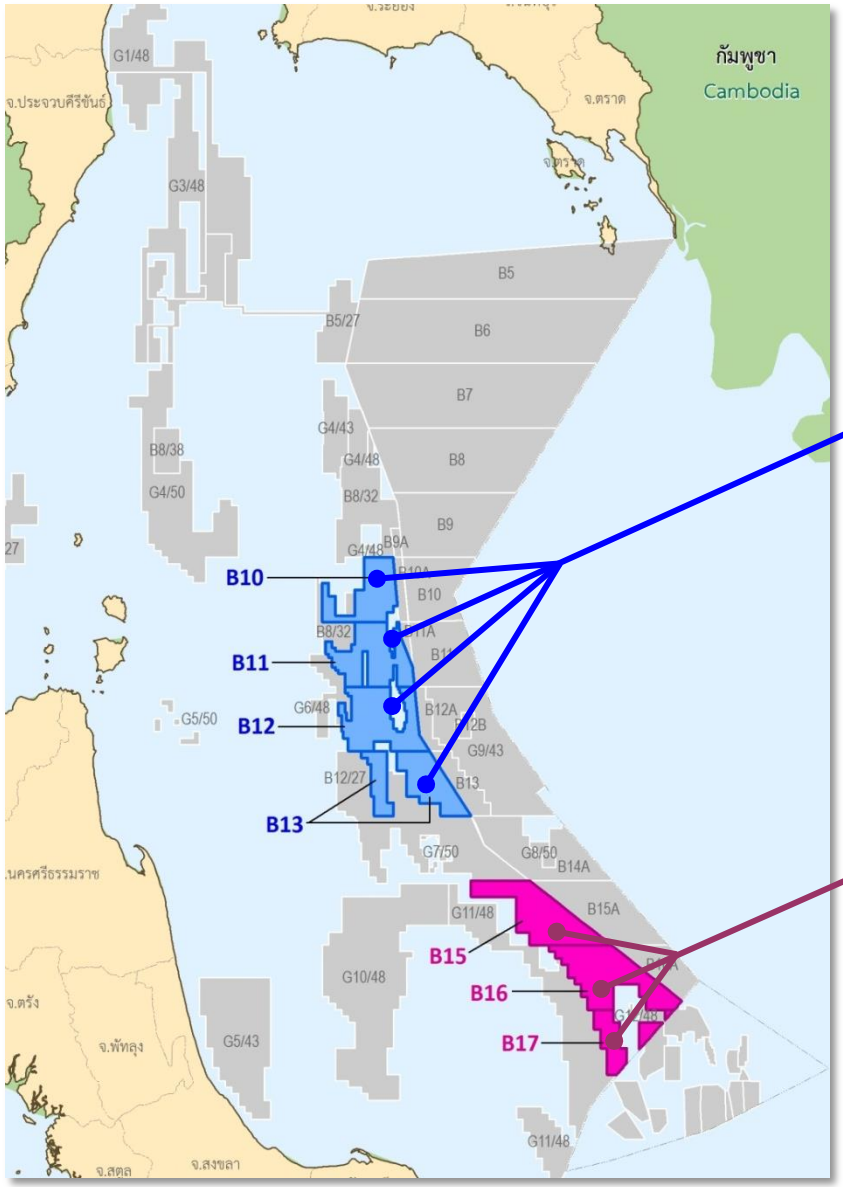
Overall decline in natural gas demand (decline in power and NGV/increase in industry and GSP use)

- NGV **5%**
- Industry **16%**
- Gas Separation Plant **22%**
- Power **57%**

Note: Compared with the same period of last year

Security = Continuous natural gas production

Erawan & Bongkot = 76% of GOT production



Erawan Gas Fields
Concession Awarded 1972
Concession End 2022

Current DCQ **1,240 mmscfd**
Minimum production **800 mmscfd**

Bidders

Chevron : PTTEP : Mubadala : Total

Bongkot Gas Fields
Concession Awarded 1972
Concession End 2022

Current DCQ **870 mmscfd**
Minimum production **700 mmscfd**

Bidders

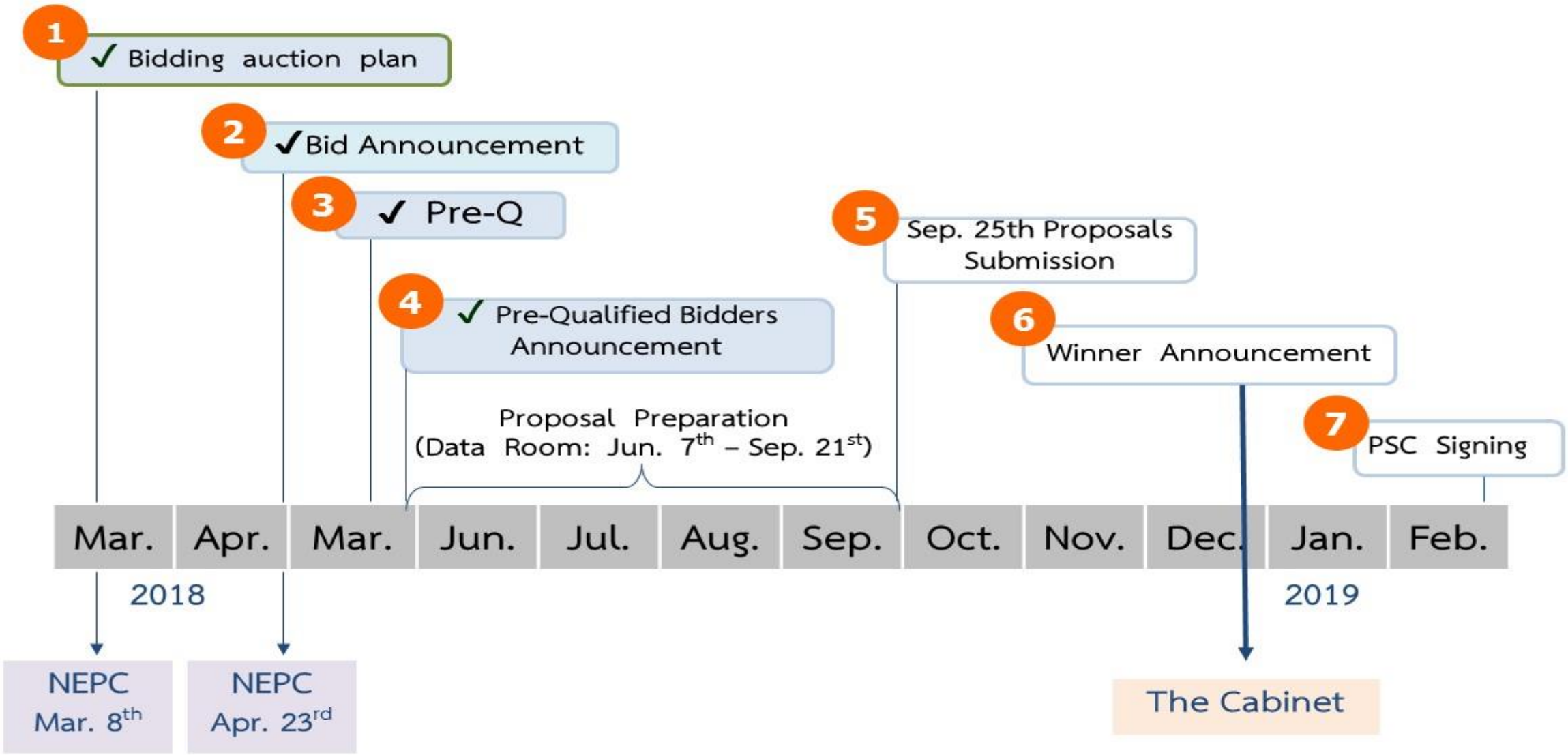
Chevron : PTTEP : Mubadala

Bidding Terms

Requirement	➢ **Minimum production and sale quantity (10 yrs)** G1/61 - 800 MMSCFD G2/61 - 700 MMSCFD ➢ **Price constant (Pc) offer** Constant Value of Gas Price (*Pc*) which is used to determine Sales Gas price (*Pr*) for the entire PSC period.
Bid Components	➢ **Gas Price Constant (Pc)**** Pc must not exceed the ceiling of 214.26 Baht/MMBTU ➢ **Percentage of contractors' share of profit petroleum (Profit split)** Must not exceed 50% of the total profit petroleum
Bid Components	➢ **Bonuses** Signature bonus/ Production bonus/ Others ➢ **Thai employee ratio** 1st year : ≥80% of total employees 5th year : ≥90% of total employees

Bidding for the expiring natural gas concessions

Process overview and Timeline



https://qz.com/1230297/us-utilities-have-finally-realized-electric-cars-will-save-them-and-asked-congress-to-put-more-evs-on-the-road/

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Thailand Electricity Situation

Jan-May 2018

Supply

Committed PPA

42,554 MW*

As of May 2018

- EGAT 37%
- IPP 35%
- SPP 19%
- Import 9%

*Exclude very small power producer (VSPP) and Isolated Power Supply (IPS)

Power Generation

0.7%

83,852 GWh

Exclude IPS

Electricity generation increased YoY with more fuel consumed across all types, except natural gas.

Peak in utilities system

29,968 MW

As of 24 April 2018 at 13.51 hrs.

Exclude Peak of IPS

1.1%

Demand

0.4%

76,405 GWh

Exclude IPS

Electricity consumption in the commercial and industrial sectors had increased, driven by economic growth and tourism. Meanwhile, cold weather and rainfalls led to a decrease in electricity consumption in the residential and other sectors. Additionally, off-grid generation by IPS and SPP decreased consumption in the grid.

Energy Consumption by Sector

Sector	Growth (%)	Share (%)
Residential	▼ 0.3	24
Business	▲ 2.1	25
Industrial	▲ 0.2	47
NGOs	▼ 2.7	0.1
Agriculture	▼ 8.7	0.2
Others	▼ 7.5	2
Free-of-charge	▲ 3.9	2

NOTE: Y-o-Y

Revising PDP 2015

Thailand's

Power Development Plan (PDP)

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Justifications for Revising PDP

Focuses on sufficient electricity generation.	New Policies / New Energy Outlook	Changing Energy Situation
Does not consider ✕ De-centralization ✕ Regional power management ✕ Regional power plants for energy security	☞ New GDP Forecast ☞ Data on Independent Power Supply (IPS) ☞ Electric Vehicle (EV) Policy ☞ Eastern Economic Corridor (EEC) ☞ RE hybrid firm Policy	Need to conduct a new load forecast and take into account changes in political, economic, social, and technological developments.

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Revision is needed to be up-to-date with the changing energy situation, especially :

- New government policies
- Economic growth
- Regional power supply and demand
- Energy Reform Plan

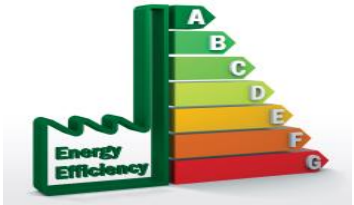
PDP Framework

Supporting the Economy

Fuel Diversification

Sufficient Generation

Energy Security and Sustainability



Public Participation

Efficient Generation

Investment in Eco-friendly Power Plants

Renewables for Electricity Generation

Deciding the Fuel Mix

- Sufficient and Reliable Reserves
- Diversification to Reduce Dependence on any Single Fuel Type
- Stable and affordable
- Meet international environmental standards
- Promoting Renewables
- Maximizing Domestic Resource Utilization

Principles of the New PDP

Satisfies Electricity Demand

- **Secured Electrical Infrastructure** across generation, transmission, and retail market network.
- **Fuel Diversification** – reduces dependence on any single fuel type.
- **Power plants for security in each region**– able to respond to unforeseen events.
- **Smart Grid Development** – to support decentralized generation (DG)

Appropriate cost of generation

- **Ensures suitable cost of generation** – to decrease burden to consumers and avoid interfering with long-term development.
- **Improve grid efficiency and adherence to merit order.**

Minimizes environmental impact

- Nationally Determined Contribution
- Promote Micro Grid in the off-grid Areas, industrial estates, and special economic zones to maximize resource utilization and reduce costs.
- Promote Generation and Consumption Efficiencies and Promote an Effective Demand Response System

Thailand's Energy Direction

- Continuous energy supply
- Adequate infrastructure investment
- Regional security

- Competitive price
- Increase competition
- Opportunity for innovation and new businesses

- Promote renewable energy
- Enhanced energy efficiency via modern technology

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