



APEC Energy Demand and Supply Outlook 6th Edition 2-4 Alternative Power Mix Scenario

Roberto LOZANO

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**Asia-Pacific
Economic Cooperation**



1. Overview

Alternative Power Mix Scenario: Fuel Cases

- This scenario provides a quantitative assessment between alternative electricity mixes involving:



High-efficient coal technologies

Cleaner Coal Case



Higher shares of natural gas

High Gas 50%
High Gas 100%



Expanded nuclear energy

High Nuclear Case

Main assumptions by Case and member economy

Economy	Alternative Power Mix Scenario - Case		
	Cleaner Coal	High Gas	High Nuclear
Australia	✓	✓	X
Brunei Darussalam	X	X	X
Canada	X	X	X
Chile	✓	✓	X
China	✓	✓	✓
Hong Kong	X	X	X
Indonesia	✓	✓	✓
Japan	✓	✓	✓
Korea	✓	✓	✓
Malaysia	✓	✓	✓
Mexico*	X	X	✓
New Zealand	X	X	X
Papua New Guinea	X	X	X
Peru	X	X	X
The Philippines	✓	✓	X
Russia	✓	✓	✓
Singapore	X	X	X
Chinese Taipei*	✓	✓	✓
Thailand	✓	✓	✓
United States	✓	✓	✓
Viet Nam	✓	✓	✓

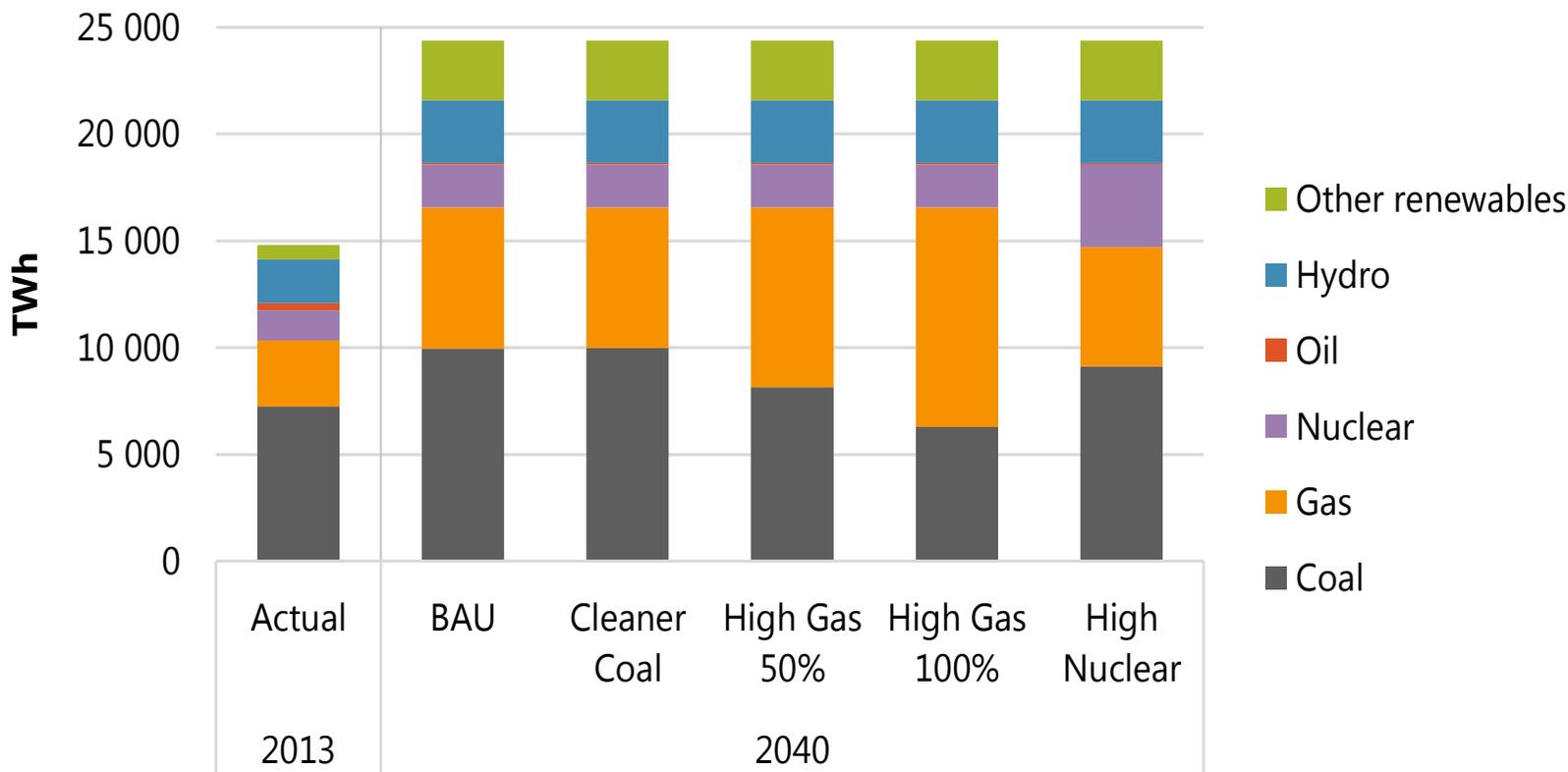
* No nuclear-based capacity expansion, but as a result of lifetime extensions of existing nuclear power plants, generation surpasses BAU levels by 2040



2. Key findings

Coal remains dominant across several Cases

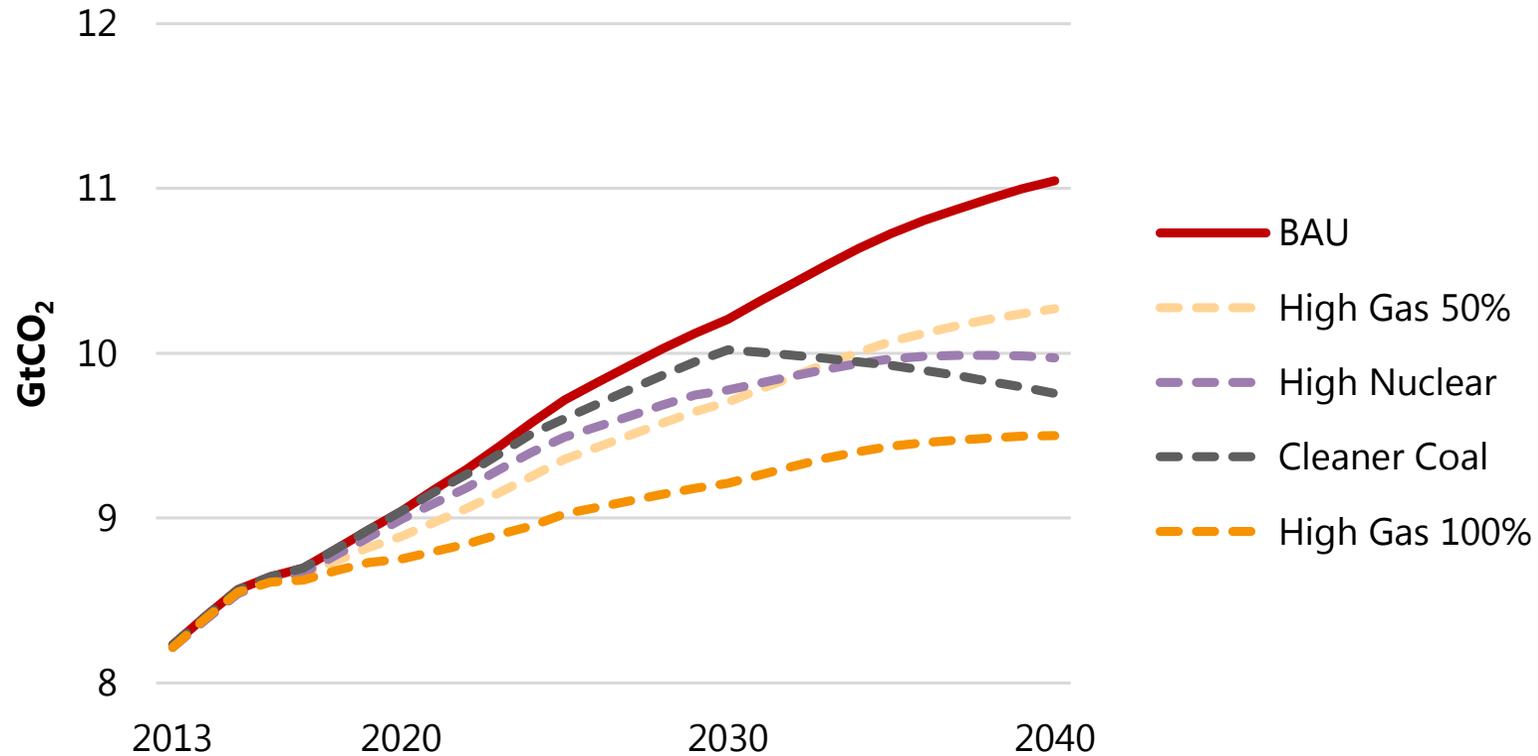
Electricity generation



Only under the High Gas Cases coal would become the second largest energy source for electricity generation

The largest reduction of CO₂ emissions comes from a maximum use of gas

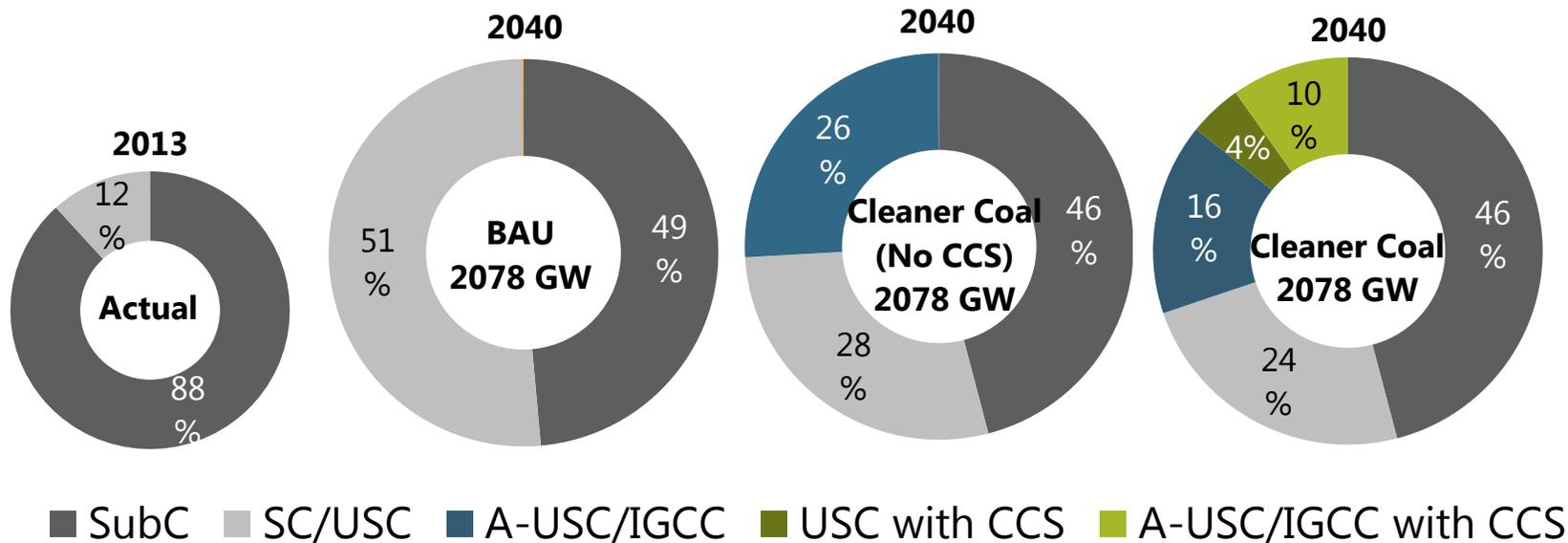
Total CO₂ emissions from electricity generation



An increased use of gas that replaces all coal-additions from 2020 brings the largest reduction in CO₂ emissions

Only the use of CCS can ensure viable growth of coal-based generation

APEC-wide coal based electricity capacity by technology and Case



Introduction of CCS from 2030 would result in CO₂ emissions falling 12% by 2040. If CCS is not included, this reduction only amounts to 3%

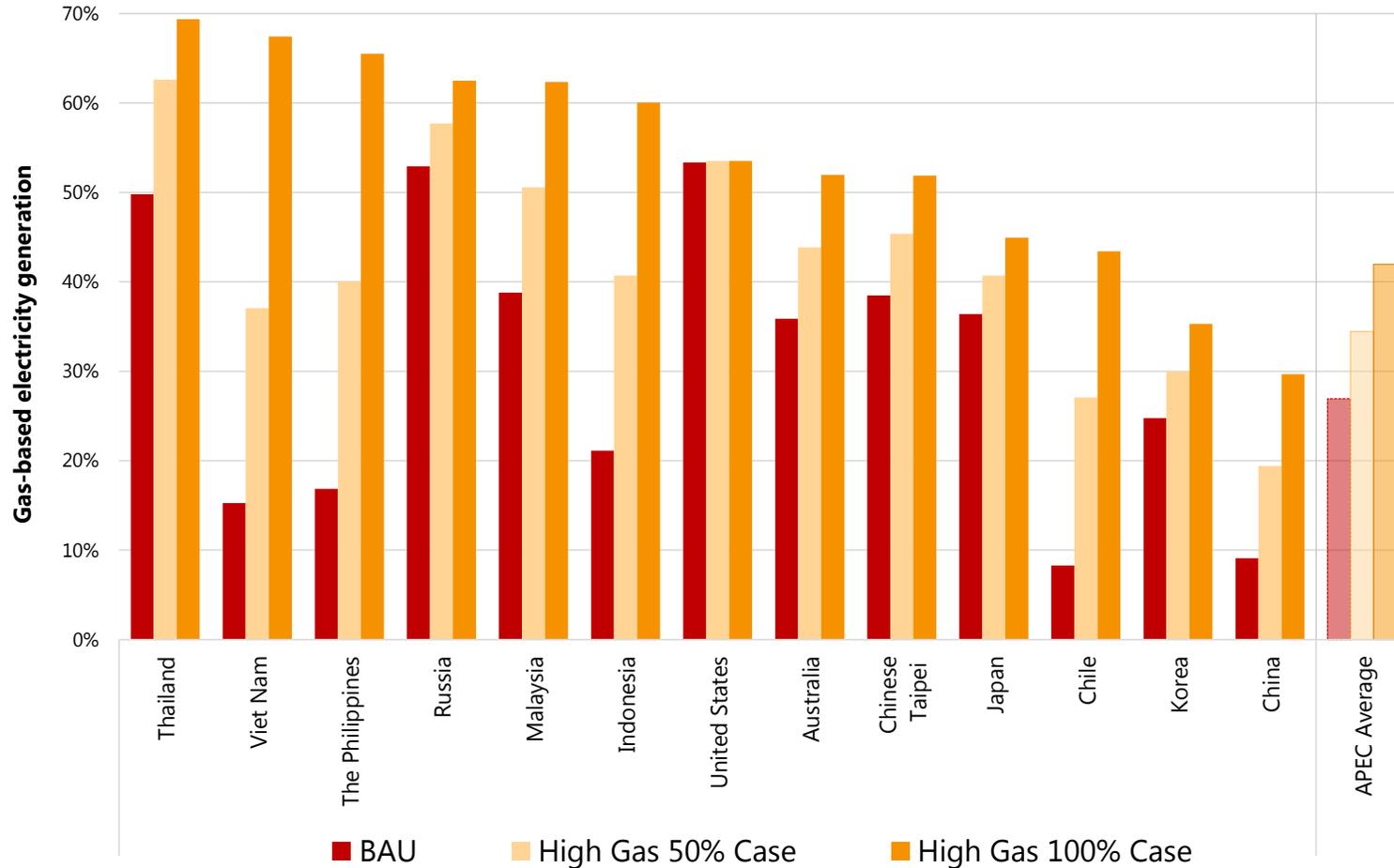
Use of CCS technologies varies widely by economy

Coal-based electricity generation capacity by technology and by Case, 2040

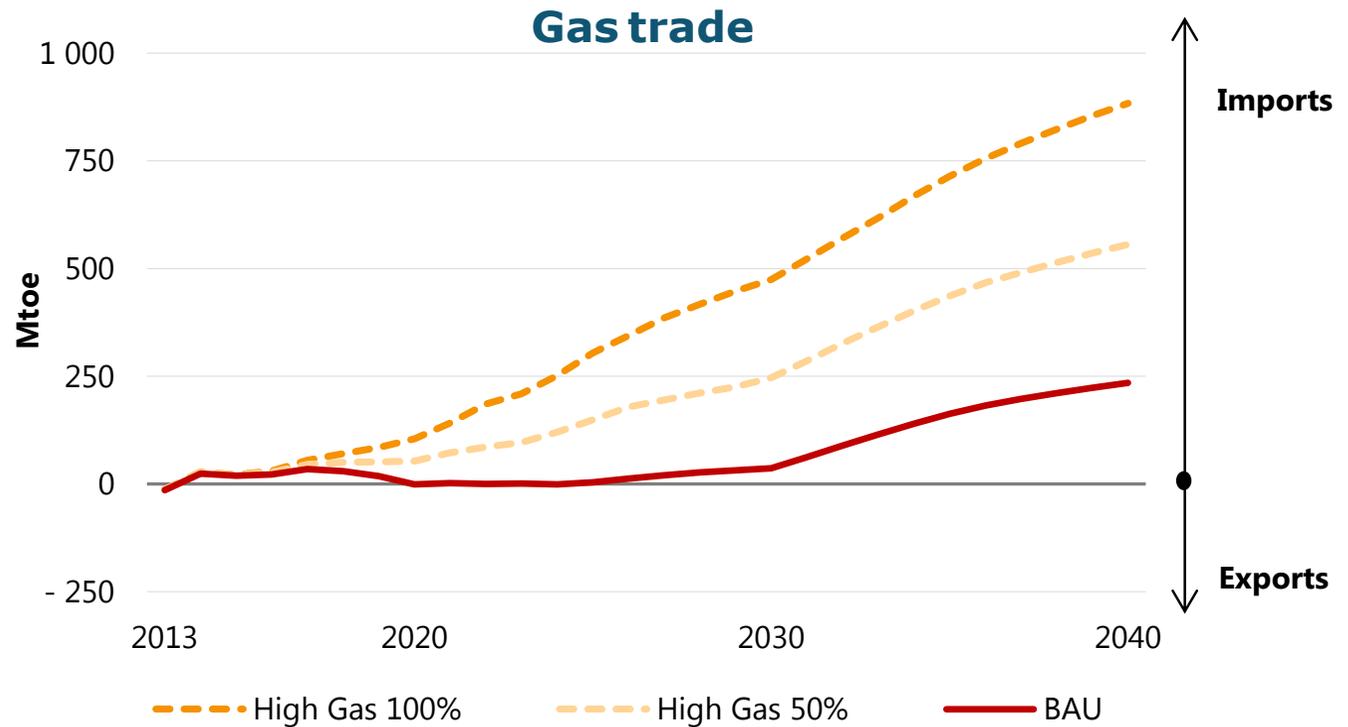
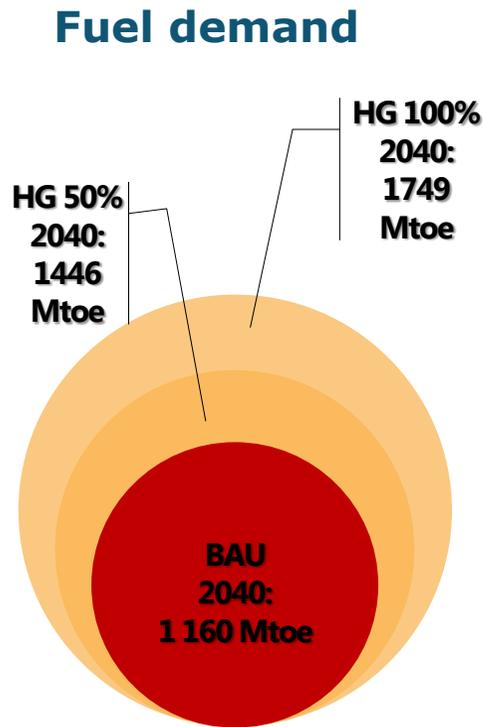
Group of coal-using economies	Economy / Region	Cleaner Coal Case (No CCS)				Cleaner Coal Case				
		SubC	SC/USC	USC with CCS	A-USC/IGCC	SubC	SC/USC	USC with CCS	A-USC/IGCC	A-USC/IGCC with CCS
		(GW)								
Mature	Australia	2	10	-	8	2	10	-	4	4
	China	703	319	-	456	703	319	-	294	162
	Japan	2	41	-	9	2	41	-	3	6
	Korea	7	24	-	10	7	24	-	7	3
	Russia	5	8	-	33	5	8	-	17	16
	Chinese Taipei	13	7	-	1	13	7	-	1	0.4
	USA	150	5	-	18	150	5	-	8	10
Developing	Chile	4	9	-	-	4	5	4	-	-
	Indonesia	34	56	-	-	34	27	29	-	-
	Malaysia	7	15	-	-	7	9	5	-	-
	The Philippines	7	17	-	-	7	10	7	-	-
	Thailand	2	13	-	-	2	7	6	-	-
	Viet Nam	6	62	-	-	6	23	39	-	-
	Subtotal	943	584	-	536	943	495	90	333	203
	Rest of APEC*	12	1	2	-	12	1	2	-	-
APEC	954	586	2	536	954	496	92	333	203	

Share of CCS in the coal-based economy-wide generation would amount to 35% in Russia and 58% in Viet Nam.

Share of gas-based electricity generation in total electricity output



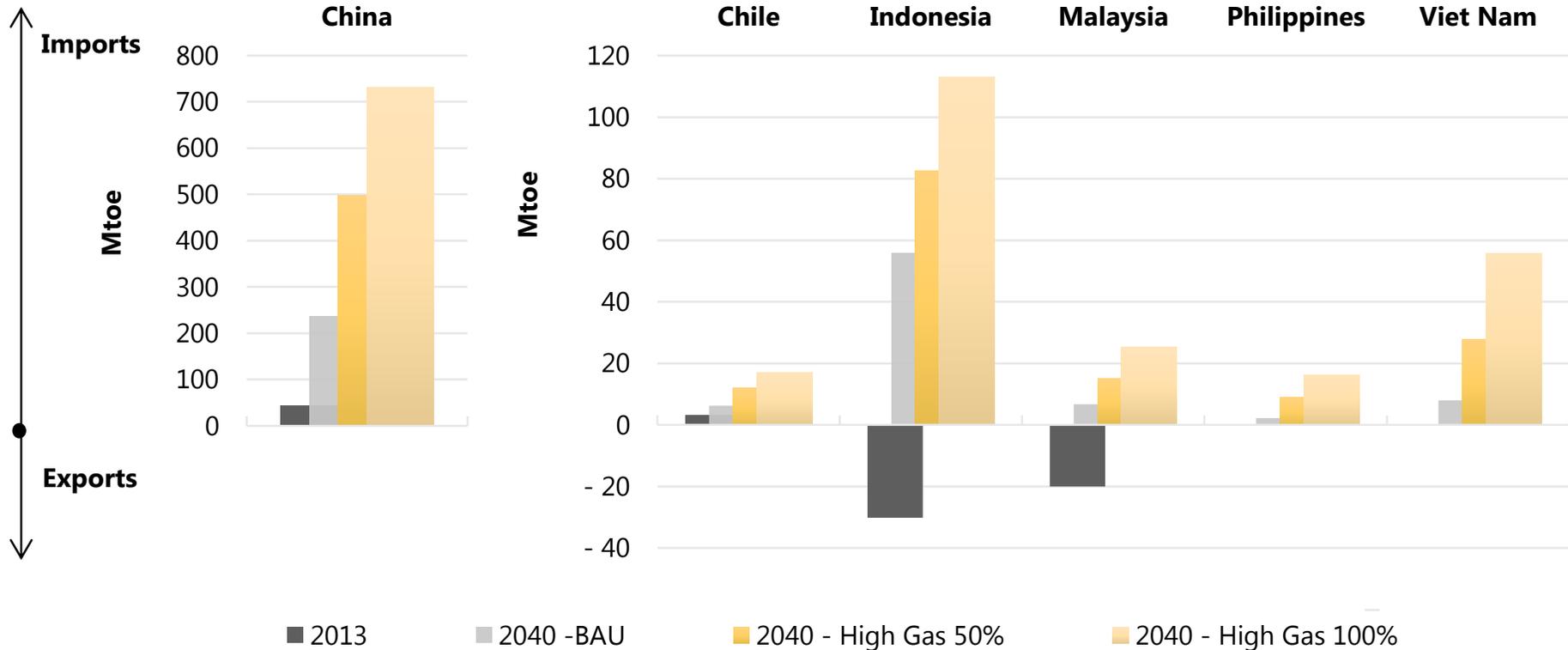
Increased gas demand for electricity generation would see gas imports grow robustly...



**Fuel demand for gas-based generation grows 25% and 51%
APEC-wide gas imports increase 2.4 and 3.6 times by 2040**

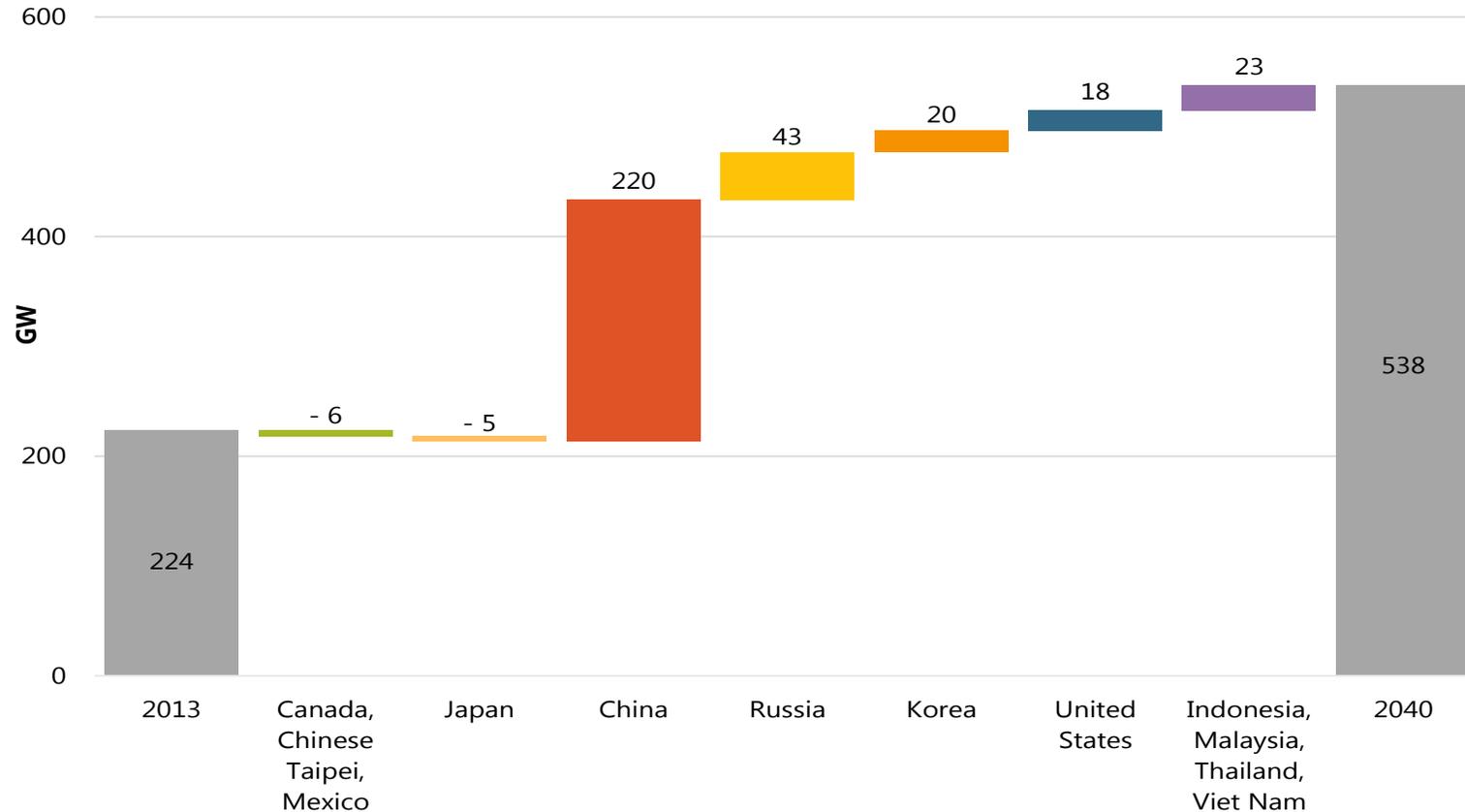
...especially in certain member economies

Gas trade in APEC economies, 2013 and 2040, BAU and High Gas Cases



Largest percentage variations expected in Malaysia, Viet Nam, the Philippines, China, Indonesia and Chile.

Additions of nuclear-based electricity capacity in the High Nuclear Case, 2013-40



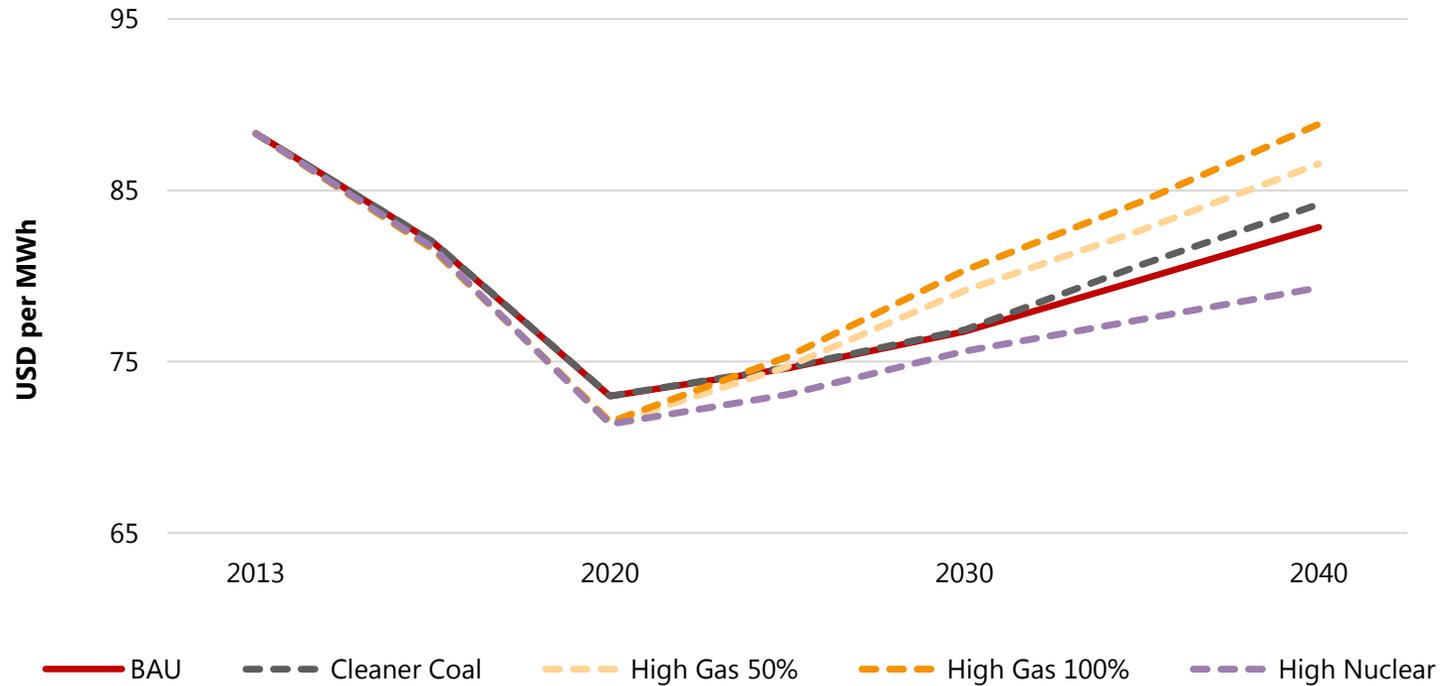
High Nuclear Case would deliver a large reduction of CO₂ emissions and the lowest generation costs

Share of fossil fuel energy in electricity generation mix in the BAU Scenario and the High Nuclear Case, 2040

Economy	BAU				High Nuclear Case				Resulting reduction in the share of fossil energy (percentage points)
	Coal (%)	Gas (%)	Oil (%)	Total fossil share (%)	Coal (%)	Gas (%)	Oil (%)	Total fossil share (%)	
China	56	9	0.0	65	51	8	<1	59	6
Chinese Taipei*	53	38	0.1	91	50	34	<1	84	7
Indonesia	62	21	1.4	84	56	19	1.4	76	8
Japan	33	36	2.2	71	30	25	2.2	57	14
Korea	39	25	NA	64	33	22	NA	55	9
Malaysia	46	39	0.1	85	42	39	<1	80	5
Mexico*	6	73	0.5	80	6	71	<1	77	2
Russia	12	53	0.1	65	10	41	<1	52	13
Thailand	24	50	0.1	74	19	46	<1	64	9
United States	20	53	0.0	73	20	43	<1	62	11
Viet Nam	62	15	0.0	77	53	15	<1	68	9

Increased nuclear energy offers the opportunity to shift away from the use of fossil fuels

Average electricity generation costs, 2013-40



Only in the High Nuclear Case are average costs lower than BAU by 4%



3. Policy implications and challenges

Major policy implications

Economy	Categories assessed								
	Reduction of CO ₂ emissions			Diversity of electricity mix			Total generation costs		
	Cases								
	CC	HG	HN	CC	HG	HN	CC	HG	HN
Australia			NA			NA			NA
Chile			NA			NA			NA
China									
Indonesia									
Japan									
Korea									
Malaysia									
Mexico	NA	NA		NA	NA		NA	NA	
The Philippines			NA			NA			NA
Russia									
Chinese Taipei									
Thailand									
United States									
Viet Nam									

Legend	Largest positive effect	Next best positive effect	Positive effect	Negative effect
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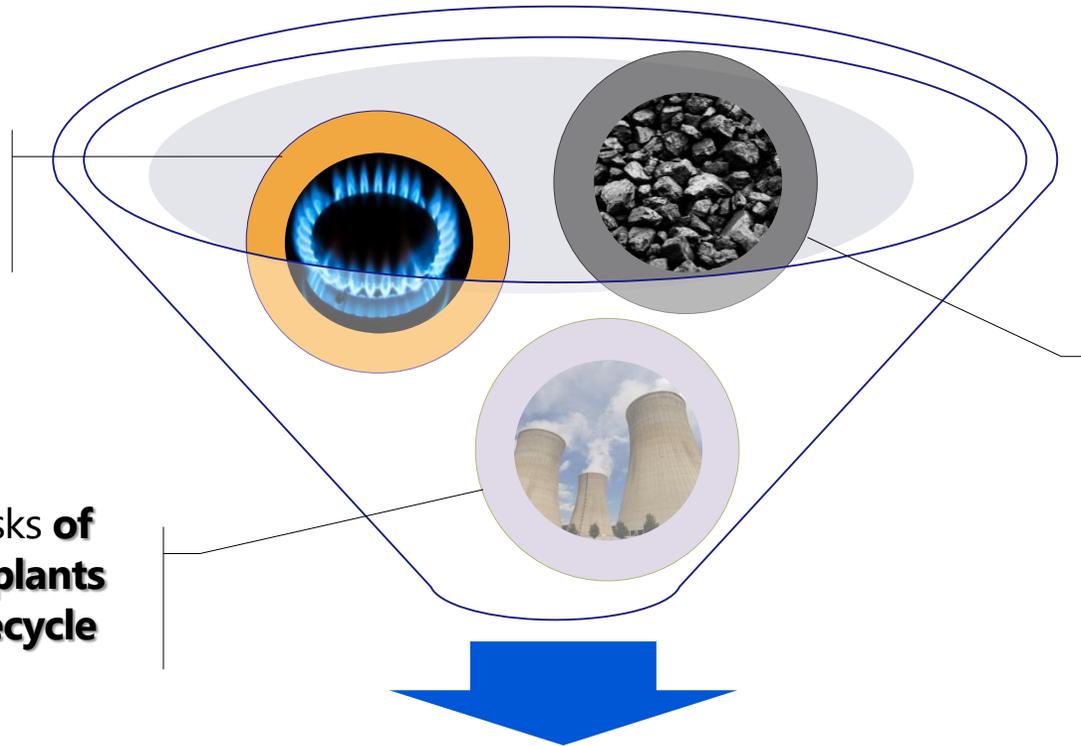
Not in the Alternative Power Mix Scenario: Brunei Darussalam, Canada, Hong Kong, New Zealand, Papua New Guinea, Peru and Singapore

Main challenges in the Alternative Power Mix Scenario

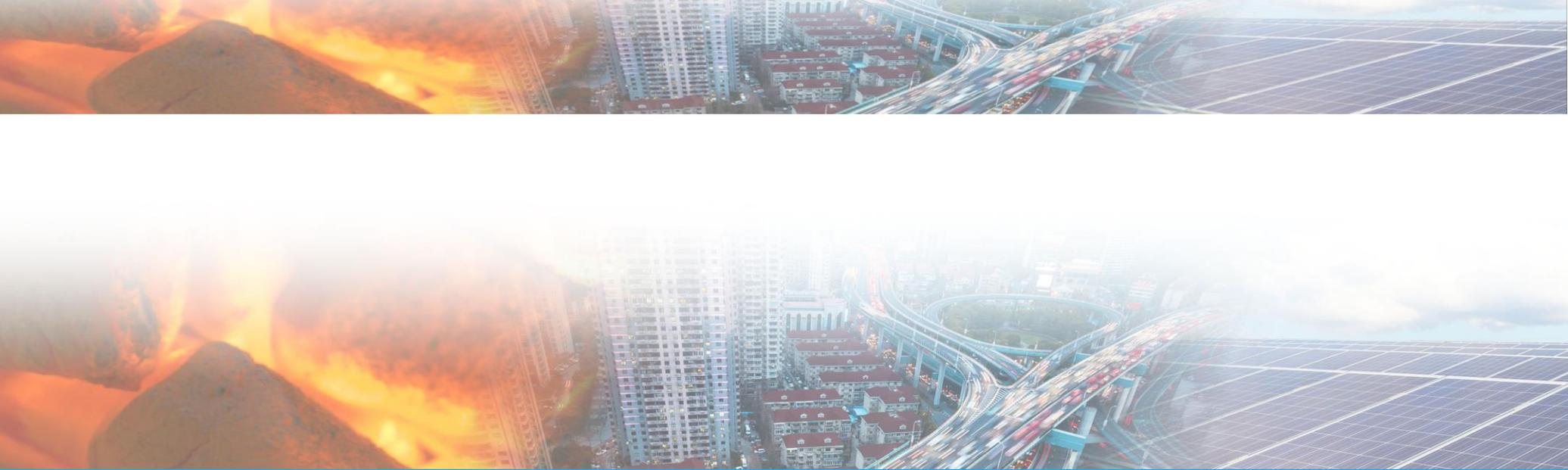
Overcoming infrastructure bottlenecks and price uncertainty to **expand gas trade**

Reducing the risks of **nuclear power plants across their lifecycle**

Increasing the share of coal-based generation **with CCS**



Reducing CO₂ emissions significantly while achieving reliable and cost-effective electricity mixes



4. Key recommendations

Paving the road for alternative power mixes

- **Prioritize the development of CCS projects and strengthen their financing and economic viability**
- **Enhance gas and LNG trade and explore the development of domestic gas resources** (conventional and unconventional)
- **Increase safety standards of nuclear** power plants and promote an informed public dialogue to **change the social perception of these projects**



Thank you

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