



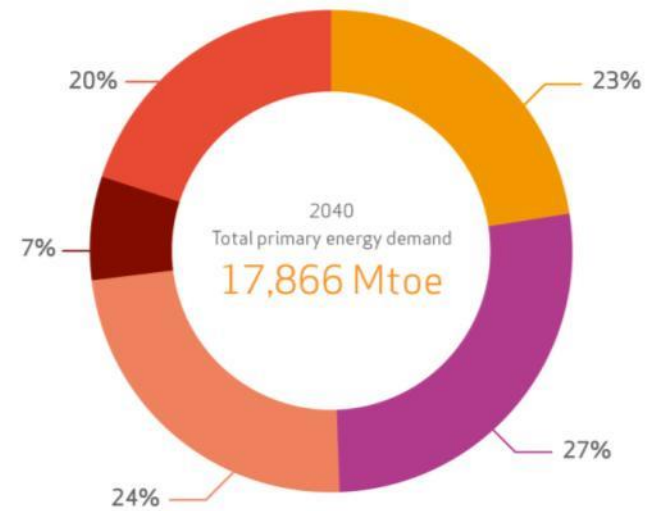
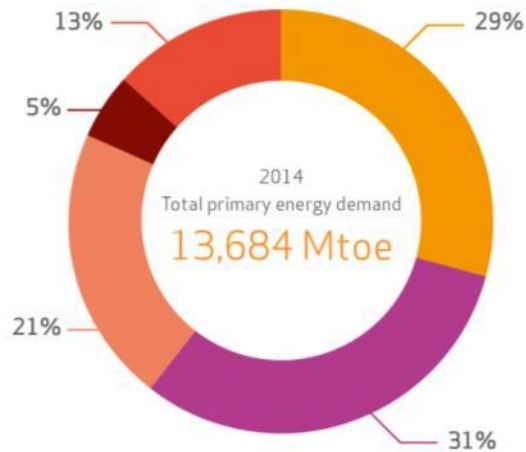
# The new global dynamics for coal

*Liam McHugh*  
*Policy Manager*



# As electricity changes, coal retains an edge

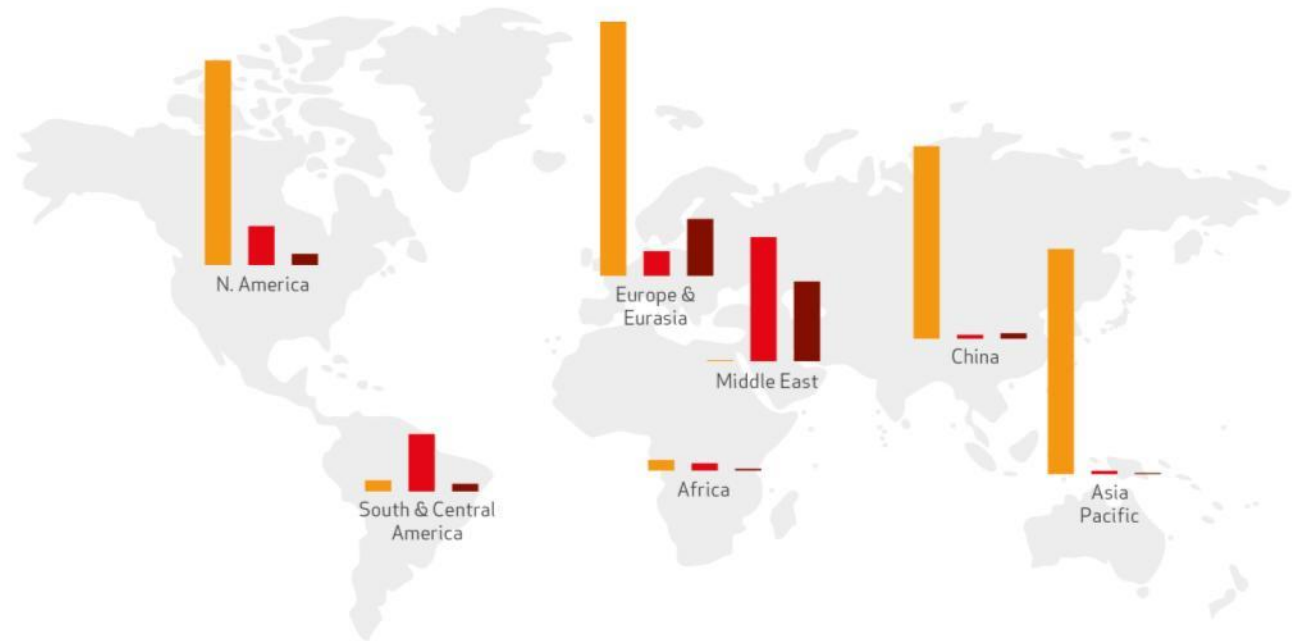
## Global primary energy demand under the IEA New Policies Scenario



Source: International Energy Agency, World Energy Outlook 2016

# 1.2 billion people live without access to electricity

## Location of the world's main fossil fuel reserves (Mtoe)



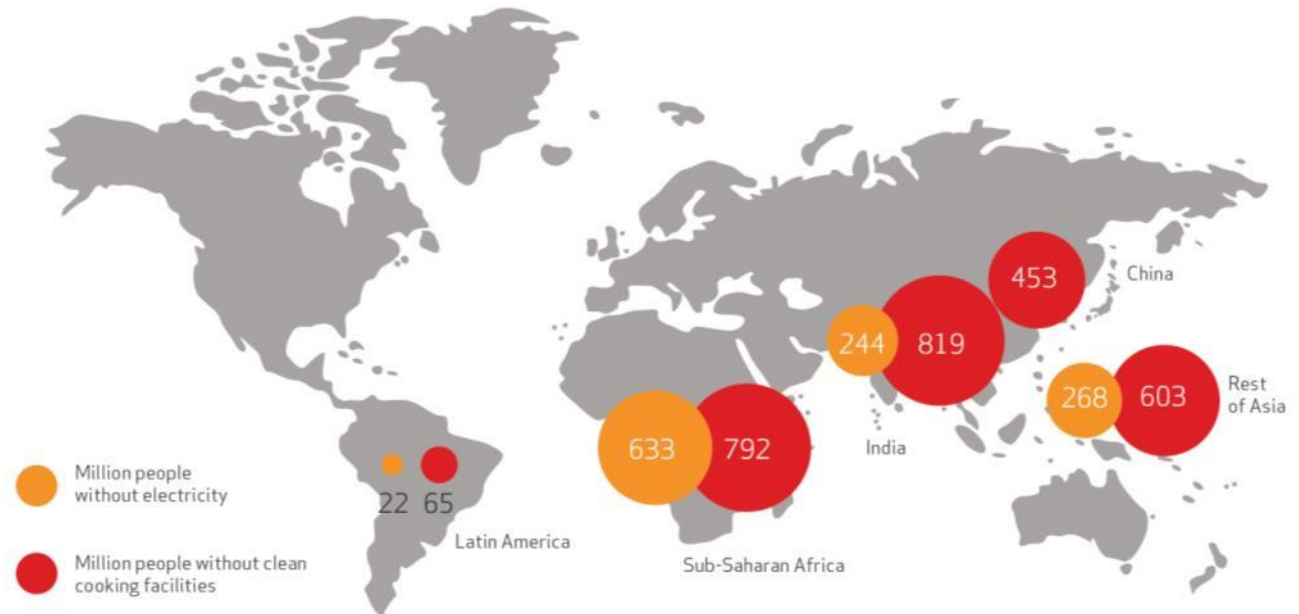
Source: BP Statistical Review of World Energy 2017 and WCA analysis 2017

- Today coal is found in 70 countries and actively mined in 50
- At current rates of consumption, the IEA forecasts that coal will last 114 years, compared to 53 years for gas and only 51 years for oil

# 1.2 billion people live without access to electricity

- 1.2 billion people worldwide live without access to electricity
- 2.7 billion rely on traditional fuels for cooking

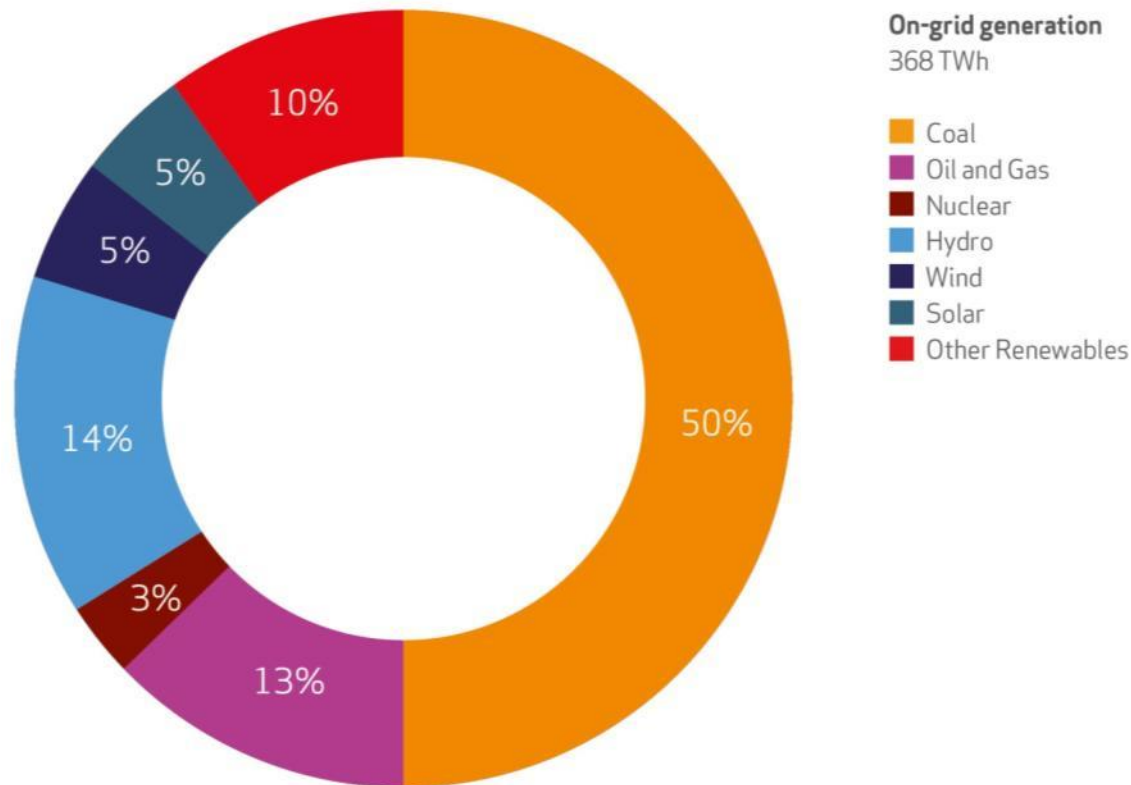
People without access to modern energy services by region



Source: International Energy Agency, World Energy Outlook 2016

# Coal is key in addressing global energy poverty

Additional on-grid electricity generation by fuel in the “Energy for All Case” compared with the New Policies Scenario, 2030

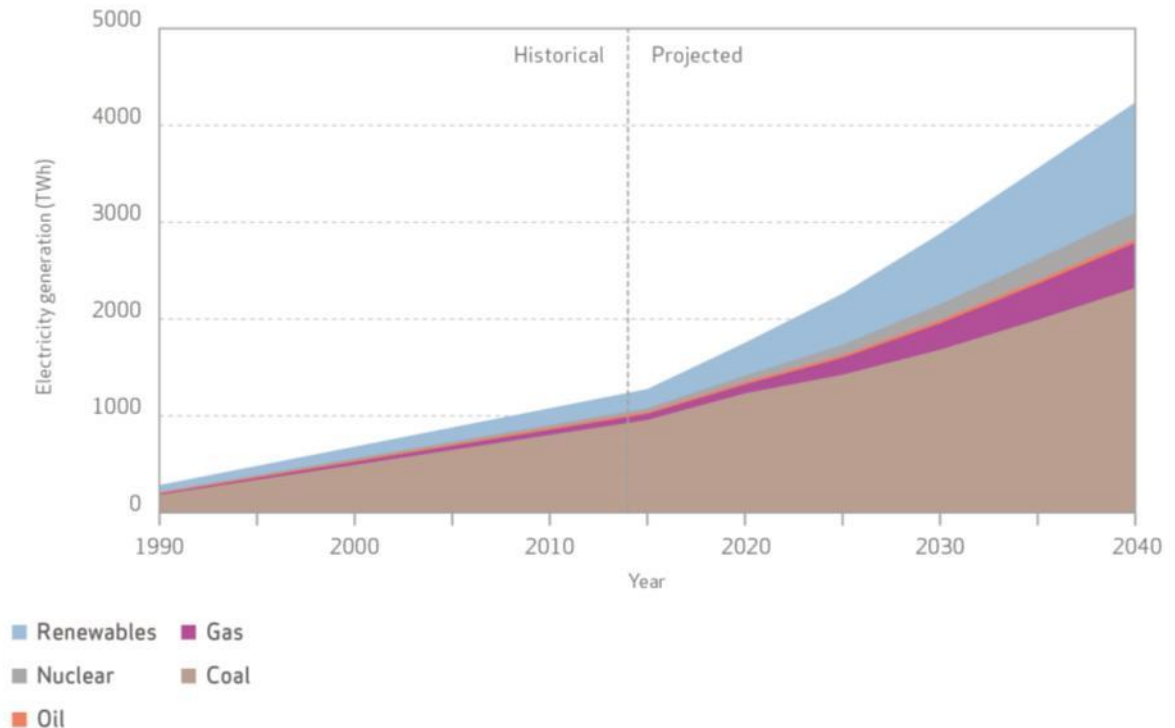


Source: World Energy Outlook, 2011

# Coal will drive India's economic growth...

- Electricity demand in India is expected to average 4.4% pa over the next 25 years
- Coal generation capacity more than doubles, while renewables also increase significantly to meet demand
- IEA indicates that maintaining an adequate electricity supply represents a significant investment challenge requiring \$2 trillion (in 2013 dollars)

India's electricity generation by source in the New Policies Scenario

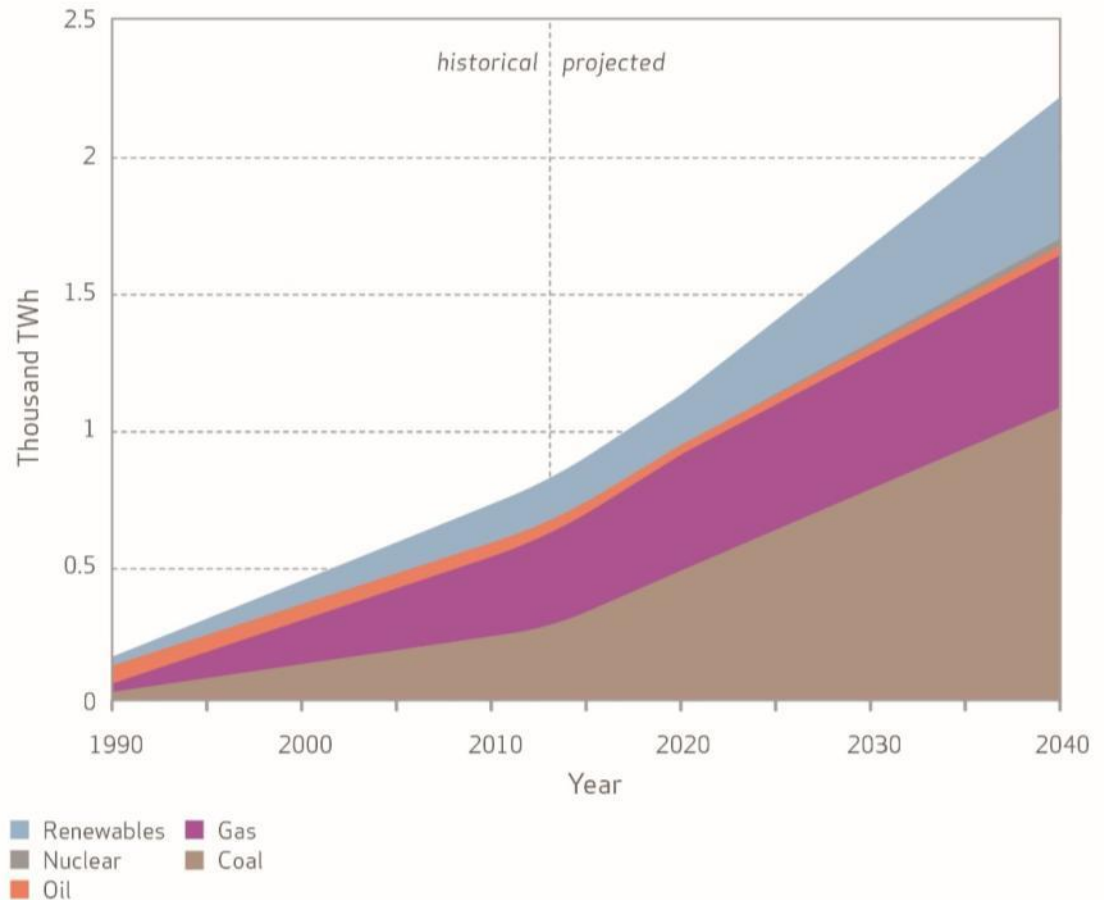


Source: International Energy Agency, World Energy Outlook 2016

## ... and will be critical in powering up SE Asia

- The share of coal in power generation rises from 32% to 50%
- Renewables-based electricity generation increases three and half times from today to 2040 (481 TWh)
- IEA highlights \$2.4 trillion investment is required over the period to 2040. This represents around 5% of the global total, or one-third of China's investment

Southeast Asia electricity generation by source in the New Policies Scenario

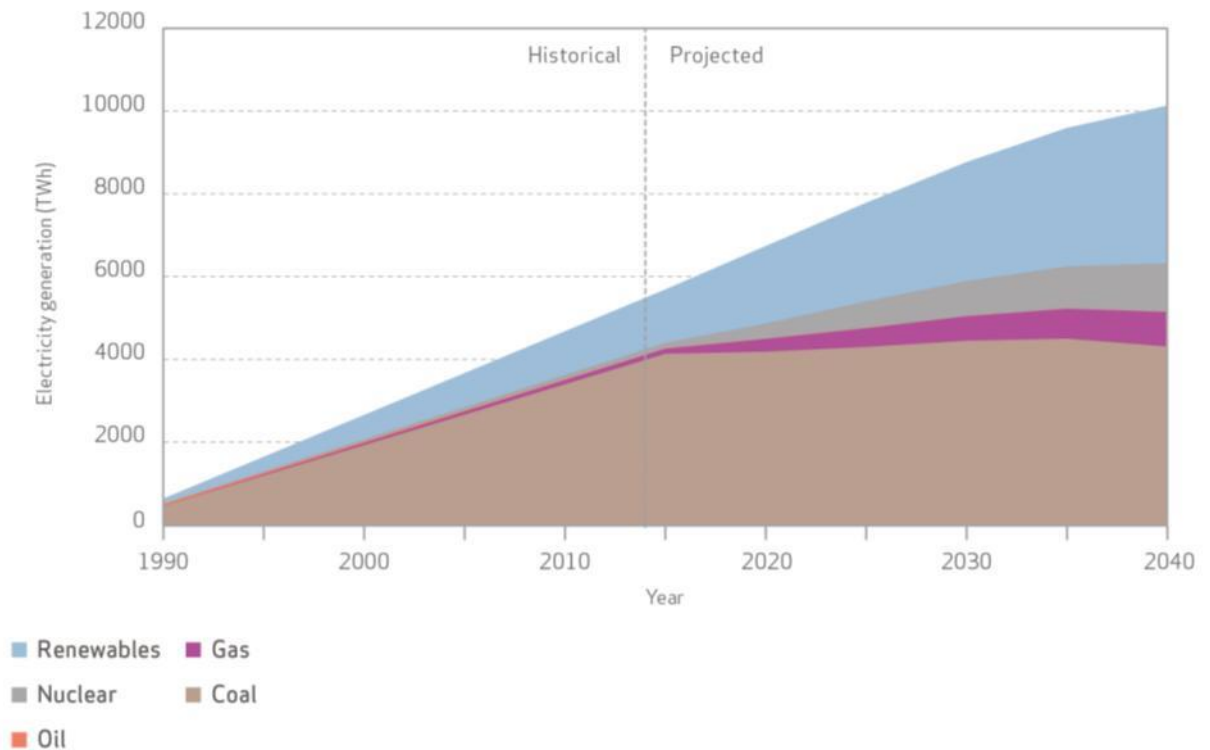


Source: Adapted from IEA WEO 2015

# Coal will be critical to China for decades

- China's electricity demand growth will be around 4.8% to 2020, then decline to around 2% through to 2040
- Electricity generation from coal will be 4.3% higher in 2040, despite its share of generation reducing from 73% to 43%
- Non-hydro renewables are expected to increase 1200% over the same period (25% of world generation)

## China's electricity generation by source in the New Policies Scenario

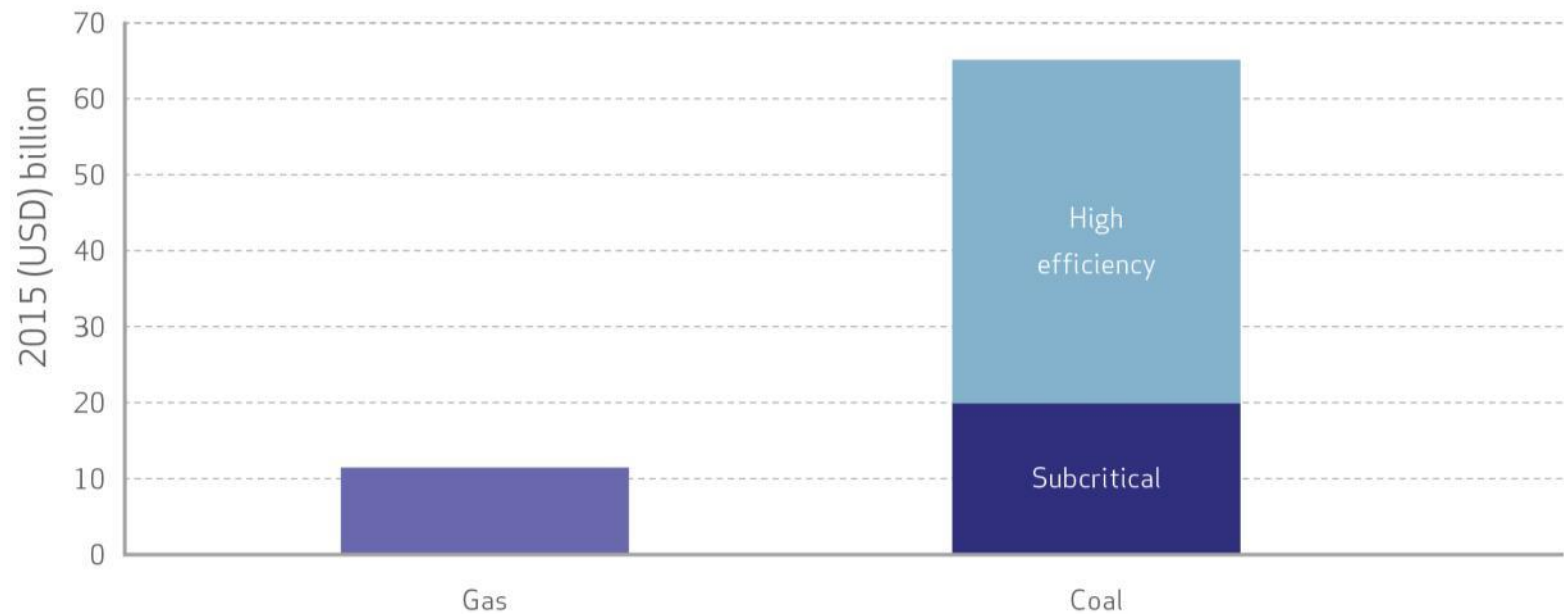


Source: International Energy Agency, World Energy Outlook 2016



# Coal, not gas, leads the charge in Asia...

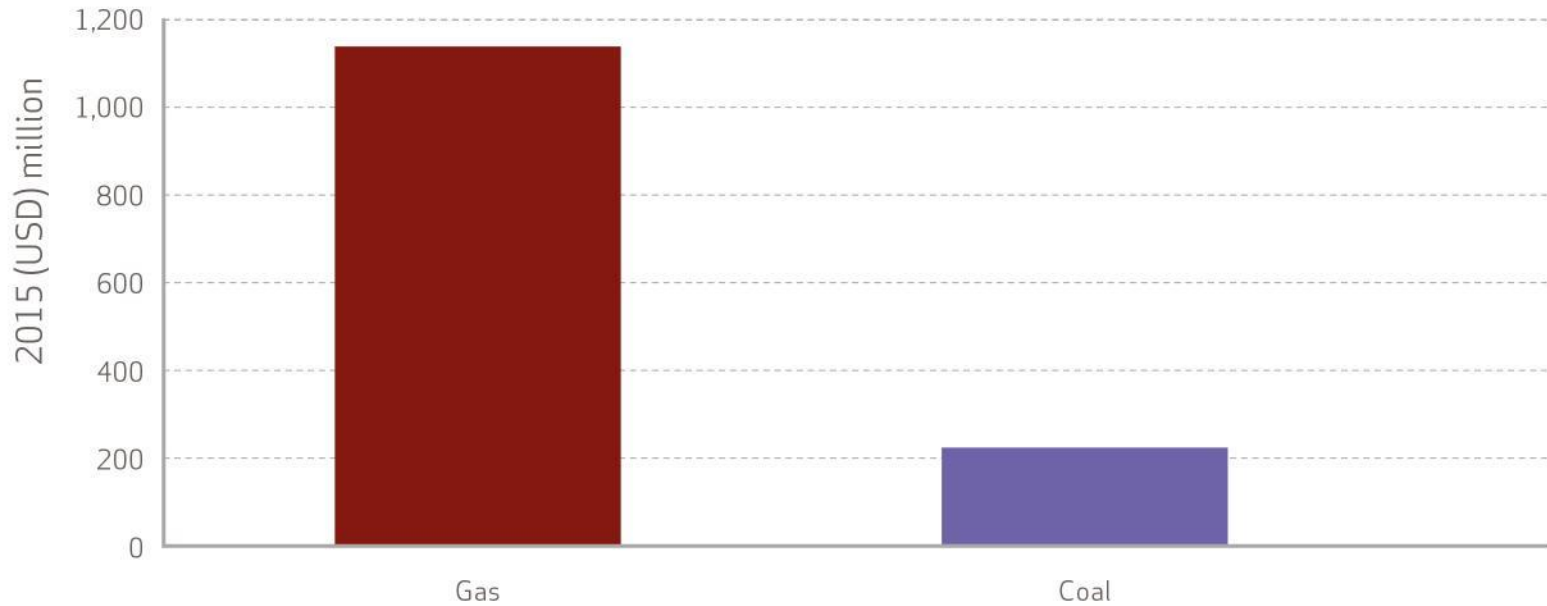
Coal and gas-fired power investment in Asian markets (2015)



Source: IEA World Energy Outlook 2016

... because its costs are far lower

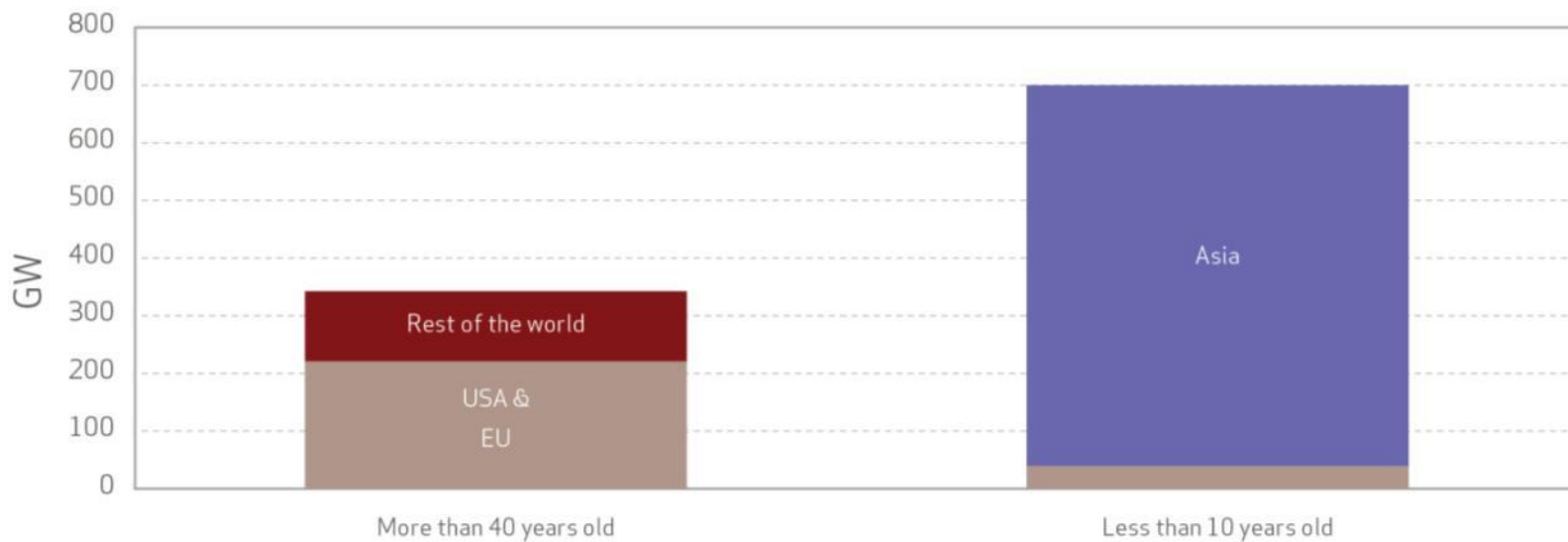
### Infrastructure investment cost for a 1 GW power plant in Asia



Source: IEA World Energy Investment 2016

# So the global coal fleet is at its youngest in decades

## Age of coal plants globally

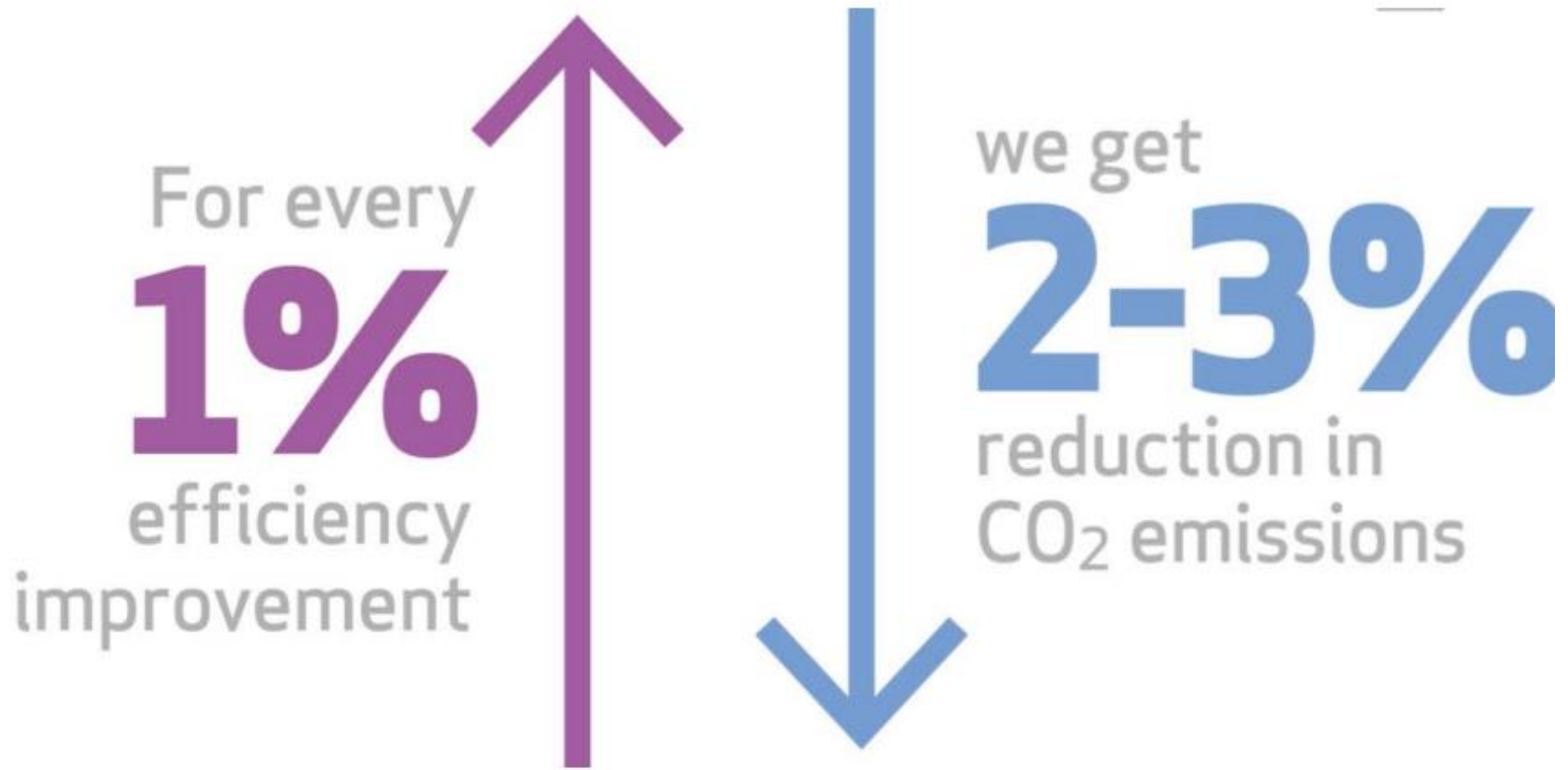


Source: International Energy Agency, Laszlo Varro, Chief Economist, 2016

# The Paris Agreement includes low emissions coal



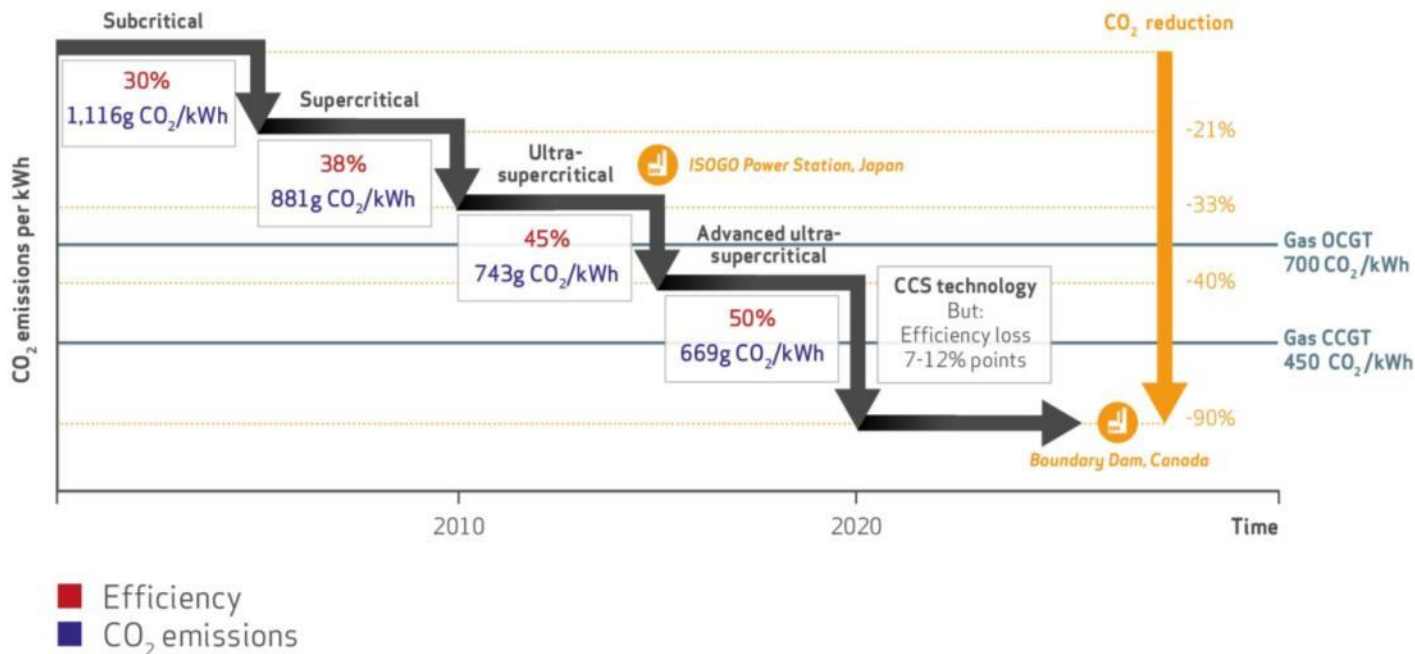
# New technology dramatically reduces CO<sub>2</sub>



# Efficiency improvements can significantly contribute to CO<sub>2</sub> emission reductions

- The most important near-term action to reduce CO<sub>2</sub> emissions is to increase the efficiency of coal-fired power plants
- 1% increase LHV efficiency = 2–3% points decrease in CO<sub>2</sub> emissions

CO<sub>2</sub> reduction potential of coal-fired power plants by increased efficiency



Source: VGB PowerTech 2013

# Cleaner coal is real but needs more action

- Japan and China have been the most active in building USC plants.
- J-Power upgraded their 1967 sub-critical Isogo coal-fired power plant to an USC 43% efficiency plant with SO<sub>x</sub>, NO<sub>x</sub>, PM reduced to less than 1/3 of previous levels.
- China's Waigaoqiao plant has a capacity of 5000MW and China is relying on these larger, advanced units for dispatch to displace higher emission from older, less efficient power stations.
- The units have integrated advanced air quality control systems, yielding non-carbon air emissions well below China's latest more stringent standards, and also below comparable standards in North America and Europe.



*Japan: Isogo Power Station – Ultra Supercritical Technology  
(Courtesy of J – Power)*



*China: Waigaoqiao No3 Power Station, Pudong New Area of  
Shanghai – 500MW*

WCA proposes the PACE concept to support HELE



# A Global Platform for Accelerating Coal Efficiency

- International platform to help drive deployment of HELE technologies in developing and emerging economies
- Public private partnership
- Currently seeking partners to help build an initial alliance



# The potential impact of HELE is significant in a global context

## Emission reductions by policies / actions, bn tonnes CO<sub>2</sub> equivalent

Policy / Action	Cumulative emissions	Period	Annual emissions*
Montreal protocol	135.0bn	1989-2013	5.6bn
Hydropower worldwide	2.8bn	2010	2.8bn
Nuclear power worldwide	2.2bn	2010	2.2bn
Increase average global efficiency of coal-fired power plants to 40%			2bn
China one-child policy	1.3bn	2005	1.3bn
Other renewables worldwide	600m	2010	600m
US vehicle emissions & fuel economy standards*	6.0bn	2012-2025	460m
Brazil forest preservation	3.2bn	2005-2013	400m
India land-use change	177m	2007	177m
Clean Development Mechanism	1.5bn	2004-2014	150m
Collapse of USSR	709m	1992-1998	118m
Global Environment Facility	2.3bn	1991-2014	100m
EU energy efficiency	230m	2008-2012	58m
EU renewables	117m	2008-2012	29m

\* Annual emissions are cumulative emissions divided by the relevant period.

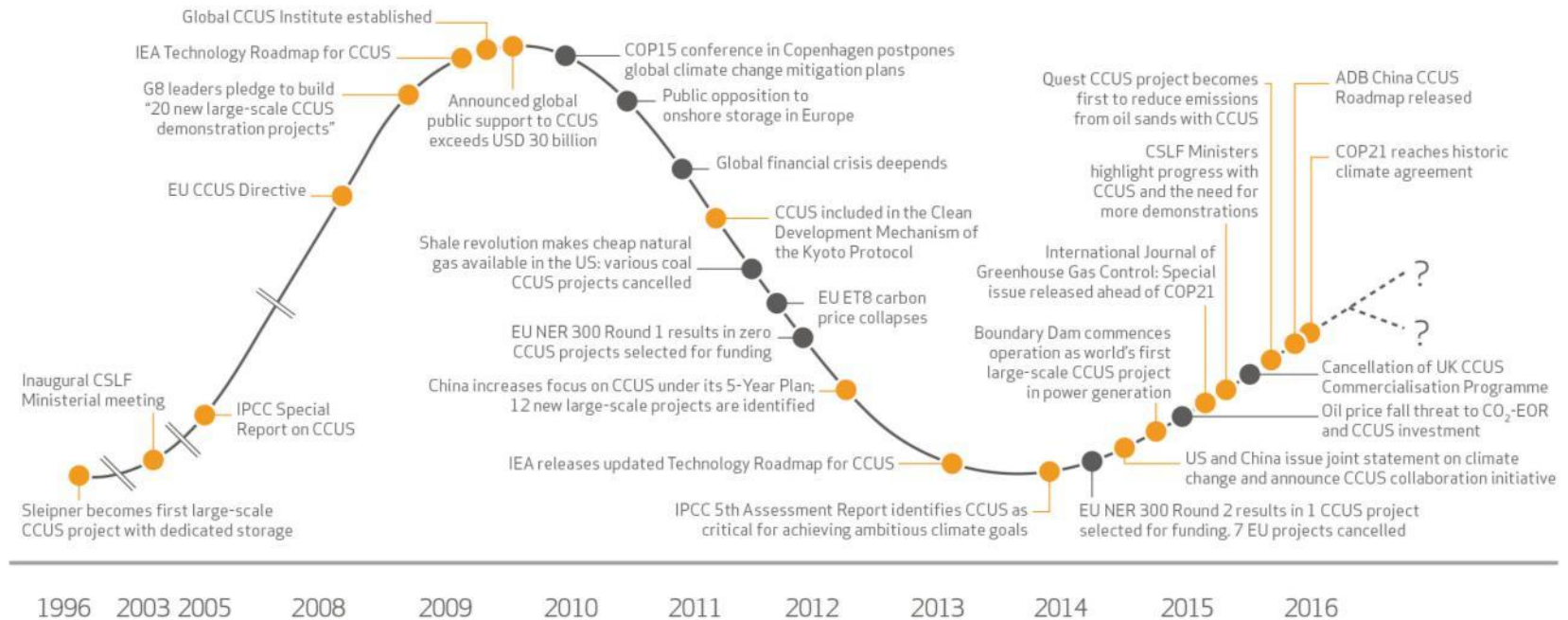
The estimate for the current emissions avoided under the Montreal protocol is eight billion tonnes of CO<sub>2</sub>e.

The annual figure for the collapse of the USSR refers to the years 1992-1998. \*Cars and light trucks

Sources: The Economist 2014 and International Energy Agency 2013

# CCS needs policy parity

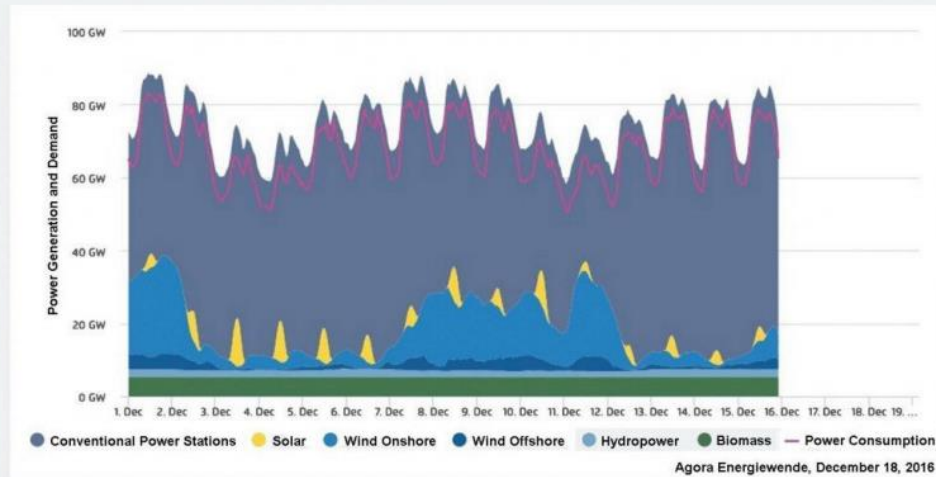
## Fluctuating policy and political support for CCS



Source: IEA (2016), *20 years of Carbon Capture and Storage: Accelerating Future Deployment*. Figure adapted from SBC Energy Institute (2016), *Low Carbon Energy Technologies Fact Book Update: Carbon Capture and Storage at a Crossroads*.

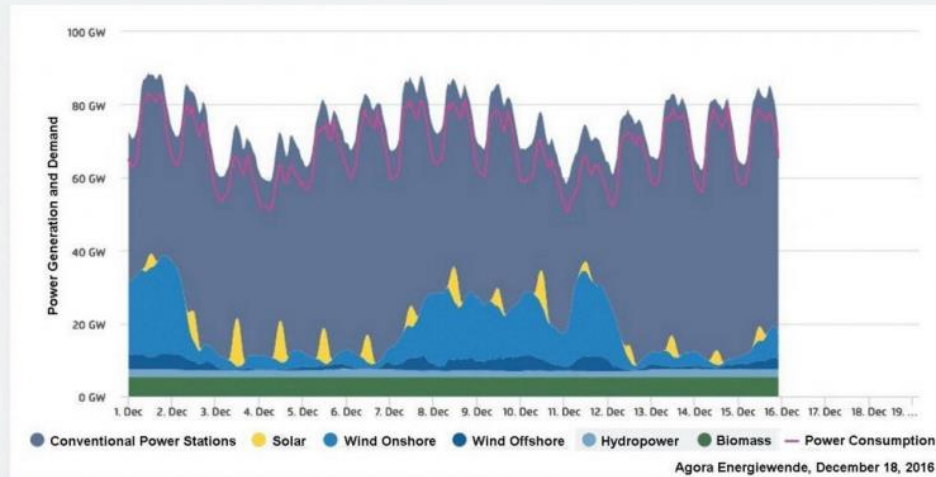
# There are real challenges to high renewable penetration

Power Generation and Demand, Germany December 2016

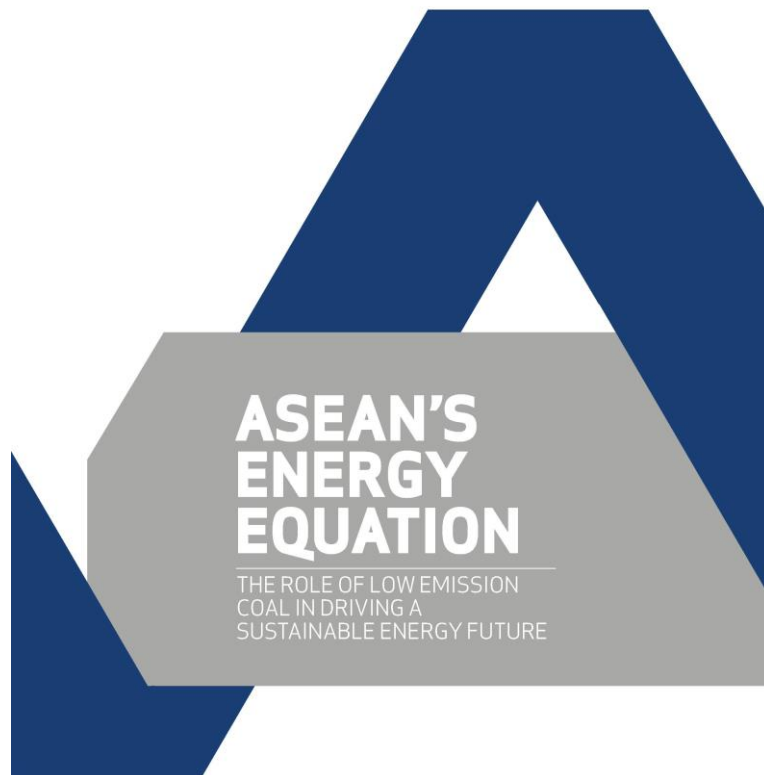


# There are real challenges to high renewable penetration

Power Generation and Demand, Germany December 2016



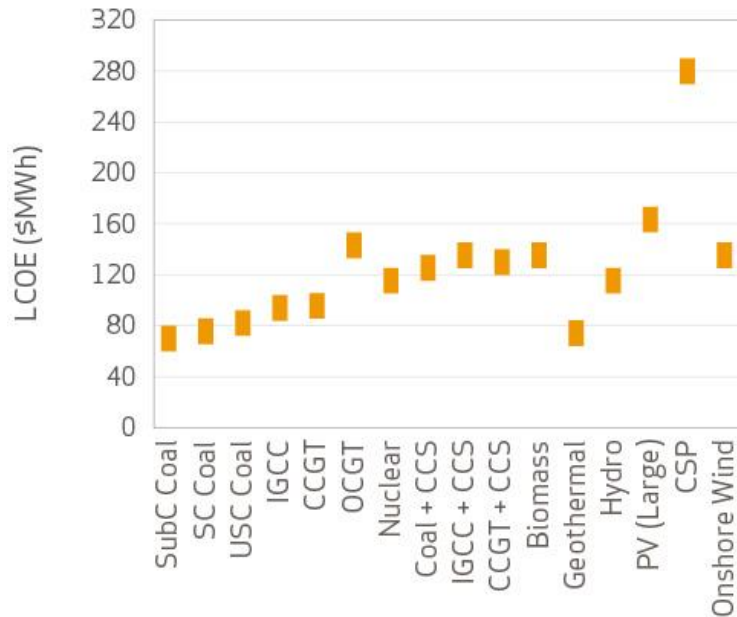
# ASEAN's Energy Equation



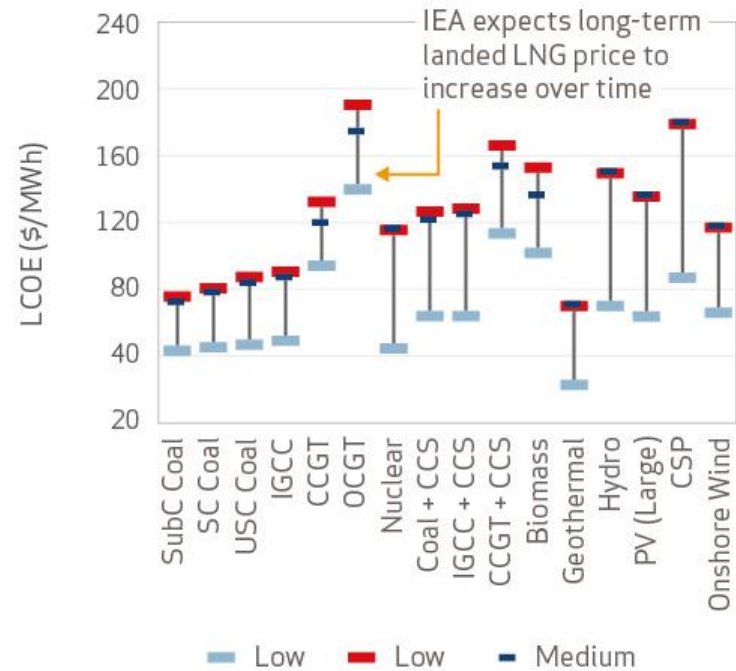
- 'Coal and Cleaner Coal Technologies' (CCT) were identified as a key programme area in APAEC 2016 – 2025
- 'ASEAN Energy Equation' provides a comprehensive analysis of the energy security and sustainable development opportunities that CCT provide

# Cleaner coal is the lowest cost option among the low-carbon technologies

ASEAN Average  
2020 Commercial Operation



ASEAN Average  
2035 (No CO<sub>2</sub> Price Assumed)



# Improving coal efficiency delivers cost benefits locally and emissions reductions globally

## ASEAN

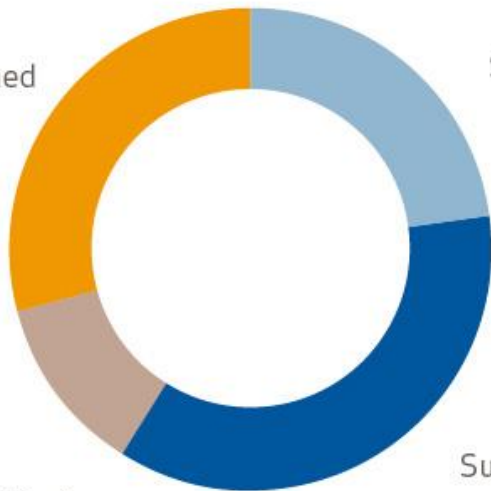
Under Construction and Planned Coal Fired Capacity (80GW)

29%  
Undefined

23%  
Subcritical

12%  
Ultra-supercritical

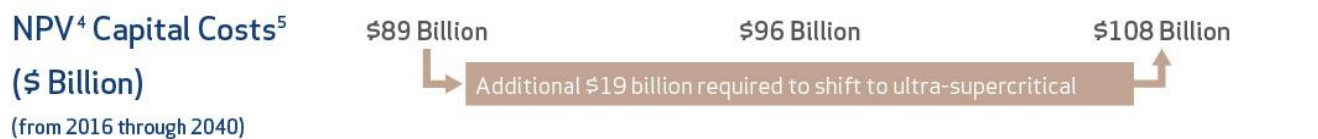
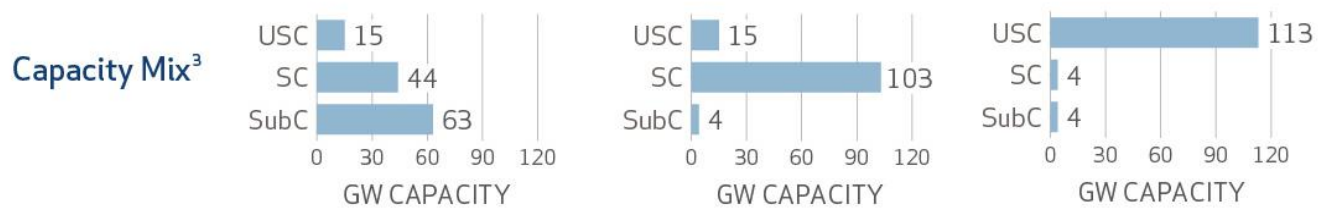
36%  
Supercritical



- Promoting HELE deployment across ASEAN would result in significant carbon emissions reduction to global benefit.
- Shifting the region's forecast coal capacity in 2035 from the current mix to ultra-supercritical would reduce cumulative emissions by 1.3 billion tonnes.

# Mobilising finance will be an important factor in realising this outcome...

	Mix per current pipeline	Shift to Supercritical	Shift to Ultra-supercritical
<b>Scenario Description</b>	Total installed coal capacity by 2035 based on IEA SEA-EO <sup>1</sup> projections with linear extrapolation between current pipeline of projects as reported by the Platts WEPD <sup>2</sup> (percentage of subcritical capacity through 2035 based on current pipeline)	Shift capacity from subcritical to supercritical except plant that are under construction or planned subcritical plant with capacity lower than 300 MW	Shift all capacity from supercritical in the previous scenario to ultra-supercritical



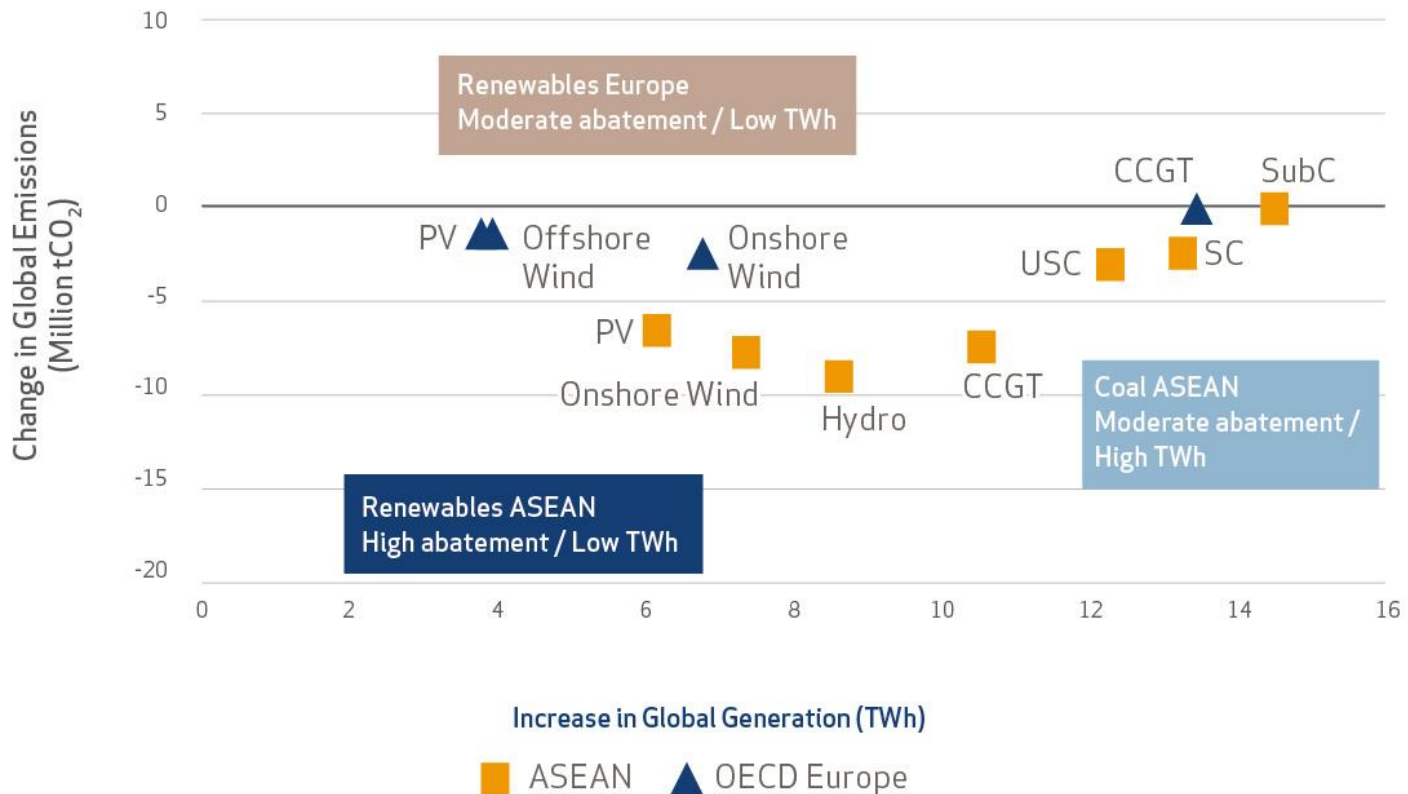


# ...The benefits are significant

Scenario	Capacity mix <sup>1</sup>	CO <sub>2</sub> emissions (tCO <sub>2</sub> ) (over 40 years)	CO <sub>2</sub> abated equivalent to										
			Subcritical plant closure <sup>2</sup>	Number of new wind turbines <sup>3</sup>	Cars removed from the road <sup>4</sup>								
Mix per development pipeline	<table border="1"> <tr><th>Technology</th><th>GW Capacity</th></tr> <tr><td>USC</td><td>15</td></tr> <tr><td>SC</td><td>44</td></tr> <tr><td>SubC</td><td>63</td></tr> </table>	Technology	GW Capacity	USC	15	SC	44	SubC	63	22.8 Billion			
Technology	GW Capacity												
USC	15												
SC	44												
SubC	63												
Shift to Supercritical	<table border="1"> <tr><th>Technology</th><th>GW Capacity</th></tr> <tr><td>USC</td><td>15</td></tr> <tr><td>SC</td><td>103</td></tr> <tr><td>SubC</td><td>4</td></tr> </table>	Technology	GW Capacity	USC	15	SC	103	SubC	4	20.8 Billion	 20	 15,000	 96 million
Technology	GW Capacity												
USC	15												
SC	103												
SubC	4												
Shift to Ultra- Supercritical	<table border="1"> <tr><th>Technology</th><th>GW Capacity</th></tr> <tr><td>USC</td><td>113</td></tr> <tr><td>SC</td><td>4</td></tr> <tr><td>SubC</td><td>4</td></tr> </table>	Technology	GW Capacity	USC	113	SC	4	SubC	4	19.5 Billion	 32	 25,000	 157 million
Technology	GW Capacity												
USC	113												
SC	4												
SubC	4												

# Investment to ensure an efficient coal fleet in Southeast Asia is vital for global climate ambitions

Assuming a \$1 Billion Investment



*Enhanced investment in coal to improve efficiency is arguably one of the most effective mitigation actions available*

# WCA encourages ASEAN Member States to adopt 'ASEAN's Energy Equation's Call to Action'

1. Statement emphasising continued commitment to the deployment of cleaner coal technologies
2. With necessary support from partners, member states commit to enhanced action, ultimately leading to a pledge to end the use of subcritical coal (where feasible)
3. Calling on the international community to provide support for cleaner coal technology deployment



# WORLD COAL ASSOCIATION

[www.worldcoal.org](http://www.worldcoal.org)  
[info@worldcoal.org](mailto:info@worldcoal.org)