

# No More Role for Coal??



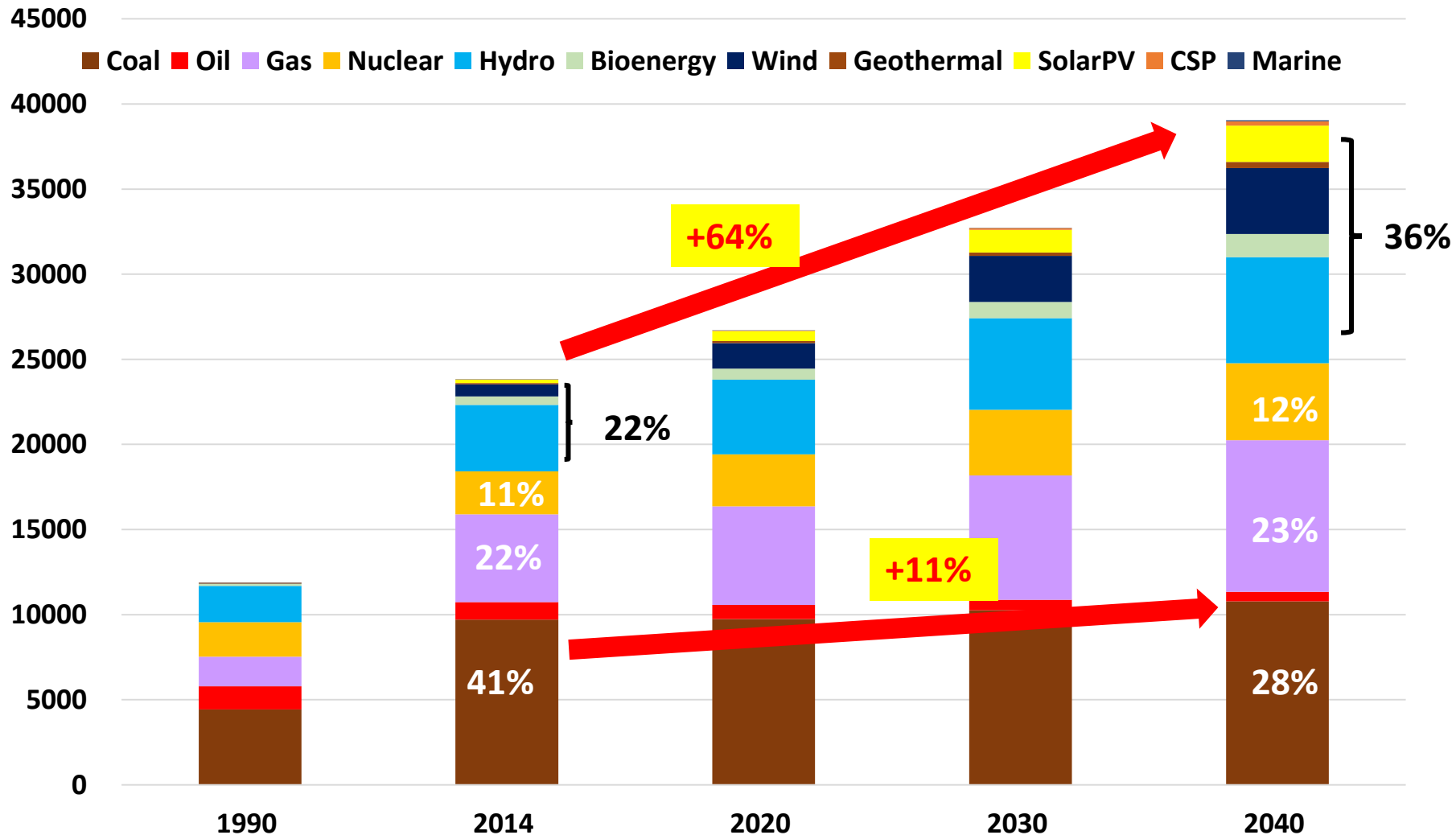
**9 August 2017**

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ERIA**

# Global Power Generation Mix in New Policy Scenario

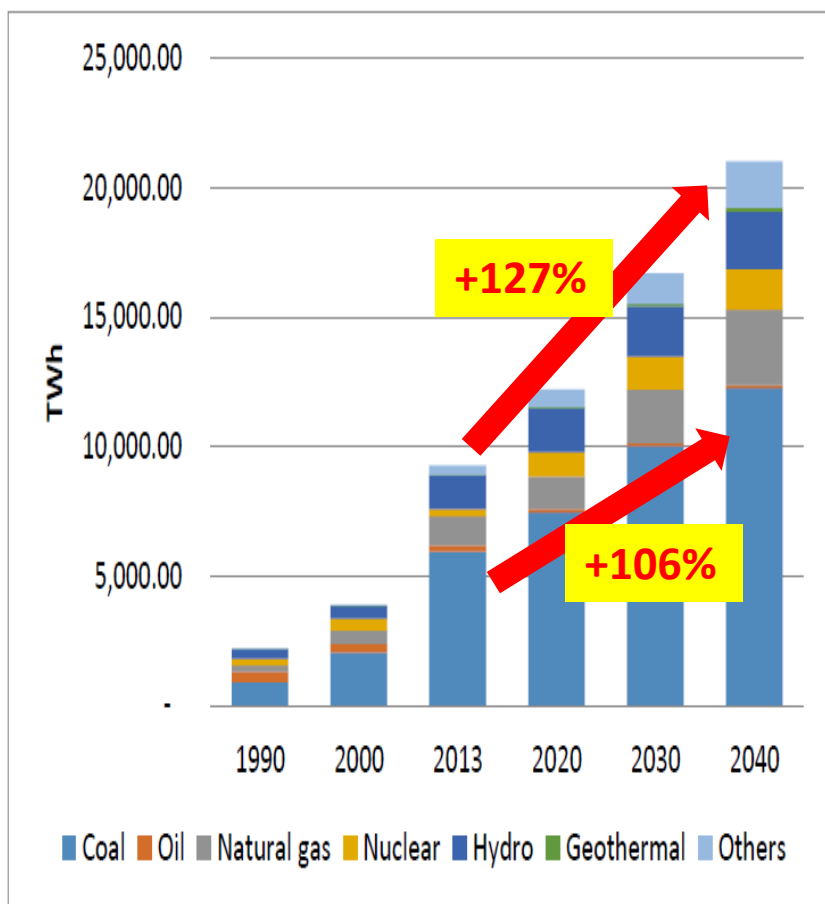
While losing out to renewable as the world's largest power source in 2040, coal still accounts for 28%.



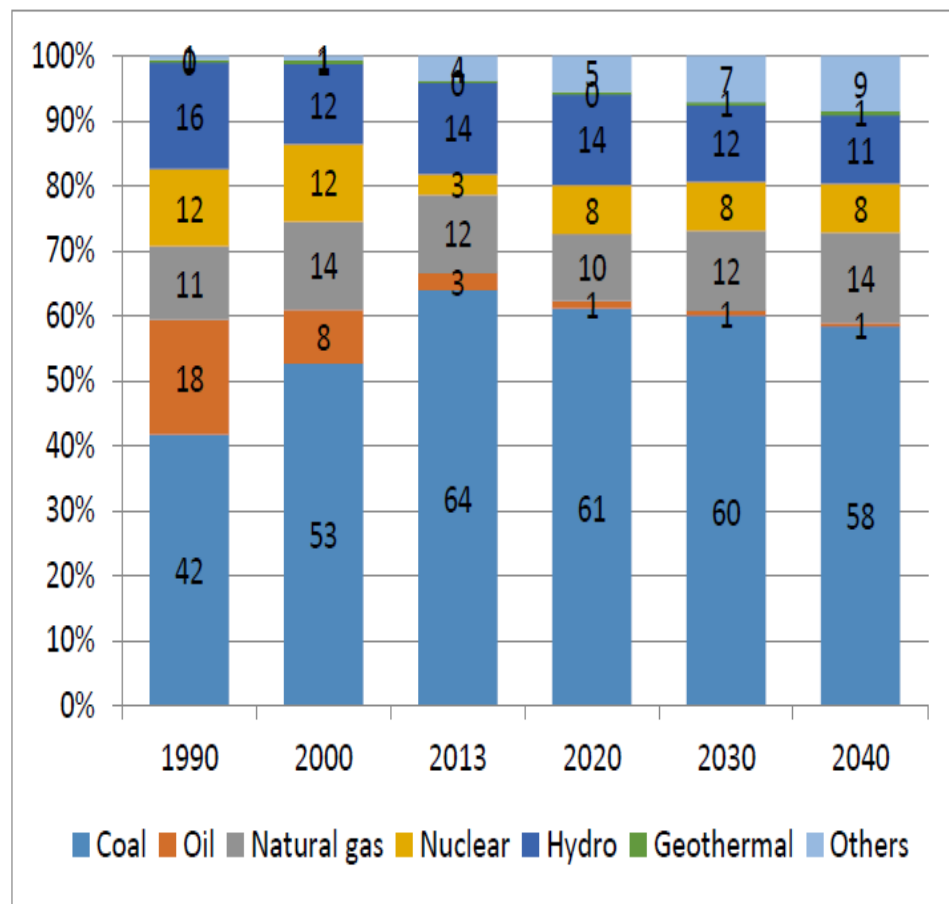
# Power Generation Mix in EAS Region

**In the EAS Region, electricity demand grows much higher than world average. Coal power generation will double by 2040.**

Power Generation in the EAS Region



Power Generation Mix in the EAS Region



EAS = East Asia Summit; TWh = terawatt-hour.

Source: Energy Outlook and Energy Saving Potential in East Asia 2016

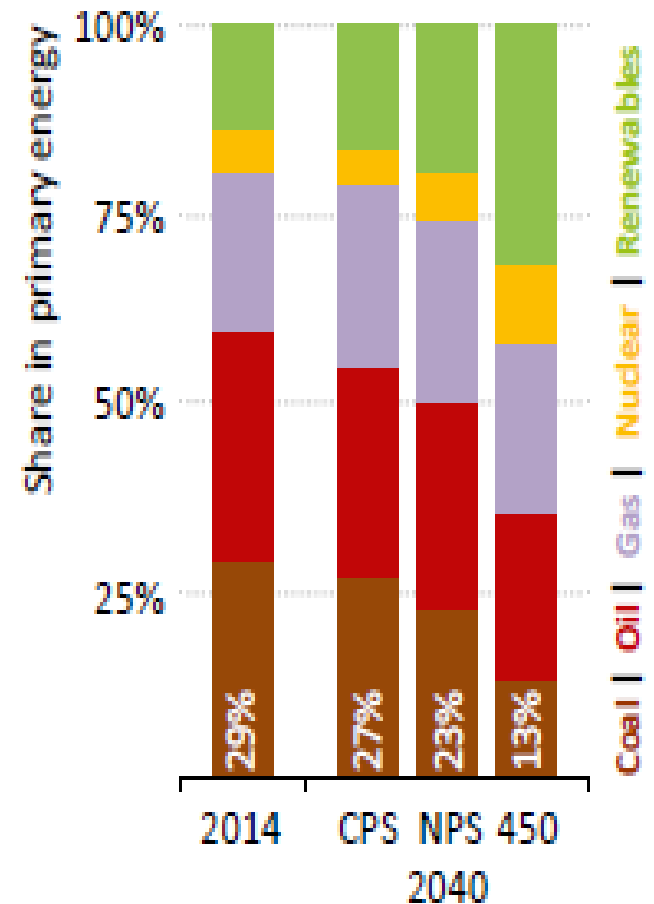
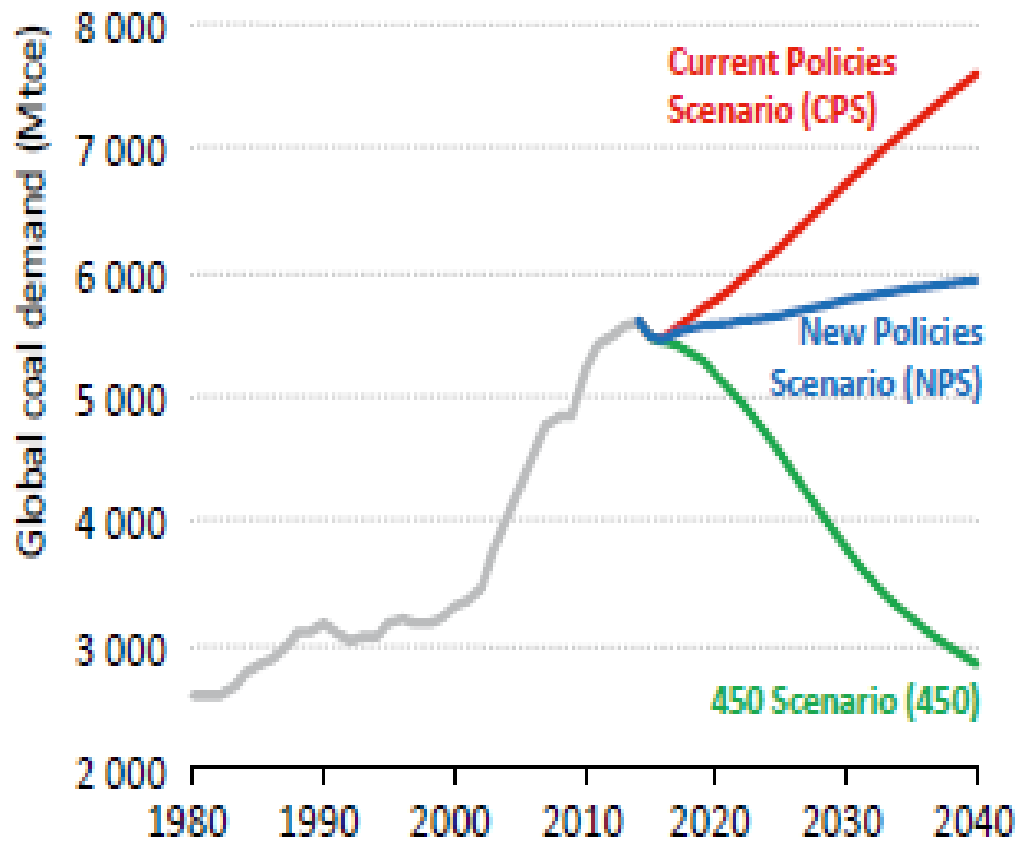
# Paris Agreement (Dec 2015)

Paris Agreement aims at keeping a global temperature rise this century well below 2 degrees Celsius and to drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels.

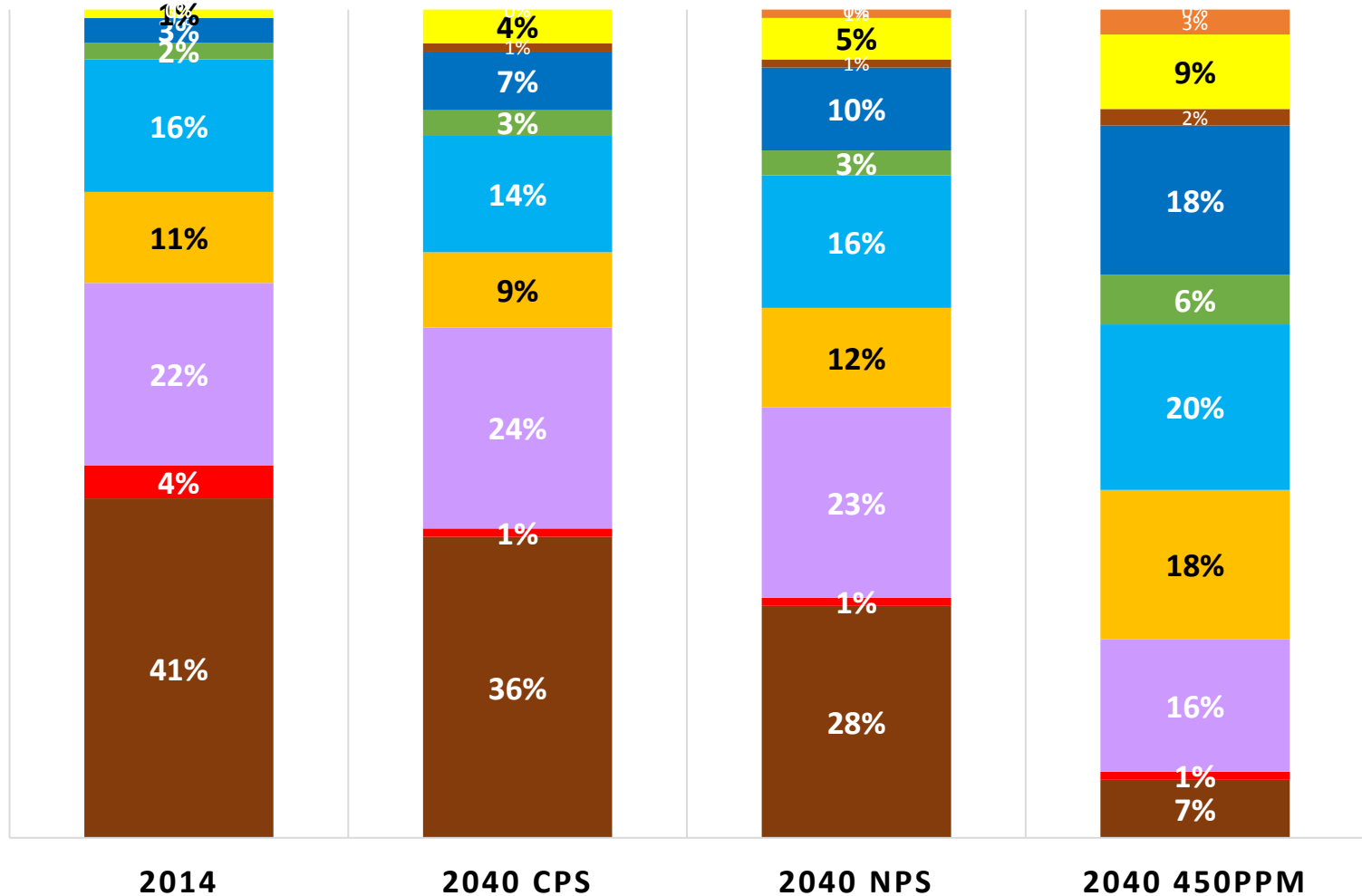


# What 450 Scenario Means

To achieve 450 ppm scenario, coal demand needs to be almost halved between now and 2040.



# What 450 Scenario Means



# Coal Divestment Movement

Coal is being vilified by environmental groups.



# “Keep Them Under Ground” Campaign

The Carbon Brief

Globally



52% of natural gas reserves



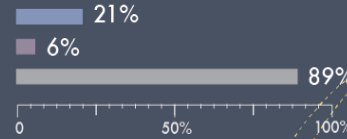
35% of oil reserves



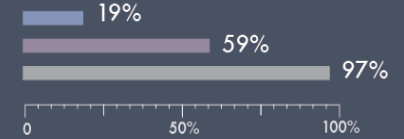
88% of coal reserves

How much oil, gas and coal will we have to leave in the ground to stay under 2 degrees of warming?

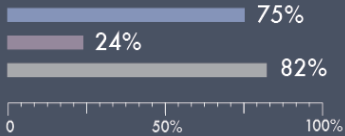
Europe



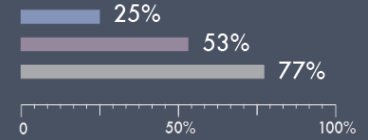
Former Soviet Union countries



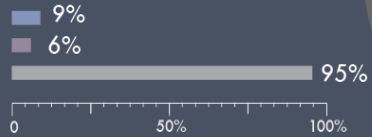
Canada



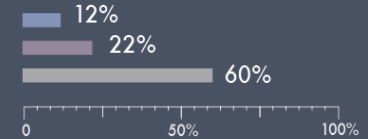
China and India



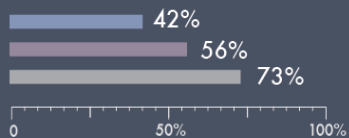
US



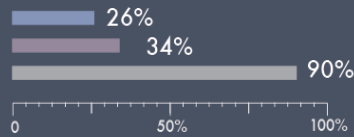
Other developing Asian countries



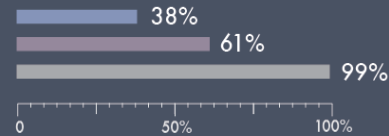
Central and South America



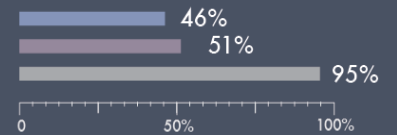
Africa



Middle East



OECD Pacific





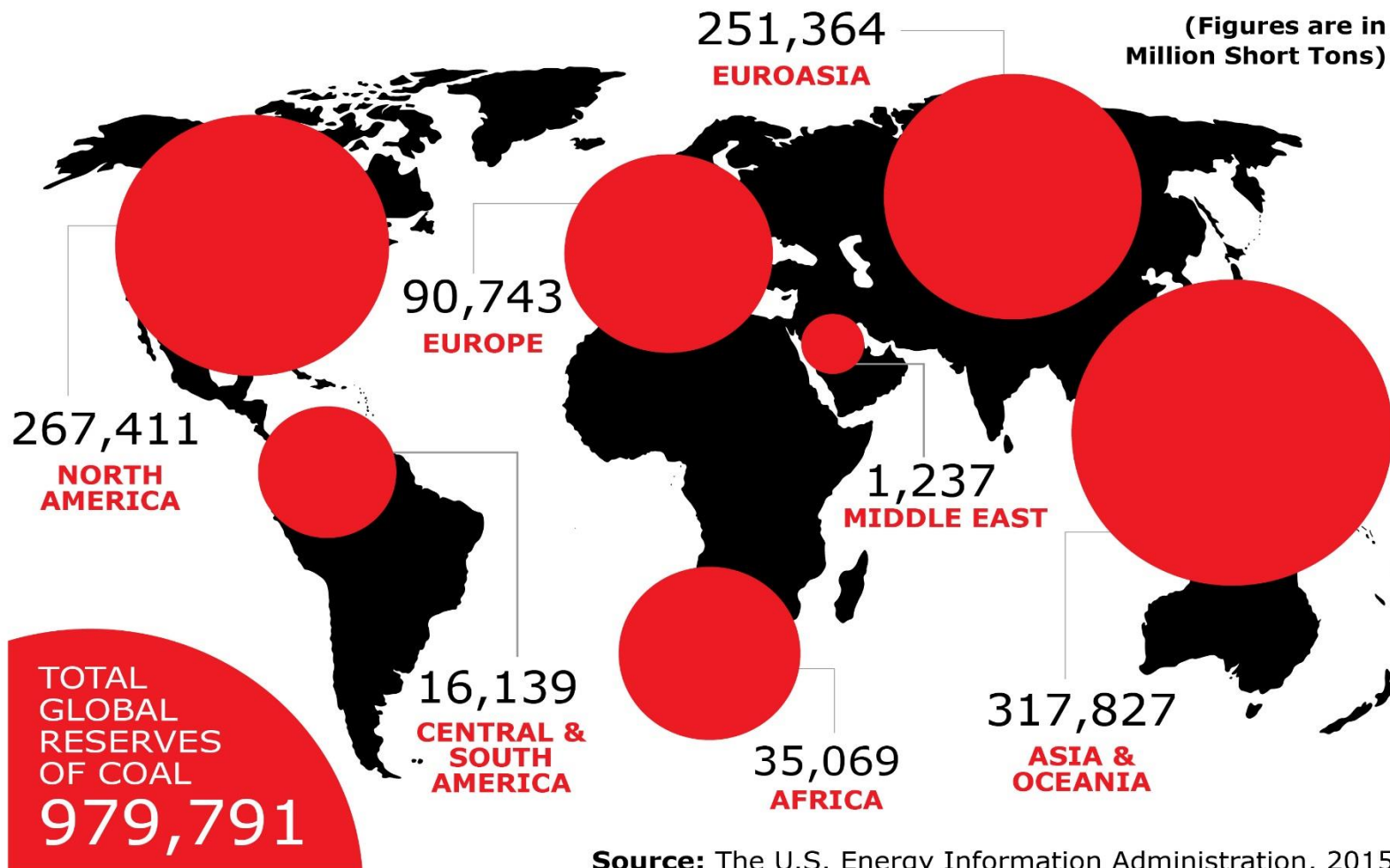
# Abundant Coal Reserves in EAS Region

## WORLD COAL RESERVES BY REGION

Coal reserves are available in almost every country. The biggest reserves are in the Asia & Oceania region.



(Figures are in Million Short Tons)

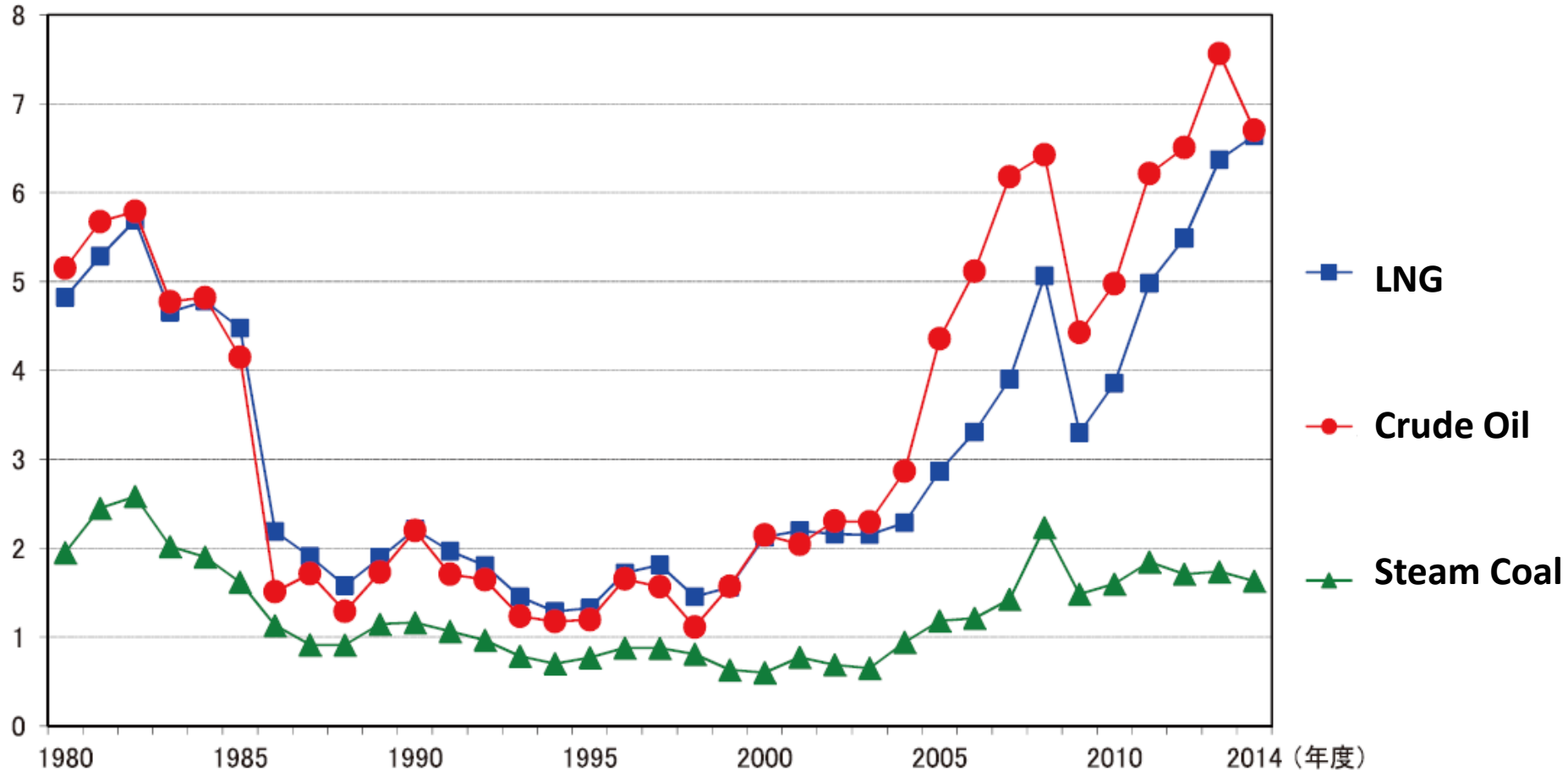


Source: The U.S. Energy Information Administration, 2015

# Fossil Energy Prices per Units of Heat

**Coal prices are lower and more stable compared with other fossil fuels.**

JPY/1000kcal

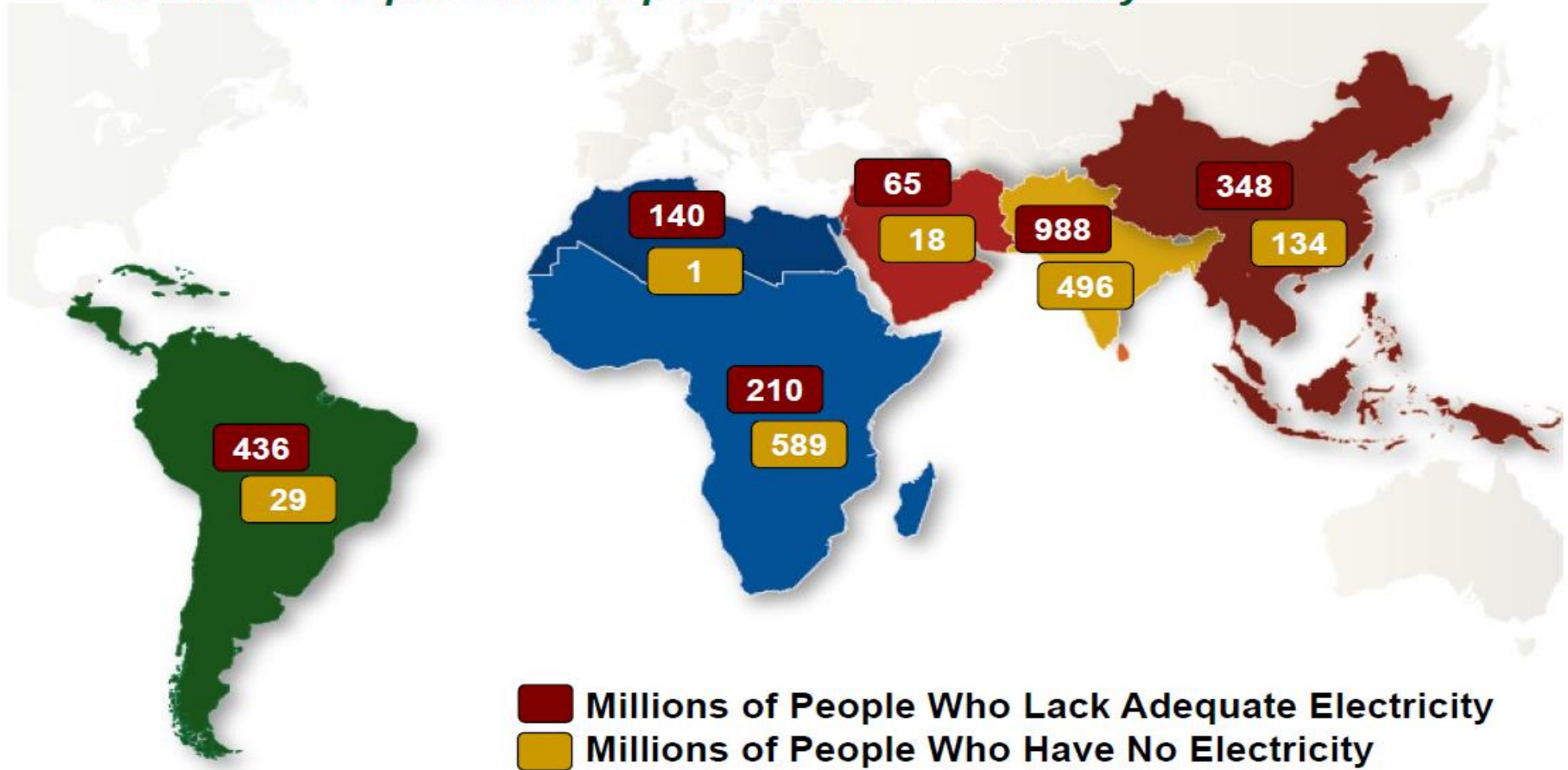


Source: Institute of Energy Economics of Japan Energy Economy Statistics 2016

# Energy Poverty

**For improving access to electricity, cheap and abundant coal cannot be simply dismissed.**

*3.5 Billion People Lack Proper Access to Electricity*

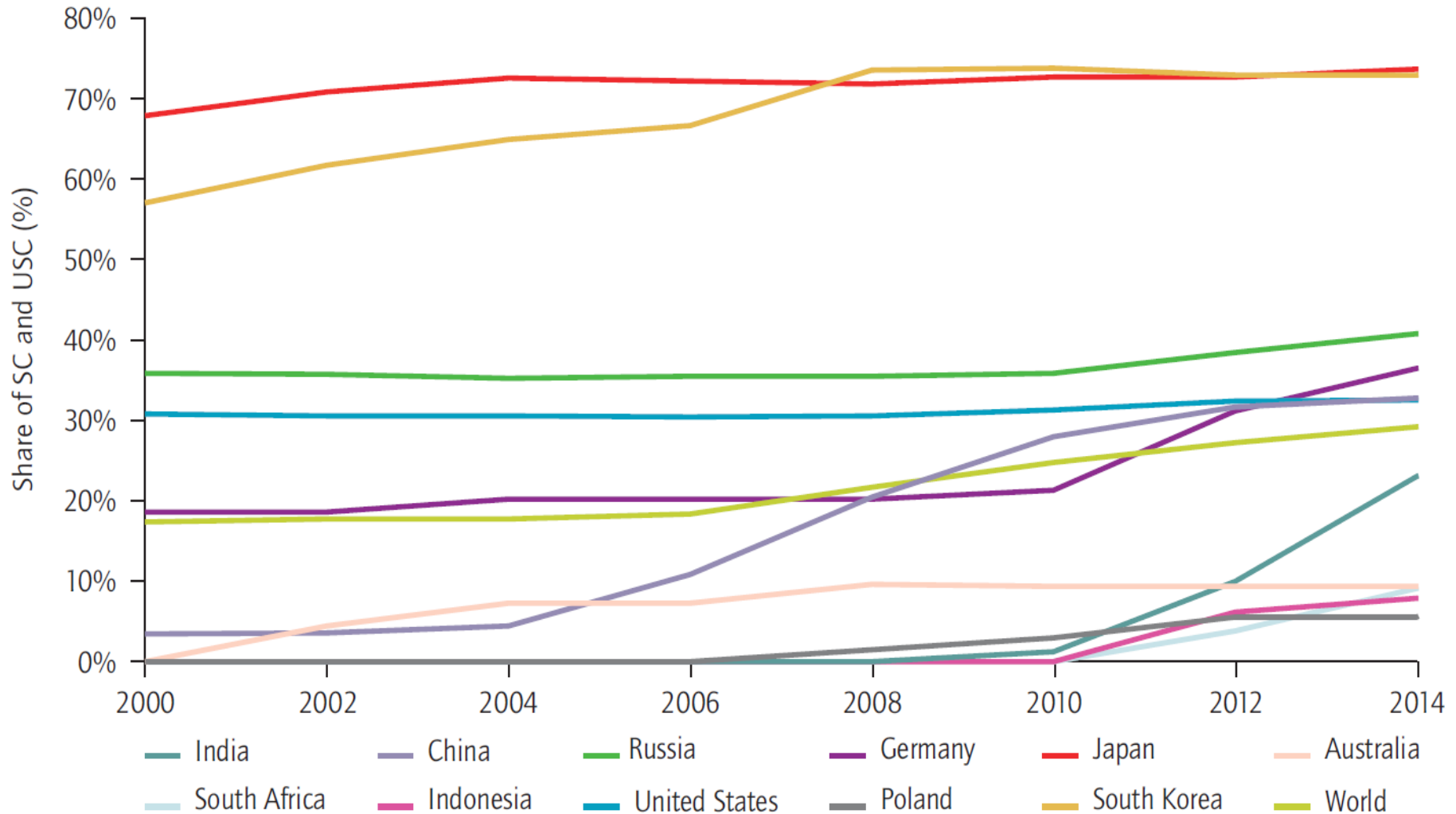


# Comparison of Upfront Cost of Coal Thermal Technologies

	Boiler Type		
	Ultra Super Critical (USC)	Super Critical (SC)	Sub-critical (C)
Thermal Efficiency	41.5% ~ 45.0%	40.1% ~ 42.7%	37.4% ~ 40.7%
Initial Cost	1,298 mln USD	991 ~ 1,240 mln USD	867 ~ 991 mln USD
Fuel Consumption	2,229,000 tons/year (100%)	2,275,000 tons/year (+2.1%)	2,413,000 tons/year (+8.3%)
CO2 Emission (ton/year)	5,126,000 tons/year (100%)	5,231,000 tons/year (+2.11%)	5,549,000 tons/year (+8.3%)
O&M Cost	3.42 mln USD/year	4.1 mln USD/year	5.0 mln USD/year
Generation Cost at USD 100/ton (USD cent/kWh)	4.03 cent/kWh (100%)	4.19 cent/kWh (+3.9%)	4.44 cent/kWh (+10.2%)
Examples	<ul style="list-style-type: none"> <li>✓ “Isogo” J-POWER</li> <li>✓ “Tachibanawan” J-POWER</li> <li>✓ “Nordjylland”, Denmark</li> <li>✓ Xinchang, China</li> </ul>	<ul style="list-style-type: none"> <li>✓ “Takehara” J-POWER</li> <li>✓ “Matsushima” J-POWER</li> </ul>	<ul style="list-style-type: none"> <li>✓ Taichung Power Plant</li> <li>✓ Thai Binh 2</li> </ul>

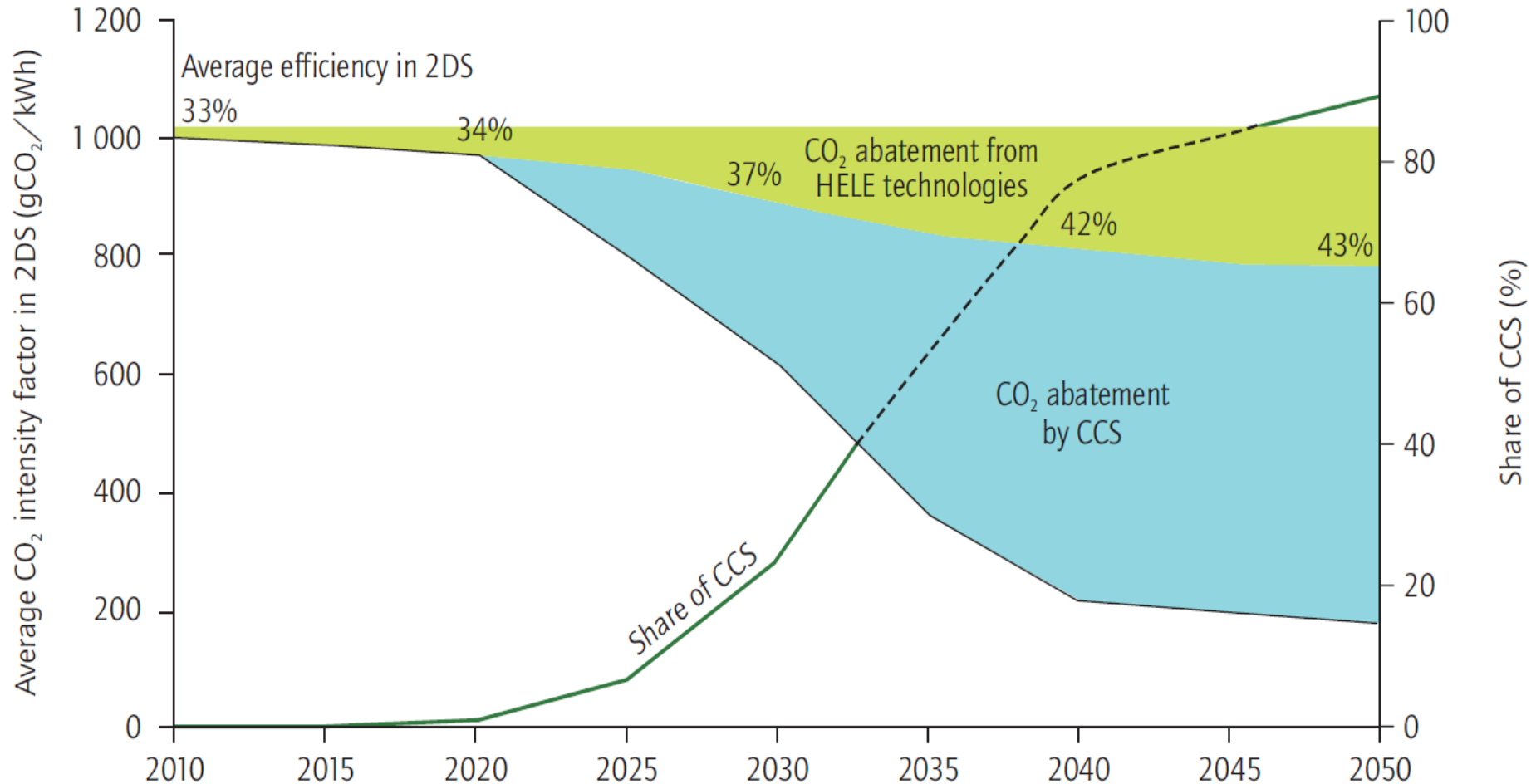
# Share of SC and USC Capacity in Major Countries

The share of SC and USC is still low in many countries



# Role of HELE Technologies and CCS in 2 Degrees Scenario

**2 degrees scenario requires widespread use of CCS (Carbon Capture and Storage) technologies on top of HELE technologies.**



# Sustainable Use of Coal: Policy Challenges

- Carbon constraints under Paris Agreement
- “Stigmatization” of coal by environmental groups is rampant
- Public acceptance is getting more challenging
- High upfront cost of high efficiency low emissions coal technologies could hinder their deployment.
- There could be financial constraints (e.g. OECD Export Credit Guideline, Taskforce of Climate-related Financial Disclosure)
- CCS needs to overcome further challenges
  - ◆ Regulatory uncertainty
  - ◆ Investor uncertainty
  - ◆ Storage space availability
  - ◆ Stakeholder resistance