



GLOBAL COMMISSION
ON THE GEOPOLITICS
OF ENERGY TRANSFORMATION



IRENA

International Renewable Energy Agency

A New World

The Geopolitics of the Energy Transformation

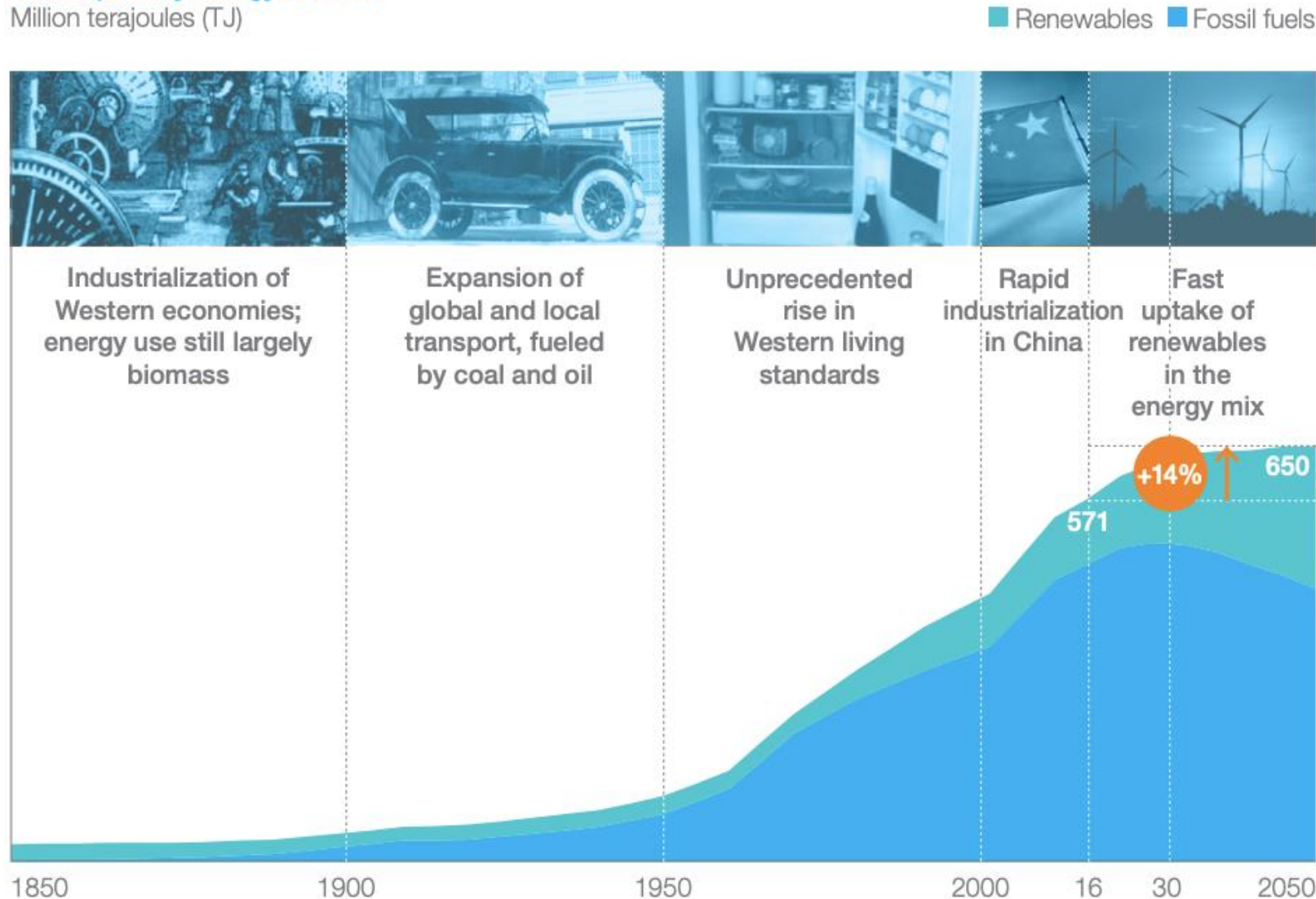
Mari Pangestu
Commission Member

Jakarta, 31 July 2019



Evolusi Permintaan Energi “tradisional” (migas, batubara) seiring dengan perkembangan ekonomi dunia – diprediksi akan mendatar pada 2030 dengan adanya penggunaan energy terbarukan (renewables) dalam komposisi energy. Fossil fuels meningkat 50x selama 200 thn terakhir

Global primary energy demand
Million terajoules (TJ)

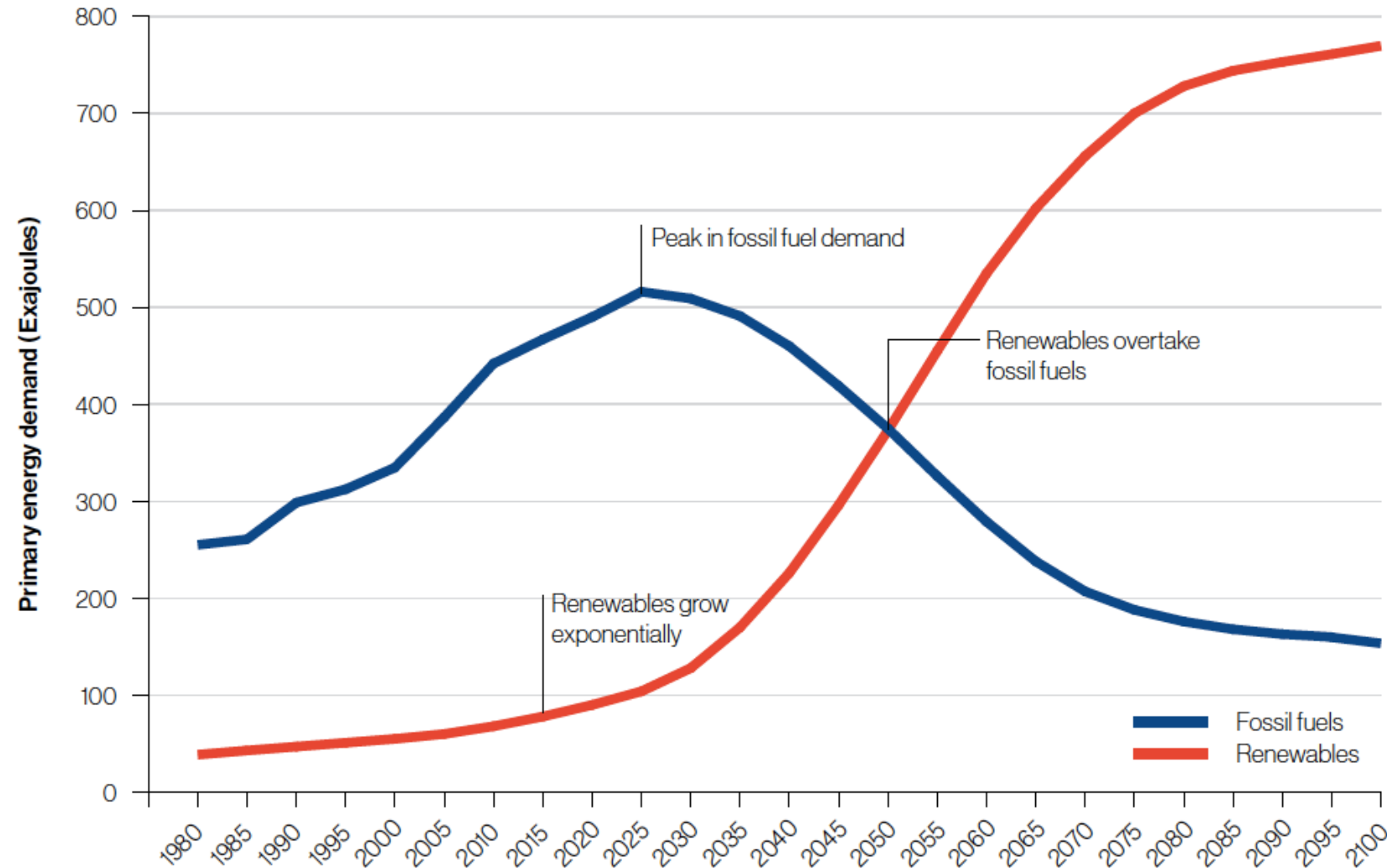


Permintaan energi justru stagnan – hanya meningkat 14% (2016-2050). Renewables (biru muda) akan berperan lebih banyak – sekitar 35% dari total permintaan energi

Bukan sekedar perubahan energy mix tetapi transformasi sistem energi: dampak sosial, ekonomi, dan politik diluar sektor energi

Scenario for Renewables overtake fossil fuels by 2050 in line with Paris Agreement

Figure 1. The energy transition framework



Source: Shell Sky Scenario, 2018

Overall, transformasi energi digambarkan oleh ilustrasi ini:

A near-term peak in fossil fuel demand

A rapid uptake of renewables (solar and wind) given limits with nuclear energy

A long decline in fossil fuel demand

Dampak Geopolitik yang Luas

- Peta geopolitik dan geoekonomi akan berubah dari konsentrasi sumber fossil fuels, jika beralih ke penggunaan renewables
 - “Energy Independence” dan mengurangi ketergantungan kepada sumber dan harga energi yang volatile
 - Negara (seperti Indonesia) yang mengandalkan ekspor migas dan batubara perlu melakukan penyesuaian
 - Leapfrog fossil fuel based systems and centralized grids
 - Renewables and democratization: decentralize energy supply, empower citizens, local communities and cities

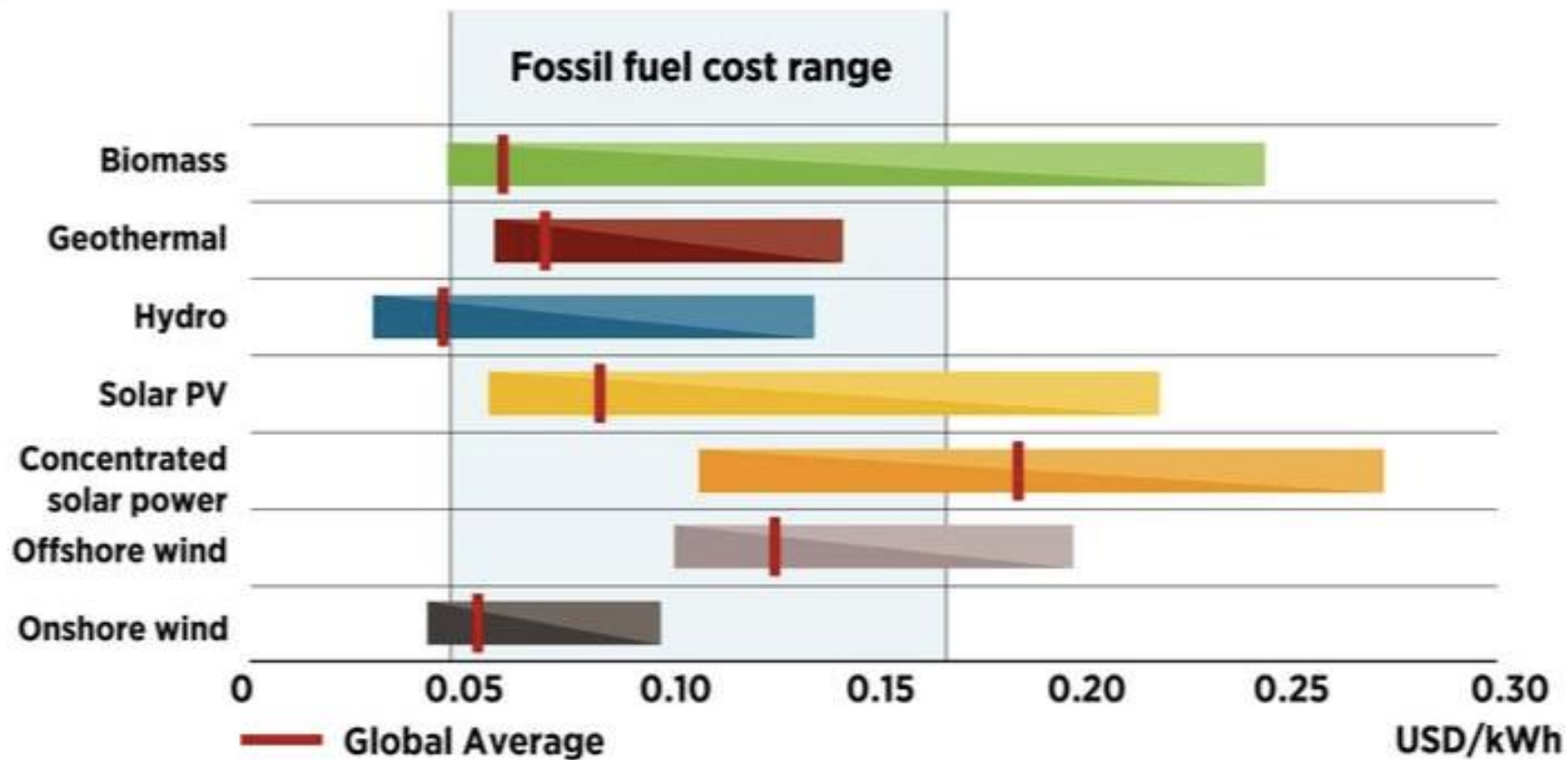
A large-scale solar farm is shown, with rows of photovoltaic panels stretching across a grassy field. The sun is low on the horizon, creating a warm, golden glow and reflecting off the panels. The sky is filled with soft, orange and yellow clouds. In the background, there are rolling hills and some distant structures.

The Forces of Change

Why Renewables grow rapidly?

1. Declining cost: hydro and geothermal, more recently solar and wind (technology, investment)

Today, the cost of electricity from renewables is cheaper or within the range of fossil fuels



1. Declining cost – especially felt in electricity sector

Table 1 Global electricity costs in 2018

	GLOBAL WEIGHTED-AVERAGE COST OF ELECTRICITY (USD/KWH) 2018	COST OF ELECTRICITY: 5TH AND 95TH PERCENTILES (USD/KWH) 2018	CHANGE IN THE COST OF ELECTRICITY 2017–2018
Bioenergy	0.062	0.048–0.243	–14%
Geothermal	0.072	0.060–0.143	–1%
Hydro	0.047	0.030–0.136	–11%
Solar photovoltaics	0.085	0.058–0.219	–13%
Concentrating solar power	0.185	0.109–0.272	–26%
Offshore wind	0.127	0.102–0.198	–1%
Onshore wind	0.056	0.044–0.100	–13%

Declining costs: investment driven by competitive business models and profit motive, not subsidized

- Since 2010 average cost of electricity from solar PV and wind energy fell by 73 and 22 percent: estimated will soon be at the lower end of fossil fuel electricity costs
 - IRENA estimates by 2025 average cost of electricity could fall by: 26% from on shore wind, 35% from offshore winds, 37% from concentrated solar power (CSP), and 59% from solar photovoltaics (PV)
- Cost of lithium ion batteries used in electric vehicles has fallen by 80% since 2010 – increase demand from electric vehicles

2. Pollution and climate change shaping public movement

- Energy sector accounts for two-thirds of global emissions
- WHO estimates that 9 out of 10 people in the world breathe polluted air and air pollution kills 7 million people every year, making it the fourth largest cause of death
- Urgency to act on climate change: last few years highest temperature
- IRENA: 90% reduction if deployment of renewables+ energy efficiency

Polusi Udara Jakarta Memburuk, Jokowi-Anies Digugat 31 Warga

CNN Indonesia | Kamis, 04/07/2019 16:12 WIB

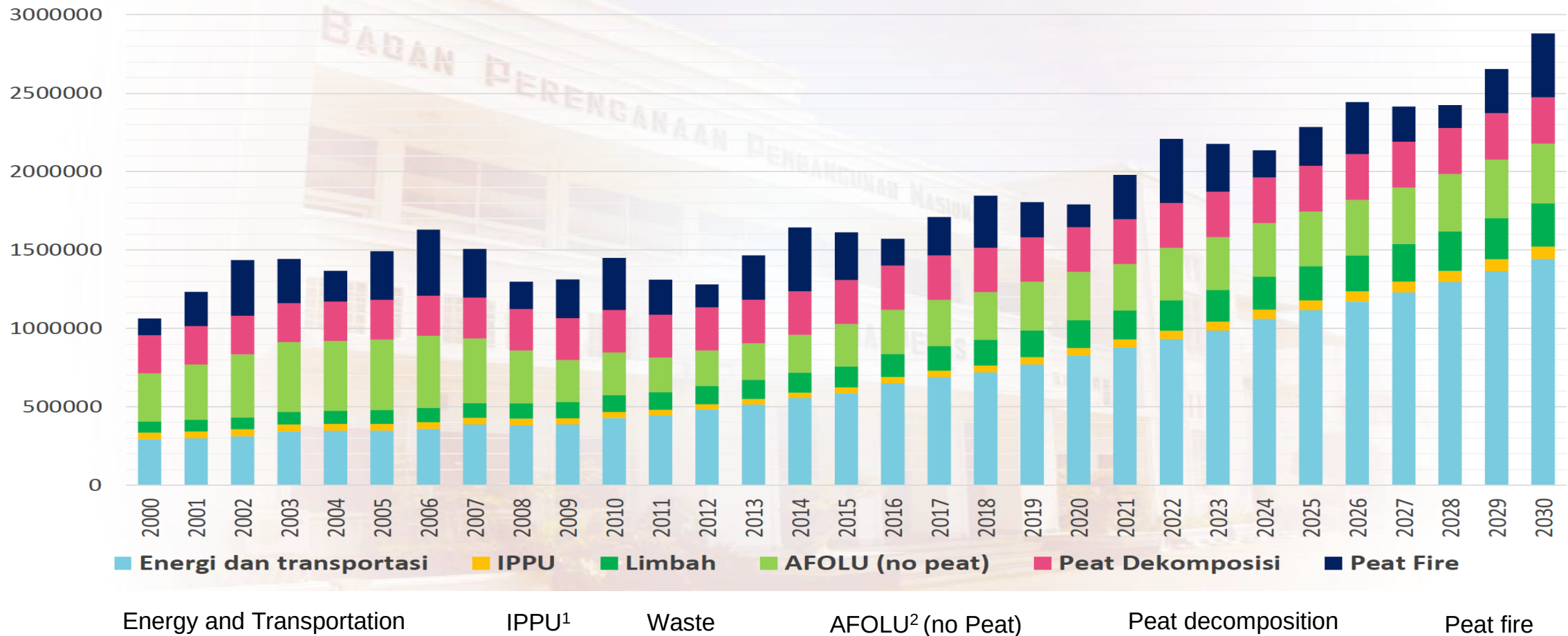
Air quality and pollution city ranking

30 July 2019, 15:45

Major city			US AQI
1		Jakarta, Indonesia	158
2		Ulaanbaatar, Mongolia	152
3		Tashkent, Uzbekistan	127
4		Hanoi, Vietnam	127
5		Santiago, Chile	119

Indonesia Emission Baseline: 2000-2030 ('000 Ton CO₂e)*

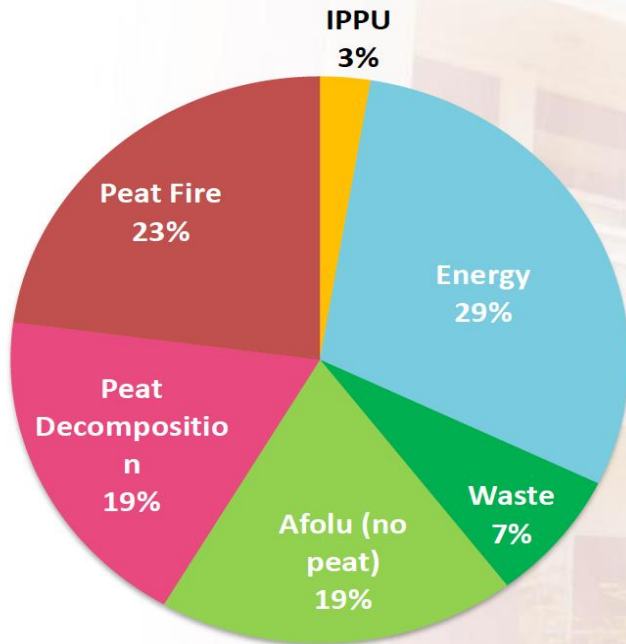
Indonesia is 8th among all countries in the World in total GHG emissions



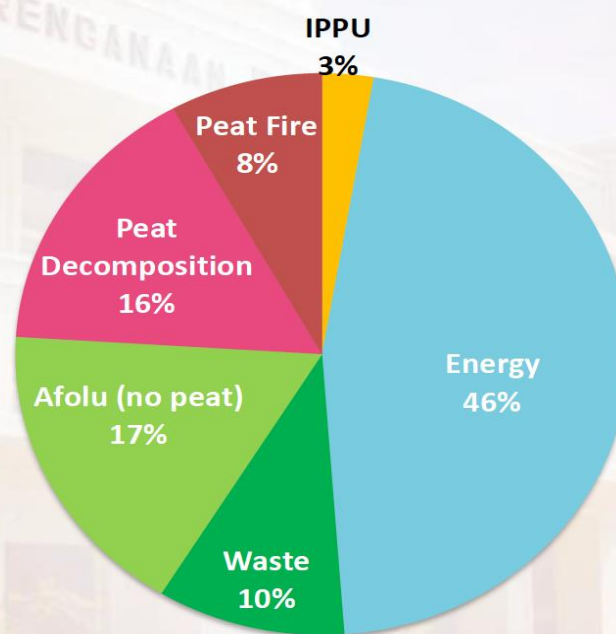
(*) Source: BAPPENAS

The Shift From Land to Energy Based Emissions*

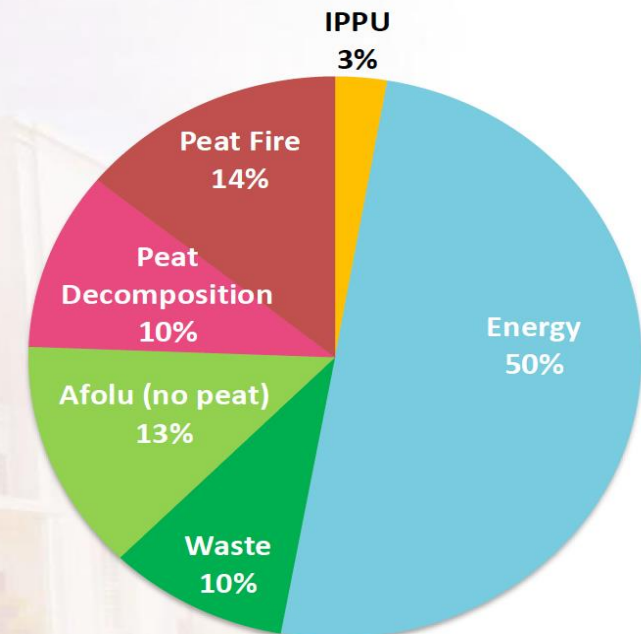
Share Baseline Emission in 2010



Share Baseline Emission in 2020



Share Baseline Emission in 2030



(*) Source: BAPPENAS

3. Renewable energy targets

- Numerous governments have raised their ambitions to achieve lower carbon
 - Sejauh ini, 57 negara telah mengembangkan rencana utk dekarbonisasi sektor energi secara menyeluruh
 - 179 negara telah menetapkan target energi terbarukan
- Including major oil-producing countries, like The United Arab Emirates
 - UAE's energy strategy: sets an objective of 44% of renewables in its power supply and a 70% reduction in its carbon emissions by 2050.
- Local governments also acted in central governments place.
 - More major cities have announced plans to ban combustion cars, like in Mexico City and Madrid

Indonesia's Commitment on Reducing GHG Emissions*



Land-based



Agriculture



Energy



Transportation



Industry



Waste

**Presidential Regulation No. 61/2011,
supported by 34 Provincial Governments**

<https://pep.pprk.bappenas.go.id>

Indonesia's Nationally Determined Contribution (NDC):

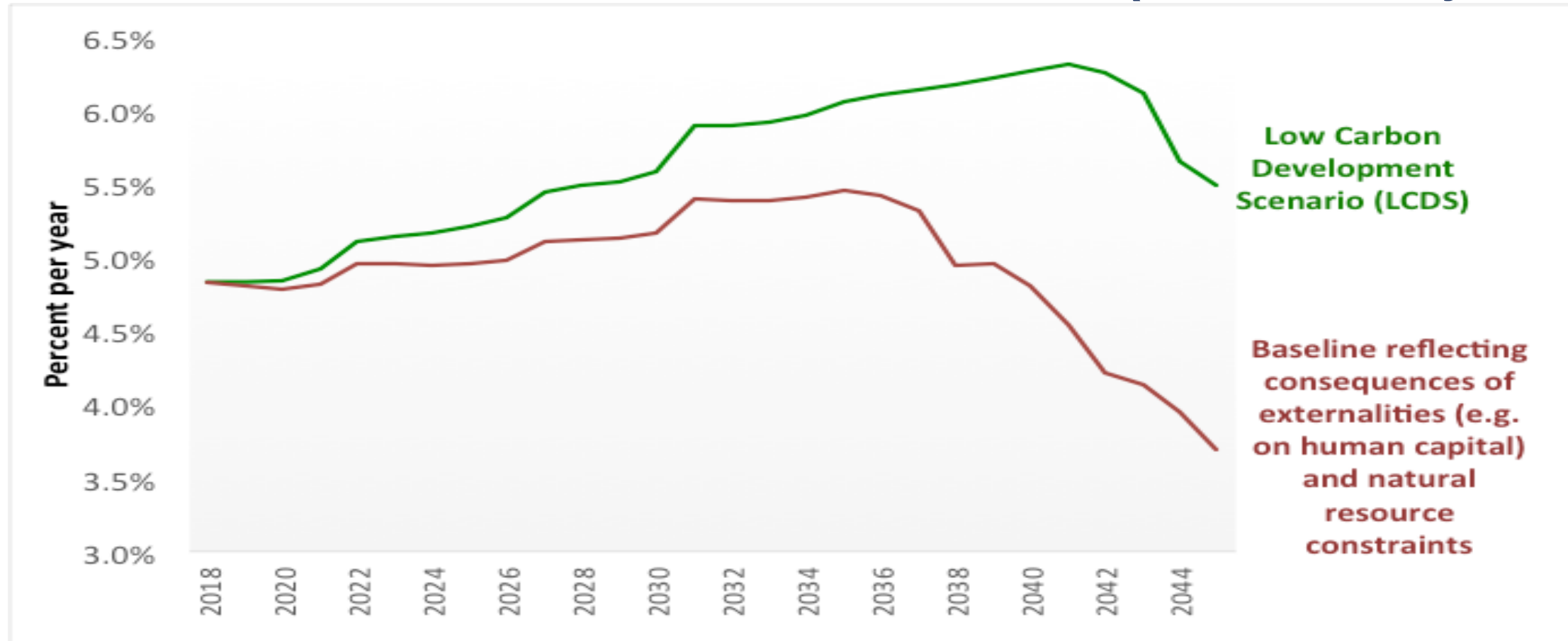
- **GHG Emission target for 2020:** 26% reduction relative to baseline, already included in RPJMN (Medium Term Development Plan) 2015-2019
- **GHG Emission target for 2030:** 29% unconditional reduction relative to baseline; 41% reduction reduction relative to baseline conditional to international financial support



Involve related ministries, local governments, and other institutions through coordination the implementation and reporting on activity to reduce the GHG emission

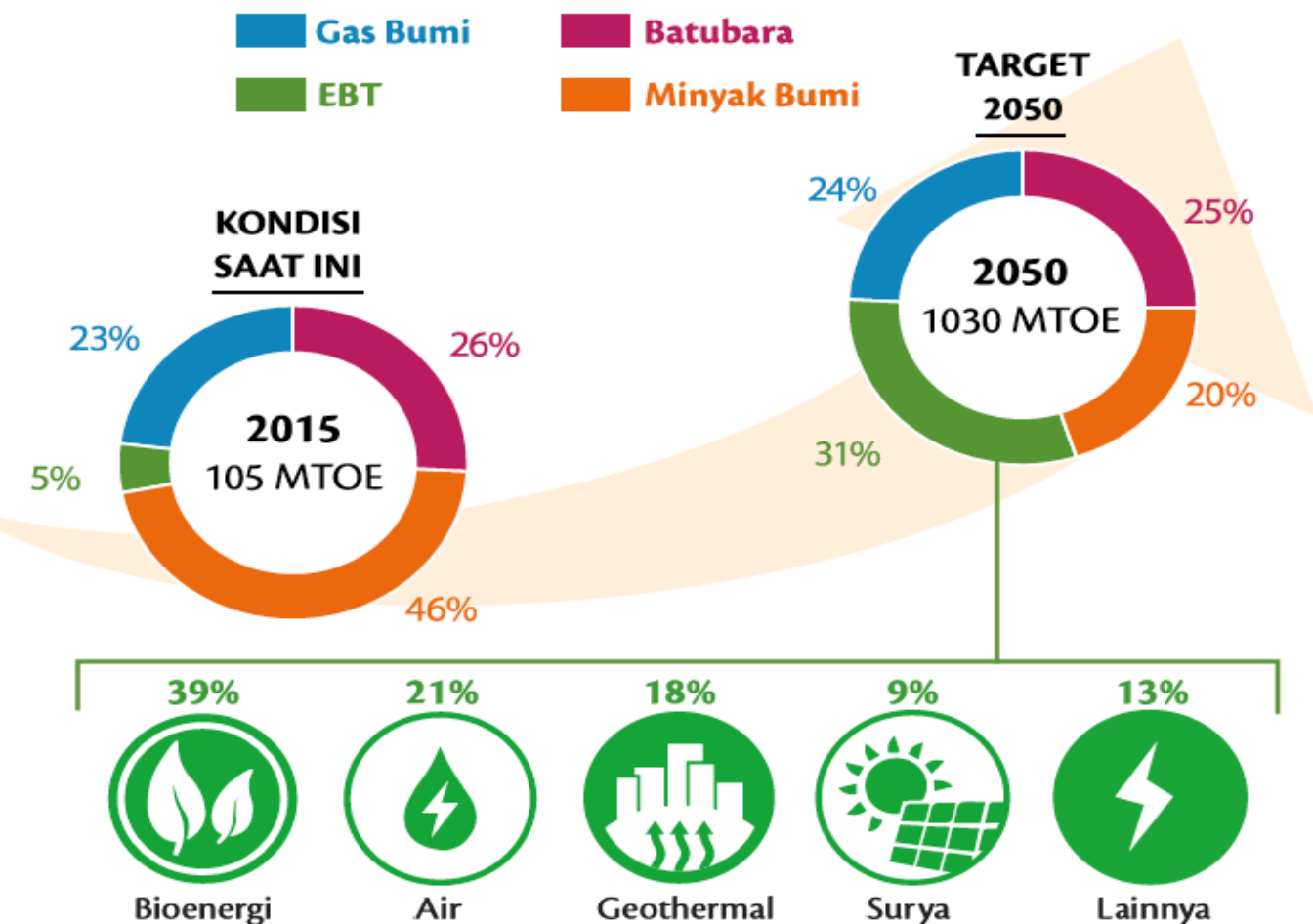
Dengan Baseline, akan mengalami penurunan pertumbuhan – tapi jika melakukan perubahan sekarang, pertumbuhan yang lebih tinggi

Total GDP Growth Rate: With Low Carbon Interventions (Green Economy – GE)



Source: NCE-LCDII and BAPPENAS Environment Directorate, based on results from Indonesia Vision 2045 Model

Peningkatan Ketahanan Energi



Energi sebagai modal pembangunan melalui peningkatan peran Energi Baru dan Terbarukan (EBT).

- Peran EBT ditingkatkan menjadi 30 persen pada tahun 2045,
- Pembangkit tenaga listrik ditingkatkan menjadi lebih dari 430 GW,
- Rasio elektrifikasi 100 persen sejak tahun 2020 dan pasokan energi per kapita menjadi 7 ribu per kWh,
- Pengembangan infrastruktur ketenagalistrikan menerapkan konsep kepulauan,
- Pemenuhan kebutuhan energi memperhatikan dampak terhadap lingkungan hidup,
- Kemungkinan pemanfaatan energi nuklir apabila sumber energi lain tidak memenuhi.

4. Technological innovation

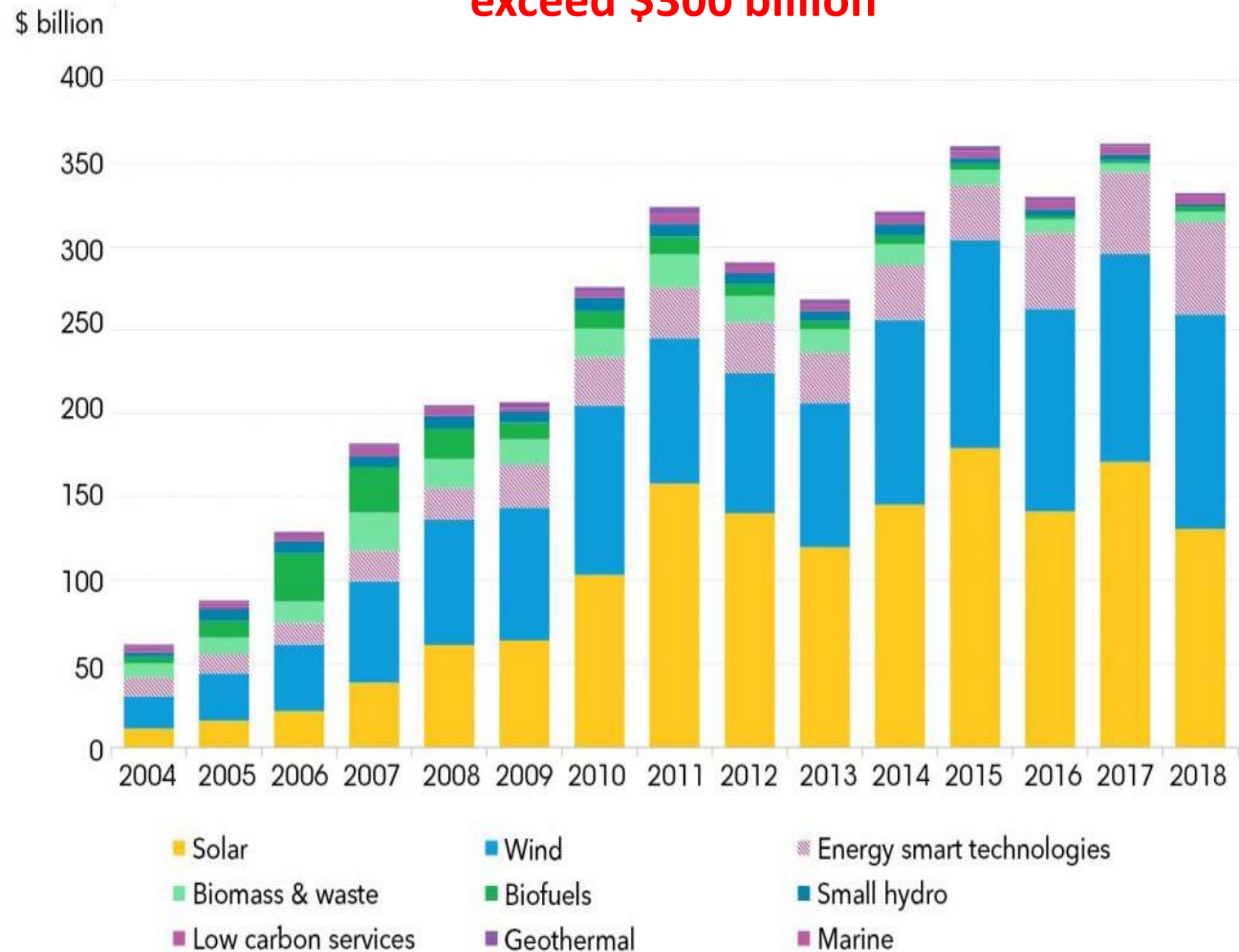
- Higher solar photovoltaic (PV) module efficiencies
- Taller wind turbines: on-shore and off-shore
- Storage technologies: longer-term batteries
- New energy technologies with digitalization: smart grids, the internet of things, big data, AI
- Renewable generated power for hard-to-electrify sectors, such as aviation, shipping and heavy industry



5. Corporate and investor action

- Pressure on companies to reduce their carbon footprints.
- Major multilateral development banks and private banks taking efforts by no longer financing coal investment.
- COP24 (a group of 415 investors) who are representing over \$32 trillion, supports the Paris Agreement. They called on governments to put a price on carbon, abolish fossil fuel subsidies, and phase out thermal coal power.
- Many world's leading companies, including IKEA and Walmart have committed to source 100% of their electricity consumption from renewables.

Global new investment in clean energy continue to exceed \$300 billion



Source: BloombergNEF

6. Public Opinion

- Consumer preferences for low carbon footprint
- Civil society pressures
 - Greta Effect
 - Pope Francis Laudata Si



The background of the slide features a dark, monochromatic image of several wind turbines. The turbines are silhouetted against a deep blue sky, with their blades and towers clearly visible. The bottom of the image shows the dark surface of the sea. The overall mood is serene and technological.

Why Renewables will transform geopolitics?

Energy transformation will be one of the major elements that reshape geopolitics in the 21st century, alongside trends in demography, inequality, urbanization, technology, environmental sustainability, military capacity, and domestic politics in major states

Renewables are different from fossil fuels - and that pose geopolitical consequences

1. Renewables resources are available in most countries.
2. Renewables take the form of flows, which do not exhaust and are harder to disrupt – unlike fossil fuels which are stocks and can be used only once.
3. Renewables can be deployed at almost any scale.
4. Renewables have nearly zero marginal costs, like solar and wind enjoy cost reductions of nearly 20% for every doubling of capacity.

Figure 2. World solar potential

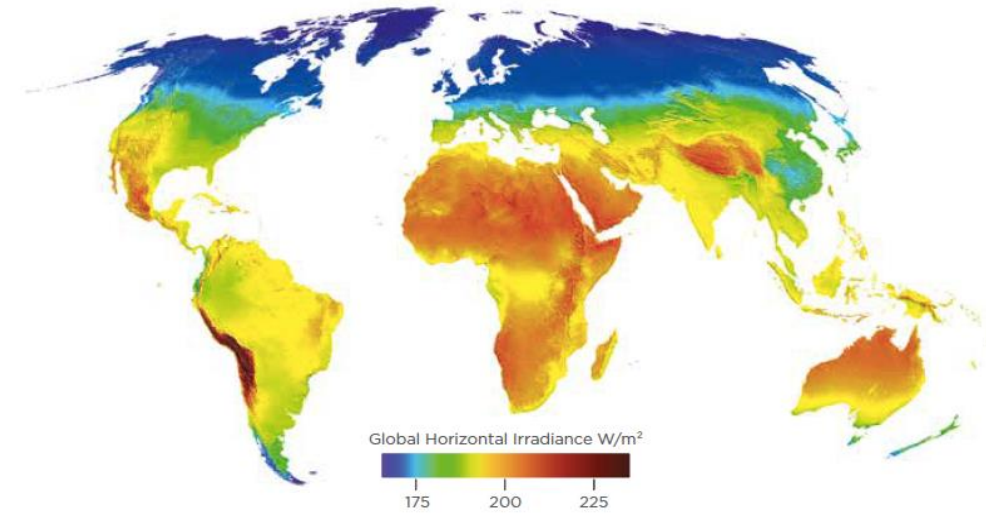
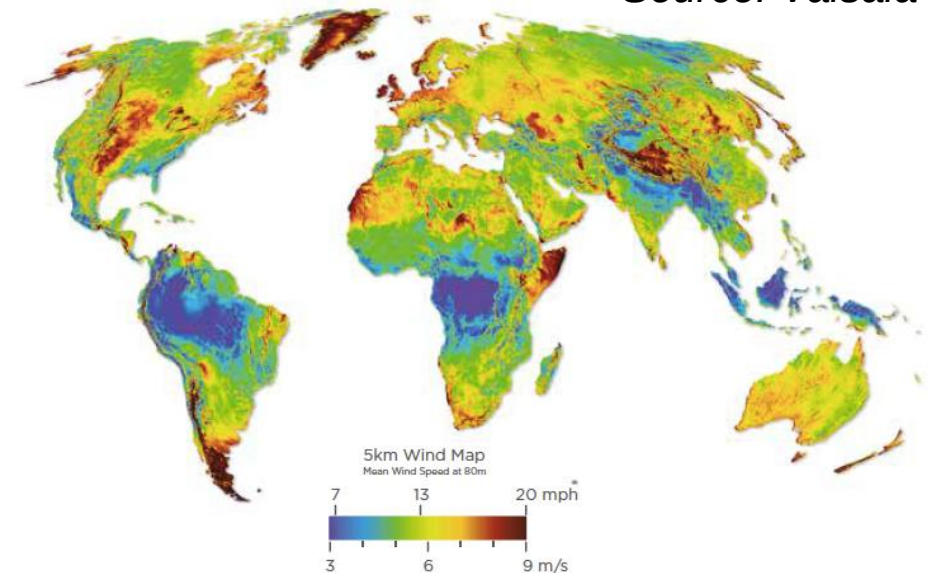
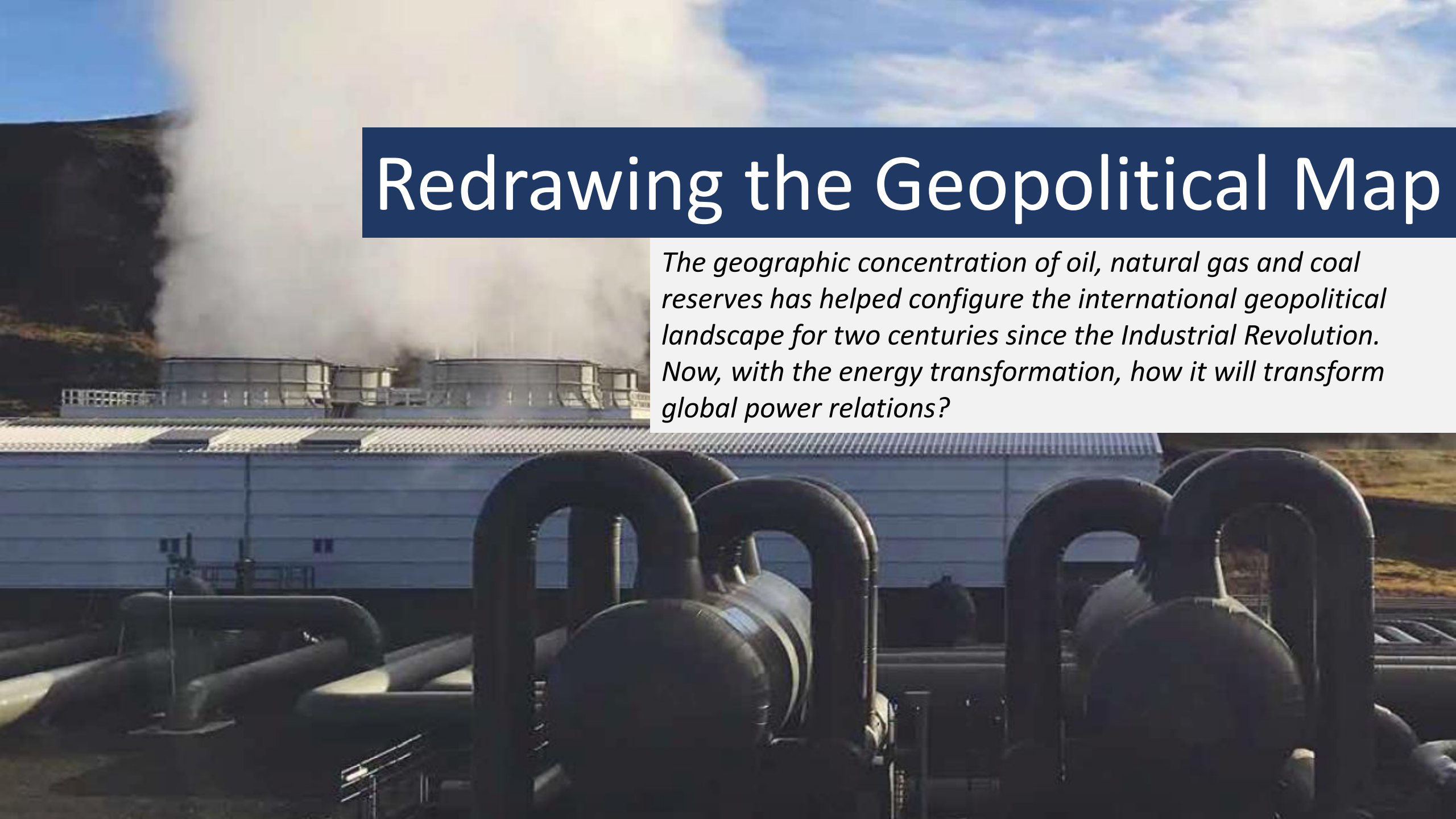


Figure 3. World wind potential

Source: Vaisala



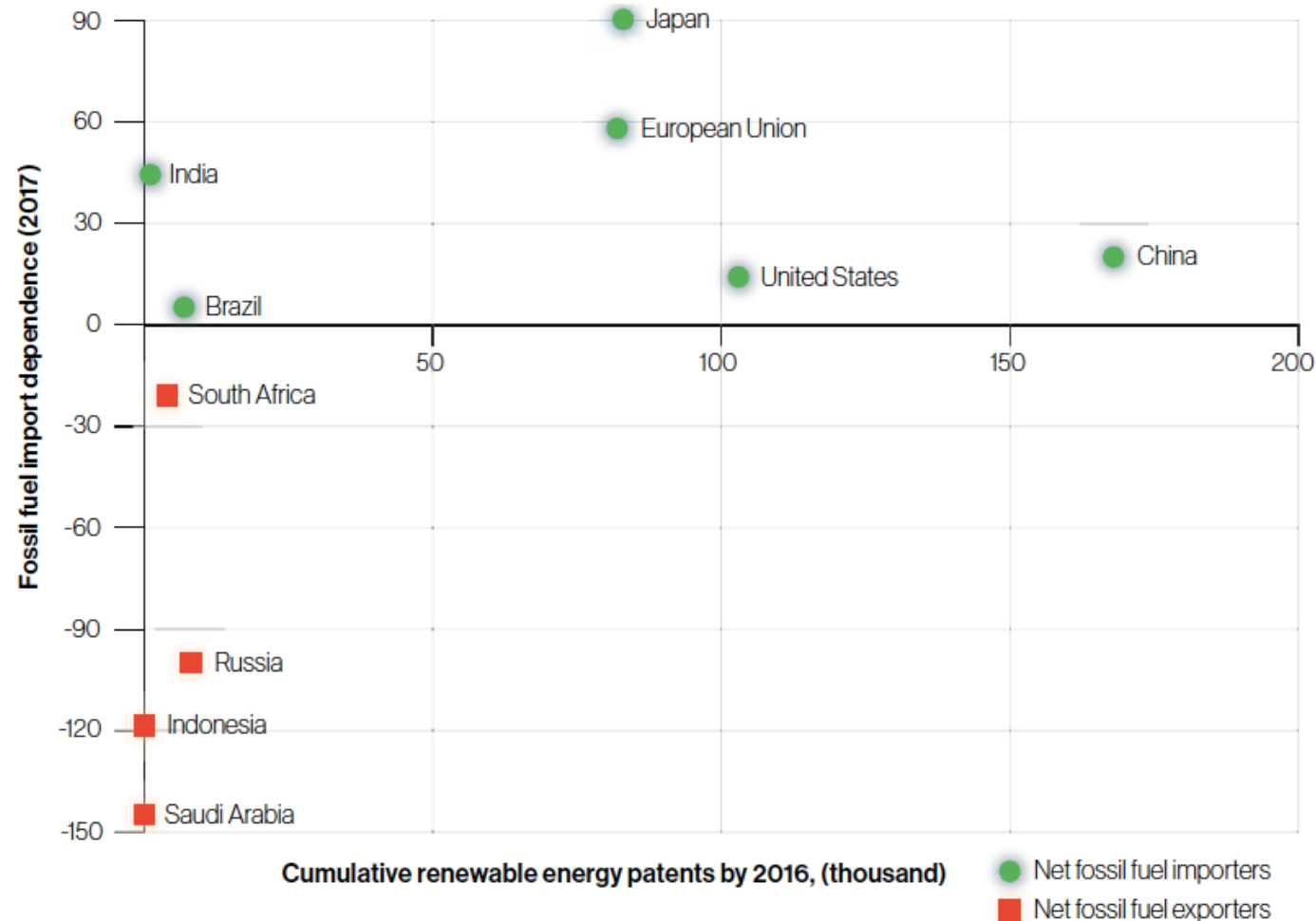
The background image shows an industrial facility, possibly a power plant or refinery. In the foreground, there are large, dark, curved pipes or structures. In the middle ground, there are several large, cylindrical tanks or storage vessels. In the background, a large plume of white steam or smoke rises from the facility against a blue sky with some clouds. The overall scene is industrial and suggests a focus on energy production or processing.

Redrawing the Geopolitical Map

The geographic concentration of oil, natural gas and coal reserves has helped configure the international geopolitical landscape for two centuries since the Industrial Revolution. Now, with the energy transformation, how it will transform global power relations?

I. New Energy Era – countries need to reinvent to avoid economic, social and political risks

Figure 4. Impact of the energy transition on selected countries and groupings

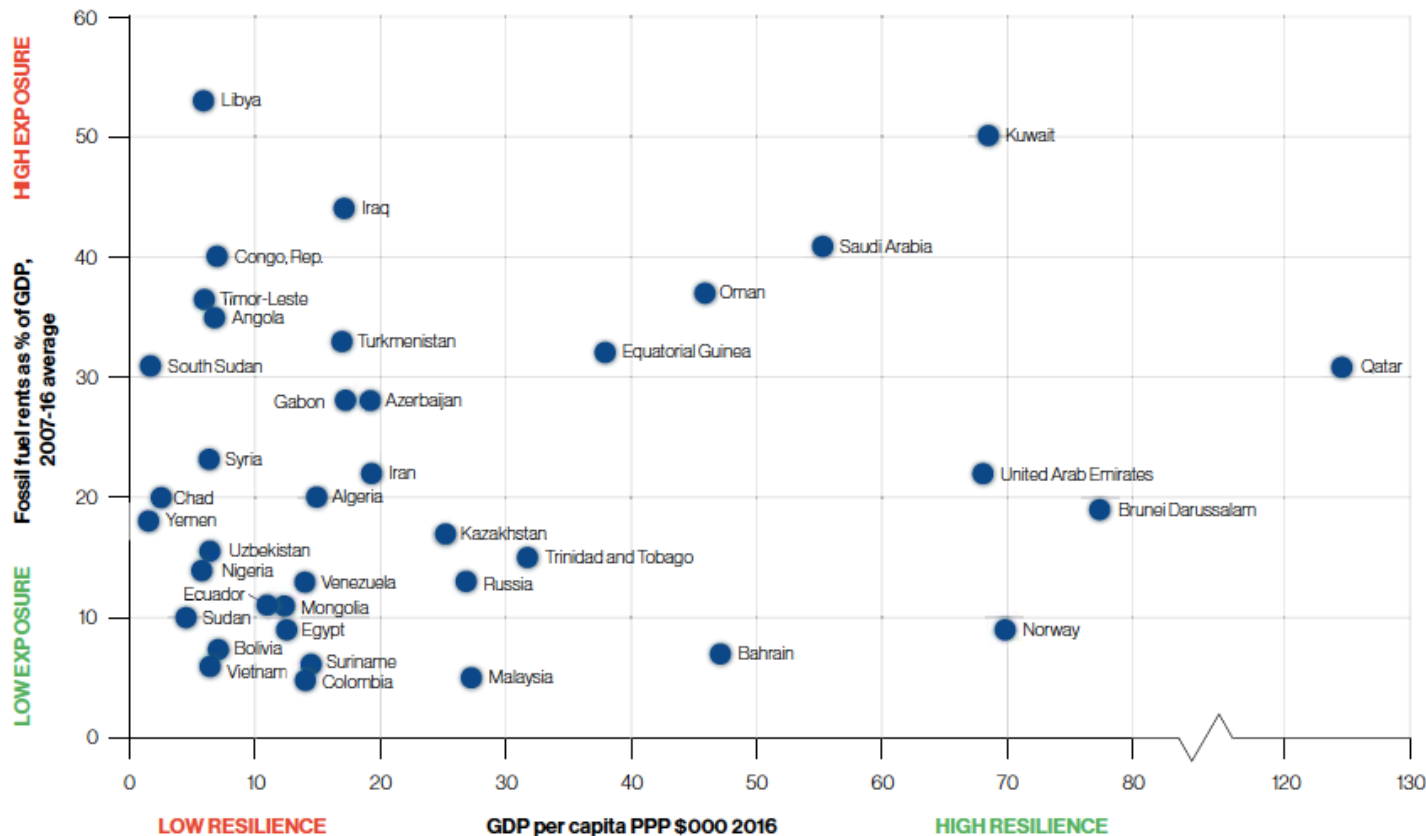


Countries with high dependence on imported fossil fuels but have positioned themselves at the forefront of the clean energy race through technologies and innovations. China particularly has a leading position in manufacturing as well as innovation for clean energy technologies.

Fossil-fuel exporters are likely to see a decline in their global reach and influence unless they can reinvent their economy for a new energy era. Russia as the world's largest gas exporter and second largest oil exporter may face challenges and exposed to a reduction in fossil fuel revenues, since oil and gas rents are a vital component of the state budget, accounting for around 40% of fiscal revenues.

Resilience towards the decline in fossil fuel rents... matters

Figure 7. The relative preparedness of fossil fuel producing countries for the energy transition



Note: The chart includes countries in which fossil fuel rents account for more than 5% of GDP. The GDP of Syria dates from 2010.

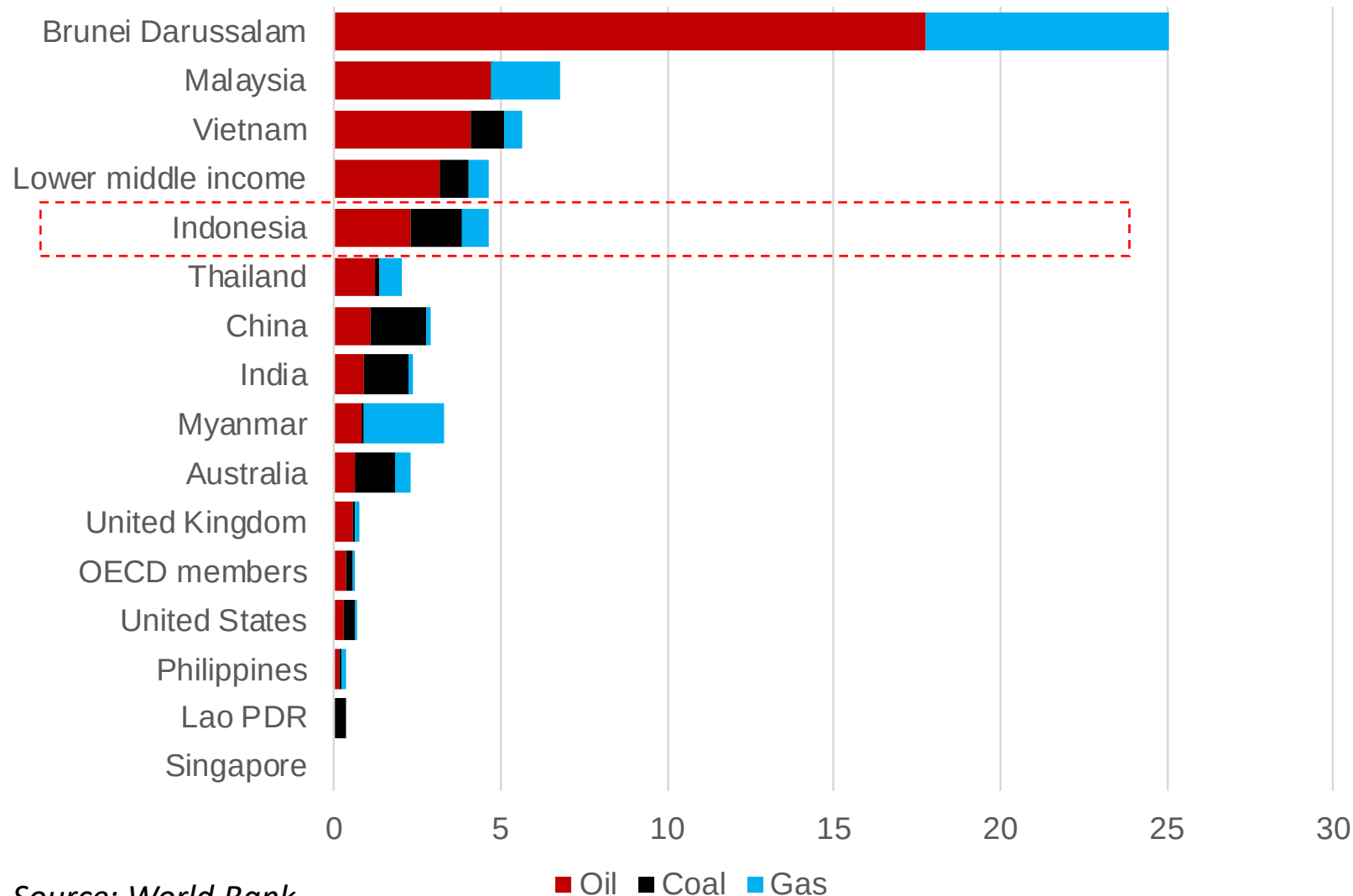
Source: IMF World economic outlook database April 2018, World Bank.

The loss of fossil fuel rents in countries with weak governance could lead to fractures in society and political instability.

The drop in oil price in the 1980s was one of the factors that contributed to the decline and eventual fall of the Soviet Union, which in turn led to the end of the Cold War, arguably the biggest geopolitical shift since the end of the Second World War.

The vulnerability of fossil fuel exporters

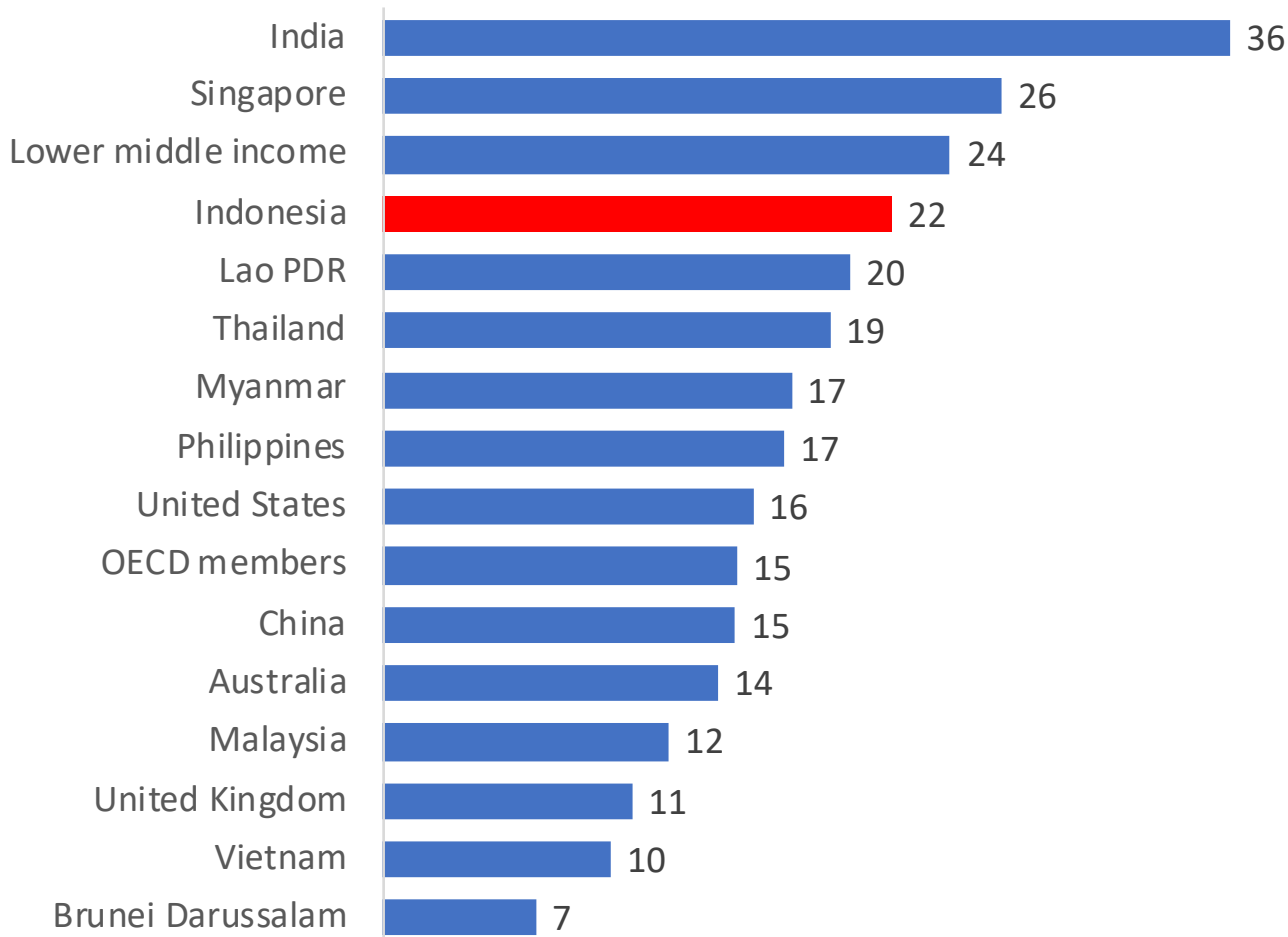
Fossil fuel rent as a percentage of GDP (average 2007-17)



Negara dengan fossil fuel rents yang tinggi perlu melakukan diversifikasi seiring dengan transformasi energi ke arah Renewables

2. Energy independence ...

Fuel import as a percentage of merchandise import
(average 2007-17)



Source: World Bank

Switching from imported fossil fuels to domestically generated renewable energy:

- Giving countries greater energy security
- Countries are less vulnerable or beholden to their suppliers and will therefore be able to pursue their strategic and foreign policy goals more independently

'No one can ever embargo the sun or interrupt its delivery to us'
- Jimmy Carter, US President

... is changing pattern of trade ...

While trade in fossil fuels will decline, trade in at least three other areas will grow:

1. Trade in renewable energy-related goods and technologies

- Include wide range of goods and technologies, as well as their components and parts
- Not to mention the services in building the infrastructure

2. Electricity trade

- Integration of electricity grid with neighbouring countries, or even inter-continental

3. Trade in renewable energy fuels

- Synthetic fuels, like ammonia, methane and methanol
- Biofuels for hard-to-electrify sectors such as aviation, shipping and heavy industry

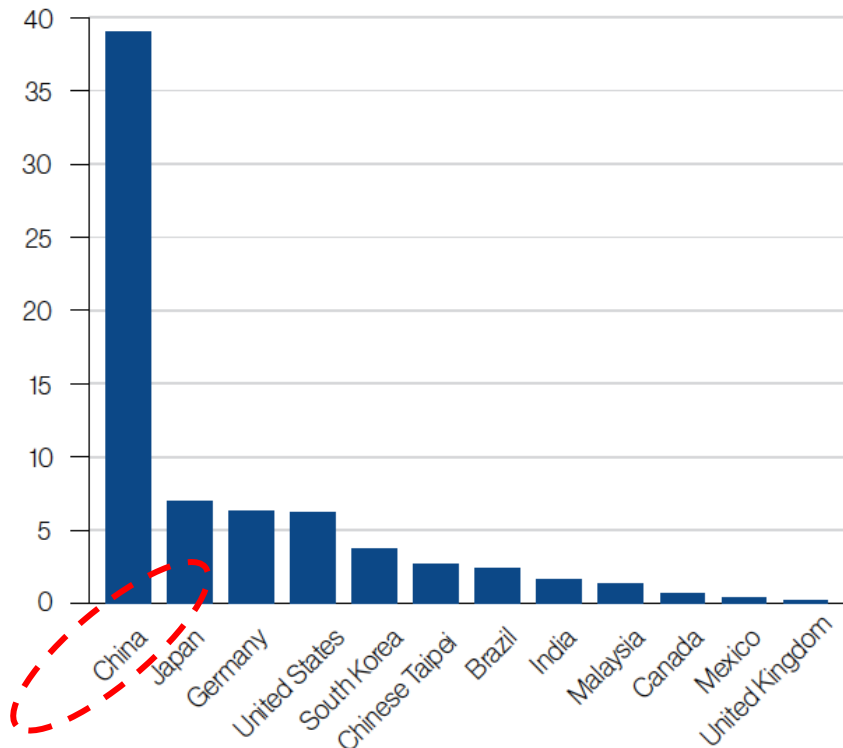
... and shifting global alliances

- The use of energy as a geopolitical instrument will lose much of its currency
- Alliances that are built on fossil fuels, such as OPEC, are likely to weaken and change
- While new bilateral and multilateral energy relations will emerge that are centered on renewables. For example, the International Solar Alliance (ISA) that just launched and held its first Assembly in 2015.

3. Control over significant energy resources and markets

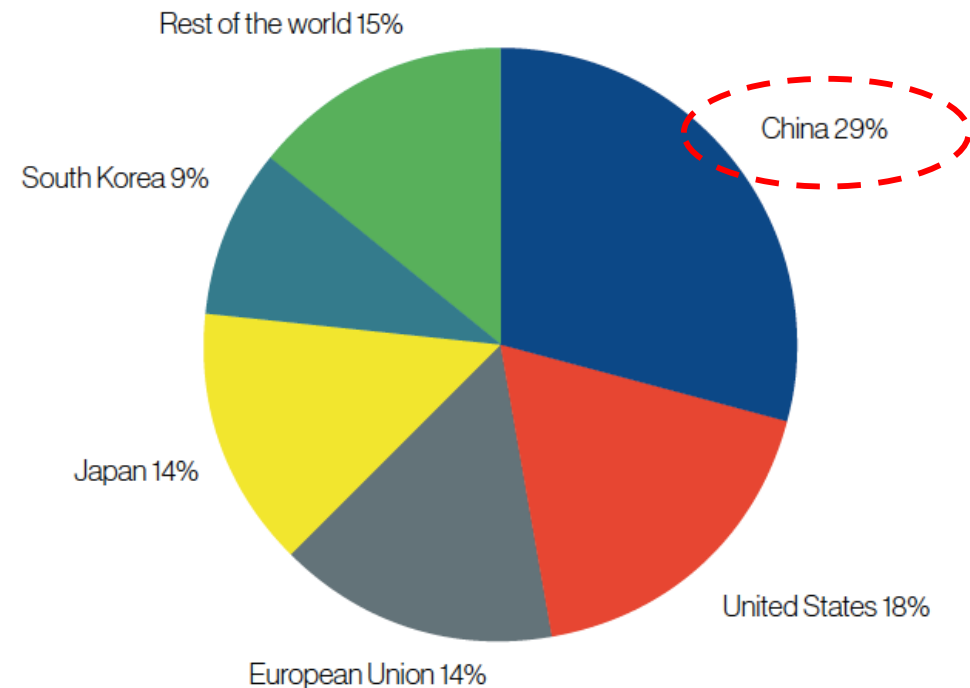
Countries that lead in technological innovation stand to gain from the global energy transformation. It is an important asset because it enables states to protect vital national interest at home and to leverage economic and political influence abroad.

Figure 9. Clean energy manufacturing value added (2014, US\$ billion)



Source: Clean energy manufacturing analysis center.⁷⁶

Figure 10. Cumulative share of renewable energy patents end 2016



Source: IRENA.

Mineral conflicts may also be the root of geopolitical instability

Table 2. Minerals required for green energy technologies

	Solar technology	Wind technology	Electric vehicles, energy storage
Bauxite and aluminium	x	x	x
Cadmium	x		
Chromium		x	
Cobalt		x	x
Copper	x	x	x
Gallium	x		
Germanium	x		
Graphite			x
Indium	x		
Iron	x	x	x
Lead	x	x	x
Lithium			x
Manganese		x	x
Molybdenum		x	
Nickel	x		x
Rare earths		x	x
Selenium	x		
Silicon	x		x
Silver	x		
Tellurium	x		
Tin	x		
Titanium			x
Zinc	x	x	

Source: IISD, *Green Conflict Minerals*, August 2018.

The energy transformation will increase the demand for a range of minerals and metals required for the production of renewable energy

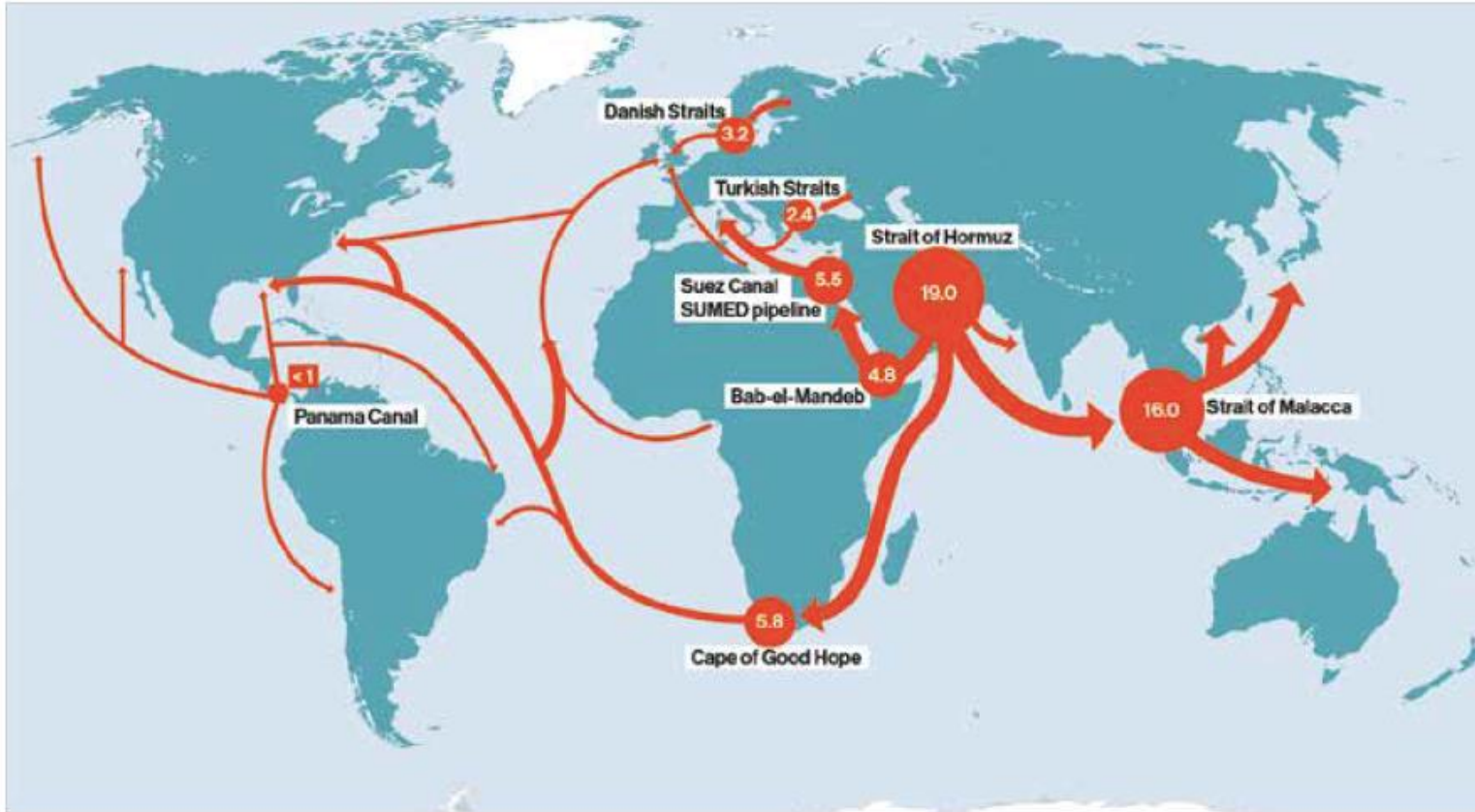
Countries with abundant minerals associated with the production of clean technology will see benefits. But, the largest reserves of metals and minerals often found in weak states with poor governance.

Weak or poor governance poses significant negative consequences: social, economic, political and environmental factors that are often among the root causes of geopolitical instability and conflict.

Conflicts minerals should be addressed with transparent and according to international norms and standards.

4. Reduction in oil- and gas-related conflict

Figure 11. Daily transit volumes through world maritime oil chokepoints



Note: All estimates in million barrels per day. Includes crude oil and petroleum liquids.
Based on 2016 data.

Source: U.S. Energy Information Administration.

Ketika minyak tidak menjadi komoditas utama untuk energi, konflik di Selat Hormuz dan Selat Malaka sebagai jalur perdagangan utama akan berkurang secara signifikan.



Challenges Ahead

New Challenges

Risks and tensions

- Cybersecurity to protect electricity grids from hacking
- Technology dominance and dependence
- Renewables resources or production materials: water, food, minerals
- Risks and vulnerability generated by the decline in conventional energy system: new social tensions and financial risks, such as employment, stranded assets

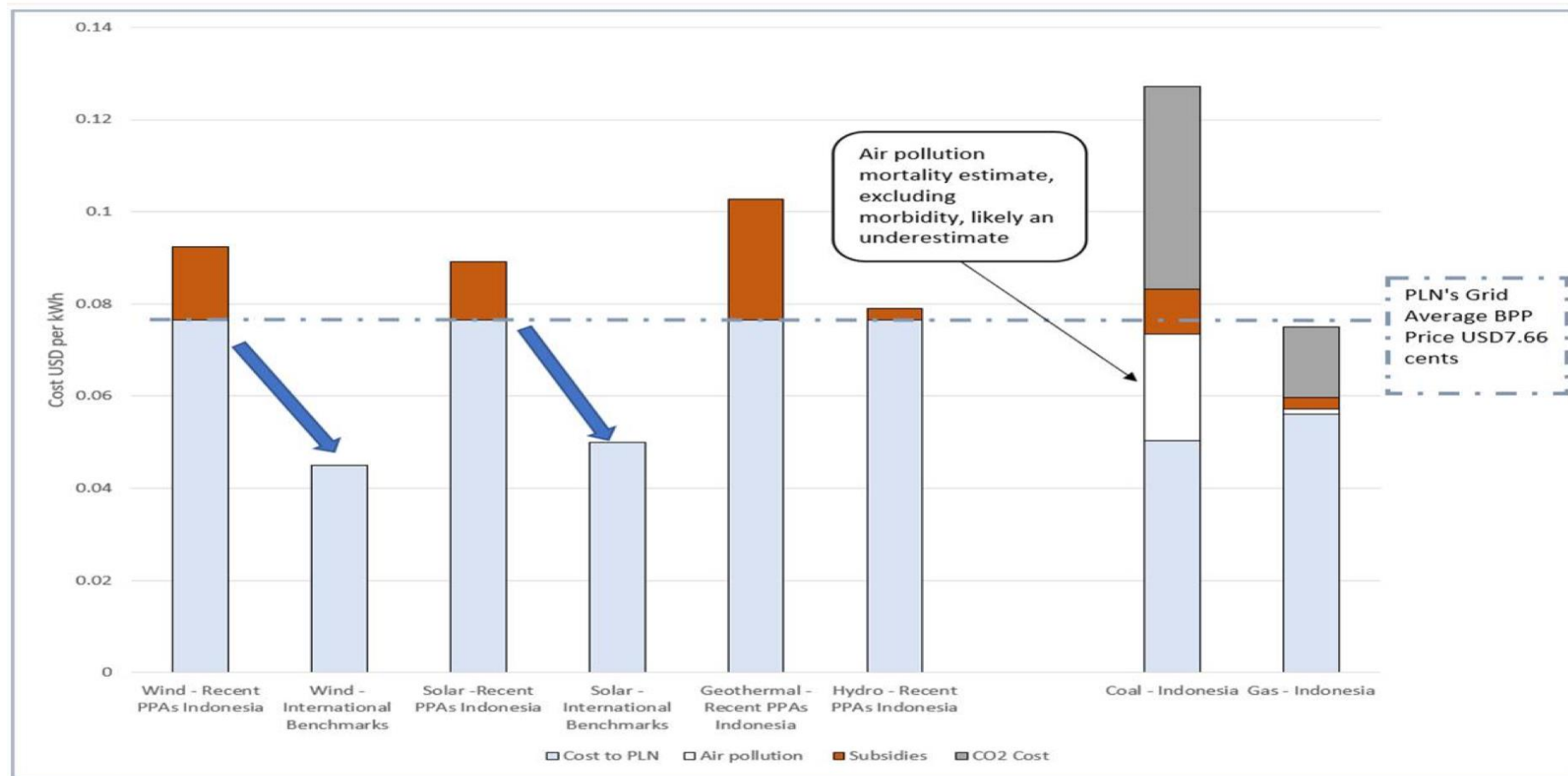
Need to be managed through

- New rules for trade in clean energy technologies and resources generating Renewables
- Good governance to navigate the countries towards a smooth and just transition

Overall, the benefits of the global energy transformation outweigh the challenges

- The pivot to renewables will promote prosperity and job creation, improve food and water security, and enhance sustainability and equity.
- The shift to renewables will also help to alleviate competition over important natural resources, notably oil, gas, water, and food, and help combat air pollution and climate change.
- It will increase energy access and offer developing economies an opportunity to leapfrog a fossil fuel-based development model and centralized grids.
- The number of energy-related conflicts is likely to decline.
- Renewables bring numerous benefits which will address many of the root causes of poverty, marginalization, migration and political instability.
 - New business and job opportunities

Figure ES1: Cost comparison for electricity production sources in Indonesia, 2018



Sources: see main report.

Source:

Table ES1: Estimate of direct jobs created by achieving Indonesia's 23 per cent renewable energy target in the electricity sector

	2025 Target	Manufacturing		Construction/ installation¹		O&M	
	MW	Jobs/ MW	Jobs	Job- years/ MW	Jobs	Job years/ MW	Jobs per year
Biomass	5500	2.9	15,950	14	154,000	1.5	8,250
Hydro-large	17,900	3.5	62,650	7.4	264,920	0.2	3,580
Hydro-small	3000	10.9	32,700	15.8	94,800	4.9	14,700
Wind ²	1,800	4.7	8,460	3.2	11,520	0.3	540
Solar Photovoltaics	6,400	15.6	43,550	13	84,500	0.7	4,550
Geothermal	7,100	6.7	28,080	6.8	97,920	0.4	2,880
Other ³	3,100	10.2	31,620	10.2	63,240	0.6	1,860
Total			223,010		770,900		36,360

Notes and sources: see main report.