Overcoming barriers to solar and wind energy adoption in Indonesia: Learnings from India

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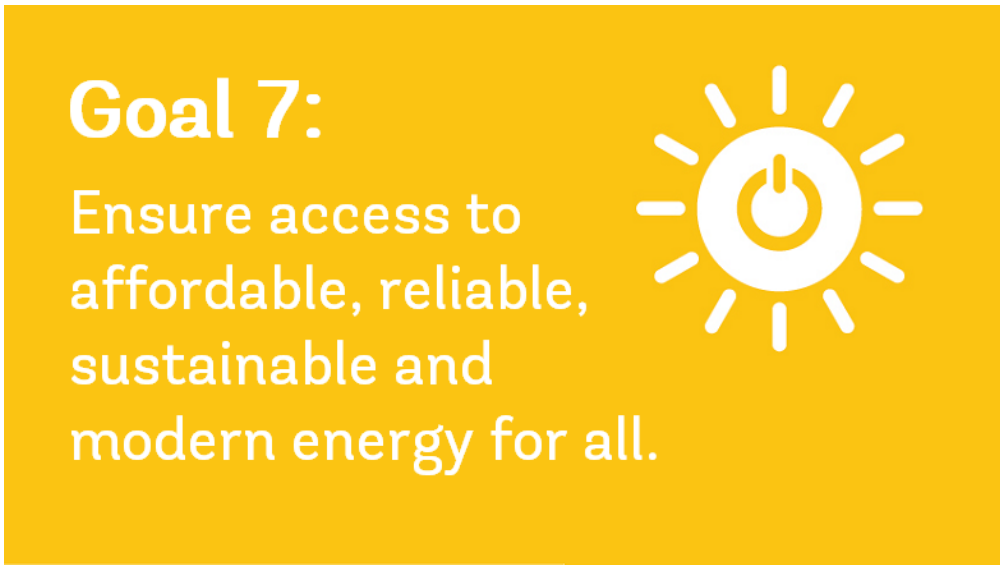
SDGs



In 2016, > 20 million Indonesians did not have residential access to electricity

The solar + wind revolution

> 50% of net electricity capacity installations worldwide

Historically, solar and wind were expensive. Not any more

Goal: clean, affordable, reliable energy for all

Globally, more solar capacity was added in 2017 than total net additions of coal + natural gas + nuclear

Indonesia's targets

Renewables and new energy = 23% of the primary energy mix by 2025 (Regulation 79/2014)

National Energy Plan (RUEN): 8.3 GW of solar + wind by 2025

Sidrap I wind farm, South Sulawesi (2018)

Image: http://online24jam.com/2018/07/02/111353/berita-foto-di-sidrap-jokowi-rasakan-suasana-seperti-di-belanda/

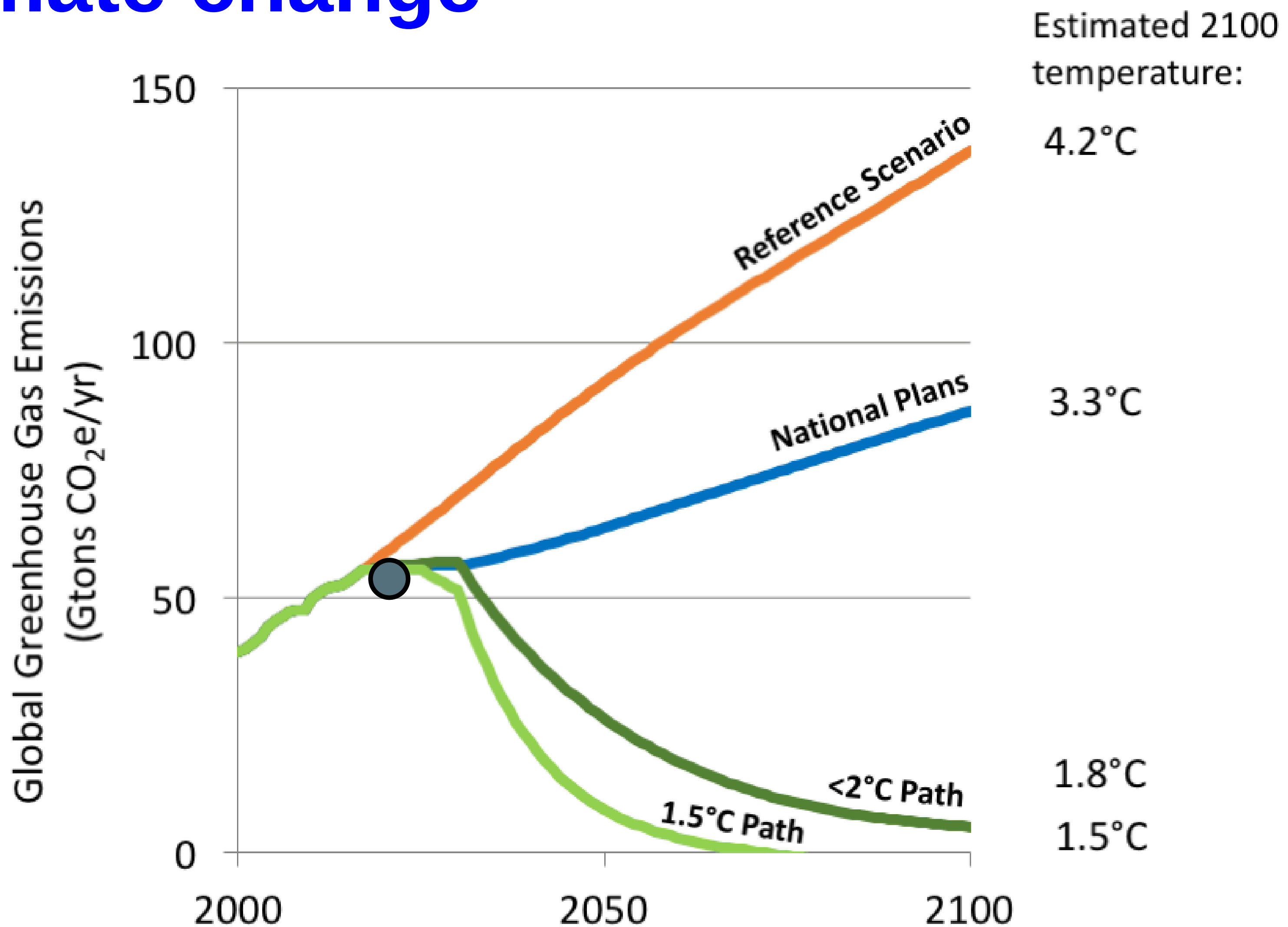
Motivations for making the switch

- Cheap energy
- Clean air
- Fight climate change

Outdoor air pollution causes > 78,000 deaths per year in Indonesia

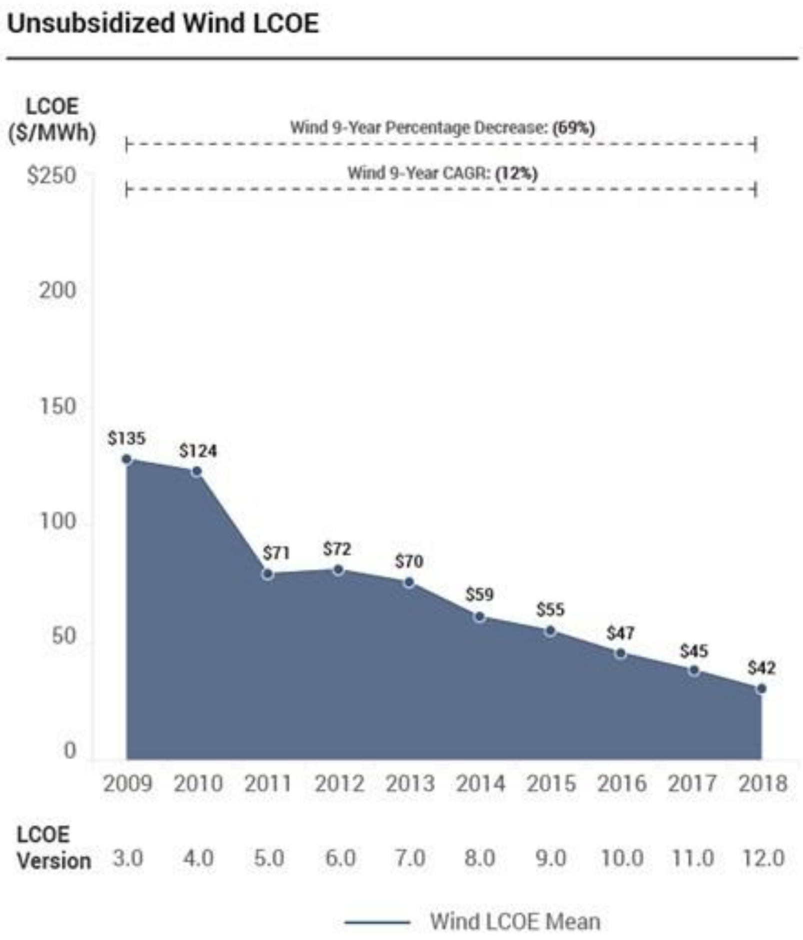
Source: Global Burden of Diseases Study 2015

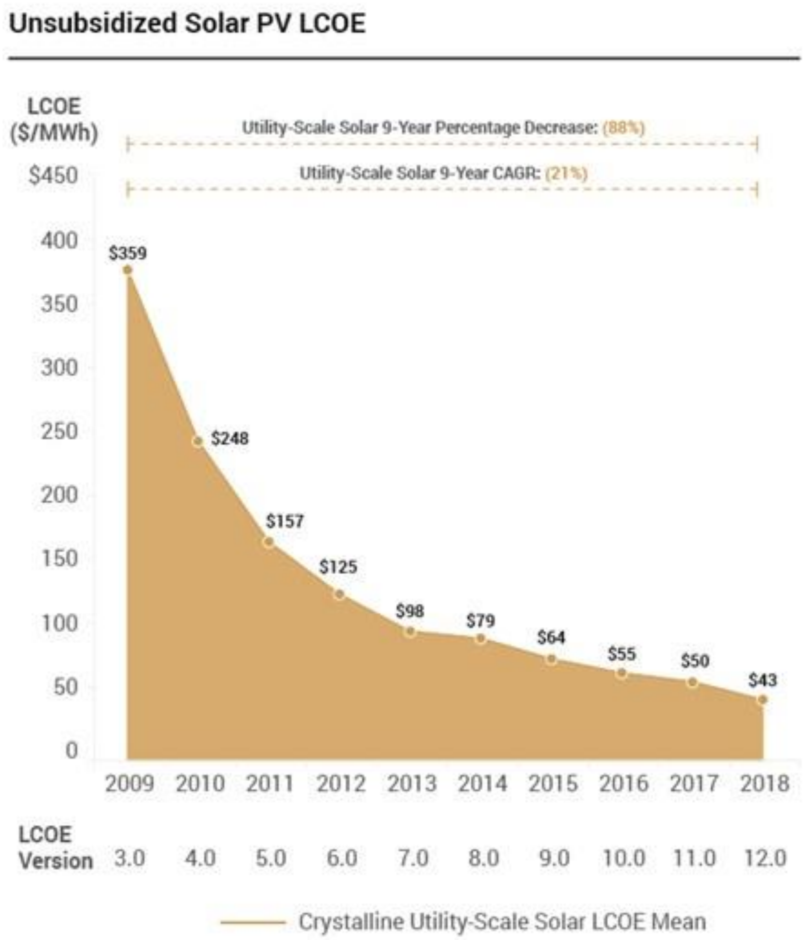
Climate change



Source: Climate Interactive

LCOE for US (Lazard)

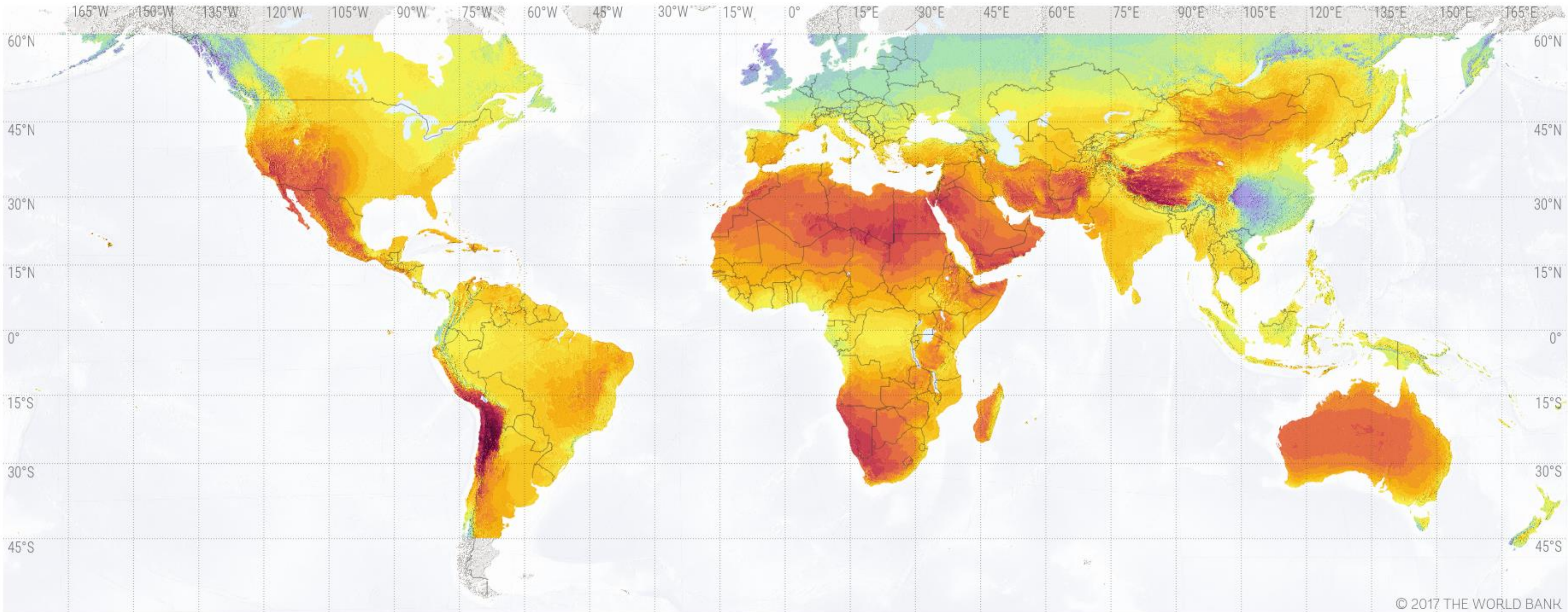




SOLAR RESOURCE MAP

PHOTOVOLTAIC POWER POTENTIAL

WORLD BANK GROUP
THE WORLD BANK IBRD • IDA
IFC International Finance Corporation
ESMAP Energy Sector Management Assistance Program
SOLARGIS



Long-term average of daily/yearly sum

Daily sum: < 2.0 2.4 2.8 3.2 3.6 4.0 4.4 4.8 5.2 5.6 6.0 6.4 >

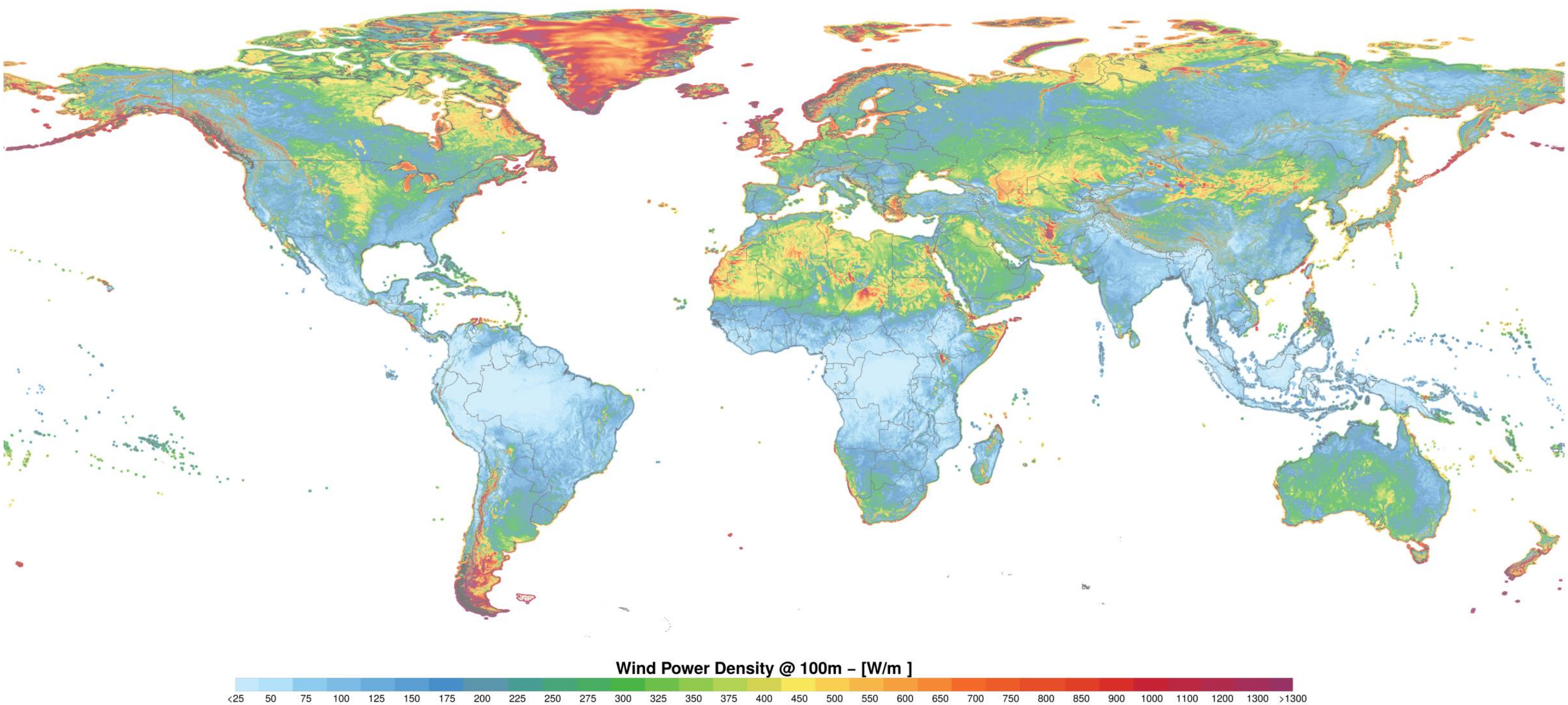
kWh/kWp

Yearly sum: < 730 876 1022 1168 1314 1461 1607 1753 1899 2045 2191 2337 >

ONSHORE & OFFSHORE WIND RESOURCE MAP

WIND POWER DENSITY POTENTIAL

WORLD BANK GROUP
DTU Wind Energy
Department of Wind Energy
ESMAP
Energy Sector Management Assistance Program
VORTEX

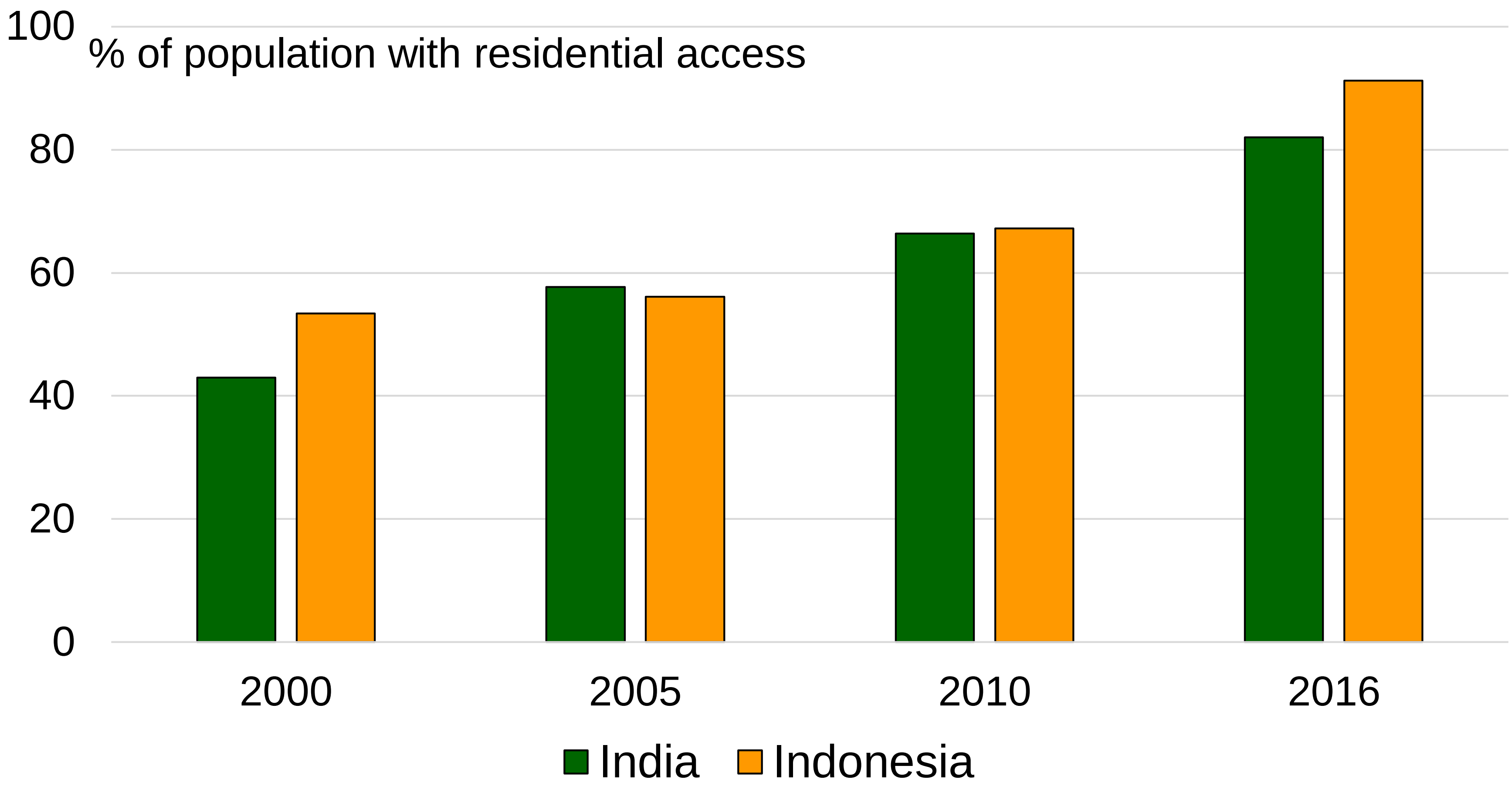


Why India vs Indonesia?

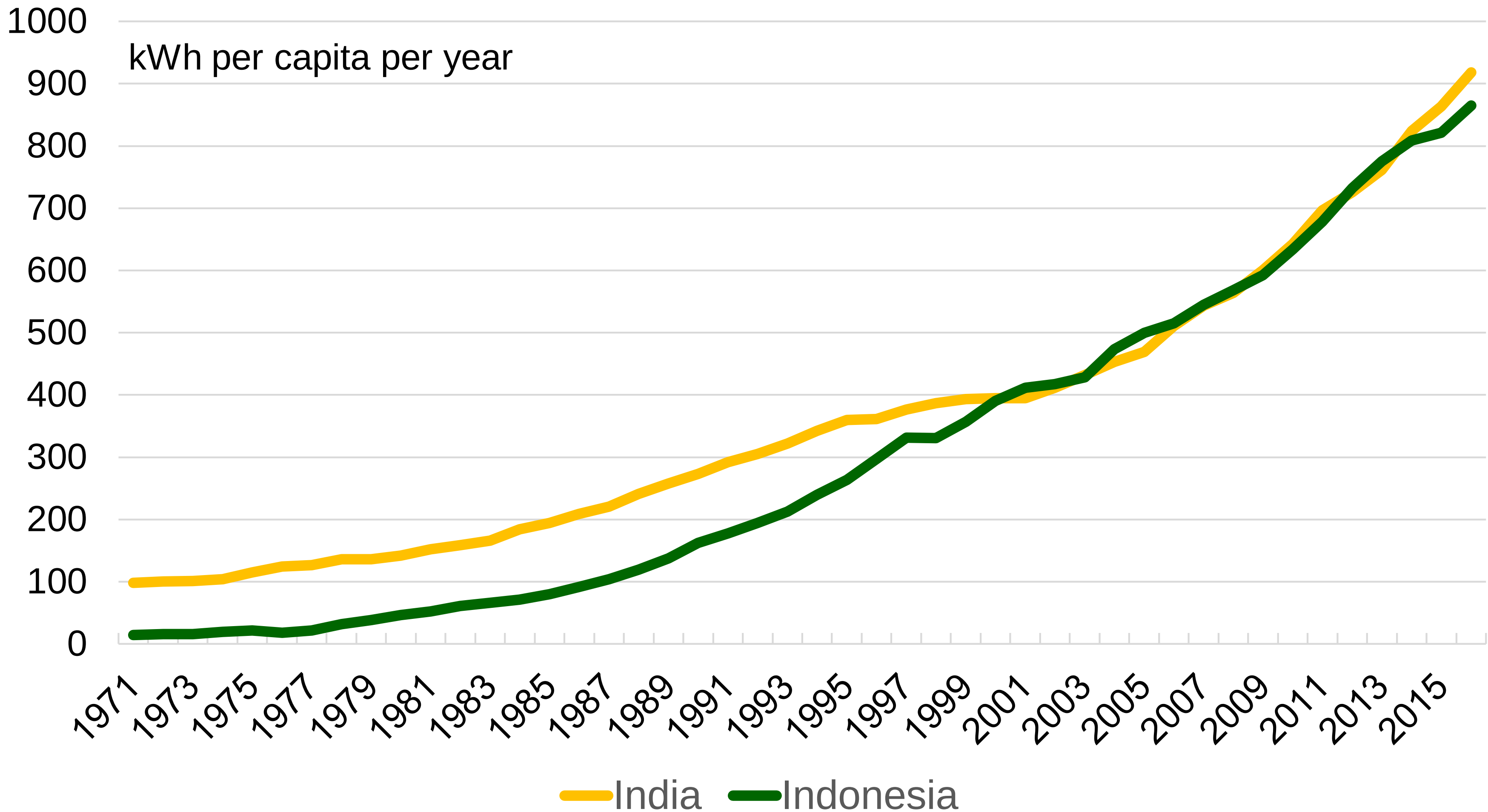
India vs Indonesia

India	Indonesia
Highly dependent on coal	Highly dependent on coal
Relatively good electricity interconnections	Relatively underdeveloped electricity interconnections
Many electricity utilities, decentralized system	PLN
Ample land area suitable for solar (arid land)	Relatively land constrained (especially Java)
Strong research capacity	Scope to improve research capacity
Land access is challenging	Land access is challenging

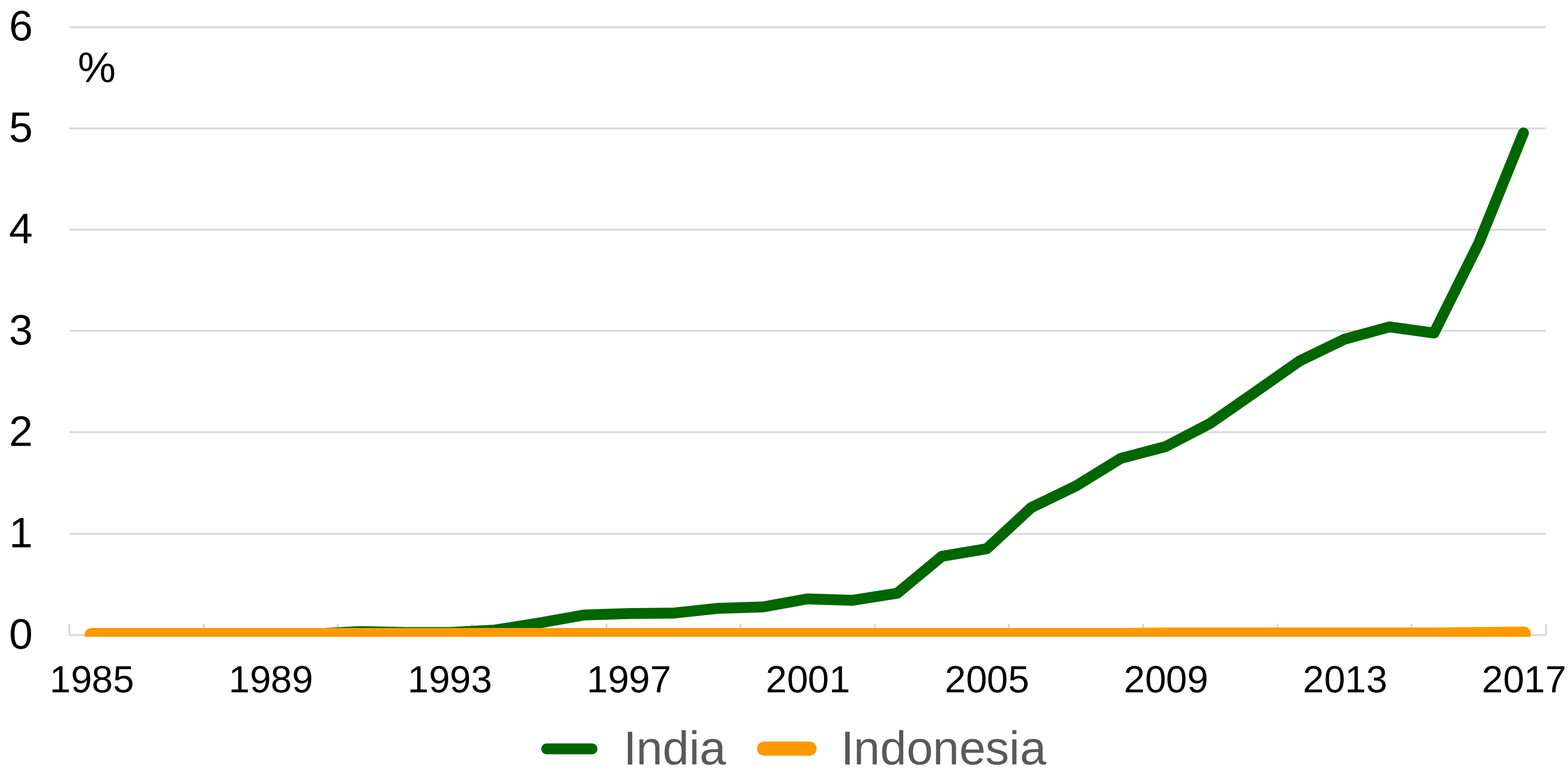
Electricity access



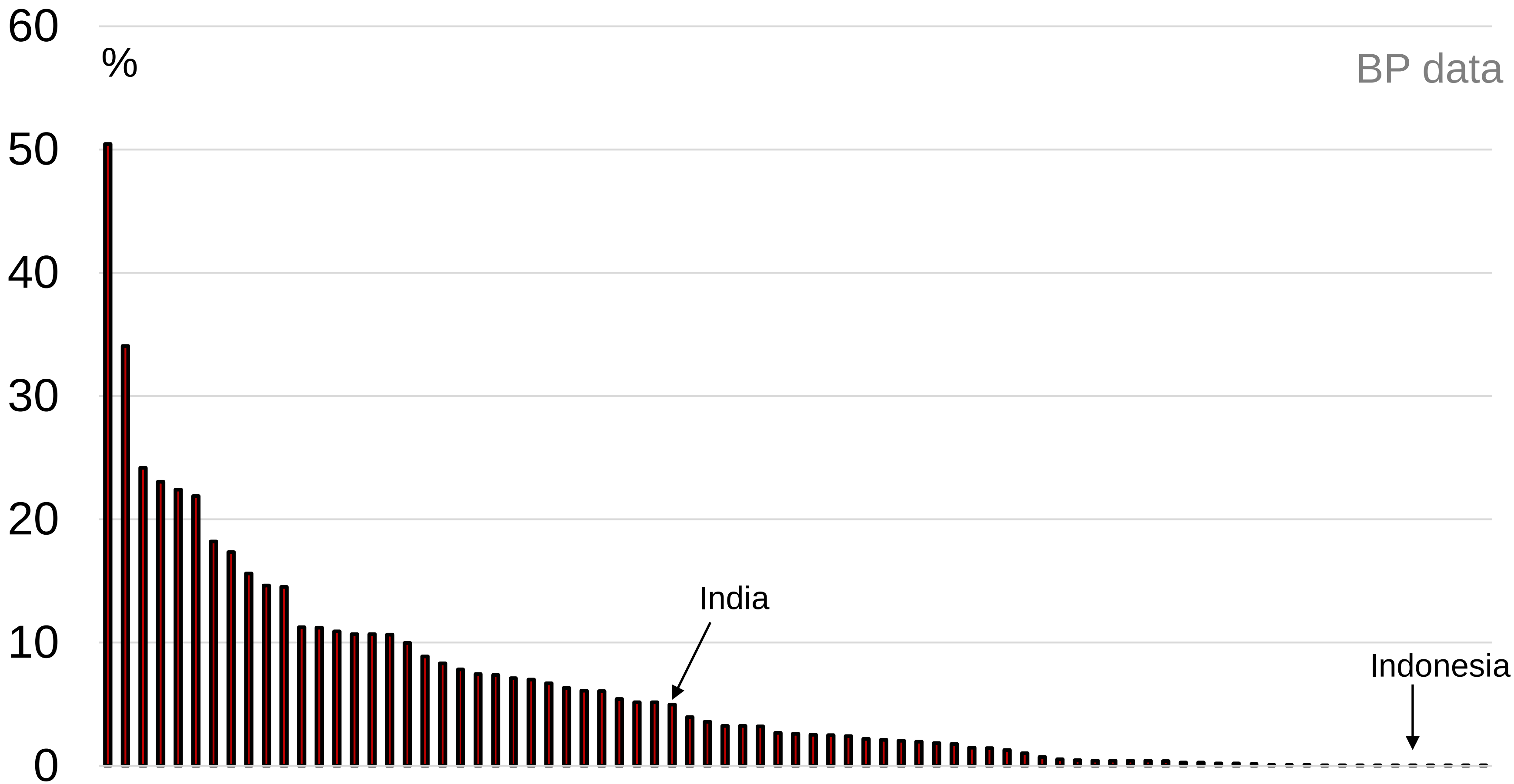
Electricity use per capita



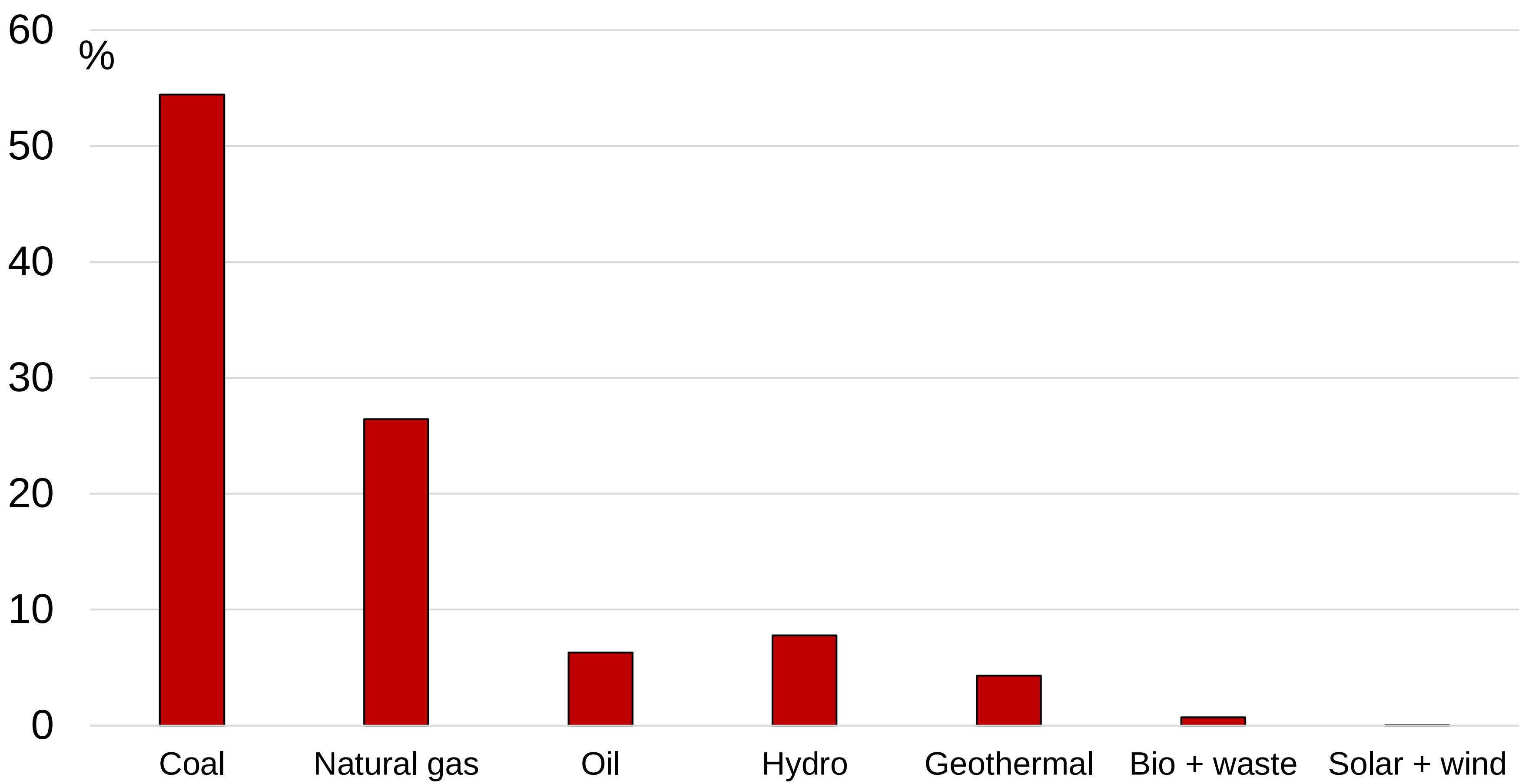
Solar + wind share of electricity mix



Rankings:
Solar + wind shares of electricity mix, 79 countries, 2017



Indonesia’s electricity mix, 2016



Solar + wind capacity, 2017

Indonesia: <0.1 GW

India: 51 GW

India aiming for
160 GW by 2022

Image: https://www.pv-tech.org/news/modi_calls_solar_ultimate_solution_to_indias_energy_problem

India: historical development of solar + wind

1987: Indian Renewable Energy Development Agency (IREDA)

1992: Ministry of Non-Conventional Energy Sources

2006: Name change to Ministry of New and Renewable Energy (MNRE)

2010: Jawaharlal Nehru National Solar Mission

2011: Solar Energy Corporation of India (SECI)

Also has:

- National Institute of Solar Energy (NISE)
- National Institute of Wind Energy (NIWE)

Image: https://commons.wikimedia.org/wiki/File:India_fields_and_wind_turbines.jpg

Keys to India's success

1. Strong facilitation by governments (mission-based approach)

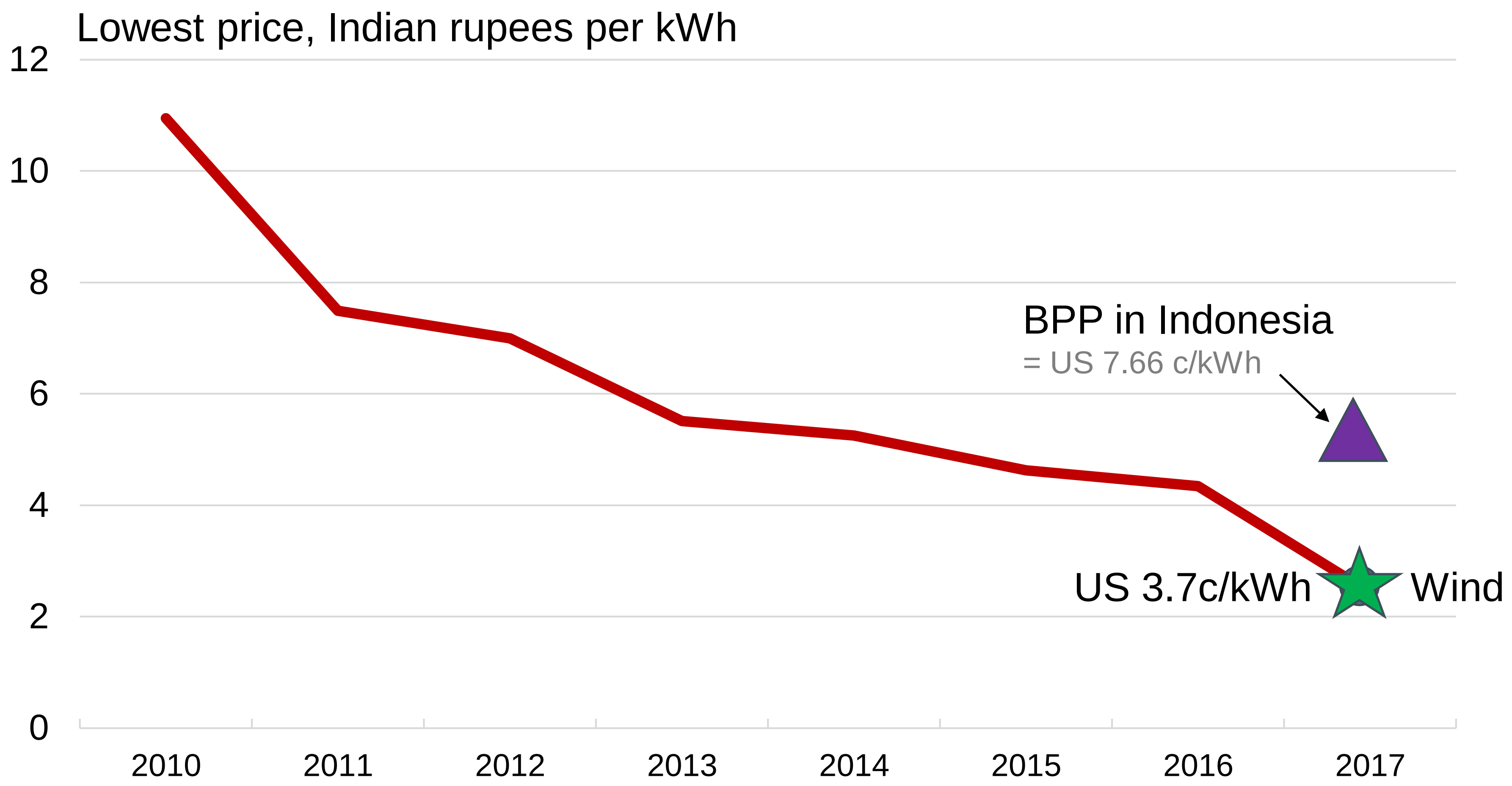
2. Large-scale reverse auctions for power purchasing agreement (PPA) contracts

3. De-risking the reverse auctions as much as possible
   - Solar parks
   - Transmission connections
   - Payment security mechanism

Mariana Mazzucato
The Entrepreneurial State

Image: https://economictimes.indiatimes.com/news/politics-and-nation/narendra-modi-dedicates-worlds-first-canal-top-solar-project-to-nation/articleshow/12863675.cms

India’s reverse auction prices, solar



Current exchange rate: 70 Indian rupees = 1 USD

Policy issues for solar + wind in Indonesia

- BOOT (Build-Own-Operate-Transfer)
- Domestic market obligations for coal
- Domestic content requirements
- Price cap on renewables
  - 85% of the regional average cost of electricity generation (BPP) in regions where regional BPP > national BPP
- Regulatory uncertainty
- Licensing and negotiation issues
- Net meter availability

Case study: 168 MW solar PV auction in Sumatra, 2017

- Pre-qualification process attracted substantial interest
- Announcement of results delayed
  - This type of practice damages investor interest

Policy idea: Large-scale reverse auctions + solar parks

- Could generate substantial investor interest
- Need a facilitating policy environment
  - De-risked
  - Large-scale projects
  - Minimized regulatory restrictions
- Where to locate a solar park?

Solar park, India

Policy idea: Renewable portfolio obligation scheme ("Green certificates")

PLN

- Simple approach, as used in India
- PLN could be required to acquire a certain number of certificates each year
- Compliance could be included among KPIs of PLN's Board
- PLN could be financially rewarded for meeting RPO requirements
- Easier to implement in Indonesia than India

Policy idea: Continue energy subsidy reforms

Oil + electricity subsidies:

- 2014: **341.8 IDR trillion**
- 2017: **97.8 IDR trillion**

The coal industry also receives production incentives, e.g. preferential tax rates

Reducing these subsidies increases the competitiveness of solar + wind

Source: https://www.indonesia-investments.com/news/news-columns/indonesia-s-energy-subsidy-spending-far-above-target-in-2018/item9036?
Image: https://www.scmp.com/business/commodities/article/1642541/oil-slump-help-indonesian-president-widodo-subsidy-cut

Policy idea: Coal tax

India has levied a tax on coal (both imported and domestic)

Has raised revenue for the clean energy sector and other purposes

Other options:

- Carbon tax
- Emissions trading scheme
- Gasoline + diesel excise

Attwood et al. (2017): externality cost of coal-fired electricity in Indonesia
= US$0.06 per kWh

Institutional idea: Indonesian Clean Energy Agency

Potential responsibilities:

- Managing renewables procurement (reverse auctions)
- Establishing and administering solar parks
- Administering RPO
- Planning
- Capacity building
- Securing and utilizing international concessional finance
- Investing in R&D
- Data provision

Image: https://www.pv-tech.org/news/adb-finances-venas-42mw-of-large-scale-solar-projects-in-indonesia

Boosting research capacity

India has strong research capacity:

- The Energy and Resources Institute (TERI)
- Policy-focused think tanks

Potential for substantially boosted research capacity in Indonesia

Benefitting from cheap imports

The cheapest + highest-quality solar panels are from overseas

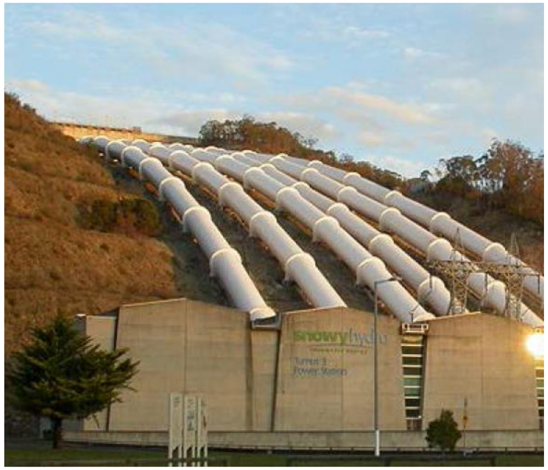
Total employment in the renewables would benefit from a vibrant installation industry

Installation industry and consumers would benefit from

- Removal of 5% import tariff on solar panels
- Relaxation of domestic content requirements

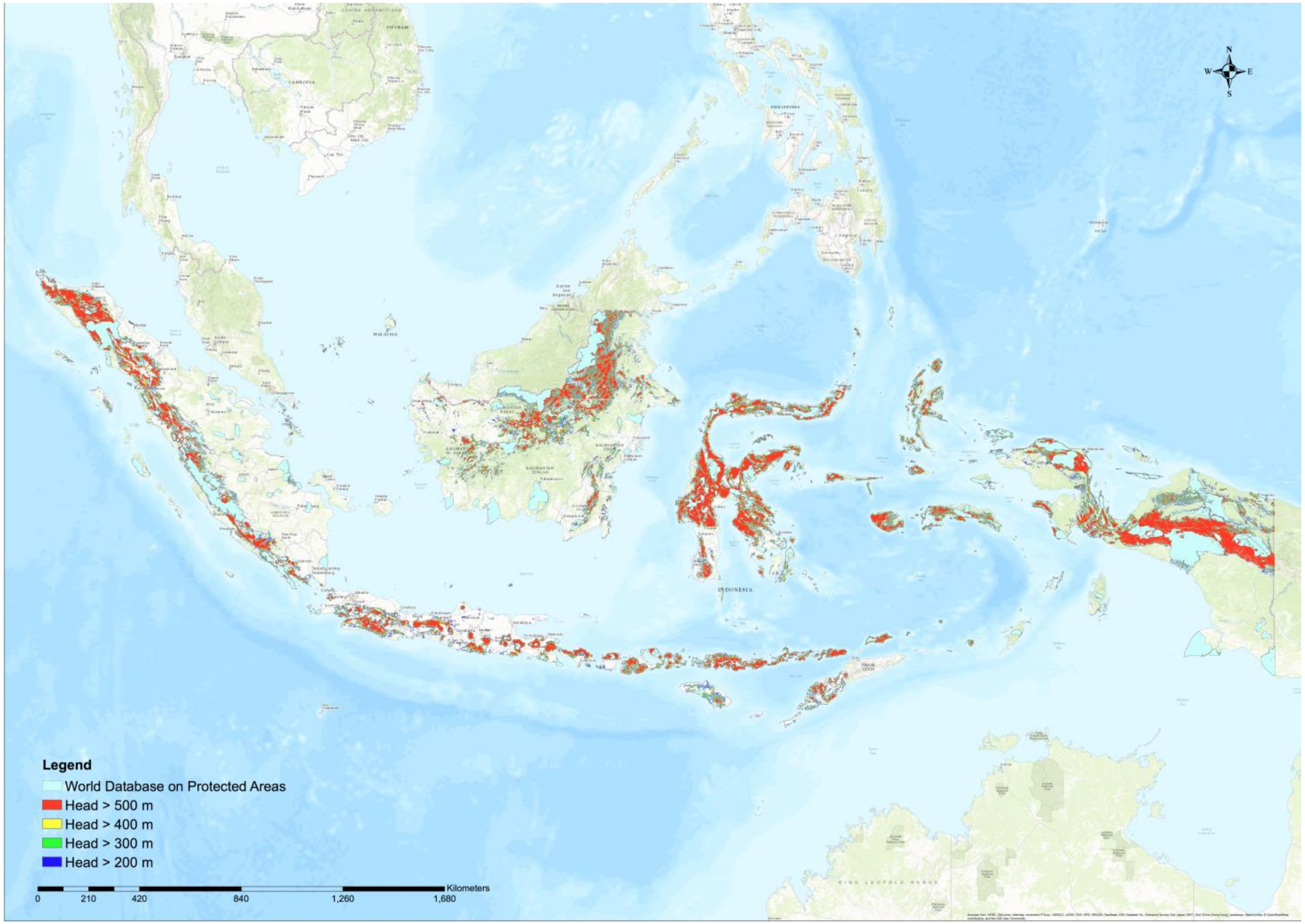
Source: https://news.energysage.com/should-i-use-chinese-solar-panels-for-my-solar-installation/, https://www.flickr.com/photos/martin_alexius/22658072969

Managing intermittency



- Pumped hydro
- Batteries
- Improved interconnectivity
- Grid-management capacity
  - Real-time markets
  - Improved forecasting
  - System planning

Potential pumped hydro sites



Source: http://re100.eng.anu.edu.au/research/re/for/indondetail.php

Private-led solutions

RE100 (http://there100.org)

Important to establish attractive platform for the supply-side of the market to operate

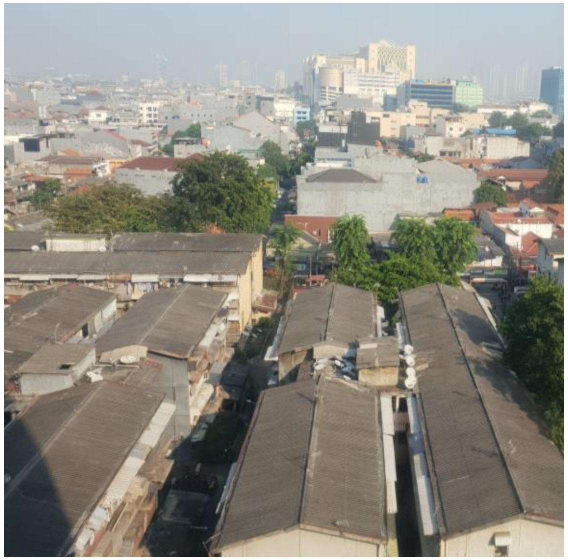
Goal: make the grid an open-access platform for trade in electricity

Rooftop solar

Rooftop solar often helps the local installation industry to develop

Indonesian cities have a lot of rooftop space

Ideally, it'd be as easy as possible to connect



Jakarta rooftops

Other issues

- Complying with Constitutional requirements
- Project quality
- Maintenance
  - IRENA recommended an entity responsible for project maintenance
- Human capital
- Policies for a transition from coal

Image: https://www.flickr.com/photos/jedavillabali/5127224247

Electricity trade

Key insights from India

- Top-level **government** prioritization is vital
- Establish mechanisms for **market supply** of low-cost solar + wind

The solar + wind revolution

The technologies will continue to improve

Huge economic opportunities in making the switch

India offers a success case

Strong policy leadership required

Big risks of coal lock-in and stranded assets

Looking forward to the discussion

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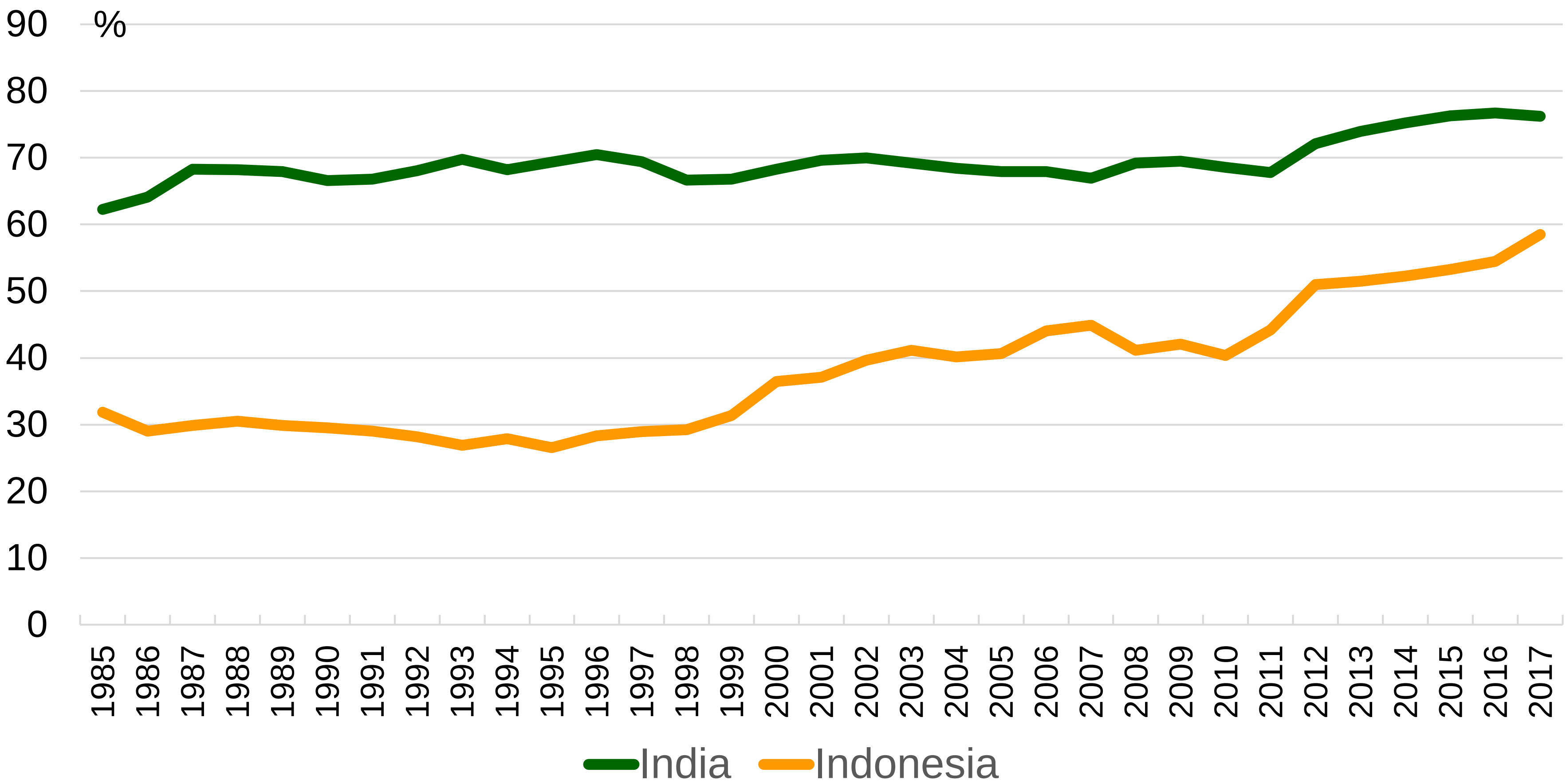
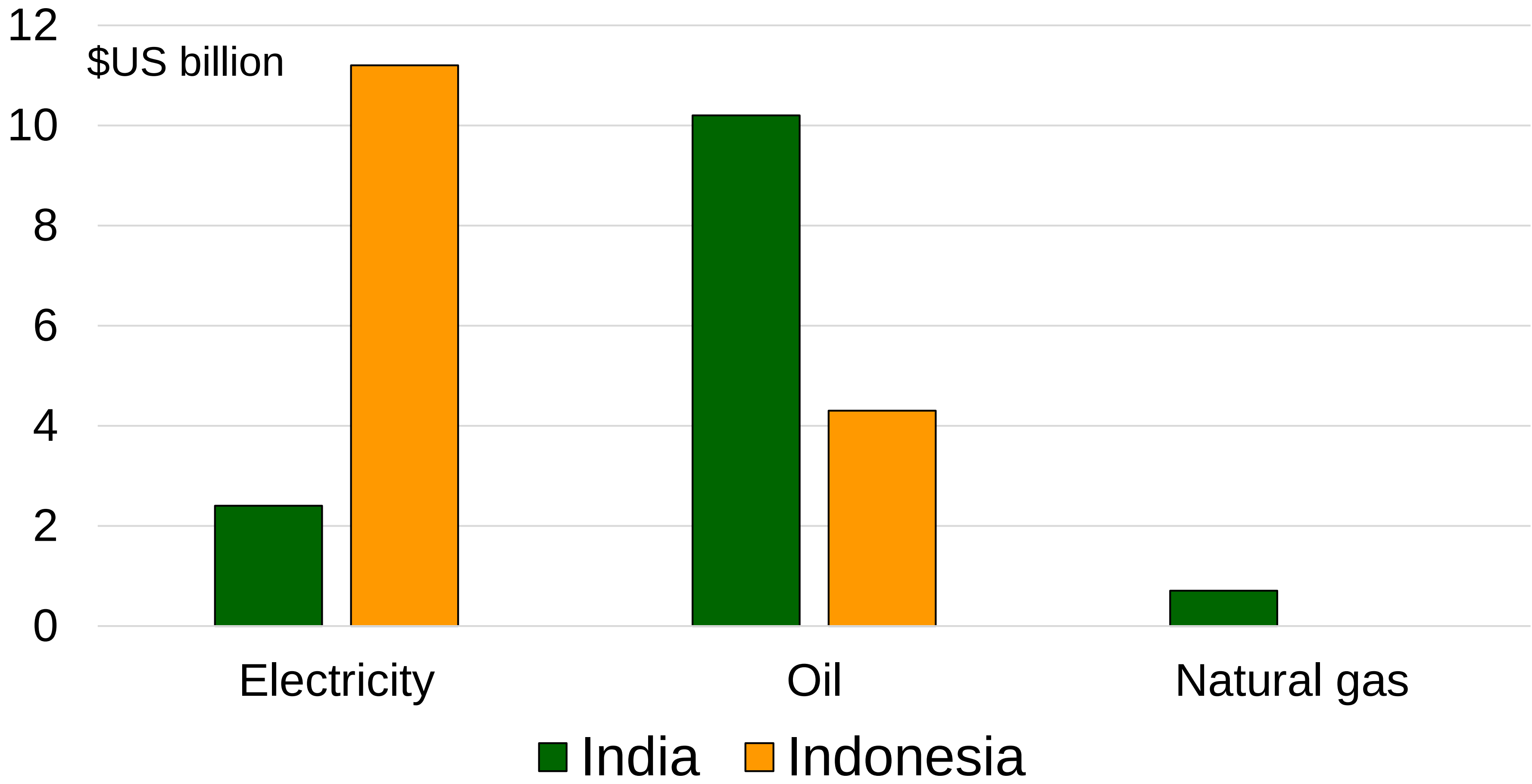
Picture: https://pixabay.com/en/solar-panel-solar-energy-panels-1175819/, http://commons.wikimedia.org/wiki/File:Solar_Power_Plant_Karnataka_I_in_state_of_Karnataka,_India,_40.5-MWp_DC.jpghttp

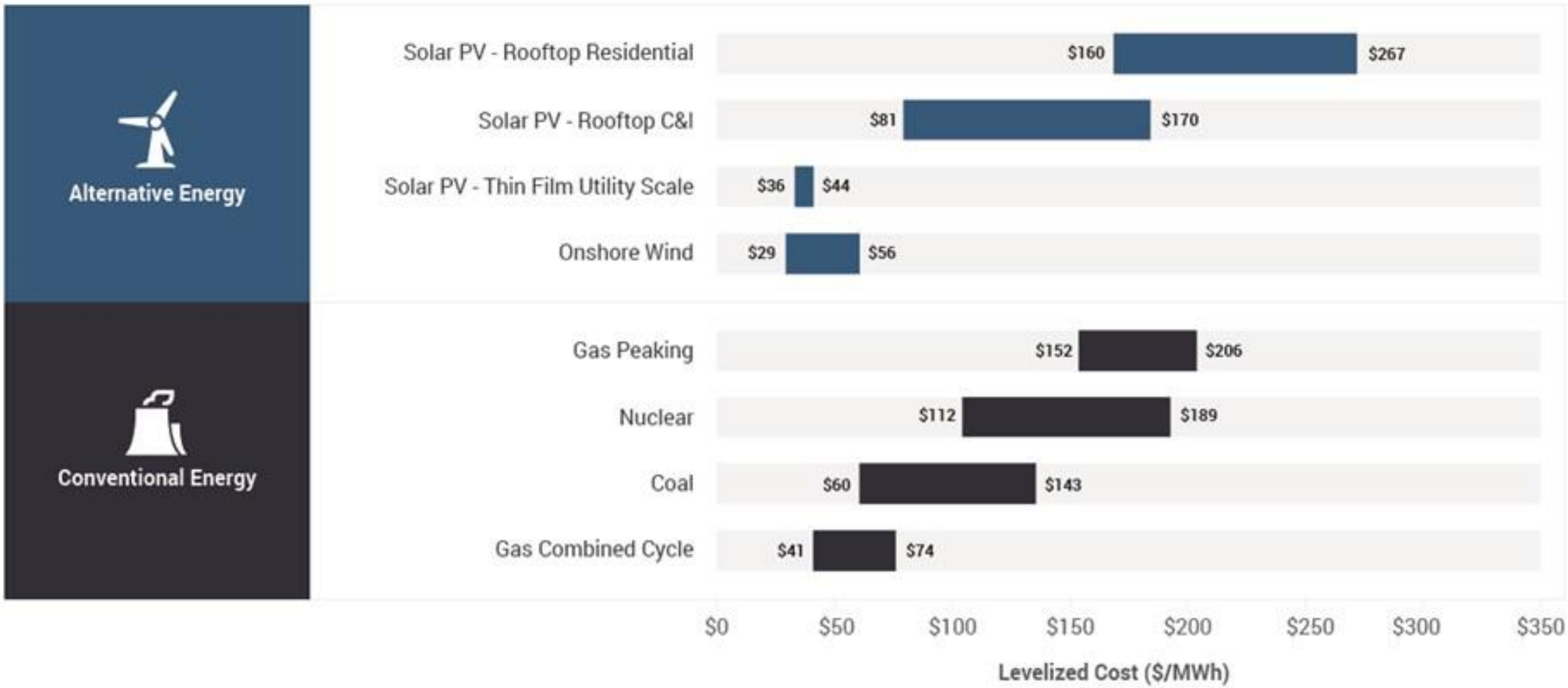
Coal share of electricity mix



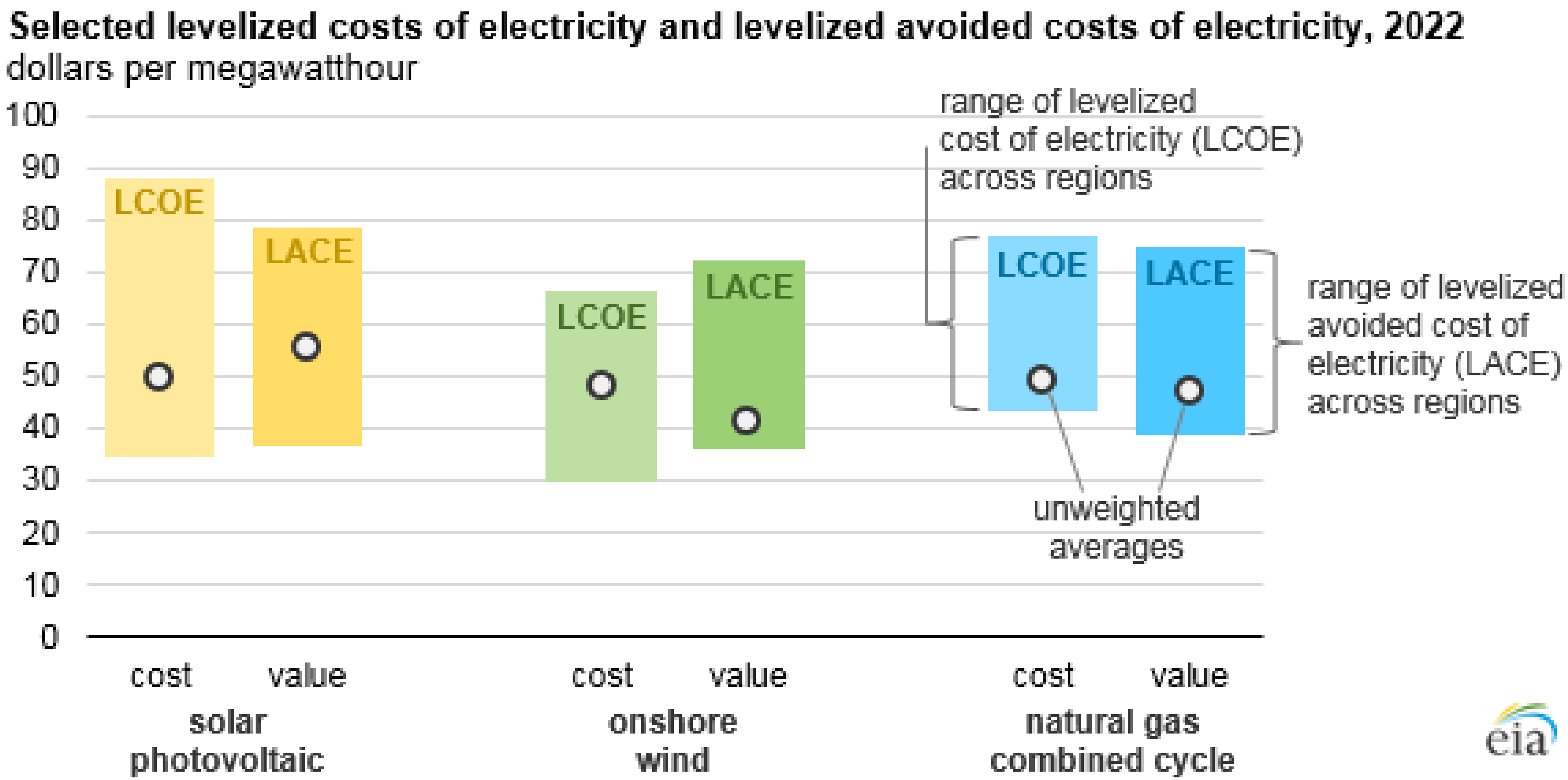
Fossil fuel subsidies (IEA data)



LCOE for US (Lazard)



LCOE for US

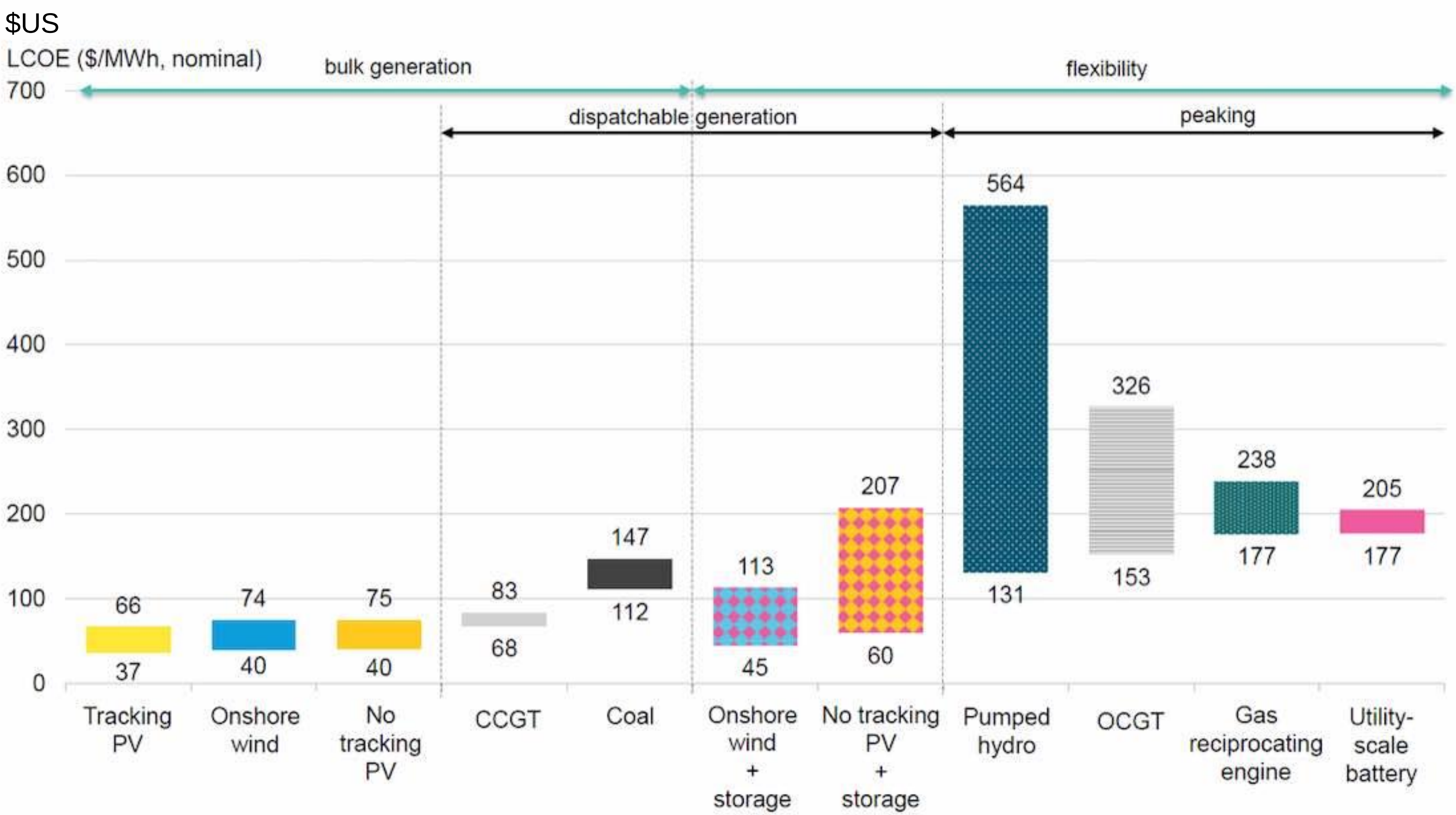


Selected levelized costs of electricity and levelized avoided costs of electricity, 2022
dollars per megawatthour
100
90
80
70
60
50
40
30
20
10
0
LCOE
LACE
LCOE
LACE
LCOE
LACE
range of levelized cost of electricity (LCOE) across regions
range of levelized avoided cost of electricity (LACE) across regions
unweighted averages
cost
value
solar photovoltaic
cost
value
onshore wind
cost
value
natural gas combined cycle
eia

Australian National University

Australia

Levelized cost of electricity



Source: BloombergNEF. Note: The LCOE range represents a range of costs and capacity factors. Battery storage systems (co-located and stand-alone) presented here have four-hour storage. In the case of solar- and wind-plus-battery systems, the range is a combination of capacity factors and size of the battery relative to the power generating asset (25% to 100% of total installed capacity). All LCOE calculations are unsubsidized. Categorization of technologies is based on their primary use case.