Lecture 14

Energy Transition Economics and Policy

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Outline

- Energy transition economics: market, financing, business
- Energy transition policy

Energy transition economics

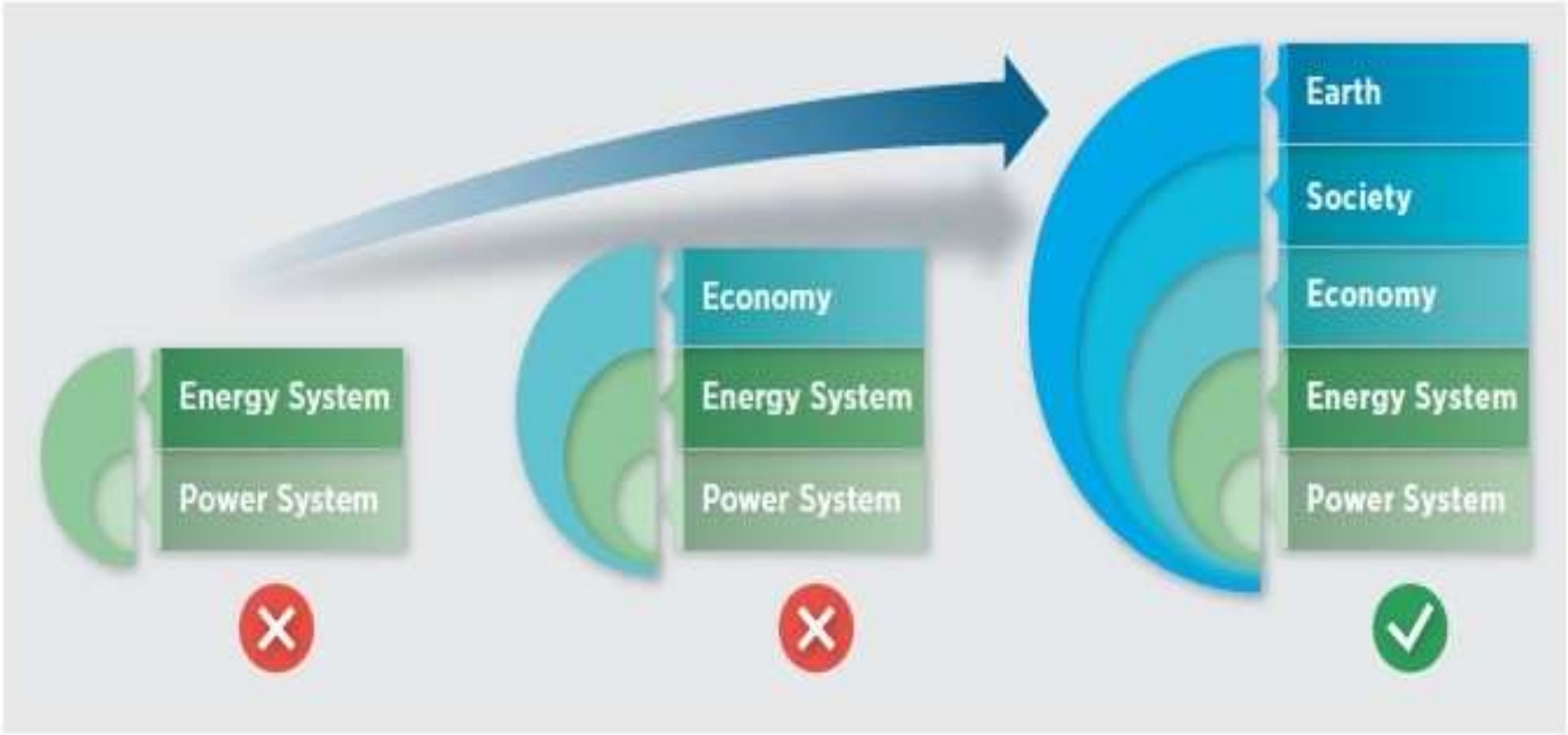
Consequences of energy transition

- Future affordable, reliable and clean energy requires changes to
  - ✓ Physical system
  - ✓ Consumer behaviour
  - ✓ Market rules,
- Moving from an energy system of scarcity to one of potential abundance for almost every country,
- The country that have benefitted from fossil fuel production, it could geopolitical changes and potentially disrupt,
- The greatest challenges for fossil fuel-producing countries to adopt a new, diversified, economic model.

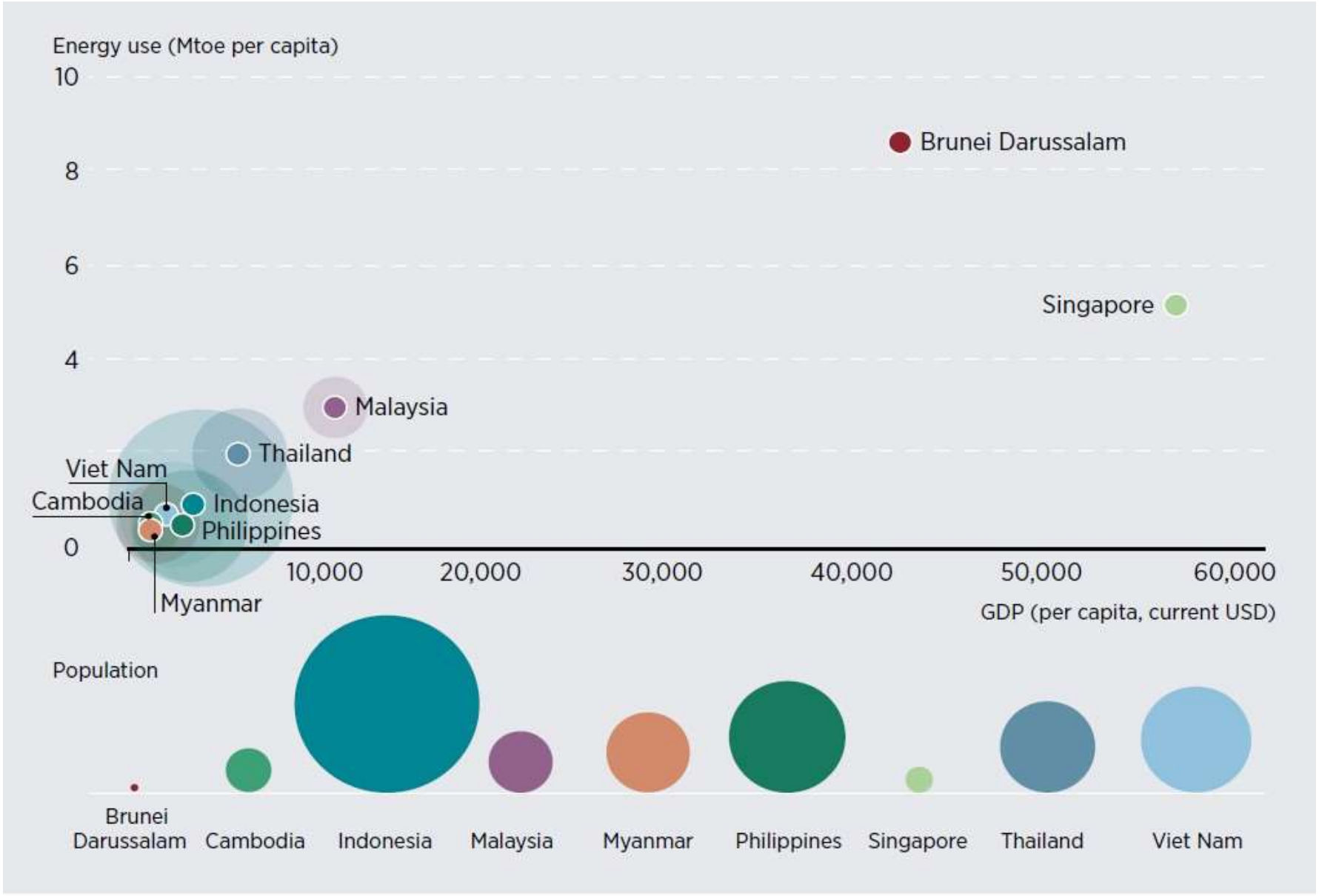
Economic dimensions of the energy transition

- policy,
- markets,
- Technologies,
- and preferences.

The embedded nature of the energy system

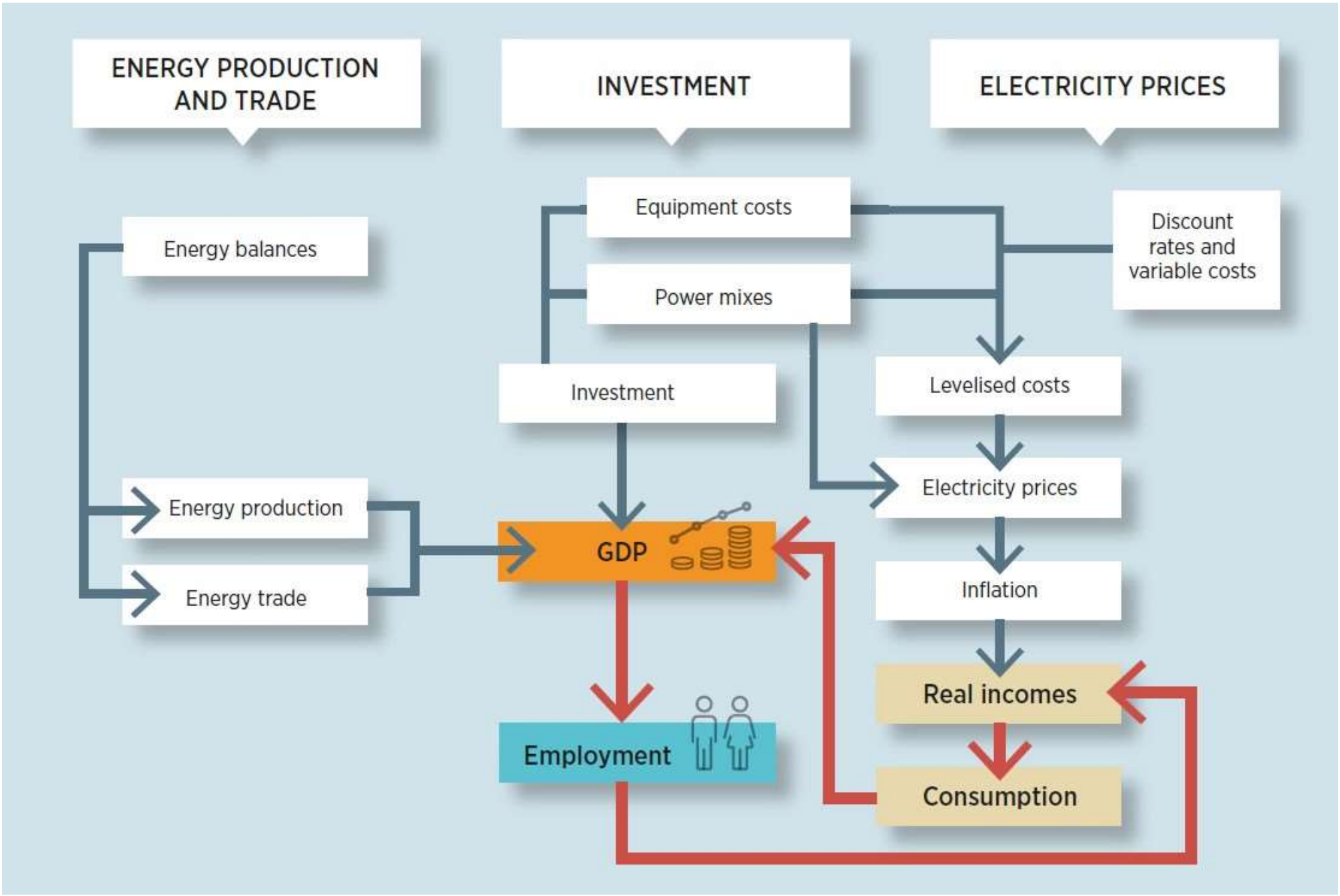


Source: IRENA (2019b)

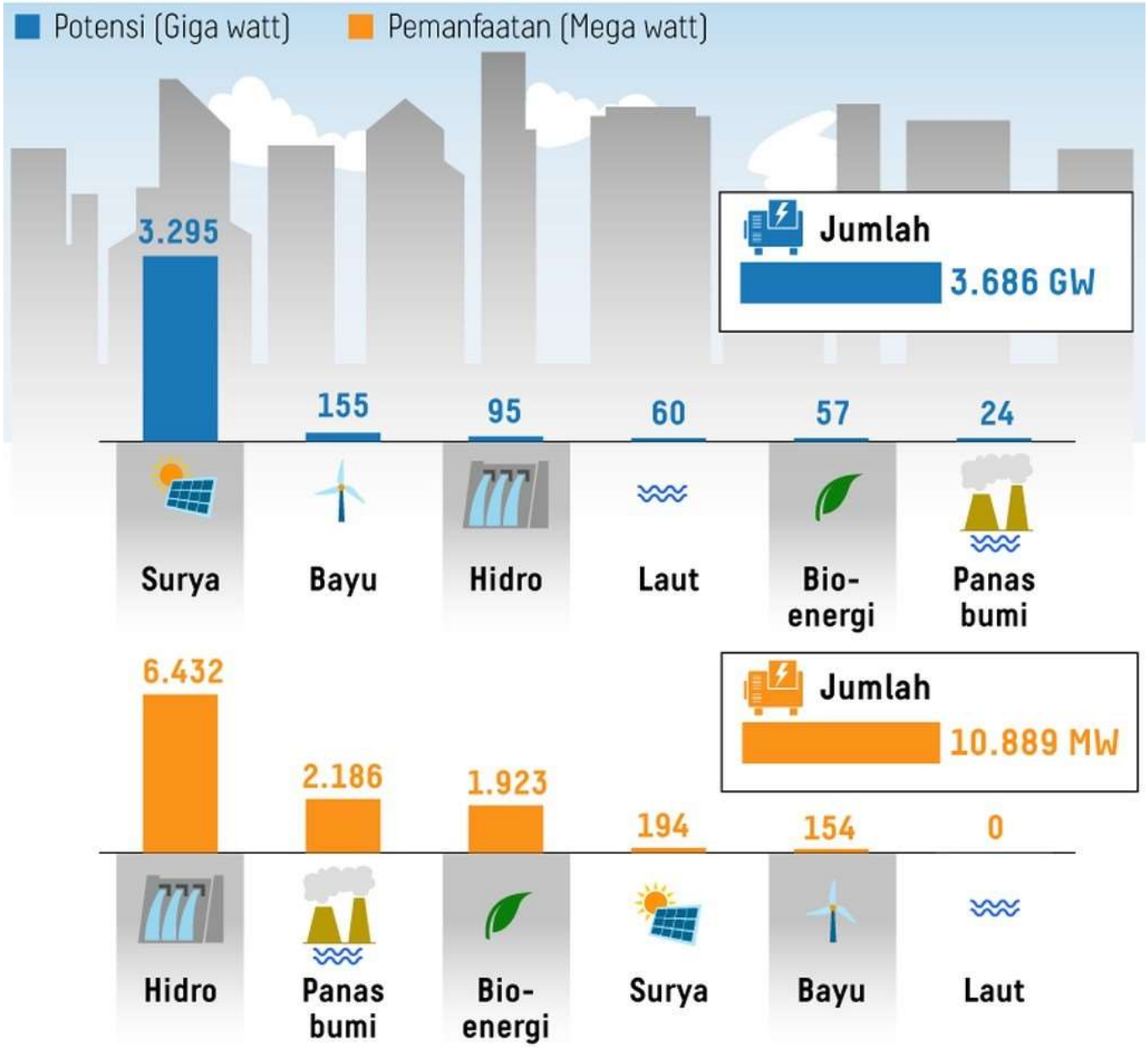


Source: Based on World Bank, n.d.-b. Note: Based on 2014 data for all countries except Viet Nam for which 2013 has been used. The size of the bubble represents the population of the country.

Source: IRENA, 2018


ENERGY PRODUCTION AND TRADE
INVESTMENT
ELECTRICITY PRICES
Equipment costs
Energy balances
Discount rates and variable costs
Power mixes
Investment
Levelised costs
Electricity prices
Energy production
GDP
Energy trade
Inflation
Real incomes
Employment
Consumption

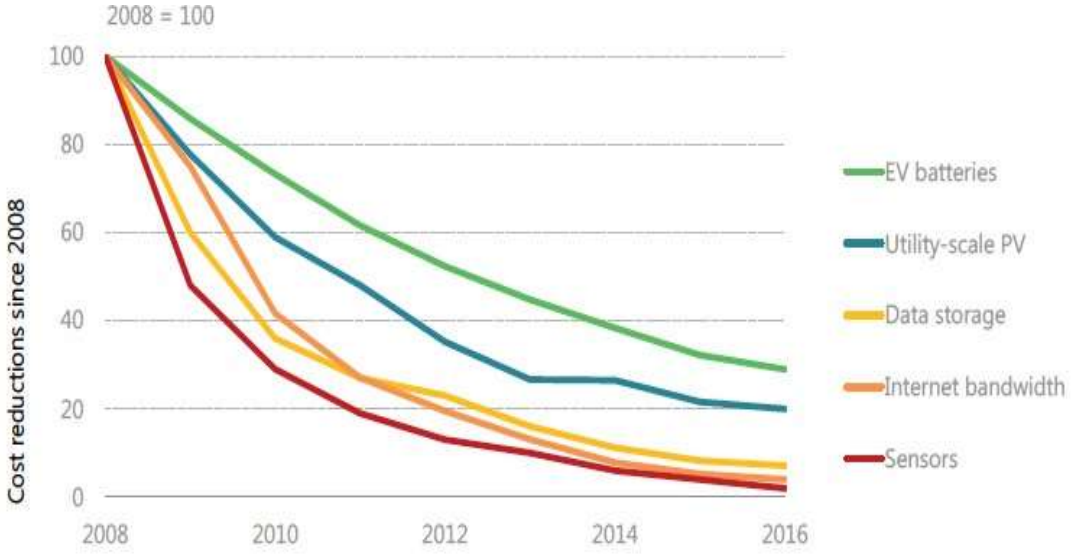
Potensi Energi Baru dan Terbarukan di Indonesia



Sumber: Ditjen EBTKE, Kementerian ESDM

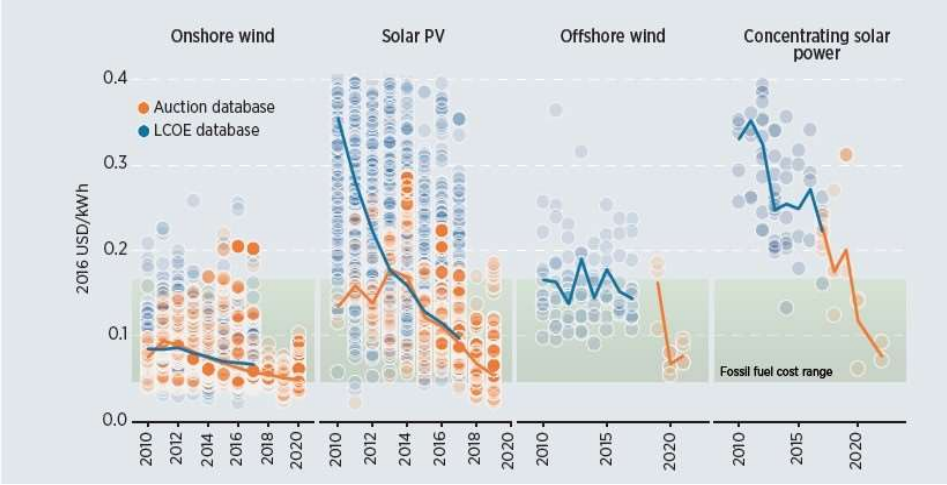
INFOGRAFIK: ARJENDRO

Cost reductions in RE technology and digital sector



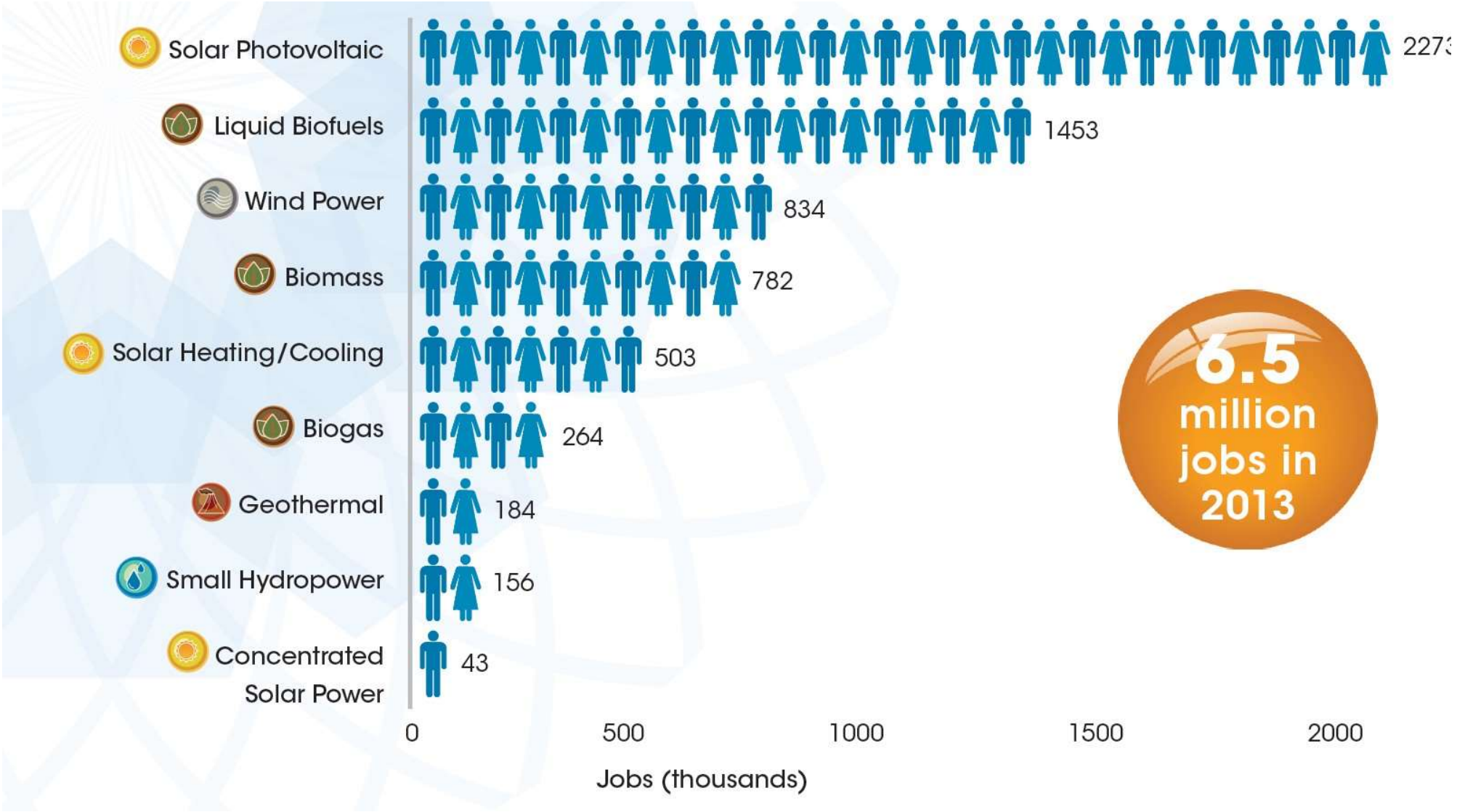
Note: EV = electric vehicle.

Source: Based on BNEF (2017), *Utilities, Smart Thermostats ans the Connected Home Opportunity*; Holdowsky etal. (2015), *Internet of Things*; IEA (2017), *Renewables; Tracking Clean Energy Progress*; *World Energy Investment*, Navigant Research (: *Market Data: Demand response*. Global Capacity, Sites, Spending and Revenue Forecasts.



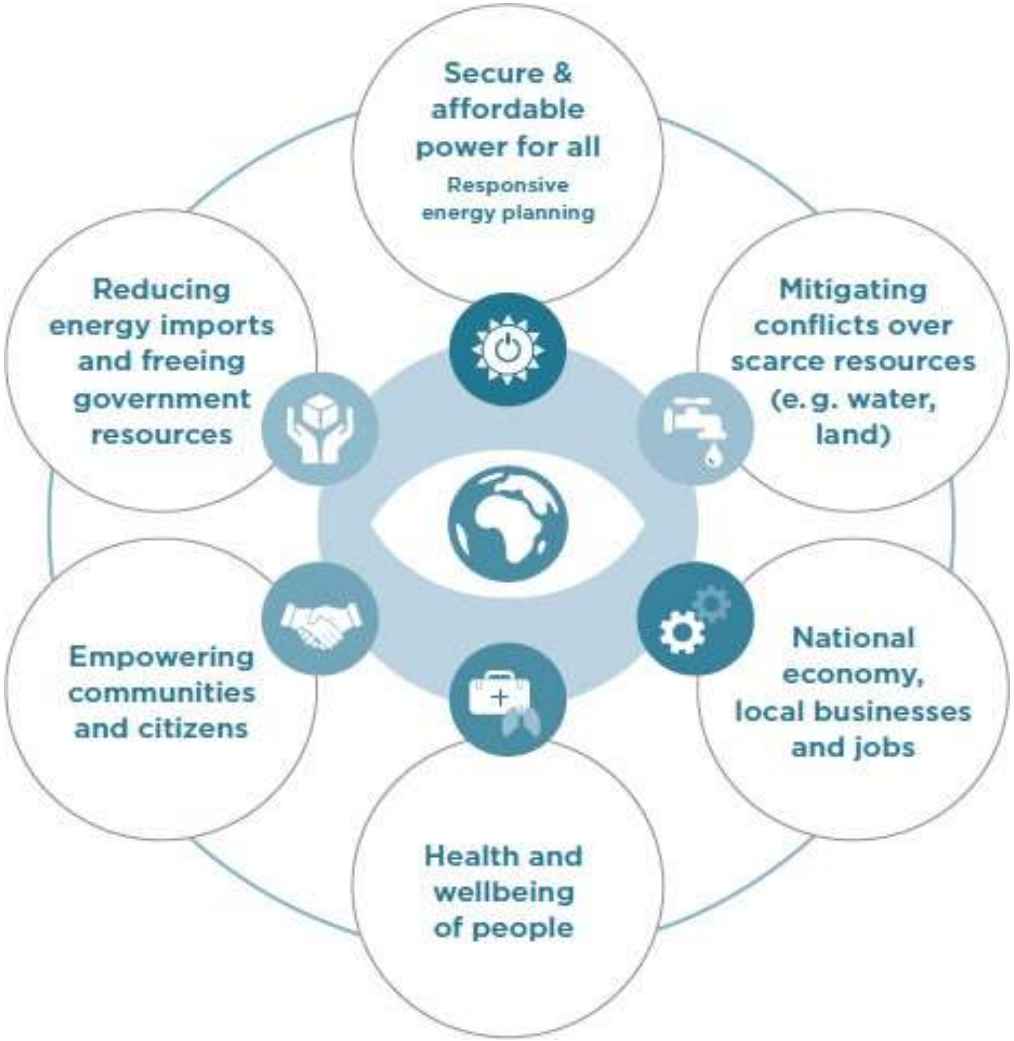
Source: IEA, 2019, IRENA, 2018

Tenaga kerja /teknologi RE



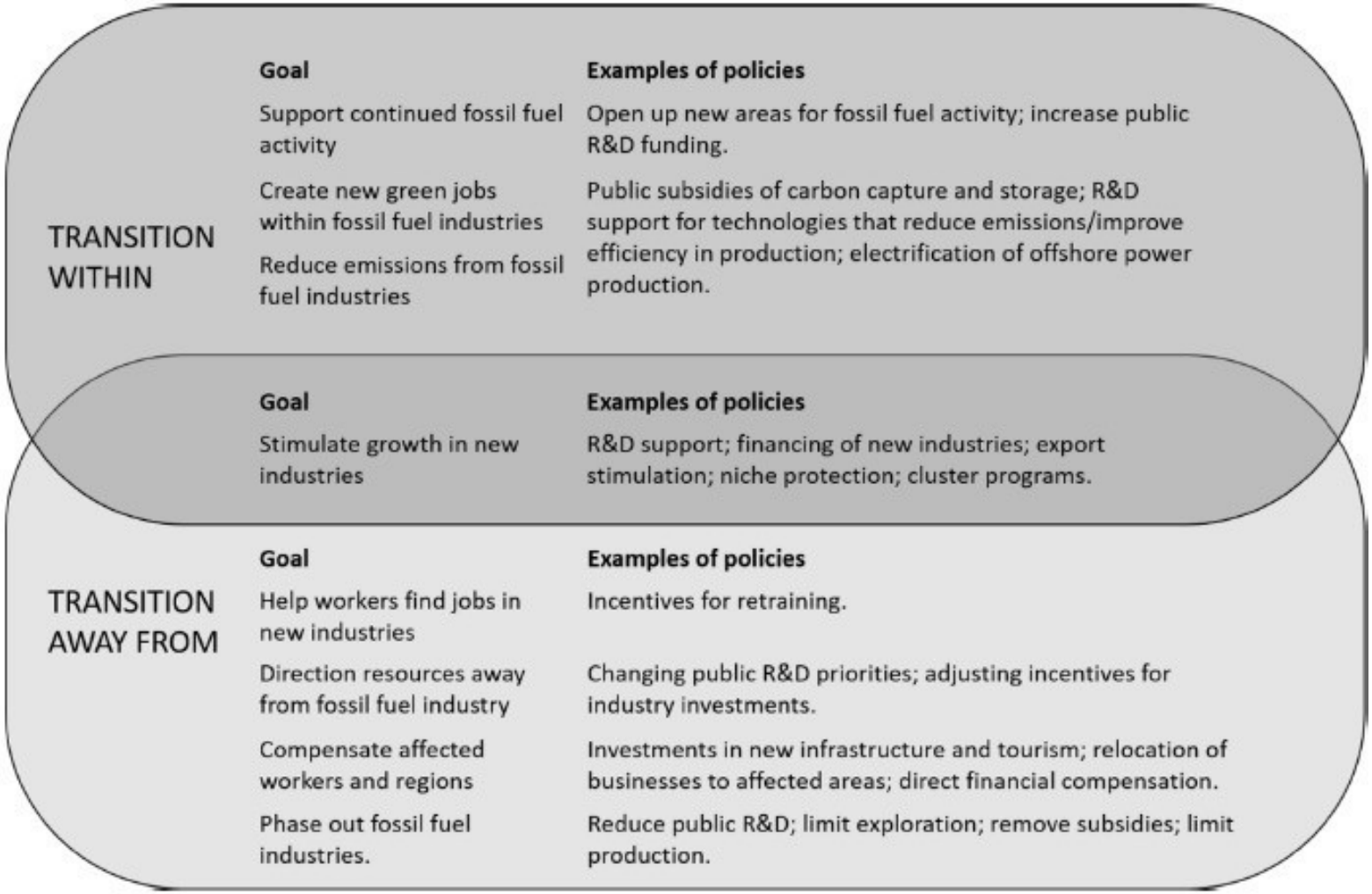
Source: IRENA , 2014

Social and economic co-benefits driving the energy transition



Source: IASS, 2019

Analytical model for investigating different interpretations of a just transition



	Goal	Examples of policies
TRANSITION WITHIN	Support continued fossil fuel activity	Open up new areas for fossil fuel activity; increase public R&D funding.
	Create new green jobs within fossil fuel industries	Public subsidies of carbon capture and storage; R&D support for technologies that reduce emissions/improve efficiency in production; electrification of offshore power production.
	Reduce emissions from fossil fuel industries	
	Goal	**Examples of policies**
	Stimulate growth in new industries	R&D support; financing of new industries; export stimulation; niche protection; cluster programs.
TRANSITION AWAY FROM	**Goal**	**Examples of policies**
	Help workers find jobs in new industries	Incentives for retraining.
	Direction resources away from fossil fuel industry	Changing public R&D priorities; adjusting incentives for industry investments.
	Compensate affected workers and regions	Investments in new infrastructure and tourism; relocation of businesses to affected areas; direct financial compensation.
	Phase out fossil fuel industries.	Reduce public R&D; limit exploration; remove subsidies; limit production.

Source: Normann and Tellman, 2021

Renewable Energy Markets & Financing

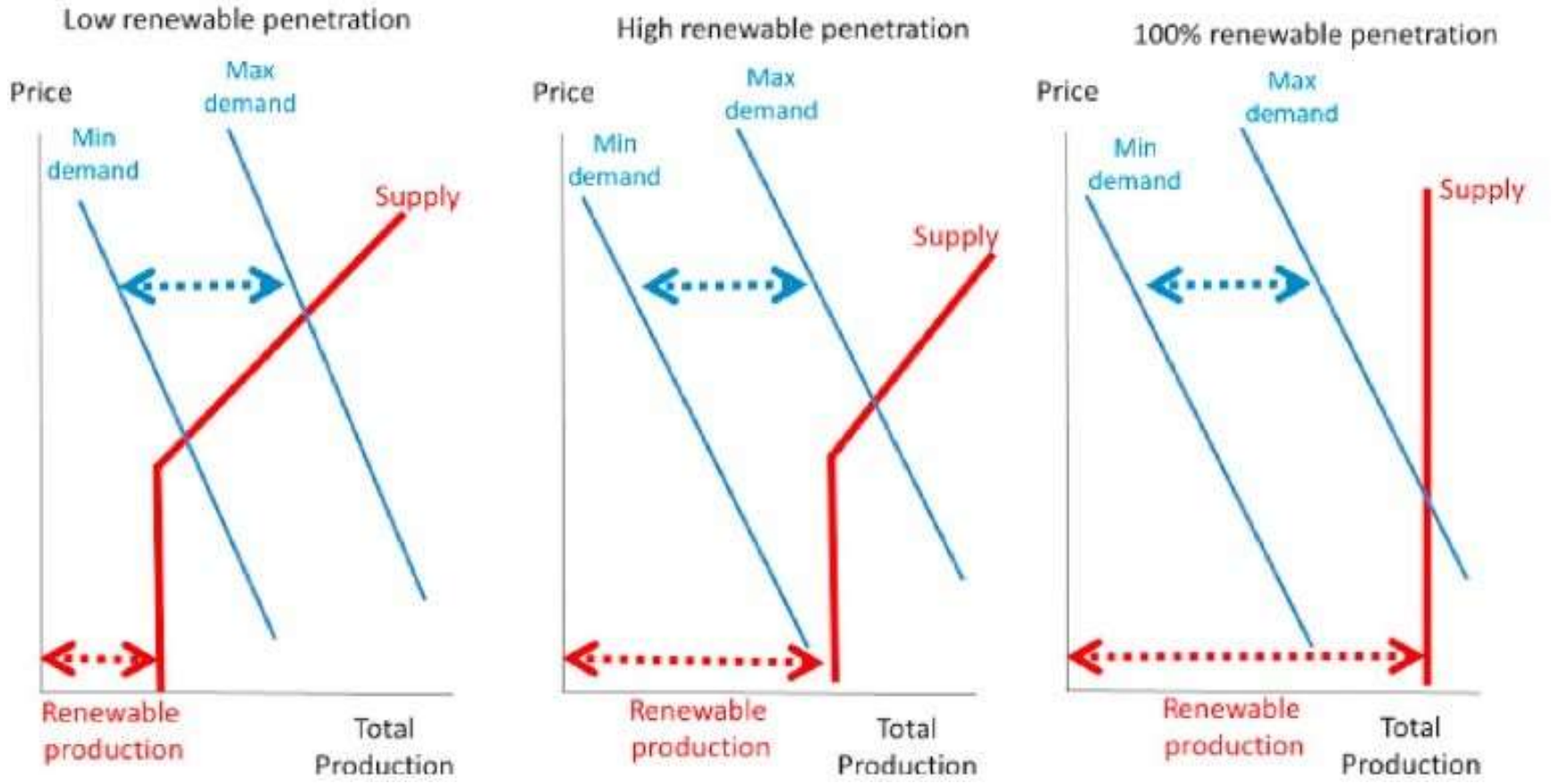
The following consequences of key principles

- The outcome in terms of electricity prices and energy production will depend on the policies applied. There are multiple possible polices and potentially multiple paths of energy transition.
- A complete transition based on renewable energy may be technically possible, but politically difficult to manage in liberalized markets. These markets need a totally new design.
- There is a change in consumers preferences towards decarbonized energy, creating new business opportunities and jeopardizing traditional business models.

Source: Blazquez et al., 2020

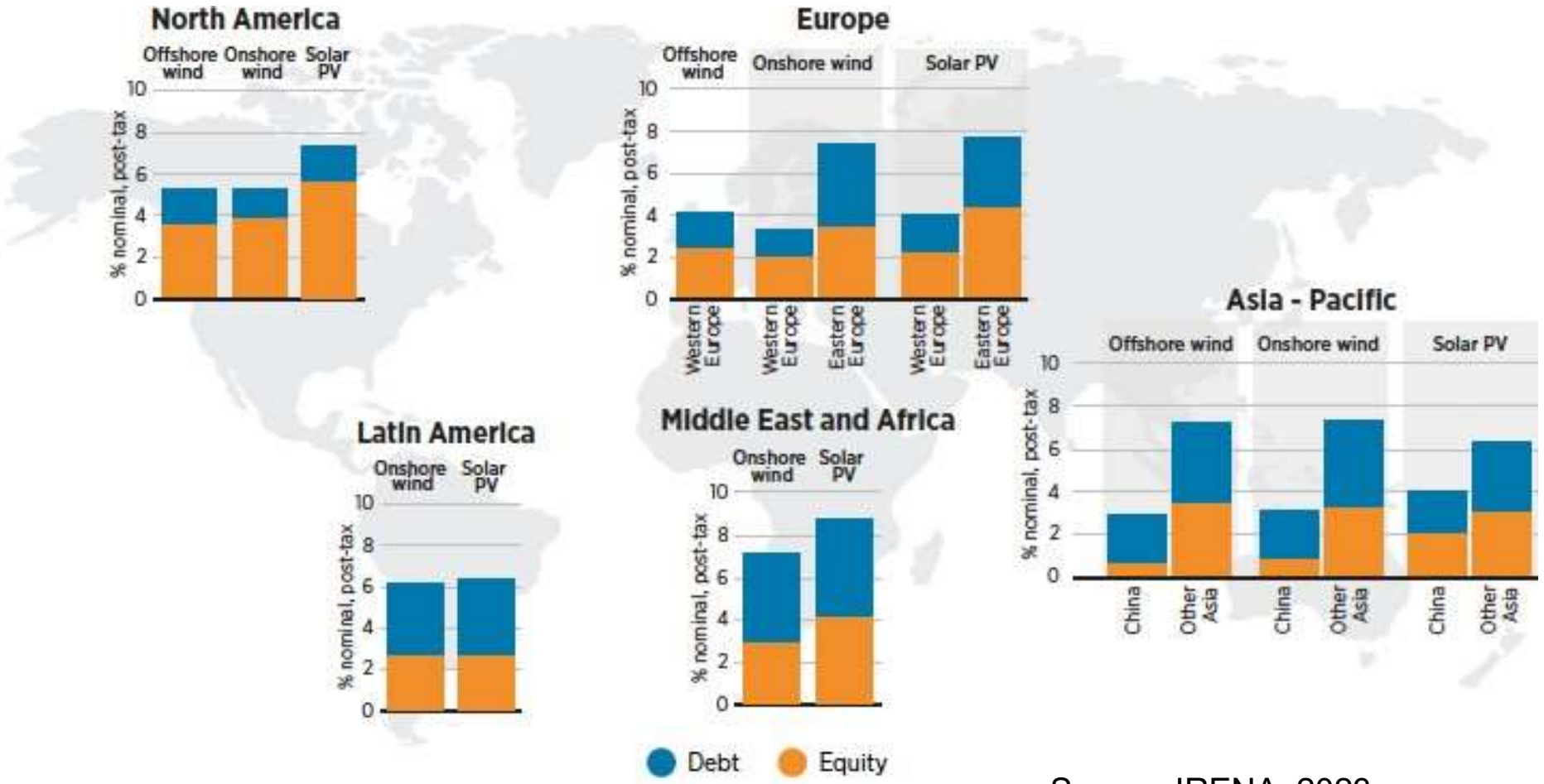
Source: Based on KPMG, 2015.

Supply curves in the stages in the energy transition



Source: Blazquez et al., 2020

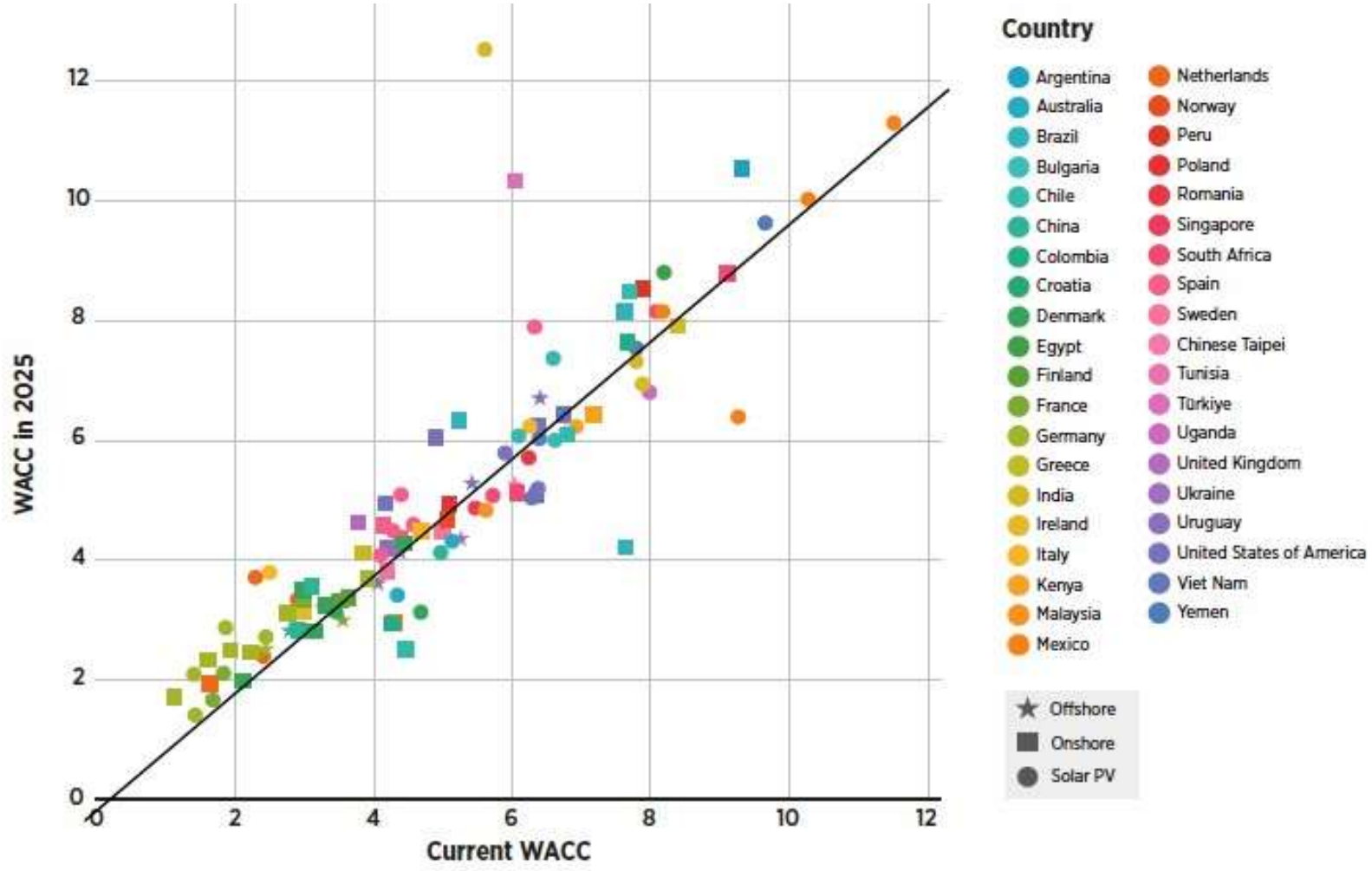
Debt and equity contribution to the total weighted average cost of capital



Note: PV = photovoltaic.

Source: IRENA, 2023

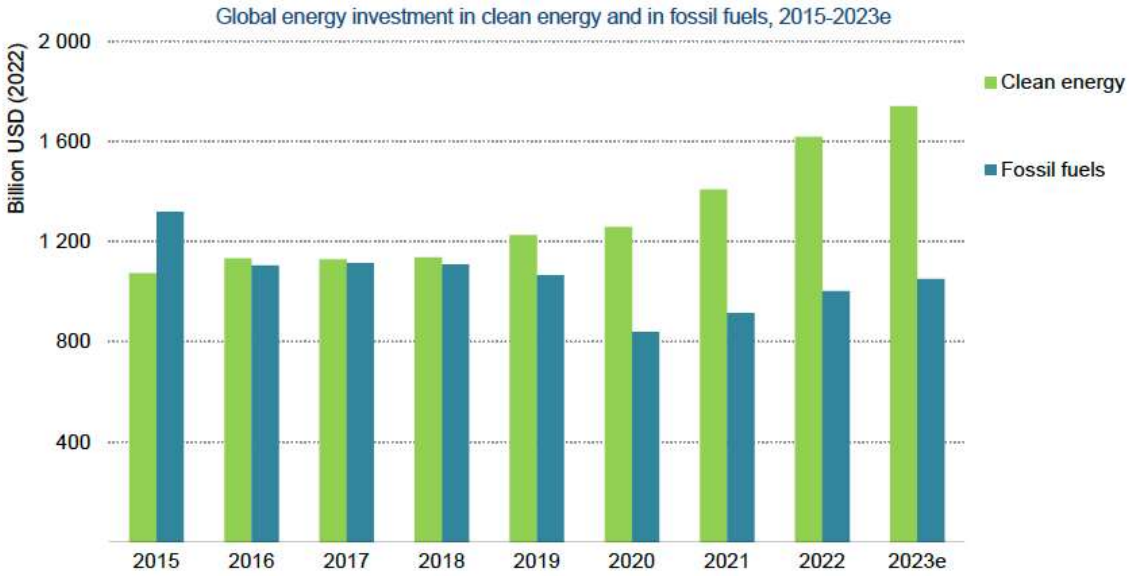
Estimated cost of capital change between 2019-2021 and 2025



Note: PV = photovoltaic; WACC = weighted average cost of capital.

Source: IRENA, 2023

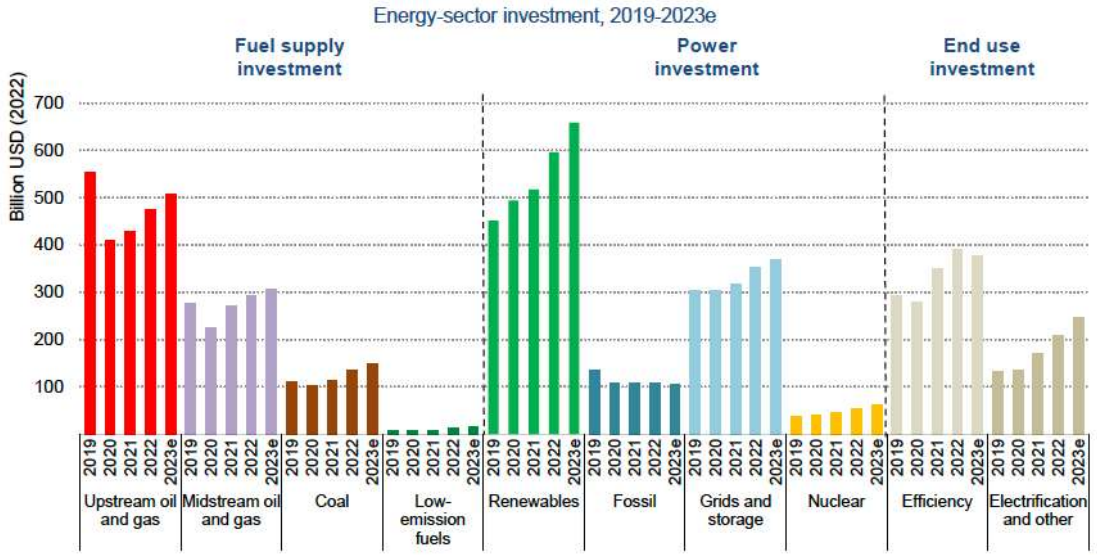
The recovery from the Covid-19 pandemic and the response to the global energy crisis have provided a major boost to global clean energy investment



IEA. CC BY 4.0.

Note: 2023e = estimated values for 2023.

Increases across almost all categories push anticipated spending in 2023 up to a record USD 2.8 trillion

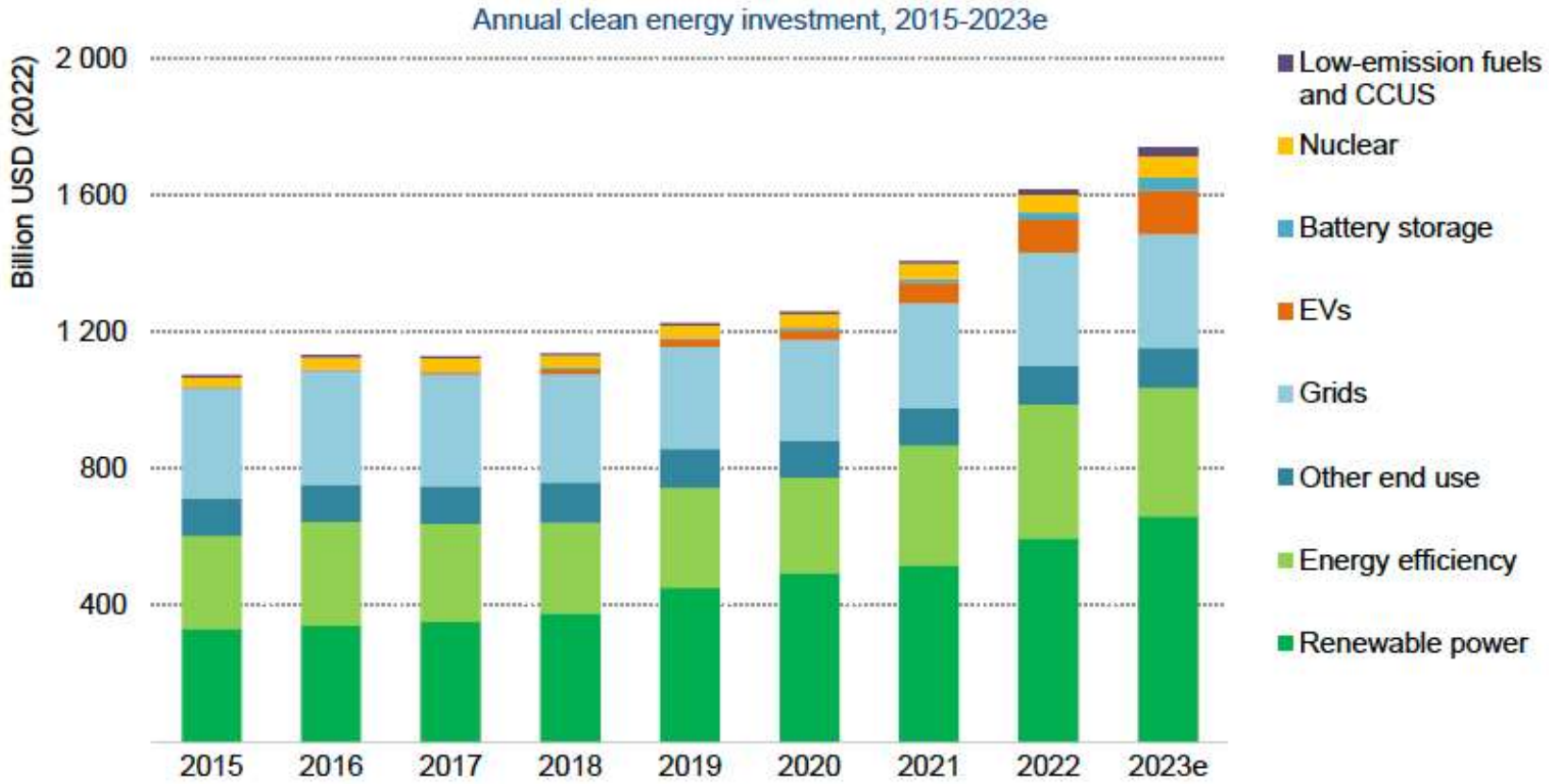


IEA. CC BY 4.0.

Notes: "Low-emission fuels" include modern liquid and gaseous bioenergy, low-emission hydrogen and low-emission hydrogen-based fuels; "Other end use" refers to renewables for end use and electrification in the buildings, transport and industrial sectors. The terms grids and networks are used interchangeably in this report and do not distinguish between transmission and distribution; 2023e = estimated values for 2023..

Source: IEA, 2023

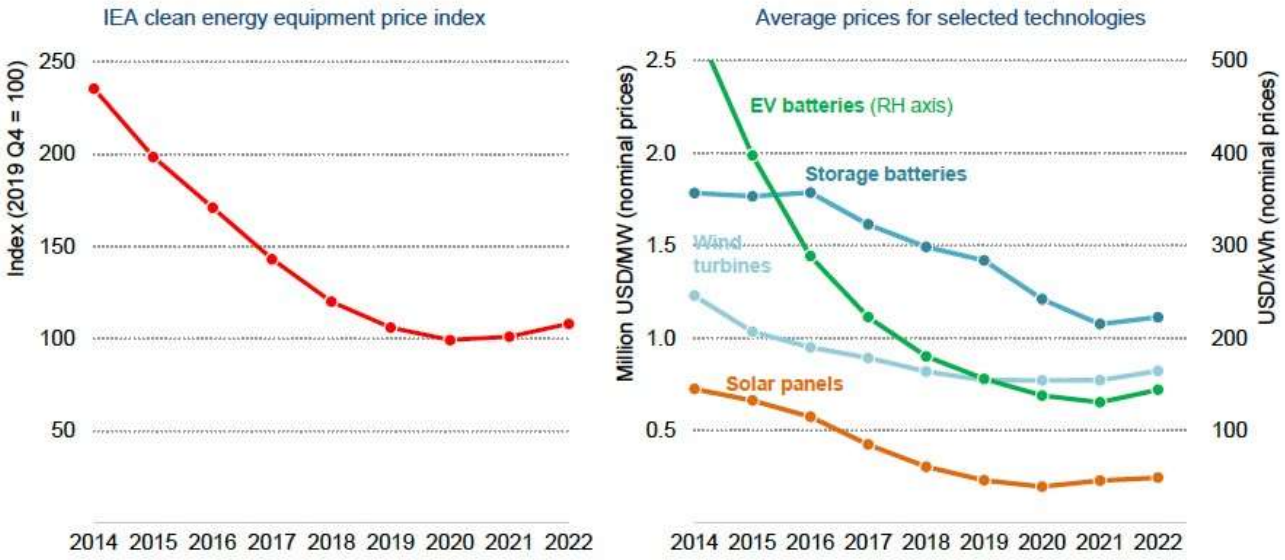
Renewables, led by solar, and EVs are leading the expected increase in clean energy investment in 2023



Notes: "Low-emission fuels" include modern liquid and gaseous bioenergy, low-emission hydrogen and hydrogen-based fuels that do not emit any CO_2 from fossil fuels directly when used and emit very little when being produced; "Other end use" refers to renewables for end use and electrification in the buildings, transport and industrial sectors. 2023e = estimated values for 2023; CCUS = carbon capture, utilisation and storage; EV = electric vehicle.

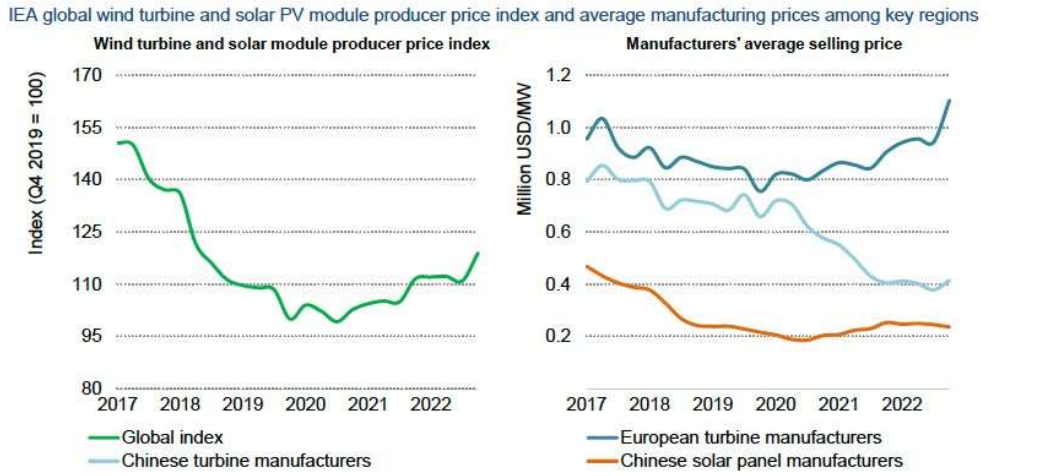
Source: IEA, 2023

Clean energy costs edged higher in 2022, but pressures are easing in 2023 and mature clean technologies remain very cost-competitive in today's fuel-price environment



Notes: The IEA clean energy equipment price index tracks price movements of a fixed basket of equipment products that are central to the clean energy transition, weighted according to their share of global average annual investment in 2020-2022: solar PV modules (48%), wind turbines (36%), EV batteries (13%) and utility-scale batteries (3%). Prices are tracked on a quarterly basis with Q4 2019 defined as 100.

…despite tight supply chains and higher input costs pushing up renewable project costs in many markets



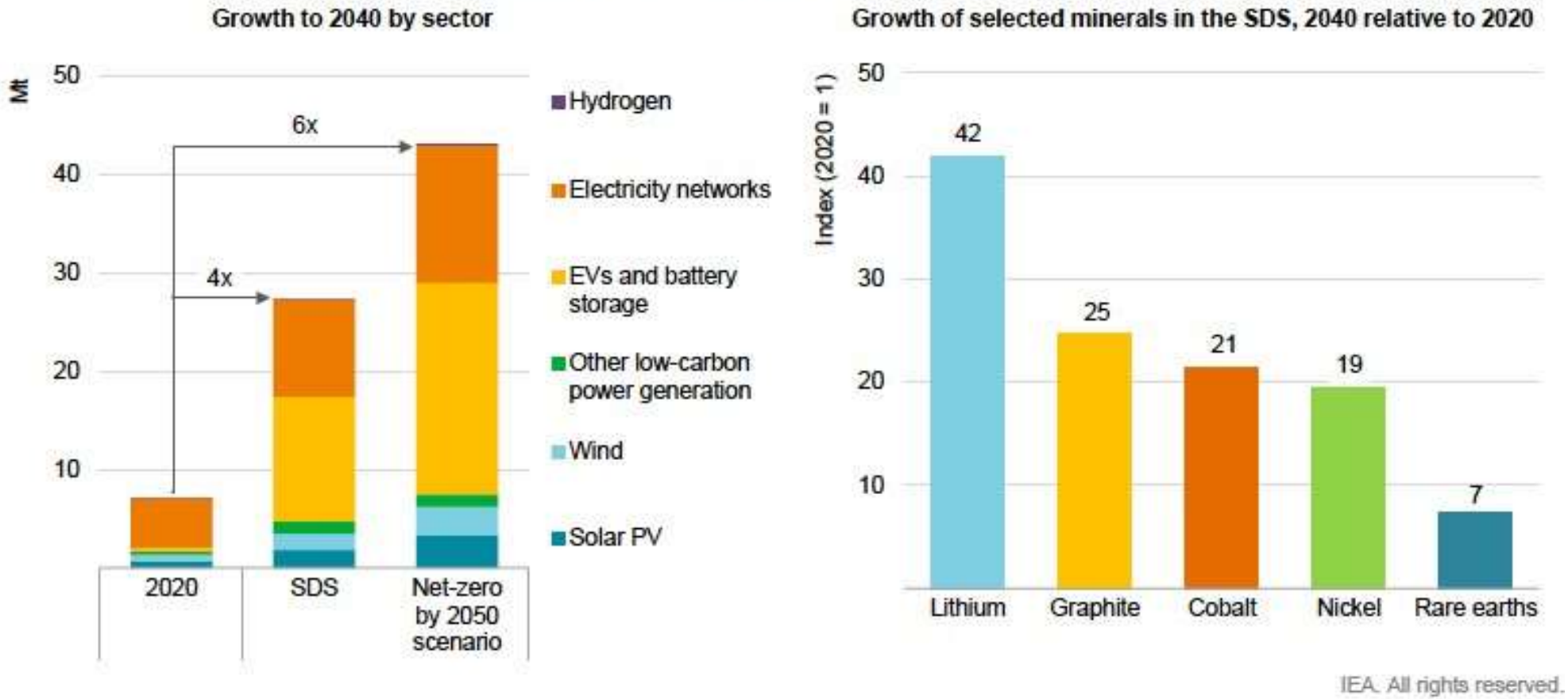
Notes: The index, developed by the IEA, tracks price movements of a fixed basket of solar PV panels and wind turbines against a base period (Q4 2019); prices are weighted according to the shares of global average annual investment in 2020-2022: solar modules (58%) and wind turbines (42%); wind turbine prices reflect a weighted average of both onshore and offshore turbine manufacturers' prices, noting that this is more sensitive to changes in onshore turbine prices given that they account for a larger share of production; given that the supply of solar PV modules is highly geographically concentrated (with the majority of production based in China), and data availability constraints, where only the price trends of Chinese manufacturers are included.

Sources: IEA calculations based on companies' financial reports, Bloomberg data and BNEF.

Source: IEA, 2023

Mineral demand for clean energy technologies would rise by at least four times by 2040 to meet climate goals, with particularly high growth for EV-related minerals

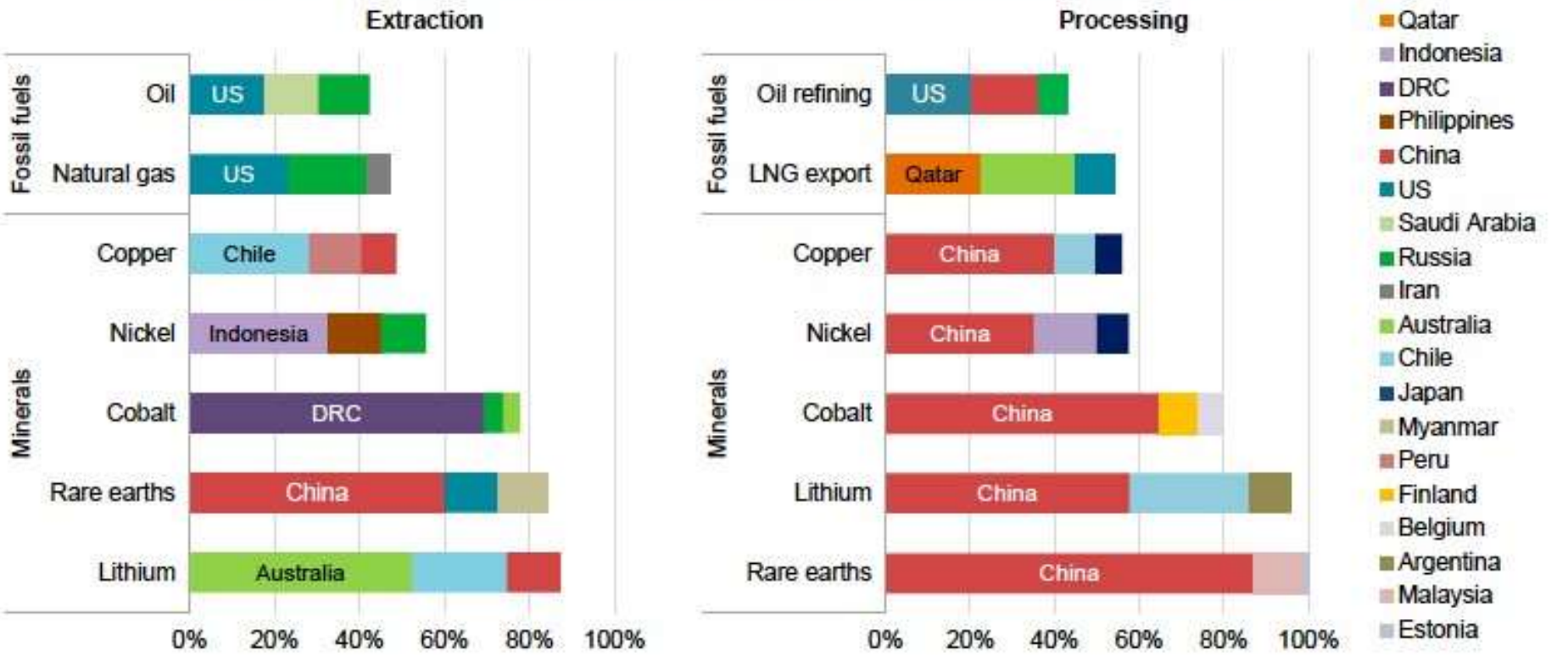
Mineral demand for clean energy technologies by scenario



Notes: Mt = million tonnes. Includes all minerals in the scope of this report, but does not include steel and aluminium. See Annex for a full list of minerals.

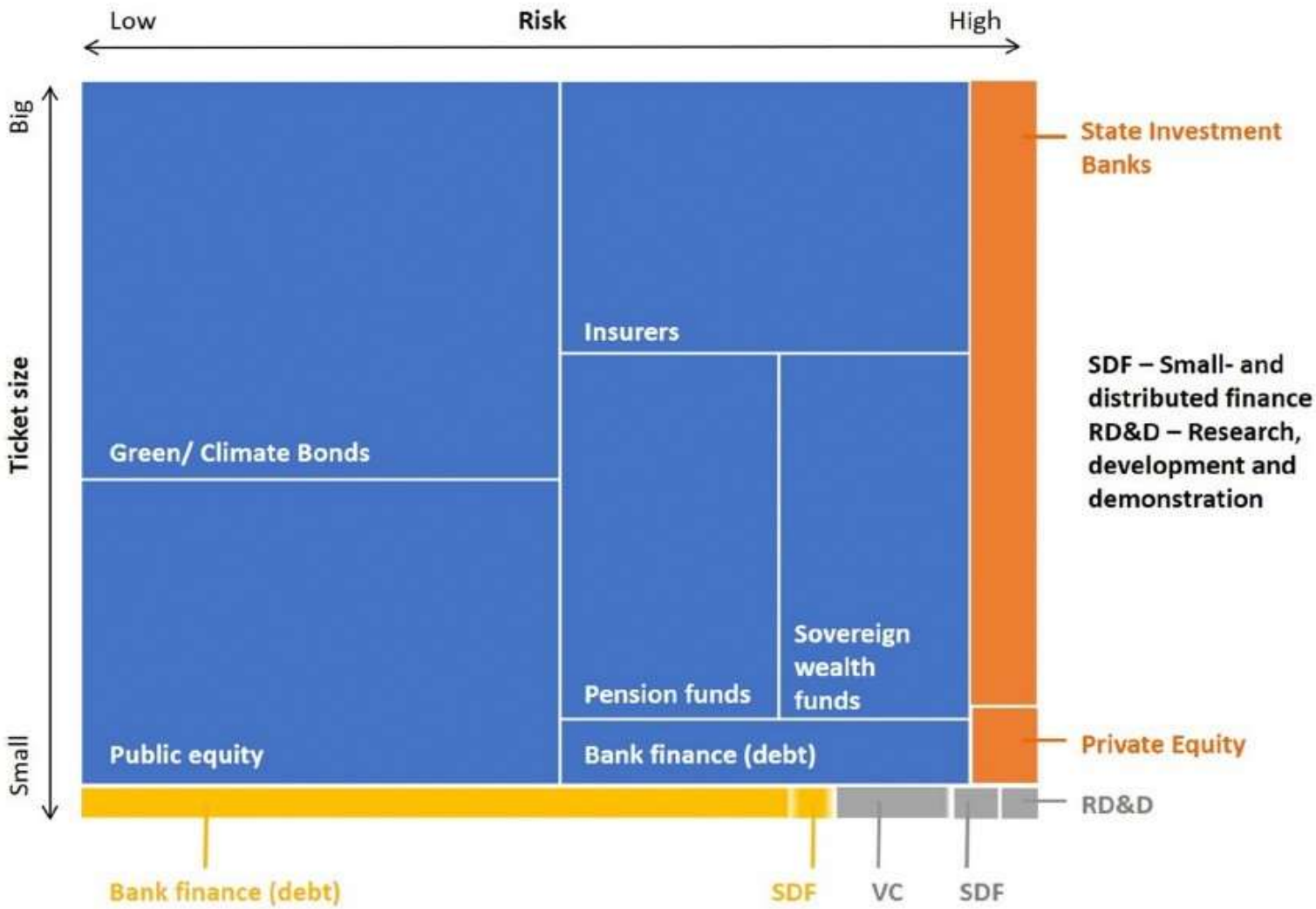
Production of many energy transition minerals today is more geographically concentrated than that of oil or natural gas

Share of top three producing countries in production of selected minerals and fossil fuels, 2019



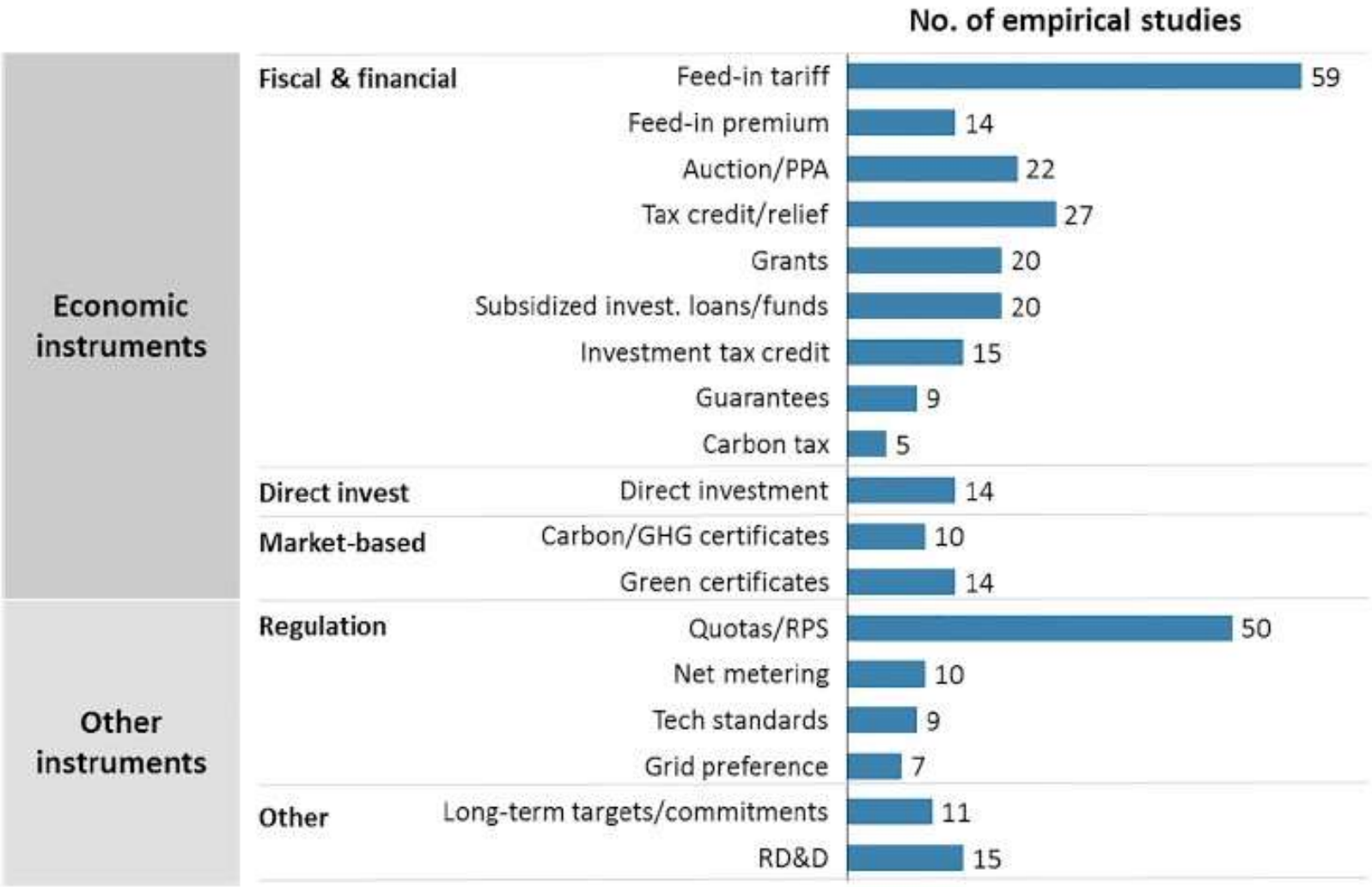
Notes: LNG = liquefied natural gas; US = United States. The values for copper processing are for refining operations.
Sources: IEA (2020a); USGS (2021), World Bureau of Metal Statistics (2020); Adamas Intelligence (2020).

Availability of sources of finance for the energy transition



Source: Polzin and Sanders, 2020

Types of policy instruments



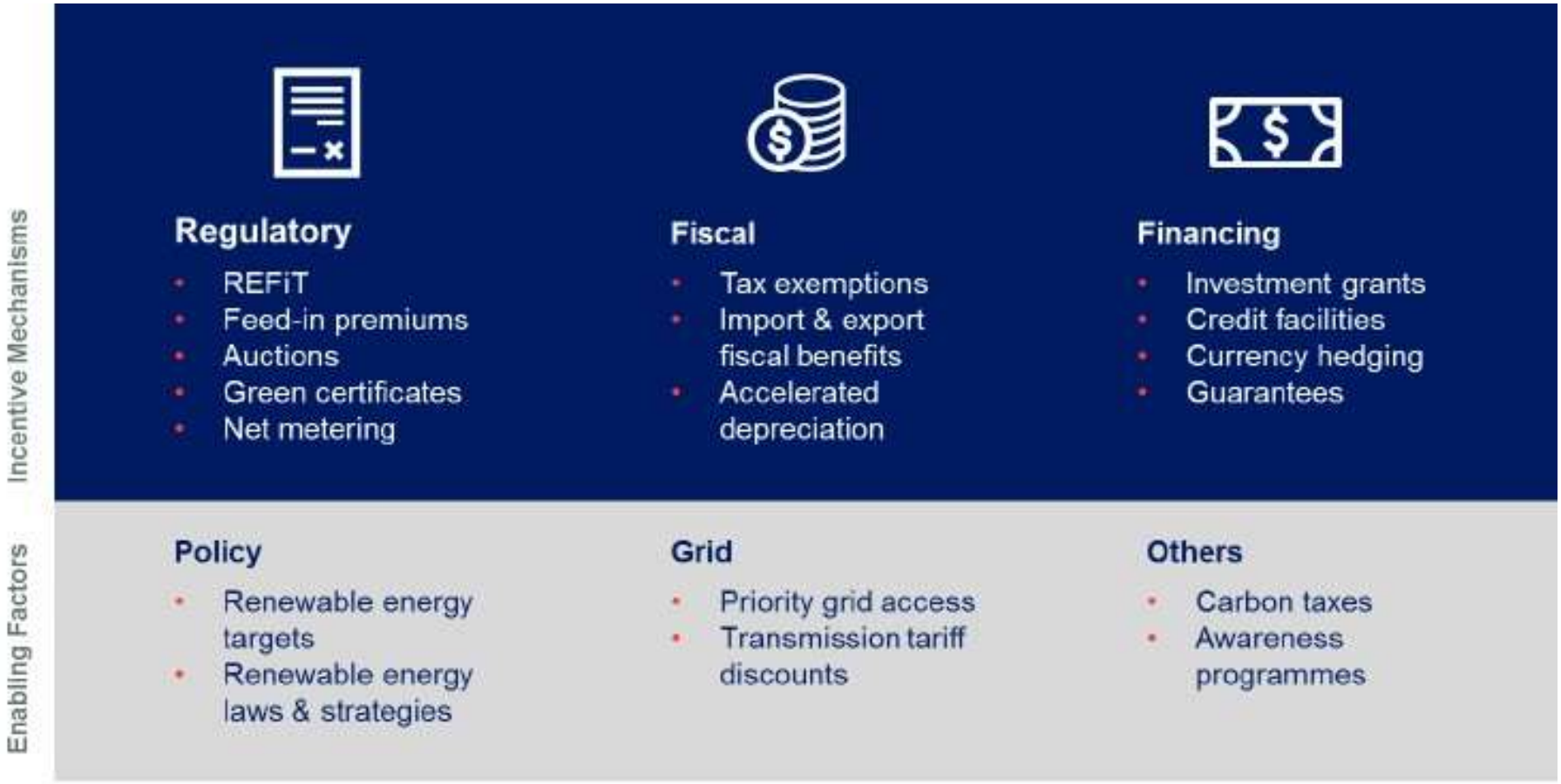
Source: Polzin, 2019

Incentive mechanisms for renewable energy deployment

- ***Regulatory incentive mechanisms*** are comprehensive programs to provide the regulatory and market conditions required for a renewable energy investment to take place.
- ***Fiscal incentive mechanisms*** aim to reduce the burden of high upfront costs for renewable energy projects. They typically come in the form of tax incentives, rebates, and grants.
- ***Financing incentive mechanisms*** typically aim to improve access to capital and lower financing costs. They often come in the form of concessional loans, guarantees, and other measures to mitigate risk

Source: ESREM

Common incentive mechanisms for promotion of renewable energy

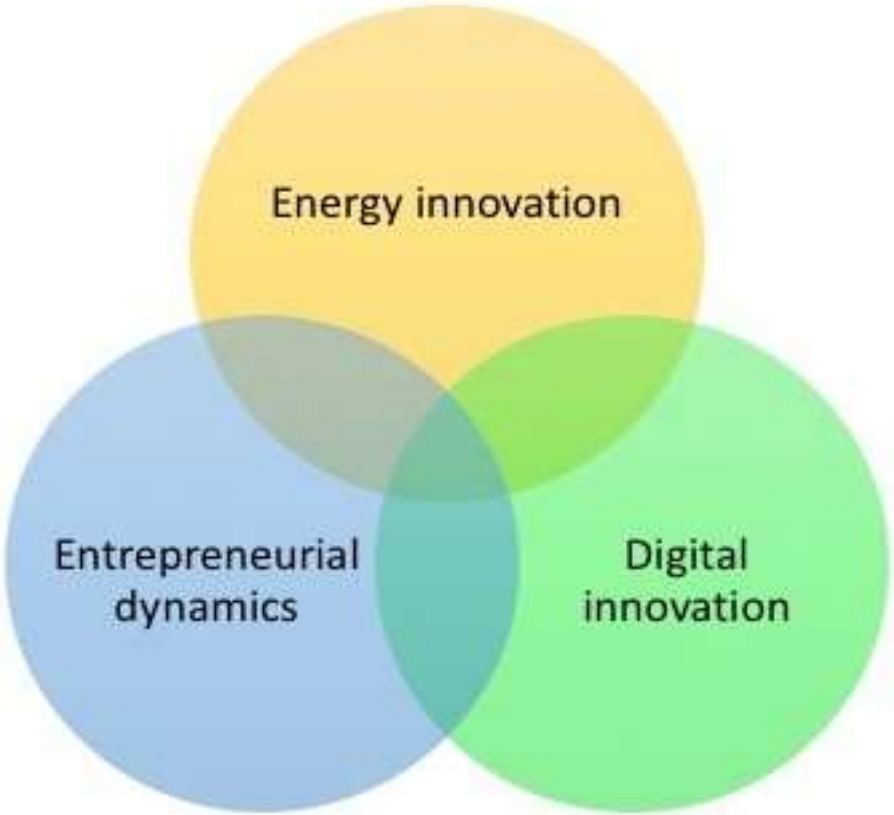


Source: Adapted from IRENA (2015)

Source: ESREM

New business

Entrepreneurship, clean energy, and digital innovation confluence



Source: Energy transition hub

INNOVATION DIMENSIONS

ENABLING TECHNOLOGIES

1	Utility scale batteries
2	Behind-the-meter batteries
3	Electric-vehicle smart charging
4	Renewable power-to-heat
5	Renewable power-to-hydrogen
6	Internet of Things
7	Artificial intelligence and big data
8	Blockchain
9	Renewable mini-grids
10	Supergrids
11	Flexibility in conventional power plants

BUSINESS MODELS

12	Aggregators
13	Peer-to-peer electricity trading
14	Energy-as-a-service
15	Community-ownership models
16	Pay-as-you-go models

MARKET DESIGN

17	Increasing time granularity in electricity markets
18	Increasing space granularity in electricity markets
19	Innovative ancillary services
20	Re-designing capacity markets
21	Regional markets
22	Time-of-use tariffs
23	Market integration of distributed energy resources
24	Net billing schemes

SYSTEM OPERATION

25	Future role of distribution system operators
26	Co-operation between transmission and distribution system operators
27	Advanced forecasting of variable renewable power generation
28	Innovative operation of pumped hydropower storage
29	Virtual power lines
30	Dynamic line rating

Source: IRENA, 2020

1 BENEFITS

Peer-to-peer (P2P) electricity trading empowers prosumers and consumers, leading to increased renewable energy deployment and flexibility in the grid. P2P platforms also aid in balancing and congestion management and providing ancillary services.

Peer-to-peer electricity trading

- Higher renewable power deployment and flexibility
- Balancing and congestion management
- Ancillary services

2 KEY ENABLING FACTORS

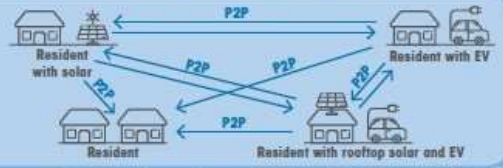
- Distributed renewable energy resources
- Digitalisation
- Conducive regulatory framework

3 SNAPSHOT

- → Australia, Bangladesh, Colombia, Germany, Japan, Malaysia, the Netherlands, the UK, the US and others have started trial P2P schemes.
- → Many pilot projects used blockchain technology.

What is P2P electricity trading?

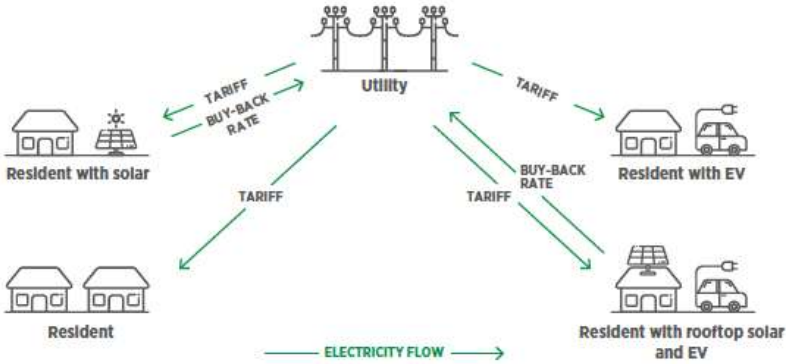
The P2P model creates an online marketplace where prosumers and consumers can trade electricity, without an intermediary, at their agreed price.



PEER-TO-PEER TRADING

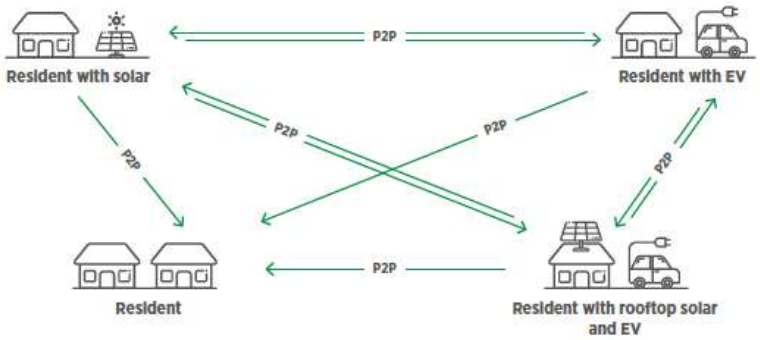
Trading based on P2P models makes renewable energy more accessible, **empowers consumers** and allows them to make better use of their energy resources.

Figure 1 Traditional trading model of residential consumers and prosumers with utilities



Source: Adapted from Liu *et al.*, 2019

Figure 2 Structure of P2P electricity trading model



Source: Liu *et al.*, 2019
Note: The direction of the arrow indicates the accounting and transactions flow directions.

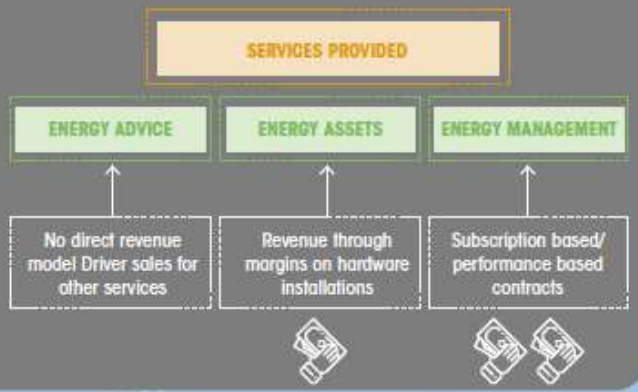
Source: IRENA, 2020

1 BENEFITS

Through different services provision and revenue models, EaaS supports:

- deployment and operation of distributed energy resources and
- demand-side management

This unlocks demand-side flexibility.



2 KEY ENABLING FACTORS

- Digitalisation
- Time-of-use tariffs
- Revision of distribution system operator methodologies to account for demand-side flexibility

3 SNAPSHOT

- → Smart meter penetration is 14% globally, 70% in China and the US, and 44% in the EU (2019).
- → EaaS models with time-of-use pricing can reduce peak demand by 3–10%.
- → EaaS models are emerging in many countries, including Australia, China, Finland, Ireland, Italy, Japan, Sweden, the UK and the US.

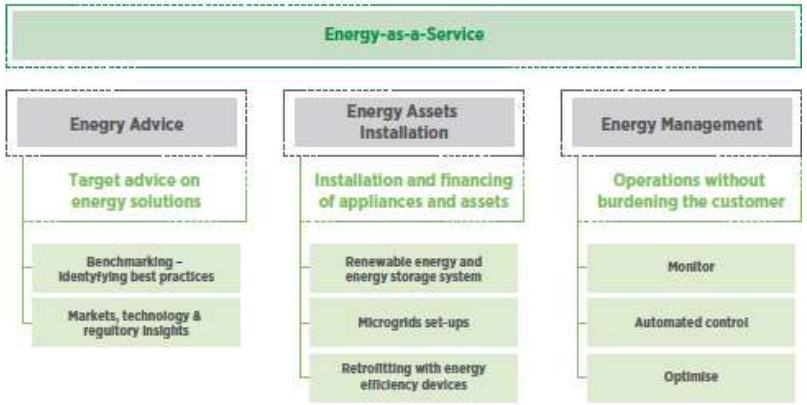
What is Energy as a Service (EaaS)?

The EaaS model offers various energy-related services to the consumers, rather than only supplying electricity.

ENERGY AS A SERVICE

Increased deployment of distributed energy resources along with the widespread availability of smart devices has created room for innovative business models to emerge, shifting the value from selling kilowatt-hours to service provision.

Figure 1 Range of services offered by energy service providers



Source: Adapted from Edison Energy, 2016; Eneco, 2019

Figure 3 Key stakeholders and types of services provided under the EaaS model

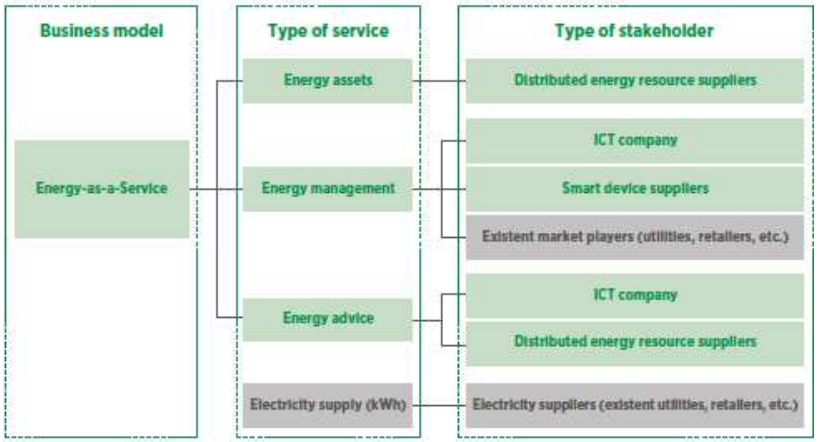
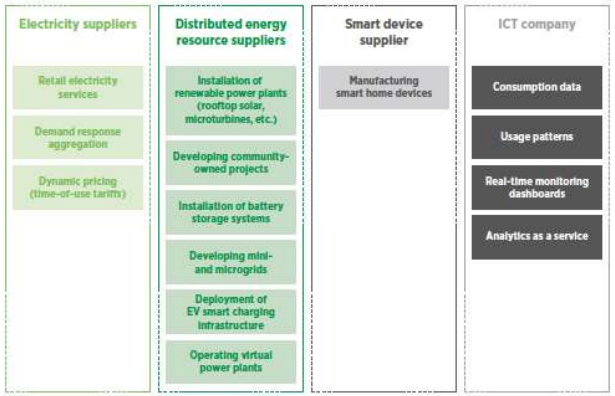


Figure 4 Example of key services provided by different stakeholders



Source: Adapted from KPMG US, 2015

Source: IRENA, 2020

1 BENEFITS

Community projects can provide flexibility and, when connected to the main power system, increase the reliability and resilience of the whole system. They provide many socio-economic benefits in addition to low-cost renewable energy to the local community.

Community ownership models

Main grid benefits
- Greater grid flexibility
- Increased grid resilience

Power sector transformation in the community
- Increased deployment of distributed renewable generation
- Improved renewable energy access
- Lower energy cost for the community

2 KEY ENABLING FACTORS

- Enabling policy and regulatory frameworks
- Simplification of administrative processes
- Access to finance
- Capacity building within community

3 SNAPSHOT

- More than 4 000 community-owned projects provide power, mainly in Australia, Europe and the United States
- Innovations emerging with community ownership include aggregation, demand response, mini-grids, energy storage, electric vehicles
- Egg Electric – a community-owned company – provides 95% renewable power to all residents of a Scottish (UK) island.

What does community ownership mean for renewable energy?

Energy-related assets, such as energy generation systems, energy storage systems, energy efficiency systems, and district cooling and heating systems, can be collectively owned and managed by their users.

COMMUNITY-OWNERSHIP MODELS

Through cost-sharing, community-ownership models enable participants to own **key local energy assets**, contribute to community energy development and help to scale up renewables.

Figure 1 Schematic of energy system based on the community-ownership business model

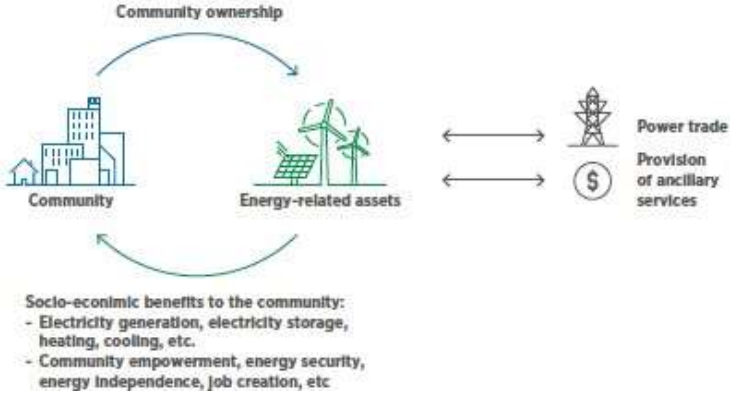
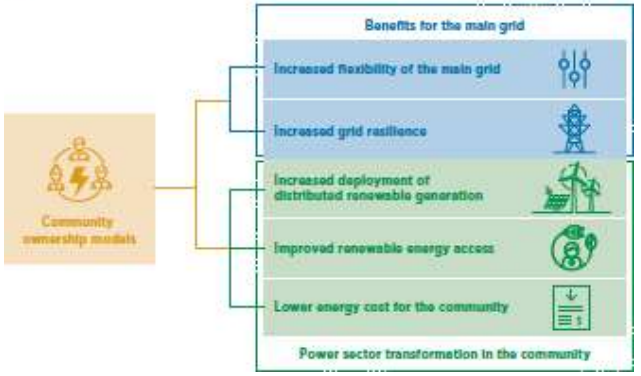


Table 1 Legal forms of community-ownership business model

Community-ownership model	Description
Co-operatives	Co-operatives are jointly owned by their members to achieve common economic, social or cultural goals based on the democratic principle of "one member, one vote". Co-operatives rely largely on volunteers but can have paid staff.
Partnerships	In partnerships, individual partners own shares in the community-ownership model. The key objective of a partnership is to generate profits for the shareholders, in addition to any other benefits of the project. Unlike co-operatives, partnerships may not operate on the basis of "one member, one vote". Nor do partnership firms rely largely on volunteers, as co-operatives do. They may employ full-time staff to provide expertise needed for specific projects.
Non-profit organisations	A non-profit organisation is formed by investments from its members, who are responsible for financing the organisation but do not take back any profits. Profits are re-invested in projects focused on community development.
Community trusts	Trusts use the returns from investments in community projects for specific local purposes. These benefits are also shared with people who are not able to invest directly in projects.
Housing associations	A form of non-profit, such associations offer housing to low-income families and individuals.

Figure 3 Key contributions of community-ownership models to power sector transformation



Source: IRENA, 2020

www.irena.org

IRENA

1 HOW IT WORKS

An energy service provider rents or sells solar PV systems in exchange for regular payments through mobile payment systems. In cases of non-payment, the service provider can remotely disconnect the service.

2 BENEFITS

- Improve energy access in off-grid areas
- Defer network expansion investments
- Enable other innovative business models, such as peer-to-peer trading or community ownership

3 KEY ENABLING FACTORS

- Electrification strategy that accounts for pay-as-you-go (PAYG) and off-grid systems
- Consumer awareness of PAYG models
- Access to finance for local energy service providers

4 SNAPSHOT

- Between 2015 and 2020, around 8 million people gained energy access with PAYG models
- About two-thirds of the world's off-grid energy consumers have access to mobile networks
- Almost 40 million off-grid solar systems were sold globally by 2019

What are PAYG models?

The package usually includes a **home solar system** that customers pay for using **mobile payment technologies** and mobile phone credit.

PAY-AS-YOU-GO MODELS

PAYG can provide affordable energy access from renewable sources to off-grid communities, using available technologies to facilitate payment by instalments.

Figure 1 Components of a PAYG system

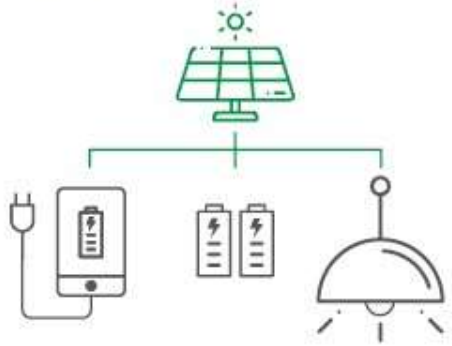
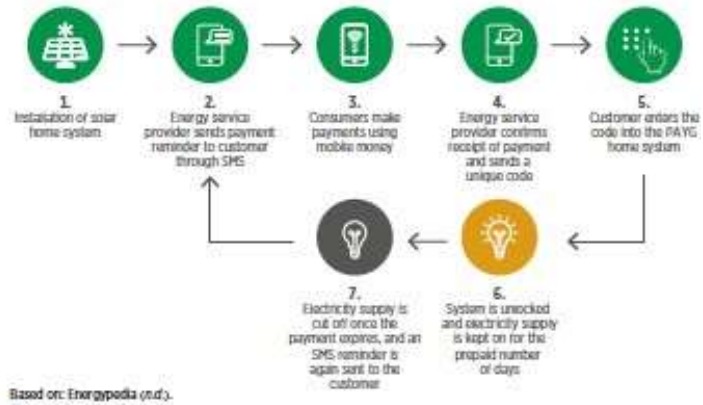


Figure 2 Energy access tiers

Based on: ESMAP (2015).

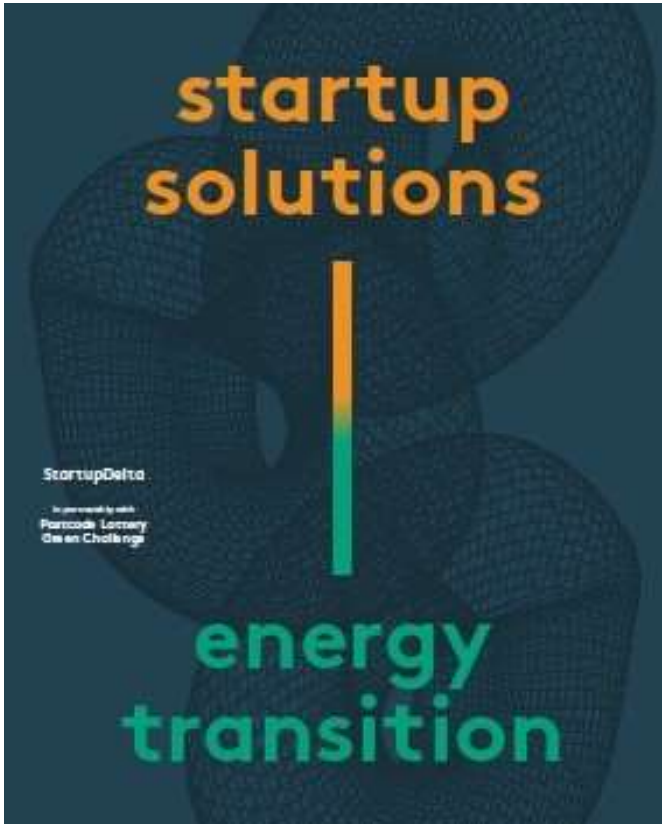
Figure 3 PAYG concept



Based on: Energypedia (n.d.).

Source: IRENA, 2020

Typical Energy new businees



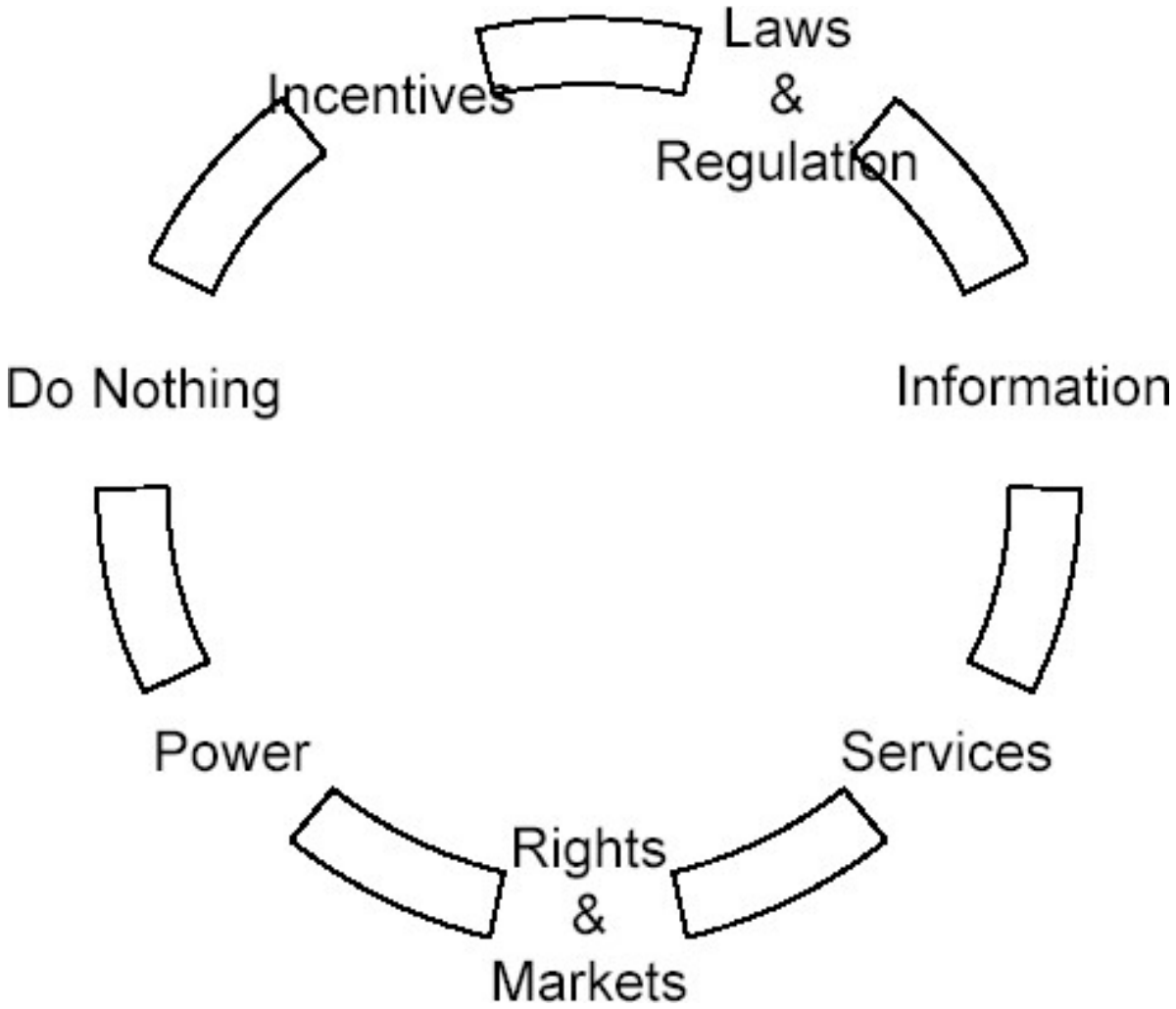
Attendees at the Clean Energy Ministerial and Mission Innovation Forums in Canada.

Energy transition policy

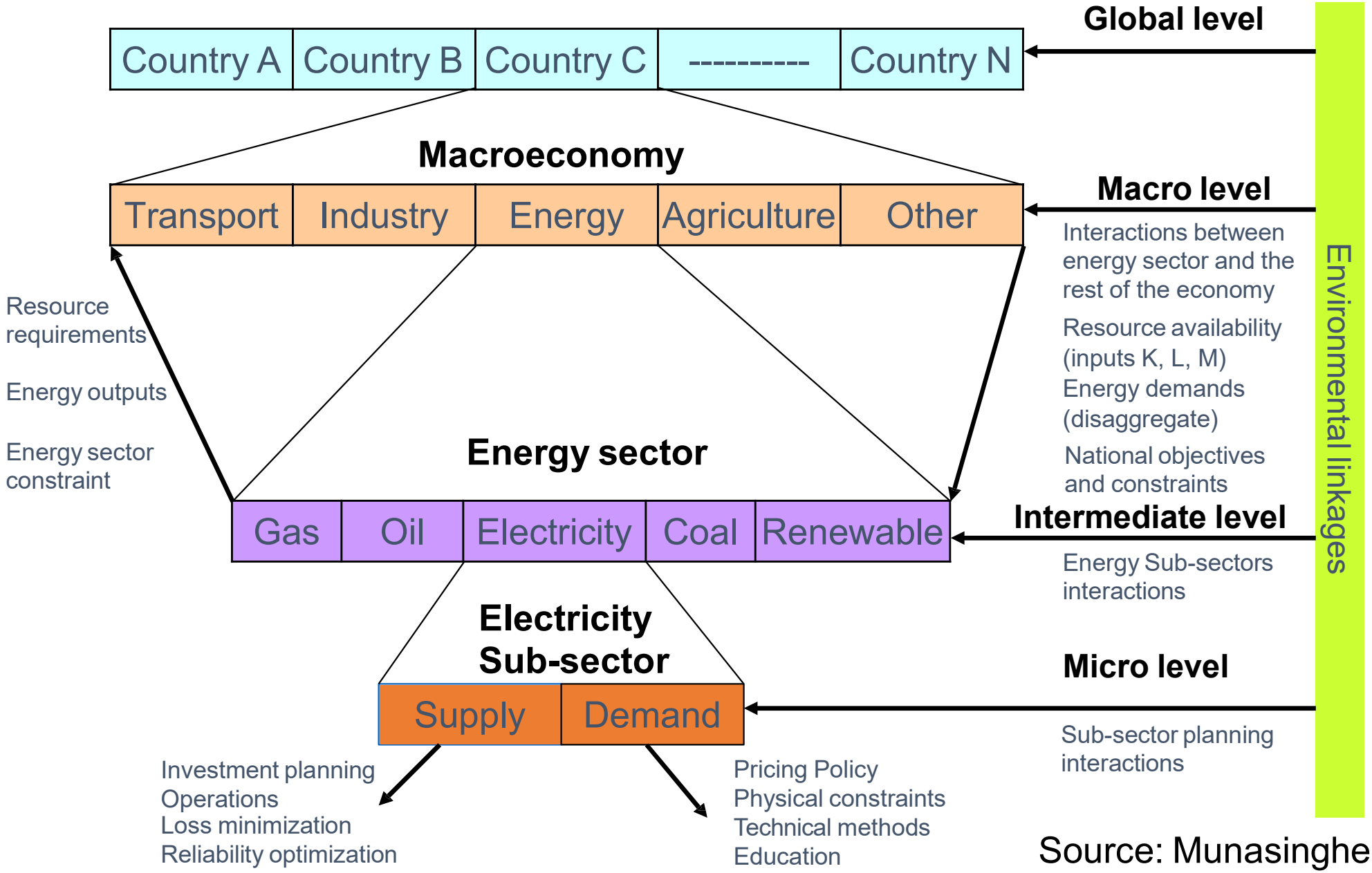
What is Policy?

- Method of action selected from among alternatives and in light of given conditions to guide and determine present and future decisions
- High-level overall plan embracing the general goals and acceptable procedures especially of a governmental body
- Public policy is government action in response to social problems

Tools of government

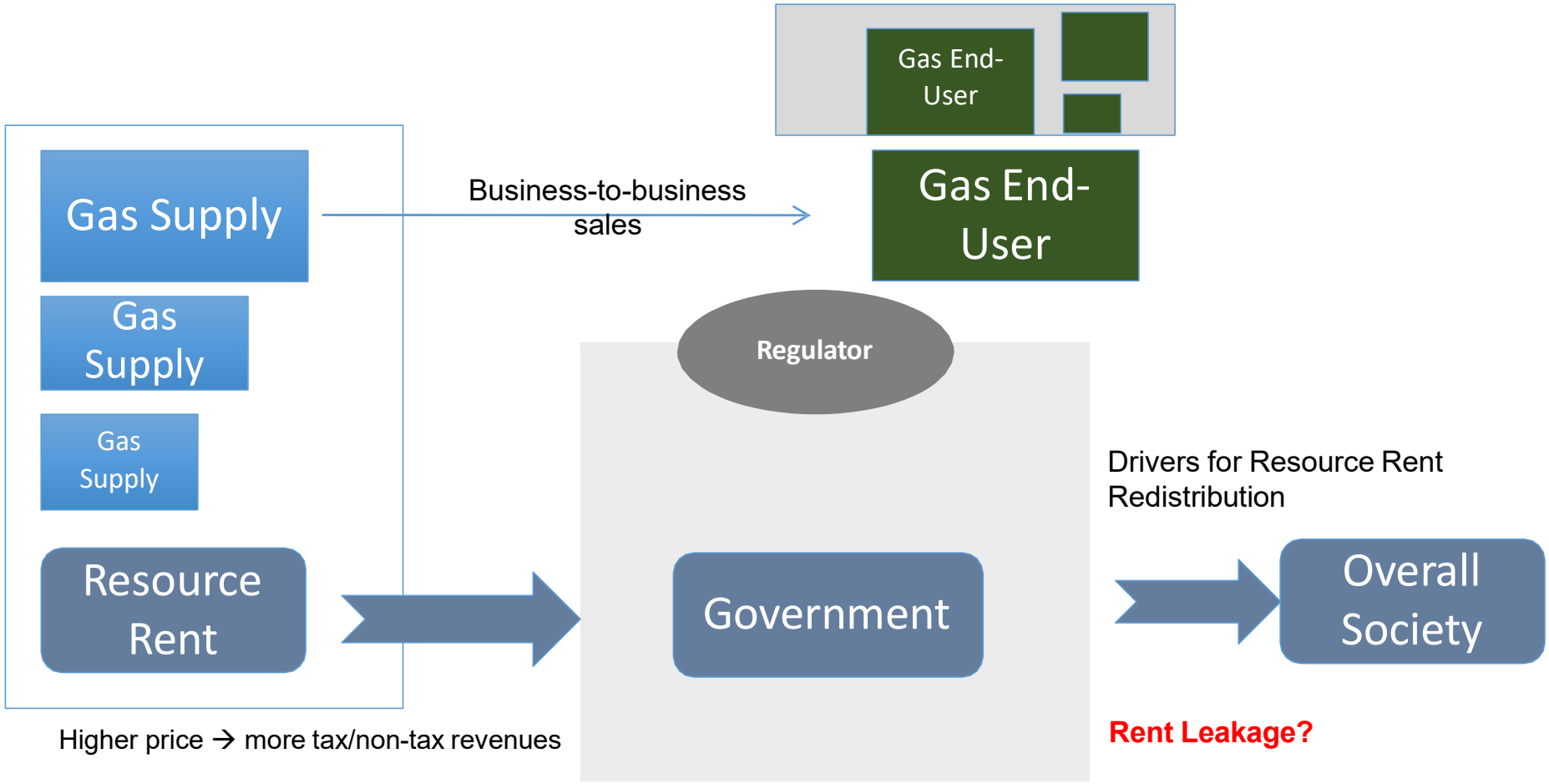


Integrated Energy Planning



Source: Munasinghe

NRM - Resource Value through State Budgetary



Source:WB

Perkuat peran *Market authority*

DMIgas

Market authority

KPPU

Competition authority

BPH

Regulator

Government

Futures market

Spot market

Link with financials

Competitive suppliers

Sufficient network capacity

Third-party access

Wholesale price deregulation

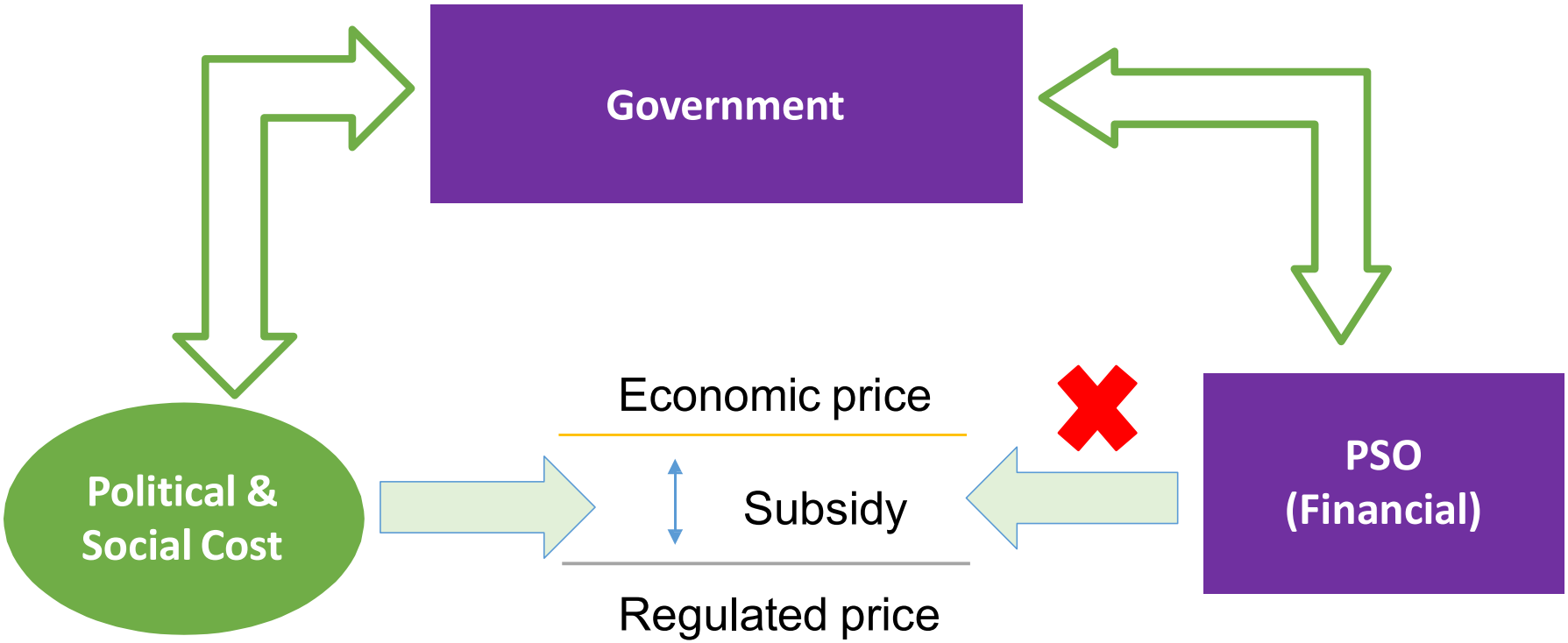
Hands-off attitude

Non-competitive market

Deregulated/developing market

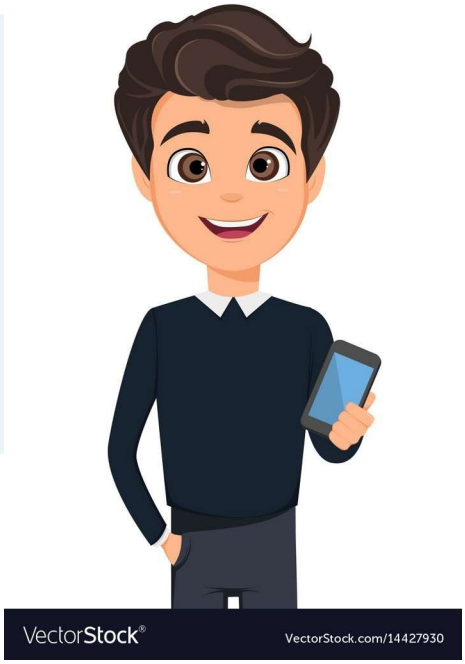
Functioning market

Political and social cost by Gov.



RE pricing mechanism

Fossil energy

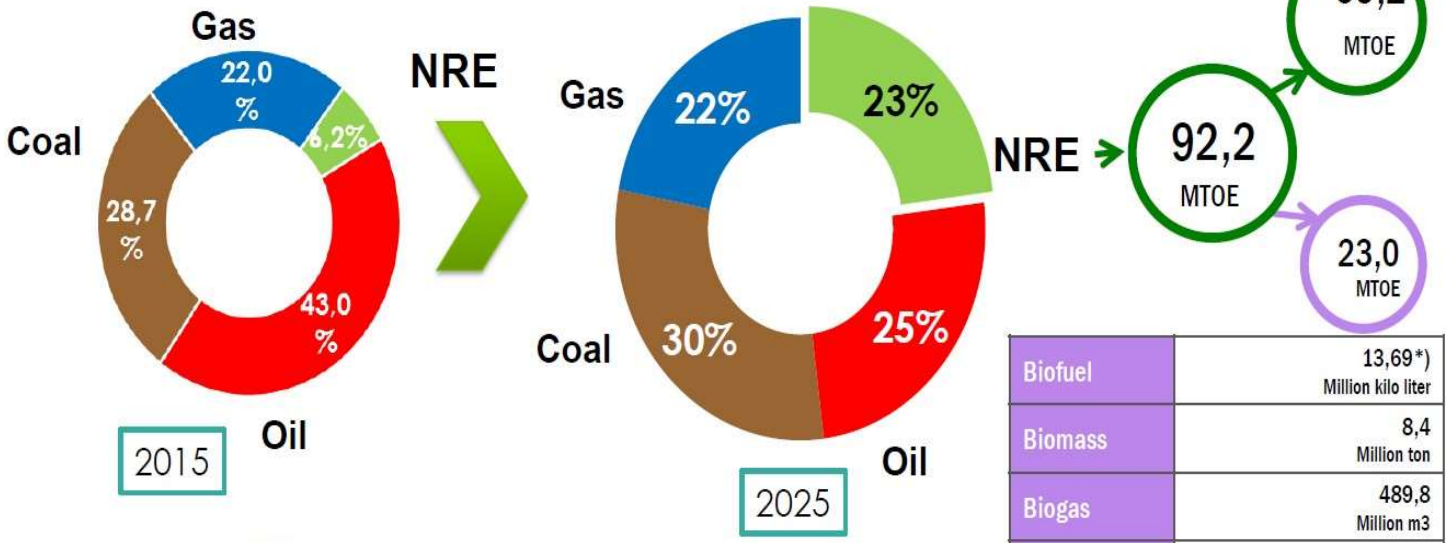


Renewable energy

Achievement of *RE mix* – *far from the target*

2025	
National Power Plant Capacity	135 GW
NRE Power Plant Capacity	45 GW

NRE Electricity 45 GW	
	1. Geothermal, 7,2 GW 2. Hydro, 17,9 GW 3. Microhydro, 3 GW 4. Bioenergy, 5,5 GW 5. Solar, 6,5 GW 6. Wind, 1,8 GW 7. Other NRE, 3 GW



Biofuel	13,69*) Million kilo liter
Biomass	8,4 Million ton
Biogas	489,8 Million m3
CBM	46,0 mmscfd

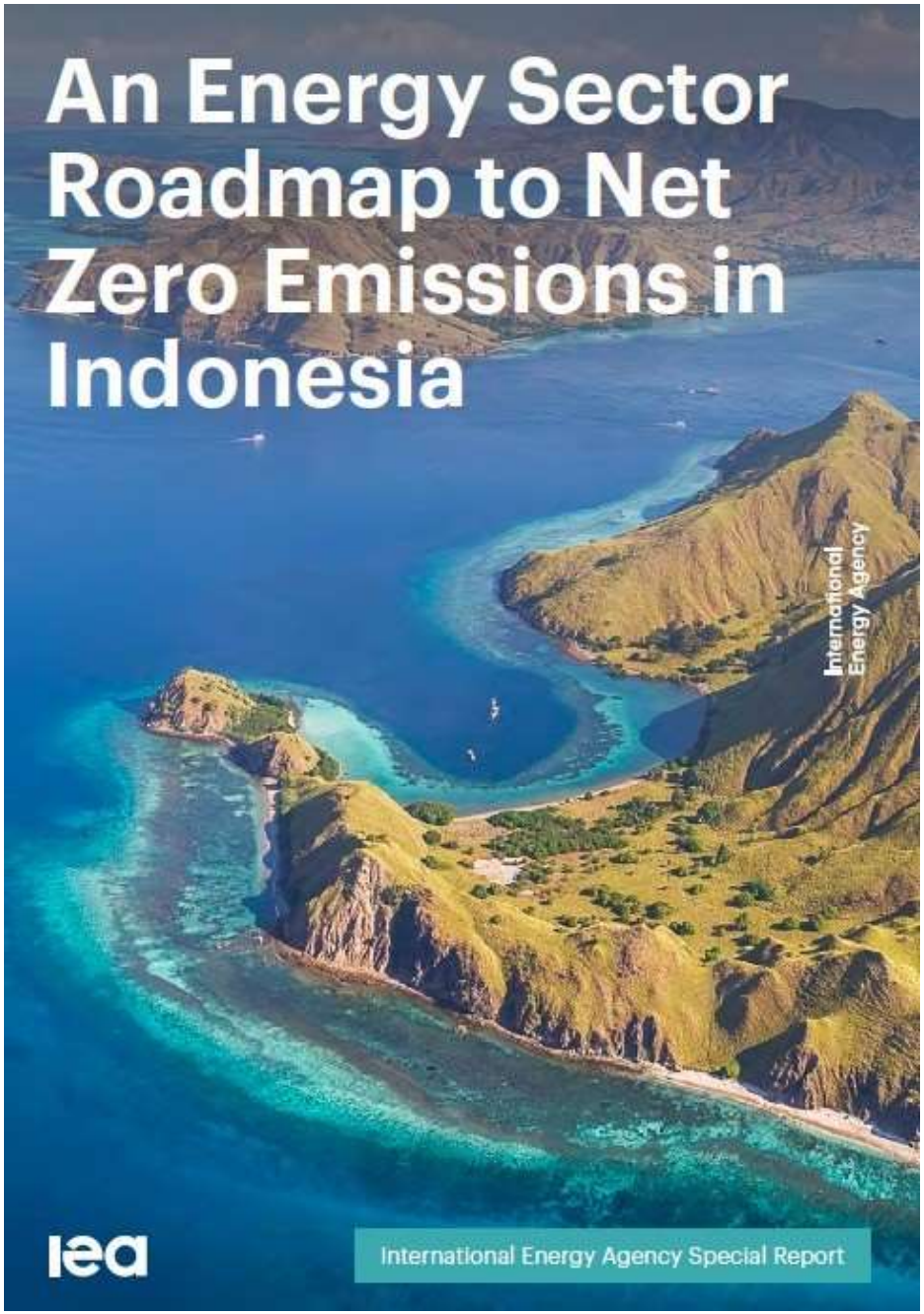
Electricity 11,7 % RE share 13,6% (incl. Biomass)

achievement: 7.7% RE share of total energy supply

Source: MEMR

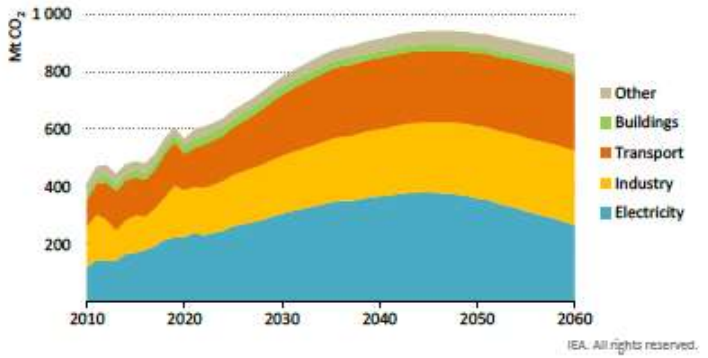
Indonesia's climate change policy

Source: Maulidia et al., 2019



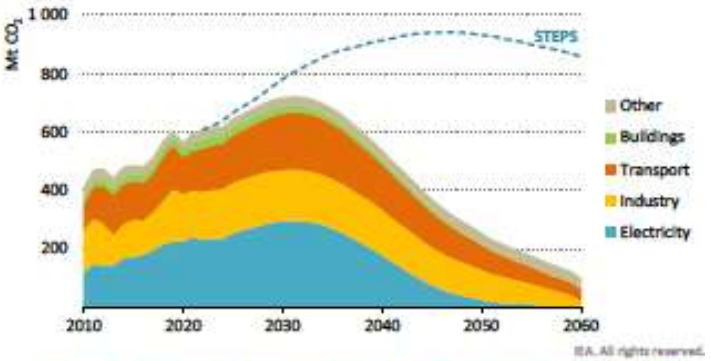
Source: IEA, 2022

Figure 2.4 ▹ **Total energy CO_2 emissions by sector in Indonesia in the Stated Policies Scenario, 2010 – 2060**



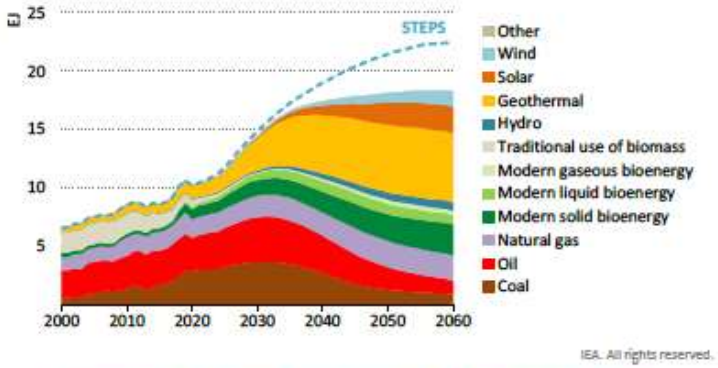
Total energy sector CO_2 emissions peak at 950 Mt in the late 2040s, with growth driven initially by electricity generation and then increasingly by industry and transport

Figure 2.5 ▹ **Total energy CO_2 emissions by sector in Indonesia in the Announced Pledges Scenario, 2010 – 2060**



Total CO_2 emissions peak around 2030 in the APS at a level that is about 10% lower than in the STEPS in the same year; by 2040 emissions are 10% lower than today

Figure 2.10 ▹ **Total energy supply in Indonesia in the Announced Pledges and Stated Policies scenarios, 2000 – 2060**



Transformation of the energy supply mix in the APS is driven by rapid growth of renewables and the phase-out of unabated coal use in the electricity sector

Overview of policies to support energy transition solutions

TECHNO-LOGICAL AVENUE	OBJECTIVE	RECOMMENDATIONS
Renewables (power and direct uses)	Deploy renewable energy in end uses	These policies include regulatory measures that create a market, as well as fiscal and financial incentives to make them more affordable and increase their cost competitiveness compared to fossil-fuel-based solutions.
	Deploy renewable energy in the power sector	The choice of instrument and its design should consider the nature of the solution (*e.g.*, utility scale, distributed, off-grid), the sector's level of development, the power system's organisational structure and broader policy objectives.
Energy conservation and efficiency	Increase energy conservation and efficiency in heating and cooling	Energy efficiency policies such as strict building codes, support for building retrofits and appliance standards are critical for the energy transition in buildings and industrial processes.
	Increase energy conservation in transport	Decarbonising the transport sector, among other measures, requires a shift from energy-intensive modes to low-carbon modes.
Electrification of end uses	Electrify heating and cooling	Targets for renewable power should consider the rising demand from the electrification of end uses, in line with long-term decarbonisation objectives. Moreover, policies and power system design are needed to support electrification in achieving its potential for providing system flexibility.
	Electrify transport	
Green hydrogen	Support the development of green hydrogen	An enabling policy framework should consider four key pillars: a national green hydrogen strategy, priority setting, guarantees of origin and enabling policies.
Sustainable bioenergy	Ensure the sustainable use of bioenergy	Renewable energy is not exempt from sustainability concerns. Some of these concerns include greenhouse gas emissions related to land-use change, and impacts on air and water quality and biodiversity.

Source: IRENA, 2021

TABLE 4.1 Overview of cross-cutting policies to enable the energy transition

OBJECTIVE	EXAMPLES OF MEASURES	COMMENTS
Raise ambition in commitments to the energy transition	Net zero targets can be seen in legislation in Denmark, France, Hungary, New Zealand, Sweden and the United Kingdom.	Targets should go beyond the power sector to include the energy needed for heating and cooling and transport, and for specific solutions and technologies, such as green hydrogen.
Phase out fossil fuels	Many European countries (*e.g.*, Denmark, France, Finland, Hungary, Italy, Portugal, Slovenia, the United Kingdom) have announced a plan to phase out coal power plants by 2030.	A holistic policy framework is necessary to address the issue of fossil fuel as a stranded asset and its socio-economic implications.
Eliminate distortions and incentivise energy transition solutions	Sweden's taxation of fossil fuels.	Policies (that may include fiscal policies such as carbon pricing) should be implemented with careful consideration of broader social and equity issues, particularly for low-income populations.
Facilitate access to finance	The Brazilian Development Bank offers a loan supporting biomass co-generation projects.	Public financing can facilitate the adoption of energy transition solutions. Interventions range from the public ownership of transition-related assets, to unlocking private sector participation and supporting just transition measures.
Foster innovation	Direct funding to research and development in energy transition technologies (*e.g.*, fast-charging infrastructure, green hydrogen linked with industrial use).	Enabling policies can further innovation across various dimensions of technology, infrastructure, financing, business models, market design and regulation, as well as governance and institutional frameworks.
Raise awareness among consumers and citizens in general	The campaign HeatSmart Northampton raises public awareness and promotes the installation of heat pumps in a town in the state of Massachusetts (United States).	Consumers and citizens play a big role in the energy transition: they influence governments and corporations to move faster in their decarbonisation plans and make proactive choices regarding their energy consumption and sources.

Source: IRENA, 2021

A wide range of energy and climate policies reduce GHGs

Policy Type	Policy options
Price-based instruments	Taxes on CO_2 directly Taxes/charges on inputs or outputs of process (*e.g.* fuel and vehicle taxes) Subsidies for emissions-reducing activities Emissions trading systems (cap and trade or baseline and credit)
Command and control regulations	Technology standards (*e.g.* biofuel blend mandate, minimum energy performance standards) Performance standards (*e.g.* fleet average CO_2 vehicle efficiency) Prohibition or mandating of certain products or practices Reporting requirements Requirements for operating certification (*e.g.* HFC handling certification) Land use planning, zoning
Technology support policies	Public and private RD&D funding Public procurement Green certificates (renewable portfolio standard or clean energy standard) Feed-in tariffs Public investment in underpinning infrastructure for new technologies Policies to remove financial barriers to acquiring green technology (loans, revolving funds)
Information and voluntary approaches	Rating and labelling programmes Public information campaigns Education and training Product certification and labelling Award schemes

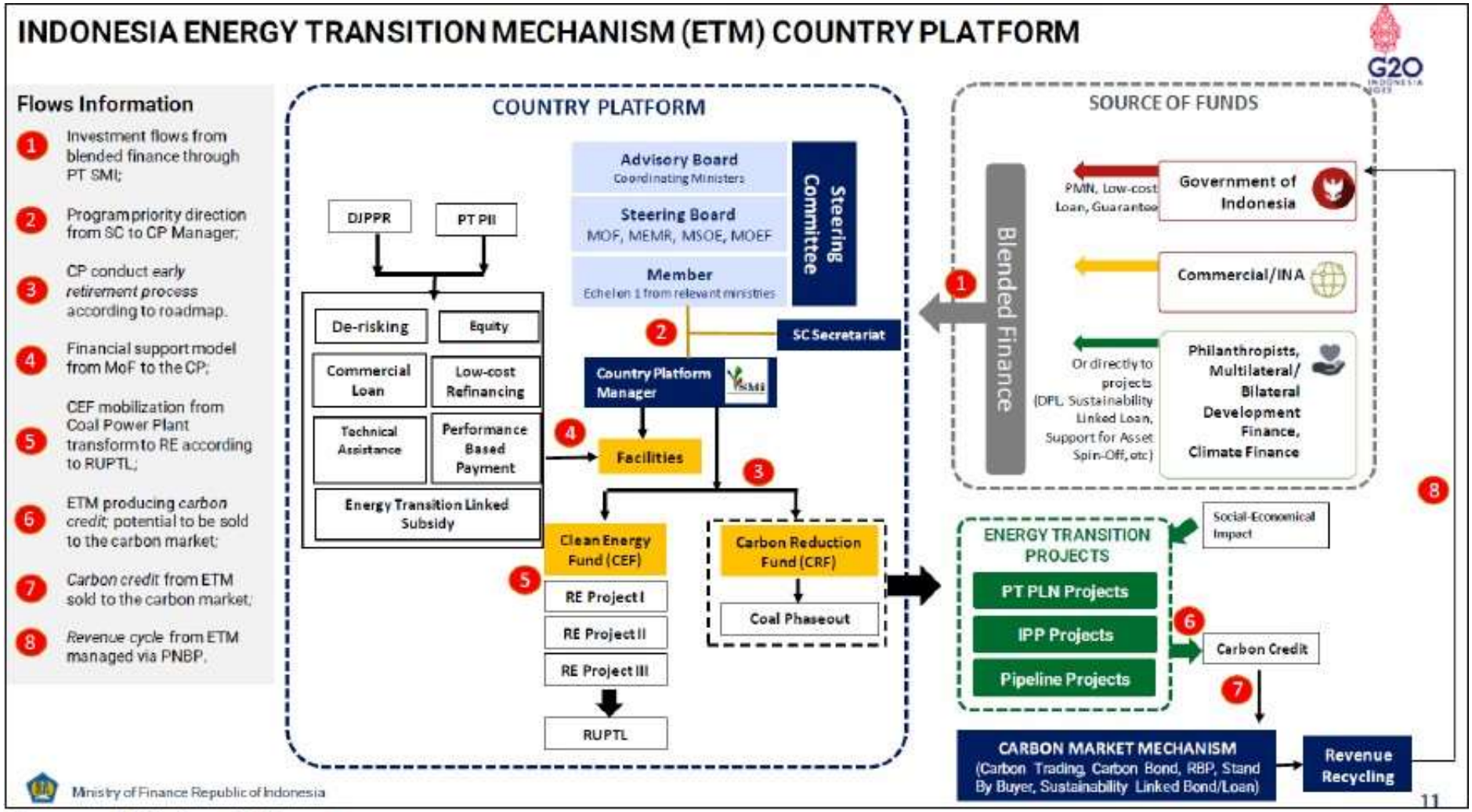
Source: Hood (2011), based on de Serres, Murtin and Nicolleti (2010).

Source: IEA

Types of renewable energy policies and measures

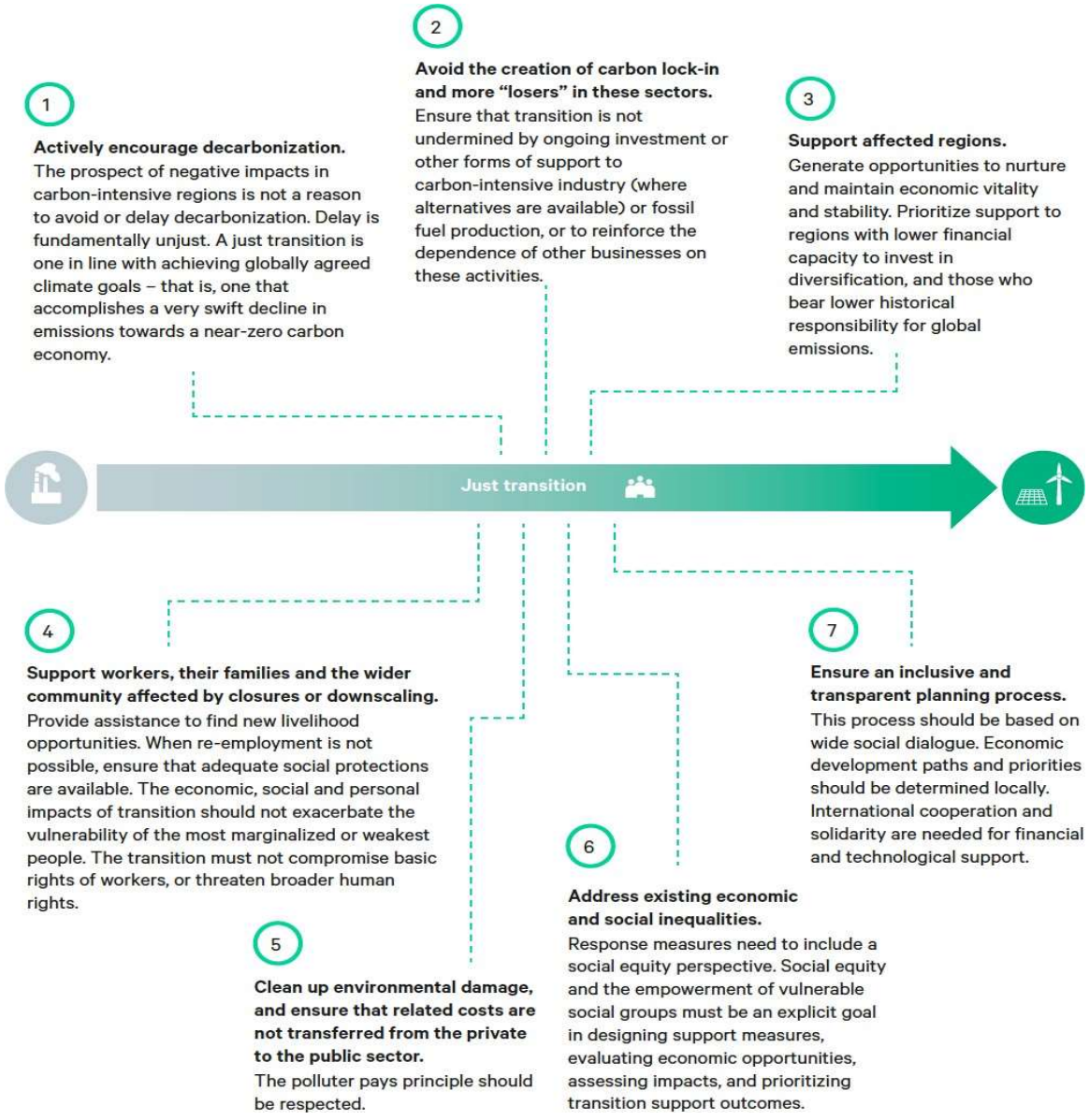
NATIONAL POLICY	REGULATORY INSTRUMENTS	FISCAL INCENTIVES	GRID ACCESS	ACCESS TO FINANCE[a]	SOCIO-ECONOMIC BENEFITS[b]
◆ Renewable energy target ◆ Renewable energy law/ strategy ◆ Technology-specific law/ programme	◆ Feed-in tariff ◆ Feed-in premium ◆ Auction ◆ Quota ◆ Certificate system ◆ Net metering ◆ Mandate (*e.g.*, blending mandate) ◆ Registry	◆ VAT/ fuel tax/ income tax exemption ◆ Import/export fiscal benefit ◆ National exemption of local taxes ◆ Carbon tax ◆ Accelerated depreciation ◆ Other fiscal benefits	◆ Transmission discount/ exemption ◆ Priority/ dedicated transmission ◆ Grid access ◆ Preferential dispatch ◆ Other grid benefits	◆ Currency hedging ◆ Dedicated fund ◆ Eligible fund ◆ Guarantees ◆ Pre-investment support ◆ Direct funding	◆ Renewable energy in rural access/cook stove programmes ◆ Local content requirements ◆ Special environmental regulations ◆ Food and water nexus policy ◆ Social requirements

Source: IRENA, 2017



Source: Ministry of Finance

The principles of just transition



Source: SEI

Illustrative examples of fossil fuel transition policies

Policy and jurisdiction	Description	Transition support provided
Coal Workforce Transition Fund and Coal Community Transition Fund[31,32] *Province of Alberta, Canada*	Provides assistance to coal workers and municipal governments in regions affected by provincial and federal government plans to phase out coal-fired electricity.	Support for workers: unemployment and retirement bridging grants, relocation assistance, career counselling, and tuition vouchers. Grants for local governments to conduct social and economic impact studies, long-range economic planning, and local business development programs.
Framework Agreement for a Just Transition of Coal Mining and Sustainable Development of the Mining Regions for the Period 2019-2027[14] *Government of Spain*	Action plan, signed by government representatives and unions, to aid workers and regions affected by planned closure of coal mines in Spain.	Support for workers: early retirement provisions, social assistance, and re-training programs for workers to move to green jobs. Funding for business initiatives and development of mined regions. Plans for environmental restoration of mined areas.
Mine closure provisions in the 13th Five Year Plan for Coal Industry Development, 2016-2020[33] *People's Republic of China*	Full five-year plan outlines strategy to cap coal output and improve mining efficiency. Mine closure provisions outline steps to ensure an orderly withdrawal of mines.	Support for workers: unemployment relief, training and job placement services. Assistance with abandoned mine reclamation and redevelopment.
Oil Worker Transition Fund[34] *Scottish Government*	Provides funding for oil and gas workers affected by a downturn in North Sea oil production to access training needed to transition to new roles. (Note: this is not specifically focused on transitioning away from fossil fuels; 44% of re-employed participants remained in the oil and gas sector)[34]	Grants to help recently redundant oil and gas workers (or those at risk for redundancy) re-train or gain new accreditations.

Source: SEI

Box 2.5 ▷ "Bold proposals" for accelerating clean energy finance in EMDEs

Over 20 companies, financiers and institutions are participating in a task force on Mobilizing Investment for Clean Energy in Emerging Economies organised by the World Economic Forum (WEF), with whom the IEA is collaborating on evaluating barriers, developing case studies and real-world ideas, and implementing solutions for addressing financing challenges in clean energy in EMDEs. From the discussion, participants have brought forth several "bold proposals" to support an acceleration of clean energy investment, described below. These proposals and opportunities for implementation are being further explored within the task force and by other relevant stakeholders:

- Energy Transition Mechanism: a blended finance mechanism based on national government transition plan and tied to the nation's NDC commitment to allow countries to retire portions of their carbon-intensive power assets over a defined period of time. The mechanism is composed of two complementary financial facilities: a carbon reduction facility and a clean energy facility.
- Net Zero Equity: a new investment product that channels money from investors not expecting immediate returns (e.g. foundations, citizens, governments and other sources) but looking for a greater contribution to society. This layer of capital can de-risk and enable projects which would not otherwise be funded.
- Decommissioning coal mapping: a purpose-built methodology that maps plants at national fleet level and prioritises retirements. The model helps frame and sequence decommissioning pathways and gives visibility to the investments needed while providing a standard approach to deal with debt/equity payouts. Participants are investigating potential application in geographies beyond the current effort in India.
- Cost of Capital Observatory: this effort would collect data on estimated and actual cost of capital for projects, as well as investigate reasons for differences. A related study, Clean Energy Investing: Global Comparison of Investment Returns, by Imperial College and the IEA (IEA and Imperial College, 2021), shows that publicly traded renewable companies have outperformed fossil fuel companies with higher returns and lower volatility, with the renewable portfolio less correlated to the broader market.
- Accelerating Corporate PPAs: a proposal to promote direct procurement as corporations target high levels of renewables consumption. Most emerging markets do not enable direct power purchase, which could provide another contracting option for renewable power projects beyond utility counterparties. Efforts are needed to improve enabling regulation, system integration and addressing the implications for utilities at risk of losing profitable customers.

Source: IEA, 2021

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Source: IRENA, 2021

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Source: IRENA, 2021

Types of carbon pricing

Direct methods

- Cap-and-trade (emissions trading systems)
  - Cap on the total emissions
  - Cap on the emissions intensity
- Carbon tax
  - Tax on the carbon emissions
  - Tax on the carbon content of fuels
  - Tax on the amount of fuel extracted or imported
- Hybrid approaches
  - Combination of carbon tax and ETS with or without sectoral overlaps
  - ETS with a "price collar"
  - Jurisdiction with a Carbon tax linked to another jurisdiction with an ETS

Indirect methods

- Regulatory approaches
- Voluntary shadow pricing by firms

Source: Climate Policy Lab

Design features

Cap-and-Trade

EU, Switzerland, Regional Greenhouse Gas Initiative (RGGI), California, Québec, New Zealand, Republic of Korea, and China's seven provinces - Beijing, Shanghai, Tianjin, Chongqing, Shenzhen, Guangdong, Hubei

Design features compared

Emissions cap
Allowance allocation and distribution
Liquidity and price control mechanisms
Leakage and gaming of the markets
International linkage
Revenue management
Stakeholder engagement
Ambition

Carbon Tax and Hybrid Systems

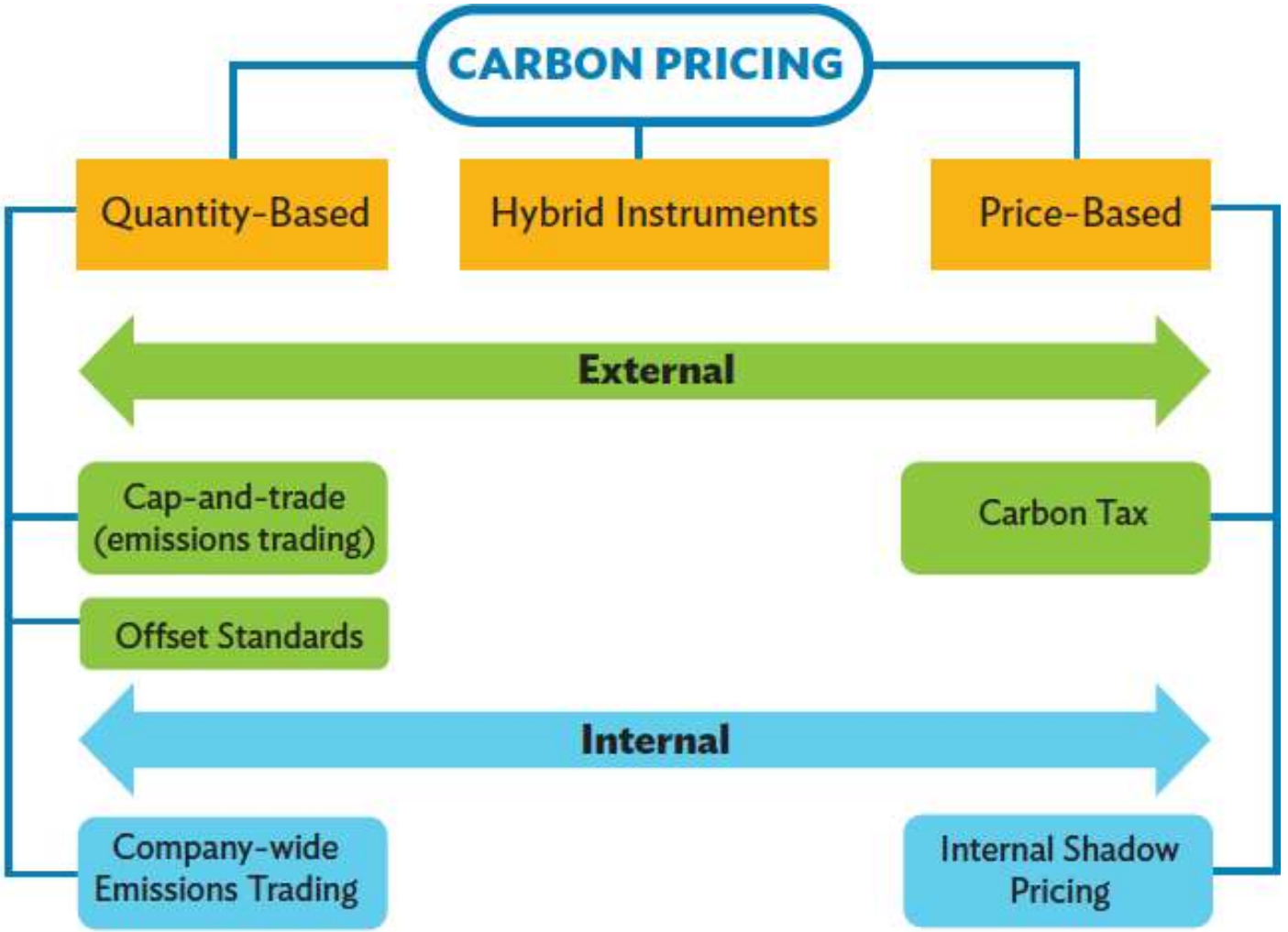
British Columbia, Mexico, Chile, Japan, India, Norway, and Ireland.

Design features compared

Price setting
Emissions coverage
EITE sector exemptions
Ambition
Revenue management

Source: Climate Policy Lab

Landscape of Direct Carbon-Pricing Instruments



Source: Asian Development Bank.

Source: ABD

Benefits of Carbon Pricing

Carbon pricing alters relative prices, causing firms and consumers to internalize global warming impacts.	Carbon pricing changes the relative prices of goods and services in accordance with the polluter pays principle, by internalizing the cost of negative environmental and social impacts of climate change. The price signals created through carbon pricing lead firms, consumers, and investors to incorporate the social and environmental costs associated with their market decisions. Those decisions, in turn, can influence the quantity of greenhouse gas (GHG) emissions generated throughout product life cycles, from resource to waste. As a result, the entire economy can become less carbon-intensive, by incentivizing consumers and producers to adjust their decisions to reflect the climate externality. To obtain the same result with non-market-based instruments would require regulation that reflects complete information about emissions and abatement options for all polluting processes and behaviors, and detailed regulatory controls. This is extremely difficult to achieve and involves huge governance costs.
Carbon pricing addresses the heterogeneity of emitters, reducing overall emissions and the cost of abatement.	Compared to other types of policy instruments, carbon pricing can address the vast heterogeneity of GHG emitters, thus helping to minimize the cost of pollution control. Heterogeneity results from firms providing diverse goods and services using a range of different technologies and inputs, and thus causing different quantities of emissions per unit of output. This translates into unequal marginal costs across firms of mitigating GHG emissions. When faced with paying a price for polluting, firms generally attempt to maximize profits by choosing the cheapest production route (i.e., minimizing costs). That involves, within the limits of capital constraints, reducing their emissions until achieving additional reductions becomes more expensive than paying the carbon price. When the cost of mitigation is passed on to consumers through the price of goods and services, the firms whose total cost of mitigation measures, together with the lowest carbon price paid, become more competitive. Hence, a clear carbon-price signal shifts both production and consumptive behaviors away from activities causing GHG emissions. No other policy instrument can achieve this outcome.
Global carbon pricing curtails emissions leakage between countries.	GHG emissions leakage between countries, i.e., the cross-border movement of emission sources, occurs when policy changes cause shifts in comparative advantages that alter international trade patterns. One example of this is when pollution-intensive industries relocate internationally, driven by relative cost increases in countries with stricter regulations. There is a risk of this when countries adopt carbon pricing individually. An international carbon price covering the same sectors in all countries would abate this risk.
Carbon pricing decentralizes policy, reducing regulators' need for information.	Carbon pricing is consistent with flexibility and autonomy of choice, allowing emitters to freely change their behavior to reduce their costs. They can opt for emitting and paying any charges or taxes associated with emissions, or for undertaking a variety of activities, immediately or after relevant investments, to avoid emitting. Carbon pricing thus decentralizes policy, with associated low information requirements and administrative costs on the part of the regulator.
Carbon pricing acknowledges that most consumers respond more consistently to price signals than to environmental information.	Even for environmentally conscious consumers, it is challenging to translate environmental information into climate-adjusted purchasing decisions. It is, moreover, unthinkable that one can voluntarily contribute to all public goods in the world. Carbon pricing enables consumers to respond consistently, lifting some of the information burden from their shoulders by incentivizing low-carbon consumption (and production) through clear price signals.

Source: A. Baranzini et al. 2017. Carbon pricing in climate policy: seven reasons, complementary instruments, and political economy considerations. *Wiley Interdisciplinary Reviews: Climate Change*. 8(4), p. e462.

Source: ABD

INSTRUMEN PASAR KARBON MERESPONS KRISIS IKLIM

Pilihan mekanisme dalam pasar karbon dinilai mampu mengurangi emisi karbon dengan model pembiayaan yang lebih rendah.

DASAR PEMBENTUKAN PASAR KARBON

Pasar Karbon	Ciri	Contoh
Sukarela	• Proyek berbasis alam • Umumnya diinisiasi swasta • Terbentuk atas keinginan sendiri	VCS (per Juni 2022) • 1.806 proyek • 962 juta VCU
Wajib	• Terbentuk karena regulasi • Volume bergantung pada lingkup kebijakan • Relatif mudah direncanakan jangka panjang	CDM oleh PBB (Juni 2022) • 7.845 proyek • 2,2 miliar CER

TIGA SKEMA PELAKSANAAN

Sistem Perdagangan Karbon
- Emisi dibatasi pada tingkat tertentu
- Harga ditentukan kuota/tunjangan

Pajak Karbon
- Adanya kewajiban fiskal untuk emisi
- Pembuat kebijakan mengontrol tingkat pajak

Mekanisme Kredit Karbon
- Pengurangan emisi relatif terhadap baseline
- Terlaksana pada tingkat proyek atau program

MANFAAT BAGI PENGURANGAN EMISI KARBON

- Peningkatan kualitas udara & tanah
- Pemenuhan ketersediaan air
- Peralihan teknologi rendah karbon
- Peningkatan penerimaan fiskal
- Keseimbangan neraca pembayaran
- Pengurangan tingkat kemacetan & kecelakaan

Keterangan:
CDM: *Clean Development Mechanism*
CER: *Certified Emission Reduction*
VCS: *Verified Carbon Standard*
VCU: *Verified Carbon Units*

SUMBER: **KATADATA INSIGHT CENTER**
NASKAH: **RISANTI DELPHIA**
DESAIN: **ARIS L. SETIAWAN**

ETS SEBAGAI MEKANISME PERDAGANGAN KARBON

Emission Trading System (ETS) merupakan salah satu mekanisme perdagangan karbon yang ditentukan oleh kuota emisi dan diadopsi sejumlah negara untuk mencapai target NDC.

DASAR PEMBENTUKAN ETS

Kerangka	Keterangan
Cakupan	Semakin luas jika makin banyak sektor ekonomi dengan potensi mitigasi lebih besar.
Target & Batas (Cap)	**Target:** emisi per PDB **Cap:** jumlah GRK yang diizinkan oleh entitas
Alokasi Kuota	Secara gratis, melalui sistem pelelangan, atau kombinasi.
Pemantauan, Pelaporan & Verifikasi	Cara menentukan emisi & jumlah kuota yang harus diserahkan.
Kepatuhan & Penalti	Badan pengawas yang menetapkan sistem pengelolaan izin & menindak ketidakpatuhan.
Infrastruktur Kelembagaan	Kelembagaan untuk institusi pengawas.

PERKEMBANGAN ETS DI DUNIA

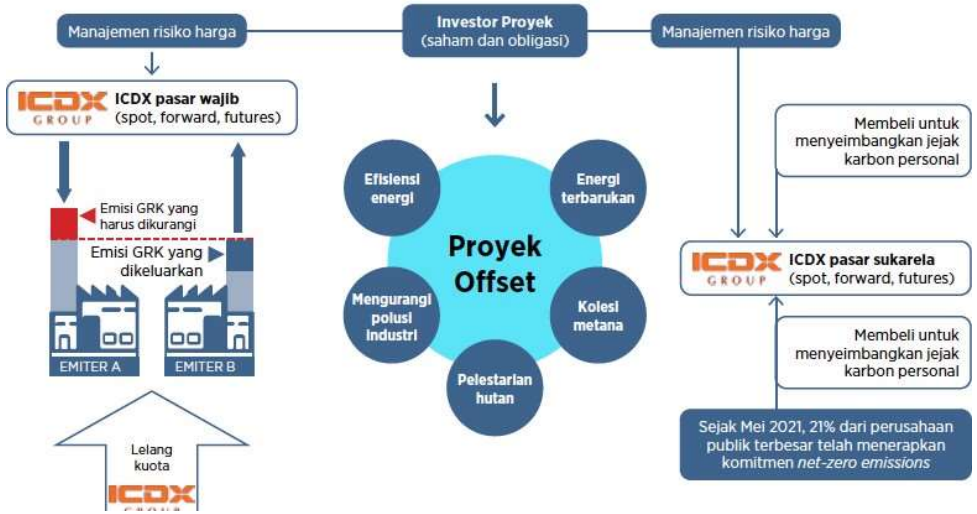
ETS	Perkembangan	Pembelajaran
Uni Eropa	• Sistem perdagangan emisi pertama di dunia (2005) • **11,4%** penurunan emisi tahunan terbesar (2019-2020)	• Penetapan MSR untuk stabilitas pasar & ketahanan goncangan ekonomi • Adanya standar pelaporan emisi perusahaan terdaftar
Tiongkok	• Dibangun sejak 2013 • Mencakup **40%** total emisi Tiongkok	• Perusahaan mengalokasikan kuota emisi secara gratis • Lebih fleksibel & mudah beradaptasi

Keterangan:
GRK: Gas Rumah Kaca
MSR: *Market Stability Reserve*
NDC: *Nationally Determined Contributions*
PDB: Produk Domestik Bruto

SUMBER: **KATADATA INSIGHT CENTER**
NASKAH: **HANNA FARAH VANIA**
DESAIN: **ARIS L. SETIAWAN**

Source: Katadata, 2022

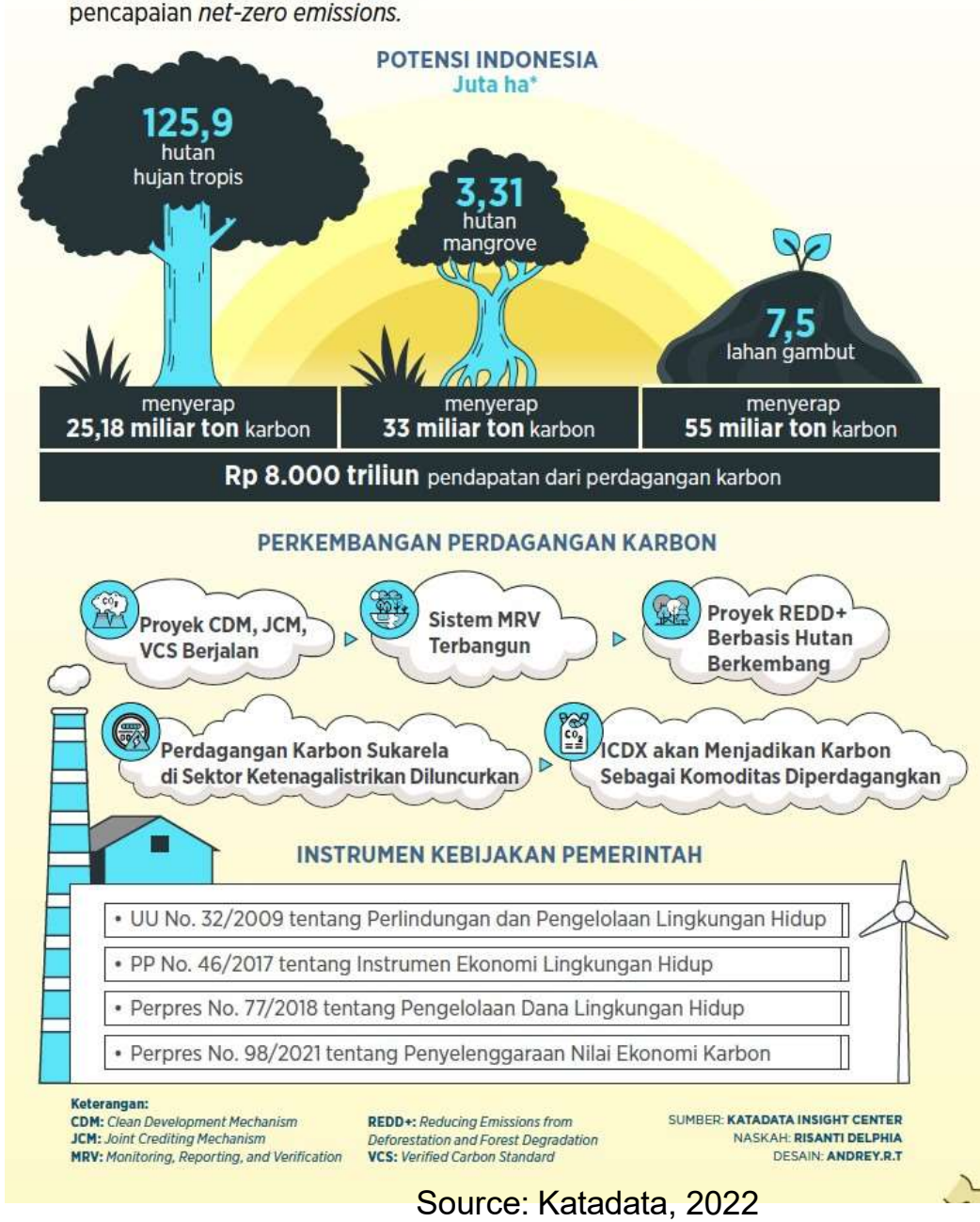
Gambar 4.2 Skema Perdagangan Karbon ICDX



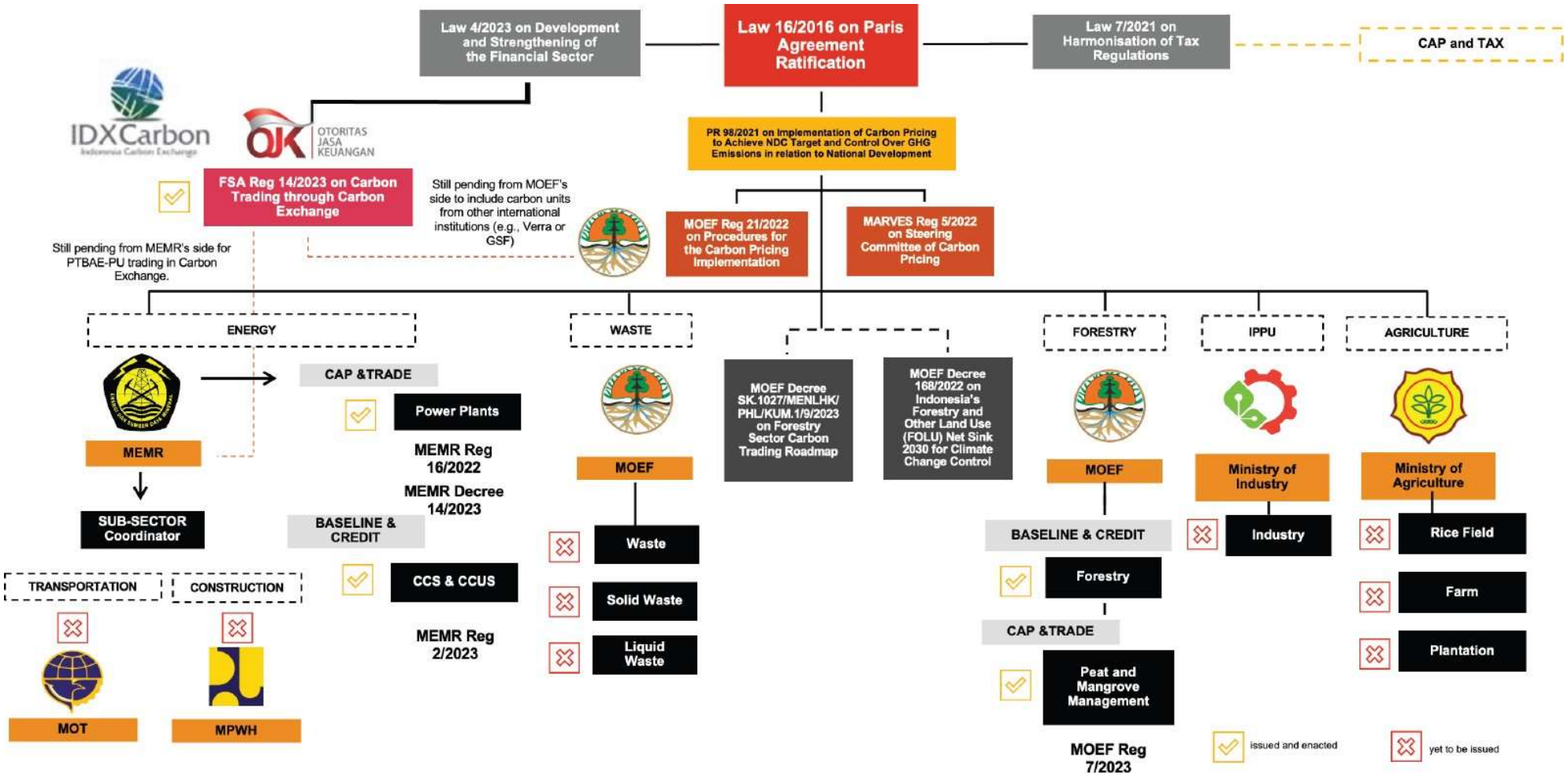
Tabel 2.2 Peta Sektor dan Aktivitas Terkait

No	Sektor	Kegiatan terkait
1	Pertanian	Kegiatan pertanian dan pengelolaan lahan, termasuk juga aktivitas peternakan
2	CCS/CCU	Kegiatan penangkapan, penyimpanan, dan penggunaan karbon
3	Efisiensi energi	Kegiatan yang mengurangi emisi melalui pengurangan konsumsi energi. Termasuk limbah panas/pemulihan gas dan listrik dari bahan bakar fosil melalui proses yang lebih efisien
4	Kehutanan	Kegiatan perhutanan seperti penghijauan, peningkatan pengelolaan kehutanan dan pengurangan emisi dari degradasi dan deforestasi
5	Penggunaan bahan bakar	Aktivitas yang dasarnya adalah penggunaan bahan bakar fosil untuk listrik atau panas, termasuk beralih ke bahan bakar intensif karbon yang lebih sedikit (misalnya batu bara menjadi gas tetapi tidak termasuk energi terbarukan)
6	*Fugitive emission*	Kegiatan yang menangani emisi metana industri seperti mencegah kebocoran metana di area pertambangan, tidak termasuk aktivitas peternakan dan pertanian (misalnya sawah)
7	Gas industri	Aktivitas yang menghasilkan gas berfluorinasi—hidrofluorokarbon (HFC), perfluorokarbon (PFC), bahan perusak ozon
8	Manufaktur	Aktivitas yang terkait dengan pembuatan material yang tidak terlalu intensif emisi (bahan konstruksi, semen, logam)
9	Tata guna lahan lainnya	Kegiatan pengelolaan tata guna lahan kecuali kehutanan dan pertanian, misalnya lahan basah
10	Energi terbarukan	Kegiatan energi terbarukan termasuk biomassa yang berkelanjutan
11	Transportasi	Kegiatan untuk mengurangi emisi yang berhubungan dengan transportasi dan mobilitas
12	Limbah	Kegiatan yang terkait penanganan dan pengolahan limbah, termasuk gas dan air limbah yang bersumber dari tempat pembuangan akhir (TPA)

SUMBER: STATE AND TRENDS OF CARBON PRICING 2020



Source: Katadata, 2022


Law 4/2023 on Development and Strengthening of the Financial Sector
Law 16/2016 on Paris Agreement Ratification
Law 7/2021 on Harmonisation of Tax Regulations
CAP and TAX
IDXCarbon
OJK OTORITAS JASA KEUANGAN
FSA Reg 14/2023 on Carbon Trading through Carbon Exchange
Still pending from MEMR's side for PTBAE-PU trading in Carbon Exchange.
Still pending from MOEF's side to include carbon units from other international institutions (e.g., Verra or GSF)
PR 98/2021 on Implementation of Carbon Pricing to Achieve NDC Target and Control Over GHG Emissions in relation to National Development
MOEF Reg 21/2022 on Procedures for the Carbon Pricing Implementation
MARVES Reg 5/2022 on Steering Committee of Carbon Pricing
ENERGY
WASTE
FORESTRY
IPPU
AGRICULTURE
MEMR
SUB-SECTOR Coordinator
CAP &TRADE
Power Plants
MEMR Reg 16/2022
MEMR Decree 14/2023
BASELINE & CREDIT
CCS & CCUS
MEMR Reg 2/2023
TRANSPORTATION
CONSTRUCTION
MOT
MPWH
MOEF
Waste
Solid Waste
Liquid Waste
MOEF Decree SK.1027/MENLHK/PHL/KUM.1/9/2023 on Forestry Sector Carbon Trading Roadmap
MOEF Decree 168/2022 on Indonesia's Forestry and Other Land Use (FOLU) Net Sink 2030 for Climate Change Control
MOEF
BASELINE & CREDIT
Forestry
CAP &TRADE
Peat and Mangrove Management
MOEF Reg 7/2023
Ministry of Industry
Industry
Ministry of Agriculture
Rice Field
Farm
Plantation
issued and enacted
yet to be issued

Source: pwc

Key takeaways from power plant sub-sector

The regulatory framework in Carbon Pricing is sector based, hence, MoEMR Regulation Number 16 Year 2022 prevails over the Carbon Pricing provisions in MoEF Regulation Number 21 Year 2022.

Key provisions on carbon trading	MoEMR Regulation Number 16 Year 2022	MoEF Regulation Number 21 Year 2022
PTBAE PU trading period	• Carbon Trading period runs from 1 January to 31 December. • Maximum 2 years from end of Carbon Trading period.	• Defined as Compliance Period: a period determined by the Sector Ministry to measure the business entity compliance in GHG emission against the designated emission allowance; • 2 years from end of compliance year.
PTBAE PU surplus converted into SPE GRK	Not allowed (art 13 (5)).	PTBAE PU surplus can be converted to SPE GRK (art 13 (4)), provided that: • The emission reduction is real, permanent, measurable, monitored and reported; or • The emission reduction and the surplus PTBAE PU is the result of climate change mitigation action.
PTBAE PU Trading between Sector	• Limited between PTBAE PU holders in the same sub sector (i.e., power plant). • Not allowed within the same power plant units.	PTBAE PU can be traded domestically and/or between PTBAE PU holders.
SPE GRK issuance	Mitigation activities eligible for SPE GRK: 1. New and renewable energy power plant; 2. Activities in transportation, construction, industry including energy efficiency activities; and 3. Other activities in energy sector.	Delegate to sector minister for further implementation.
SPE GRK in Sector trading	Only SPE GRK in energy sector can set off the emission in energy sector. For example: SPE GRK from geothermal project can set off the deficit allowance in power plant sector.	SPE GRK can be traded between sectors subject to inter-sector trading allowance set by the sector ministry.
Carbon Trading/ Credit Registration	APPLE GATRIK (MoEMR website-based platform for carbon pricing mechanism) and SRN PPI.	Carbon registry in sector ministry must be integrated or connected to SRN PPI.

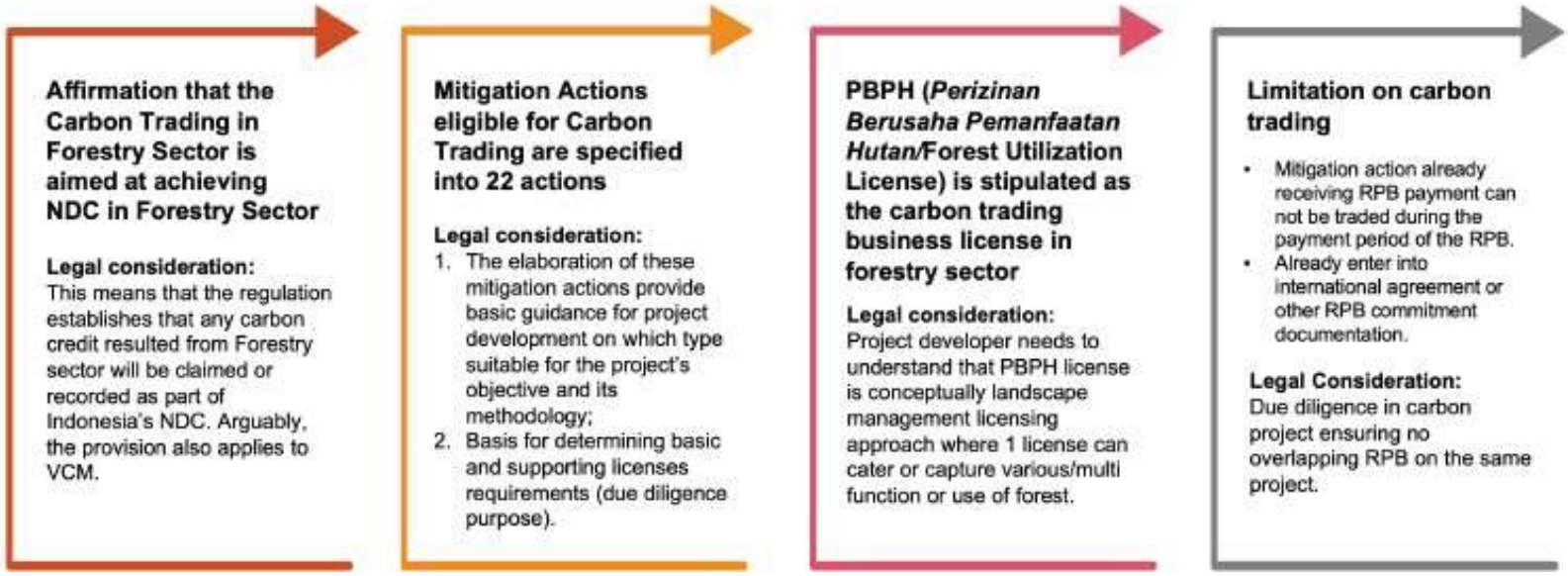
Source: pwc

The key takeaways from energy sector for carbon players consideration are:

- VCM exists in energy sector but can only be set off for the emission allowance within the energy sector. As such the carbon credit demand is foreseeable when PTBAE is gradually decreased up to 75% by 2030 and the PTBAE PU holders need to set off if they fail to mitigate or stay within the allowance.
- New and Renewable Energy projects are emission offset eligible for both energy sector mandatory market and VCM. However, the definition or categorisation of new and renewable energy shall follow the MoEMR stipulation, not solely based on industrial practices. For example, solar panel, wind and geothermal are considered as Renewable Energy (RE) subject to certain technical specification stipulated by the MoEMR.
- Another potential carbon opportunity which can be inferred from the MoEMR regulation is that transportation sub-sector, for example, electric buses in public transportation can apply for SPE GRK and use the credits for emission offset in energy sector and the VCM.

Key takeaways from forestry sector

Basically, MoEF Regulation Number 7 Year 2023 applies the carbon trading provisions as stipulated in MoEF Regulation Number 21 Year 2022. However, the specific provisions relating to the forestry sector provide the following key takeaways:



Source: pwc

Mutual recognition of International Carbon Registry

Indonesia accepts Emission Reduction Certificates (ERC) issued by the International Carbon Registry, for example Verified Carbon Standard, Gold Standard or Plan Vivo, through mutual recognition with the Minister of Environment and Forestry. The basic concept of Mutual Recognition of international ERC is as follows:

Provision on Mutual Recognition

Article 72 Pres Reg 98/2021

Mutual recognition for non SPE GRK certificate or ERCs issued by non SRN PPI registry subject to the following:

1. In accordance with principles, procedures, and provisions of international standard and/or Indonesia National Standard (SNI) as per ISO 14064 dan ISO 14065.
2. Mutual recognition of other ERCs shall be conducted by the Minister.

Accepted Mechanism

a. Clean Development Mechanism.
b. Other mechanism as determined based on the Mutual Recognition agreement document.

Mechanism and Action Criteria

Article 73 Pres Reg 98/2022

ERCs issued by SRN PPI Registry can be traded in domestic carbon trading, subject to the following:

a. The ERC is the result of mitigation action conducted in Indonesia;
b. The result of mitigation action before 2021;
c. Issued from reputable registry;
d. Mechanism required third party verification; and
e. Recorded in SRN PPI.

Mitigation Action

a. Located in Indonesia.
b. Vintage before 2021.

Methodology Criteria

Article 68 and 68 MoEF Reg 21/2022

Mutual Recognition actions are:

1. Mutual information disclosure on MRV Standards used by SRN PPI and other Registry;
2. Conformity assessment on the international standard and/or the Indonesia's national standard;
3. Assessment result statement;
4. Establish Mutual Recognition agreement document; and
5. Publication of both certificates in SRN PPI.

Conformity Assessment

a. CDM as accepted by Intergovernmental Panel on climate change.
b. Validation and Verification conducted by internationally accredited validator and verifier.

Mutual Recognition for non-SPN PPI ERCs is possible, but the international carbon registry must first enter into agreement on the Mutual Recognition with MoEF. However, since the ERC for domestic trading is a vintage one from before 2021, this may mean that after 2021, the Mutual Recognition for ERC is for international trading only with a Minister's letter of authorisation. But it contradicts the mutual recognition concept where both registries will accept each other's ERCs. If there is a limitation to domestic trading, then even though SPE GRK is acknowledged by the International Carbon Registry, it will not be able to be traded in cross border transaction. This situation creates what seems to be a stagnant condition for carbon trading, especially for project proponents looking into potential cross-border transactions. However, since the regulation progresses from time to time, potential project proponents may consider certifying its carbon project since it is expected that, with the current demand for certification, the process may take more than the regulated nine month period.

Source: pwc

Carbon unit as securities (efek) in IDX Carbon

Carbon trading is carried out by direct trading or via carbon exchange. IDX obtained the approval of the Financial Services Authority (Otoritas Jasa Keuangan/OJK) to organise the IDX Carbon. Carbon units, as the trading object, constitute securities (efek) as detailed in Article 26 by Law Number 4 Year 2023 on the Development and Strengthening of the Financial Sector. Though it is titled as Securities (efek) by virtue of Law, its nature does not represent the conventional securities in the capital market. Carbon unit as Securities, it is treated more like intangible assets as per the Indonesian Civil Code definition.

OJK Regulation Number 14 Year 2023 followed by IDX Regulations for its implementation set specifies the tradeable units and the market mechanisms, as follows:

Carbon market types in IDX Carbon

- Carbon unit trading on the IDX can only be conducted by and between IDX Carbon users.
- Carbon Units must be registered in SRN PPI and IDX Carbon.
- The unit trading volume is a multiple of one lot or one tonne of CO2e.
- There are four types of markets on IDX Carbon, namely:
  (i) auction markets;
  (ii) regular markets;
  (iii) negotiated markets; and
  (iv) non-regular markets.

Various trading factors (e.g., the subject and the object of trading) will vary depending on the types of markets on which trading takes place.

The tradable carbon units in IDX Carbon

Carbon Units in the form of:

1. PTBAE-PU stipulated by the sectoral ministries; and
2. SPE-GRK (issued by SRN PPI).

International verified carbon units (VCU) unregistered in SRN PPI can be traded by and in the IDX Carbon, provided that:

1. Registered, validated, and verified by institution accredited by international registration system operator;
2. Fulfil the trading requirement by foreign Carbon Exchange; and
3. Other requirement as stipulated by OJK.

Though the OJK Regulation seems to open-up opportunity for foreign ERCs to be traded in IDX Carbon, this provision is subject to further implementing regulation to be discussed with MoEF and it needs to be read that each Carbon Credit must be registered in SRN PPI. Thus, the application of this provision on foreign ERCs will subject to the implementing regulation on the Mutual Recognition mechanism.

Source: pwc

Thank You