On behalf of:

Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety

of the Federal Republic of Germany

Power Transition Progress Tool

Methodology Document

August 2026

This document accompanies the Power Transition Progress Tool developed under the Clean, Affordable and Secure Energy for Southeast Asia (CASE) Programme. It describes the methodological approach for each indicator, including how it is assessed and scored, as well as its rationale and limitations.

The Power Transition Progress Tool assesses the status of the power sector transition across nine challenge areas. Each challenge area comprises several sub-challenges, which together contain 69 quantitative and qualitative indicators. Together, these indicators capture a range of technical, economic, regulatory, social and institutional conditions that can enable or constrain the transition.

Each indicator receives a score between 0 and 10, where 10 represents conditions most supportive of the power sector transition. The score for each challenge area is calculated as the average of the available indicator scores within that area. Indicators for which sufficient data is unavailable are excluded from the calculation.

Data collection prioritises the latest available national sources. Regional and international datasets are used where relevant, particularly where they provide more complete or comparable information across countries. The data sources are provided at the indicator level in the interactive tool.

For questions on the methodology or the tool please reach out to info@newclimate.org

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About CASE

Southeast Asia (SEA) is the fastest developing region in the world with **Indonesia, the Philippines, Thailand, and Vietnam** representing around 80% of the region's total energy share and population. The four countries also have the highest projected GHG emissions and energy demand in the region. SEA is a key region to drive global climate action and to achieve the Paris Agreement objective.

The Project "Clean, Affordable and Secure Energy for Southeast Asia" (CASE) aims to support **a narrative change** in the power sector towards an evidence-based energy transition that robustly supports the region's development strategies as it pursues the Paris Agreement goals. The project harnesses available research initiatives to generate new evidence grounded in local realities that can persuade economic advisors, power sector decision makers, industry leaders and consumers to support rapid and responsive strategic reforms in the power sector.

To reach this objective, the project applies a joint fact-finding approach involving expert analysis and dialogue to work towards consensus by converging areas of disagreement. The creation of this evidence is expected to equip stakeholders with the knowledge and capacities to manage the power sector transition in a socially just way. CASE also supports **exchange and coordination** in the SEA power sector, provides **technical and policy support** and **facilitates discourse** around a new energy vision. By implementing these activities, CASE will directly contribute to the transition of the power sector towards clean, affordable and secure energy for Southeast Asia.

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Acronyms

AGC	Automatic generation control
CAT	Climate Action Tracker
CCGT	Combined-cycle gas turbine
CHP	Combined heat and power
CPI	Corruption Perceptions Index
CSO	Civil society organisation
CSP	Concentrated solar power
DER	Distributed energy resources
DSM	Demand-side management
DSO	Distribution system operator
EE	Energy efficiency
ET	Energy transition
EV	Electric vehicle
FID	Final investment decision
FiT	Feed-in tariff
FRT	Fault ride-through
GDP	Gross domestic product
HHI	Herfindahl-Hirschman Index
IPP	Independent power producer
LCOE	Levelised cost of electricity
LTS	Long-term strategy
MW	Megawatt
NDC	Nationally Determined Contribution
PV	Photovoltaic
R&D	Research and development
RE	Renewable energy
RPS	Renewable portfolio standard
SNSP	System non-synchronous penetration
TJ	Terajoule
TSO	Transmission system operator
USD	United States Dollar
VRE	Variable renewable energy
WACC	Weighted average cost of capital

1 Investment Environment

1.1 Power Market Risk

This refers to risks on the revenue streams (i.e. electricity sales). The stability and magnitude of the revenue streams are two of the largest risk factors in renewable energy (RE) and flexibilities investments. Regardless of the existence or not of a power market, establishing certainty of revenue streams is one of the most successful tricks to trigger the development of RE (e.g. auctions or feed-in tariffs that are even lower than market prices). The lack of mechanisms or distortions in remuneration schemes are potential barriers to develop the RE industry. The same applies to investments in other technologies that support RE integration (e.g. storage).

1.1.1 Grid parity (Indicator 1)

Approach

This indicator compares average electricity prices (wholesale price, average generation cost or a similar national reference) against the levelised cost of electricity (LCOE) of utility-scale solar and wind, using the lower end of the national LCOE range.

Table 1: Components - Indicator 1

	Indicator's component #1	Indicator's component #2	Indicator's component #3
Description	Average wholesale electricity price (currency/MWh)	Solar LCOE - lower end of a range (currency/MWh)	Wind LCOE - lower end of a range (currency/MWh)

Note: The indicator is calculated as the percentage difference between the lower end of components #2 and #3, relative to component #1.

Table 2: Deriving the scale - Indicator 1

Scale	Indicator value	Scale description
10	< 10%	The lower end of the RE LCOE range is lower than average electricity prices by around 10%
7.5	± 10%	The lower end of the RE LCOE range and the average electricity prices are around the same value
5	> 10-30%	The lower end of the RE LCOE range is higher than average electricity prices by 10%-30%
2.5	> 30-50%	The lower end of the RE LCOE range is higher than average electricity prices by 30%-50%
0	> 50%	The lower end of the RE LCOE range is higher than average electricity prices by more than 50%

Rationale

The difference between generation costs and achievable electricity prices determines the margin available to project developers. The LCOE captures capital, financing, fuel and operating costs over a plant's lifetime output, and comparing it with prevailing electricity prices indicates whether projects can be

financed on market fundamentals or remain dependent on support schemes. Grid parity therefore marks the point at which RE deployment becomes commercially self-sustaining.

Limitations

National averages are used for both electricity prices and LCOE. Actual values vary with resource quality, project scale, financing conditions and market circumstances, and prices differ across zones and time-of-use periods. Comparing average prices with the lower end of the LCOE range may overstate competitiveness for a typical project. In single-buyer systems without a wholesale market, average generation costs serve as an imperfect price reference.

1.1.2 Large scale RE without financial support scheme (Indicator 2)

Approach

This indicator analyses the share of utility-scale RE capacity (>1 MW) that operates without administratively set remuneration (e.g. feed-in tariffs or auction-based contracts), including subsidy-free pilot projects.

Table 3: Components - Indicator 2

	Indicator's component #1	Indicator's component #2
Description	Projects participating in the market w/o support mechanism	Are there subsidy-free RE pilot projects?

Note: Component #1 'Yes' results in a score of 10; component #1 'No' with component #2 'Yes' results in 5; both 'No' results in 0.

Table 4: Deriving the scale - Indicator 2

Scale	Indicator value	Scale description
10	RE merchants in place	Several RE projects are operating w/o financial support schemes
7.5		
5	Only starting / pilot projects	Merchant projects (subsidy-free) are announced for the future or a few pilots in place but in niche markets
2.5		
0	Negligible	No RE projects are financed subsidy-free. No pilot projects

Rationale

Merchant projects are financed without support schemes and indicate that developers are willing to carry price risk rather than rely on guaranteed revenues. Their presence suggests a market in which renewable energy attracts private investment on commercial terms, which typically follows sustained cost declines and stable revenue expectations.

Limitations

Where support schemes remain available, eligible projects will normally make use of them, so limited merchant activity can understate technology maturity. Regulatory frameworks must also permit merchant structures before such projects can emerge. In addition, many nominally subsidy-free projects rely on

corporate PPAs with creditworthy off-takers, which provide revenue certainty in practice. The indicator does not distinguish these from fully merchant projects.

1.2 Financing Risks

1.2.1 WACC (cost of debt) of RE projects (Indicator 3)

Approach

This indicator compares the weighted average cost of capital (WACC) of solar and wind projects against that of fossil fuel generation, as a proxy for the financing risk premium attached to RE.

Table 5: Components - Indicator 3

	Indicator's component #1	Indicator's component #2	Indicator's component #3
Description	WACC solar	WACC wind (offshore or onshore)	WACC fossil fuel

Note: The indicator compares components #1 and #2 against component #3, expressed as the percentage difference relative to component #3.

Table 6: Deriving the scale - Indicator 3

Scale	Indicator value	Scale description
10	< -50%	WACC of RE lower than fossil fuels by more than 50%
7.5	-50% to -5%	in between
5	-5% to 5%	WACC of RE and fossil fuels around the same value
2.5	5% to 50%	in between
0	> 50%	WACC of RE is more than 50% higher than fossil fuels

Rationale

Variable renewable energy (VRE) incurs most of its lifetime costs at construction and has negligible running costs, which makes project economics more sensitive to financing conditions than fuel-dominated fossil generation. A WACC premium over fossil generation reflects perceived revenue, policy and off-taker risks and raises the effective hurdle rate for investment. Access to risk mitigation instruments and mature financing structures can narrow this premium.

Limitations

WACC varies by project, sponsor track record and deal structure. Projects backed by strong PPAs can achieve materially lower financing costs than merchant projects in the same market, so national averages are indicative only. The indicator covers utility-scale solar and wind and excludes technologies such as geothermal and hydropower, which are relevant in some markets.

1.3 Access to Capital

1.3.1 Availability of RE specific loans/credit lines number of banks offering RE finance (Indicator 4)

Approach

This indicator counts the number of banks active in the energy sector that offer dedicated RE credit lines or loan products.

Table 7: Components - Indicator 4

	Indicator's component #1
Description	Number of banks with credit lines for RE

Note: The indicator uses component #1 directly, compared against the scale thresholds.

Table 8: Deriving the scale - Indicator 4

Scale	Indicator value	Scale description
10	≥ 4 banks	Four or more banks offer dedicated RE credit lines
7.5		
5	2 to 3 banks	Two to three banks offer dedicated RE credit lines
2.5		
0	< 2 banks	Fewer than two banks offer dedicated RE credit lines

Rationale

Renewable energy projects are typically financed with high shares of debt, which makes bank lending central to project viability. Banks offering dedicated renewable energy credit lines indicate a financial sector that has developed the expertise to appraise these projects, including technology performance, resource assessment and regulatory risk. Competition among lenders can also improve financing terms.

Limitations

The number of banks does not reflect the volume, pricing or accessibility of the finance offered. A market with few banks lending at scale may provide better conditions than one with many banks offering limited products. Lending by development finance institutions, export credit agencies and institutional investors outside commercial banking is not captured.

1.4 Regulatory Risks

1.4.1 Reliability and continuity of RE regulatory policies (Indicator 5)

Approach

This indicator counts the number of consecutive years with RE regulatory policies in place (feed-in tariffs or premiums, quota obligations, tradable certificates, auctions, net metering), accounting for retroactive changes and for policies abandoned without an equivalent or improved replacement.

Table 9: Components - Indicator 5

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4
Description	RE Regulatory policies in place from the list: - Feed-in tariff (FiT), feed-in premiums - Electric utility quota obligation/renewable portfolio standards (RPS) - Tradeable RE certificates - RE auctions - Net-metering	Earliest year when RE policy was enacted (that has neither been abandoned nor replaced with a weaker policy)	Has an RE policy been abandoned with no similar/improved replacement in the last decade? If so, what year?	Have there been retroactive changes in RE policies in the last 10 years?

Note: Component #2 determines the number of consecutive years of policy continuity, provided components #3 and #4 are 'No'; a retroactive change (component #4) results in a score of 0.

Table 10: Deriving the scale - Indicator 5

Scale	Indicator value	Scale description
10	> 12 years	RE Policy in place (or replaced by other support mechanism at least equally strong) continuously for >12 years
7.5	> 8 years	RE Policy in place (or replaced by other support mechanism at least equally strong) continuously for > 8 years
5	> 5 years	RE Policy in place (or replaced by other support mechanism at least equally strong) continuously for > 5 years
2.5	> 3 years	Policy in place continuously for > 3 years
0	< 3 years OR retroactive change	- No policies in place or only since less than 3 years OR an RE policy was retroactively modified in the last 10 years

Rationale

Renewable energy investments recover capital over payback periods spanning one to two decades, so investors need confidence that the regulatory environment will remain supportive. A long record of stable policies supports a reputation as a reliable investment destination and can lower financing costs. Policy withdrawal, and particularly retroactive changes to committed remuneration, can damage investor confidence well beyond the policy concerned and may be reflected in risk premiums for several years.

Limitations

Countries with strong but recently introduced policies score low despite genuine momentum, as a track record takes time to accumulate. Continuity also does not guarantee policy quality. Assessing retroactivity requires interpretation of whether modifications materially harmed existing investments or only adjusted terms for new projects.

1.4.2 Subsidies to fossil fuels for electricity generation (Indicator 6)

Approach

This indicator checks for fossil fuel subsidies in the electricity sector, including tax exemptions for fossil fuels used in power generation.

Table 11: Components - Indicator 6

	Indicator's component #1	Indicator's component #2
Description	Fossil fuel subsidies in electricity sector	Are there tax exemptions for fossil fuels used for power generation?

Note: The two components are combined: no subsidies and no tax exemptions scores 10; tax exemptions only scores 5; subsidies in place scores 0.

Table 12: Deriving the scale - Indicator 6

Scale	Indicator value	Scale description
10	No subsidies, no tax exemptions	No subsidies for fossil fuel
7.5		
5	No subsidies, but there are tax exemptions	Tax exemptions for fossil fuels used in power generation
2.5		
0	Subsidies for fossil fuels	Subsidies for fossil fuels in the electricity sector

Rationale

Subsidies to fossil fuel generation, including direct payments and tax exemptions, reduce the apparent cost of fossil-based electricity and disadvantage renewables even where their underlying costs are lower. Removing such support addresses a market distortion directly and can support renewables.

Limitations

The indicator records the existence of subsidies rather than their magnitude or design, which determine how strongly they affect the transition. Definitions also vary. Price-gap approaches capture explicit support, while broader estimates include unpriced externalities. Implicit support, such as below-market fuel supply to generators, can be difficult to identify.

1.4.3 Ensuring use of produced electricity (Indicator 7)

Approach

This indicator checks whether regulation guarantees the offtake of RE generation (e.g. priority dispatch or economic dispatch), or whether processes to establish such guarantees have been initiated.

Table 13: Components - Indicator 7

	Indicator's component #1	Indicator's component #2
Description	Is there a policy defining grid priority for RE?	If 'No' to the previous question, are processes initiated to guarantee the use of RE?

Note: Component #1 'Yes' results in 10; component #1 'No' with component #2 'Yes' results in 5; both 'No' results in 0.

Table 14: Deriving the scale - Indicator 7

Scale	Indicator value	Scale description
10	Priority of dispatch	Priority dispatch for renewables (ensured by regulation)
7.5		
5	In process	Policies not in place but initiated to guarantee the use of RE electricity produced
2.5		
0	Not ensured	RE electricity produced is subject to curtailment

Rationale

Certainty that generated electricity can be fed into the grid and remunerated removes a core revenue risk. Priority dispatch provides that renewable output is accepted and compensated when available. Without such provisions, output may be curtailed during periods of low demand or network constraints in favour of conventional generators, which reduces expected revenues and affects bankability.

Limitations

The indicator checks whether provisions exist in regulation rather than how consistently they are applied. Operators may curtail renewable generation for legitimate technical reasons even where priority rules exist, and compensation arrangements are not assessed. At high shares of VRE, absolute priority dispatch also becomes more difficult to maintain, and systems tend to move towards economic dispatch combined with curtailment compensation.

2 Market Entry

2.1 Permit Risk

Permitting and licensing barriers might be present in countries with RE resources located in environmental and/or community protected areas (e.g. environmental regulations). This also applies to expanding the grid to areas where it is not developed. Complex bureaucratic procedures to obtain a license are frequent entry barriers encountered in the electricity industry.

2.1.1 Ease of small scale RE permits (connected to distribution grid) (Indicator 8)

Approach

This indicator assesses whether dedicated permitting procedures for small-scale RE are in place (separate from large-scale procedures), and how long they take on average.

Table 15: Components - Indicator 8

	Indicator's component #1	Indicator's component #2
Description	Average / estimated time of permitting procedures for small scale RE (Residential)	Average / estimated time of permitting procedures for small scale RE (Commercial)

Note: Components #1 and #2 capture the average or estimated permitting time in weeks, which is compared against the scale thresholds; if small-scale RE is not permitted at all, the score is 0.

Table 16: Deriving the scale - Indicator 8

Scale	Indicator value	Scale description
10	< 8 weeks	Streamlined permit application and procedure (less than 8 weeks or 2 months)
7.5		
5	> 8 weeks	Slow permit application and procedure
2.5		
0	not possible	Not possible at all

Rationale

Complex permitting creates administrative costs that, for small installations, can be comparable to equipment costs. Lengthy processes, multiple agency approvals and associated fees can suppress uptake by households and businesses irrespective of the underlying economics. Dedicated procedures for small-scale RE, separate from utility-scale processes, reduce transaction costs and waiting times.

Limitations

Average permitting times are difficult to establish and often rest on estimates or anecdotal evidence, and durations vary substantially between regions and utilities within a country. Permitting is also only one determinant of distributed RE uptake, alongside connection rules, technical standards and remuneration arrangements covered by other indicators.

2.1.2 Dealing with construction permits (Indicator 9)

Approach

This indicator uses the "Dealing with Construction Permits" sub-index from World Bank Doing Business data (average of the procedures and permitting time scores)[1], which is not renewable-specific. It is complemented by a qualitative assessment of permitting processes for RE projects.

Table 17: Components - Indicator 9

	Indicator's component #1	Indicator's component #2
Description	"Dealing with Construction Permits" score	Ease of permitting processes for RE projects (qualitative assessment to upgrade/downgrade scale)

Note: Component #1 is used directly, mapped to the scale thresholds; component #2 provides a qualitative adjustment (upward or downward) to the scale where RE-specific permitting differs markedly from general construction permitting.

Table 18: Deriving the scale - Indicator 9

Scale	Indicator value	Scale description
10	>70.2	Country in the first quartile of the "Dealing with Construction Permits" score
6.6	63.4 - 70.2	Country in the second quartile of the "Dealing with Construction Permits" score
3.3	53.9 - 63.4	Country in the third quartile of the "Dealing with Construction Permits" score
0	<53.9	Country in the fourth quartile of the "Dealing with Construction Permits" score

Rationale

Cumbersome construction permitting increases development costs and delays projects. The World Bank sub-index measures the number of procedures and the time required for a standardised case, which provides an internationally comparable proxy for the administrative efficiency that developers encounter before energy-specific approvals begin.

Limitations

The indicator is not renewable-specific. It measures general construction permitting for a standardised case in the largest business city, so renewable-specific requirements such as environmental assessment, generation licensing and grid connection are not directly captured, and a qualitative adjustment is applied.

[1] World Bank (2020). *Doing Business (archive): Dealing with Construction Permits*. Available at: https://archive.doingbusiness.org/en/doingbusiness (Accessed: 8 April 2026). The series was discontinued by the World Bank in 2021 and the values reflect the 2020 edition.

The underlying Doing Business dataset was discontinued in September 2021, so scores reflect the situation as of 2020.

2.2 Grid Access

In most cases, the direct connection between a generation site and the existing network must be established first. Clarity regarding rights, responsibilities, procedures and planning processes is important for project implementation. Since distributed generation is often small-scale, the complexity of application procedures and connection costs can be decisive for project viability.

2.2.1 Grid access (Indicator 10)

Approach

This indicator assesses the conditions of grid access for RE projects (priority, non-discriminatory, capacity-limited, or no access).

Table 19: Components - Indicator 10

	Indicator's component #1
Description	Grid access to RE

Note: The indicator is answered with one of 4 options (component #1), each mapping directly to a scale level.

Table 20: Deriving the scale - Indicator 10

Scale	Indicator value	Scale description
10	Priority grid access for RE	Priority grid access for RE
6.6	Non-discriminatory and no capacity limit	Non-discriminatory grid access for RE and no capacity limits
3.3	Non-discriminatory but with capacity limit	Non-discriminatory grid access for RE but with capacity limits
0	No access	No access

Rationale

Certainty of grid connection is a prerequisite for any grid-connected project. Without clear access rights, developers face the risk of stranded investment if connection is denied or indefinitely delayed. Priority access removes a key development risk, while discriminatory or capacity-limited access imposes delays and costs that can deter market entry.

Limitations

The indicator reflects what regulation stipulates rather than how access works in practice, and formally non-discriminatory access can coexist with lengthy connection queues. The indicator does not differentiate by voltage level or project size and does not capture connection timelines and costs.

2.3 Market Barriers

When there is a market in place, the concentration of the market in few incumbents and their strategic behaviour can represent an entry barrier to new entrants. The possibility to exercise market power abuse (affect prices or over-invest to push new competitors away) may be geared to lowering new entrants' expected earnings. This is true for all technologies but especially for new VRE projects, which are not dispatchable and very sensitive to market and financial risks. Other relevant market barriers could be inflexible tariff and contract designs that affect the revenue streams of clean technologies.

2.3.1 Market access for RE independent power producers (Indicator 11)

Approach

This indicator assesses the level of integration of independent power producers (IPPs) in the market, based on the market / power sector structure.

Table 21: Components - Indicator 11

	Indicator's component #1
Description	Market / power sector structure

Note: The indicator is answered with one of 4 options (component #1), each mapping directly to a scale level.

Table 22: Deriving the scale - Indicator 11

Scale	Indicator value	Scale description
10	Retail competition	IPPs have access to wider range of options (sale in wholesale market or end consumers)
6.6	Wholesale competition	IPPs can participate in the wholesale market
3.3	Single buyer market	IPPs are forced to sell to a single buyer (utility)
0	Vertically integrated	No room for IPPs

Rationale

The market structure determines the routes to market available to an IPP. In vertically integrated systems, independent producers depend on the incumbent's willingness to purchase. Wholesale competition provides access to exchanges and bilateral trading, while retail competition enables direct contracting with consumers, including corporate power purchase agreements (PPAs). A larger number of routes to market reduces dependence on a single off-taker and lowers counterparty risk.

Limitations

The classification into market models is a simplification, as hybrid structures exist. Formal openness also does not guarantee that independent producers compete on equal terms, which additionally requires creditworthy off-takers, liquid markets and enforceable contracts. Liberalised markets expose renewable generators to price volatility and revenue cannibalisation, which the indicator does not assess.

2.3.2 Market concentration (Indicator 12)

Approach

This indicator uses the Herfindahl-Hirschman Index (HHI), calculated as the sum of the squares of the power market participants' market shares.

Table 23: Components - Indicator 12

	Indicator's component #1
Description	HHI

Note: Component #1 value is either a directly available HHI value for the power sector or derived as the sum of squares of the power market participants' market shares. The HHI is then compared against the scale thresholds.

Table 24: Deriving the scale - Indicator 12

Scale	Indicator value	Scale description
10	HHI < 1,000	Unconcentrated
7.5		
5	1,000 < HHI < 1,800	Moderately concentrated
2.5		
0	HHI > 1,800	Highly concentrated

Rationale

A highly concentrated market indicates the dominance of a few incumbents, which can deter entrants through market power, lobbying against supportive policies or preferential regulatory treatment. Markets with more participants offer a wider range of off-takers and stronger competition in auctions. The HHI, calculated as the sum of squared market shares, is a standard competition-policy measure of concentration.

Limitations

The index depends on the definition of the relevant market and on data on generators' shares, which can be incomplete or outdated. Concentration measures ownership rather than conduct. A concentrated market can remain contestable under effective regulation, while a formally diverse market may coordinate implicitly. Vertical integration with networks or retail, which creates additional barriers to entry, is not captured.

2.4 Regulatory Barriers

Tightly regulated systems constitute a barrier by themselves, which usually gives greater certainty and advantages to incumbents. The design of cost allocation of grid expansion to VRE projects is also a significant barrier to RE potentials that are not near the existing grid. This increases the need for capital and limits their development.

2.4.1 Grid connection cost allocation (Indicator 13)

Approach

This indicator assesses the grid connection cost regulation: deep vs. shallow cost allocation.

Table 25: Components - Indicator 13

	Indicator's component #1
Description	Type of allocation of grid costs

Note: The indicator is answered with one of 3 options (component #1), each mapping directly to a scale level.

Table 26: Deriving the scale - Indicator 13

Scale	Indicator value	Scale description
10	Super-Shallow	Super- Shallow cost allocation: All costs socialised. No costs are charged to the connecting entity
7.5		
5	Shallow	Shallow cost allocation: Generators required to pay their grid connection to the closest point of connection available in the grid
2.5		
0	Deep	Deep cost allocation: Generators are entailed an extra charge for general grid reinforcements on top of the costs to connect to the closest point in the network

Rationale

The allocation of connection and reinforcement costs affects the capital requirements of renewable energy projects. Deep cost allocation charges generators for network reinforcements triggered by their connection, which places a higher burden on early projects and on projects located away from the existing grid, often where resource quality is highest. Shallow approaches distribute these costs across network users, an approach many systems have adopted to facilitate renewable integration.

Limitations

Cost allocation regimes are often more differentiated than the categories used, and hybrid or technology-specific rules exist. The indicator does not measure absolute connection costs. Shallow charging also shifts costs to consumers through network tariffs and removes the locational signals that deep charging provides, so the appropriate model depends on the wider market design.

2.4.2 Barriers to participate in RE support schemes (Indicator 14)

Approach

This indicator checks for barriers to participate in RE support schemes: local content requirements, high financial guarantees to participate, and exhaustive pre-licensing approvals.

Table 27: Components - Indicator 14

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4	Indicator's component #5
Description	Local content requirement to participate in RE support mechanism (e.g. FiT, auction, etc.)	High financial guarantees to participate in RE support mechanism (e.g. FiT, auction, etc.)	Exhaustive pre-licensing approvals required to participate in RE support mechanism (e.g. FiT, auction, etc.)	Are there other major showstoppers in the country to accessing RE support schemes?	Are any of the above requirements a showstopper to the deployment of RE?

Note: Components #1 to #4 are counted as barriers; component #5 determines whether any of them constitutes a showstopper. The score decreases with the number of barriers identified, and any showstopper results in 0.

Table 28: Deriving the scale - Indicator 14

Scale	Indicator value	Scale description
10	≤ 1 barrier ('Yes') but no showstopper	There are minor barriers
7.5	2 barriers ('Yes') but no showstopper	There are few barriers to participation, but they can be overcome
5	3 barriers ('Yes') but no showstopper	There are several barriers to participation, but they can be overcome
2.5	> 3 barriers ('Yes') but no showstopper	There are many barriers to participation, but they can be overcome
0	≥ 1 barrier ('Yes') and a showstopper	There are barriers to participation that are showstoppers to RE deployment

Rationale

Support schemes fulfil their function only if projects can access them. Local content rules can disqualify projects where domestic supply does not exist, while high financial guarantees and extensive pre-

licensing requirements favour established players and reduce the pool of viable bidders. Each additional requirement can reduce the effectiveness of an otherwise well-designed scheme.

Limitations

Some requirements serve legitimate purposes, including deterring speculative bids, supporting domestic industry and ensuring administrative efficiency. Assessing barriers therefore requires contextual judgement about proportionality beyond identifying outright showstoppers. Informal practices and access to information about upcoming rounds can matter as much as the formal rules assessed here.

3 Supply Chain

3.1 Hardware Availability Risk

Lack of availability of equipment, components and spare parts will require a substantial increase in the production costs. In the absence of a domestic manufacturing market, these items need to be imported, often being procured at high prices and so increasing the overall cost. Additional delays and costs can occur due to local import regulations, duties etc.

3.1.1 RE equipment industry in country (Indicator 15)

Approach

This indicator assesses the presence of RE manufacturing companies in the country, checking the in-country presence of the 10 largest RE companies (globally) for wind[2] and solar[3].

Table 29: Components - Indicator 15

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4	Indicator's component #5
Description	Wind manufacturers: No. of wind companies (top 10 biggest) with manufacturing presence in the country	Wind service-assembly: No. of wind companies (top 10 biggest) with service presence in the country	Solar manufacturers: No. of solar companies (top 10 biggest) with manufacturing presence in the country	Solar service-assembly: No. of solar companies (top 10 biggest) with service presence in the country	Is there a strong presence of a national company / industry in RE equipment manufacturing?

Note: Components #1 to #4 are used to count manufacturers and service or assembly providers among the 10 largest global wind and solar companies present in the country; component #5 complements the assessment where a strong national industry exists.

Table 30: Deriving the scale - Indicator 15

Scale	Indicator value	Scale description
10	≥ 4 manufacturers (at least 1 of	Manufacturers available for all technologies

[2] BloombergNEF (2025). *Chinese Manufacturers Lead Global Wind Turbine Installations*. Available at: https://about.bnef.com/insights/clean-energy/chinese-manufacturers-lead-global-wind-turbine-installations-bloombergnef-report-show (Accessed: 8 April 2026).

[3] Wood Mackenzie (2025). *Top 10 solar module manufacturers shipped 500 GW in 2024 despite $4 billion in losses*. Available at: https://www.woodmac.com/press-releases/2025-solar-ranking/ (Accessed: 8 April 2026).

	each technology); Or a strong national company manufacturing RE equipment	
6.6	1 - 4 manufacturers >2 RE service providers	Few manufacturers available and also service providers
3.3	0 manufacturers >2 RE service providers	No manufacturers available but few service providers available
0	0 manufacturers ≤ 2 RE service providers	No manufacturers available

Rationale

A domestic presence of leading manufacturers shortens supply chains, reduces logistics costs and operation and maintenance risk, and supports local technical expertise and employment. Checking the in-country presence of the largest global wind and solar companies provides a tractable proxy for supply chain maturity.

Limitations

The focus on the ten largest global companies and wind and solar overlooks smaller or specialised manufacturers, other RE-technologies and the wider component supply chain, and does not distinguish assembly operations from integrated manufacturing. Presence also provides no information on production scale or cost competitiveness relative to domestic demand.

3.1.2 Import duties and regulation (Indicator 16)

Approach

This indicator compares import duties on RE equipment against those on other manufacturing goods (ratio).

Table 31: Components - Indicator 16

	Indicator's component #1	Indicator's component #2	Indicator's component #3
Description	Import duties for RE equipment (if available)	Import duties for manufacturing goods (if available)	Qualitative description of import duties

Note: The indicator is calculated as the ratio of component #1 to component #2; component #3 informs the assessment where duty data is unavailable. Exemptions for RE equipment score 10.

Table 32: Deriving the scale - Indicator 16

Scale	Indicator value	Scale description
10	Yes (exemption) or ratio < 0.9	Import duties of RE equipment lower than for other manufacturing equipment
7.5		
5	Ratio 0.9 - 1.1	Import duties of RE equipment similar to other manufacturing equipment
2.5		
0	Ratio > 1.1	Import duties of RE equipment higher than for other manufacturing equipment

Rationale

Where domestic manufacturing is limited, most renewable energy equipment is imported and import duties feed directly into capital costs. Duties above those applied to comparable manufacturing goods place renewable energy technologies at a relative disadvantage. Exemptions or reductions are a comparatively low-cost support measure that many countries have adopted.

Limitations

Duty schedules are complex and vary by component, classification and trade agreement, so a single ratio is a simplification, and nominal rates may differ from effective protection from one good to the other.

3.1.3 Ease of trading across borders (Indicator 17)

Approach

This indicator uses the "Trading across Borders" sub-index of the World Bank's ease of doing business index[4]. It is not renewable-specific.

Table 33: Components - Indicator 17

	Indicator's component #1
Description	Ease of doing business score

Note: Component #1 is used directly, compared against the scale thresholds.

Table 34: Deriving the scale - Indicator 17

Scale	Indicator value	Scale description
10	≥ 91.9	Higher than percentile 80th, considering all countries
7.5	[79 - 91.9]	Higher than percentile 60th, considering all countries
5	[68.7 - 79]	Higher than percentile 40th, considering all countries
2.5	[58.2 - 68.7]	Higher than percentile 20th, considering all countries

[4] World Bank (2020). *Doing Business (archive): Trading across Borders*. Available at: https://archive.doingbusiness.org/en/doingbusiness (Accessed: 8 April 2026). The series was discontinued by the World Bank in 2021 and the values reflect the 2020 edition.

0	< 58.2	Lower than percentile 20th, considering all countries

Rationale

Renewable energy projects in most emerging markets rely on imported equipment. Customs efficiency, port operations and documentation requirements therefore affect project costs and timelines, and trade facilitation performance provides a proxy for supply chain reliability.

Limitations

The indicator is not renewable-specific and reflects general trade logistics measured at the main business city's port, which may not represent inland borders or smaller ports. RE equipment can face additional procedures such as certification or exemption processing. The underlying Doing Business series was discontinued in September 2021, so scores reflect the situation as of 2020.

3.2 Skilled Workforce

New employment opportunities develop from adopting renewable energy sources, and a skilled workforce is indispensable to a successful energy transition (ET). Without well-trained, experienced workers, renewable energy deployment and energy efficiency (EE) targets may be missed or the quality of equipment and installations could suffer.

3.2.1 RE jobs in the country as % of total labour force (Indicator 18)

Approach

This indicator measures the number of jobs directly related to RE[5] divided by the total labour force[6].

Table 35: Components - Indicator 18

	Indicator's component #1	Indicator's component #2
Description	Number of RE jobs (thousand jobs)	Labour force (thousands)

Note: The indicator is calculated as component #1 divided by component #2.

Table 36: Deriving the scale - Indicator 18

Scale	Indicator value	Scale description
10	> 1%	More than 1% of the total labour force is employed in renewable energy
7.5	0.7% - 1%	Between 0.7% and 1% of the total labour force is employed in renewable energy

[5] IRENA (2025). *Renewable Energy Employment by Country*. Available at: https://www.irena.org/Statistics/View-Data-by-Topic/Benefits/Renewable-Energy-Employment-by-Country (Accessed: 8 April 2026).

[6] World Bank. *Labor force, total*. Available at: https://data.worldbank.org/indicator/SL.TLF.TOTL.IN (Accessed: 8 April 2026).

5	0.4% - 0.7%	Between 0.4% and 0.7% of the total labour force is employed in RE
2.5	0.1% - 0.4%	Between 0.1% and 0.4% of the total labour force is employed in RE
0	< 0.1%	Less than 0.1% of the total labour force is employed in renewable energy

Rationale

The share of the labour force employed in renewable energy indicates the maturity of the domestic industry and the availability of practical skills for installation, operation and maintenance. A sizeable workforce also suggests that the country is capturing economic value from the transition.

Limitations

Employment statistics rely on estimates with varying methodologies, particularly regarding direct, indirect and induced jobs, and may lag by several years. The indicator provides no information on job quality or durability, such as the difference between construction-phase peaks and sustained operational employment. A low share can also reflect a large overall labour force rather than a small renewable energy sector.

3.2.2 Energy engineering degrees or similar degrees with a renewable energy/energy transition focus (Indicator 19)

Approach

This indicator counts RE-relevant university degrees or professional courses.

Table 37: Components - Indicator 19

	Indicator's component #1
Description	No. of university degrees relevant for RE industry

Note: The indicator uses component #1 directly, compared against the scale thresholds.

Table 38: Deriving the scale - Indicator 19

Scale	Indicator value	Scale description
10	> 5 programmes	Critical mass of RE-related professional courses available
7.5		
5	2 - 5 programmes	Moderate availability of RE-related professional courses
2.5		
0	< 2 programmes	No availability of RE-related professional courses

Rationale

University degrees and professional courses with a renewable energy or energy transition focus build the pipeline of engineers, analysts and operators required for deployment, system operation and policy making. Educational institutions also anchor research capacity and can inform policy processes.

Limitations

Counting programmes provides limited information on enrolment, teaching quality or the absorption of graduates into the sector. Skills are also built through vocational training, certification and on-the-job learning, which are not captured. The transition additionally requires expertise beyond engineering, including in finance, law and planning. The indicator scale may not be large enough to illustrate difference between countries: All countries analysed by PTPT have easily scored the highest value because the number of courses exceeds five, but the tool does not capture to what extent.

3.3 Developer Risk

As renewable projects are capital-intensive, damage to assets or construction delays can have a significant impact on overall costs. The construction phase is the riskiest period of a project from this point of view. Following construction and commissioning, there remains a material risk of damage to physical assets as a result of accident, negligence, wear and tear, design flaws, or natural catastrophe during operation.

3.3.1 Time to construct an RE power plant (Indicator 20)

Approach

This indicator measures the average time to construct a (utility-scale) RE plant (including delays and time to issue licenses/permits). Construction time is defined as the time from final investment decision (FID) until commissioning is completed (start of commercial operation), expressed in years.

Table 39: Components - Indicator 20

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4
Description	Average time to construct a wind plant (on-shore) - years	Average time to construct a wind plant (off-shore) - years	Average time to construct a solar photovoltaic (PV) plant - years	Average time to construct a concentrated solar power (CSP) plant - years

Note: Components #1 to #4 are compared against international reference construction times per technology; the score reflects in how many technologies realised times exceed the reference and by how much.

Table 40: Deriving the scale - Indicator 20

Scale	Indicator value	Scale description
10	Comply in at least 3/4 of the following: < 1.5 years wind (on-shore) < 3.5 years wind (off-shore) < 1 year solar PV	Construction times in line with international reference values (1.5 years for onshore wind, 3.5 years for offshore wind, 1 year for solar PV, 2 years for CSP; based on IPCC AR5 WGIII Annex III)

	< 2 years CSP (omit technologies that are not built in the country or too small compared to average plant sizes)	
6.6	>25% in 2 of the technologies	More than 25% above the reference in a maximum of 2 of the technologies
3.3	>50% in 2 of the technologies	More than 50% above the reference in a maximum of 2 of the technologies
0	>50% in more than 2 of the technologies	More than 50% above the reference in more than 2 of the technologies

Rationale

Long construction and permitting timelines increase financing costs through interest during construction, delay revenues and extend exposure to policy and currency risk. Comparing realised construction times against international reference values indicates administrative and supply chain bottlenecks, as construction periods that are technically short can extend considerably in difficult regulatory environments.

Limitations

Averages conceal wide variation by project size, technology and site, and data on realised construction times including delays is scarce and often anecdotal. Pre-construction phases such as permitting, land acquisition and grid connection often take longer than construction itself and are only partly captured. the indicator is designed for utility-scale renewables, but the uptake of solar rooftop for example in the context of the US-Israel war on Iran and the following energy crisis in Thailand and Philippines shows that substantial potential of small-scale installations.

4 Grid Integration

4.1 Load Balancing

Load balancing describes limitations in the system to cope with the additional variability and uncertainty introduced by an increasing penetration of VRE sources, while keeping the balance between supply and demand.

4.1.1 System flexibility in the current system (Indicator 21)

Approach

This indicator measures the percentage of capacity from each flexibility source (interconnection, dispatchable RE, flexible thermal, storage) relative to average demand. The underlying assumption is that the system should be able to cope with the penetration of VRE in “average situations”. Each of the resulting percentages is compared against a benchmark.

Table 41: Components - Indicator 21

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4	Indicator's component #5	Indicator's component #6	Indicator's component #7
Description	Number of large non-interconnected systems within the country (#)	Flex option #1: Interconnection capacity (MW)	Flex option #2: Capacity of dispatchable RE (MW) - hydro, geothermal, biomass	Flex option #3: Capacity of flexible thermal (MW) - open-cycle gas and combined-cycle gas turbines (CCGT)	Flex option #4: Storage capacity (MW) - pumped hydro, large batteries	Capacity of non-flexible baseload or must-run (MW) - e.g. nuclear, coal-fired, combined heat and power (CHP)	Average demand (MW)

Note: Components #2 to #5 are each divided by component #7 (average demand) to obtain flexibility shares; the score depends on how many of these shares exceed the benchmarks set out in the scale. Components #1 and #6 provide context on system fragmentation and inflexible baseload capacity.

Table 42: Deriving the scale - Indicator 21

Scale	Indicator value	Scale description
10	2 biggest flex options > 30%; OR 1st flex option > 100%	At least 2 of the flexibility options higher than the reference

6.6	1st flex option > 30%; 2nd largest flex option > 15%	At least 1 of the flexibility options exceeds the reference
3.3	The sum of the 2 largest flex options < 50%	The sum of the 2 largest flexibility options is larger than the reference
0	0% in 2 (or more) flexibility options; OR the sum of all flex options < 60%	0% in 2 or more of the flexibility options

Rationale

The ability of a system to integrate VRE in normal operation depends on the flexibility resources available relative to demand, including interconnection, dispatchable renewables, flexible thermal capacity and storage. Systems with substantial flexibility can accommodate higher shares without operational stress, while systems dominated by inflexible baseload capacity may face curtailment, balancing difficulties and reliability concerns as shares of variable sources grow.

Limitations

Installed capacity is a proxy for usable flexibility. Actual ramping capability and availability, and whether resources are dispatched and remunerated flexibly, are not captured, and demand-side flexibility is excluded. Benchmarks are generic rather than tailored to national demand profiles, flexibility needs and sources are partly locational, and non-interconnected island systems complicate a single national assessment.

4.1.2 Future flexibility (preparedness of current system) (Indicator 22)

Approach

This indicator assesses the preparedness of the future system with respect to flexibility, comparing the percentage of the capacity of flexibility resources (interconnection, dispatchable RE, flexible thermal, storage) against peak demand. The underlying assumption is that the system should be able to cope with the penetration of VRE in stressed conditions (peak demand). Each of the resulting percentages is compared against a benchmark. Component values reflect current capacity (as in the previous indicator) plus additional capacity that is financially secured or under construction and will be in place by 2030.

Table 43: Components - Indicator 22

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4	Indicator's component #5
Description	Interconnection capacity (MW)	Capacity of dispatchable RE (MW) - hydro,	Capacity of flexible thermal (MW) - Open gas and CCGT	Storage capacity (MW) - pumped hydro, large batteries	Peak demand (MW)

		geothermal, biomass			

Note: Components #1 to #4 (current capacity plus capacity financially secured or under construction) are each divided by component #5 to obtain flexibility shares, which are compared against the benchmarks set out in the scale.

Table 44: Deriving the scale - Indicator 22

Scale	Indicator value	Scale description
10	[2 biggest flex options > 40%; OR 1st flex option > 40% & interconnection > 20%; OR 1st flex option > 100%] AND storage in place (>0%)	At least 2 of the flexibility options higher than the reference (peak demand), and some storage in place
6.6	1st flex option > 30%; 2nd largest flex option > 20%	At least 1 of the flexibility options exceeds the reference (peak demand)
3.3	The sum of the 2 largest flex options < 60%	The sum of the 2 largest flexibility options is larger than the reference (peak demand)
0	0% in 2 (or more) flexibility options; OR the sum of all flex options < 70%	0% in 2 or more of the flexibility options

Rationale

Shares of VRE are expected to grow, so the flexibility of the future system is as relevant as current flexibility. Flexibility assets such as storage, pumped hydro and interconnectors typically have longer lead times than wind and solar projects. Considering capacity that is financially secured or under construction against projected peak demand indicates whether the system is being prepared for stressed conditions.

Limitations

Project pipelines change, and capacity under construction can be delayed or cancelled. Peak demand projections also carry uncertainty. Demand-side flexibility is not covered by the indicator's components.

The appropriate scale of future flexibility depends on the country's deployment trajectory, which complicates cross-country comparison. Future updates may need to consider shifting the time horizon. The target year 2030 was introduced in 2022.

4.1.3 System operation, regulation and monetisation to exploit flexibility (Indicator 23)

Approach

This indicator checks the list of options and measures to exploit flexibility in the system: flexible system operations (large generators with automatic generation control (AGC)); ancillary services targeted to flexibility (ramp products); market design to encourage flexible generation (intraday market, gate closure close to real time, flexible contracts, short time scales, locational signals); market design to encourage flexible demand (e.g. time-of-use tariffs, real-time pricing); and programmes/incentives to retrofit existing power plants.

Table 45: Components - Indicator 23

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4	Indicator's component #5	Indicator's component #6
Description	Large generators with AGC	Ancillary services for flexibility products	Market design to exploit demand-side flexibility	Market design to increase supply-side flexibility	Flexible contracting	Retrofitting of power plants

Note: Component #1 (AGC) is assessed first; the remaining components are counted as 'Yes' answers. The score combines the presence of AGC with the number of additional flexibility measures in place.

Table 46: Deriving the scale - Indicator 23

Scale	Indicator value	Scale description
10	AGC + ≥ 4 'Yes'	AGC in place + ≥4 of the list implemented and aligned with flexible options in indicator above
6.6	AGC + 3 'Yes'	AGC in place + 3 of the list implemented and aligned with flexible options in indicator above
3.3	AGC or 1-2 'Yes'	AGC in place + 1-2 of the list implemented
0	No AGC or < 2 'Yes'	No AGC in place or less than 2 of the list implemented

Rationale

Physical flexibility supports integration only if system operation and market design allow it to be used and remunerated. AGC, ancillary services for flexibility, short dispatch intervals, gate closure close to real time, and market access for demand response and storage on terms comparable to generation together create the operational and commercial framework in which flexible assets are dispatched.

Limitations

The indicator checks the existence of measures rather than their effectiveness or liquidity. An intraday market may exist but be barely traded, and rules may permit participation that market design does not reward. Vertically integrated systems can also achieve flexible operation through central dispatch without formal markets, which a checklist approach may undervalue.

4.2 Monitoring and Control

The reliable operation of a power system requires a minimum level of visibility and control of its generation resources to be able to respond to all contingencies. These challenges increase with more decentralised and small-scale VRE generation at distribution level.

4.2.1 Penetration of DER (Indicator 24)

Approach

This indicator measures the penetration of distributed energy resources (DER), using the share of rooftop PV systems in total installed capacity as a proxy, complemented by a check of measures in place to smartly integrate prosumers (i.e. households or businesses that produce and consume electricity).

Table 47: Components - Indicator 24

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4
Description	Share of Rooftop PV in total installed capacity (%)	Rooftop PV installed capacity (MW)	Total installed capacity (MW)	Are there any measures in place to smartly integrate prosumers?

Note: Component #1 is calculated as component #2 divided by component #3; component #4 determines whether prosumer-integration measures are in place, which is combined with the share as set out in the scale.

Table 48: Deriving the scale - Indicator 24

Scale	Indicator value	Scale description
10	≥12%; AND measures in place/planned	First quartile of DER penetration in sample countries - available data: Some European countries, China, India and Vietnam AND there are measures in place to integrate smartly prosumers into the grid
7.5	5% - 12%; AND measures in place/planned	Second quartile of DER penetration in sample countries - available data: Some European countries, China, India and Vietnam AND there are measures in place to integrate smartly prosumers into the grid
5	5% - 12%; BUT no measures in place/planned	Second quartile of DER penetration in sample countries - available data: Some European countries, China, India and Vietnam

		BUT there are no measures in place to integrate smartly prosumers into the grid
2.5	3% - 5%	Third quartile of DER penetration in sample countries - available data: Some European countries, China, India and Vietnam
0	< 3%	Fourth quartile of DER penetration in sample countries - available data: Some European countries, China, India and Vietnam

Rationale

Distributed resources are largely invisible to system operators, as rooftop solar appears as reduced demand rather than as generation. At low penetration this is manageable, but as shares grow, forecasting net demand, maintaining distribution voltage and balancing in real time become more difficult. Tracking penetration alongside measures to integrate prosumers, such as smart metering, aggregation and time-of-use tariffs, indicates whether integration capability is keeping pace.

Limitations

Rooftop solar is used as a proxy for all DER, so batteries, electric vehicles and small wind are not counted. Small installations are often not systematically registered, so data is incomplete. Penetration alone also does not indicate whether integration challenges materialise, which depends on network strength, metering and the coincidence of output with local consumption.

4.2.2 Foreseeability, visibility and control of DER (Indicator 25)

Approach

This indicator checks for the following capabilities, which are essential elements to ensuring the system integration of DER: RE control centre with forecasting; RE control centre; advanced forecasting at generator level; DER aggregation in place; and DER with response capabilities (e.g. frequency/voltage support, access to the market).

Table 49: Components - Indicator 25

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4
Description	Is there an RE control centre with forecasting in place?	RE installations count with advanced forecasting	From a policy and market perspective, can DER be aggregated to provide/sell electricity to the grid?	Can DER participate in the market (e.g. offer grid services)?

Note: Components #1 to #4 are answered 'Yes' or 'No'; the score depends on which combination of components is fulfilled, as set out in the scale (the numbers in the scale refer to the component numbers).

Table 50: Deriving the scale - Indicator 25

Scale	Indicator value	Scale description

10	Components #1 and #2 + [#3 and/or #4]	There is an RE control centre in place and DER aggregation is possible or able to provide grid services
7.5	Components #1 and #2	There is an RE control centre in place and DER aggregation is possible but not able to participate in the market or provide grid services
5	Component #1 or #2 + [#3 and/or #4]	RE control centre in place OR RE installations count with forecasting systems. Additionally, they can participate in the market
2.5	Component #1 or #2	RE control centre in place OR RE installations count with forecasting systems
0	Component #3 and/or #4	No visibility and monitoring of RE

Rationale

System operators can respond only to distributed and variable generation that they can forecast, observe and, where possible, control or aggregate. Control centres for renewable generation, advanced forecasting at generator level and aggregation with response capabilities allow distributed resources to be managed as a system resource and support higher penetration without reliability concerns.

Limitations

The assessment is qualitative and based on public information and expert judgement, and the technical performance of forecasting and control systems is not tested. Deployed tools may also not be used effectively without the necessary skills, processes and regulatory authority. Requirements scale with penetration, so extensive monitoring may not yet be necessary where distributed shares are minimal.

4.3 System Stability

Massive replacement of synchronous generation from thermal or hydro power plants by wind and solar plants (which rely on electronic converters that do not contribute to providing inertia to the system) changes the behaviour of the entire power system. Lack of inertia in the system brings challenges when facing technical contingencies (e.g. power plant or grid failures) and keeping the nominal levels of frequency and voltage.

4.3.1 Process in place to define SNSP limit (Indicator 26)

Approach

This indicator provides a qualitative review of the process to define a system non-synchronous penetration (SNSP) limit.

Table 51: Components - Indicator 26

	Indicator's component #1	Indicator's component #2
Description	Process in place to define SNSP limit	If no SNSP limit is in place, has a process been initiated to determine it?

Note: Component #1 'Yes' results in 10; component #1 'No' with component #2 'Yes' results in 5; both 'No' results in 0.

Table 52: Deriving the scale - Indicator 26

Scale	Indicator value	Scale description
10	SNSP limit	SNSP limit defined
7.5		
5	No SNSP limit but initiated	Process to define SNSP limit initiated (aware of the importance of SNSP)
2.5		
0	No SNSP limit	SNSP not considered

Rationale

Inverter-based generation does not provide inherent inertia, so the instantaneous share of non-synchronous sources that a system can safely accommodate is a stability constraint. A formal process to define an SNSP limit indicates that the operator manages this constraint analytically and provides the basis for raising the limit over time.

Limitations

The existence of a process provides no information on the level of the limit or on the mitigation measures planned, such as fast frequency response, synchronous condensers or grid-forming inverters. Limits are highly system-specific, depending on system size, interconnection and generation mix, which restricts cross-country comparison. In systems at an early stage of variable renewable deployment, a formal limit may not yet be operationally relevant.

4.3.2 Grid-friendly VRE – VRE plants have FRT capabilities (Indicator 27)

Approach

This indicator checks whether VRE plants are required to comply with fault ride-through (FRT) requirements during disturbances.

Table 53: Components - Indicator 27

	Indicator's component #1
Description	Fault-ride-through (FRT) capability required for a <10 MW RE plant

Note: The indicator is answered 'Yes' (10) or 'No' (0) based on component #1.

Table 54: Deriving the scale - Indicator 27

Scale	Indicator value	Scale description
10	Yes	VRE count with ride through capabilities
0	No	VRE are not required to count with ride through capabilities

Rationale

Modern power electronics allow wind and solar plants to support the grid during disturbances. FRT requirements provide that plants remain connected through voltage dips and supply reactive power rather than disconnecting, which prevents a local disturbance from cascading into the loss of substantial renewable capacity. Grid code requirements also ensure that manufacturers supply appropriately specified equipment.

Limitations

The indicator checks the legal requirements rather than compliance across the installed fleet. Plants installed before code updates may lack these capabilities, and requirements typically differ by plant size, so the chosen threshold is a simplification. Overly stringent specifications can also raise equipment costs without commensurate system benefit, and the calibration of requirements is not assessed.

4.4 Network Congestion

The capacity of the network and its operation play a key role in keeping the system in balance and this way integrate VRE. Together with supply-side flexibility, network congestion are among the first challenges encountered. This challenge relates to the ability to balance the system (supply and demand) across geographical sites. Congestions in the network are an indicator for limited flexibility.

4.4.1 Grid reinforcement to reduce future network congestion (Indicator 28)

Approach

This indicator checks whether grid bottlenecks have been identified and grid reinforcement projects are in the pipeline.

Table 55: Components - Indicator 28

	Indicator's component #1	Indicator's component #2
Description	Have bottlenecks in the grid been clearly identified (associated with RE)?	Are there grid reinforcement projects in the pipeline (to support RE deployment)?

Note: Component #2 'Yes' results in 10; component #1 'Yes' only results in 5; neither results in 0.

Table 56: Deriving the scale - Indicator 28

Scale	Indicator value	Scale description
10	Grid reinforcements in the way	Grid reinforcement in the pipeline (and with realistic timelines), which is expected to reduce grid congestion and support the deployment of RE
7.5		
5	Bottlenecks identified	No grid reinforcements but bottlenecks in the grid identified (associated with RE deployment)
2.5		
0	No process initiated	No grid reinforcements in the pipeline (associated with RE deployment)

Rationale

Transmission infrastructure typically takes longer to plan and build than the renewable projects it serves, so networks need to be expanded in anticipation of deployment. Identified bottlenecks and reinforcement projects in the pipeline, particularly where aligned with designated renewable energy zones, indicate that the grid is being prepared and that future congestion and connection constraints may be reduced.

Limitations

A project pipeline does not guarantee delivery, as reinforcements are frequently delayed by permitting, financing, land acquisition or public opposition. The indicator does not assess whether planned reinforcements are sufficient for expected deployment. Grid expansion is also only one option, as storage, demand flexibility and market design can reduce the transmission capacity required.

4.4.2 Grid congestion (Indicator 29)

Approach

This indicator provides a qualitative assessment of grid congestion and its impacts on RE deployment and integration.

Table 57: Components - Indicator 29

	Indicator's component #1	Indicator's component #2	Indicator's component #3
Description	Have bottlenecks in the grid been identified (e.g. lines/corridors frequently congested)?	Are new RE projects put on hold or not approved due to congestion in the grid?	Grid congestion management

Note: The three components are combined qualitatively: the degree of congestion (component #1), its impact on RE projects (component #2) and the congestion management measures in place (component #3) jointly determine the scale level; the numbers in the scale refer to the congestion management options listed under component #3.

Table 58: Deriving the scale - Indicator 29

Scale	Indicator value	Scale description
10	No major congestion identified; or corridor(s) occasionally congested without affecting RE	No congestion identified, or congestion not limiting RE deployment
7.5	Corridor(s) occasionally congested, affecting RE only in very few and specific cases; congestion management options (1 & 2), (1 & 3) or (2) in place	Moderate congestion identified, but proactive congestion management measures in place or planned
5	Corridor(s) occasionally congested, affecting RE (or	Moderate congestion identified, and congestion management measures with limited effectiveness

	affecting RE in very few and specific cases); only congestion management option (3) in place	
2.5	One or more corridors frequently congested, affecting RE; congestion management options (1 & 2), (1 & 3) or (2) in place	Significant grid congestion affecting the development of RE, but proactive congestion management measures in place or planned
0	One or more corridors frequently congested, affecting RE, with only congestion management option (3) in place; or not applicable because non-interconnected island systems are the main grid-related issue	Significant grid limitations (congestion or non-interconnectable island systems) affecting the development of RE, with congestion management measures of limited effectiveness

Rationale

Recurring congestion indicates that the network constrains renewable deployment and integration. Projects may be delayed, curtailed or directed to less suitable connection points, and generation can be constrained in regions unable to export their output, which affects project economics and investor confidence. Effective congestion management can mitigate these impacts while reinforcements are built.

Limitations

Congestion data is rarely published systematically, so the assessment relies on qualitative evidence and expert judgement, and conditions change as new lines and plants are commissioned. Some congestion also reflects efficient utilisation of transmission assets, as the complete absence of congestion would indicate an overbuilt network, so interpretation requires care.

4.5 Securing Adequacy

An increasing share of VRE reduces the average electricity prices and reduces the electricity output of conventional generators (but increases the need for their flexibility). The change of system cost structures impacts the profitability of conventional generators that are still needed to support the balance of the system. An energy transition must take this interplay into account to enable large penetration of RE in the system.

4.5.1 Capturing the value of adequacy (Indicator 30)

Approach

This indicator checks non-energy remuneration: adequacy mechanisms in place and remuneration of flexibility.

Table 59: Components - Indicator 30

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4

Description	Capacity / adequacy mechanisms in place	Allow high electricity prices (price signals for peak demand)	Aggregated indicator (either of the 2 is true)	Is the generation expansion of the system decided by a central planner that needs to be fulfilled

Note: The indicator is answered 'Yes' (10) or 'No' (0): it scores 10 if either an adequacy mechanism or scarcity pricing is in place (components #1 to #3), or if generation expansion is secured by a central planner (component #4).

Table 60: Deriving the scale - Indicator 30

Scale	Indicator value	Scale description
10	Yes	Adequacy concerns addressed, in the context of higher shares of RE
0	No	Adequacy concerns not addressed

Rationale

As VRE displaces conventional generation, plants required for reliability operate fewer hours and earn less from energy sales while remaining necessary during periods of peak demand and low renewable output. Adequacy mechanisms such as capacity remuneration, strategic reserves or scarcity pricing, or central planning that secures the required investments, help maintain reliability by valuing firm capacity and flexibility that energy-only revenues may not remunerate sufficiently.

Limitations

The indicator does not assess design quality, which strongly determines whether such mechanisms support or hinder the transition. Capacity payments to coal plants can entrench lock-in, and poorly designed mechanisms may overcompensate incumbents. Adequacy concerns can also be less pronounced in systems with substantial hydropower, interconnection or demand flexibility.

4.6 System Balance and Negative Residual Load

In systems with very high shares of VRE penetration, there are instances where the system is not able to absorb all the power generated. If no structural changes occur in the system, a substantial growth of VRE capacity will lead to significant VRE curtailments that are not economically viable.

4.6.1 Curtailment of renewables (Indicator 31)

Approach

This indicator measures the percentage of RE curtailment (MWh curtailed over total MWh generated from RE). If data is available for a specific region or area, it is provided.

Table 61: Components - Indicator 31

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4
Description	RE Curtailment [%]	RE Curtailment [MWh]	RE generation [MWh]	[qualitative] There is no evidence of RE curtailment in the system

Note: Component #1 is calculated as component #2 divided by component #3; where no data exists, the qualitative component #4 (no evidence of curtailment) results in a score of 10.

Table 62: Deriving the scale - Indicator 31

Scale	Indicator value	Scale description
10	< 4% or No evidence of RE curtailment	Curtailment less than 4% of total RE generation
7.5		
5	4% - 6%	Curtailment between 4% and 6% of total RE generation
2.5		
0	> 6%	Curtailment more than 6% of total RE generation

Rationale

Curtailment indicates that a system cannot absorb all available renewable generation. A degree of curtailment can be economically efficient, as occasionally reducing output may be less costly than building flexibility to accommodate every unit of generation. Persistently high rates, however, affect project economics and investor confidence and indicate integration bottlenecks that may require grid expansion, flexibility investment or market reform.

Limitations

Curtailment statistics are often unpublished or incomplete, and the absence of reported curtailment is not evidence that none occurs. Reported figures rarely distinguish price-driven from operator-ordered curtailment or attribute causes such as transmission limits or minimum generation constraints. National averages also obscure regional and seasonal variation.

4.6.2 Excess supply valuation (Indicator 32)

Approach

This indicator checks whether there is a mechanism, or a discussion, in place to value the excess of supply from RE.

Table 63: Components - Indicator 32

	Indicator's component #1
Description	Are there mechanisms to value excess of supply in place?

Note: The indicator is answered with one of 3 options based on component #1: mechanism(s) in place and functioning (10); mechanisms under discussion (5); none in place or under discussion (0).

Table 64: Deriving the scale - Indicator 32

Scale	Indicator value	Scale description
10	There is a mechanism(s) in place and functioning	Surpluses are absorbed through mechanisms such as storage, flexible demand or exports
7.5		
5	Mechanisms are being discussed	Options to value excess supply are under discussion but not yet operational
2.5		
0	No mechanisms in place and not being discussed	Excess renewable supply is not valued and no mechanisms are under discussion

Rationale

Periods of excess renewable supply can be used productively rather than treated only as a balancing problem. Storage charging, price-responsive and flexible industrial demand, electrolysis for hydrogen production and exports over interconnectors can absorb surpluses that would otherwise be curtailed, which supports both project economics and system efficiency.

Limitations

The indicator checks whether mechanisms exist or are under discussion rather than their scale relative to anticipated surpluses. Absorption capacity through storage, demand response or interconnection is limited, and the economics of surplus-energy applications depend on prices and competing uses.

5 Social Acceptance

5.1 Participation of Society in Policy Making

Public opinion can help shape an energy transition in both directions and can influence decision making at all levels. The level of influence can be system dependent, e.g. civil society organisations (CSOs) have more influence in open democracies than under an authoritarian regime. The direction of influence depends on the level of engagement of CSOs in the decision making process and the degree of public discourse regarding energy-related topics.

5.1.1 Stakeholder engagement processes (e.g. round tables) in policy making (Indicator 33)

Approach

This indicator checks whether experts are commonly consulted in the policy making process (e.g. round tables).

Table 65: Components - Indicator 33

	Indicator's component #1
Description	Is there evidence of dialogues with relevant stakeholders/experts in the policy-making process?

Note: The indicator is answered with one of 4 options: common practice; occasionally; rarely; no. Each option maps directly to a scale level.

Table 66: Deriving the scale - Indicator 33

Scale	Indicator value	Scale description
10	Yes, common practice	Dialogues commonly used in the policy making process (e.g. round tables or dedicated institution established to advise on government policy)
6.6	Yes, occasionally	Occasional use of dialogues in the policy making process
3.3	Yes, rarely	Infrequent use of dialogues in the policy making process
0	No	No dialogues used in the policy making process

Rationale

Consulting experts and stakeholders can improve the quality of decisions and their acceptance. Industry contributes implementation experience, civil society raises equity concerns, and technical experts provide analytical grounding. Systematic engagement, as distinct from ad hoc consultation, tends to produce more implementable policies with broader support.

Limitations

The frequency of dialogues does not measure their influence on final decisions. Consultations can be pro forma or dominated by particular interest groups, and engagement practices differ across policy areas, which complicates an aggregate assessment.

5.1.2 Public consultation (e.g. white papers or equivalent on policy document) (Indicator 34)

Approach

This indicator checks whether there is public consultation as part of the policy process (e.g. in the form of white papers on energy-related policy proposals).

Table 67: Components - Indicator 34

	Indicator's component #1
Description	Is public consultation (e.g. white papers or equivalent) part of the policy-making process?

Note: The indicator is answered with one of 4 options: common practice; occasionally; rarely; no. Each option maps directly to a scale level.

Table 68: Deriving the scale - Indicator 34

Scale	Indicator value	Scale description
10	Yes, common practice	White papers or similar processes to consult are commonly used
6.6	Yes, occasionally	White papers or similar processes to consult are occasionally used
3.3	Yes, rarely	White papers or similar processes to consult are infrequently used
0	No	White papers are not used

Rationale

Formal public consultation, including white papers, published drafts and hearings, extends input beyond organised stakeholders to affected communities and citizens and opens proposals to wider scrutiny. This can strengthen the transparency and legitimacy of transition policies and surface implementation barriers at an early stage.

Limitations

The indicator does not capture whether consultation inputs are reflected in final policies, nor how accessible the process is in practice. Technical documents may limit meaningful participation by non-expert groups regardless of the formal opportunities provided.

5.2 Societal Engagement on Energy Issues

This refers to the level of public awareness of, and engagement with, energy transition topics beyond formal policy processes. Media and social media coverage both reflect and shape public opinion, keeping

the transition politically salient. Where public engagement is low, transition policies are more easily deprioritised or reversed, and misinformation faces less scrutiny.

5.2.1 Media coverage (Indicator 35)

Note: This indicator was not updated in the 2026 cycle due to the limited reliability of the underlying data; the assessment carries over from the previous cycle.

Approach

This indicator uses Google Trends and a scan of news articles in major newspapers/media outlets (number of mentions per month).

Table 69: Components - Indicator 35

	Indicator's component #1	Indicator's component #2
Description	Search of "Renewable energy"	Search of "Energy Transition"

Note: Components #1 and #2 capture the frequency of mentions, which is compared against the scale thresholds relative to a best-practice reference country.

Table 70: Deriving the scale - Indicator 35

Scale	Indicator value	Scale description
10	Daily mention	Daily mentions of renewable energy and the energy transition.
7.5		
5	Once a week	Weekly mentions of renewable energy and the energy transition
2.5		
0	0	No mentions identified

Rationale

Regular media coverage of renewable energy and the energy transition both reflects and supports public awareness and debate, which keeps the topic politically salient. Coverage trends provide an indication of the information environment shaping public opinion and, in turn, the political feasibility of transition policies.

Limitations

Mention counts do not distinguish supportive from critical framing, or accurate reporting from misinformation, and results depend on the outlets, languages and search terms selected.

5.2.2 (Social) media coverage – key words related to energy transition (Indicator 36)

Note: This indicator was not updated in the 2026 cycle due to the limited reliability of the underlying data; the assessment carries over from the previous cycle.

Approach

This indicator uses a social media monitoring tool (e.g. Brandwatch) to track key words related to the energy transition in social media.

Table 71: Components - Indicator 36

	Indicator's component #1	Indicator's component #2
Description	Mentions of "Renewable energy"	Mentions of "Energy Transition"

Note: Components #1 and #2 capture the frequency of mentions in social media, which is compared against the scale thresholds relative to a best-practice reference country.

Table 72: Deriving the scale - Indicator 36

Scale	Indicator value	Scale description
10	Daily mention	Daily mentions of renewable energy and the energy transition.
7.5		
5	Once a week	Weekly mentions of renewable energy and the energy transition
2.5		
0	0	No mentions identified

Rationale

Social media activity on transition-related keywords reflects engagement beyond traditional media and can indicate which aspects of the transition resonate with online audiences, as well as emerging concerns and misinformation trends.

Limitations

Social media users are not representative of the general population, and automated analysis may miss nuance and context. Volumes can be driven by single events, campaigns or coordinated activity rather than sustained engagement, and results depend on the platform coverage of the monitoring tool.

5.3 Consumer Engagement and Influence

Energy transitions can influence and impact social inequities, especially with respect to energy access and levels of consumption. Emerging markets, in particular, can be sensitive to power prices because of limits on discretionary spending power. An ineffective transition may prohibitively increase energy costs and place a disproportionate burden on the energy poor.

5.3.1 Promote consumer engagement with energy transition (benefit from it) (Indicator 37)

Approach

This indicator checks whether consumers can access the benefits of RE (net metering/net billing, FiTs (FiT) for households and small businesses, supplier choice or market participation, community ownership).

Table 73: Components - Indicator 37

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4

Description	Is net metering/net billing in place?	Can households or small-business enterprises benefit from FiT?	Are consumers allowed to choose energy supplier or participate in the electricity market?	Are community-ownership models possible for RE plants?

Note: Components #1 to #4 are answered 'Yes' or 'No'; the indicator is calculated by counting the 'Yes' answers.

Table 74: Deriving the scale - Indicator 37

Scale	Indicator value	Scale description
10	≥ 3 'Yes'	At least 3 of the mechanisms are in place
6.6	2 'Yes'	2 of the mechanisms are in place
3.3	1 'Yes'	1 mechanism is in place
0	0 'Yes'	None of the mechanisms are in place

Rationale

Where consumers can benefit directly through net metering or net billing, household FiTs, supplier choice or community ownership, they become participants in the transition rather than only rate payers, which can broaden support for transition policies. Consumer participation also mobilises distributed resources such as rooftop solar and demand flexibility.

Limitations

The existence of mechanisms does not indicate uptake or accessibility. Net metering may carry restrictive caps or in practice exclude renters, apartment dwellers and low-income households. Some mechanisms, particularly net metering at full retail rates, can also shift network costs to non-participants, which raises distributional questions that the indicator does not assess.

5.3.2 Redistribution of energy transition costs among rate payers (Indicator 38)

Approach

This indicator assesses how the additional costs of the energy transition are distributed among rate payers.

Table 75: Components - Indicator 38

	Indicator's component #1	Indicator's component #2
Description	Are electricity costs equally distributed among rate payers (incl. generation costs, grid costs, other)?	Is the distribution/allocation of costs among rate payers based on equity differences (e.g. lower-income rate payers pay a different tariff)?

Note: The indicator is answered with one of 3 options, based on components #1 and #2; each option maps directly to a scale level.

Table 76: Deriving the scale - Indicator 38

Scale	Indicator value	Scale description
10	Uneven distribution of costs based on equity	Distribution of costs considers equity differences (low-income rate payers pay less)
5	Equal distribution of costs	Costs equally distributed (no equity considerations)
0	Uneven distribution of costs NOT based on equity	Certain rate payers receive lower rates not based on equity considerations

Rationale

The distribution of transition costs among rate payers affects the social fairness and the political durability of the transition. Equity-based allocation, social tariffs or targeted exemptions can protect low-income consumers from a disproportionate burden, while disregarding distributional impacts may generate opposition as costs become more visible.

Limitations

Tariff structures are complex, and the indicator simplifies the assessment to whether equity considerations are present rather than measuring distributional outcomes, which would require detailed tariff and consumption data. Taxes and levies outside electricity tariffs are excluded, and what constitutes a fair distribution ultimately involves a normative judgement.

6 Fossil Industry

6.1 Geopolitics and Perception of Energy Security

Economic growth is often tied to stable supplies of energy resources, either via the reliance on fuel imports, or the use and export of domestic resources. Where renewable energies offer to break traditional geopolitical dependencies, incumbent systems represent a challenge to advancing the energy transition.

6.1.1 Fossil fuel export dependence (Indicator 39)

Approach

This indicator measures fuel exports as a percentage of merchandise exports[7].

Table 77: Components - Indicator 39

	Indicator's component #1	Indicator's component #2	Indicator's component #3
Description	Fuel exports (% of merchandise exports)	Total fuel exports (USD)	Total merchandise exports (USD)

Note: Components #2 and #3 are used to calculate fuel exports as a share of total merchandise exports, only in the case where data is not directly available in percentage form for component #1.

Table 78: Deriving the scale - Indicator 39

Scale	Indicator value	Scale description
10	<5%	No export dependence. From international trade perspective, there are no conflict of interests to reduce the participation of fossil fuels in the economy.
7.5	<15%	Low export dependence. Fossil fuel exports make a limited contribution to merchandise export revenues.
5	<30%	Moderate export dependence. Fossil fuel exports make a significant contribution to merchandise export revenues.
2.5	<45%	High export dependence. Fossil fuel exports account for a large share of merchandise export revenues.
0	>45%	Heavily export-dependent. From international trade perspective, there are strong conflict of interests to reduce the participation of fossil fuels in the national economy.

Rationale

Where fossil fuel exports make up a large share of merchandise exports, export revenues or duties may contribute significantly to public budgets and the balance of payments, giving the country strong

[7] World Bank (2024). *Fuel exports (% of merchandise exports)*. Available at: https://data.worldbank.org/indicator/TX.VAL.FUEL.ZS.UN (Accessed: 8 April 2026).

economic interests in continued extraction. This typically translates into political resistance to transition policies unless explicit diversification strategies are pursued alongside them.

Limitations

Export shares fluctuate with commodity prices and capture relative rather than absolute significance, as a diversified economy can still host a very large fossil fuel sector.

6.1.2 Share of imported fossil fuel in total energy supply (Indicator 40)

Approach

This indicator measures the share of imported coal and gas in total energy supply[8].

Table 79: Components - Indicator 40

	Indicator's component #1	Indicator's component #2
Description	Primary fuel imports (TJ)	Total Primary Energy Supply (TJ)

Note: The indicator is calculated as component #1 divided by component #2.

Table 80: Deriving the scale - Indicator 40

Scale	Indicator value	Scale description
10	<20%	No import dependence. Limited participation of imported fossil fuels in energy supply. From an energy security perspective, there are less incentives to on an energy transition for the purpose of reducing dependence on imported fossil fuels.
7.5	20% - 40%	Low import dependence. Imported fossil fuels play a limited role in energy supply.
5	40% - 60%	Moderate import dependence. Imported fossil fuels play a considerable role in energy supply.
2.5	60% - 80%	High import dependence. Imported fossil fuels play a major role in energy supply.
0	>80%	Heavily import dependent. Imported fossil fuels play a significant role in the energy supply. From an energy security perspective, there are strong incentives to embark on an energy transition that would diminish the reliance on imported fuels.

[8] International Energy Agency (2025). *World Energy Balances.* Available at: https://www.iea.org/data-and-statistics/data-product/world-energy-balances (Accessed: 8 April 2026).

Rationale

The indicator reflects the exposure of the current energy supply to international fuel markets. Heavy dependence on imported fossil fuels exposes a country to price volatility, supply disruption and currency risk, and indicates a structural vulnerability of the present system. The scale therefore rates lower dependence more favourably. At the same time, high dependence strengthens the energy security case for domestic renewables, and the indicator captures the exposure itself rather than this incentive effect.

Limitations

The measure covers total primary energy supply rather than the power sector specifically, aggregates fuels with different risk profiles, and can shift with annual demand and market conditions. Domestic reserves and long-term contracts that mitigate supply risk are not reflected. The scale rates current exposure rather than the transition incentive that high import dependence creates, and countries with heavy dependence may face stronger security-driven motivation to deploy renewables.

6.2 Incumbent's Dominance

RE technologies are breaking through in energy systems generally dominated by fossil fuel technologies that reap the benefits of economies of scale, long-lasting subsidies and institutional embedding. The dominance of incumbent fossil fuels means that institutions, system planning and operations are aligned to their characteristics and needs, making them cheaper and more efficient. All these are additional challenges to emerging RE actors and to the energy transition.

6.2.1 Employment in coal industry (Indicator 41)

Approach

This indicator measures the number of people working in the coal industry as a percentage of the total labour force[9].

Table 81: Components - Indicator 41

	Indicator's component #1	Indicator's component #2
Description	Number of employees in the coal industry (thousands)	Labour force (thousands)

Note: Components #1 and #2 are used to calculate the share of coal sector jobs in the total labour force.

Table 82: Deriving the scale - Indicator 41

Scale	Indicator value	Scale description
10	0%	No employment in the coal sector
7.5	0% - 0.2%	Limited employment in the coal sector
5	0.2% - 0.4%	Moderate employment in the coal sector
2.5	0.4% - 0.6%	Considerable employment in the coal sector

[9] World Bank (2025). *Labor force, total*. Available at: https://data.worldbank.org/indicator/SL.TLF.TOTL.IN (Accessed: 8 April 2026). Coal sector employment figures are compiled from country-specific sources.

0	≥ 0.6%	Significant employment in the coal sector. Reference value of 0.6% is based on the share in largest coal exporters (South Africa, Australia, Poland, Colombia; excluding Indonesia as an outlier)

Rationale

A large coal workforce increases the social and political costs of transition. Employment is typically concentrated in regions with few alternative opportunities, which creates constituencies among workers, unions and local governments that may resist change unless just transition measures are in place. The scale of employment therefore indicates the magnitude of adjustment support that a phase-out would require.

Limitations

Employment statistics for coal, particularly for indirect and informal jobs, are uncertain, and national shares conceal the regional concentration that matters politically. Counts may also combine mining for export, whose future depends on international demand, with coal used in the domestic power sector. Indonesia is excluded from the cross-country benchmark underlying the scale because its coal-employment share is an outlier that would distort the thresholds for the remaining countries.

6.2.2 Existence of fossil subsidies (Indicator 42)

Approach

This indicator measures total fossil fuel subsidies as a share of GDP (%)[10].

Table 83: Components - Indicator 42

	Indicator's component #1	Indicator's component #2	Indicator's component #3
Description	Total subsidy as share of GDP (%)	Total subsidies for fossil fuels	GDP

Note: Components #2 and #3 are used to calculate total fossil fuel subsidies as a share of GDP only in the case where data is not directly available in percentage form for component #1. The scale grades the magnitude of identified subsidies relative to GDP rather than their mere existence.

Table 84: Deriving the scale - Indicator 42

Scale	Indicator value	Scale description
10	0	There are no fossil fuel subsidies.
7.5		
5	0% - 1%	Fossil fuel subsidies exist but remain negligible i.e., below 1% of GDP
2.5		

[10] International Monetary Fund (2024). *Fossil Fuel Subsidies*. Available at: https://climatedata.imf.org/datasets/d48cfd2124954fb0900cef95f2db2724_0/about (Accessed: 8 April 2026).

0	>1%	Fossil fuel subsidies exceed 1% of GDP

Rationale

Fossil fuel subsidies disadvantage renewables, encourage consumption and commit public budgets. Their size relative to GDP indicates the degree of fiscal and political entrenchment of fossil fuel use. Reform can improve fiscal positions, reduce emissions and create more balanced competition, although larger subsidies also make removal politically more difficult.

Limitations

Estimates vary widely by methodology. The IEA price-gap approach captures support that holds prices below market levels, while IMF estimates that include unpriced externalities are considerably larger, and both fluctuate with international fuel prices. Distributional impacts of reform also differ by fuel and consumer group, which the indicator does not assess.

6.2.3 Market share of large coal players in the power sector (Indicator 43)

Approach

This indicator measures the share of coal in the portfolios of the two largest power companies by installed capacity and checks for the existence of concrete company-level phase-out plans.

Table 85: Components - Indicator 43

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4	Indicator's component #5
Description	Installed capacity of 1st largest power utility (MW)	Installed coal capacity for 1st largest power utility (MW)	Installed capacity of 2nd largest power utility (MW)	Installed coal capacity for 2nd largest power utility (MW)	Are there concrete targets/plans of either of the two to phase out coal?

Note: The indicator is calculated in 3 parts:

- *Components #1 and #2 are used to obtain the share for the 1st largest power utility*
- *Components #3 and #4 are used to obtain the share for the 2nd largest power utility*
- *Component #5 is answered in 'Yes' or 'No' for both power utilities. For systems with more than one large utility, the share thresholds are applied one level more leniently than for single-utility systems, reflecting that the same coal share is less blocking when ownership is distributed across several players.*

Table 86: Deriving the scale - Indicator 43

Scale	Indicator value	Scale description
10	If there is only one utility: • <25% coal share AND a vision to phase out If there is more than one utility:	The largest power utilities have a low share of coal in their portfolios AND a long-term vision to phase it out.

	• both have <25% coal share AND a vision to phase out	
7.5	If there is only one utility: • <25% coal share BUT no vision to decarbonise If there is more than one utility: • both have <25% coal share BUT no vision to phase out coal OR • both have <50% coal share AND vision to phase out	The largest power utilities have a low share of coal in their portfolios BUT no long-term vision to phase it out OR a medium share of coal in their portfolios AND a long-term vision to phase it out.
5	If there is only one utility: • <50% coal share AND vision to phase out If there is more than one utility: • both have <50% coal share BUT no vision to phase out	The largest power utilities have a medium share of coal in their portfolios AND a long-term vision to phase it out.
2.5	If there is only one utility: • <50% coal share BUT no vision to phase out OR • >50% coal share AND vision to phase out If there is more than one utility: • at least one has >50% coal share AND vision to phase out	The largest power utilities have a medium share of coal in their portfolios BUT no long-term vision to phase it out OR a high share of coal in their portfolios AND a long-term vision to phase it out.
0	If there is only one utility: • >50% coal share BUT no vision to phase out If there is more than one utility: • at least one has >50% coal share BUT no vision to phase out	The largest power utilities have a high share of coal in their portfolios BUT no long-term vision to phase it out.

Rationale

When the largest utilities are heavily invested in coal and lack a credible decarbonisation vision, incumbent business interests can work against the transition through their scale, political influence and control of infrastructure. Conversely, dominant companies that reposition towards clean energy can accelerate change, and a credible phase-out commitment from them indicates a structural shift in the sector.

Limitations

Assessing a vision to phase out coal is qualitative, as announced strategies may be aspirational and diverge from lobbying activity and actual capital allocation. Ownership structures and holding companies also complicate the identification of the two largest utilities and their capacities. Fossil-dominant

incumbents do not always preclude rapid transition where independent developers can compete effectively.

6.2.4 Existence of a "green lobby" (Indicator 44)

Approach

This indicator checks the existence of a group or association that attempts to influence the decisions of the government to promote environmental issues.

Table 87: Components - Indicator 44

	Indicator's component #1	Indicator's component #2
Description	Is there a 'green lobby', foundation or association in place?	If existent, is it influential?

Note: Component #1 'Yes' with component #2 'Yes' results in 10; component #1 'Yes' with component #2 'No' results in 5; component #1 'No' results in 0.

Table 88: Deriving the scale - Indicator 44

Scale	Indicator value	Scale description
10	Yes	Association exists with meaningful political influence
7.5		
5	Yes, but no political influence	Association exists, but with limited political influence
2.5		
0	No	No such association exists

Rationale

Political outcomes reflect the balance of organised interests. An influential association promoting environmental and renewable energy interests can counterbalance established fossil fuel lobbies and provide the transition with an organised voice in the policy process.

Limitations

Influence is difficult to observe and the assessment relies on expert judgement. Formal existence does not equate to policy access, and informal networks, media presence or funding channels may matter more than registered associations.

6.3 Public Finance Dependencies

Revenue from fossil fuel extraction or use, e.g. taxes or royalties, is attractive as mineral assets are immobile. Renewable energies typically do not generate extraction-related revenues. Public finance dependencies on fossil fuels depend on energy markets and can challenge the development of indigenous renewable energy resources.

6.3.1 National revenues from fossil fuel production (upstream) (Indicator 45)

Approach

This indicator reviews the sources of revenue in the public budget, identifying any that can be directly linked to fossil fuel extraction or use in the electricity sector.

Table 89: Components - Indicator 45

	Indicator's component #1
Description	Source(s) of national revenues from fossil fuels

Note: The indicator can be answered with one of 3 options: No revenue streams; Taxes on fossil fuel production; Direct revenues (profits from nationally owned oil/gas companies)

Table 90: Deriving the scale - Indicator 45

Scale	Indicator value	Scale description
10	No revenue streams	There are no revenues from fossil fuel production
7.5		
5	Taxes on fossil fuel production	There are indirect revenues from fossil fuel production through taxes
2.5		
0	Direct revenues (profits from nationally owned oil/gas companies)	There are direct revenues from fossil fuel production

Rationale

Where public budgets rely on direct revenues from fossil fuel production, including royalties, production shares and dividends from state-owned producers, governments have a fiscal interest in prolonging extraction. The transition creates budget risks that revenue streams from renewables do not fully replace, which indicates a need for an explicit fiscal strategy alongside energy policy.

Limitations

Budget documentation does not always identify fossil-related revenues clearly, particularly for state-owned enterprises. The indicator captures the existence and type of revenue streams rather than their size.

6.4 Lock-in of Fossil Fuel Infrastructure Developments

Planned and in-the-pipeline fossil-fuel infrastructure invites a path dependency, or “lock-in”, which creates considerable inertia in advancing the energy transition. Infrastructure projects do not exist in isolation and have wider system impacts that perpetuate other transition barriers, such as policy and tax structures, or

consumption patterns. Path dependencies are costly to change due to sunk investment costs and can lead to future stranded assets. These can represent a significant challenge to the development of alternative infrastructure.

6.4.1 Share of young coal-fired power plants (Indicator 46)

Approach

This indicator measures the share of existing coal-fired power plants younger than 20 years in total installed coal capacity in the power system[11].

Table 91: Components - Indicator 46

	Indicator's component #1	Indicator's component #2
Description	Total installed coal capacity (that were installed < 20 years ago) - MW	Total installed coal capacity - MW

Note: Components #1 and #2 are used to calculate the share.

Table 92: Deriving the scale - Indicator 46

Scale	Indicator value	Scale description
10	0	Negligible participation of young coal power plants in total coal installed capacity in the system
7.5	0% - 10%	Low participation of young coal power plants in total coal installed capacity
5	10% - 20%	Moderate participation of young coal power plants in total coal installed capacity
2.5	20% - 30%	Considerable participation of young coal power plants in total coal installed capacity
0	> 30%	Significant participation of young coal power plants in total coal installed capacity in the system

Rationale

Young coal plants represent recent capital that owners expect to recover over operating lives of several decades. Early retirement therefore imposes stranded asset costs on owners, lenders or governments where compensation is paid, which creates resistance to phase-out and may require targeted retirement mechanisms or repurposing strategies. A predominantly old fleet approaching the end of its operating life reduces these barriers.

[11] Global Energy Monitor (2025). *Global Coal Plant Tracker*. Available at: https://globalenergymonitor.org/projects/global-coal-plant-tracker (Accessed: 8 April 2026).

Limitations

Age is a proxy for retirement barriers. Plant economics also matter, as a young plant can already be unprofitable, alongside location, contractual structures such as PPAs with capacity payments, and ownership, since state-owned utilities may absorb stranded costs more readily than private investors. The 20-year threshold is a convention rather than a system-specific optimum.

6.4.2 Fossil fuel pipeline (Indicator 47)

Approach

This indicator measures planned coal power plant plans and upstream oil and gas infrastructure[12] and expresses it as a share of existing such capacities.

Table 93: Components - Indicator 47

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4
Description	Total installed coal capacity in the pipeline (secured finance and permits) - MW	Total installed coal capacity - MW	Number of upstream fossil fuel infrastructure in the pipeline (oil, LPG and gas pipelines, LPG terminals)	Number of upstream fossil fuel infrastructure in operation (oil, LPG and gas pipelines, LPG terminals)

Note: The indicator is calculated in 2 parts:

- *Components #1 and #2 are used to obtain the share of planned coal plants in total existing coal capacity.*
- *Components #3 and #4 are used to obtain the share of planned upstream oil and gas infrastructure in total existing infrastructure.*

Table 94: Deriving the scale - Indicator 47

Scale	Indicator value	Scale description
10	No fossil fuel plans	No new coal fired power plants planned, no upstream fossil fuel infrastructure
7.5	No coal; Minor gas/oil (<2.5%)	No new coal fired power plants, only minor upstream fossil fuel infrastructure developments (less than 2.5% of existing capacity)
5	<5% coal; Some gas/oil (<10%)	New coal fired power plants less than 5% of existing capacity, new upstream fossil fuel infrastructure developments less than 10% of existing capacity

[12] Global Energy Monitor (2025). *Global Coal Plant Tracker* and *Global Oil and Gas Infrastructure Tracker*. Available at: https://globalenergymonitor.org/projects/global-coal-plant-tracker, https://globalenergymonitor.org/projects/global-oil-infrastructure-tracker, and https://globalenergymonitor.org/projects/global-gas-infrastructure-tracker (Accessed: 8 April 2026).

2.5	<10% coal; Substantial gas/oil (>10%)	New coal fired power plants less than 10% of existing capacity, new upstream fossil fuel infrastructure developments more than 10% of existing capacity
0	>10% coal; Substantial gas/oil (>10%)	Substantial planned coal capacity, substantial upstream fossil fuel infrastructure developments (both more than 10% of existing capacity)

Rationale

Projects in the fossil pipeline extend carbon lock-in for decades and carry the risk of becoming stranded assets. Halting projects before construction avoids future lock-in at considerably lower cost than retiring operating plants later, and a shrinking pipeline indicates that the transition is consolidating.

Limitations

Pipelines are dynamic, as announced projects are frequently shelved, cancelled or revived, and counting all stages equally can overstate future capacity. The indicator focuses on upstream and power-sector infrastructure, including power plants and gas supply infrastructure. Downstream facilities such as refineries, which mainly serve transport fuel demand, are outside its scope.

6.5 Just Transition Policy

The fossil-fuel lock-in originates from various sources, including reluctance to social and economic disruptions. A progressive transition to a cleaner energy system must take actions to support a just transition of fossil-fuel societies, including job creation, restructuring of local economies, re-directing skills and capacity building.

6.5.1 Programmes for disadvantaged fossil fuel industry workers and regions (Indicator 48)

Approach

This indicator checks for programmes addressing industries and regions disadvantaged by the transition (e.g., financial compensation, job re-training, etc.).

Table 95: Components - Indicator 48

	Indicator's component #1
Description	Are there programmes targeting regions/industries disadvantaged by the transition?

Note: This indicator can answered with 3 options: Programmes in place; Programmes under discussion; No programmes

Table 96: Deriving the scale - Indicator 48

Scale	Indicator value	Scale description
10	Programme in place	Programmes for regions/industries disadvantaged by the transition exist
7.5		

5	Programme under discussion	Programmes for regions/industries disadvantaged by the transition are under ongoing discussion
2.5		
0	No programmes	Programmes for regions/industries disadvantaged by the transition are not under ongoing discussion

Rationale

Support for workers and regions disadvantaged by the transition addresses genuine hardship and reduces opposition to transition policies. Retraining, early retirement schemes and regional diversification can therefore contribute to making an accelerated phase-out politically sustainable.

Limitations

The existence of programmes provides no information on funding adequacy, coverage or effectiveness, and many just transition initiatives are underfunded or poorly targeted. Appropriate interventions also differ considerably with context, for example between countries with strong social safety nets and those with large informal sectors.

7 Capacity Building

7.1 Stakeholders' Knowledge Gap

An evidence-based approach is needed to enable policy- and decision-makers to deliberate on different energy transition pathways and build on other international experiences. Information exchange about energy transition policies and knowledge transfer can foster better and clearer understanding of policy choices, their directions, implications and consequences to allow for well-informed, consolidated decision making. Knowledge needs comprise both genuine gaps – where no scientific analysis exists or existing knowledge is not known to decision makers – and cases where knowledge exists but is not presented in a form that decision makers can readily use.

7.1.1 Opportunities for interchange on RE and ET topics (Indicator 49)

Approach

This indicator counts the number of workshops, conferences and dialogues on renewable energy and the energy transition per year.

Table 97: Components - Indicator 49

	Indicator's component #1	Indicator's component #2	Indicator's component #3
Description	Frequency of conferences focused on an ET technology (e.g., wind, solar, storage)	Frequency of conferences focused on another ET technology (e.g., wind, solar, storage)	Frequency of conferences focus on energy transition (cross-topic, cross sectoral)

Note: This indicator can be answered with 4 options: Annual; Bi-annual; Infrequent; None

Table 98: Deriving the scale - Indicator 49

Scale	Indicator value	Scale description
10	All 3 answered Annual	Regular conferences for at least 2 RE technologies + ET conference
7.5	2 answered Annual (one of them being ET)	Two regular (annual) conferences or dialogues, at least one of them on cross-cutting energy transition topics
5	1 answered Annual OR ≥1 answered Bi-annual or Irregular (one of them being ET)	One regular (annual) conference plus at least one bi-annual or irregular event, at least one of them on cross-cutting energy transition topics

2.5	≥2 answered Bi-annual or Irregular	Irregular conferences on at least 2 energy transition related themes
0	All 3 answered None	No regular conferences

Rationale

Regular conferences and dialogues disseminate experience, connect policy makers, practitioners, researchers and advocates, and build the shared understanding needed for well-informed decisions. An active exchange landscape allows effective approaches to spread and indicates an engaged domestic transition community.

Limitations

Counting events does not measure quality, attendance or influence, and may not distinguish substantive exchange from primarily commercial or promotional events. Relevant exchange also takes place in formats that are not captured, such as webinars and bilateral cooperation programmes, and international events can substitute for domestic ones, particularly in smaller countries.

7.1.2 Existence of energy transition-related industry associations (Indicator 50)

Approach

This indicator counts industry associations for different types of renewable energy that are active (e.g. holding at least one annual conference).

Table 99: Components - Indicator 50

	Indicator's component #1	Indicator's component #2	Indicator's component #3
Description	Number of industry association for an RE technology (e.g., wind)	Number of industry association for another RE technology (e.g., solar)	Number of industry association for other ET-relevant topics (e.g. storage, hydrogen, etc.)

Note: The indicator is calculated by summing all 3 components.

Table 100: Deriving the scale - Indicator 50

Scale	Indicator value	Scale description
10	≥ 3 associations	At least 3 associations exist and are active
6.6	2 associations	2 associations exist and are active
3.3	1 association	1 association exists and is active
0	0 associations	No associations exist

Rationale

Active technology-specific associations aggregate and transfer sectoral knowledge, provide market data, contribute to standards and give the industry a coordinated voice towards policy makers. Their presence indicates a maturing renewable energy sector with organised representation.

Limitations

The activity threshold of at least one annual conference is a rough filter. Counts of associations also do not reflect membership, resources or actual influence, as one well-resourced association can be more effective than several underfunded ones.

7.2 Knowledge Infrastructure

Gaps exist between the knowledge and skills produced at universities and what is needed in practice. Technology and business risks can be exacerbated by a lack of understanding among actors and poor information exchange between actors. Either there is a wrong focus in research, or the knowledge exists but a lack of information exchange persists. Effective information exchange involves multiple stakeholders from, e.g., government, public knowledge institutes, consultants and industry. Interaction challenges can occur when network actors give poor guidance, or if the network impedes new knowledge entrants. Knowledge and research 'lock-in' can also be a barrier. Poor interaction between knowledge network stakeholders can lead to a lack of a shared vision, divergent outcomes, and wasted research efforts or investments.

7.2.1 Patent registration (Indicator 51)

Approach

This indicator counts the number of patents registered for energy transition-related technologies (RE technologies and enabling technologies such as battery storage)[13].

Table 101: Components - Indicator 51

	Indicator's component #1	Indicator's component #2
Description	RE technology patent registration	Enabling technologies patent registration

Note: The indicator is calculated by summing the 2 components.

Table 102: Deriving the scale - Indicator 51

Scale	Indicator value	Scale description
10	> 5,000 patents	Robust and frequent patent registration
7.5	1,500 - 5,000 patents	Remarkable patent registration
5	500 - 1,500 patents	Moderate patent registration
2.5	100 - 500 patents	Low patent registration
0	< 100 patents	Negligible patent registration

[13] IRENA (2025). *Patents Evolution*. Available at: https://www.irena.org/Data/View-data-by-topic/Innovation-and-Technology/Patents-Evolution and IRENA (2024). *Enabling Technologies Patents*. Available at: https://www.irena.org/Data/View-data-by-topic/Innovation-and-Technology/Enabling-Technologies-Patents (Accessed: 8 April 2026). Values are cumulative patent counts for 2000-2024.

Rationale

Patent registrations for energy transition technologies indicate domestic innovation capacity, research and development investment and the capability of research institutions, and can show where a country's technological comparative advantages lie.

Limitations

Patents measure invention rather than deployment, and many countries deploy renewable energy successfully using imported technology. Patent counts also combine breakthrough innovations with incremental or strategic filings of limited commercial value. Results depend on patent office practice, the classification of transition-related technologies, and corporate filing strategies that reflect target markets rather than the location of innovation.

7.2.2 Share of public R&D spending for energy transition related activities (including EE and RE) (Indicator 52)

Approach

This indicator reviews the share of the public R&D budget spent on energy transition-related activities.

Table 103: Components - Indicator 52

	Indicator's component #1	Indicator's component #2	Indicator's component #3
Description	Share of public R&D budget for energy transition related activities	Total public R&D budget	Total public budget for energy transition R&D

Note: Components #2 and #3 are only used to calculate the share if data is not readily available in percentage form for component #1.

Table 104: Deriving the scale - Indicator 52

Scale	Indicator value	Scale description
10	>4%	Large share of the public R&D budget spent on energy transition-related activities
7.5	3%- 4%	Sizeable share of the public R&D budget spent on energy transition-related activities
5	2%- 3%	Moderate share of the public R&D budget spent on energy transition-related activities
2.5	1%- 2%	Small share of the public R&D budget spent on energy transition-related activities
0	<1%	Negligible share of the public R&D budget spent on energy transition-related activities

Rationale

The share of public research and development directed at the energy transition indicates whether the public research agenda is aligned with transition needs, signals government priority relative to other

research objectives, and supports the domestic knowledge base for adapting technologies to local conditions.

Limitations

Budget classifications may differ across countries and years, and transition-related spending is distributed across ministries and may be difficult to isolate. The indicator measures spending rather than research outcomes.

7.2.3 Research and development expenditure (% of GDP) (Indicator 53)

Approach

This indicator measures research and development expenditure as a percentage of GDP[14] and benchmarks this against the country's income-group peers.

Table 105: Components - Indicator 53

	Indicator's component #1	Indicator's component #2
Description	Research and development expenditure (% of GDP)	Income group (according to World Bank)

Note: Component #1 is compared against the distribution of R&D intensity within the country's income group (component #2); the scale thresholds correspond to the first quartile, median and third quartile of the respective World Bank income group, based on World Bank data on research and development expenditure (% of GDP).

Table 106: Deriving the scale - Indicator 53

Scale	Indicator value	Scale description
10	For High Income: > 1.97% For Upper Middle Income: > 0.74% For Lower Middle / Low Income: > 0.44%	Above third quartile in its peer-income group
6.6	For High Income: 1.19% - 1.97% For Upper Middle Income: 0.37% - 0.74% For Lower-Middle / Low Income: 0.24% - 0.44%	Between second and third quartiles in its peer-income group
3.3	For High Income: 0.47% - 1.19% For Upper Middle Income: 0.19% - 0.37% For Lower-Middle / Low Income: 0.10% - 0.24%	Between first and second quartiles in its peer-income group
0	For High Income: < 0.47% For Upper Middle Income: < 0.19% For Lower-Middle / Low Income: < 0.10%	Below first quartile in its peer-income group

[14] World Bank (2025). *Research and development expenditure (% of GDP)*. Available at: https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS (Accessed: 8 April 2026). Values reflect the most recent year available per country.

Rationale

Overall research and development spending indicates the strength of the national knowledge infrastructure, including research institutions, skilled researchers and commercialisation channels, which also supports research and technology absorption for the energy transition. Benchmarking against income-group peers accounts for different levels of development.

Limitations

The indicator is not energy-specific, as high aggregate research intensity may reflect a focus on other sectors, such as pharmaceuticals, that are unrelated to the energy transition. Data can also lag by several years and coverage gaps exist.

7.2.4 Existence of intermediary research institutions that are more policy oriented (Indicator 54)

Approach

This indicator counts intermediary policy-oriented institutions like think tanks with a staff of at least 5 that work actively on the energy transition.

Table 107: Components - Indicator 54

	Indicator's component #1
Description	Number of institutions working actively in energy transition (i.e. think tanks)

Note: The indicator uses component #1 directly, compared against the scale thresholds.

Table 108: Deriving the scale - Indicator 54

Scale	Indicator value	Scale description
10	> 5 institutions	At least 5 institutions in place
5	1 - 5 institutions	Less than 5 institutions in place
0	0 institutions	No institution

Rationale

Policy-oriented think tanks and intermediary institutions translate research into actionable advice, evaluate programme effectiveness, connect academia and policy making, and support informed public debate. This can improve both the design and the implementation of energy transition policies.

Limitations

The count of institutions, based on a minimum staff threshold, provides limited information on quality, independence or actual influence. Effectiveness also depends on the openness of policy makers to evidence-based recommendations, which the indicator cannot observe.

7.3 Entrepreneurship

Entrepreneurs can play a catalysing role in driving energy transitions. Strong networks and innovation platforms allow entrepreneurs to form coalitions to influence regulations, obtain resources and create niche markets. Without enabling networks, entrepreneurs can end up competing against each other and

reduce their overall efficacy. Uniform messaging towards other stakeholders helps inform better decision making with respect to regulations and enables development and diffusion of new technologies. Without this, technological 'lock-in' can persist.

7.3.1 Ease of doing business score (Indicator 55)

Approach

This indicator uses the World Bank ease of doing business score[15].

Table 109: Components - Indicator 55

	Indicator's component #1
Description	Ease of doing business score

Note: Component #1 is used directly, compared against the scale thresholds.

Table 110: Deriving the scale - Indicator 55

Scale	Indicator value	Scale description
10	≥ 76.7	Higher than 80th percentile, considering all countries
7.5	[69.6 - 76.7)	Higher than 60th percentile, considering all countries
5	[60.4 - 69.6)	Higher than 40th percentile, considering all countries
2.5	[51.8 - 60.4)	Higher than 20th percentile, considering all countries
0	< 51.8	Lower than 20th percentile, considering all countries

Rationale

The transition depends on entrepreneurship, including new firms developing projects, providing services and driving innovation. General business conditions such as registering firms, enforcing contracts and obtaining credit shape their ability to enter the sector and attract private investment, which the ease of doing business score captures in an internationally comparable way.

Limitations

The indicator is not specific to the renewable energy sector, which may have its own procedures, such as dedicated permitting windows, that the aggregate score does not capture. The underlying Ease of Doing Business series was discontinued in September 2021, so scores reflect the situation as of 2020 and more recent reforms are not captured.

[15] World Bank (2020). *Doing Business (archive)*. Available at: https://archive.doingbusiness.org/en/doingbusiness (Accessed: 8 April 2026). The series was discontinued by the World Bank in 2021 and the values reflect the 2020 edition..

8 Political Will and Vision

8.1 High-Level Signal

Long-term (renewable) energy targets, in legislation, at national or regional level provide confidence that governments are taking the energy transition seriously. However, a strong level of ambition, when setting the target, is important for creating the market demand and growth prospects needed to drive investment into manufacturing and other parts of the supply chain, as well as conditions for scaled-up project development.

8.1.1 Climate mitigation targets (Indicator 56)

Approach

This indicator uses the Climate Action Tracker (CAT) overall rating of the country's climate targets and policies[16].

Table 111: Components - Indicator 56

	Indicator's component #1
Description	CAT rating

Note: The indicator uses the CAT rating (component #1) directly; each rating category maps to a scale level.

Table 112: Deriving the scale - Indicator 56

Scale	Indicator value	Scale description
10	1.5°C Paris Agreement compatible	Rating indicates that a country's climate policies and commitments are consistent with the Paris Agreement's 1.5°C temperature limit.
7.5	Almost sufficient	Rating indicates that a country's climate policies and commitments are not yet consistent with the Paris Agreement's 1.5°C temperature limit but could be with moderate improvements. If all countries followed the rated country's approach, warming could be held below—but not well below—2°C
5	Insufficient	Rating indicates that a country's climate policies and commitments need substantial improvements to be consistent with the Paris Agreement's 1.5°C temperature limit. If all countries followed the rated country's approach, warming could reach over 2°C and up to 3°C.
2.5	Highly insufficient	Rating indicates that a country's climate policies and commitments are not consistent with the Paris Agreement's

[16] Climate Action Tracker (2026). *Country assessments*. Available at: https://climateactiontracker.org/ (Accessed: 8 April 2026). Ratings reflect the most recent assessment available per country.

		1.5°C temperature limit. If all countries followed the rated country's approach, warming could reach over 3°C and up to 4°C.
0	Critically insufficient	Rating indicates that a country's climate policies and commitments reflect minimal to no action and are not at all consistent with the Paris Agreement. If all countries followed the rated country's approach, warming would exceed 4°C.

Rationale

The ambition of climate targets and policies, independently assessed by the CAT against the Paris Agreement temperature limit, signals the strength of the high-level commitment within which power sector policy is set. Ambitious, credible targets drive policy development, infrastructure planning and investment signals across the economy.

Limitations

The CAT rating is economy-wide rather than power-sector-specific, available only for selected countries, and reflects the assessment cycle at the time of data collection. Target assessment also rests on assumptions about carbon budgets and fairness principles that involve normative judgement, and targets are statements of intent, not guarantees of implementation.

8.1.2 Renewable energy target (Indicator 57)

Approach

This indicator reviews the RE share targets (mid-term and long-term)[17] and their alignment with long-term decarbonisation.

Table 113: Components - Indicator 57

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4
Description	RE share target (Mid-term) - % of electricity generation	Target year (Mid-term)	RE share target (Long-term) - % of electricity generation	Target year (Long-term)

Note: Components #1 to #4 capture the mid- and long-term targets and their target years; the score depends on the existence of both targets and their alignment, as set out in the scale.

Table 114: Deriving the scale - Indicator 57

Scale	Indicator value	Scale description

[17] REN21 (2023). *Renewables Global Status Report*. Available at: https://www.ren21.net/reports/global-status-report/ (Accessed: 8 April 2026). From the 2026 update the indicator is populated with country-specific data.

10	Targets in mid and long-term - Aligned	Defined target for 2030 and 2050, in line with long-term decarbonisation
6.6	Targets in mid and long-term - Not aligned	Defined targets, but middle-term target not in line with long-term decarbonisation
3.3	No long-term target	No target in the long term
0	No targets	No clear RE target

Rationale

Quantified mid- and long-term RE targets translate broad climate commitments into sectoral objectives that can inform generation planning, grid development and supply-chain investment. Alignment between the 2030 and long-term horizons signals a coherent decarbonisation trajectory; a weak near-term target under an ambitious long-term one suggests deferred action.

Limitations

Targets differ in legal status, scope (generation versus capacity shares) and baselines, complicating comparison, and setting targets is easier than meeting them. The indicator assesses the ambition and consistency of the targets but not whether the country is on track to achieve them.

8.1.3 Agreed plans on coal phase-out (Indicator 58)

Approach

This indicator reviews the fossil pipeline, commitments to no new coal, and any agreed phase-out date.

Table 115: Components - Indicator 58

	Indicator's component #1	Indicator's component #2
Description	Are there any decisions or plans to phase-out coal?	Year of coal phase-out

Note: Component #1 determines whether a phase-out decision exists; component #2 (the phase-out date) determines the scale level.

Table 116: Deriving the scale - Indicator 58

Scale	Indicator value	Scale description
10	Phase out before 2030	Phase out in place and Paris Agreement compatible
6.6	Phase out after 2030	Phase out in place but not Paris Agreement compatible
3.3	Phase out, no date	Phase out in discussion
0	No Phase out	No phase out in place

Rationale

Coal-fired power is among the most carbon-intensive sources of electricity. A clear and credible phase-out commitment provides an important signal for retirement planning, replacement capacity, grid investment, and support for affected workers and regions. Consistency between the phase-out date, the development pipeline and implementation plans is necessary to distinguish a credible commitment from an aspirational announcement. An early date indicates ambition aligned with Paris-compatible pathways.

Limitations

Coal phase-out commitments differ in scope. Some apply to all coal-fired power, while others cover only unabated plants or grid-connected generation. Phase-out dates may also be revised following political or economic changes. A commitment is not necessarily credible without plant-level retirement schedules, financing arrangements, replacement capacity, and measures addressing distributional impacts. This indicator concerns coal-fired power and does not necessarily capture policies affecting coal mining or industrial coal use.

8.2 Cross-Sector Alignment

The transition to a low carbon future challenges ‘energy silos’ (separate market and regulatory frameworks for different energy sectors and infrastructures). Misalignment between different sectors can create divergent outcomes and undermine the success of the energy transition as a whole. Many sectors remain vertically organised, with little horizontal interaction between them. As one moves to a higher energy transition phase, cross-sectoral interactions will grow in number, scale and importance.

8.2.1 Joint strategy available (Indicator 59)

Approach

This indicator checks the existence of coordinated sectoral planning (e.g. power sector planning considering energy transition trends such as EE and the electrification of transport and industry).

Table 117: Components - Indicator 59

	Indicator's component #1	Indicator's component #2
Description	Are there instruments in place to integrate/coordinate planning across sectors?	If answer to previous question is negative, are the inputs/outputs from one sector considered in other sectors' plans (e.g. expected deployment of electric vehicles (EVs) in transport sector plan considered in the power sector plan)?

Note: Component #1 'Yes' results in 10; component #1 'No' with component #2 'Yes' results in 5; both 'No' results in 0.

Table 118: Deriving the scale - Indicator 59

Scale	Indicator value	Scale description
10	Integrated planning	Integrated planning across interrelated sectors

7.5		
5	Not integrated, but inputs considered	Independent planning of sectors with inputs (not integrated) from other sectors
2.5		
0	Separate / Independent planning	Fully independent planning (each sector makes its own planning without any coordination with other sectors)

Rationale

Cross-sectoral planning helps ensure that power-system expansion reflects changes in electricity demand arising from EVs, industrial electrification, cooling, heating and other end uses. Integrated or at least coordinated planning ensures power sector expansion anticipates electrified demand, avoids collectively infeasible sectoral targets and inconsistent assumptions (e.g. EV uptake missing from load forecasts), and captures synergies in infrastructure development.

Limitations

Formal instruments do not guarantee effective coordination: ministries can co-sign documents while planning independently, and institutional silos persist within nominally integrated processes. The appropriate degree of coordination also depends on the structure and complexity of the energy system. In smaller or less differentiated systems, effective coordination may occur through relatively simple institutional arrangements.

8.3 Government Ownership of Energy Transition Process

A government's dedication to the energy transition can be measured by its political commitment domestically and internationally. Engaged international participation in energy transition and climate change action networks helps to substantiate and solidify stable and enabling policy regimes. The level of government involvement in the energy transition domestically can involve government institutions dedicated to coordinating the energy transition.

8.3.1 Mentioning of ET topics in high-level government agreement that are put together between the governing parties (Indicator 60)

Approach

This indicator checks the mentioning of energy transition topics in high-level government agreements that are put together between the governing parties.

Table 119: Components - Indicator 60

	Indicator's component #1
Description	Is 'Energy Transition' mentioned in government's agenda or development plans?

Note: The indicator is answered with one of 3 options based on component #1: mentioned in official documents (10); only verbally mentioned (5); not mentioned (0).

Table 120: Deriving the scale - Indicator 60

Scale	Indicator value	Scale description
10	Yes - Mentioned in official documents	Energy transition is explicitly recognised in an official high-level government document, such as a government programme, national development plan or coalition agreement.
7.5		
5	Yes - Only verbally mentioned by governmental officials	Energy transition has been publicly mentioned by senior government officials but is not reflected in an official high-level government document.
2.5		
0	Not mentioned	No material reference to energy transition has been identified in official high-level government documents or public statements by senior government officials.

Rationale

Explicit reference to the energy transition and recognition in a high-level government programme can establish the energy transition as a cross-government priority rather than an issue confined to the energy or environment ministry. Concrete objectives and mandates can provide ministries and public institutions with a stronger basis for allocating resources, developing policies and coordinating implementation.

Limitations

Mentions can be symbolic: rhetoric may not match resource allocation, institutional capacity, or follow-through, and stated priorities can serve international audiences while domestic policies diverge. Formats of high-level agreements also differ across political systems, limiting comparability.

8.3.2 Policies / strategy in place to encourage electrification of end-use sectors (Indicator 61)

Approach

This indicator assesses whether adopted and operational policies support electrification in transport, buildings and industry. A policy should only be considered “in place” where it has been formally adopted and is supported by an identifiable implementation mechanism.

Table 121: Components - Indicator 61

	Indicator's component #1	Indicator's component #2	Indicator's component #3
Description	Policies in place to electrify Transport sector	Policies in place to electrify Industry sector	Policies in place to electrify Buildings sector

Note: Components #1 to #3 are answered 'Yes' or 'No'; the indicator is calculated by counting the sectors with electrification policies in place.

Table 122: Deriving the scale - Indicator 61

Scale	Indicator value	Scale description
10	All 3 sectors ('Yes')	Policies or strategies in place for all sectors
6.6	2 sectors ('Yes')	Policies or strategies in place for 2 sectors
3.3	1 sector ('Yes')	Policies or strategies in place 1 sector
0	0 sectors ('Yes')	No policies or strategies in place

Rationale

Power sector decarbonisation delivers its full benefit only if end-use sectors electrify: transport, buildings and industry account for most final energy demand. Policies supporting electrification – EV incentives, heat pump programmes, industrial support – signal a comprehensive strategy that extends government energy transition policy beyond the power sector and creates future demand for clean electricity.

Limitations

The indicator checks the existence of policies per sector, not their stringency, funding or outcomes – small incentives can have minimal impact. Direct electrification is also not necessarily the most optimal pathway for every end use, particularly in industrial applications where other low-emission energy carriers may be required.

8.3.3 Availability of regulatory support schemes and conducive policies for ET (Indicator 62)

Approach

This indicator provides an overview of support schemes for RE in place (FiTs, auctions, tenders, etc.)[18], the technologies they cover, and complementary conducive finance policies.

Table 123: Components - Indicator 62

	Indicator's component #1	Indicator's component #2	Indicator's component #3
Description	RE Regulatory policies in place from the list: - FiT / feed-in premiums - Electric utility quota obligation/RPS - Tradable RE certificates - RE auctions - Net-metering	How many of the major ET technologies are covered with support mechanisms (PV - large and small, wind - onshore and offshore, biomass, storage, hydrogen, etc.)?	How many of the following conducive finance policies are in place? 1) priority sector lending 2) differentiated interest rates 3) dedicated funding mechanisms

[18] REN21 (2025). *Renewables 2025 Global Status Report - Global Overview*. Available at: https://www.ren21.net/gsr-2025/downloads/datapacks/go/GSR_2025_GO_datapack.xlsx (Accessed: 8 April 2026).

			4) green bonds issuance guidelines in the country 5) presence of guarantees etc.

Note: The three components are combined: the breadth of RE policies in place (component #1), the number of ET technologies covered (component #2) and the number of conducive finance policies (component #3) jointly determine the scale level.

Table 124: Deriving the scale - Indicator 62

Scale	Indicator value	Scale description
10	- RE Policies (cover all technologies) + - 5 conducive finance policies in place	Favourable support policies exist for at least 5 technologies and are complemented by conducive financial support policies and measures to mitigate financial risks, i.e. all five conducive financial policies/conditions in place.
7.5	- Policies for at least 3 RE technologies + - 5 support conditions in place OR - Policies for at least 4 RE technologies + - 4 support conditions in place	Either favourable support policies exist for only 3 technologies with complementary financial support policies OR support policies exist for at least 4 technologies but without complementary financial support policies and measures to mitigate financial risks i.e. only 4 of the 5 conducive financial policies/conditions in place
5	- Policies for at less than 3 RE technologies + - 3-5 support conditions in place	Only an initial policy support exists (i.e. support policies cover less than 3 technologies and/or policy support is technology neutral) but with complementary conducive financial support policies
2.5	- Policies for at less than 3 RE technologies + - less than 3 support conditions in place	Only an initial policy support exists (i.e. support policies cover less than 3 technologies and/or policy support is technology neutral) but without complementary conducive financial support policies
0	- No Policies for RE technologies OR - No financial support conditions in place	No support for renewables OR Support announced but not yet implemented OR Support schemes in place do not necessarily provide sufficient incentives to level the playing field for renewables against fossil fuel-fired technologies (e.g.

		only tax breaks and accelerated depreciation without other policies)

Rationale

A broad set of RE support policies covering multiple technologies – utility-scale and distributed – recognises that technologies at different maturity stages need different mechanisms, and avoids concentrating deployment in a single option. Complementary conducive finance policies (priority sector lending, guarantees, green bond frameworks) mitigate the financing risks that are often the binding constraint in emerging markets.

Limitations

The indicator counts instruments rather than assessing design quality, remuneration levels or budget adequacy – schemes can exist on paper without triggering deployment. Breadth may also matter less than depth: focused support for cost-competitive technologies can outperform scattered support, and technology-specific support may also become less necessary as technologies mature.

8.3.4 Ensuring realisation of projects benefiting from RE support policies (Indicator 63)

Approach

This indicator assesses whether the realisation of projects benefiting from RE support policies is ensured (e.g. pre-conditions in auctions, assured access to FiTs).

Table 125: Components - Indicator 63

	Indicator's component #1	Indicator's component #2
Description	Auctions (if in place): Ensuring realisation with pre-conditions to participate (1) Pre-defined realisation periods in policy schedules (2) Pre-qualification requirements are in place that help identify “serious” bids and eliminate projects with low realisation probability (3) effective penalties for non-realisation	FiT / premium (if in place): Ensure access to FIT (e.g. No capacity limits or limits with clearly communicated rules)

Note: The indicator counts the realisation safeguards in place for the support schemes that exist (components #1 and #2); the count maps to the scale levels. If neither auctions nor a FiT are in place, the score is 5.

Table 126: Deriving the scale - Indicator 63

Scale	Indicator value	Scale description

10	- For auctions (if in place): 3 pre-conditions implemented AND - For FiT (if in place): Access to FiT ensured	Strong: Ensuring realisation of RE projects with policies - For auctions: three pre-conditions implemented - For FiT: Access to FiT ensured
7.5	- For auctions (if in place): 2 pre-conditions implemented OR - For FiT (if in place): Access to FiT ensured	Medium: some conditions in place to guide realisation of RE projects with policies - For auctions: two of the three pre-conditions implemented - For FiT: Access to FiT ensured
5	No auctions AND No FiT in place	Neutral: no assessment
2.5	- For auctions (if in place): 1 pre-conditions implemented OR - For FiT (if in place): Access to FiT difficult	Weak: limited conditions in place to ensure realisation of RE projects with policies - For auctions: one of the three pre-conditions implemented - For FiT: Access to FiT difficult
0	- For auctions (if in place): 0 pre-conditions implemented OR - For FiT (if in place): Access to FiT difficult	No RE policies in place or no conditions to ensure realisation of RE projects with policies - For auctions: no pre-conditions in place - For FiT: Access to FiT difficult

Rationale

Support policies only translate into capacity if awarded projects are built, and many countries have seen large gaps between auction awards and commissioned capacity due to speculative underbidding or developer failure. Pre-qualification requirements, realisation deadlines backed by securities and penalties, and reallocation procedures for failed projects protect scheme outcomes and policy credibility.

Limitations

The assessment requires detailed scheme design information that is not always public, and the effectiveness of penalties depends on enforcement, which is difficult to observe. Design must also balance rigour with accessibility as overly stringent requirements exclude capable smaller developers, and realisation additionally depends on factors beyond the support scheme itself, including land acquisition, supply chain, permitting, and grid connection.

8.4 Consistency of Policies and Strategies Affecting ET

Mixing policy objectives can obscure the point at which implementation is not on track for meeting goals. There is an expectation that government would intervene to ensure a policy objective is met, otherwise the perception will be that it is not serious about its policy in the first place, thereby undermining its achievement. Rollbacks, i.e. the withdrawal or reduction of a policy, undermine stakeholder confidence. Misaligned near-term policies that are not consistent with longer-term objectives can discredit long-term sustainability.

8.4.1 Alignment of long and mid-term commitments and existence of policies to implement them (Indicator 64)

Approach

This indicator checks the alignment of the long-term strategy (LTS) with the nationally determined contribution (NDC); whether the LTS has a target specific to the power or energy sector; and whether the LTS includes policies/proposals on how to achieve the strategy.

Table 127: Components - Indicator 64

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4
Description	Is there a long-term target in place for the energy sector/power sector (e.g. 2040, 2050)?	Is the mid-term target aligned with the long-term target (e.g. NDC as a milestone)?	Are there policies or measures in place to reach the long-term targets?	Are these measures implemented and sufficient to reach the target?

Note: Components #1 to #4 are answered 'Yes' or 'No'; the score depends on which combination is fulfilled, as set out in the scale.

Table 128: Deriving the scale - Indicator 64

Scale	Indicator value	Scale description
10	Long and short-term targets aligned; Policies in place to support and sufficient to drive towards targets	Long-term (e.g. LTS) and mid-term (e.g. NDC) targets aligned, with measures in place to implement them
7.5	Long and short-term targets aligned; Policies in place to support but not sufficient to drive towards targets	Long term and mid term targets in place, aligned, with measures to implement them (not necessarily sufficient)
5	Long and short-term targets but not aligned; Policies in place to support	Long term and mid term targets in place, not necessarily aligned, with measures to implement them (not necessarily sufficient)
2.5	Long and short-term targets; but no policies in place to support	Long term and mid term targets in place, not necessarily aligned, without measures to implement them
0	No long-term target in place	No targets in place

Rationale

Credibility depends on consistency across the policy chain. Long-term strategies should guide interim targets, while interim targets should shape the policies and investments. Comparing targets with policy

projections helps distinguish between countries that are operationalising their commitments and those where a substantial implementation gap remains.

Limitations

Temporary inconsistencies may also occur because long-term strategies, NDCs and sector plans are revised on different schedules.

9 Actors and Institutions

9.1 Legitimacy

Legitimacy is a matter of social acceptance and compliance with relevant institutions and can be a slow process. In many cases within energy transitions, existing institutions tend to block or deny the development of new institutions, processes or technologies. Legitimacy is gained through a socio-political process involving various stakeholders, and therefore is not only blocked by incumbent institutions, but also media members, activist groups etc.

9.1.1 Existence of fossil fuel lobbies/vested interest groups (Indicator 65)

Approach

This indicator counts effective associations for different types of fossil fuels that hold at least one annual conference.

Table 129: Components - Indicator 65

	Indicator's component #1
Description	Number of fossil fuel lobbies / associations

Note: The indicator uses component #1 directly: no active fossil fuel associations scores 10; 1 to 5 scores 5; more than 5 scores 0.

Table 130: Deriving the scale - Indicator 65

Scale	Indicator value	Scale description
10	0 associations	No active fossil fuel lobbies in the country
7.5		
5	1 - 5 associations	Limited number (4-5) of fossil fuel lobbies
2.5		
0	> 5 associations	5+ active fossil fuel lobby organisations

Rationale

The political economy of incumbent industries can materially affect the pace of the energy transition. Active fossil fuel associations defend incumbent interests in the policy process by lobbying against supportive policies and promoting continued fossil development, and their number proxies the organised resistance the transition faces, indicating whether stronger countervailing advocacy or different political strategies are needed.

Limitations

Political influence is difficult to observe and may occur through informal channels, including state-owned enterprises, individual companies, funding of think tanks or campaign finance. The indicator does not measure actual influence, which varies with government composition. The annual-conference activity threshold is a rough filter, and associations also serve legitimate functions beyond lobbying.

9.2 Coordination of Actors and Institutions in the Power Sector

The changing paradigm from centralised dispatchable generation to decentralised and distributed VRE generation requires a restructuring and stronger coordination between institutions within the power sector. This is the case for the transmission system operator (TSO, high-voltage grid operator) and the distribution system operators (DSOs, low-voltage grid operators). Since VRE capacity is often connected to distribution networks, the responsibility of distribution companies for system operation increases.

9.2.1 TSO/DSO coordination (Indicator 66)

Approach

This indicator defines different levels of coordination (in order of integration): 1. vertically integrated utility / centralised operation; 2. integrated / common TSO-DSO market models; 3. TSO-DSO shared balancing responsibilities; 4. common operational network codes and coordination in grid operation (e.g. protection, congestion management); 5. data exchange platforms; 6. separate / independent activities and roles.

Table 131: Components - Indicator 66

	Indicator's component #1	Indicator's component #2	Indicator's component #3	Indicator's component #4	Indicator's component #5	Indicator's component #6
Description	Are transmission and distribution operated by the same entity?	Integrated / common TSO-DSO market models	TSO-DSO shared balancing responsibilities	Common operational network codes and coordination in grid operation (e.g. protection, congestion management)	Data exchange platforms between TSO and DSO	Separate / independent activities and roles

Note: The indicator is answered by selecting the highest level of TSO-DSO coordination in place among components #2 to #6; component #1 identifies fully integrated utilities, which score 10.

Table 132: Deriving the scale - Indicator 66

Scale	Indicator value	Scale description
10	TSO-DSO full integration	Full integration between TSO/DSO - "Yes" in component #1 or #2
7.5	Shared responsibilities	TSO/DSO with shared balancing responsibilities - "Yes" in component #3
5	Common codes	Common network codes / operation - "Yes" in component #4
2.5	Data exchange	Data exchange between TSO/DSO - "Yes" in component #5
0	Independent activities	Independent activities and roles - "Yes" in component #6

Rationale

With VRE increasingly connected at distribution level, secure operation depends on TSO-DSO coordination: shared forecasts, joint network planning, coordinated congestion management and, at deeper integration, shared balancing responsibility and access to distributed flexibility. Where operators work in silos, observability and the use of distributed resources are limited.

Limitations

Coordination arrangements are often technical, informal or evolving and may be difficult to verify externally. The five components simplify relationships that differ substantially across regulatory and market structures. Formal procedures may exist without being implemented effectively, while informal arrangements may work well despite limited documentation.

9.3 Vertical and Horizontal Coordination of Policy Action

Coordinated policy action and integration can be attained from different points of view, i.e. within or across government levels. Horizontal policy integration focuses on mainstreaming energy transition policy objectives into other sectoral policy areas on one level of government (e.g. across federal ministries), while vertical policy integration takes a top-down approach and focuses on mainstreaming throughout multiple levels of government and policy making (e.g. from federal directives to state or municipal implementation).

9.3.1 Inter-ministerial coordination (Indicator 67)

Approach

This indicator checks the existence of an inter-ministerial body (including working groups, etc.) or a leading ministry with a clear mandate to guide the energy transition.

Table 133: Components - Indicator 67

	Indicator's component #1	Indicator's component #2
Description	Is there an inter-ministerial body with clear mandate related to ET?	Focal points in leading ministries on topics such as RE/ET/climate change

Note: Component #1 'Yes' results in 10; component #1 'No' with component #2 (focal points in leading ministries) 'Yes' results in 5; both 'No' results in 0.

Table 134: Deriving the scale - Indicator 67

Scale	Indicator value	Scale description
10	Inter-ministerial body or leading ministry with ET mandate	An inter-ministerial body or a leading ministry has a clear mandate to coordinate government policies on ET
7.5		
5	No inter-ministerial body in place but there are focal points in non-energy ministries	Focal points in non-energy ministries (e.g. department on energy/climate-related topics)

2.5		
0	No	No inter-ministerial body or focal points in non-energy ministries with regards to ET

Rationale

The transition spans the energy, finance, industry, environment, transport and planning portfolios. An inter-ministerial body or a lead ministry with a clear mandate aligns policy development, prevents fragmented or contradictory policies, enables coherent government positions, and aligns resource allocation across ministries.

Limitations

Formal mandates on paper do not guarantee convening power or resources: committees can meet without achieving alignment, and lead ministries may lack authority over peers. Effectiveness depends on political backing, which the indicator cannot observe. Appropriate institutional arrangements also differ across government systems.

9.3.2 Coordination between national - subnational policy making (Indicator 68)

Approach

This indicator checks for recurrent meetings between national and subnational government representatives on the status of the energy transition or topics relevant to it (e.g. RE deployment).

Table 135: Components - Indicator 68

	Indicator's component #1
Description	Number of meetings a year between representatives of national and subnational governments

Note: The indicator uses component #1 directly: more than one meeting per year scores 10; one meeting scores 5; none scores 0.

Table 136: Deriving the scale - Indicator 68

Scale	Indicator value	Scale description
10	> 1 meeting per year	Representatives of national and subnational governments meet twice a year
7.5		
5	1 meeting per year	Representatives of national and subnational governments meet once a year
2.5		
0	No meetings	No recurrent meetings

Rationale

Much of implementation happens subnationally – land use planning, building codes, local permitting and grids. Recurrent exchanges between national and subnational governments align priorities, surface implementation barriers early, and prevent local obstacles from undermining national targets.

Limitations

Meeting frequency is a crude proxy for coordination quality, and coordination needs differ between federal, decentralised and unitary systems, and some countries may achieve effective coordination through existing administrative structures rather than dedicated energy transition bodies. Informal interaction may also be important but difficult to document.

9.4 Transparency

The improvement of transparency around processes, data and accountability can help to remove barriers related to the development of renewables in the power sector (e.g. mitigate investment risks, enhance public acceptance and foster stakeholder engagement). In general, transparency also facilitates tracking processes to guide sound assessments and robust planning.

9.4.1 Corruption index (Indicator 69)

Approach

This indicator assesses the general level of corruption in the country, measured by the Corruption Perceptions Index (CPI)[19].

Table 137: Components - Indicator 69

	Indicator's component #1
Description	CPI (score)

Note: Component #1 is used directly, compared against the scale thresholds.

Table 138: Deriving the scale - Indicator 69

Scale	Indicator value	Scale description
10	>77	Very low level of perceived corruption
7.5	60 - 77	Low level of perceived corruption
5	40 - 59	Moderate level of perceived corruption
2.5	20 - 39	High level of perceived corruption
0	<20	Very high level of perceived corruption

Rationale

Corruption raises transaction costs and risks for investors and can distort the processes on which the transition depends. Procurement may favour connected suppliers over competitive bidders, permitting

[19] Transparency International (2026). *Corruption Perception Index 2024*. Available at: https://www.transparency.org/en/cpi/2024 (Accessed: 8 April 2026)

may depend on payments rather than merit, and regulation may be captured by incumbents. The CPI is the most widely used comparative measure of these conditions.

Limitations

The index measures perceived public sector corruption in general rather than practices in the energy sector, and a country may conduct clean energy procurement despite broader governance challenges, or the reverse. Perception-based indices can also lag actual change.

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