ELECTRICITY AUTHORITY OF VIETNAM

CURRENT LEGAL FRAMEWORK REGULATING COAL-FIRED THERMAL POWER PLANT OPERATION IN VIETNAM

HANOI, JANUARY 2026



CONTENT

01 APPLICABLE SYSTEM OF LEGAL NORMATIVE DOCUMENTS

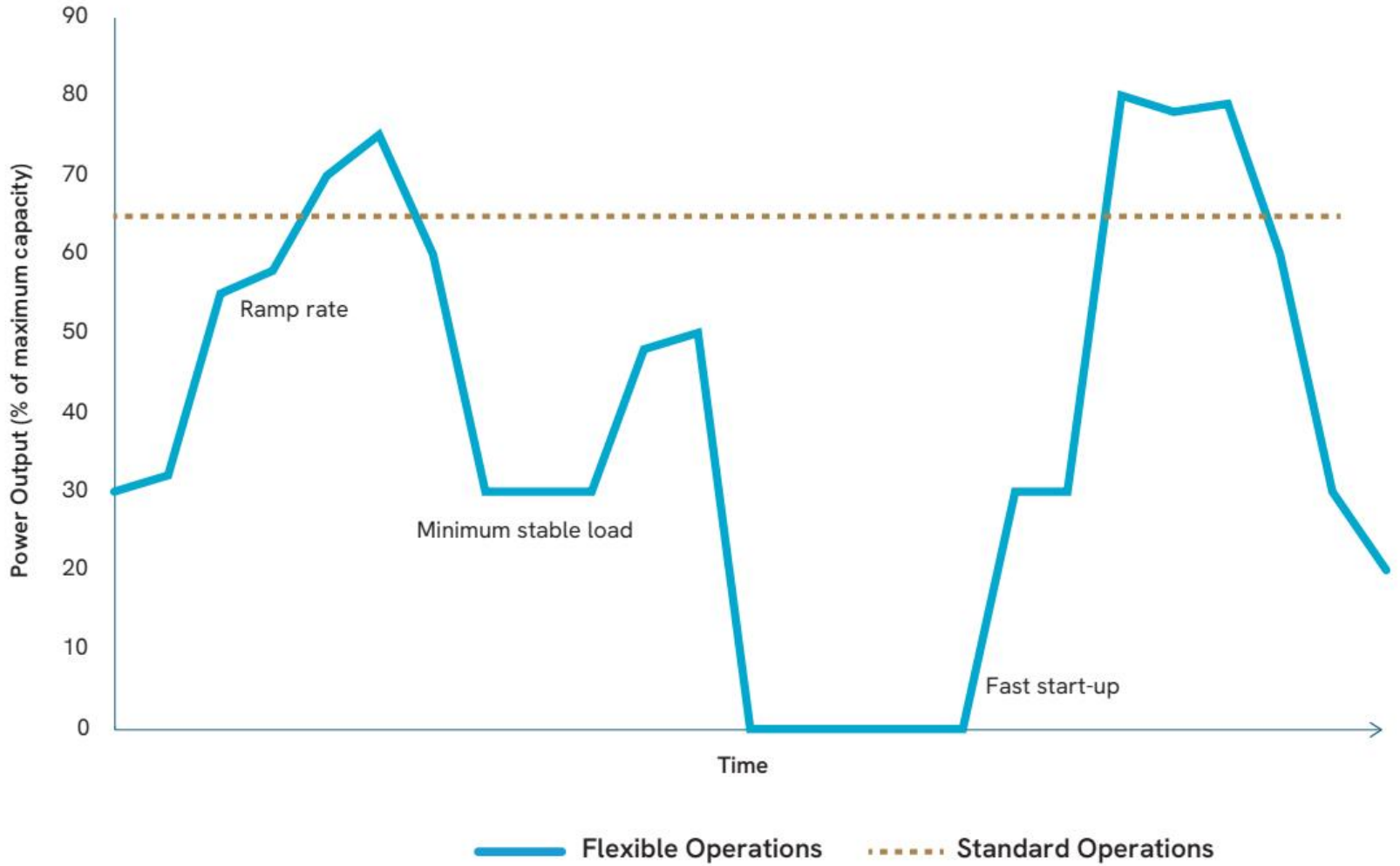
02 SOME ISSUES ON THE FLEXIBILITY OF THERMAL POWER PLANTS

03 INTERNATIONAL EXPERIENCE ON MECHANISMS FOR IMPROVING FLEXIBILITY

04 OTHERS

Technical parameters defining the flexibility of coal-fired power plants

- Minimum Load (ML): The lowest load at which a unit can maintain stable operation without fuel support (FO/DO) to sustain the flame. Lowering ML allows a plant to avoid a full shutdown, thereby reducing restart costs and equipment wear and tear.
- Ramp Rate: The ability to change power output within a given unit of time (often measured in MW/minute or % of rated capacity per minute). The higher the rate, the faster a plant can respond to sudden drops in wind or solar generation.
- Start-up Time: The time required to bring a unit from shutdown to grid connection and to reach rated load.



Source: Adapted from Grzeszczak, Jan & Grela, Łukasz & Achter, Thomas. (2017). Environmentally Friendly Replacement of Mature 200 MW Coal-Fired Power Blocks with 2 Boilers Working on One 500 MW Class Steam Turbine Generator (2on1 Unit Concept). Archives of Thermodynamics. 38. 10.1515/aoter-2017-0030.

Revised Power Plant Development VIII (PDP 8)

Technology	PDP8 (MW)	Ratio (%)	Revised PDP8 (MW)	Ratio (%)	Change (MW)	Change (%)
Nuclear power	0	0	4,000 – 6,400*	2.2 – 2.7	4.000 – 6,400	-
Coal thermal power	30,127	19.4	31,055	13.1 – 16.9	928	3.1
Domestic gas power	14,930	9.6	10,861 – 14,930	5.9 – 6.3	≤4,069	≤27.3
LNG power	22,400	14.4	22,524	9.5 - 12.3	124	0.6
Offshore wind power	**6,000**	**3.9**	**6,000 – 17,032***	**3.27 – 7.2**	**0 – 11,032**	**0 – 183.9**
Biomass	2,270	1.5	1,523 – 2, 699	-	-	-
Waste to energy			1,441 – 2,137	-	-	-
Geothermal power and new energy	0	0	45	0.02	45	-
Hydropower	29,346	18.9	33,294 – 34,667	14.7 - 18.2	3,948 – 5,321	13.5 – 18.1
Onshore and nearshore wind	21,880	14.1	26,066 – 38,029	14.2 – 16.1	4,186 – 16,149	19.1 – 73.8
Solar power	20,591	13.2	46,459 – 73,416	25.3 – 31.1	25,868 – 52,825	125.6 – 256.5
Pumped storage hydro	2,400	1.5	2,400 – 6,000	N/a	0 – 1,600	0 – 66.7
Flexible thermal power sources	300	0.2	2,000 – 3,000	1.1 - 1.3	1,700 – 2,700	566.7 - 900
BESS	300	0.2	9,994 – 16,294	5.5 – 6.9	9,694 – 15,994	3231 – 5231
Imported	5,000 – 8,000	3.2 – 5.1	9,360 – 12,100	4,0 – 5.1	4,100 – 4,360	51.3 - 87.2
Total installed capacity (exc. export sources)	**155,544 – 158,544**		**183,291 – 236,363**			

Revised PDP 8

- To ensure the achievement of the carbon-neutrality target by 2050, the Revised PDP 8 places strong emphasis on and gives priority to accelerating the use of green and clean energy sources, minimizing environmental impacts, and gradually reducing adverse effects on climate change, with the guiding principle of fully harnessing all national potential and advantages for energy development, particularly renewable energy.
- The Revised PDP 8 also sets out orientations for the development of coal-fired thermal power projects, stating that: *"Only projects already included in the plan and currently under construction shall continue to be implemented up to 2030. Fuel conversion to biomass or ammonia is oriented for power plants that have been in operation for 20 years, subject to cost feasibility. Power plants with a service life of over 40 years shall cease operation if fuel conversion is not possible."*
- Approved by the Prime Minister, the Revised PDP 8 establishes a clear and long-term roadmap to gradually realize the goal of carbon neutrality by 2050, in line with Viet Nam's commitments at COP26 and global energy development trends.

Provisions of Circular No. 05/2025/TT-BCT

Frequency

- BAU mode: 50 ± 0.2 Hz

Operating mode of the power system	Permissible frequency deviation range	Recovery time, calculated from the time an incident occurs	
		Unstable state (configuration)	Restore to BAU mode
Single incidents	49 Hz ÷ 51 Hz	02 minutes to restore the frequency to 49.5 Hz ÷ 50.5 Hz	05 minutes to restore the frequency to 49.8 Hz ÷ 50.2 Hz
Incidents affecting multiple components, severe or emergency incidents	47.5 Hz ÷ 52 Hz	10 seconds to restore the frequency to 49 Hz ÷ 51 Hz 05 minutes to restore the frequency to 49.5 Hz ÷ 50.5 Hz	10 minutes to restore the frequency to 49.8 Hz ÷ 50.2 Hz

Permissible frequency deviation ranges and recovery times for restoring the power system to BAU mode under other operating modes of the national power system

Provisions of Circular No. 05/2025/TT-BCT

Technical requirements for thermal power plants

- **Technical requirements for generation units**
- **Mobilization and control of active power and reactive power:**
  - Ability to generate $P_{đm}$ within a power factor range from 0.9 (generating Q) to 0.95 (receiving Q), in accordance with unit characteristics.
  - Additional requirements on equipment and AGC system connection.
  - Ability to maintain $P_{đm}$ within the frequency range of 49 Hz – 51 Hz.
  - Ability to remain grid-connected within power plant-specific frequency ranges (hydropower, thermal power).

Frequency range of the power system	**Minimum duration**	
	Hydropower plants	**Thermal power plants**
46 Hz - 47.5 Hz	20 seconds	No requirement
Above 47.5 Hz - 48.0 Hz	10 minutes	10 minutes
Above 48 Hz - below 49 Hz	30 minutes	30 minutes
49 Hz - 51 Hz	Maintain generation	Maintain generation
Above 51 Hz - 51.5 Hz	30 minutes	30 minutes
Above 51.5 Hz - 52 Hz	03 minutes	01 minute

Provisions of Circular No. 05/2025/TT-BCT

Technical requirements for thermal power plants

Technical requirements for generation units

- **Generator excitation system:**
  - Must ensure unit operation within the power factor range of 0.9–0.95.
  - Equipped with an AVR operating continuously, capable of maintaining terminal voltage with a deviation not exceeding ±0.5% of rated voltage.
  - The Automatic Voltage Regulator must be capable of compensating for voltage drops across the generator step-up transformer.
  - Mandatory requirement: Generating units with a capacity of 30 MW or more must be equipped with a Power System Stabiliser (PSS) with a damping ratio of not less than 5% to damp oscillations with frequencies in the range of 0.1 Hz - 5 Hz.
- **Governor control:**
  - Generation units in operation must involve in primary frequency control.
  - The static droop must not exceed 5%.
  - The minimum achieavable setpoint of the governor system deadband must be within ±0.05 Hz.

Provisions of Circular No. 05/2025/TT-BCT and Circular No. 11/2025/TT-BCT

01 Secondary frequency regulation

02 2. Fast start-up

03 3. Voltage regulation

04 4. Operating reserve with must-run requirement

05 5. Black start

Technical requirements for ancillary services

Secondary frequency regulation: Supply power within 20 seconds; sustain for 15 minutes.
Fast start-up: Ramp up within 25 minutes; sustain for 8 hours.
Voltage regulation: Adjust reactive power following dispatch orders.
Operating reserve with must-run requirement: Ramp up within 1 hour; sustain for 8 hours.
Black start: Self-start without requiring power from the system.

Provisions of Circular No. 11/2025/TT-BCT

Ancillary service price is calculated based on the following components:

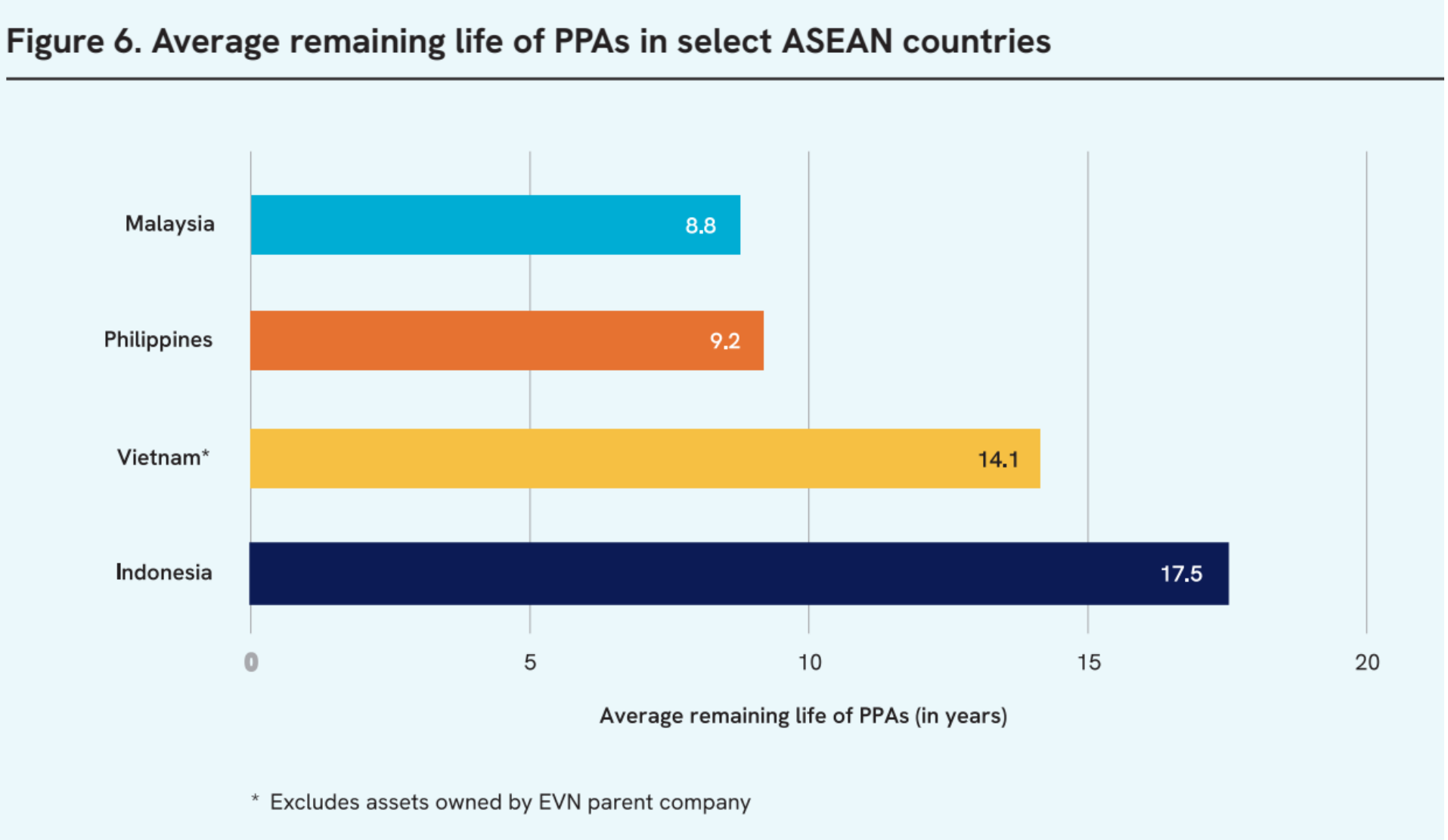
a) Fixed price: Determined based on the total fixed revenue required to recover CAPEX and fixed O&M costs over the project life.
b) Variable price: Includes fuel costs, auxiliary materials, and fuel consumption.
c) Start-up price: Method for calculating start-up costs is based on the number of start-ups and the standard fuel consumption for start-up.
d) Other costs (if any).

Provisions of Circular No. 11/2025/TT-BCT

Annual adjustment for ancillary service prices:

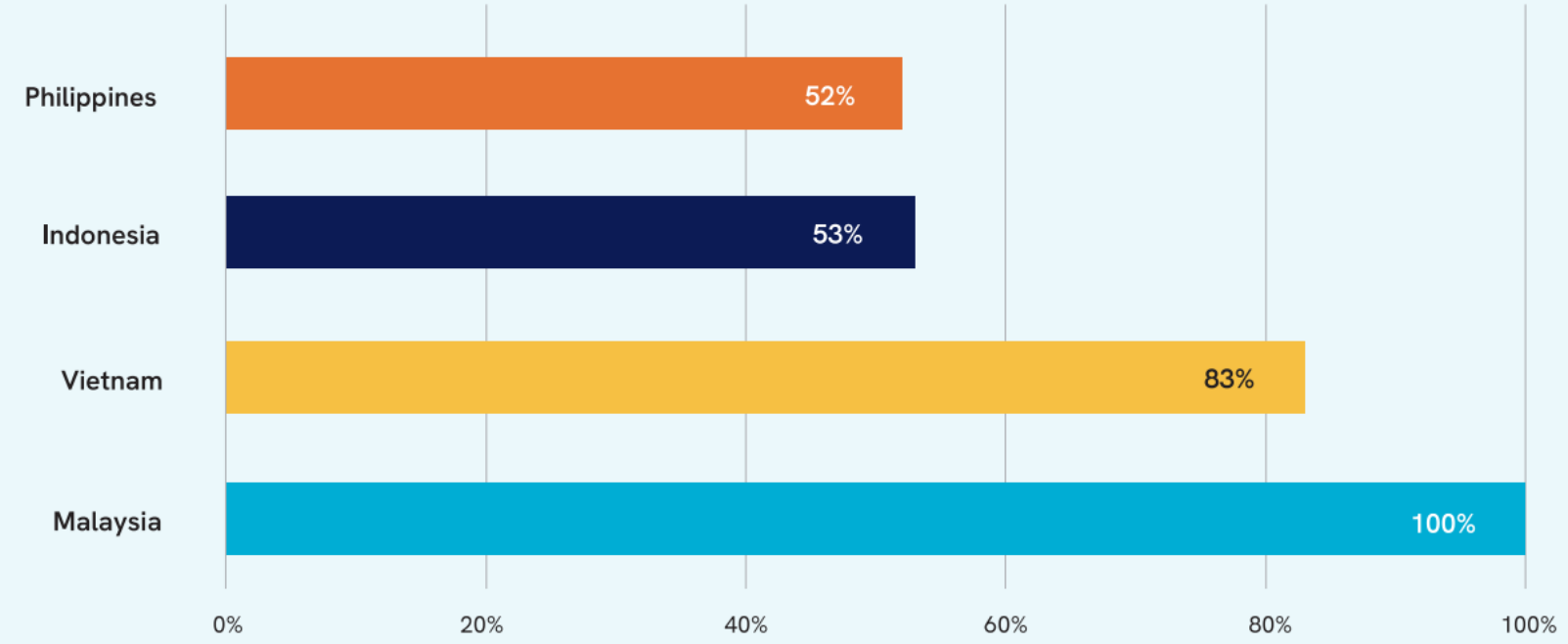
a) Before November 1 each year, upon availability of financial close and audit data for the immediately preceding year, where there are differences in major repair costs, labor costs, exchange rate differences, or availability factors between the ancillary service price plan and actual implementation of the immediately preceding year, the parties shall consider incorporating such differences in the ancillary service price plan for the subsequent year;
b) Before November 1 each year, where there is a difference in depreciation of fixed assets between the ancillary service price plan and the actual figures of that year, the parties shall consider incorporating such difference in the ancillary service price plan for the subsequent year;
c) Before November 1 each year, upon availability of audit data for the immediately preceding year on material costs, outsourced service costs, and other cash expenses, the parties shall consider updating these costs in the ancillary service price plan for the subsequent year.

Power purchase agreements (PPAs) of coal-fired power plants in Southeast Asia



Power purchase agreements (PPAs) of coal-fired power plants in Southeast Asia

Figure 5. Share of coal capacity in Southeast Asia covered by PPAs



[12] TransitionZero, Coal Asset Transition (CAT), 2025

How PPAs affect the flexibility of coal-fired power plants in Southeast Asia

PPA characteristics	Barriers
Contract term	Creates a “lock-in” effect until the expiry of the PPA.
Tariff structure	- For plants participating in the electricity market: + No capacity payment component for available generation; payment is made only for actually mobilized generation, creating the risk for recovering variable and fixed costs. + Fixed heat loss rate, which does not reflect actual costs when operating at different load levels. - For BOT power plants: Take-or-pay obligations constrain flexibility.
Must-run requirement	Generating units are required to follow dispatch orders, with no compensation mechanism for changes to the planned dispatch schedule.
Fuel supply	Encourages a high mobilized/dispatched rate, as fuel becomes a sunk cost.
Termination or amendment clauses	Penalties or fees for early termination, amendments, or deviations from the contracted dispatch schedule may increase transaction costs.

Source: From Flex to Phase-out, Coal Transition Commission, 2025

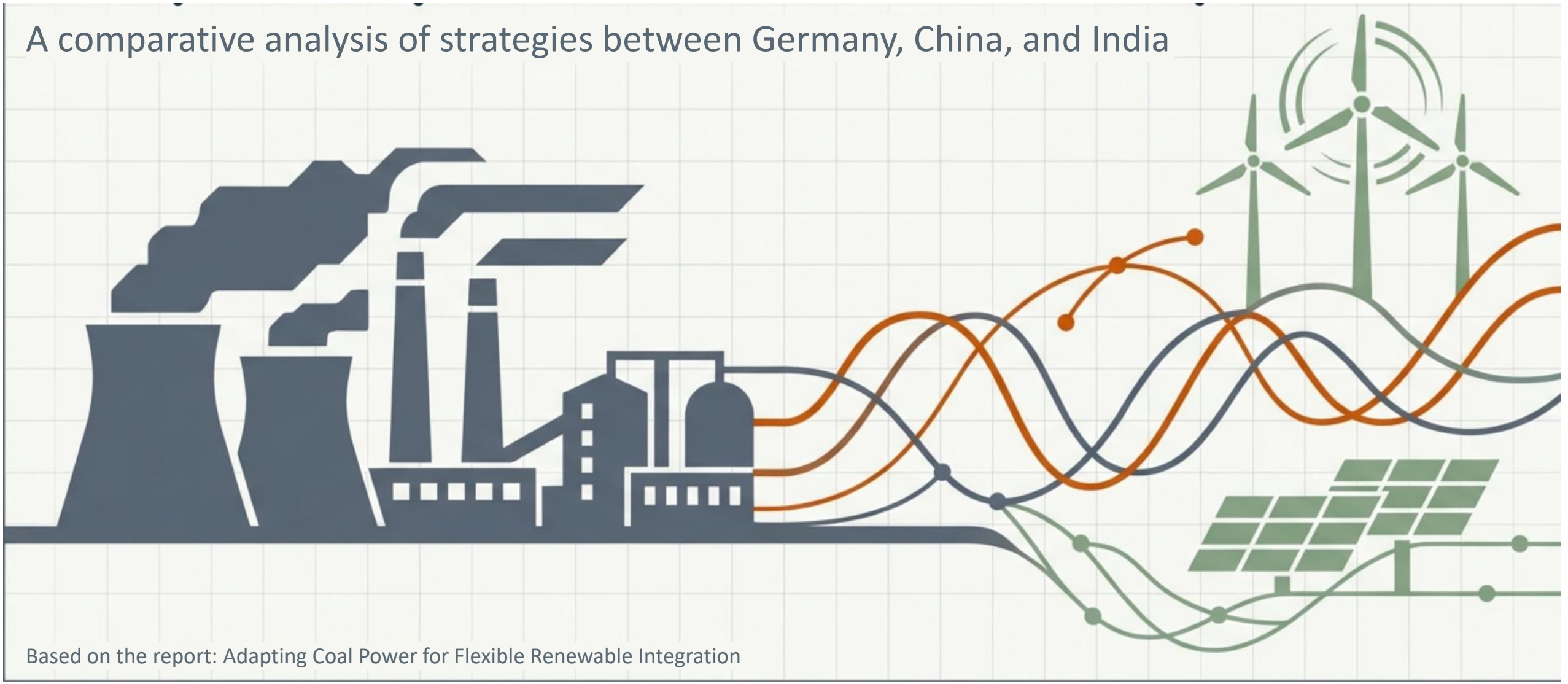
Financial mechanism for coal-fired power plant flexibility in Southeast Asia

Financial pathway	Compatibility with coal power flexibility	Main barriers
Long-term PPAs	Not compatible	Fixed operating schedules; no payment for ramping capability (ramping pay).
Government support	Limited	Specific circumstances, fiscal (budgetary) space.
Loan-based financing	Difficult to align with financial institution (FI) policies	Does not ensure emissions permanence.
Equity investment	High risk and low returns, potentially incompatible with equity investment thresholds	Revenue uncertainty.
Carbon credits	No methodologies currently under development	Does not ensure emissions permanence.
Grid services markets	Not yet widely available	Revenue uncertainty and immature markets.

Source: From Flex to Phase-out, Coal Transition Commission, 2025

Lessons on flexibility from other countries

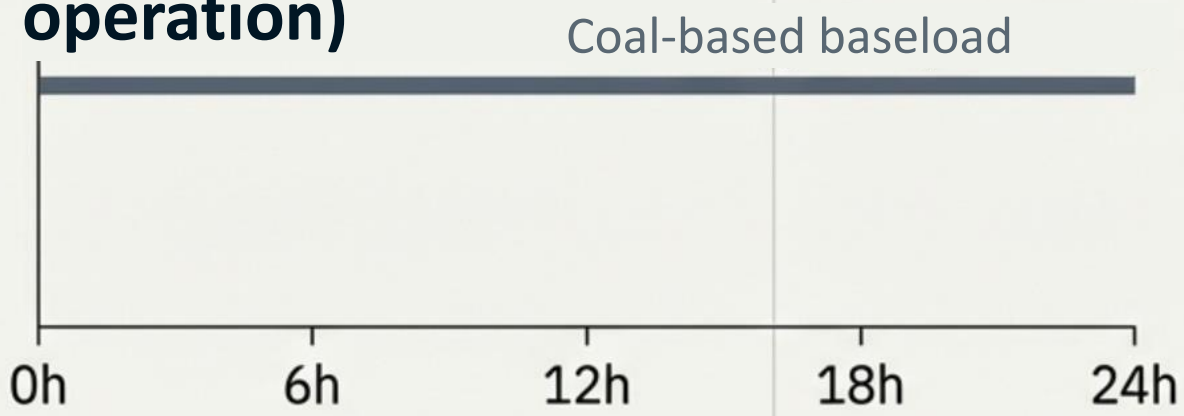
A comparative analysis of strategies between Germany, China, and India



Based on the report: Adapting Coal Power for Flexible Renewable Integration

The need for flexibility

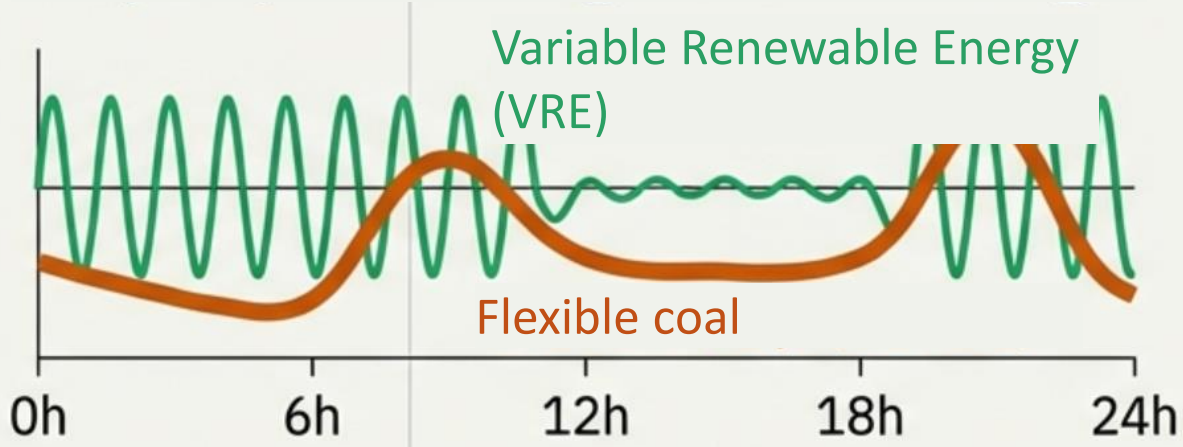
Past (Baseload operation)



Coal-fired power plants achieve stable operation at high load levels.

- Minimum load: 40-60%
- Ramp rate: 1-2%/minute

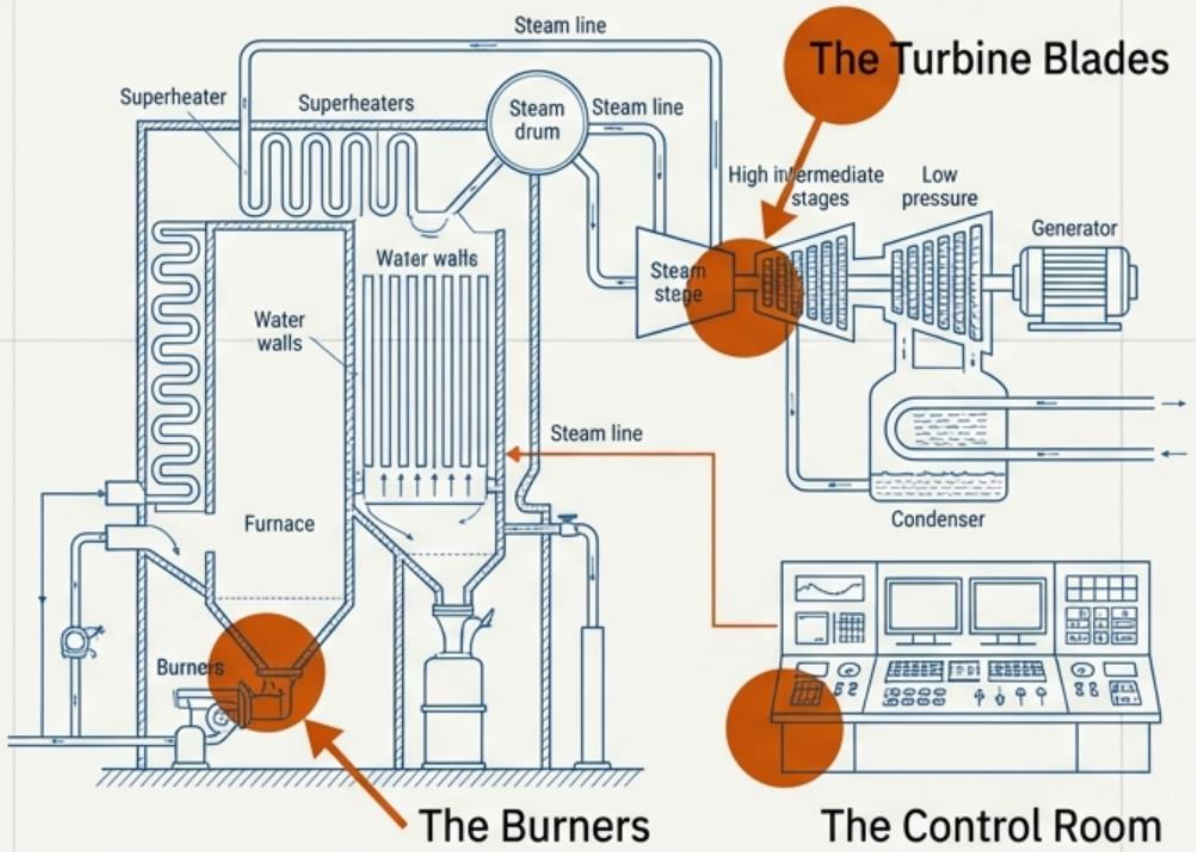
Present & Future (Balancing)



Integration of variable renewable energy (VRE) requires fast ramping capability and low load operation.

Lessons from Germany: Developed economy + Technology

Initially applied to extend the service life of older generating units while alternative sources were being deployed.



Technical achievements	
Minimum Load	10-12% of rated capacity
Ramp rates	Up to 6% of rated load per minute

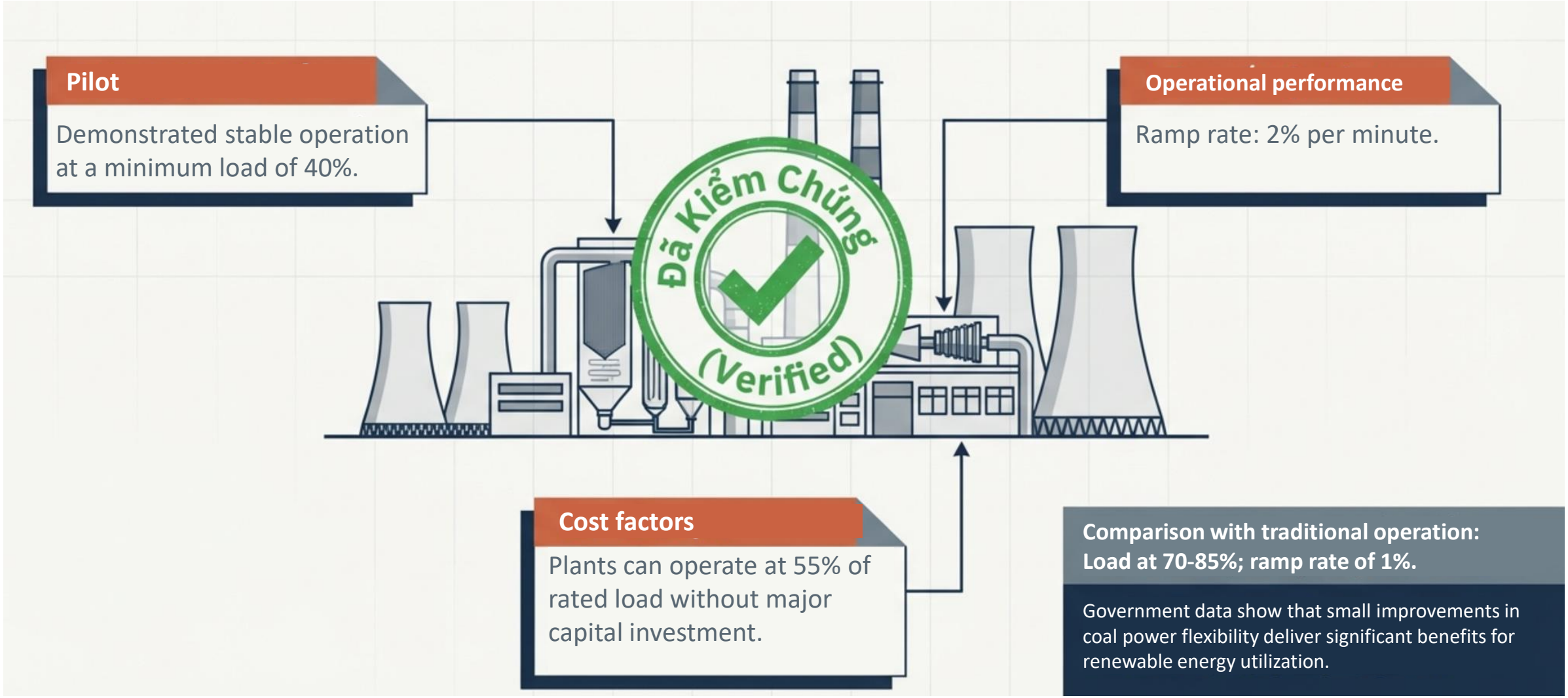
Retrofit requirements

- Turbine upgrades
- Control system improvements
- Boiler modifications

Challenges: Significant upgrades required to address thermal stress, slagging, and combustion stability.

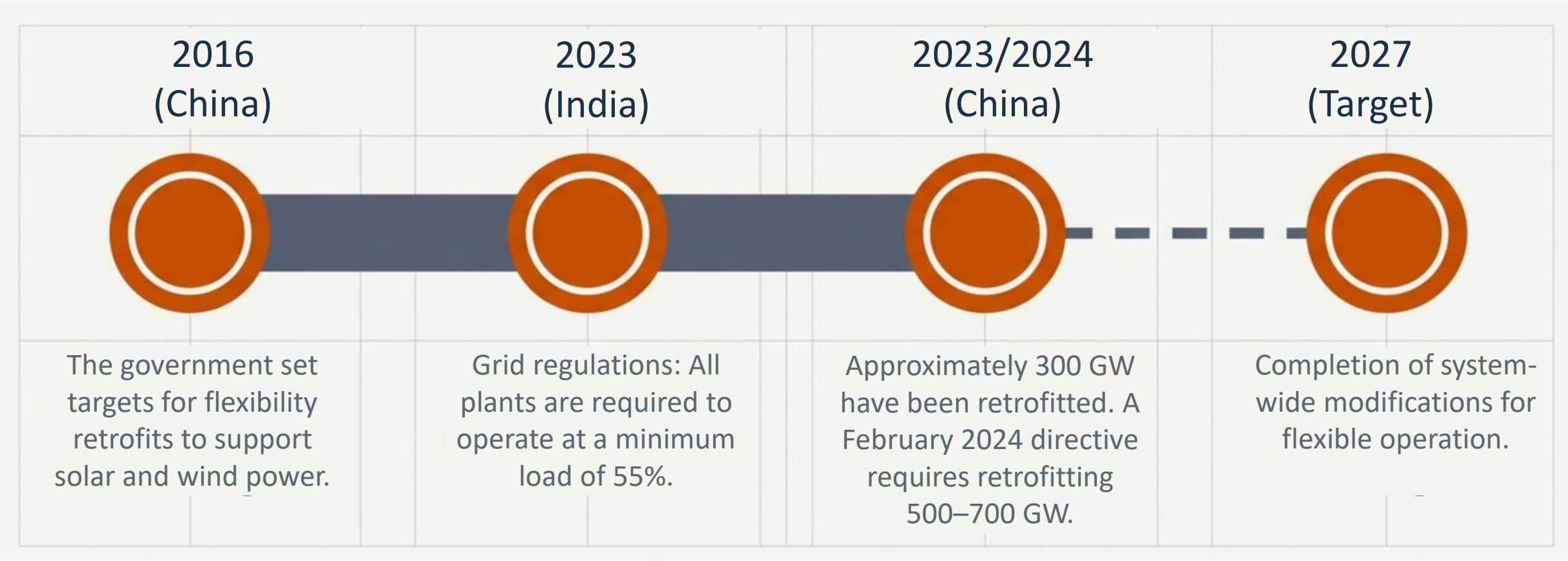
Source: From Flex to Phase-out, Coal Transition Commission, 2025

Lessons from India



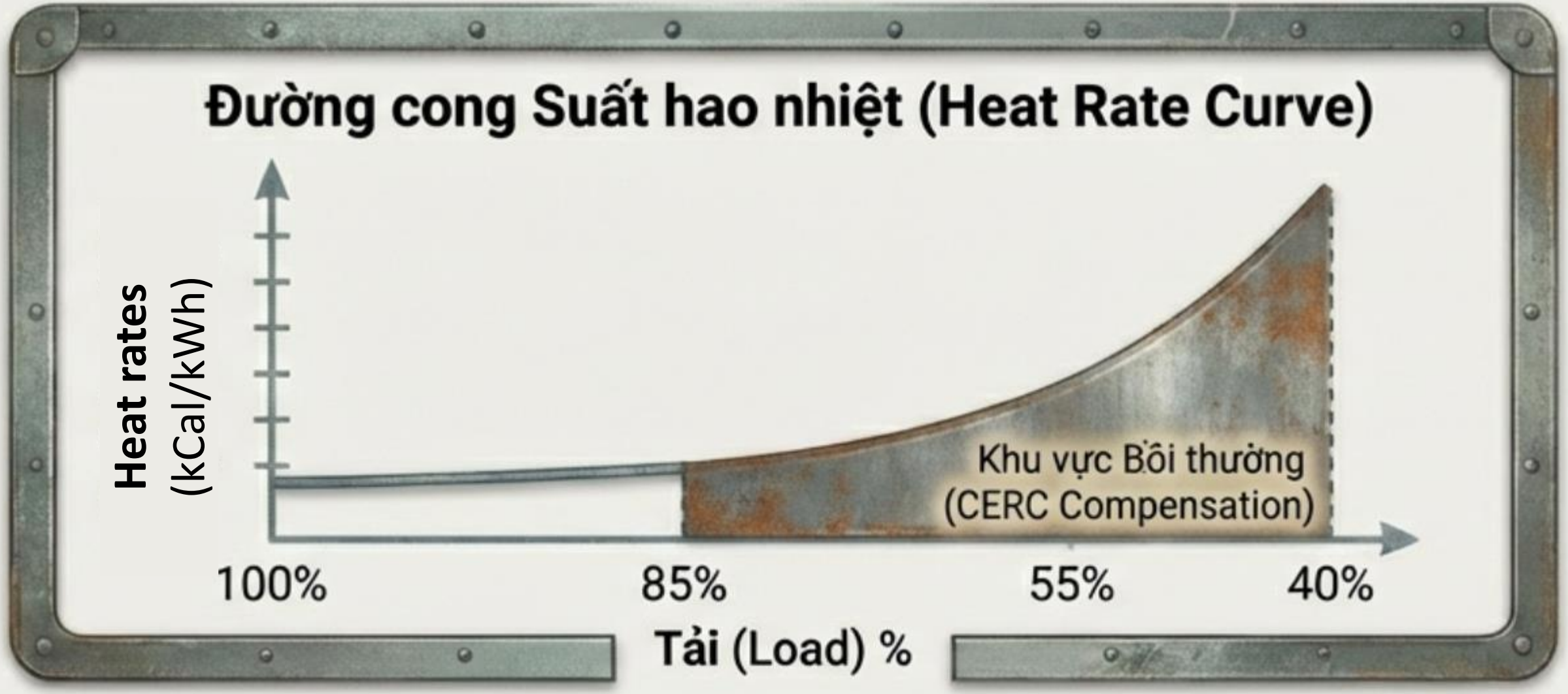
Source: From Flex to Phase-out, Coal Transition Commission, 2025

Lessons from China and India: Use of policies



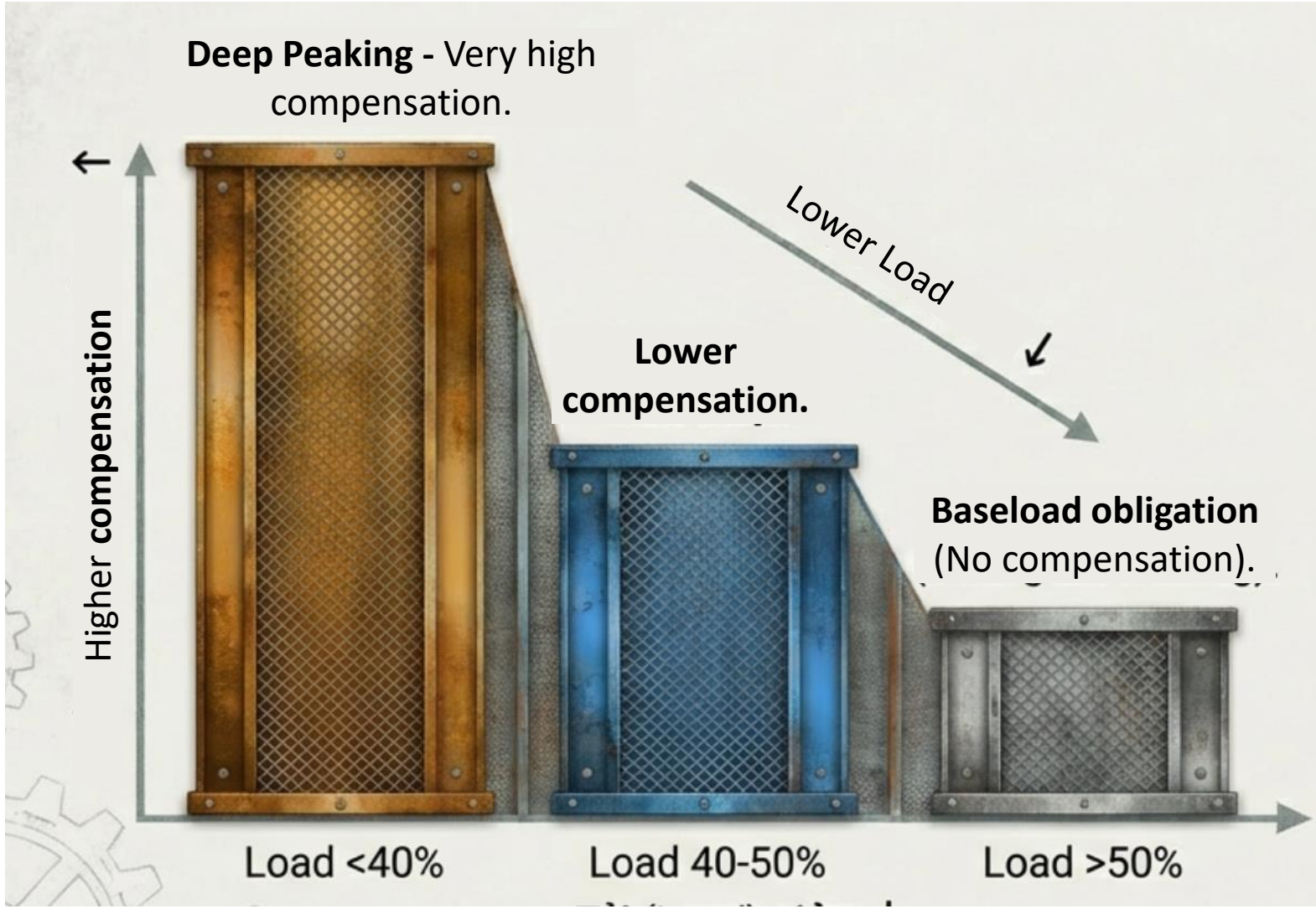
Source: From Flex to Phase-out, Coal Transition Commission, 2025

Lessons from India



Source: From Flex to Phase-out, Coal Transition Commission, 2025

Lessons from China



Targets under the 14th Five-Year Plan (14-FYP):

- Flexible retrofitting of 220 GW of coal power.
- MTL targets: 30–35% (condensing units), 40–50% (cogeneration units).

Source: From Flex to Phase-out, Coal Transition Commission, 2025

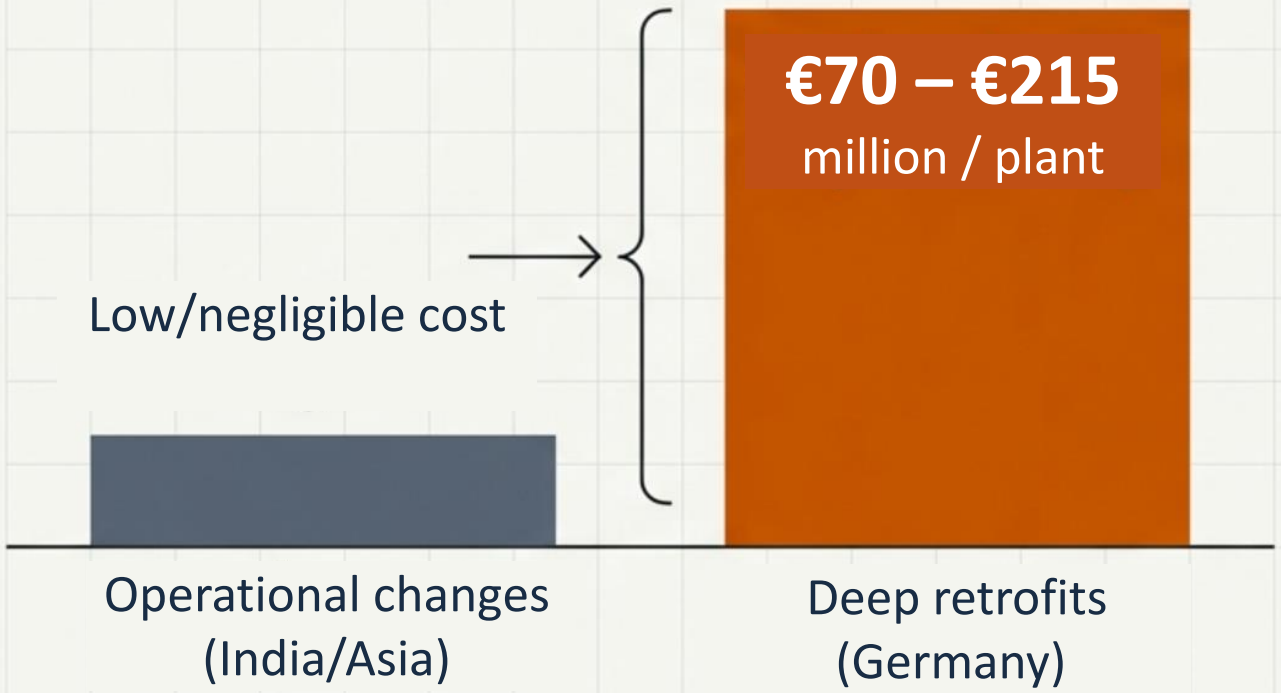
Comparison of technical requirements

Parameter	Germany (Development model)	China (Large scale)	India (Potential/low-cost)
Minimum Load	10-12%	-50%	40-55%
(Minimum Load)	(Very deep)	(Moderate)	(Target 40%)
Ramp Rate	6% per minute	Not specifically defined	2-3% per minute
Retrofit Depth	High / High cost	Mandatory on a large scale	Low / limited Capex focus

India currently requires a ramp rate of 3% per minute for load levels above 70%.

Source: From Flex to Phase-out, Coal Transition Commission, 2025

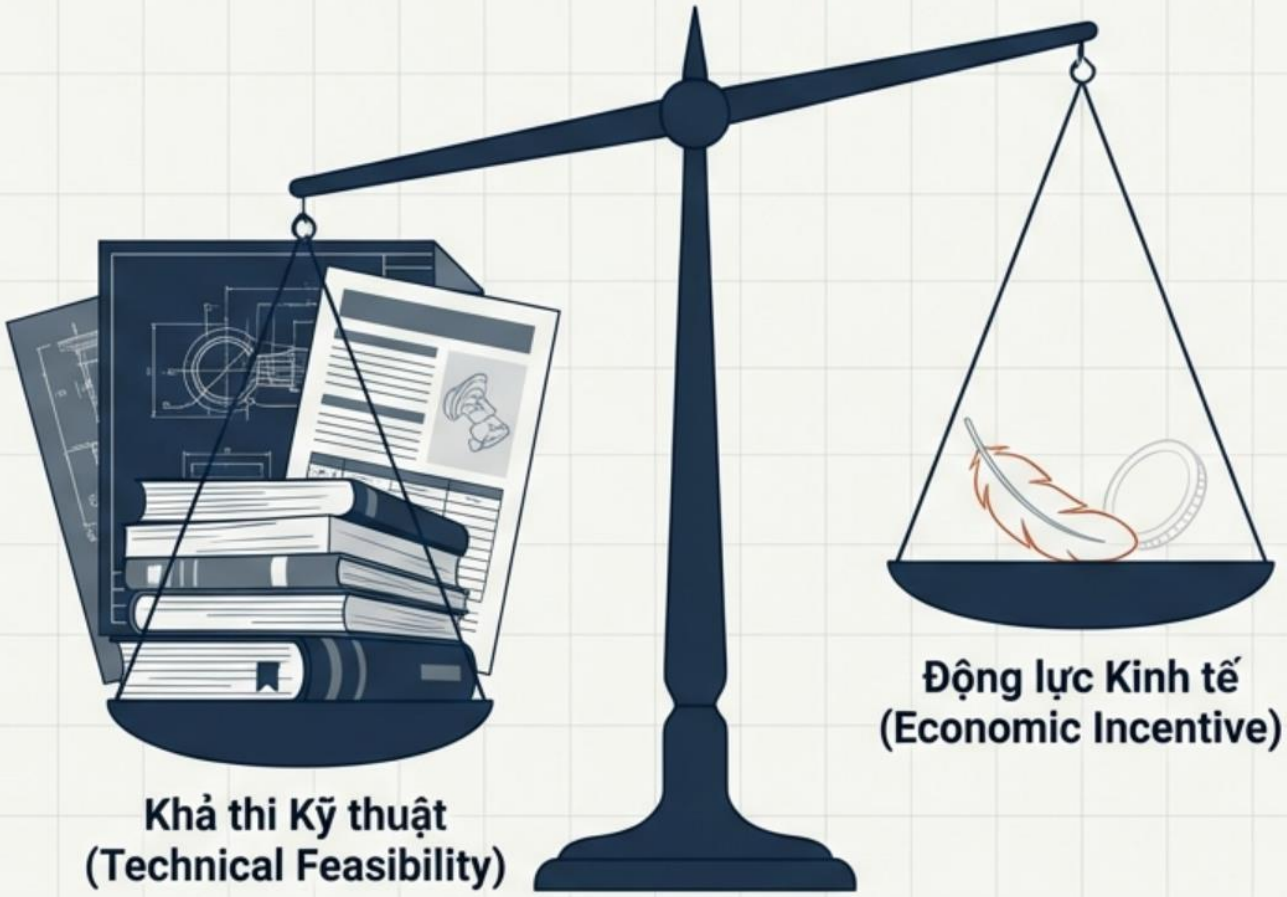
Cost of flexibility



Achieving a minimum load of 10-12% **requires significant investment.** This contrasts with conventional subcritical units (common in Asia), which typically operate at **minimum loads of 40–60% with low ramp rates (1–2%).**

Higher operational performance comes with high insurance costs, mainly suitable for markets where extending asset service life justifies the investment (Capex).

Gap between Technology and the Market



Why is commercial deployment lagging?

- Weak economic signals.
- Ancillary service markets remain at an early stage.
- Lack of compensation mechanisms for generators when providing flexibility.

Result: **Generating units continue to operate under baseload schedules despite having flexibility capability.**

Source: From Flex to Phase-out, Coal Transition Commission, 2025

Recommendations from international experience

- Recommendation 1: Consider focusing refurbishment efforts on enhancing the flexibility of coal-fired power plants where the greatest system value can be achieved at the lowest cost. For example, plants located close to renewable energy generation sources, with contractual arrangements that are conducive to renegotiation, and requiring only minimal modifications to enable flexible operation.
- Recommendation 2: Implement solutions ranging from market-based measures to system-level arrangements to support flexibility: adjust grid regulations; create revenue-enhancement mechanisms or markets for ancillary services beyond energy-only generation (e.g. frequency regulation); and integrate financial mechanisms (e.g. carefully designed capacity payments that remunerate availability without leading to overcompensation) to sustain investment in flexible capacity.

Source: From Flex to Phase-out, Coal Transition Commission, 2025

Summary

When should coal-fired power plant flexibility be considered?	**Which coal-fired power plants should be prioritized for flexibility retrofits?**	**What is needed for successful implementation?**
Signals indicating where coal-fired power flexibility can help address short-term system needs	*Technical and financial feasibility considerations for plant selection*	*Key factors affecting technical, operational feasibility and market viability*
• High or **rapidly increasing** shares of **variable renewable energy** (wind and solar). • Rising levels of **renewable curtailment**. • **Power grid congestion** or bottlenecks in the network. • **Limited or unavailable** clean flexibility alternatives in the short term. • **Rapid demand growth**.	• High system value for **grid balancing** and reliability. • Technical suitability or **low retrofit costs**. • **Remaining economic lifetime** and depreciation profile. • Potential for **PPA renegotiation**. • Ability to reduce **pollution and emissions**.	• Support for **contract renegotiation**. • **Grid operation** and procedural preparedness. • Mechanisms for generating **revenue or compensation streams** for part-load operation and ramping services, aligned with market structures. • **Regulatory standards** and market rules that enable flexibility. • **Institutional capacity** to monitor emissions, performance, and compliance.

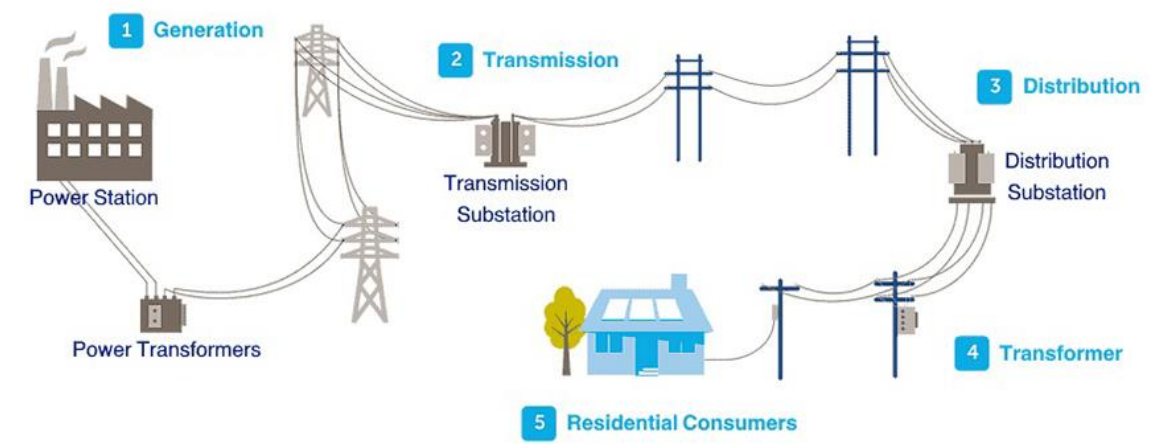
Source: From Flex to Phase-out, Coal Transition Commission, 2025

THANK YOU!

ELECTRICITY AUTHORITY OF VIETNAM

Electricity Authority of Viet Nam

No. 23 Ngo Quyen Street, Hoan Kiem District, Hanoi



Hệ thống điện