CURRENT NEWS

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UNDERSTANDING THE ROLE OF BYPASS DIODES - QUIET SAVIOUR OF SOLAR PV PANELS

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When we install a rooftop solar system, we usually pay attention to the visible components—the solar panels, inverter, mounting structure, and electrical cables. Hidden inside every solar panel, however, is a tiny electronic component that silently protects the panel from damage and helps maintain its performance. This small component is called the bypass diode. It costs only a few rupees but a bypass diode plays a crucial role in ensuring the safety, reliability, and efficiency of a solar panel. In this article, let us understand why bypass diodes are needed, how they work, and why engineers consider them one of the most important protective components inside a solar module.

A publication from

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A solar panel does not generate electricity by itself. It is made up of several solar cells, which are the actual electricity-producing units. For example, a conventional crystalline silicon solar module may contain 60 or 72 full-size solar cells, while many modern modules use 120 or 144 half-cut cells. Each solar cell produces only a small voltage of about 0.5 to 0.6 volts. Therefore, many cells are electrically connected together to produce the higher voltages required for charging batteries or supplying electricity to the grid.

Inside a solar panel, most of these solar cells are connected in series. In a series connection, the current generated by the first cell must pass through every other cell before reaching the output terminals. A simple way to understand this is to think of the serial decorative bulbs used during temple festivals, weddings, Christmas decorations, and other celebrations. When all the bulbs are connected in series, the failure of a single bulb causes the entire decorative string to stop glowing. Similarly, in a series-connected solar panel, every solar cell forms part of the same electrical path. This naturally raises an important question: What happens if one solar cell is shaded by a bird dropping, fallen leaf, dust accumulation, or the shadow of a nearby object?

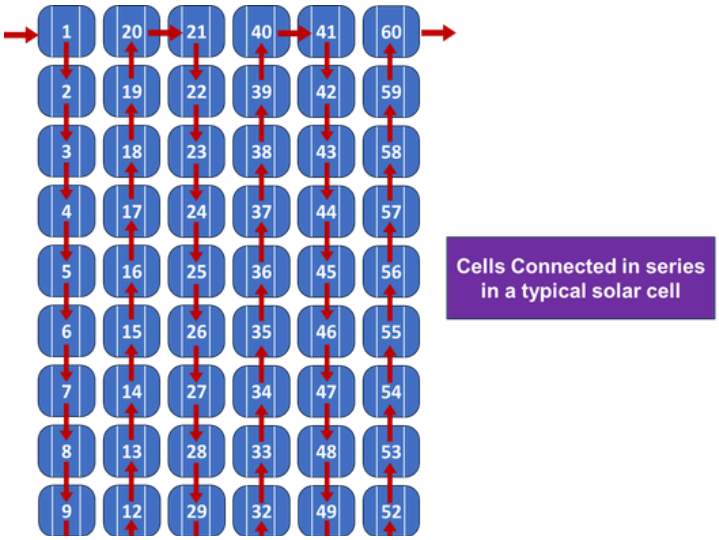


Figure 1 : Cells connected in series in a typical solar panel

Shaded Cells

Shading occurs when sunlight falling on a solar panel is partially blocked by objects such as nearby trees, buildings, water tanks, antennas, electric poles, bird droppings, dust accumulation, or even fallen leaves. Most people assume that if one small solar cell is shaded, only that particular cell will stop producing electricity. Unfortunately, that is not what happens. Since all the cells are connected in series, the shaded cell restricts the flow of current through the entire string. Without any protective mechanism, the output of the entire panel would reduce drastically. However, reduced power generation is not the only concern. A much more serious problem begins inside the shaded solar cell itself.

The unshaded cells force current through the shaded cell. Instead of generating electrical energy, the shaded cell starts absorbing electrical power, which is converted into heat. This excessive localized heating is known as a hot spot. Hot spot temperatures can become extremely high, damaging the solar cell, cracking the encapsulation material, degrading the backsheet, and in severe cases increasing the risk of electrical failure. Therefore, the real concern is not merely reduced power generation but also the possibility of permanent damage to the solar module.

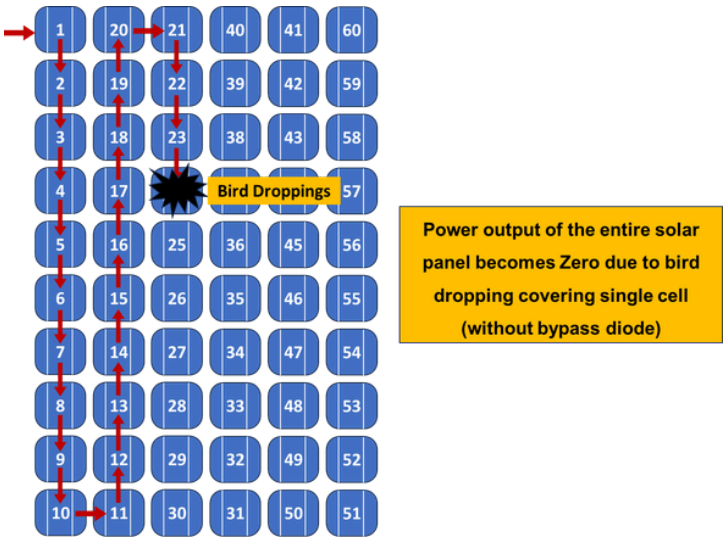


Figure 2 : Effect of bird dropping in a solar panel without bypass diode

At this point, many homeowners may naturally wonder whether bird droppings, fallen leaves, or moving shadows from nearby buildings make rooftop solar systems unsafe. Fortunately, the answer is **no**. Engineers anticipated this problem many years ago and developed an elegant and highly effective solution known as the **bypass diode**.

Usefulness of Bypass Diode

A bypass diode is a small electronic component installed inside the junction box located at the back of the solar panel. Its job is remarkably simple. Whenever a section of the solar panel becomes shaded, instead of allowing current to force its way through the shaded cells, the bypass diode provides an alternative path for the current. This protects the shaded cells from overheating while allowing the remaining healthy cells to continue generating electricity. The name "bypass diode" itself explains its function. Consider a national highway passing through a busy town. Rather than entering congested streets, vehicles often use a bypass road to travel around the town and continue their journey smoothly. A bypass diode works in exactly the same way. Instead of forcing current through the shaded section, it allows the current to travel around it through an alternative path. Hence the name "bypass diode." A typical crystalline silicon solar module usually contains only three bypass diodes. Each diode protects a group of approximately 20 to 24 solar cells. For example, in a 60-cell solar module, the cells are generally divided into three groups of 20 cells, with each group protected by one bypass diode.

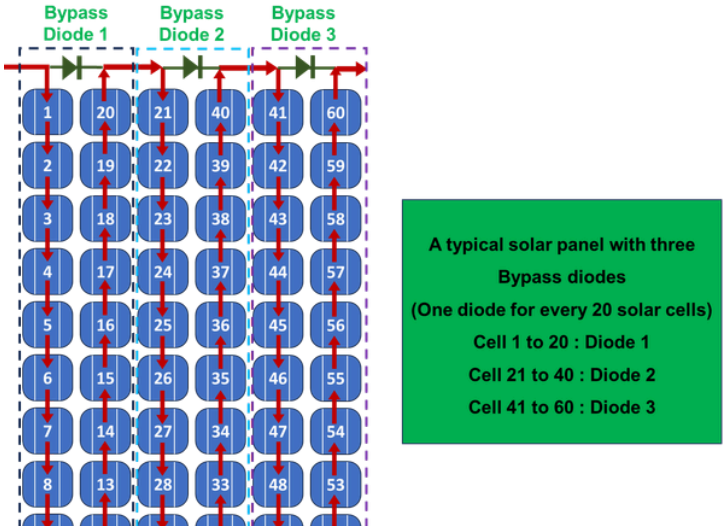


Figure 3 : A typical solar panel with three bypass diodes

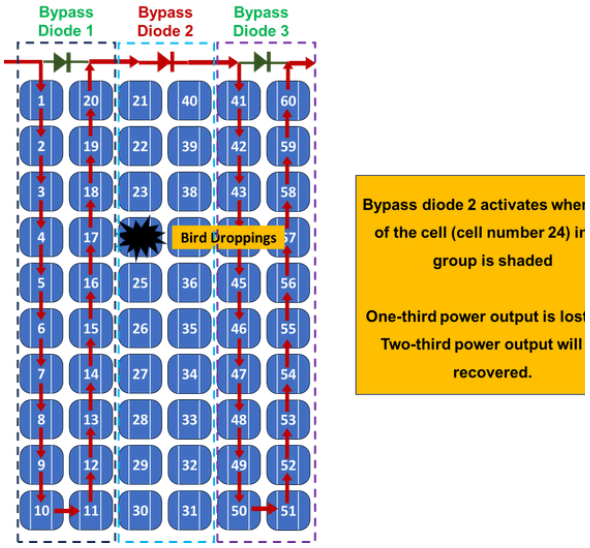


Figure 4 : Solar panel with functional bypass diode under shading of a solar cell

Suppose one solar cell in the first group becomes heavily shaded. Without a bypass diode, the shaded cell would restrict the current flowing through the entire panel, hot spots could develop, and the panel's output would reduce drastically to zero. With a bypass diode in place, the diode automatically becomes active, allowing the current to bypass only the affected group of cells. The remaining two groups continue generating electricity safely. Instead of losing the entire output of the panel, only about one-third of the module power is bypassed, while the remaining two-thirds continue operating normally. This is why modern solar panels remain functional even under partial shading conditions.

Installing one bypass diode for every solar cell is also technically possible but would require more than 60 additional electronic components inside each module, along with many more solder joints and electrical interconnections. This would increase manufacturing costs, complicate the module design, and introduce many additional potential failure points over a service life that often exceeds 25 years. Therefore, manufacturers have adopted a practical engineering compromise by using three or four carefully positioned bypass diodes that provide effective protection while keeping the module affordable, reliable, and easy to manufacture. This is an excellent example of engineering optimization in practice.

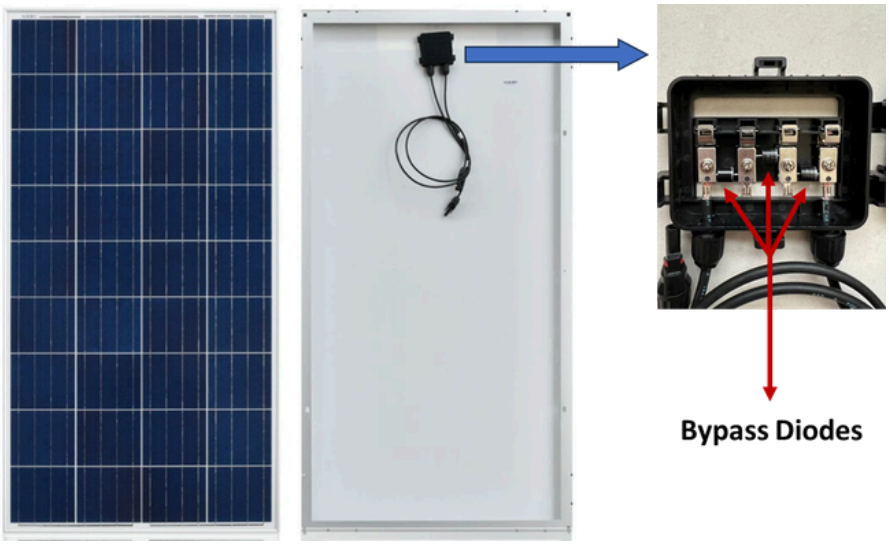


Figure 5 : Solar panel with bypass diode inside the junction box

Conclusion

Although bypass diodes provide excellent protection, consumers should still maintain their solar panels properly. Regular cleaning removes dust and bird droppings that can create unnecessary shading. Nearby tree branches should be trimmed to prevent shadows from falling on the panels, and care should be taken to avoid constructing new structures that create permanent shading. During periodic maintenance, homeowners can also request technicians to inspect the junction box and verify the health of the bypass diodes using appropriate electrical tests. Monitoring the energy generation of the solar system also helps identify abnormal reductions in performance at an early stage. Good maintenance not only improves electricity generation but also extends the service life of the entire solar installation.

CONSUMER FOCUS

The Appellant, a domestic consumer, purchased a residential property through a registered sale deed dated 08.07.2024. At the time of purchase, the appellant found that a domestic service connection (Service Connection No. 352) stood in the name of the previous owner and continued to remain a live service connection in TNPDCL records. However, this service number did not match a live connection. Another service connection (Service Connection No. 3017), had also been provided as a temporary construction service connection. This also stood in the name of the previous owners, though this had already been permanently dismantled.

The appellant approached the Tamil Nadu Power Distribution Corporation Limited (TNPDCL) with the property documents seeking restoration of both service connections. However, the TNPDCL did not restore the connections, stating that the Appellant had not produced sufficient documentary evidence to establish that Service Connection No. 579-007-352 pertained to the property. The TNPDCL also contended that Service Connection No. 579-007-3017 had already been dismantled and the account closed. Consequently, the appellant directly filed a petition before the Consumer Grievance Redressal Forum (CGRF) seeking restoration of both service connections.

During the proceedings before the Consumer Grievance Redressal Forum (CGRF), the TNPDCL submitted that Service Connection No. 579-007-3017 had been permanently disconnected after prolonged non-payment of electricity charges. The meter had been removed and the account closed in June 2024, and therefore, as per TNERC regulations, the dismantled connection could not be restored. Regarding Service Connection No. 579-007-352, the TNPDCL argued that the appellant had not produced sufficient documentary evidence to establish that the connection belonged to her property. The department further stated that if the appellant required electricity supply, she could apply for a fresh service connection by producing the required property documents and obtaining the necessary Coastal Zone Authority clearance, as the property was located close to the seashore.

After considering the submissions of both parties, the CGRF upheld the department's stand. It observed that the appellant had not established ownership of Service Connection No. 579-007-352 to the satisfaction of the department and held that Service Connection No. 579-007-3017, having already been dismantled and the account closed, could not be restored.

Aggrieved by the CGRF's decision, the appellant filed an appeal before the Electricity Ombudsman.

Based on the hearing of both parties' arguments, the following were the Ombudsman's observations:

- The Ombudsman examined the chain of title documents and found that the appellant had legally acquired the property through successive registered sale and settlement deeds, establishing ownership of the premises.
- Service Connection No. 352 remained active in the utility's records under the previous owner's name, despite the supply not being restored due to identification disputes.
- With respect to Service Connection No. 579-007-3017, the Ombudsman noted that the service had been disconnected and the account permanently closed before the appellant purchased the property. Therefore, payment of arrears after closure of the account did not confer any right to restoration.

- The Ombudsman further observed that the appellant produced additional documentary evidence, including title deeds, original electricity receipts, photographs of the premises, affidavits from neighbouring residents. She has also submitted an affidavit from the previous owner, establishing that Service Connection No. 352 pertained to the property.
- Upon examining the additional evidence, the TNPDCL also accepted during the hearing that Service Connection No.352 could be reconnected.

Based on these observations, the Ombudsman's findings were:

- The appellant consumer had successfully demonstrated that Service Connection No. 352 was associated with her property. The TNPDCL failed to provide substantial evidence against granting the service connection to the property owner, i.e., the appellant consumer. Therefore, the prayer for restoration of this service connection shall be allowed, subject to the appellant consumer submitting the undertaking form to the TNDPCL.
- The Ombudsman rejected the request to restore Service Connection No. 579-007-3017, holding that the service had already been permanently disconnected and the account had been closed before the appellant became the owner. Under Regulation 22 of the Tamil Nadu Electricity Supply Code, such dismantled service connections cannot be restored after the prescribed period.

Based on these findings, the Ombudsman directed the TNPDCL to reconnect Service Connection No. 579-007-352 after the appellant consumer complied with the prescribed procedural requirements. The request to restore Service Connection No. 579-007-3017 was rejected.

SOURCE: OMBUDSMAN CASE

NEWS FROM TAMIL NADU

3,531 rooftop solar applications pending in TN under PM Surya Ghar scheme

Over 3,500 rooftop solar applications under the centre's PM Surya Ghar: Muft Bijli Yojana scheme are pending across Tamil Nadu, with nearly two-thirds of them stuck for more than 15 days, according to data from the Tamil Nadu Green Energy Corporation Limited (TNGECL) accessed by TNIE. As of June 6, a total of 3,531 applications were pending, of which 2,211 had been waiting for over a fortnight. Some of them, officials said, were two to three months old. Chennai leads the backlog with 932 pending cases, followed by Coimbatore (395) and Madurai (191). A senior TNGECL official told TNIE that as per the union government's guidelines, consumers installing rooftop solar systems of up to 10 kilowatt (kW) are exempt from obtaining a feasibility report. Once the installation is completed, assistant engineers or assistant executive engineers inspect the system and approve it. Following approval, the existing electricity meter is replaced with a net meter. As per the centre's guidelines, there is no deadline to install rooftop solar panels after registration process under PM Surya Ghar scheme. TNGECL officials, however, said that a large share of pending applications belong to consumers who have completed registration on the portal but never proceeded with installation. The official urged the union government to introduce stage-wise deadlines after registration to help utilities clear the backlog. Besides, staff shortages have added to the monitoring challenge. As against a state target of 3 lakh households, only 74,200 installations have been completed. On the supply side, vendors say the restriction on Chinese panel imports means a wait of nearly a month for domestically manufactured panels. They also flagged delays in net meter installation.

SOURCE: THE NEW INDIAN EXPRESS, 22 JUNE 2026

NEWS FROM ACROSS THE COUNTRY

Grid bottlenecks hamper green energy expansion

India's rapid renewable energy expansion is running into a serious bottleneck, with delays in transmission infrastructure forcing large-scale curtailment of green power. According to Ember, an energy think-tank, transmission constraints accounted for nearly two-thirds of the 470 gigawatt-hours of renewable energy curtailed in first quarter of 2026. The problem has become particularly acute in Rajasthan and Gujarat, which host the bulk of India's utility-scale solar and wind projects. Of the country's total installed power generation capacity of 543 GW, solar energy accounts for 154 GW and wind, 56 GW. The mismatch between pace of renewable energy deployment and transmission readiness is emerging as one of the biggest operational risks for sector. "India's renewable energy curtailment arising from transmission constraints is beginning to reach materially significant levels," said Duttatreya Das, energy analyst at Ember. He said the system would eventually have to move away from "generation-led transmission planning" towards a model where generation and transmission are planned together. An official from the ministry of new and renewable energy, acknowledging that curtailment was becoming a concern, said govt was working on solutions. Large-scale deployment of battery energy storage systems and grid-forming inverters would be crucial for integrating renewable energy into the grid. "We are in regular touch with power ministry and Central Electricity Regulatory Commission for enhancement of transmission capacity," the official said. As per Ember, India has achieved only about 80% of its annual transmission targets over past five years, leading to a growing backlog. For FY27 alone, the requirement for additional inter-state transmission capacity has been estimated at over 61,000 circuit kilometres. The delays are driven by right-of-way disputes, land acquisition hurdles, forest clearances and supply constraints for critical high-voltage transmission equipment, the report noted.

SOURCE: THE TIMES OF INDIA, 22 JUNE 2026

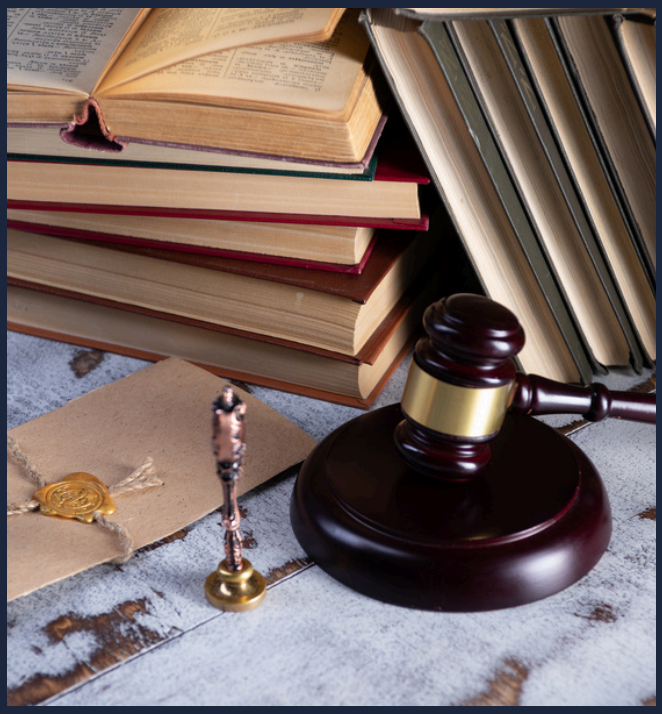
WORLD NEWS

China targeting half of power from non-fossil sources by 2030

China is aiming for half of its electricity to come from non-fossil sources by 2030, up from a 42.3% target for 2025, in a new five-year plan for the energy sector. Analysts said the plan's renewable energy targets were conservative relative to the sector's recent growth trajectory, suggesting actual renewable deployment may outpace the official goals. Here are other key points from the plan, which was released on Thursday:

- 30% of China's power generation will come from wind and solar alone by 2030, according to the plan, up from 22% in 2025. Given that target, "emissions from the power sector might still increase during 2026-2030, particularly given that growth in electricity consumption exceeding 5% is likely to become the norm over the next five years," said Greenpeace East Asia policy advisor Yao Zhe. However, the target is still consistent with China's goal to peak carbon emissions by 2030, Yao said.
- Wind and solar will exceed 50% of installed capacity by 2030, or 2,700 gigawatts (GW), up from 47% at end-2025.
- Both the world's largest builder of renewable energy and the biggest carbon emitter, China set a binding goal to cut power-sector carbon emissions intensity by more than 10% over the five-year period. Carbon intensity measures emissions per unit of output.
- China aims to expand non-pumped hydro energy storage to 300 gigawatts by 2030, up from a previously targeted 180 GW by 2027.

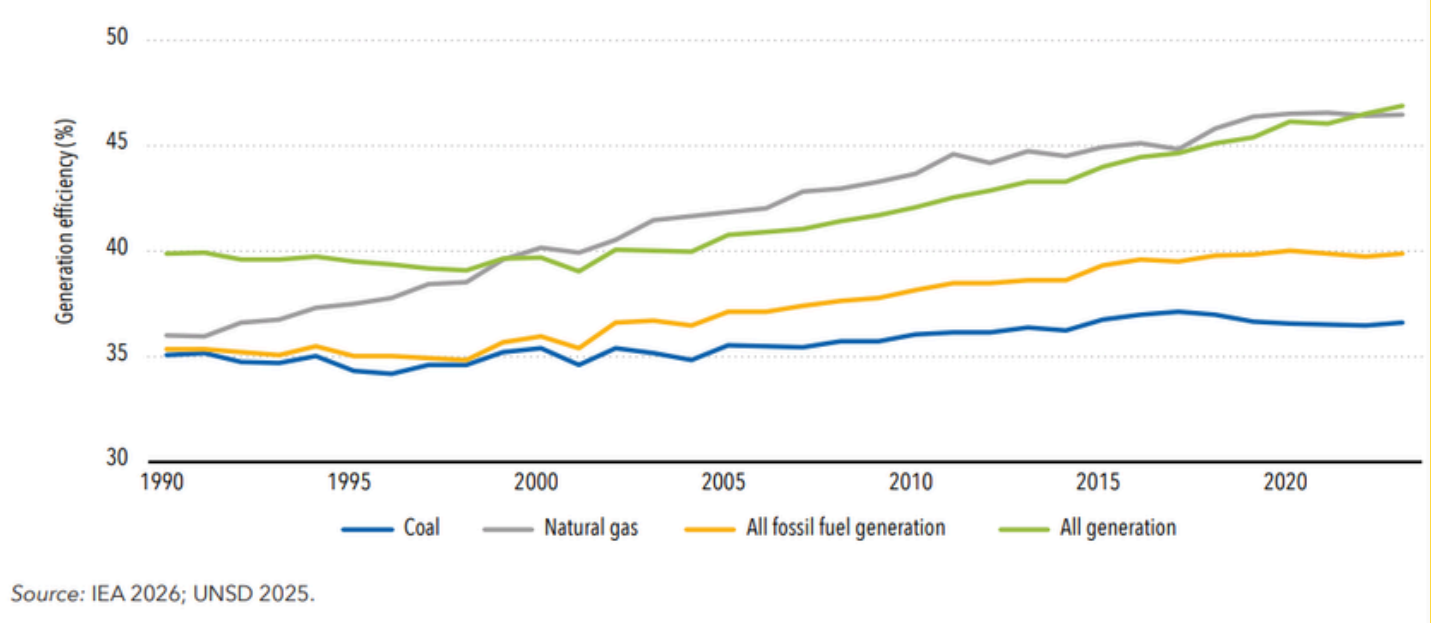
SOURCE: REUTERS, 25 JUNE 2026



PUBLICATIONS

- **Tracking SDG7: The Energy Progress Report, 2026, IEA**
- **Energy Transition Index 2026, World Economic Forum**
- **Southeast Asia Energy Outlook 2026, IEA**
- **Global trade update (June 2026): The shifting dynamics of critical minerals trade, UNCTAD**

GLOBAL ELECTRICITY GENERATION EFFICIENCY, BY FUEL TYPE AND OVERALL EFFICIENCY, 1990-2023



Source: IEA 2026; UNSD 2025.

SOURCE: IEA

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