LeapFrog Investments



The Transition Ledger 2027

From Green Solutions to Climate Deployment



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The market will keep growing for solutions that deliver reliable clean power, and for services that cushion the impact of climate and geopolitical shocks.

Foreword



Dominic Barton,
Non-Executive
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A year ago, LeapFrog Investments published its first Transition Ledger, which explored the climate and energy transition now unfolding at unprecedented speed. Emerging markets across India, Southeast Asia and Africa are increasingly at the centre of the story, as their growing populations and economies significantly drive up energy demand.

The energy transition challenge has evolved from **proving** that clean technologies are effective and cost-competitive, to **deploying them at the speed and scale** these markets need. Investors face practical questions about how to integrate clean energy technologies into existing systems, how to finance the build-out and where value will be created and captured. There is also the rare opportunity for fast-growing emerging markets to build modern energy systems without replicating the very costly infrastructure and technologies of the past.

In the essays that follow, leaders from the investment profession, industry, think tanks and academia examine the forces shaping this investment landscape:

- **Nakul Zaveri** makes the case that the financiers, contracts, standards and service networks that oil and gas had a century to develop must now be assembled in a much more compressed transition timeline. This changes how investors underwrite risk, returns and holding periods.
- **Kingsmill Bond** challenges the assumption that emerging markets must first become wealthy before they electrify. He expects the businesses that can connect cheap power to demand through grids, storage and smart controls to capture a disproportionate share of the value.
- **Sumant Sinha** shows that clean energy is also a matter of energy security. He describes how, as the cost of renewable power falls and geopolitical tensions rise, countries that generate renewable power at home will be better protected against global shocks.
- **Dr Radhika Khosla** examines how excess heat in emerging markets creates challenges on several fronts, from failing cold chains and lost productivity to overloaded grids and rising household bills. She sees opportunities at the intersection of energy, food and agriculture, the built environment and mobility.
- **Lisa Sachs** makes the case that protecting people and businesses from floods, storms, heat and drought can become one of the defining investment opportunities of the coming decade. Some products already pay for themselves by avoiding losses, but where many people benefit and it is unclear who should bear the cost, governments play a critical role in creating the market.
- **Joan M. Larrea** explains why emerging-market energy transition businesses struggle to raise finance they can afford, on terms their cash flows allow. She sets out how blended finance, which uses public and philanthropic money to share risk, can crowd in private investors at scale.
- Finally, **Souleymane Ba** draws the threads together into LeapFrog's thesis: clean energy now wins on cost competitiveness and security of supply, and the next decade's work is to build the businesses that turn cheap clean technology into everyday infrastructure, benefiting the customer, the company and the planet.

I expect the shift to clean energy to accelerate much further in the coming decade, as electricity demand surges with the mass electrification of transport and the rapid expansion of artificial intelligence, as well as due to the increasingly frequent extreme climate events and increased geopolitical conflicts.

The market will keep growing for solutions that deliver reliable clean power, and for services that cushion the impact of climate and geopolitical shocks on households and businesses. Those who build these solutions early will be well placed to create outsized value for their investors. Those businesses will also provide the communities they serve with a cleaner, more resilient pathway to prosperity.



Dominic Barton
Non-Executive Chairman, LeapFrog Investments



1

The Compressed Transition: A Century's Work in a Generation





Nakul Zaveri, Partner and Global Co-Head, Climate Investment Strategy, LeapFrog Investments

The 2026 edition of The Transition Ledger made the case that the energy transition cannot be delivered without emerging markets, and that across these markets clean technology increasingly carries a green discount, not a green premium.[1] This edition asks a harder question: how fast? Oil and gas had the better part of a century to build their technology and everything around it. The clean-energy economy is being asked to achieve in a single generation what traditional energy systems took decades to build. This compression defines the transition and creates significant opportunities for investors.

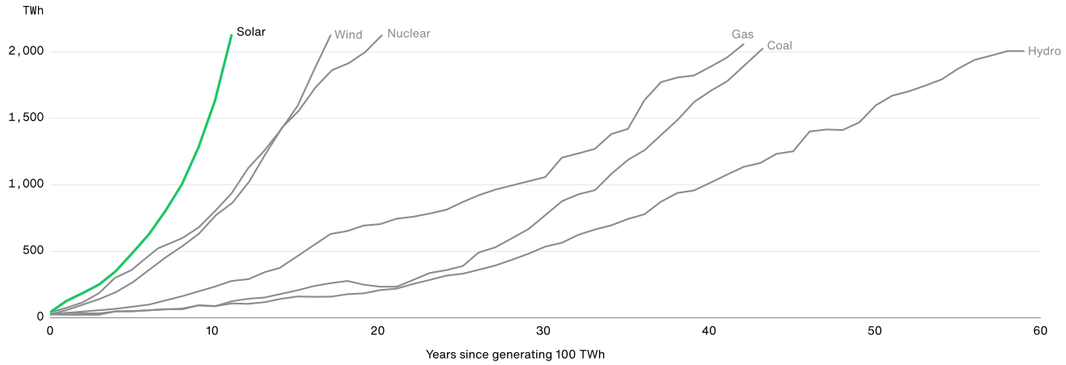
A century's work, compressed into a generation

Every energy system is more than its technology. Oil did not win on chemistry alone. It took decades to build the scaffolding around it: financing models that turned reserves into bankable assets, contracts that allocated risk between states and companies, courts that tested those contracts, safety regimes written in the aftermath of disasters, standards and taxonomies that let markets price it, and consumer habits that made the petrol pump unremarkable.

Oil took roughly 50 years from its first commercial wells to supply a tenth of the world's primary energy, and another 30 to reach a quarter; natural gas took more than 70 years to climb from 1% to 20%.[2] The institutions arrived in layers, each a response to the last problem. The break-up of Standard Oil in 1911 reshaped the industry's structure. The American Petroleum Institute, founded in 1919, began codifying common standards. The first commercial LNG cargo sailed only in 1964, and the production-sharing contract, now a staple of host-government deals, emerged in Indonesia in 1966. The modern offshore safety-case regime followed the Piper Alpha disaster of 1988. Each layer took years, often decades, and capital markets had time to learn alongside it.

The clean-energy economy has no such luxury. It is building the hardware and the institutions at the same time. Solar generated about 1% of the world's electricity in 2015; by 2025 it supplied around 9%, after a record 30% jump in output in a single year. That same year, renewables overtook coal as the world's largest source of electricity for the first time in a century.[3] Between 2015 and 2024, the world added around 2,600 GW of renewable capacity against roughly 640 GW of fossil-fuel capacity: four to one.[4]

It took 8 years for solar to go from 100 TWh to 1,000 TWh of power, and then just 3 years to pass 2,000 TWh



Global electricity generation per source, by years since passing 100 TWh. Source: Ember

1 LeapFrog Investments, The Transition Ledger 2026.
2 Smil, V. (2010), Energy Transitions: History, Requirements, Prospects, Praeger.
3 Ember, Global Electricity Review 2026.
4 United Nations (2025), Seizing the Moment of Opportunity: Supercharging the New Energy Era of Renewables, Efficiency and Electrification.

India shows what compression looks like on the ground. Installed solar capacity rose from 2.8 GW in 2014 to more than 162 GW by mid-2026, a 57-fold increase in twelve years.[5] In India, electric vehicles now account for 61% of three-wheeler sales.[6] And the rules are being stress-tested in real time. When the Indian state of Andhra Pradesh moved in 2019 to reopen tariffs on signed solar and wind contracts, the courts settled the question within three years, ruling in 2022 that competitively bid tariffs could not be unwound.[7] When electric-scooter fires made headlines in April 2022, revised battery-safety standards were issued within five months.[8] What took oil and gas decades of litigation and regulation is being worked out in a few years.

Why this transition runs on a different clock: forces that set the pace

The carbon budget sets a deadline. Earlier transitions were pulled by economics alone. This one is also pushed by a finite emissions budget, so governments, companies and investors must scale solutions faster than infrastructure, regulation and commercial models would naturally mature.

It must replace, not just add. Coal, oil and gas largely piled on top of the fuels before them. This time, emissions must fall while demand rises. In 2025, global energy demand grew by 1.3% and electricity demand by around 3%, yet energy-related CO_2 emissions still hit a record high.[9] The tension is sharpest in emerging markets, where reliable, affordable power is still far from universal.

The whole system must move together. Swapping one fuel for another is the easy part. Solar is worth little without grids to carry it; electric vehicles stall without charging or swapping networks; industrial electrification needs reliable power and the right equipment. Generation, grids, storage, mobility and supply chains must scale in step.

Meanwhile, the economics have already flipped. Between 2010 and 2025, the cost of electricity from utility-scale solar fell by 89% and the installed cost of utility-scale battery storage by around 95%, including a drop of close to 30% in 2025 alone. That year, more than 90% of newly commissioned utility-scale renewable capacity undercut the cheapest new fossil-fuel option.[10] Because renewables burn no fuel, they are also a hedge: they avoided an estimated US$480B of fossil-fuel costs in 2025, and that hedge grew more valuable when conflict in the Middle East pushed up fuel prices in early 2026.[11] This is the green discount at work. But cheap hardware does not deploy itself.

The bottleneck has moved. It is no longer the technology; it is everything around it: the finance, distribution, contracts, service networks and operating know-how. That is precisely where growth equity earns its return.

The LeapFrog lens: investing in the ecosystem

This is the heart of the LeapFrog Climate Investment Strategy thesis. We call it the “green leap”. Emerging markets do not need to rebuild the full fossil-era stack before they electrify. Just as mobile phones bypassed the copper landline and digital payments bypassed the bank branch, an e-rickshaw driver in Uttar Pradesh or a factory in Gujarat can move straight to solar, storage and electric mobility. But every leap needs a landing. The businesses that win are those that build the missing ecosystem of finance, distribution, service and standards around technology that is already cheap enough.

5 Ministry of New and Renewable Energy, reported in Bioenergy Times (2026), India's solar capacity surges nearly 57-fold to 162.15 GW since 2014.
6 Autocar Professional (2026).
7 AZB & Partners.
8 Business Standard.
9 IEA, Global Energy Review 2026.
10 IRENA, Renewable Power Generation Costs in 2025.
11 Ibid.

Battery Smart is a case in point. Founded in 2019, it has built a network of more than 1,500 swapping stations across more than 80 Indian cities, serving close to 100,000 commercial electric-vehicle drivers.[12] Its edge is not just the battery, but everything around it: a franchise model that runs most of its stations, the density and uptime of the network, and pay-per-swap pricing that removes the largest upfront cost for drivers. In effect, it compresses the fuel station, the fuel retailer and the vehicle financier into a single, asset-light platform.

We look for businesses at these chokepoints across four key sectors - energy, electric mobility, food and agriculture, and the built environment. Each is tested through three lenses: a credible climate thesis, company quality, and a deal construct built for a compressed timeline.

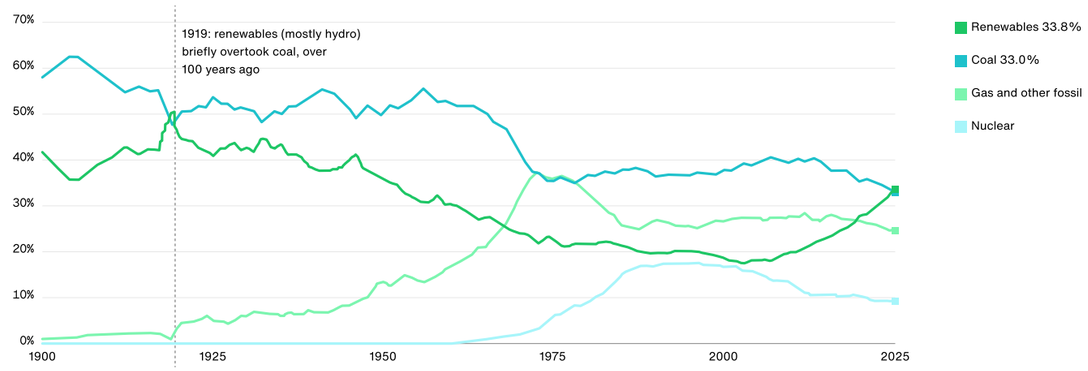
What compression changes for investors: five shifts stand out

Technology risk arrives sooner. Cost curves this steep cut both ways. The same declines that make a business viable can strand an incumbent technology, asset or model within a single holding period. We underwrite not only whether a technology works today, but where it will sit on the cost curve at exit, especially for capital-intensive, long-lived assets.

Policy is an underwriting variable, not a backdrop. Targets, subsidies, tariffs and procurement rules can make a market; reversals or weak implementation can break one. We favour businesses whose customers would buy on economics alone, with policy as a tailwind rather than a lifeline. In emerging markets, the consistency of policy and who carries regulatory risk matter as much as the policy itself.

Capital must be matched, not just mobilised. In 2023, emerging and developing economies outside China received around 15% of global clean-energy investment, despite accounting for about a third of global GDP and two-thirds of the world’s population.[13] Their cost of capital for utility-scale solar can be more than twice that of advanced economies.[14] Increasingly, where a project is built matters more than what is built: IRENA estimates that country-level conditions explain around 2.3 times as much of the variation in financing costs as technology.[15] The task is to match capital to each opportunity’s risk, duration and cash-flow profile, using blended and catalytic structures to clear specific barriers while ensuring the underlying business stands on commercial terms.

Renewables have surpassed global coal power for the first time in over 100 years



Share of global electricity generation (%). Source: Ember

12 YourStory (2026).
13 IEA (2024), Reducing the Cost of Capital.
14 Ibid.
15 IRENA, Renewable Power Generation Costs in 2025.

Operating capability is the moat. Distribution, skilled teams, supply chains, customer acquisition, installation and after-sales service are where compressed markets break down, and where active owners earn their returns. Helping companies professionalise operations, deepen management and expand into new markets is the core of how we create value.

Exits must be designed in from day one. Building infrastructure or scaling a new model can outrun a fund's horizon, and shifts in technology, policy or capital markets can close exit routes before a business matures. Entry valuation, capital expenditure, follow-on funding and exit route must be planned together. Growth alone will not secure an exit; buyers pay for scale, profitability and a track record.

Where compression bites hardest

These pressures are most acute in emerging markets, where demand is rising fastest and starting points differ most. South and Southeast Asia must expand grids and storage, improve reliability and absorb growing shares of renewables while industrialising. Across Sub-Saharan Africa, the transition is also about access: around 600 million people still lack electricity, some 80% of them in rural areas.[16]

Infrastructure gaps, thin purchasing power and high financing costs can hold back even commercially viable technologies. They also define where the opportunity lies: distributed energy, storage, charging and swapping, efficiency and customer finance. None of this is automatic. Models proven in Europe or California rarely transplant unchanged; local policy, infrastructure, customer economics and access to finance decide what scales. That is why we back grounded innovation: solutions built for the markets they serve.

Building the foundations

Compression is a risk for capital that waits and an opportunity for capital that builds. Oil and gas had a century to develop their financiers, contracts, standards and service networks. The clean-energy economy is assembling all of them at once, and in emerging markets much of that architecture has yet to be built. The businesses that supply it, making clean technology financeable, distributable, serviceable and trusted, are where we see the most durable value.

For LeapFrog, the priority is clear: back the companies that turn cheap clean technology into everyday infrastructure for emerging consumers and businesses, underwrite them with discipline, and help them scale with hands-on support.

The transition will not wait for capital to get comfortable. The investors who move now, with discipline, will shape how it is built.

Compression is a risk for capital that waits and an opportunity for capital that builds.

16 IEA (2025), Financing Electricity Access in Africa.



2

The Deployment Shift:

Infrastructure for the New Economy





Kingsmill Bond,
Energy Strategist,
Ember

There are two conventional ways of looking at the energy transition. One says the old energy system is too difficult to change, so fossil fuels will remain dominant. The other sees a climate problem so large that we must fundamentally constrain how economies grow. I would suggest there is a third way of seeing it: build the new energy system, make it cheaper and better, and allow it to push out the old.

This is already happening. Solar panels, batteries and electric vehicles are becoming cheaper with every doubling of deployment. Their costs typically fall by 10% to 20% each time. They are not just competing with fossil fuels on emissions. Increasingly, they are winning on economics.

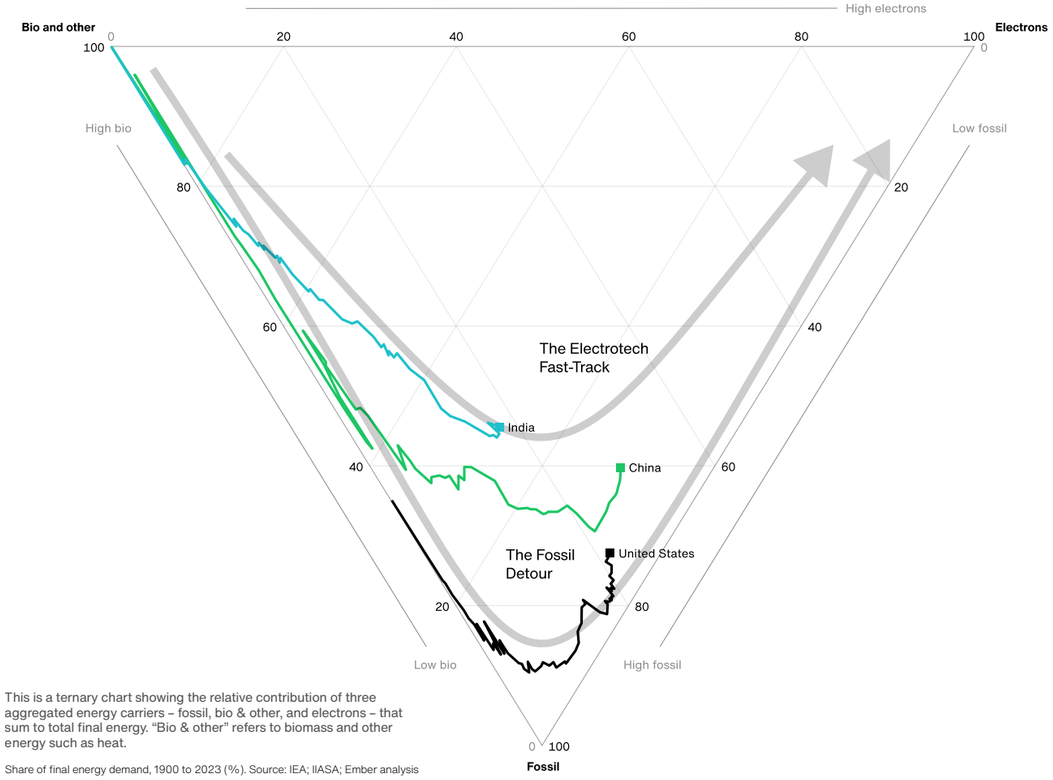
For emerging markets, this creates an extraordinary opportunity. The great weakness of many of these economies has been that they simply do not have enough affordable, reliable energy. Now they have access to technologies that can provide it without following the fossil-fuel-intensive path taken by industrialised economies.

The transition has two parts. We must decarbonise electricity, and we must electrify everything we can. Both need to happen together. But the investment opportunity is not limited to the generation of clean power. In the middle, connecting supply and demand, is a rapidly growing set of technologies that may prove just as important.

We often view the energy transition through the experience of Europe and North America. That can lead us to mistake local constraints for global ones.

The UK's solar experience is not representative of global conditions. Most of the world's population lives at considerably lower latitudes, where abundant sunshine creates a more favourable starting point for solar power.

India is taking the electrotech fast-track, bypassing the fossil detour taken by the West and China



This is a ternary chart showing the relative contribution of three aggregated energy carriers – fossil, bio & other, and electrons – that sum to total final energy. “Bio & other” refers to biomass and other energy such as heat.

Share of final energy demand, 1900 to 2023 (%). Source: IEA; IIASA; Ember analysis

Combine cheap solar with increasingly affordable batteries, and the proposition changes substantially. In our analysis, solar, storage and backup generation can already deliver around-the-clock electricity for less than US$100 per megawatt-hour across most of the world.

This matters because emerging markets do not need to repeat the development sequence followed by richer economies. Historically, countries moved from traditional biomass to coal, then oil and gas, and eventually to widespread electrification. Today, they can move directly from biomass to electricity, bypassing part of that fossil-fuel detour. That means that fossil-fuel demand peaks far earlier; US oil demand peaked in the 1970s at 31 barrels per person a year, while Chinese oil demand is peaking today at less than 5 barrels per person a year.

The evidence is already visible in electrification. Southeast Asia overtook Europe in the electrification of final energy demand in 2024, reaching 23%. Many emerging Asian markets are ahead of the US in electrification, and our calculations suggest that three-quarters of emerging markets are ahead of the US for electric vehicles as a share of sales. India is rapidly catching up with the UK in end-use electrification (19% v 21% in 2024) despite having a fraction of its GDP per capita.

Together, these shifts challenge the assumption that emerging markets must first become wealthy before they can adopt more advanced energy technologies. In many cases, cheaper technology is allowing them to move directly to a better solution.

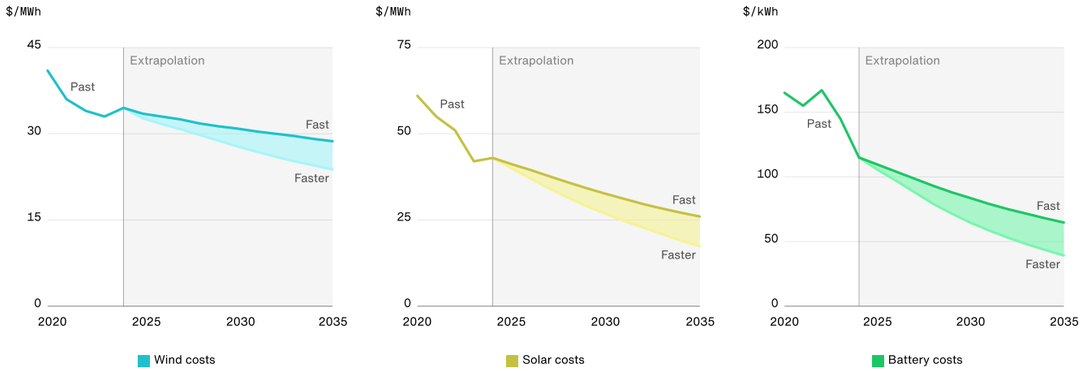
The same pattern is visible in distributed energy. You do not always need a multibillion-dollar power plant and a large transmission network before a household can begin to access more energy. A family can buy a small solar panel, then another, then a battery, an efficient light and an electric scooter. It is a development ladder, with each step improving the services that energy can provide.

This is particularly important in markets where infrastructure is limited and customers need practical solutions now, rather than after a decade of construction. The opportunity is to make energy more accessible, productive and affordable, one installation and one customer at a time.

Security is accelerating the shift

Security is often a more visceral driver of change than climate. Many emerging markets are net importers of fossil fuels. Asia, for example, has only around 5% of the world's oil and gas reserves but accounts for over half of the world's population. That leaves economies exposed to international prices, supply disruptions and the cost of paying for imported energy.

Learning curves will continue to push electrotech costs down



Wind, solar and battery costs, 2020 to 2035. Source: IRENA; BNEF; Ember

The disruption around the Strait of Hormuz illustrates the point. In March 2026, the first full month of the crisis, Chinese solar exports to Africa nearly tripled from February to a record 10 GW, while sales of Chinese electric vehicles and batteries rose sharply. These are early indicators, but they show how quickly energy-security concerns can translate into demand for alternative technologies.

The opportunity is particularly compelling because emerging markets have abundant renewable resources, even where they lack domestic oil and gas. In Africa and South America, renewable resources are enormous relative to current energy demand. Cheap technology can turn that natural endowment into a source of domestic energy, rather than leaving economies dependent on imported fuels.

Africa is a striking example. We estimate that the continent will deploy around 17 GW of solar in 2026, a 45% increase on the previous year. The reported capacity figures do not capture the full picture. Official statistics can lag the physical deployment of equipment, particularly when smaller distributed systems are involved.

This is an important distinction for investors. The transition is moving faster than the conventional datasets suggest. A lack of recorded capacity is not necessarily evidence of a lack of deployment.

There is also a potential macroeconomic consequence. If countries can replace a meaningful share of fossil fuel imports with domestically generated electricity, their import bills will fall. That supports stronger external balances and, over time, currency appreciation. The benefits extend beyond the energy sector to consumers, businesses and financial institutions across the wider economy.

The transition will be locally bumpy, but globally smooth. Individual markets will face policy reversals, infrastructure constraints and financing challenges. These are real barriers, but we should distinguish temporary bottlenecks from permanent limits to change. As costs continue to fall, the economics will keep opening new markets and applications.

The missing middle: where the system connects

Cheap generation is only one part of the story. Electricity must be delivered when and where it is needed, and increasingly it must serve transport, buildings and industry that previously relied on fossil fuels.

This is where grids, storage and flexibility become central. Battery storage is doubling in deployment roughly every 18 months. Batteries can shift solar power into the evening, provide backup and help balance supply and demand. Transmission, including high-voltage direct-current lines, can move electricity across regions. Digital technologies can coordinate distributed generation, batteries, vehicles and electricity-consuming devices.

I think of this as the smart-electron opportunity. Electricity does not have the inherent storage characteristics of fuels such as oil and gas. Information changes what it can do. With smart controls and artificial intelligence (AI), millions of supply devices can be coordinated with millions of demand devices at the same time. AI adds to electricity demand, but it can also help make the electricity system more efficient and more flexible.

The growth of data centres is already forcing companies and utilities to think differently about how quickly they can connect new demand, secure power and build infrastructure. That creates pressure, but it also accelerates investment in grids, flexibility and new ways of storing and using energy. The same technologies can benefit industrial users, commercial buildings and households.

The investment point is that these technologies work best as a system. Solar becomes more useful when paired with storage. Batteries become more valuable when they can respond to price signals and grid conditions. Electric vehicles create new demand, but can also become part of a more flexible energy system. Digital tools help connect these pieces.

Making solar panels is an important part of the transition, but it is not the whole story. Companies that focus on the connections between supply and demand are likely to capture a disproportionate share of the value.

Invest in the connections

The history of cleantech offers a familiar lesson. A promising technology does not automatically make a successful business. Products still need to solve an urgent customer problem and compete on cost, quality and reliability. Where a technology is not yet commercially competitive, the investment case must be clear about the role of policy, financing and bankable demand.

For investors, this means looking beyond the obvious hardware. Commodity equipment can be difficult to differentiate as manufacturing scales and prices fall. More attractive opportunities may emerge in businesses that integrate technologies, finance equipment, manage energy assets, provide reliable services or build new business models around cheap electricity and storage.

The internet offers a useful analogy. While there was value in the core technology, many of the most important opportunities came from the businesses and services it enabled. The same could happen with electrotech. Cheaper batteries, for example, become much more powerful with a commercially viable model for swapping them, financing them or making them accessible to customers who cannot afford a large upfront purchase.

For emerging markets, these business models must be adapted to local realities. Customers may face unreliable grids, limited access to finance or highly variable incomes. Solving those constraints is not peripheral to deployment. It is what makes deployment possible.

The central investment task is therefore to identify the technologies with structural tailwinds, the bottlenecks that constrain their adoption, and the companies capable of removing those bottlenecks. As energy and digital technologies become cheaper together, the range of commercially viable applications will continue to expand.

The opportunity is bigger than replacing fossil-fuel generation. It is to build an energy system that supports more economic activity, improves energy security and allows emerging markets to develop along a different path. The generation technologies are becoming cheaper. The next question is how effectively we connect them, store their output and put the electricity to work.

That is where I would look for the next wave of growth, and where I believe the most exciting investment opportunities can be found.

Source: Ember analysis based on IEA World Energy Balances, the Energy Institute Statistical Review of World Energy, BNEF, IRENA, UN population data and Chinese customs data.

The transition will be locally bumpy, but globally smooth.



3

Energy Security:

Energy Transition Becomes Strategic





Sumant Sinha, Founder, Chairman and CEO of ReNew

The rationale for clean energy is expanding beyond decarbonisation. Energy security is becoming an increasingly important economic consideration as geopolitical shocks expose the vulnerabilities of concentrated energy supply chains. Increasingly, energy security and clean energy have become the same argument.

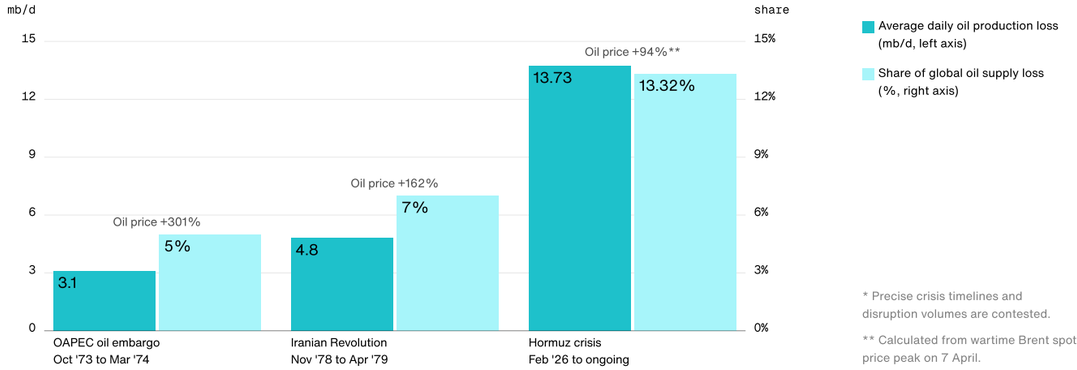
Successive geopolitical crises have highlighted the economic cost of relying heavily on a single external source of energy. Governments have responded by diversifying supply, increasing energy efficiency and accelerating renewable deployment. The lesson extends beyond individual regions: energy security depends on a diverse and resilient supply of energy, as well as having enough of it.

Disruptions to major energy-trade routes illustrate how quickly geopolitical risk can translate into price volatility and supply uncertainty, particularly for economies dependent on imported oil and gas. The 2026 closure of the Strait of Hormuz caused the largest oil-supply shock on record. Between March and August, Brent crude rose by as much as 94% and European gas prices by more than 100%. Around a third of global crude trade, a fifth of LNG trade and a third of fertiliser trade pass through the strait, and roughly 85% of its crude and LNG flows go to Asia. Only around 2.5 million barrels a day of the roughly 20 million disrupted could be rerouted, so the shock fed almost directly into prices.[17] Such shocks can raise import bills, increase pressure on public finances and businesses, and make reliable, affordable energy harder to secure.

There is, however, one crucial difference from earlier oil shocks. The global energy crisis of 1973 was followed by a decade of stagflation. Today, cost-competitive clean alternatives exist and can be deployed in months rather than decades. Governments have moved accordingly; South Korea raised its 2030 renewables target from 37 GW to 100 GW, and Indonesia announced a 100 GW solar programme. Around 50 countries set new highs for solar imports, including India (+141% year on year), Kenya (+207%) and Ethiopia (+391%).[18]

Energy security matters in developed and emerging markets alike. But the implications are particularly significant for emerging markets, where energy demand is still growing rapidly and the infrastructure needed to meet it is still being built. Emerging and developing economies accounted for around 80% of global electricity-demand growth in 2025 and are expected to maintain that share over the next five years.[19, 20]

Crude oil disruption by crisis



Average daily oil production loss and share of global oil supply loss. mb/d = Million barrels per day
Source: IEA: EIA: Verrastro/Caruso: WEF: German Economic Institute. Köln

17 Energy Transitions Commission (2026), Lessons on Energy Security after the Hormuz Crisis.
18 Ibid.
19 Note: 'Emerging and developing economies' (EMDEs) refers to the IEA classification used in its electricity-demand analysis, which includes China.
20 IEA, Electricity 2026.

For these markets, the challenge is twofold: reducing exposure to imported energy while expanding reliable, affordable power to support industrialisation, electrification and rising consumption. India, for instance, still imports around 35-40% of its primary energy.[21]

The structural shift is therefore broader than replacing existing fossil-fuel capacity with cleaner alternatives. This changes the investment question from which energy sources will grow to which businesses can deliver reliable, affordable power and build the supply chains needed to support it.

From energy dependence to supply-side transformation

Renewables, distributed generation, storage and energy efficiency can diversify the sources of power available to an economy and reduce exposure to external energy shocks. Unlike fossil-fuel generation, solar and wind power do not require a continuous supply of fuel, reducing exposure to international fuel markets and shipping disruptions once the systems are installed. A barrel of oil is burnt once; a solar panel generates power for 25 years. Storage can make intermittent generation more useful; distributed generation can reduce pressure on centralised grids; and efficiency can reduce the amount of energy the economy needs in the first place. Cost is also becoming less of a barrier. Solar module prices have declined by approximately 90% since 2010, fundamentally improving the economics of solar power. The shift is now extending beyond standalone generation. In Abu Dhabi, a 5.2 GW solar PV and 19 GWh battery storage project is being developed to deliver 1 GW of uninterrupted renewable power, demonstrating the growing potential of combining solar generation with storage to provide round-the-clock electricity.[22]

Emerging markets illustrate the scale of the supply-side transformation underway: energy systems are being reshaped to meet rising demand with a more diversified mix of domestic and low-emission energy. In Southeast Asia, for example, renewable capacity is projected to nearly triple by 2035 under current policies.[23] Vietnam has raised its renewable-energy ambitions, with its revised power development plan targeting renewables excluding hydropower at around 28-36% of electricity generation by 2030.[24] Indonesia's B40 biodiesel mandate, meanwhile, helped reduce diesel imports by around 3.3 million kilolitres in 2025 compared with the previous year, reinforcing the role of domestic biofuels in the country's energy-security strategy.[25]

In India, even as electricity demand is expected to grow by around 6.4% a year through 2030, more than 300 GW of non-fossil power capacity has already been installed against the target of 500 GW by 2030.[26, 27, 28] At the same time, India's battery energy storage requirements are projected to reach 236 GWh by 2031-32, as the country expands renewable generation and seeks to improve grid reliability.[29] The economics are increasingly compelling. A recent auction for solar with six hours of battery storage cleared at ₹3.12/kWh, around half the cost of new coal power. In 2025, growth in renewables displaced coal generation for the first time in more than five decades. In February 2026, a record-low green-hydrogen bid of around US$3/kg came in at less than half the cost in Europe.[30]

In Africa, the starting point is different. Around 600 million people in Sub-Saharan Africa still lack access to electricity, representing the vast majority of the global access gap.[31]

21 IEA, India Energy Outlook 2021: Implications for India and the World.
22 Energy Transitions Commission, Energy Transition Monitor 2026.
23 IEA, Southeast Asia Energy Outlook 2026.
24 Government of Viet Nam (2025), Gov't approves amendments to 8th National Power Development Plan.
25 Petromindo, B40 biodiesel consumption exceeds target in 2025, cuts diesel imports.
26 IEA, Electricity 2026.
27 Ministry of New and Renewable Energy, Government of India (2026), Physical Progress: installed renewable capacity.
28 Press Information Bureau, Government of India (2026), Press release on progress towards the 500 GW non-fossil capacity target.
29 Press Information Bureau, Government of India, Press release on India's projected energy storage requirement (236 GWh by 2031-32).
30 Energy Transitions Commission, Energy Transition Monitor 2026.
31 IEA (2025), Financing Electricity Access in Africa.

Falling technology costs are allowing solar and other distributed solutions to expand rapidly: solar-panel imports into Africa rose by 48% in 2025.[32] This creates an opportunity to expand energy access while building a less carbon-intensive energy system. Storage is emerging as another part of this shift: Africa's battery energy storage systems (BESS) capacity could grow by up to 700% between 2025 and 2030, as storage helps integrate renewables, stabilise grids and extend reliable power to off-grid communities and industrial users.[33]

These shifts point to a broader transformation of energy systems: meeting growing demand while diversifying supply, making better use of domestic resources and improving the reliability and affordability of power.

Where supply-side transformation becomes a business

The transformation creates opportunities for private capital. As the supply side changes, businesses can capture value by making cleaner sources of energy cheaper, more commercially viable and better suited to the needs of customers.

Five areas are particularly relevant:

- Low-emission power generation: falling technology costs are making renewable power increasingly competitive, creating opportunities to scale generation in markets where energy demand is growing rapidly.
- Energy storage: batteries and other storage technologies can increase the usefulness of renewable generation and help customers manage fluctuations in supply and demand.
- Sustainable biofuels: where direct electrification remains difficult, sustainably produced fuels can provide an alternative to imported fossil fuels, particularly in transport and industry.
- Waste-to-energy: converting agricultural, municipal and industrial waste into useful energy can create domestic energy supply while addressing waste-management challenges.
- Energy efficiency: businesses that reduce energy consumption can create value through lower customer costs while reducing exposure to energy-price volatility.

Capital is already moving. Global energy investment reached a record US$3.3T in 2025, of which US$2.2T went to clean technologies, twice the amount directed to oil, gas and coal.[34] The underlying capital requirement, however, is large. The IEA estimates that emerging and developing economies outside China will require around US$1.4-1.9T of annual clean-energy investment by the early 2030s. Around 60% of this will need to come from private sources – implying US$0.9-1.1T of annual private-sector financing, up from US$135B in 2022.[35] The scale of the private financing requirement points to a growing market for businesses that can commercialise and scale supply-side solutions.

These opportunities sit within the energy system itself. But the transition also depends on the materials, processing capabilities and manufacturing capacity required to build it. As these supply chains become strategically important, they create a distinct set of investment opportunities upstream.

The overarching investment case for clean energy is also evolving. Falling technology costs have made it increasingly competitive, while geopolitical shocks add a further source of value: reduced exposure to imported fuels and external price volatility.

32 Ember, Global Electricity Review 2026.
33 Watson Farley & Williams (2026), Betting on battery storage: Africa's growing BESS market (citing Rho Motion).
34 IEA, World Energy Investment 2025.
35 IEA (2023), Scaling up Private Finance for Clean Energy in Emerging and Developing Economies.

The green discount meets geopolitics

The “green discount” becomes particularly compelling in this context: clean energy is cheaper and cleaner and it also reduces exposure to imported fuels and external price shocks.

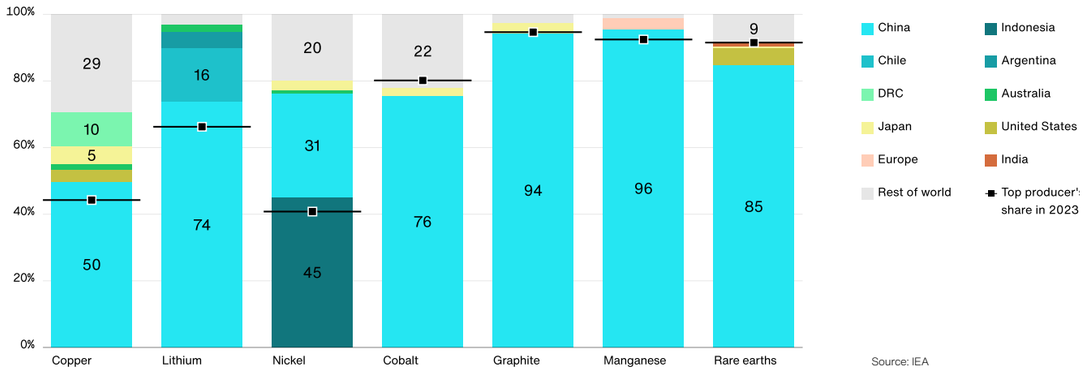
Phenomenal World puts this dynamic in stark economic terms. Around 75% of the world’s population lives in net fossil-fuel-importing countries, which collectively spend around US$1.7T a year on fossil-fuel imports. Its analysis argues that electrification can increasingly act as a form of geopolitical insurance: countries can substitute domestically generated electricity for imported fuels and reduce their exposure to global energy markets.[36]

For emerging markets, replacing imported fuels with domestic electricity can reduce the economic leakage associated with fuel imports while meeting growing energy demand. Unlike oil and gas, whose prices are set in global markets, renewable electricity is priced at home and gets cheaper with scale. The more of an economy that can be powered by domestic renewable resources, the less exposed it becomes to international fuel markets and the geopolitical shocks that can disrupt them. This is why electrification is moving to the centre of the agenda. The COP31 Presidency has proposed that electricity should provide 35% of global final energy use by 2035.[37] In India, electricity still accounts for only around a fifth of final energy use, which leaves considerable room to replace imported fuels with domestic power.[38] The green discount has become more than a cost story: clean energy can combine lower operating costs and emissions with greater diversification and energy security.

ReNew Green’s C&I platform provides a useful example. The platform connects businesses with renewable energy that is reliable and affordable, supporting industrial decarbonisation while addressing a fundamental commercial need for competitive power. The proposition reflects the evolution of the green discount.

There is, however, a further consideration. Moving away from imported fuels shifts some supply-chain risk towards the critical minerals, components and manufacturing capacity needed to build clean-energy systems. Supply remains concentrated: the average share of the top refining country across key energy minerals reached 72% in 2025, excluding rare earths, with Indonesia dominant in nickel and China in most other key energy minerals.[39] The concentration extends to manufacturing. China supplies more than 80% of global renewable-energy equipment, more than 90% of polysilicon and wafers, and around 60% of global electrolyser manufacturing capacity.[40]

Share of top refining countries for key energy minerals



36 Phenomenal World (2026), Dawn of the Electric World Order.
37 UNFCCC (2026).
38 Ember, Indian States' Electricity Transition 2026.
39 IEA, Global Critical Minerals Outlook 2026.
40 CSIS (2026), China's Solar Industry Is in Upheaval – The Effects Will Be Global; Hydrogen Council, Global Hydrogen Compass 2026.

This is not the same kind of dependence as imported oil. Once installed, the equipment generates power for decades, and low-cost Chinese manufacturing has helped make the transition affordable worldwide. The sensible goal is therefore not self-sufficiency, which would raise costs and slow deployment. It is diversified, trusted and competitive supply chains that avoid swapping dependence on many fossil-fuel exporters for dependence on a few technology suppliers.

The question for investors is: how can supply chains underpinning the energy transition be diversified and scaled?

Critical minerals: building the supply chains of the energy transition

Critical minerals such as lithium, copper, graphite and rare earths underpin batteries, electricity networks, wind turbines and other technologies. As demand grows, investment opportunities extend beyond extraction to the businesses that process, recover and convert raw materials into industrial inputs. The opportunity lies in scaling commercially viable businesses that can serve this expanding demand.

Mining is only one part of the value chain. Refining, processing and component manufacturing require specialised technologies, skills and infrastructure, creating opportunities to develop capacity in underdeveloped segments. Private capital can help businesses expand production, improve efficiency and meet downstream customer requirements. Fragmented markets may also offer scope to consolidate smaller operators and build integrated platforms with greater scale and stronger competitive positions.

Recycling offers another avenue for investment. Recovering materials from end-of-life batteries, electronics and other products can create secondary sources of supply. However, commercial viability depends on reliable feedstock, collection infrastructure, recovery costs and demand for recycled materials. The opportunity is therefore strongest where proven processes and sound unit economics support a credible path to scale.

Rare earths highlight the opportunity to build out supply chains for critical materials. Essential to high-performance permanent magnets used in electric vehicles and wind turbines, they are the focus of efforts to develop alternative sources of supply. The IEA estimates that diversified magnet rare-earth supply chains would require around US$60B in investment over the next decade, from public and private sources.[41] This creates opportunities to scale specialist processors, recyclers and component manufacturers, with strategic customers or public-sector support potentially helping address capital intensity and market risk.

Securing the energy transition therefore requires diversifying energy supply as well as building more resilient supply chains for the materials and components on which it depends.

Energy security and clean energy have become the same argument.

41 IEA (2026), Rare Earth Elements: Pathways to Secure and Diversified Supply Chains.

4

A Systems Lens:

Investing at the Intersections





Dr Radhika Khosla, Professor of Environmental Science and Policy, University of Oxford

On a bad afternoon in Chennai or Lagos, the same few degrees of excess warmth arrive as several different problems at once. A transformer fails because demand for air conditioning peaks at the same hour. A clinic loses a refrigerator full of vaccines. A vegetable trader writes off a crate of supplies that did not survive the heat during the journey from the farm.

I have spent the past decade examining how cooling demand grows as cities in the Global South heat up, and governance often lies at the heart of this current and fast-growing global challenge. While solutions are mostly organised around energy, buildings, food, health and finance, each sitting in separate ministries, investment teams or chapters of a report, heat is indifferent to those boundaries. Rather than simply what sector a company is in, the more useful question is what service it delivers, who pays for it, and which constraints it removes, in coordination with whom.

Why cooling is a good test case

Extreme heat kills more than any other extreme weather event, yet it has been a blind spot in our sustainability and investment debates. In UNEP's Global Cooling Watch report, we found that global cooling capacity could more than triple between 2022 and 2050, from 22 to 68 TW. On a business-as-usual path, emissions from cooling rise from 4.1 to 7.2 Gt of CO_2e even with the efficiency gains and refrigerant phase-down already agreed under the Kigali Amendment.[42]

The same work also shows the pathways to achieving near-zero emissions cooling for all. A sustainable cooling pathway (with passive design, low-energy and hybrid equipment, energy efficient units, and a faster refrigerant transition) cuts emissions 64% below the business-as-usual level in 2050, and by 97% if the power system decarbonises at the same time. About two-thirds of that mitigation comes from measures that use little or no electricity: shading, insulation, cool roofs, ventilation, orientation. These are not exotic technologies. They pay back in two to eight years, and they can bring indoor temperatures down by half a degree to eight degrees.[43]

In India, which is on the cusp of exponential growth in cooling demand, only about 13% of households own an air conditioner.[44] Those units already account for something close to a quarter of national peak electricity demand, some 60 to 70 GW, and the country is adding 10 to 15 million new units a year, with perhaps 130 to 150 million more expected over the next decade.[45] The load is arriving well before the income does, and the peak is being set by households that cannot easily pay for the capacity required to serve them. That is what makes the transition of emerging markets a systems problem rather than a technology problem.

So, the interesting question for an investor is not whether India will need more cooling. It is which businesses can meet that demand without asking the grid, the household and the public budget to absorb a cost they cannot carry.

Three intersections worth underwriting

The first is cooling and the grid, and it is the one most easily mistaken for an equipment story. At the level of the system, the binding constraint is not annual energy but the peak. Efficiency is the cheapest capacity available: our modelling suggests the sustainable pathway avoids up to US$26T of grid investment to 2050, alongside US$17T in energy savings. Buildings designed to shed heat need less equipment in the first place, which is why the pathway reduces the projected stock of cooling equipment by 41%.[46]

42 UNEP, Global Cooling Watch 2025.
43 Ibid.
44 Bureau of Energy Efficiency and CLASP, Residential Energy Consumption Patterns and Appliance Ownership in India: Insights from a 2024 Household Survey.
45 India Energy & Climate Center, UC Berkeley (2026), Beating the Heat: How Air Conditioner Efficiency Standards Help India Avert Power Shortages and Cut Consumer Bills.
46 UNEP, Global Cooling Watch 2025.

The businesses that capture this value are rarely manufacturers but the ones that sell comfort as a service, finance an upgrade or retrofit out of the saving it produces, or aggregate thousands of small loads into something a utility can rely on.

There is also a systemic market failure here that capital has to be structured around. The person who chooses the air conditioner is often not the person who pays the electricity bill, and neither of them pays for the transformer. A landlord buys the cheapest unit, a tenant carries the running cost, and the utility absorbs the peak. Until a business model aligns those three, the cheapest outcome for the system will not be the one that gets bought.

The second intersection is food. Around 13% of the world's food is lost between harvest and retail, and much of that loss is a cooling failure.[47] A cold chain, though, is at least four businesses and they can fail for different reasons: the packhouse that cannot fill its room, the truck that runs back empty, the hub that is idle for half the year, the shop whose power is unreliable. The farmer cannot finance a cold store against a crop that will be sold in six weeks. The trader can, if the room stays full. This is why the models that work tend to sell cooling by the crate rather than by the tonne, and why the most investable cold chains are built around aggregation rather than around a single producer.

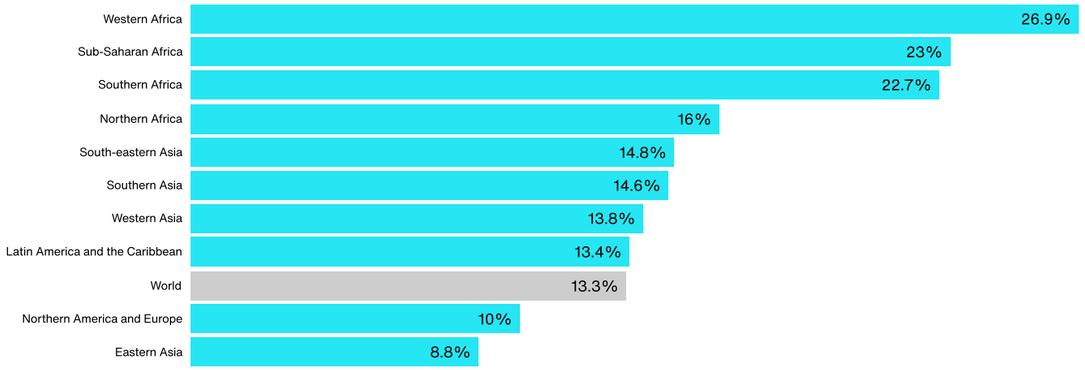
The third intersection is work. Heat is the deadliest of the climate hazards, and much of its economic cost appears as lost productivity rather than as damage to an asset, which makes it easy to miss in a thesis built around physical risk.

Electric two and three-wheelers illustrate how climate impact and commercial value can reinforce each other. For drivers, switching to electric mobility is fundamentally an economic decision: lower running costs can translate directly into higher daily earnings. Companies such as India's Battery Smart address key barriers to adoption. Battery Smart's model allows drivers to access energy on a pay-per-swap basis without buying the battery, and has facilitated over 125 million swaps across more than 1,500 stations. The company demonstrates how innovative business models can make cleaner mobility affordable while improving driver economics.

Where capital can contribute

To achieve scale, capital has to come in with the discipline of returns and be applied at the right level. Often, businesses that hold the customer relationship and the data that comes with it can price a service rather than an asset and improve the unit economics as they learn.

Share of Food Lost in Post-Harvest Processes by Region, 2023



Source: FAO (2025). Our World in Data: illustrative

47 FAO (2026), Reducing food loss and waste to protect forests and transform agrifood systems.

There is a huge need for growth capital by companies that are past product-market fit but short of the capital and capability to enter new regions, deepen distribution or add the services that scale. These are the businesses that both protect and prosper.

Protect	Prosper
Climate value: Lower emissions, cooler homes, less wasted food and more efficient use of power.	**Economic value:** Higher incomes, steadier work and services that households can afford to keep paying for.

The distinction forces a test that a sector lens does not. It is not enough to cut emissions if the service depends on a subsidy that will not survive; nor to raise incomes if the model cannot cover its own cost of capital. The strongest cases do both, and each side makes the other more durable. Cheaper cooling frees household income, which widens adoption, which lowers unit costs. A cold chain that cuts waste raises the value of a harvest, which pays for the storage.

The transition is usually described as a problem of supply, of building enough generation, fast enough, at a low enough cost. However, that description is incomplete. The constraint is increasingly the system around the supply: a building that overheats, an electricity grid that cannot carry peak demand, a harvest that does not reach a cold room, or a household that cannot finance an upgrade. Those constraints are where the market for the transition lies. The investors who do well over the next decade will be the ones who can see the system clearly enough to price it.

One harvest, four businesses

	1 **Farm gate** →	2 **Movement** →	3 **Storage hub** →	4 **Retail** ■
What it is	Packhouse and first mile chilling	Refrigerated transport	Cold store at the aggregation point	Last mile to the shop or consumer
Who pays	Paid by the trader or aggregator	Paid per trip, often rented	Paid by the hub operator	Paid at the point of sale

Exhibit: The cold chain is four businesses with four different payers, which is why a single asset rarely fixes it. Illustrative: post-harvest loss estimates from FAO (2026).

The useful question is not which sector a company sits in, but what service it delivers, who pays for it, and which constraint it removes.

5

Climate Impacts:

From Risk to Resilience





Lisa Sachs, Director, Columbia Center on Sustainable Investment, Columbia University

In August 2026, floods triggered by a glacier collapse on Nepal's border killed more than 1,500 people in Nepal and left more than 5,000 missing.[48] Between January and March 2026, floods in Mozambique affected nearly 870,000 people.[49] In October 2025, Hurricane Melissa caused an estimated US$8.8B in direct physical damage in Jamaica, about 41% of the country's 2024 GDP.[50] These were the losses from hazards that overwhelmed the preparation and protection in place, and they indicate how much more investment is needed, as hazards intensify, to anticipate and prevent losses like these.

The needs are broad and span across materials and construction systems, sensors and forecasting, water and cooling technologies, seeds and farm inputs, distributed energy, data platforms, physical infrastructure, insurance products, and the institutions to mandate and coordinate their use.

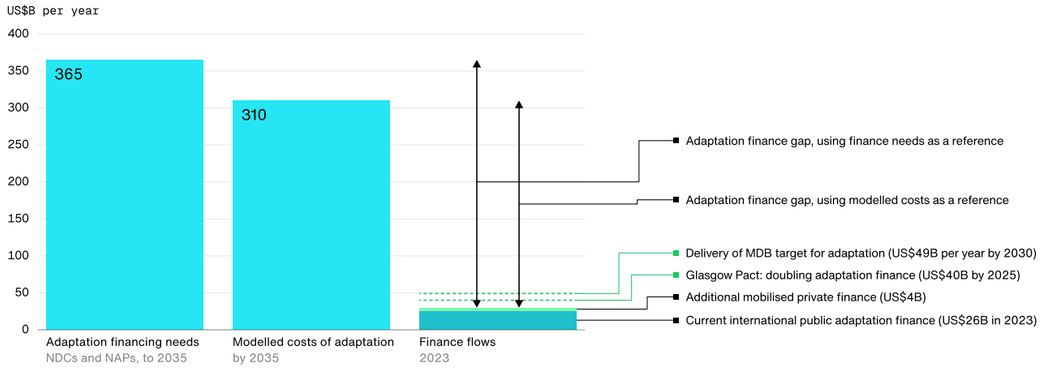
Vulnerability to any given hazard is shaped by existing infrastructure, the ability of users to pay, and the state's fiscal space. The investment gap relative to vulnerability is therefore greatest in developing countries, where the need falls disproportionately on those least able to pay. UNEP estimates that these countries will need US$310B to US$365B a year for adaptation by 2035. International public adaptation finance to those countries was just US$26B in 2023, suggesting a significant ramp-up is required.[51]

Innovators have developed myriad new products and business models to support resilience and adaptation. Whether they reach the people and places that need them depends on who benefits, who can pay and who has to make the market.

Why the economics of resilience differ

Most mitigation involves producing goods and services that people and firms already buy, such as electricity, transport and buildings. When a cleaner technology performs better or costs less, there is a market for it, and whoever produces it earns the revenue. Where a clean technology is not yet competitive, the levers are familiar: find ways to reduce cost, reallocate risk, or expand the market. In resilience, the path from a technology or product to its effective deployment is more complicated, for three key reasons.

Adaptation financing needs vs. actual international public finance flows in developing countries



Source: UNEP, Adaptation Gap Report 2025.

48 UN News (2026), Nepal's deadly glacier flood a 'defining moment' for the international community.
49 IOM Displacement Tracking Matrix, Mozambique: Floods Flash Update 10 (27 March 2026).
50 World Bank and GFDRR (2025), Global Rapid Post-Disaster Damage Estimation (GRADE): Hurricane Melissa, Jamaica.
51 UNEP, Adaptation Gap Report 2025.

First, the benefits are avoided future losses, so a private market exists only when a beneficiary judges the avoided loss to be worth paying for today. A World Resources Institute study of 320 adaptation investments estimated more than US$10 in benefits for every dollar invested over ten years, but many of those benefits accrue to people and institutions who are never invoiced for them.[52]

Second, many of the investments needed to avoid future losses operate at the scale of a city, a watershed or a region, where the beneficiaries are diffuse and no one can be excluded; there is no meter for flood management. Third, investment follows demand that can pay, and the criteria investors usually apply (a reason and ability to pay, value capture and scalability) will only ever find the direct market where the people that benefit can also pay. Beyond it, the questions become who should pay and who has to make the market. These features explain the persistent financing gap in resilience. They also show which investments are likely to be more easily financed, and how the market can be created for those that are not.

Where the commercial case is strongest

Where businesses or households invest in their own resilience and can pay, the market is direct, and the path from product to deployment is short: the product is sold to the user. In emerging markets, those buyers are mostly the households, farmers and SMEs experiencing the losses: smallholders facing erratic monsoons in South Asia and recurrent drought in East and Southern Africa, or small firms whose margins cannot absorb a lost season.

The commercial case is strongest where a product pays for itself today, by raising yields, lowering operating costs or protecting output, and delivers resilience as well. In East Africa, solar irrigation pumps cost less to run than diesel pumps and keep smallholders producing through a dry spell. Handheld water-quality sensors linked to farm-management apps let aquaculture farmers check oxygen, temperature and salinity and act before conditions turn lethal to their stock. Similar opportunities include drip irrigation, soil-moisture sensors paired with advisory services, climate-adapted seeds, efficient fans and evaporative coolers, household water storage and batteries for backup power.

Innovations in financing bridge the gap for customers who cannot pay upfront. Pay-as-you-go solar distributors across Africa sell home systems in small mobile-money instalments, and can switch a system off remotely if payments stop, which lets them lend to customers with no credit history. Systems bought for light and phone charging also keep power on through a grid outage. Insurance can be embedded in the same way: index insurance bundled into seed, fertiliser and agricultural loans, often through government support schemes, now reaches millions of smallholders in Africa and Asia. Lenders often require insurance before they will finance a farming season, and a payout after a drought lets farmers repay and borrow again the following season. But financing cannot reach those who cannot pay at all, or investments whose benefits are diffuse and non-excludable.

Making the market

The direct market is only a small segment of resilience needs. Most resilience operates at the scale of an economy or a landscape, upstream of any one household or user, or serves people who would benefit but cannot pay. There, a product reaches effective deployment only when the public sector makes the market, in one of three ways that differ in who bears the cost:

- **Public purchase.** Infrastructure, early warning systems, and contracts for drainage, restoration and maintenance make public buyers the anchor customers for the firms that supply them. In emerging markets, development finance can, and often must, help pay for it.
- **Collection from beneficiaries.** Where an investment has direct beneficiaries but is needed at a scale no single beneficiary can cover, it will not be made unless they pay collectively. In Kenya, for example, a water fund pools contributions from donors, utilities, companies and government to support upstream soil and water conservation.
- **Requirements on private parties.** Building codes, construction standards, and land-use and siting rules create demand for resilient materials and construction. Since 2023, the Indian state of Telangana has mandated cool roofs for government, commercial and larger residential buildings and enforces the rule through building permits.[53]

The investments needed at each stage

Resilience investments fall into three stages: decisions about what to build and where, which determine how much is exposed; buffers between a hazard and the damage; and the responses when events get through. Each has its own investment opportunities and its own mix of payers.

Who benefits, who can pay and who has to make the market vary within each stage as well as across them. Insurance and other mechanisms to transfer risk belong in the third stage: they reallocate who bears a loss and how quickly it is paid, and do not reduce the physical damage.

What to build and where

Public rules create most of the market for geospatial risk platforms, digital permitting and code-compliance software, flood and heat modelling tools, cyclone- and flood-resistant roofing and wall systems, reflective coatings and modular construction. Without building codes and siting rules, resilient construction sells only to owners who choose to pay for it. Rebuilding standards after a disaster determine whether exposure is rebuilt or reduced.

Buffers

Private adaptation is the direct market described above. Hard protection of a port, industrial park or logistics hub can be financed on the owner's balance sheet, with a public share where the protection benefits others too. Protection of a city or a coastline depends on public finance, with private firms building and supplying under contract. The opportunities include grid sensing, fault detection and wildfire detection for utilities, and deployable flood barriers, smart drainage and protective materials. Low-carbon investments such as distributed solar with storage can be designed with resilience as a feature.

Landscape and ecosystem resilience, such as watershed restoration, avoids losses across a whole territory and is chronically underfunded because its benefits accrue to everyone in the landscape but not to individual balance sheets; firms in satellite and drone monitoring, restoration supply chains and nature-based flood engineering supply public or pooled buyers.

When events get through

Early warning, evacuation and emergency response protect lives, and they have to reach everyone irrespective of ability to pay. Public budgets therefore make the market for the low-cost weather stations, AI forecasting, mobile alert platforms and heat-health warning systems that serve them. Those systems remain thin in much of Africa: in 2023, the WMO's weather radar database listed 37 radars on the continent, against 345 in Europe.[54] In Odisha, the 1999 super cyclone killed nearly 10,000 people. Before Cyclone Fani in 2019, the state evacuated more than 1.5 million people, many into some 880 purpose-built cyclone and flood shelters run by trained village committees, and 64 people died.[55]

52 World Resources Institute (2025), Strengthening the Investment Case for Climate Adaptation.

53 NRDC (2023), Telangana announces groundbreaking cool roof policy.
54 Associated Press (2023), Africa's upcoming climate summit highlights urgent need for better weather data (via PBS NewsHour).
55 Ministry of Home Affairs, India.

Risk transfer offers opportunities in index and parametric insurance, which pays quickly on a measured trigger and saves the cost of assessing each loss, and in the satellite and weather data that trigger payouts, mobile distribution and automated claims, but it has limits. Insurance-linked structures pay only for insured losses, and in emerging markets both public and private insurance cover just a fraction of the protection needed against natural catastrophes. The products worth backing reward risk reduction, such as insurance that offsets part of the premium to help clients invest in loss prevention. Contingent credit for firms and households and rapid damage assessment from satellite imagery help finance the recovery.

How private capital can help build these markets

In the direct segment, private capital builds markets through financing innovation, bundling resilience into goods and services, and pay-per-use models. Where the public sector makes the market through purchase, charges or rules, private firms supply and compete to meet the demand it creates. Public finance, and robust institutions that use data for planning, are the foundation that allows resilience investments to scale, and to scale in the communities and regions that are most vulnerable, across much of South and Southeast Asia and Sub-Saharan Africa. Without these, private investment will disproportionately miss those places.

Public capacity is weakest where exposure is highest: credit rating methodologies and debt sustainability frameworks constrain public borrowing, and a storm can raise ten-year sovereign yields in a typical high-debt emerging economy by more than 140 basis points at the peak.[56] Ensuring that governments are adequately financed and supported is one of the most important resilience interventions, and a responsibility of the international community.

Avoided losses can yield high returns to society without yielding returns to any investor. Resilience becomes an investment opportunity where the users who benefit can pay, and where the public sector buys, pools or regulates and firms compete to supply the demand it creates. Private capital can help build both kinds of market. In the places most exposed to climate impacts, those markets will be only as large as governments' capacity to pay for them. That makes reform of sovereign borrowing and international public finance a condition for private investment in resilience.

Resilience pays for itself several times over. Where the public sector makes the market, private capital can build it.

56 European Central Bank, Climate-related disasters can push up the cost of debt, The ECB Blog, 19 February 2026.



6

Catalytic & Blended Capital:

Solving the Capital-Structure Problem





Joan M. Larrea, CEO, Convergence Blended Finance

I have spent most of my career in a corner of finance that is easy to describe and hard to deploy: using public and philanthropic money to persuade private investors to go where they would not otherwise go. As CEO of Convergence, the global network for blended finance, I lead an organisation that addresses this challenge through data and insights, connections across public, private, and philanthropic investors, and support for the design of new blended finance vehicles. Our task is to help practitioners use scarce concessional resources more effectively to bring private investment to emerging markets. The case for that work has never been stronger. The conditions for doing it have rarely been harder.

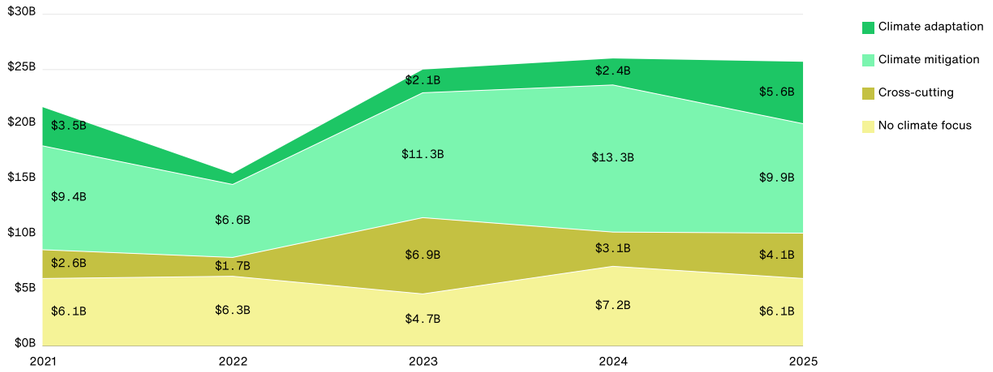
Preliminary OECD data show that official development assistance - the largest source of concessional finance for blended finance fell by 23% in real terms in 2025, its largest annual contraction on record.[57] Yet our recently published State of Blended Finance Report 2026 found that blended finance held at US$25.8B across 181 transactions, and every concessional dollar mobilised, on average, US$5.33 in commercial financing, up from the historical average of US$3.92.[58]

Climate finance is also a growing component of the blended finance market. Even as the overall blended finance market remained level, climate blended finance increased 6% to US$19.7B, meaning that climate-related transactions now account for around three-quarters of total blended finance activity. But resilience is not scale, and the growth of climate-focused blended transactions is occurring within an ecosystem that is proving resilient but only growing incrementally.

One primary barrier to growth is that too many transactions still depend on complex, bespoke structures and long negotiations, rather than models that local banks, fund managers and institutional investors can replicate. The challenge is to make blended finance transactions more replicable, so that scarce concessional resources can mobilise private capital at greater scale and on better terms.

Falling technology costs are creating new opportunities for the energy transition, but these gains will not translate into widespread deployment if the financing needed to bring solutions to market remains expensive or inaccessible. Financing costs, limited access to capital and structures that do not match the needs of local businesses can erode the advantage of cheaper technologies before it reaches customers.

Climate blended finance market: annual financing flows, 2021 to 2025



Annual financing flows by climate focus: adaptation, mitigation, cross-cutting and no climate focus (US$B). Source: Convergence (2026). State of Blended Finance.

57 OECD, Preliminary ODA Levels in 2025.
58 Convergence, State of Blended Finance 2026.

The problem is the shape of capital

There is no shortage of capital in the world. There is, however, a shortage of capital in the form an emerging-market climate business can actually use, at a price it can afford, on terms its cash flows allow. A solar farm in a developing economy can use the same panels as one in an advanced economy, yet it will produce power at a substantially higher cost because the financing available to it is pricier and often shorter-term.

The constraint has four dimensions. Country risk is about institutions and whether capital can be recovered at all. Currency risk is the mismatch between dollar liabilities and local revenue. Credit risk is about default and recovery rates. Climate risk is whether the asset still performs in a world of floods, heat and shifting regulations.

Currency risk is especially hard to deal with because a business can perform well and still be caught out by exchange-rate movements. A company earning in local currency but borrowing in dollars can see its debt burden rise even when sales are on plan. A credit guarantee does not remove that exposure. Local-currency lending, longer-tenor hedging and facilities that share some foreign-exchange risk can all help.

These risks are real. But perceived risk can differ from observed performance. The Global Emerging Markets Risk Database (GEMs), which draws on development finance institutions' lending records, reports an average default rate of 3.56% and an average recovery rate of 72% for private lending over 1994–2023.[59] These figures are not a proxy for every emerging market investment and are not focused on blended transactions, but they suggest that actual portfolio experience can be significantly better than broad perceptions of risk.

Instruments, matched to barriers

Blended finance is a structuring approach. Its value depends on whether the intervention addresses the barrier that is actually preventing investment.

Where the barrier is credit, guarantees can be an efficient tool. Convergence identifies increased use of guarantees as one factor behind the record mobilisation ratio in 2025.[60] A guarantee is attractive because it is contingent: the guarantor funds the commitment only if the guarantee is called, and it can give a domestic bank the confidence to lend to a borrower it might otherwise decline.

Where the barrier is early-stage uncertainty, grants and project-development capital carry a business to the point where it can be underwritten at all. Where the barrier is downside risk, first-loss tranches keep senior investors inside their mandates. Where the barrier is return, catalytic equity accepts a capped return or a lower place in the waterfall. Where the barrier is liquidity or exit, hedging, political-risk cover and backstops matter most, and exits remain the least developed part of the toolkit.

Two principles govern all of this. First, use the least amount of concessional finance to make the deal viable for investors seeking market-rate returns. In a sample of its blended concessional finance portfolio for FY2010–FY2025, IFC reports average concessional levels equal to 2.2% of total project cost for equity and 6.8% for guarantees.[61] The figures come from a limited sample, but they illustrate the point: concession should be calibrated to the financing gap, not offered by default. The second is graduation: catalytic actors should plan their exit from a sector or a market from the beginning.

59 World Bank (2024), Global Emerging Markets Risk Database (GEMs) Consortium.
60 Convergence, State of Blended Finance 2026.
61 IFC, How Blended Finance Works.

Where it breaks down

High transaction costs make smaller blended finance deals harder to justify, which amounts to a tax on the markets that can least afford it. In climate blended finance, fund structures accounted for 77% of deals in 2023-2025.[62] Pooled vehicles help smaller businesses and local managers in emerging markets to reach capital, even when individual projects are getting larger.

Capital also concentrates where transactions are easier to structure and risks are easier to price. Convergence reports that Sub-Saharan Africa's share of blended-finance transactions across all sectors fell from 34% in 2024 to 19% in 2025, while activity increased in middle-income countries.[63] The shift matters: markets with high climate vulnerability and significant investment needs can be left behind when capital flows towards places where transactions are easier to execute.

Adaptation remains difficult to finance, although flows rose from US$2.4B in 2024 to US$5.6B in 2025, more than doubling year on year.[64] The increase is welcome, but the underlying challenge remains: many adaptation benefits are dispersed, long-dated or difficult for a single investor to monetise.

These challenges call for greater precision about what concessional finance is intended to achieve. We should use it to overcome identifiable investment barriers, while recognising the limits of financial structuring.

The equity gap

The deepest gap is equity. Climate Policy Initiative and GFANZ estimate that annual clean-energy equity investment in emerging markets and developing economies, excluding China, must reach US$375B by 2035, against about US$160B under current trends.[65] That leaves an annual shortfall of US$215B. Equity matters because it absorbs early uncertainty and gives businesses room to build before their cash flows can support significant debt.

This is where growth-equity investors such as LeapFrog Investments matter, because equity can help a business build the operating record that lenders and later-stage investors need to see. It gives management room to strengthen governance, improve reporting, build distribution and enter new markets before taking on more debt. In emerging markets, that work can be as important as financing the next stage of growth. Without credible exits and evidence of commercial returns, it is harder to persuade institutional investors to commit.

At the fund level, blended finance uses catalytic capital to make equity funds more attractive to institutional investors. When catalytic capital takes a first-loss or capped-return position in a fund rather than in a single deal, it can improve the risk-adjusted returns for portfolio investors, making them more likely to make fund investments.

62 Convergence, State of Blended Finance 2026.
63 Ibid.
64 Ibid.
65 Climate Policy Initiative and GFANZ (2025), The Clean Energy Equity Investment Gap: Mobilizing Private Finance in Emerging Markets.

The finance gap, and what better structures could unlock

Convergence's 2026 State of Blended Finance offers evidence that we can use concessional resources more effectively. The leverage ratio, the amount of commercial finance mobilised by concessional finance, reached a record high in 2025. Guarantees and Brazil's Eco Invest programme contributed to the increase. That is meaningful progress, but a stronger leverage ratio alone will not close the climate-finance gap. The quality of the underlying investments, the availability of local-currency finance, enhanced policy and enabling environments, and the ability to recycle capital still matter.

Set that against the requirement. The Baku to Belém Roadmap sets out a path to mobilise US$1.3T a year in external climate finance for developing countries by 2035.[66] Public money cannot close that gap on its own, and private investors cannot be expected to absorb risks they cannot price or manage. The task is to match each risk to the capital best placed to bear it.

The cost of capital shapes where the transition happens. Until the financing premium narrows, investment will continue to flow most easily to places where capital is cheapest, not necessarily to the places where the need for new infrastructure is greatest.

Emerging markets are not short of viable businesses, and the world is not short of capital. The disconnect is financing that fits the business and the market and sufficient data for investors to accurately price risk. Blended finance works best when it addresses a specific barrier, brings in investors who would otherwise stay away, and leaves behind a business or a market that can attract capital on commercial terms. The test is whether the structures can be used again, and whether capital can be returned and invested in the next business.



The task is to match each risk to the capital best placed to bear it.

66 COP29 and COP30 Presidencies (2025), Baku to Belém Roadmap to 1.3T.

Conclusion:

Landing the Leap





Souleymane Ba, Partner and Global Co-Head, Climate Investment Strategy, LeapFrog Investments

The next decade will turn on a simple test: whether climate finance becomes climate deployment capital. This edition helps us be more precise about what passing it will demand.

The events of 2026 offered a preview of the decade ahead. The closure of the Strait of Hormuz triggered the largest oil shock on record.[67] After the oil crisis of 1973, importing countries had nowhere to turn, and a decade of stagflation followed. This time they had an alternative, and they reached for solar panels, batteries and electric vehicles in record numbers. Clean energy did not need a climate argument to win those orders. It won on price and on security, and that is how it will keep winning.

The essays in this edition come from investors, industry leaders, academics and blended finance practitioners, yet they reach a common conclusion. The question is no longer whether clean technology works, or whether it is cheap. It is whether the businesses around it can be built fast enough, and financed well enough, to put it to work.

What this edition tells us

The clock has changed. The clean energy economy must build in a generation what oil and gas built over a century. Solar supplied about 1% of the world's electricity in 2015 and around 9% in 2025.[68] When cost curves move this fast, a business can be overtaken within a single holding period. We now underwrite where a company will sit on the cost curve at exit, as well as where it sits today.

Security has joined climate as a reason to buy. Imported fuel is priced in global markets and exposed to every shock along the way. Renewable electricity is priced at home and gets cheaper with scale. The green discount now carries a security dividend as well, and both will grow as renewables keep getting cheaper. The shift is also running ahead of the official data: Africa is on course to deploy around 17 GW of solar in 2026, much of it in distributed systems that conventional statistics miss. Investors who wait for the data to confirm the trend will arrive late.

The value has moved to the middle. Between cheap generation and the people who use it sits a missing middle of grids, storage, finance and service. Only about 13% of Indian households own an air conditioner, yet those units already account for close to a quarter of national peak electricity demand.[69] The binding constraint is rarely the panel or the compressor. It is the evening peak, the half-empty cold room, the household that cannot finance an upgrade. The same is true of resilience. Heat, floods and failed harvests aren't only risks being priced. Protecting people from them is becoming a market in itself.

The shape of capital matters as much as its quantity. A solar farm in an emerging market can use the same panels as one in Europe and still produce more expensive power, because its financing costs more and runs for shorter terms. The tools to fix this are improving: each concessional dollar in blended transactions mobilised a record US$5.33 of commercial finance in 2025.[70] The deepest gap, though, is in equity. Clean energy equity investment in emerging and developing economies outside China needs to reach around US$375B a year by 2035, against roughly US$160B on current trends.[71] Growth equity is where that gap starts to close, because equity builds the operating record that lenders and later investors need to see.

67 Energy Transitions Commission, Energy Transition Monitor 2026.
68 Ember, Global Electricity Review 2026.
69 Bureau of Energy Efficiency and CLASP, Residential Energy Consumption Patterns and Appliance Ownership in India: Insights from a 2024 Household Survey.
70 Convergence, State of Blended Finance 2026.
71 Climate Policy Initiative and GFANZ (2025), The Clean Energy Equity Investment Gap: Mobilizing Private Finance in Emerging Markets.

Four shifts we are investing behind

For LeapFrog's Climate Investment Strategy, these ideas point to four shifts that will define the next phase of the transition in India, Southeast Asia and Africa. They are where we expect the most durable value to be created, and where we are focusing our search for the companies we back next.

From generation to reliability. Dependable power is now the scarce resource. We are backing businesses that turn low-cost generation into supply a customer can plan around: commercial and industrial solar, distributed generation, battery storage, efficiency, and the software that balances them. ReNew Green, which we backed in March 2026, has more than 2 GW of operating capacity for business customers.[72] The same shift is happening behind the meter across Africa and Southeast Asia, one rooftop and one battery at a time.

From owning to paying per use. In our markets, the customers who most need clean technology are often the least able to buy it outright. Businesses that own the asset, carry the finance and sell the service are solving that. In Kenya, electric motorcycles took 15.3% of new motorcycle registrations in 2025, up from 3.6% two years earlier.[73] In Vietnam, around 209,000 electric motorbikes were sold in the first half of 2025, nearly double the year before, making it the world's third-largest market.[74] Swapping, pay-as-you-go solar and cooling sold by the month all follow the same logic.

From mitigation to resilience. Heat, water stress and failed harvests already cost our markets dearly, and the businesses that protect against them are becoming investable. We are looking at cold chains that stop produce from spoiling, efficient cooling and resilient housing, water and sanitation, and climate-smart inputs that hold yields in a hotter climate. Capital is starting to follow: blended finance for adaptation more than doubled in 2025, to US$5.6B.[75] What changes now is the business model. Resilience has long been funded as aid. Increasingly, customers will pay for it because it protects their income.

From imported to local. 2026's shocks made the case for energy and equipment produced closer to home. We are looking at sustainable biofuels, waste-to-energy and recycling businesses that turn local feedstock into supply, and at assemblers and component makers building regional supply chains. We will back this shift selectively, where the process is proven and the unit economics stand on their own, because self-sufficiency for its own sake raises costs and slows deployment.

Each shift cuts across our four sectors of energy, mobility, food and agriculture, and the built environment. Each must also pass the same test: the customer is better off on economics alone, and the climate benefit is built into how the company makes money.

72 ReNew Energy Global.
73 CleanTechnica.
74 VietNamNet (2025).
75 Convergence, State of Blended Finance 2026.

Building the landing

I have spent most of my career investing in emerging markets, including a decade across Africa in food security and financial inclusion before I turned to climate. The lesson that has stayed with me is that good products rarely fail on technology. They fail on access: on whether customers can afford them, find them and trust them. LeapFrog has built its record on that lesson, and its companies now reach 645 million people, around three quarters of them emerging consumers. The climate transition will be won the same way.

Our commitment is simple. We will back the companies that turn cheap clean technology into everyday infrastructure for emerging consumers and businesses. We will underwrite them through our lenses of climate, company and construct, with the exit planned from the first day. And we will invest alongside development finance, catalytic and strategic capital, each carrying the risk it is best placed to hold.

This is one of the biggest opportunities of our lifetime. Emerging markets can leap past the old energy system, and the evidence in this edition shows the leap is already under way. The work of the coming decade is to build the landing.

Good products rarely fail on technology. They fail on access. Clean energy now wins on price, so the next decade is about putting it within reach of emerging consumers. That is the landing we are investing behind.





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