Who Owns the Green Transition? The Triple Asymmetry of Low-Carbon Capital

Consider a rooftop solar panel: it cuts carbon emissions, alleviates power bills and inflates property values—all while being subsidised by households who own no renewable assets themselves. The relevant economic question, hence, is simply not whether the green transition creates wealth, but who owns the complementary assets needed to capture it.

This essay proposes that climate-friendly technologies have no innate distributional direction. Its impact stems from three asymmetries of green capital: a complementary asymmetry in labour markets, where green investment initially complements workers possessing scarce technical skills more strongly; an incidence-ownership asymmetry at a household level, where transition costs are distributed while returns from subsidised capital are conditional on property, credit access and liquidity; and a value-capture asymmetry across global supply chains, where mineral extraction, processing, intellectual property and downstream production create unequal international gains. However, learning, skill accumulation and industrial upgrading can reduce these rents. Therefore, the transition may be non-monotonic: green capital may increase inequalities while complements are scarce, before diffusion gradually democratises its benefits.

Complementary asymmetry

Technological progress is not automatic. Acemoglu's theory distinguishes two forces affecting innovation: a market-size effect (innovators prefer larger markets), and a price effect, where high factor prices incentivise innovation for scarce inputs. Acemoglu et al. (2012) demonstrated that carbon pricing and clean research subsidies can redirect innovation towards clean sectors. Climate policy therefore alters relative profitability, increasing R&D and capital accumulating in green technologies.

Distributional consequences emerge when green capital meets labour markets. Krusell et al. (2000) show equipment capital is more complementary with skilled than unskilled labour; the elasticity of substitution is greater between equipment and unskilled labour. Consequently, equipment deepening increases relative demand for skilled workers and the skill premium. If green capital is similarly complementary with scarce engineering, programming and technical

abilities, then rapid clean-capital accumulation may temporarily increase relative demand for skilled workers.

In fact, recent evidence supports this mechanism. Cass et al. (2026) found green jobs across 12 EU countries pay a 5.5% premium, half driven by high-paying firms and skill complexity, leaving a 2% residual return for green tasks. Sato and colleagues (2023) similarly found that low-carbon job vacancies across the US and UK are more intensive in technical, managerial, cognitive and IT skills relative to non-green equivalents. The evidence hence supports stronger demand for complementary skills, but not a permanent or invariably large wage premium.

Income flows versus wealth stocks

Temporary wage premium and persistent wealth effects are distinct. Green engineers gain higher wage flows, while homeowners with subsidised solar, entrepreneurs owning clean-technology patents and investors acquiring appreciable assets capture policy subsidies and collect rent. While labour-market benefits accumulate as income flows, ownership benefits concentrate into capitalisable stocks. Stocks matter for wealth inequality because they accumulate, compound, appreciate, are collateralisable and transferable intergenerationally.

Thomas Piketty's model proposes that when the rate of return on capital (r) exceeds growth (g), accumulated wealth grows faster than labour income. Applying this to the green transition requires care. Piketty (2015) clarifies that a widening r-g gap does not necessarily raise inequality, but amplifies existing disparities from inheritance, saving and asset returns. Green-asset returns may include market returns, scarcity rents, intellectual-property rents and policy benefits. Competitive asset markets absorb expected subsidies into asset prices, transforming public policy into upfront capital gains rather than ongoing profits. Dastrup et al. (2012) estimate California solar installations were capitalised into house values at about 3.5% premium, showing how future green benefits manifest in existing wealth. Piketty's relevance is therefore not that every green subsidy raises returns indefinitely, but that an unequal ownership of assets receiving rents or capital gains can transform a temporary policy into persistent wealth divergence.

Incidence-ownership asymmetry

Policy worsens inequality when costs fall on the public while its benefits flow to asset owners. Germany's EEG system provides strong evidence of this mechanism. Under the EEG, renewable subsidy costs were passed to consumers through surcharges, while households owning photovoltaic systems received feed-in tariffs. Winter and Schlesewsky (2019) showed subsidy costs spread evenly across households but represented a larger proportional burden for lower-income households, while revenues increasingly accrued to wealthier PV owners. The overall arrangement increased inequality by about 1.0-2.4%, most of which was a result of the EEG levy. Thus, financing is distributed, but eligibility for capital returns is narrow. Installing solar requires property, credit and savings to absorb upfront costs. A renter thus helps finance renewable policy through electricity expenditure without holding the asset that receives subsidies and capitalisation.

This mechanism is visible beyond Germany. Borenstein and Davis (2025), using US tax-return data covering over $47 billion in clean-energy tax credits, reported that the bottom three income quintiles received about 10% of credits, while the top quintile received approximately 60%, and the top quintile for EV credits received over 80%. Although this mechanism differs from the German one, both systems demonstrate the same point: subsidies open to all in theory favour the wealthy when eligibility requires property ownership, taxable income or prior wealth. However, this regressivity belongs not to the technology itself but to its ownership architecture. Replacing tax rebates with accessible upfront financing distributes clean energy rather than compounding asset inequality—same technology, different distribution.

Global value-capture asymmetry

Global value ownership of green technologies is governed not by a rich-poor country model, but by entry barriers across the value chain. The battery production chain, from extraction to EV software integration, involves barriers and rents at different stages. Extraction yields scarcity rents and mineral rights income; refining requires capital intensity, economies of scale and process expertise; advanced manufacturing needs tacit production abilities and

supplier networks; system level integration uses patents, software, branding and accumulated R&D. A mineral-rich country may be able to gain resource rents without capturing manufacturing or intellectual-property rights.

UNCTAD emphasises that refined materials hold substantially higher value than unprocessed minerals, and that downstream participation can increase domestic value addition for developing economies (UNCTAD, 2025). A World Bank analysis similarly revealed EV battery chains could multiply African minerals' value, emphasising that requirements vary across stages (Cervantes Barron et al., 2026). The IEA's 2025 outlook shows that by 2035, China could still supply over 60% of refined lithium and cobalt and 80% of battery-grade graphite and rare-earth elements (IEA, 2025). This supports the idea that technological capability, scale and existing industrial ecosystems create persistent financial advantages beyond owning raw materials.

China shows that value chain position can change through investment, manufacturing scale, learning, industrial policy and technological accumulation (Geels, 2026). Indonesia's movement into nickel processing provides another partial example of successful expansion into the downstream supply chain (UNU WIDER, 2017). The third asymmetry is therefore a capability asymmetry. The central economic question is whether temporary mineral wealth can be transformed into self-sustaining industrial and technological capabilities.

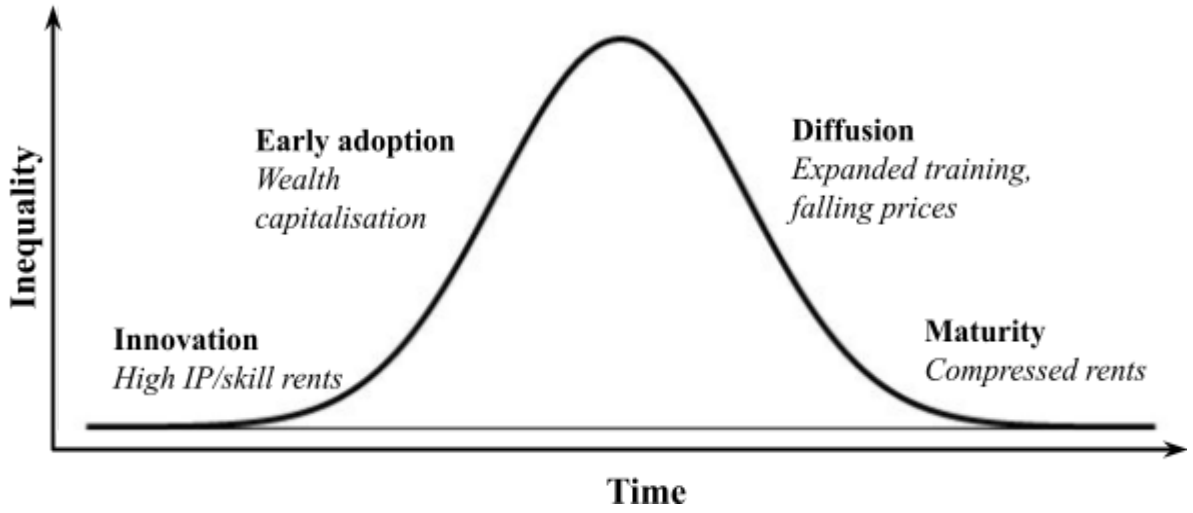
Counterarguments

Several forces weaken these asymmetries. First, once built, wind and solar have near-zero fuel costs; so, if energy prices reduce, lower-income households whose budgets are energy-heavy gain disproportionately. Mature systems may thus be more progressive than the investment path required to build them. Secondly, green jobs may support lower-skilled workers. Curtis and Marinescu (2022) show US solar and wind vacancies tripled after 2010, paying 21% more than average, with strong relative earnings for jobs requiring less formal education. Cass et al. (2026) similarly found green employment is not restricted to elite workers; its share was highest among low-skilled occupations. This challenges the assumption that clean energy, like digitalisation, innately disadvantages manual workers. But even if a better-paid heat-pump installer earns labour income, infrastructure ownership can

still claim future returns. Thus, wage inequality reduction can coexist with wealth inequality increases.

Third, diffusion may destroy rents. Early solar was expensive, but mass manufacturing, skill spread, patent expiry, competition and training reduces costs. The scarcity rents behind the three asymmetries should eventually weaken with time. Theoretically, a hump-shaped distributional transition demonstrates this (Figure 1).

Figure 1. Dynamic Hump-Shaped Distributional Curve



Initially, scarce R&D skills and patents create concentrated rents. Then, property and credit constraints disproportionately benefit higher-income early adopters. Over time, skill diffusion and learning expand access. Finally, mineral-rich countries may benefit if they transform temporary rents into enduring economic capacity through education, infrastructure, and refining.

Evaluating climate policy requires a grounded baseline. Instead of comparing the green transition against a zero-cost reality, we must weigh it against the escalating adverse effects of unmitigated climate change and fossil-fuel dependency. Ultimately, a policy might be welfare-improving and essential against climate change, yet still remain poorly designed distributionally.

Policy implications

Through the developed framework, each symmetry can be addressed directly. For complementary asymmetry, skill scarcity can be reduced through vocational education, apprenticeships, retraining, and geographically targeted labour-market policies (Employment and Skills Policies for the Green Transition, 2025). Incidence-ownership asymmetry can be addressed through upfront grants, concessional financing, community solar and renter-landlord benefit sharing. Global value-capture asymmetry can be alleviated through infrastructure, training, downstream processing, R&D, technology transfer, transparent regulation and improved supply networks. An equitable transition should do more than compensate households for unequal outcomes; it should focus on expanding access to the skills, assets and capabilities that produce green returns.

In conclusion, climate-friendly technologies influence inequality differently across development, adoption and maturity. Initially, development produces patent, skilled-worker and entrepreneurial rents. Early adoption creates property advantages, capitalisation gains and possible regressive subsidy incidence. Global scaling creates resource, processing, manufacturing and IP rents. Ultimate distribution depends less on whether capital is green than on who owns its complements. When policies expand access, the same technologies that initially amplified inequality may be able to compress it. Initial green wealth distribution mirrors pre-existing distribution of its scarce complements. Whether inequality calcifies or shrinks depends on strategic intervention. The fundamental challenge is not technology itself, but how effectively governments and markets transform exclusionary assets into broadly accessible resources.

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