Case study for Cornwall, UK: a transition pathway for energy systems and natural resource use that supports a sustainable future.

Abstract

Cornwall's energy transition is often framed as a technical shift from fossil fuels to renewables. However, when evaluated through a planetary boundaries and ecosystem services lens, it becomes clear that this transition must go far beyond decarbonisation. This report analyses Cornwall's current energy landscape—characterised by growing renewable capacity, continued reliance on imported energy, and significant ecological pressures—and identifies the key trade-offs involved in meeting local energy needs within biophysical limits. Drawing on the Local Nature Recovery Strategy, the Cornwall Wildlife Trust's *State of Nature* report, and the Millennium Ecosystem Assessment framework, the analysis highlights tensions between land use, biodiversity, resource extraction, cultural identity, and social equity. It argues that without a reduction in overall material and energy throughput, Cornwall risks shifting environmental burdens elsewhere rather than achieving true sustainability. The report concludes with a set of integrated recommendations centred on sufficiency, ecological restoration, community ownership, inclusive governance, and post-growth economic principles. Together, these proposals outline a pathway for a just transition that enhances human well-being while restoring the natural systems that underpin life in Cornwall

Introduction

Cornwall's residents currently rely on a mixed energy system dominated by imported electricity from the National Grid and fossil-fuel-based heating. This dependency partly reflects the region's housing stock and architectural constraints. However, Cornwall also possesses significant renewable generation capacity, including solar farms, onshore wind, and emerging geothermal and offshore marine resources. These sources are expanding and increasingly contribute to local electricity and heat supply.

While this transition away from fossil fuels appears positive, a planetary boundaries perspective reveals a more complex picture. Energy demand cannot be understood solely as human requirements for fuel, heating, and transport; it must also be evaluated against ecological limits that sustain life. Cornwall's current energy mix overshoots planetary boundaries related to biodiversity, land-system change, and pollution. Using the Millennium Ecosystem Assessment framework the problems become clear: services such as electricity and mobility are delivered through low-carbon resources, but often at the expense of regulating and supporting ecosystem services like climate stability, soil health, and marine integrity—on which long-term human well-being depends.

Cornwall's evolving energy landscape reveals both a shortfall and an opportunity: current systems do not yet meet the deeper requirements of a just and sustainable future, but they offer pathways to align human energy use within planetary limits.

Discussion: Key Trade-Offs

Transitioning Cornwall's energy system within planetary boundaries involves significant trade-offs:

Land Use Conflicts

Competition between land for nature recovery, energy generation, and food production is acute. Large-scale solar farms often occupy land deemed unsuitable for agriculture, yet discussions rarely consider biodiversity. Cornwall's nature recovery target—30% of land, rivers, and seas by 2030—faces challenges from land ownership patterns and profit-driven management. Local investment schemes, such as Cornwall Council's 2024 nature recovery payments, have struggled to attract applications, highlighting structural barriers.

Habitat Disturbance from Infrastructure

Offshore floating wind projects introduce cables, turbine bases, and access tracks that disrupt habitats and fragment ecosystems. According to Cornwall Wildlife Trust's State of Nature report, these developments, while delivering low-carbon energy, cause short-term habitat loss and species disturbance—affecting populations already in decline.

Resource Extraction for Renewables

Scaling renewable adoption and retrofitting housing stock requires metals, concrete, and extensive supply chains. These processes carry global and local environmental footprints through quarrying and coastal imports, potentially shifting carbon and ecological impacts outside Cornwall while appearing to improve local sustainability.

Economic and Cultural Tensions

Cornwall's economy has long relied on tourism and extractive industries. Visible onshore infrastructure and offshore works often face resistance from residents and businesses concerned about impacts on natural beauty and cultural landscapes. Rewilding or passive reforestation may threaten coastal grasslands central to Cornwall's identity as a destination, creating friction between conservation goals and traditional economic models.

Social Equity and Just Transition

Moving toward a low-impact, high-welfare economy challenges embedded businesses, risking job losses in extractive sectors. While evidence suggests green transitions can create employment in community energy, retrofitting, and habitat restoration, Cornwall lacks mechanisms to ensure a just

transition. Without proactive planning, social harm could accompany efforts to reduce material and energy throughput.

Beyond Carbon Reduction

The past decade shows that prioritising carbon reduction as a singular goal can produce perverse outcomes for species, water quality, soil health, and human well-being. Local strategies, including the Nature Recovery Strategy and initiatives by Cornwall Wildlife Trust and Cornwall Poverty Forum, call for goals beyond carbon—emphasising biodiversity, ecosystem integrity, and social resilience.

These trade-offs raise a critical question: is pursuing green growth more harmful than adopting a transformative post-growth or degrowth trajectory? A degrowth approach accepts that consumption and production must decline to remain within biophysical limits. Even if energy-sector emissions fall, other planetary systems remain under pressure unless overall energy and material throughput decreases. Cornwall's current trajectory depends on high resource use, underscoring the need for systemic change, which the following recommendations can form the basis of.

Recommendations for a Just Energy Transition in Cornwall

To address the barriers and trade-offs identified, the following recommendations aim to guide Cornwall toward a transition that respects planetary boundaries while ensuring social equity and ecological resilience.

Reframe Energy Transition Around Sufficiency and Well-being

Cornwall's strategy must go beyond decarbonisation and reject the assumption that current energy use and lifestyles can continue unchanged. The goal should be to meet essential human needs—housing, mobility, community, and self-realisation—within ecological limits. Policies should prioritise well-being over GDP growth, embedding this principle in housing retrofits, public transport, community energy, and nature restoration. Success should be measured by improvements in human and ecological health, not economic output.

Integrate Ecosystem Assessment into Planning

Every energy or infrastructure project should undergo a rigorous evaluation using the Millennium Ecosystem Assessment framework, combined with Cornwall Council's planning tools. This process must account for impacts on all ecosystem services—regulating, supporting, cultural, and

provisioning. Nature recovery targets should be treated as non-negotiable constraints on land and energy use, ensuring that development aligns with biodiversity and climate goals.

Prioritise Community-Owned, Place-Based Energy Systems

Small-scale, locally governed renewable projects should replace large-scale, growth-driven infrastructure. Community energy initiatives distribute benefits more equitably, reduce ecological footprints, and strengthen local resilience.

Link Energy Transition with Ecological Restoration

Energy projects should deliver multiple co-benefits by integrating ecological restoration into their design. Investments should accelerate the recovery of peatlands, wetlands, woodlands, and coastal habitats—enhancing biodiversity, carbon sequestration, flood regulation, and ecosystem resilience. This approach avoids narrow carbon-focused strategies that risk degrading other ecosystem services.

Ensure Social Equity and a Just Transition

Structural changes must protect livelihoods and reduce inequality. Measures include shorter working weeks, universal basic services, fair wages, and cooperative ownership of utilities. Cornwall should develop a “social guarantee” ensuring access to energy, housing, and transport even as consumption patterns shift. Free retraining programmes can help workers transition into roles in restoration, renewables, retrofitting, and community energy, aligning social justice with ecological sustainability.

Adopt Inclusive Governance Structures

Decision-making should involve local councils, community groups, conservation organisations, and third-sector partners, reducing the influence of asset-owning businesses that prioritise profit. Collaborative governance ensures that energy and infrastructure decisions reflect ecological integrity, social equity, and long-term resilience.

Redefine Success Beyond GDP

Cornwall must reject growth-based metrics and adopt indicators that reflect ecological and social well-being. These include biodiversity gains, habitat restoration, energy sufficiency, social equity, and reductions in material throughput. Existing initiatives, such as Cornwall’s doughnut economics dashboard, provide a foundation for tracking progress against planetary boundaries and high-quality life metrics. These need to be adopted by decision-makers across the board.

Conclusion

Cornwall stands at a pivotal moment in shaping its energy future. While the region has made progress in expanding renewable energy and recognising the urgency of climate action, a deeper systems perspective reveals that decarbonisation alone is insufficient. Cornwall's current trajectory risks reproducing ecological harm, social inequity, and unsustainable resource use unless guided by the constraints of planetary boundaries and the needs of local communities.

By embracing an energy transition grounded in sufficiency, ecosystem integrity, and social justice, Cornwall can move beyond the narrow frame of carbon reduction and toward a model of prosperity that enhances both human well-being and the natural world. This requires reimagining success, restructuring governance, empowering communities, and ensuring that future development protects and restores the ecosystems on which all life depends.

Cornwall has the natural assets, civic energy, and policy foundations to lead the UK in demonstrating what a truly regenerative, place-based energy system can look like. With courage, collaboration, and a commitment to ecological limits, the region can chart a future in which people and nature not only coexist but flourish together.

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