Green Economy Challenges in the Context of Sustainable Development: Policy Research and Recommendations for Armenia

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Abstract

This paper explores the concept of the green economy as a vehicle for sustainable development by integrating environmental protection, social equity, and economic growth. The global imperative to address climate change, resource depletion, and ecological degradation has brought renewed attention to the role of media, policy, and local practices in transitioning toward a green economy. The study investigates global policy challenges, environmental and economic dimensions of green economy practices, case studies of successful and failed transitions, and an in-depth analysis of Oklahoma's experience across energy, agriculture, and infrastructure sectors. Lessons are drawn for Armenia's policy future based on both global and subnational models. The paper concludes by emphasizing adaptive policy design, stakeholder engagement, and international support as cornerstones of successful green economy strategies.

Keywords: green economy, sustainable development, emissions, renewable energy, climate-smart agriculture, green infrastructure, Armenia, Oklahoma

1. Introduction

The concept of a green economy has gained prominence as a framework to align economic development with environmental sustainability and social equity. It addresses the urgent need to reduce greenhouse gas emissions, conserve biodiversity, and ensure inclusive growth. Anchored in the Sustainable Development Goals (SDGs) and the Paris Agreement, the green economy model promotes low-carbon, resource-efficient, and socially inclusive pathways. This paper presents a comprehensive analysis of green economy challenges and opportunities, focusing on policy design, environmental protection, and economic transformation. Special emphasis is placed on the state of Oklahoma and its evolving practices, as well as the application of global lessons to Armenia.

2. Green Economy and Sustainable Development: Concepts and Context

A green economy is defined as one that improves human well-being and social equity while significantly reducing environmental risks and ecological scarcities (UNEP, 2011). It decouples economic growth from environmental degradation through investments in sustainable infrastructure, renewable energy, and circular economic practices (BioMed Central, n.d.). The concept gained momentum post-2008 financial crisis and was institutionalized through SDGs, particularly goals 7, 8, and 13 (UN, 2015).

However, implementation remains fraught with challenges. Nations must balance growth with decarbonization, coordinate global policies, secure financing, stimulate innovation, and ensure policy coherence (IEA, 2023; IWMI, 2022). Moreover, equity concerns persist, as seen in France’s fuel tax protests and Sri Lanka’s fertilizer ban, where poorly sequenced policies caused social backlash (IWMI, 2022).

3. Environmental Dimensions of the Green Economy

Climate change remains the central environmental challenge. As of 2019, global emissions totaled 59 GtCO2e, necessitating halving by 2030 to meet the 1.5°C target (IPCC, 2021; WRI, 2023). Successful examples, like Denmark and Sweden, show that GDP growth can be decoupled from emissions through renewable energy and efficiency measures (Nordic Energy Research, 2012; CPLC, 2021).

The transition to a circular economy addresses unsustainable resource extraction by emphasizing reuse, recycling, and efficiency (REN21, 2023). Pollution control and biodiversity conservation are integral, with Costa Rica's payment for ecosystem services model reversing deforestation and increasing renewable energy use (Calma, 2024).

4. Economic Dimensions of the Green Economy

Economically, the green transition offers opportunities for innovation, job creation, and long-term cost savings. Global employment in renewables reached 16.2 million in 2023 (IRENA, 2023). Carbon pricing mechanisms, like Sweden's $120/ton tax, have shown efficacy in reducing emissions without compromising competitiveness (CPLC, 2017).

Green innovations, such as electric vehicles, biodegradable products, and renewable energy markets, drive new industries (IRENA, 2023). The economic cost of inaction is steep, with climate change threatening infrastructure and financial stability. Consequently, institutions like the World Bank and IMF endorse green economic policies.

5. Global Case Studies

Denmark has established itself as a global leader in renewable energy, particularly in wind power. As of 2022, over 50% of Denmark's electricity was generated from wind, with some years reaching even higher levels (IEA, 2022). This achievement is the result of long-term strategic investments in wind technology, early adoption of feed-in tariffs, and strong public-private collaboration. Denmark's energy transition was further supported by comprehensive energy efficiency policies and public awareness campaigns. Despite a high share of renewables, the country maintained robust economic growth, with an 80% GDP increase over three decades, showing that decarbonization and prosperity can go hand in hand (Nordic Energy Research, 2012).

Sweden is renowned for its pioneering carbon taxation policy introduced in 1991. The tax, which exceeds $120 per ton of CO_2, applies primarily to fossil fuel use in heating and transportation sectors (CPLC, 2017). Despite concerns that such a policy might hurt economic performance, Sweden has seen its GDP grow by 78% while reducing greenhouse gas emissions by 26% between 1990 and 2017. The tax revenue has been used to offset labor and income taxes, making the policy politically sustainable. Sweden's success illustrates how fiscal instruments can align economic and environmental objectives when well-designed and socially inclusive.

Costa Rica presents a compelling example of integrated green development. Since the 1990s, the country implemented a payments for ecosystem services (PES) program that reversed deforestation and incentivized landowners to conserve forests (Calma, 2024). As a result, forest cover more than doubled, and biodiversity loss was curtailed. Costa Rica also generates more than 98% of its electricity from renewable sources, mainly hydro, wind, and geothermal. Furthermore, the country has invested in ecotourism and launched plans for carbon neutrality. Its

holistic approach—combining environmental protection, renewable energy, and sustainable tourism—offers a model for balancing development and conservation.

Germany's Energiewende, or "energy transition," represents a large-scale effort to phase out nuclear energy and fossil fuels while boosting renewables. The policy involved generous feed-in tariffs, support for citizen energy cooperatives, and a target-driven roadmap for climate neutrality (Federal Ministry for Economic Affairs and Climate Action, 2021). By 2020, renewables accounted for around 45% of Germany's electricity generation. However, the nuclear phaseout resulted in a temporary increase in coal use, and challenges emerged in maintaining affordability and grid stability. Germany's experience demonstrates that ambitious green transitions require ongoing policy adjustments and strong infrastructure planning to ensure effectiveness and public support.

In contrast, Sri Lanka's decision to ban all chemical fertilizers and pesticides in 2021—aiming to transition to organic farming—serves as a cautionary tale. The sudden policy shift, implemented without adequate preparation or alternatives, caused widespread crop failures. Rice production fell by 32%, and tea exports declined by 18%, triggering a food crisis and economic losses (IWMI, 2023). Public backlash led to the reversal of the policy within seven months. This case highlights the importance of gradual implementation, stakeholder engagement, and technical readiness in green economy reforms.

Biofuel policies in the United States and European Union during the 2000s were initially lauded as steps toward cleaner energy. However, the large-scale diversion of food crops like corn and palm oil for biofuel production contributed to spikes in global food prices and deforestation, especially in tropical countries such as Indonesia and Brazil (CGD, 2022; The Breakthrough

Institute, 2021). These unintended consequences prompted a policy re-evaluation, with the EU and U.S. scaling back support for first-generation biofuels. The lesson is that environmental solutions must consider cross-sectoral and global impacts.

European diesel promotion policies, aimed at reducing CO_2 emissions from vehicles, also produced harmful outcomes. Diesel cars emit lower CO_2 per kilometer than gasoline vehicles, prompting tax incentives across Europe. However, they also produce higher levels of nitrogen oxides (NO_x), contributing to urban air pollution and respiratory diseases. The Dieselgate scandal in 2015 revealed that major car manufacturers had manipulated emissions data, further damaging public trust. An estimated 38,000 premature deaths were attributed to excess diesel emissions in Europe (Carrington, 2017). This case underscores the necessity of multi-dimensional policy assessments that include climate, health, and ethical considerations.

Australia's carbon pricing scheme, introduced in 2012, was a brief but instructive episode in climate policy. The system successfully reduced emissions and stimulated renewable energy investment. However, political opposition led to its repeal in 2014, causing a reversal in progress and policy uncertainty (IWMI, 2023). The case illustrates the vulnerability of climate policies to political cycles and the importance of building broad-based support for long-term sustainability reforms

6. Green Economy in Oklahoma

Green Economy Challenges

Oklahoma presents a mixed picture in its pursuit of a green economy, characterized by significant progress in renewable energy and climate-smart agriculture, alongside persistent structural and policy-related challenges.

Energy: Oklahoma's most notable success lies in its rapid expansion of wind power. By 2023, wind energy accounted for 42% of the state's electricity generation, up from near-zero levels two decades prior (EIA, 2024). This transition was primarily market-driven, supported by federal production tax credits and state-level incentives. Wind energy development brought rural economic benefits, including lease payments to landowners and job creation in wind farm construction and operations. However, the state continues to rely heavily on fossil fuels, especially natural gas and oil, which still dominate production and employment. Additionally, Oklahoma lacks a binding statewide climate policy or emissions reduction targets, which limits coordinated progress toward decarbonization. While green hydrogen and carbon capture have been discussed as future avenues, these remain in early-stage planning and face technological and economic uncertainties.

Agriculture: Oklahoma has made strides in promoting climate-smart agricultural practices. Programs encouraging no-till farming, cover cropping, rotational grazing, and carbon sequestration have gained traction, particularly through the Oklahoma Carbon Initiative and extension services (Oklahoma State University Extension, 2023). These efforts contribute to soil health, drought resilience, and emissions mitigation. However, implementation is uneven across the state. Many farmers still use conventional practices, and adoption of carbon markets or regenerative techniques remains limited due to skepticism, lack of technical support, and market infrastructure. The agriculture sector also remains a significant source of methane and nitrous

oxide emissions, and challenges like fertilizer runoff and groundwater depletion persist, particularly in the Panhandle region. While voluntary programs have spurred innovation, the absence of regulatory frameworks and targeted financial incentives hinders widespread transition.

Infrastructure: In urban infrastructure, Oklahoma has taken modest steps toward sustainability. Investments in electric vehicle (EV) charging networks, smart grids, and public transit pilots in cities like Oklahoma City and Tulsa signal early-stage momentum. The launch of downtown streetcars and incremental expansion of bike lanes and pedestrian access reflect shifting priorities. Additionally, select buildings have achieved LEED certification, and landfill methane capture programs offer environmental co-benefits. Nevertheless, major gaps remain. The state's building stock is largely inefficient, urban planning continues to favor low-density sprawl, and solar energy—despite abundant sunlight—accounts for less than 1% of electricity generation. Public transit remains underfunded, and EV adoption rates are low compared to national averages. Without comprehensive policy incentives or building codes that prioritize energy efficiency, Oklahoma's infrastructure transition remains slow and fragmented.

In sum, Oklahoma's green economy development shows strong sectoral highlights—particularly in wind energy and conservation agriculture—while also revealing significant policy and implementation challenges. Progress has been largely driven by market forces and federal support rather than coordinated state planning. To realize its full potential, Oklahoma would benefit from adopting a more strategic, inclusive green economy framework that expands renewable diversity, scales sustainable agriculture, and accelerates investments in climate-resilient infrastructure.

7. Lessons for Armenia

Drawing from international and Oklahoma examples, Armenia can shape its green economy trajectory through the following interconnected strategies:

Craft a long-term green economy strategy aligned with EU and global commitments: As seen in countries like Denmark and Sweden, and reinforced by Oklahoma's sector-specific progress, long-term policy vision is crucial for sustained green transition. Armenia can build a roadmap that incorporates its Nationally Determined Contributions (NDCs) under the Paris Agreement, synchronizing with the EU Green Deal and leveraging regional frameworks like EU4Environment (SEI, 2021). Such a strategy should include sectoral targets, a climate finance plan, and mechanisms for monitoring and accountability to guide cross-sectoral development.

Scale solar and wind energy to reduce fossil dependency: Inspired by Oklahoma's success in wind energy development and Costa Rica's use of renewables for nearly all electricity, Armenia can exploit its high solar irradiation and moderate wind potential to diversify its energy mix. While Armenia currently imports a large share of its energy, especially natural gas, scaling community solar and utility-scale renewables would strengthen energy independence and resilience. Policies modeled after Oklahoma's tax incentives or Denmark's feed-in tariffs could mobilize private investment (World Bank, 2021).

Use carbon pricing to fund climate investments: Sweden's experience with carbon taxation illustrates that it is possible to reduce emissions while maintaining economic growth. Armenia could adopt a modest carbon pricing mechanism or emissions trading system to create

predictable funding for low-carbon infrastructure, green public transport, and rural electrification. As in Sweden, revenues could be recycled into social programs or clean technology subsidies to ensure public support (CPLC, 2021).

Promote climate-smart agriculture in semi-arid regions: Oklahoma's voluntary conservation practices, such as no-till farming and cover cropping, provide a strong model for Armenia's dry and erosion-prone agricultural zones. These methods increase drought resilience and carbon storage while preserving productivity. Armenia's rural development strategy can integrate carbon markets, technical support, and extension services to accelerate the transition, ensuring that smallholders are included (Oklahoma State University Extension, 2023).

Expand clean transport and urban green infrastructure: The fragmented but growing efforts in Oklahoma City and Tulsa to improve transit and pedestrian systems offer lessons for Yerevan and other Armenian cities. Armenia can prioritize investments in electric buses, cycling infrastructure, and EV charging corridors. Upgrading inefficient buildings and incorporating green infrastructure (e.g., permeable pavements, tree planting) will also increase urban resilience to climate impacts (U.S. Department of Transportation, 2023).

Prioritize stakeholder engagement and just transition frameworks: Failed or reversed policies in Sri Lanka and Australia show that even well-intended reforms can falter without social backing. Armenia should ensure inclusive decision-making by engaging farmers, workers, municipalities, and civil society early in the policy process. Mechanisms such as retraining programs, social protection for displaced workers, and awareness campaigns will help maintain trust and legitimacy during transitions (IWMI, 2022).

Together, these steps offer Armenia a practical and locally adaptable path toward building a resilient, low-carbon economy that balances environmental, social, and economic priorities.

8. Conclusion

The transition to a green economy is no longer an aspirational ideal but a pressing necessity in the face of accelerating climate change, resource depletion, and growing social inequities. This paper has shown that while the pathways to sustainability vary by context, successful strategies share core traits: long-term policy commitment, inclusive planning, adaptive governance, and alignment of environmental goals with economic opportunity. From Denmark's wind revolution to Oklahoma's wind-powered pragmatism, and from Costa Rica's forest restoration to Sweden's effective carbon tax, the lessons are clear—green growth is both possible and profitable when paired with sound policy and public engagement.

For Armenia, these global and subnational insights illuminate a path forward. By setting clear goals, leveraging renewable resources, promoting climate-resilient agriculture, investing in clean infrastructure, and fostering social consensus, Armenia can build a green economy tailored to its unique geography and development stage. The green transition is complex and will require trade-offs, but with smart policy design and strong stakeholder collaboration, Armenia has the opportunity to become a regional model of sustainable development. Now is the moment to act decisively and strategically for a cleaner, fairer, and more resilient future.

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