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PROGRESS IN IMPLEMENTING THE EUROPEAN GREEN DEAL: LESSONS FOR RATIONAL NATURAL RESOURCE USE AND SUSTAINABLE DEVELOPMENT

Abstract. The European Green Deal (EGD) represents a pivotal strategy for achieving climate neutrality by 2050, integrating environmental sustainability with economic and social goals. This study evaluates progress toward 154 EGD targets using a traffic light assessment system, revealing uneven advancements across sectors. While 21 % of targets are on track, 41 % require acceleration, highlighting challenges in rational natural resource use. Implications for sustainable development emphasize the need for enhanced policy implementation to align with UN Sustainable Development Goals (SDGs).

Introduction. The European Union (EU) faces escalating environmental challenges, including climate change, biodiversity loss, and resource depletion, necessitating rational natural resource management for sustainable development (EEA, 2025). The EGD, launched in 2019, aims to transform the EU into a climate-neutral economy by 2050, encompassing seven thematic areas: climate ambition, clean energy, circular economy, sustainable mobility, agricultural greening, biodiversity protection, and zero pollution (European Commission, 2019).

Fig. 1. **Cover of the JRC Report on Delivering the EU Green Deal**

This initiative aligns with SDGs, particularly SDG 13 (climate action) and SDG 15 (life on land), promoting a just transition (ECNO, 2025). Despite progress, disparities among Member States and external factors like the COVID-19 pandemic underscore the urgency for evaluation (IEEP, 2025). This analysis, based on the Joint Research Centre (JRC) report, assesses mid – 2024 progress to identify lessons for global sustainability efforts (Marelli et al., 2025).

Methods. The assessment draws from the JRC report, analyzing 154 quantifiable targets from 44 policy documents spanning 2019–2024 (Marelli et al., 2025). Targets were categorized into binding (87) and non-binding, evaluated using a traffic light system: green (on track), yellow (acceleration needed), red (regressing), and gray (no data). Data sources included Eurostat, European Environment Agency (EEA) reports, and sector-specific models, assuming linear trajectories where forecasts were unavailable (EEA, 2025). Progress was benchmarked against baselines like 1990 GHG emissions, incorporating national energy and climate plans (NECPs). This methodology ensures transparency and aligns with similar evaluations, such as the EEA's 8th Environment Action Programme stocktake (EEA, 2025).

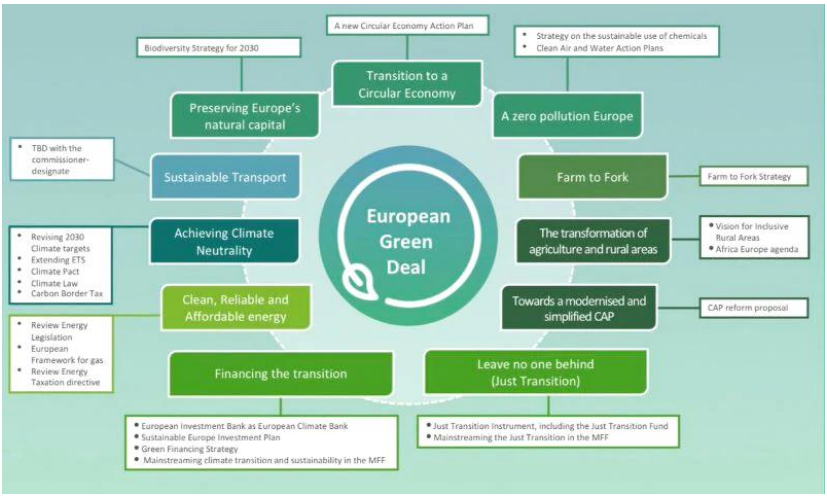

Fig. 2. **Schematic of the EU Green Deal methodology and thematic areas (European Commission, 2019)**

Results. The analysis of the European Green Deal (EGD) progress, based on the Joint Research Centre (JRC) report from 2025, reveals a complex landscape of achievements and challenges across its seven thematic areas (Marelli et al., 2025). Overall, out of the 154 evaluated targets, 32 (21 %) are on track (green), 64 (41 %) require acceleration (yellow), 15 (10 %) are regressing (red), and data are unavailable for 43 (28 %). Among the 87 binding targets, only 13 (15 %) are on track, indicating a significant gap in meeting legally mandated goals. The following detailed breakdown provides insights into each thematic area:

Climate Ambition: Greenhouse gas (GHG) emissions have decreased by 32.5 % since 1990, aligning with the EU's commitment to a 55 % reduction by 2030 compared to 1990 levels (ECNO, 2025). However, the current pace must double to meet this target, with projections suggesting a 50 % reduction with additional measures under the Fit for 55 package (Marelli et al., 2025). The Effort Sharing Regulation (ESR) sectors (transport, buildings, agriculture, waste, and small industry) have reduced emissions by 17 % since 2005, yet the 40 % target by 2030 remains elusive, rated yellow. The Land Use, Land Use Change, and Forestry (LULUCF) sector shows a red status, with carbon sinks declining due to natural disasters and deforestation, falling short of the 310 million tons CO_2-equivalent removal goal by 2030 (ECNO, 2025). Methane emissions have dropped by 20.67 % since 2005,

but agricultural contributions (53 % of total) necessitate further acceleration (yellow).

Clean, Affordable, and Secure Energy: The share of renewable energy in total consumption rose to 23 % in 2022 from 21.9 % in 2021, yet the 42.5 % target by 2030 is yellow, with national energy and climate plans (NECPs) forecasting only 38.6–39.3 % (3E, 2025). Solar power is on track with 260 GW installed by 2023, nearing the 320 GW goal by 2025, while offshore wind (19 GW in 2023) and ocean energy (700 kW in 2023) lag behind their 60 GW and 1 GW targets, respectively (yellow). Energy efficiency shows regression, with final energy consumption at 940 million tonnes of oil equivalent (Mtoe) in 2022, far from the 763 Mtoe target by 2030 (Marelli et al., 2025). Building renovations and hydrogen production (6 GW electrolyzers by 2024) also require acceleration.

Circular Economy: Progress is noted in battery recycling, with lead-acid batteries on track, though other types lag (yellow). Plastic recycling targets (50–85 % by 2030) show mixed results, with some materials green and others yellow, while the circular material use rate remains stagnant at 11.7 %, rated red (Marelli et al., 2025). Food waste reduction (10–30 %) and critical raw material diversification need acceleration, reflecting challenges in shifting from recycling to prevention-focused strategies.

Sustainable and Smart Mobility: Transport GHG emissions are regressing, with a 90 % reduction target by 2050 rated red due to a pace 10 times slower than required (IEEP, 2025). Electric vehicle (EV) infrastructure, aiming for 3 million charging points by 2030, has reached only 730,000, rated yellow. Sustainable aviation fuels (SAF) and renewable fuels of non-biological origin (RFNBO) are on track at 1 % and developing, respectively, but maritime emission intensity increases pose a red flag.

Greening the Common Agricultural Policy (CAP) and Farm-to-Fork (F2F): Pesticide use has decreased by 33 % since 2015–2017, on track for a 50 % reduction by 2030 (green), though more hazardous pesticides show a 21 % drop with a 2021 uptick (yellow) (EEA, 2025). Organic farming covers 9.1 % of land (2020), with a 6.7 % compound annual growth rate toward the 25 % target (yellow). Nutrient losses are stable, and food waste reduction goals are unmet, indicating a need for intensified efforts.

Preserving and Protecting Biodiversity: The target to protect 30 % of land and seas by 2030 is at 26 % and 12 %, respectively, requiring acceleration (yellow), with only 3.5 % strictly protected (Marelli et al., 2025). Pollinator populations are declining (red), while forest restoration efforts are on track

with 23 million trees planted. Data gaps persist for river restoration and soil protection, where 450 km² are lost annually (red).

Zero Pollution Ambition: Air quality improves, with PM2.5 reductions on track (green), but NO_2 levels regress (red) (EEA, 2025). Industrial emissions are decreasing toward a 40 % reduction by 2050 (green), yet microplastic and PFAS data are unavailable (gray), hindering full assessment of the zero-pollution goal.

These results underscore the need for targeted interventions to address regressing sectors and data deficiencies, providing a foundation for policy refinement.

The findings indicate significant but uneven EGD progress, with recent policies like Fit for 55 expected to yield future gains (Marelli et al., 2025). Challenges include financing gaps, data deficiencies, and socio-political barriers, potentially narrowing the agenda under the Clean Industrial Deal (IEEP, 2025). For rational natural resource use, lessons emphasize integrated approaches, such as enhancing circularity to reduce waste and promoting sustainable agriculture to preserve biodiversity (EEA, 2025). Globally, the EGD serves as a model for climate-neutral transitions, informing policies in non-EU contexts by prioritizing innovation and equity (ECNO, 2025). Future research should focus on scenario modeling to address emerging gaps, ensuring alignment with SDGs for a just, sustainable Europe.

Conclusions. The evaluation of the European Green Deal's progress highlights both notable successes and persistent challenges in achieving climate neutrality and sustainable development by 2050. The achievement of 21 % of targets being on track demonstrates the effectiveness of existing policies in areas such as solar energy deployment, pesticide reduction, and air quality improvements. However, the 41 % of targets requiring acceleration and 10 % regressing underscore the urgency of scaling up efforts, particularly in transport emissions, LULUCF carbon sinks, and biodiversity protection. The significant data gaps (28 %) further emphasize the need for enhanced monitoring and reporting systems to ensure informed decision-making. For rational natural resource use, the EGD provides critical lessons, including the importance of integrating renewable energy, circular economy principles, and sustainable agricultural practices to balance economic growth with environmental preservation. For the EU and beyond, these findings advocate for increased investment in green infrastructure, stronger international cooperation, and adaptive policy frameworks to address emerging environmental threats. Continued commitment to the EGD's goals, supported

by robust scientific analysis and stakeholder engagement, will be essential to realizing a sustainable and equitable future.

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