Green Jobs in Romania in the Context of the Circular Economy: Opportunities, Challenges and Public Policy Directions

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Abstract: The article analyzes the development of the concept of green jobs and the acquisition of green skills in Romania in the context of the transition towards the circular economy, highlighting the connection between employment, environmental protection and the efficient use of resources. The circular economy involves the transition from a linear economic model, based on production, consumption and disposal, towards a model focused on waste reduction, reuse, repair, recycling and resource recovery. Within this framework, green jobs can contribute to the modernization of the labour market and to the creation of professional opportunities in areas such as waste management, recycling, renewable energy, energy-efficient construction, sustainable agriculture, green transport, and repair and reuse services. The aim of the article is to highlight the opportunities, challenges and public policy directions needed for the development of green jobs in Romania. The research is based on a theoretical and descriptive approach, through the analysis of the specialized literature, strategic documents and the main trends regarding the circular economy and green employment. In this context, Romania has significant potential for the development of green jobs, but its valorisation is limited by insufficient recycling infrastructure, the low level of green skills, limited investment and the uneven implementation of public policies. The article emphasizes the need for integrated measures aimed at vocational training, stimulating green investments, supporting circular enterprises and strengthening cooperation between public authorities, the private sector and the education system.

Keywords:green jobs, circular economy, Romania, green skills, labor market transformation, public policies, sustainable development
JEL Classification: J21, J24, J48, O44, Q56, Q58

1 Introduction

In recent decades, climate change, environmental degradation, intensive resource consumption and the increasing amount of waste have led to a gradual reorientation of economic policies towards more sustainable development models. In this context, the circular economy has become one of the main directions of transformation for modern economies, as it promotes the efficient use of resources and the reduction of negative environmental impact. Unlike the linear economic model, based on the principle of "production–consumption–disposal", the circular economy aims to keep products, materials and resources within the economic cycle for as long as possible, through reuse, repair, recycling and recovery.

This transition also has important implications for the labour market. The emergence of new economic activities, the transformation of production processes and the growing demand for sustainable solutions contribute to the development and transformation of jobs associated with environmental protection, pollution reduction, resource conservation and the support of a low-carbon economy. These jobs, generally referred to as green jobs, can appear both in traditional sectors, such as agriculture, construction or industry, and in emerging

areas, such as renewable energy, waste management, recycling, eco-design, green transport, and repair and reuse services.

At the international level, the concept of green jobs became visibly defined starting in 2007, with the launch of the Green Jobs Initiative, and was consolidated in 2008 through the report Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World. At the European level, the concept was more strongly integrated into employment and sustainable development policies after 2009–2010, in connection with the transition towards a low-carbon economy and the objectives of the Europe 2020 Strategy. In Romania, the concept was officially introduced into public policies in 2018, through the approval of the National Strategy for Green Jobs 2018–2025, by Government Decision no. 594/2018.

In Romania, the development of green jobs in the context of the circular economy represents an important opportunity for labour market modernization, economic competitiveness and skills diversification. However, this process also requires the adaptation of the workforce to new demands, especially through the acquisition of green, digital and technical skills. Therefore, education, vocational training and active employment policies become essential for preparing employees and future specialists for the requirements of the green transition.

The development of green jobs in Romania also faces several challenges. These include insufficiently developed infrastructure for separate collection and recycling, the low level of green skills, limited investments in circular sectors, reduced environmental awareness and the uneven implementation of public policies. In addition, there is still a significant gap between the requirements of the green economy and the educational or vocational training offer, which highlights the need for an integrated approach involving public authorities, the private sector, educational institutions and civil society.

The aim of this article is to analyse the role of the circular economy in the development of green jobs in Romania, with a focus on existing opportunities, encountered challenges and necessary public policy directions. The article seeks to highlight the connection between environmental protection and employment, emphasizing that the green transition should not be seen only as an ecological obligation, but also as an economic and social opportunity. In this regard, green jobs can contribute both to reducing environmental impact and to creating a labour market that is more flexible, more inclusive and more future-oriented.

From a methodological perspective, the article has a theoretical and descriptive character, being based on the analysis of specialized literature, strategic documents and the main trends regarding the circular economy, green employment and green skills. The structure of the article includes a presentation of the conceptual framework regarding green jobs and the circular economy, an analysis of the opportunities existing in Romania, the identification of the main challenges and the formulation of public policy directions to support green employment.

2 Literature review

The relationship between environmental protection, employment and sustainable economic development has become increasingly relevant in academic literature and in public policy documents. The transition towards a greener economy has generated growing interest in the way labour markets can adapt to environmental objectives, resource efficiency and climate change mitigation. In this context, the concept of green jobs has been analysed as a key element linking economic development with environmental sustainability and social inclusion.

At the international level, the literature on green jobs was strongly influenced by the report Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World, published by the United Nations Environment Program (UNEP), the International Labor Organization (ILO), the International Organisation of Employers (IOE) and the International Trade Union Confederation (ITUC) in 2008. This report represents one of the first comprehensive studies on the emergence of a green economy and on the way environmental policies can create and transform jobs (UNEP et al., 2008). The report emphasizes that green jobs should not be understood only as jobs that protect the environment, but also as decent jobs that contribute to social inclusion, income security and better working conditions.

The International Labour Organization has also played an important role in clarifying the relationship between work, environmental protection and sustainable development. According to the ILO, green jobs can be found in traditional sectors such as agriculture, manufacturing and construction, as well as in emerging sectors such as renewable energy, waste management and environmental services (ILO, 2016). This approach is important because it shows that the green transition does not only create new occupations, but also transforms

existing jobs through cleaner technologies, resource efficiency and the integration of environmental requirements into daily work activities.

A significant part of the literature highlights that the transition to a green economy produces both opportunities and risks for the labour market. On the one hand, new jobs may emerge in renewable energy, recycling, waste management, sustainable agriculture, green construction, repair services and environmental consulting. On the other hand, certain jobs in polluting or resource-intensive sectors may decline, which makes reskilling and upskilling policies essential. Therefore, the development of green jobs depends not only on environmental investments, but also on the capacity of education and vocational training systems to provide the skills required by the green transition.

At the European level, green jobs have been increasingly linked to sustainable growth, resource efficiency and climate neutrality. The Europe 2020 Strategy promoted smart, sustainable and inclusive growth, encouraging the transition towards a resource-efficient, greener and more competitive economy (European Commission, 2010). Later, the European Green Deal reinforced the objective of transforming the European Union into a climate-neutral economy, while also emphasizing the need for a fair and inclusive transition (European Commission, 2019).

The circular economy has become another major topic in the literature and in European policy documents. The Circular Economy Action Plan adopted by the European Commission in 2020 presents the circular economy as a key component of the European Green Deal and as a framework for making sustainable products the norm in the European Union (European Commission, 2020). The document emphasizes the importance of addressing the entire life cycle of products, from design and production to consumption, repair, reuse, recycling and waste prevention.

From an employment perspective, the circular economy is relevant because it can generate new activities and transform existing value chains. The OECD underlines that the transition towards a resource-efficient and circular economy has the potential to influence employment by creating jobs in sectors related to recycling, repair, reuse, remanufacturing and waste management, while also reducing jobs in more resource-intensive sectors (Chateau and Mavroeidi, 2020). Thus, the circular economy should be analysed not only as an environmental model, but also as a labour market transformation process.

The role of skills is central in the literature on green jobs and circular economy. Cedefop emphasizes that vocational education and training can support the transition from linear thinking to green growth mindsets, by developing the competences required for circular production and consumption models (Cedefop, 2023). Green skills include both technical competences, such as knowledge of recycling technologies, energy efficiency or sustainable production methods, and transversal competences, such as environmental awareness, adaptability, problem-solving and responsible consumption behaviour.

In the Romanian context, the concept of green jobs was officially introduced into public policies through the National Strategy for Green Jobs 2018–2025, approved by Government Decision no. 594/2018. The strategy aimed to stimulate entrepreneurship and the creation of green jobs, improve skills for green employment and strengthen cooperation between public authorities, employers, education providers and social partners (Government of Romania, 2018). This document marked an important step in recognizing green jobs as a policy priority in Romania.

Romania has also adopted the National Strategy on Circular Economy, approved by Government Decision no. 1172/2022. This strategy supports the transition from the linear economic model to a circular model, based on resource efficiency, waste reduction, reuse, repair and recycling (Government of Romania, 2022). The existence of this strategy provides an institutional framework for developing circular economy activities that can also contribute to the creation of green jobs.

Recent analyses show that Romania still faces significant challenges in the transition towards a circular economy. The Circular economy country profile 2024 – Romania, published by the European Environment Agency, provides an updated overview of Romania's progress and highlights the need for stronger implementation of circular economy policies (European Environment Agency, 2024). These challenges are also reflected in national studies, which indicate difficulties related to waste management, recycling rates, infrastructure, investment and policy coherence.

Romanian academic literature has also started to examine the country's progress towards circular economy objectives. Pintilie (2021) analyses the progress of European Union countries towards circular economy using specific indicators and provides a useful comparative perspective for understanding Romania's position

within the EU. More recent studies, such as Ghiță-Mitrescu (2024), focus specifically on Romania's progress using the Eurostat Monitoring Framework and identify areas where improvements are still needed. These studies can support the argument that Romania has potential for circular economy development, but also faces structural limitations.

Overall, the literature suggests that green jobs can become an important instrument for linking environmental protection with employment growth. However, their development requires an integrated approach based on investment, education, vocational training, innovation and coherent public policies. In this sense, the circular economy provides a relevant framework for analysing how Romania can create new employment opportunities while reducing environmental pressure and improving the efficient use of resources.

3 Research methodology

This article is based on a theoretical, descriptive and qualitative research approach, aimed at analysing the relationship between green jobs, the circular economy and employment policies in Romania. The research does not seek to test a statistical model, but to provide an analytical overview of the main opportunities, challenges and public policy directions related to the development of green jobs in the context of the circular economy.

The methodological approach is based on the analysis of specialized literature, international reports, European policy documents, national strategies and relevant statistical indicators. The literature review includes studies and reports published by international organizations such as the International Labour Organization, the United Nations Environment Programme, the Organisation for Economic Co-operation and Development, Cedefop and the European Environment Agency. These sources are relevant because they provide conceptual definitions, comparative perspectives and policy recommendations regarding green jobs, circular economy, green skills and sustainable employment.

At the European level, the research takes into account strategic documents such as the Europe 2020 Strategy, the European Green Deal and the Circular Economy Action Plan, which define the general framework for the transition towards a greener, more resource-efficient and climate-neutral economy. These documents are used in order to understand how green employment and circular economy objectives are integrated into European public policies.

For the Romanian context, the analysis is based mainly on the National Strategy for Green Jobs 2018–2025 and the National Strategy on Circular Economy, as well as on data and country profiles provided by Eurostat and the European Environment Agency. These sources allow the identification of Romania's current position in relation to the development of green jobs and the implementation of circular economy principles.

An important methodological limitation is related to the way green jobs are defined and measured in Romania. At present, Romanian authorities do not provide a separate and clearly delimited official list of green jobs. In practice, these jobs are usually identified indirectly, either by reference to economic activities connected with environmental protection, waste management, recycling, renewable energy and resource efficiency, or by reference to industrial activities that use green equipment, apply cleaner technologies or produce environmentally friendly goods and services. Therefore, the statistical measurement of green jobs remains difficult, as these jobs are not always recorded as a distinct category in national labour market statistics.

Moreover, in Romania, available statistical information on green jobs is often connected to projects financed through European funds, especially when such projects include specific indicators regarding the creation of green jobs or the development of green skills. As a result, the analysis of green employment is frequently based on project-level data, sectoral information or proxy indicators, rather than on a unified national statistical classification. This situation limits the precision of the analysis, but also highlights the need for a clearer methodological framework for defining, monitoring and evaluating green jobs at national level.

The research follows three main analytical directions. The first direction concerns the conceptual clarification of green jobs, circular economy, sustainable employment, green transition and green skills. The second direction focuses on identifying the sectors with the highest potential for green employment in Romania, such as waste management, recycling, renewable energy, sustainable construction, repair and reuse services, sustainable agriculture and green transport. The third direction examines the main barriers that may limit the development of green jobs, including insufficient infrastructure, limited green skills, low levels of investment, weak institutional coordination and uneven policy implementation.

The article also uses a comparative perspective, by relating Romania's situation to broader European trends. This approach is useful for identifying gaps, opportunities and possible directions for improvement. However, the research has certain limitations. Since it is based mainly on secondary sources, the article does not include field research, interviews or survey data collected directly from employers, employees or public institutions. Another limitation is related to the availability and comparability of statistical data on green jobs, as this concept is still difficult to measure precisely and is not always reflected as a separate category in national labour market statistics.

Since the analysis relies mainly on secondary sources and proxy indicators, the methodological limitations related to the statistical identification of green jobs in Romania are acknowledged without treating these estimates as fully comparable official data.

Despite these limitations, the methodology allows a structured analysis of the connection between the circular economy and the development of green jobs in Romania. The article provides a basis for understanding how public policies, vocational training, investment and institutional cooperation can support the transition towards a more sustainable and employment-oriented economic model.

4 Conceptual framework: green jobs and circular economy

The concept of green jobs is closely linked to the broader transformation of the economy towards sustainability, environmental protection and efficient resource use. At the international level, the concept became more visible starting in 2007, with the launch of the Green Jobs Initiative, developed by the International Labour Organization, the United Nations Environment Programme, the International Organisation of Employers and the International Trade Union Confederation. In 2008, the report *Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World* provided one of the first comprehensive approaches to the relationship between the green economy and the world of work.

In general terms, green jobs refer to jobs that contribute to preserving or restoring the environment, either in traditional sectors such as agriculture, manufacturing and construction, or in emerging sectors such as renewable energy, waste management, recycling and environmental services. These jobs support the reduction of pollution, the efficient use of energy and raw materials, the protection of ecosystems and the transition towards a low-carbon economy. Therefore, green jobs are not limited to entirely new occupations, but also include existing jobs that are transformed through the integration of environmental objectives and green skills.

These concepts are interdependent. The circular economy provides the framework for reducing resource use and extending product life cycles, while green jobs represent the labor market response to this transformation. Green skills support workers' adaptation to new economic and environmental requirements.

The development of green jobs is strongly connected to the concept of circular economy. The circular economy represents an alternative to the traditional linear economic model, which is based on the sequence "take–make–consume–dispose". In the linear model, natural resources are extracted, transformed into products, consumed and finally discarded as waste. This model generates high pressure on the environment, increases the demand for raw materials and contributes to pollution and resource depletion.

By contrast, the circular economy aims to keep products, materials and resources in use for as long as possible. It is based on principles such as reducing waste, reusing products, repairing goods, recycling materials and recovering resources. In this model, waste is not seen only as a final residue, but as a potential resource that can be reintroduced into the economic cycle. As a result, the circular economy contributes to reducing environmental pressure and creates opportunities for new forms of economic activity and employment.

Another important concept is sustainable employment, which refers to employment that supports economic development without compromising environmental quality and social well-being. Sustainable employment implies not only the creation of jobs, but also the creation of decent, stable and future-oriented jobs. From this perspective, green jobs must be associated with decent work, adequate skills, fair working conditions and long-term employability.

The green transition refers to the process through which economies, industries and labour markets adapt to environmental objectives, climate policies and resource efficiency requirements. This transition involves both opportunities and risks. On the one hand, it can generate new jobs in circular sectors, renewable energy, sustainable construction, green transport, recycling and repair services. On the other hand, it can lead to the transformation or disappearance of certain jobs in polluting or resource-intensive sectors. Therefore, the success

of the green transition depends on the capacity of education systems, vocational training institutions, employers and public authorities to support workers in acquiring green skills.

In this context, green skills become essential. They include the knowledge, abilities and attitudes required to perform tasks in a more environmentally responsible way. These skills may be technical, such as knowledge of recycling technologies, energy efficiency, renewable energy systems or sustainable production methods, but also transversal, such as environmental awareness, problem-solving, adaptability and responsible consumption behaviour. The development of green skills is necessary not only for specialists working directly in environmental sectors, but also for employees in traditional sectors that are gradually adapting to circular economy principles.

The concepts should be understood as interdependent rather than as separate analytical categories. The circular economy provides the economic framework for reducing resource use and extending product life cycles, while green jobs represent the labor market response to this transformation. Sustainable employment gives this process a social dimension, and green skills make it possible for workers to adapt to new production, consumption and environmental requirements.

Therefore, the relationship between green jobs and the circular economy is a direct one. The circular economy creates the economic framework for new activities based on reuse, repair, recycling, eco-design and resource efficiency, while green jobs represent the employment dimension of this transformation. In other words, the transition to a circular economy cannot be achieved without a labour force capable of supporting and implementing sustainable production and consumption models. At the same time, the development of green jobs can make the circular economy more inclusive by connecting environmental objectives with employment, skills development and social progress.

5 Green jobs in Romania: opportunities in the circular economy

The transition towards the circular economy can create important opportunities for the development of green jobs in Romania. Although the country does not yet have a clearly delimited statistical classification of green jobs, several economic sectors can be associated with green employment due to their contribution to environmental protection, resource efficiency and the reduction of waste. These sectors include waste management, recycling, renewable energy, sustainable construction, sustainable agriculture, green transport, repair and reuse services.

At the global level, the employment potential of the green transition is already visible. According to the Annual Review published by the International Renewable Energy Agency (IRENA) and the International Labor Organization (ILO), employment in renewable energy reached 16.2 million jobs worldwide in 2023, representing the highest annual growth recorded in this sector. This confirms that the green transition is not only an environmental process, but also a major labour market transformation. In addition, recent ILO estimates indicate that between 121 and 142 million people are employed worldwide in circular economy activities, representing approximately 5–5.8% of total global employment (ILO, 2025). These figures show that circularity is already an important source of employment at global level, although the measurement of circular jobs remains methodologically complex.

At European level, Eurostat monitors employment in circular economy sectors through the indicator “persons employed in circular economy sectors”, which includes three main areas: recycling, repair and reuse, and rental and leasing activities (Eurostat, 2024). According to the European Environment Agency country profile for Romania, employment in circular economy sectors represented 2.1% of total employment at EU level in 2021. In comparison, Romania recorded 91,467 persons employed in circular economy sectors, representing 1.2% of total national employment and 2.1% of the EU total in circular economy employment in the same year (European Environment Agency, 2024). This indicates that Romania is below the EU average in terms of the share of employment generated by circular economy sectors.

In the study *Dynamics of Circular Economy Indicators in European Countries*, based on Eurostat data, (Giucă, Voicilă and Rodino, 2025) indicate that Romania reached approximately 198 thousand persons employed in circular economy sectors in 2023, ranking sixth among EU Member States in absolute numbers. However, the same source indicates that Romania registered a slight decrease of about 0.55% compared with 2015, when the number was around 200 thousand persons (Giucă, Voicilă and Rodino, 2025). This shows that, although Romania has a significant number of people employed in circular economy-related sectors, the dynamics of these jobs remain relatively weak compared with the potential of the transition.

One of the most relevant areas for green jobs in Romania is waste management. The circular economy requires a shift from landfilling and disposal towards prevention, separate collection, sorting, treatment and recovery of materials. This transformation can generate jobs for waste collection operators, sorting station workers, environmental technicians, recycling specialists, logistics coordinators and specialists in waste traceability. The development of separate collection systems and the implementation of modern waste management technologies can therefore support both environmental objectives and employment creation.

Recycling represents another important source of green employment. In a circular economy, materials such as paper, cardboard, glass, plastic, metals, textiles and electronic equipment should be reintroduced into production cycles instead of being discarded. This creates opportunities for jobs in material recovery facilities, recycling plants, quality control, environmental compliance, circular logistics and secondary raw material markets. In Romania, the National Circular Economy Strategy identifies significant potential for improvement in areas such as resource efficiency, the use of secondary materials and better waste management (Government of Romania, 2022). The EEA country profile also shows that Romania has a high domestic material consumption, reaching 29.2 tonnes per person in 2022, which was 205% of the EU average, indicating a strong need for better resource efficiency and circular practices (European Environment Agency, 2024).

A recent opportunity is linked to the development of the deposit-return system for beverage packaging. Such systems require collection points, reverse vending machines, transport networks, counting and sorting centres, digital traceability systems and recycling partnerships. Even if this type of system does not solve all waste management problems, it can stimulate new activities connected with circular logistics, packaging recovery and recycling infrastructure. In this sense, it can become a practical example of how circular economy mechanisms may support green employment at local and national level.

Another sector with strong potential is renewable energy. The global evolution of employment in renewable energy confirms the capacity of this sector to create green jobs. The increase to 16.2 million renewable energy jobs worldwide in 2023 shows the rapid expansion of employment related to solar energy, wind energy, bioenergy, hydropower and other renewable technologies (IRENA and ILO, 2024). In Romania, the expansion of renewable energy can support new jobs for engineers, installers, maintenance technicians, energy auditors, project managers and specialists in energy efficiency, especially in regions where new investments can generate local employment.

Energy-efficient construction is also an important field for the development of green jobs. The renovation of buildings, thermal insulation, the use of sustainable materials, energy audits, nearly zero-energy buildings and smart energy systems can create demand for new skills and occupations. Construction workers, architects, engineers, building energy auditors and installation specialists increasingly need green skills related to energy performance, sustainable materials and environmental standards. This sector is especially relevant because buildings are major consumers of energy, and improving their efficiency can reduce both emissions and household energy costs.

Sustainable agriculture offers another opportunity for green employment in Romania. Circular economy principles can be applied in agriculture through organic farming, reduction of food waste, composting, efficient water use, bioenergy production and the valorisation of agricultural residues. These activities can create jobs in ecological farming, agro-processing, local food chains, compost production, sustainable land management and environmental consultancy for farms. Given Romania's agricultural potential, the integration of circular practices in rural areas can contribute to both environmental protection and rural employment.

Green transport is another sector that can support the development of green jobs. The expansion of public transport, electric mobility, bicycle infrastructure, alternative fuels and smart mobility services can create employment opportunities in vehicle maintenance, charging infrastructure, urban mobility planning, logistics and transport digitalization. In the circular economy context, green transport is relevant because it reduces emissions, improves resource efficiency and supports cleaner urban development.

The circular economy also creates opportunities in repair, reuse and remanufacturing services. These activities extend the life cycle of products and reduce the need for new raw materials. Jobs can be created in electronics repair, furniture restoration, textile reuse, second-hand markets, equipment refurbishment, remanufacturing and rental services. These areas are particularly important because Eurostat includes repair and reuse activities in the statistical measurement of circular economy employment (Eurostat, 2024).

In addition to sector-specific opportunities, the circular economy can stimulate new professional profiles related to green skills. These include environmental managers, sustainability consultants, circular economy

experts, eco-design specialists, waste prevention officers and trainers for green competences. Cedefop emphasizes that the transition to circular production and consumption models requires both technical skills and transversal competences, including environmental awareness, adaptability and problem-solving (Cedefop, 2023).

Overall, Romania has several opportunities for developing green jobs in the circular economy, but these opportunities depend on investment, infrastructure, education and policy coherence. Compared with the EU average, Romania still has a lower share of employment in circular economy sectors, but the existence of national strategies, EU-funded projects and emerging circular economy mechanisms indicates a relevant development potential. The sectors with the highest potential are those where environmental objectives can be directly connected with labour market needs: waste management, recycling, renewable energy, sustainable construction, sustainable agriculture, green transport, and repair and reuse services. In this sense, green jobs should be understood not only as an environmental policy outcome, but also as an employment strategy capable of supporting economic modernization and social development.

Table 1. Comparative overview of green jobs / circular economy employment by green activity field

Field of green activity	Global level	European level	Romania
Total environmental / green economy employment	No single global comparable figure identified	5.8 million FTE jobs in the EU environmental economy in 2023, up from 3.6 million FTE jobs in 2014	No separate official national figure identified for total green jobs
Total circular economy employment	121–142 million jobs worldwide, about 5–5.8% of global employment, excluding agriculture	More than 4 million persons employed in circular economy sectors in the EU in 2021; around 2.1% of total employment	91,467 persons employed in circular economy sectors in 2021, representing 1.2% of total national employment; academic processing of Eurostat data indicates around 198,000 persons in 2023
Renewable energy – total	16.2 million jobs worldwide in 2023	Around 1.8 million jobs in the EU in 2023; previous EU estimates indicated 1.69 million FTE jobs in 2022	No official separate national figure identified
Solar photovoltaic energy	7.1 million jobs worldwide in 2023	Around 720,000 jobs in the EU in 2023; SolarPower Europe reported 648,000 FTE jobs in 2022	No official separate national figure identified
Liquid biofuels	2.803 million jobs worldwide in 2023	Included in EU renewable energy employment statistics, but not easily comparable by sub-sector in the same dataset	No official separate national figure identified
Hydropower	2.324 million jobs worldwide in 2023	Included in EU renewable energy employment statistics	No official separate national figure identified
Wind energy	1.457 million jobs worldwide in 2023	Included in EU renewable energy employment statistics	No official separate national figure identified
Solid biomass	765,000 jobs worldwide in 2023	Included in EU renewable energy employment statistics	No official separate national figure identified

Field of green activity	Global level	European level	Romania
Biogas	681,000 jobs worldwide in 2023	Included in EU renewable energy employment statistics	No official separate national figure identified
Waste management and recovery of materials	Included in the global circular economy estimate of 121–142 million jobs	1.3 million FTE jobs in the EU in 2023, up from 0.9 million FTE jobs in 2014	Included in the Romanian circular economy employment total, but no clear official sub-sector breakdown
Wastewater management	No single comparable global figure identified	0.6 million FTE jobs in the EU in 2023, up from 0.4 million FTE jobs in 2014	No official separate national figure identified
Repair, reuse, second-hand trade, rental and leasing	Included in the global circular economy estimate of 121–142 million jobs	Included in Eurostat's circular economy employment indicator	Included in the Romanian circular economy employment total, but no clear official sub-sector breakdown
Energy efficiency and renewable energy production/equipment	Included partly in renewable energy and green economy estimates	1.0 million FTE jobs in the EU in 2023, up from 0.6 million FTE jobs in 2014	No official separate national figure identified
Energy-efficient construction	No single comparable global figure identified	Included partly in EU environmental economy and energy efficiency employment	No official separate national figure identified; strong potential through renovation and energy efficiency projects
Sustainable agriculture	Not included in the ILO global circular economy estimate mentioned above, which excludes agriculture	Not consistently reported as a separate circular economy employment category	No official separate national figure identified; high potential due to Romania's agricultural profile
Green transport	No single comparable global figure identified	Not consistently reported as a separate green jobs category in the same statistical framework	No official separate national figure identified; emerging potential through electric mobility and public transport investments

Source: Authors' synthesis based on ILO, Eurostat/EEA for European numbers presented; ILO/Circle Economy/World Bank for global estimation of employment in circular economy.

Analysing the above information the Table 1 interpretation, shows that the most measurable green employment areas are renewable energy, the environmental economy and circular economy sectors. At global level, renewable energy reached 16.2 million jobs in 2023, while circular economy activities employed an estimated 121–142 million people worldwide. At European level, the environmental economy generated 5.8 million full-time equivalent jobs in 2023, while circular economy sectors employed more than 4 million persons in 2021. Romania recorded 91,467 persons employed in circular economy sectors in 2021, representing 1.2% of total national employment, below the EU average of 2.1%. More recent academic processing of Eurostat data indicates approximately 198,000 persons employed in circular economy sectors in Romania in 2023. However, because Romania does not have an official separate classification of green jobs, the analysis must rely on proxy indicators, such as employment in circular economy sectors, environmental goods and services, renewable energy and EU-funded green projects.

6 Challenges for developing green jobs in Romania

The development of green jobs in Romania must be analysed in direct connection with the country's circular economy potential, the structure of regional economies and the availability of financial and human resources. As shown in the previous sections, Romania has opportunities in waste management, recycling, renewable energy, energy-efficient construction, sustainable agriculture, green transport, repair and reuse services. However, these opportunities are limited by structural barriers, insufficient investment, weak statistical monitoring and a still developing system of green skills.

A first challenge is the absence of a clearly defined national statistical classification of green jobs. Romanian authorities do not currently provide a separate official list of green occupations. As a result, green jobs are usually identified indirectly, through employment in environmental protection, circular economy sectors, renewable energy, waste management, recycling, repair and reuse activities, or through jobs created by projects financed from European funds. This makes the measurement of green employment difficult and limits the possibility of designing targeted labour market policies. In practice, the analysis must rely on proxy indicators, such as persons employed in circular economy sectors, environmental economy employment, renewable energy employment or jobs created through EU-funded projects.

A second challenge is the unequal regional distribution of green employment potential. The circular economy does not develop uniformly across the country. Industrial regions may have higher potential for recycling, remanufacturing and energy efficiency, agricultural regions may generate green jobs through sustainable agriculture and biomass, while urban regions may concentrate green jobs in services, consulting, transport, waste management and repair activities. Therefore, regional development strategies are essential for transforming green transition objectives into concrete employment opportunities.

The following table presents an indicative distribution of green jobs / circular economy-related jobs in Romania by development region, expressed in thousand persons. The estimates start from the approximate national level of circular economy-related employment, around 198,000 persons in 2023, and distribute this value across regions according to their economic profile and several proxy indicators, such as the concentration of industrial activities, agricultural potential, urban services, waste management and recycling activities, renewable energy potential, transport and logistics functions, and the relevance of just transition processes. Therefore, the figures should be interpreted as analytical estimates, not as official regional statistics.

Table 2. Estimated green jobs / circular economy-related jobs by Romanian development region

Development region	Estimated green jobs / circular economy-related jobs thousand persons	Main potential fields
București-Ilfov	35	Environmental consulting, circular economy services, green public procurement, waste management, repair and reuse services, green transport
Nord-Vest	28	Recycling, sustainable manufacturing, repair services, eco-innovation, renewable energy, circular SMEs
Centru	26	Industrial circularity, wood and furniture reuse, sustainable tourism, renewable energy, energy-efficient construction
Nord-Est	24	Sustainable agriculture, biomass, food waste reduction, repair services, rural circular economy
Sud-Muntenia	23	Industrial recycling, agriculture, logistics, waste management, renewable energy
Vest	22	Advanced manufacturing, circular industrial processes, renewable energy, repair and remanufacturing
Sud-Est	21	Green transport, port logistics, renewable energy, waste management, sustainable agriculture
Sud-Vest Oltenia	19	Just transition areas, energy transition, reskilling, renewable energy, circular industrial activities
Total Romania	198	Estimated circular economy-related employment

Source: Authors' indicative estimation based on Eurostat circular economy employment indicators, the European Environment Agency country profile for Romania and regional proxy indicators related to industrial structure, agricultural potential, urban services, waste management, renewable energy, transport and just transition processes.

Given their indicative character, these regional estimates are intended to highlight potential territorial differences in green employment development, rather than to provide a precise statistical measurement of green jobs at regional level.

The table shows that the largest concentration of green jobs may be expected in București-Ilfov, due to the concentration of services, administration, consultancy, transport and environmental management activities. At the same time, regions such as Nord-Vest, Centru and Vest may have stronger potential for circular industrial activities, repair, remanufacturing and eco-innovation. Regions such as Nord-Est, Sud-Muntenia and Sud-Est may develop green jobs through agriculture, waste management, biomass, food waste reduction and renewable energy. Sud-Vest Oltenia has a specific relevance because it is connected to the just transition process and to the need for reskilling workers affected by the restructuring of carbon-intensive activities.

Another major challenge is the lack of direct and dedicated national investment instruments specifically designed for the circular economy and green jobs. In Romania, financing for circular economy activities, green infrastructure, green skills and green employment is largely dependent on European funds, complemented by national co-financing and, in some cases, by the Environmental Fund Administration. The Sustainable Development Programme 2021–2027 is one of the main instruments for environmental and climate investments in Romania, supporting water management, circular economy, climate change adaptation, energy efficiency, renewable energy, biodiversity and waste-related infrastructure. Its total public contribution is approximately EUR 7.78 billion, including EU investment and national public contribution (European Commission, 2026).

For green skills and labour market adaptation, the Education and Employment Programme 2021–2027 is particularly relevant. It supports access to education and training, inclusive labour market measures and the development of skills needed for the digital and green transitions. The programme also supports vocational education and training, work-based learning, lifelong learning, micro-credentials, second chance programmes and the adaptation of workers and enterprises to change. Its total public contribution is approximately EUR 3.84 billion, of which about EUR 3.10 billion represents EU investment (European Commission, 2026).

Another source of funding is the National Recovery and Resilience Plan, which includes reforms and investments related to the green transition. Romania's plan has a value of approximately EUR 28.5 billion, and 44.1% of it supports climate objectives. The plan includes investments in sustainable transport, building renovation, biodiversity protection, industrial decarbonisation and the deployment of renewable energy. The REPowerEU chapter also focuses on green energy production, energy efficiency of buildings and the reskilling and upskilling of the workforce in the field of green energy production (European Commission, 2024).

The Just Transition Programme is also relevant for regions affected by the transition away from carbon-intensive activities. It can support economic diversification, new green economic activities, reskilling and employment measures in territories exposed to social and economic risks generated by decarbonisation. This is particularly important for areas such as Sud-Vest Oltenia, where the transition from traditional energy activities towards renewable energy, circular industrial activities and new services requires targeted intervention.

At regional level, the Regional Programmes 2021–2027 can finance investments connected with SME competitiveness, energy efficiency, innovation, urban mobility and, in some cases, circular economy activities. These programmes are important because the development of green jobs depends strongly on regional economic specialisation. For example, a region with a strong industrial base may support circular manufacturing and remanufacturing, while an agricultural region may focus on biomass, composting, food waste reduction and sustainable local value chains.

Additional opportunities are provided by European programmes such as LIFE, Horizon Europe, Interreg and Erasmus+. LIFE is particularly relevant for environment and climate action, including circular economy and quality of life projects. Horizon Europe may finance research and innovation related to circular technologies, green transition and sustainable business models. Interreg can support cross-border circular economy projects, while Erasmus+ can finance cooperation in education and vocational training, including the development of green skills.

Another challenge concerns the development of green skills. The circular economy requires workers who can operate recycling technologies, manage waste streams, apply environmental standards, improve energy efficiency, use digital traceability systems, work with renewable energy technologies and design circular business processes. Green skills are not limited to environmental specialists; they are also needed by construction workers, engineers, agricultural workers, technicians, transport specialists, public servants, entrepreneurs and managers.

In Romania, green skills can be developed through several types of institutions. Universities can introduce sustainability, circular economy and environmental management into higher education programmes. Vocational schools and dual education institutions can prepare technicians for recycling, renewable energy, energy efficiency, green construction and repair services. Public and private training providers can offer reskilling and upskilling programmes for adults. Employers can organize workplace training, while county employment agencies can support unemployed persons or workers in transition through active labour market measures.

Financial resources for green skills are available mainly through the Education and Employment Programme, the National Recovery and Resilience Plan, the Just Transition Programme, Erasmus+ and, in some cases, regional programmes or employer-funded training. The Education and Employment Programme explicitly supports the skills needed for the digital and green transitions and expects more than 354,000 participants to gain new qualifications, while more than 1.5 million people are expected to benefit from the programme overall (European Commission, 2026).

The main problem is that these resources are often fragmented across programmes, institutions and project calls. Therefore, the development of green jobs in Romania does not depend only on the existence of funding, but also on the capacity to coordinate funding sources, identify real labour market needs and connect employers with education and training providers. Without this coordination, green jobs may remain project-based and temporary, instead of becoming a stable component of the Romanian labour market.

Overall, the main challenges for developing green jobs in Romania are the lack of a clear statistical definition, insufficient infrastructure, unequal regional development, limited direct investment, dependence on European funds, low levels of green skills and fragmented policy implementation. Addressing these challenges requires a more coherent framework for monitoring green employment, financing circular economy investments and preparing the workforce for the green transition.

7 Public policy directions and alternative policy proposals

The development of green jobs in Romania requires coherent public policies that connect environmental objectives with employment, education, vocational training, investment and regional development. As shown in the previous sections, Romania has potential for green employment in waste management, recycling, renewable energy, sustainable construction, sustainable agriculture, green transport, repair and reuse services. However, this potential cannot be fully exploited without a clear institutional framework, adequate financing and a workforce prepared for the requirements of the circular economy.

A first public policy direction should focus on the development of green skills through education and vocational training. The transition towards the circular economy requires workers who are able to use recycling technologies, apply environmental standards, improve energy efficiency, operate renewable energy systems, manage waste flows and understand circular production models. Therefore, green skills should be integrated into vocational education, university curricula, adult training programmes and workplace learning. Training programmes should target both young people entering the labour market and adults whose jobs are affected by the green transition.

A second direction concerns the financing of green employment and circular economy activities. In Romania, direct national investment instruments dedicated exclusively to green jobs remain limited, and most available resources are connected to European funds, national co-financing and specific programmes. Therefore, public policies should ensure better coordination between the Sustainable Development Programme 2021–2027, the Education and Employment Programme 2021–2027, the National Recovery and Resilience Plan, the Just Transition Programme, the Regional Programmes 2021–2027, LIFE, Horizon Europe, Interreg and Erasmus+. These programmes can support infrastructure, green skills, renewable energy, circular economy projects, SME competitiveness, research, innovation and vocational training.

A third policy direction should support circular enterprises and green SMEs. Companies that develop business models based on repair, reuse, remanufacturing, recycling, eco-design, renewable energy or waste

prevention can directly contribute to job creation. Public authorities should provide grants, tax incentives, advisory services, innovation vouchers, simplified access to European funds and green public procurement opportunities. Small and medium-sized enterprises are particularly important because they can create local green jobs and support regional circular economy ecosystems.

A fourth direction should involve the development of regional green employment strategies. Since Romania's development regions have different economic profiles, green jobs should not be promoted through a uniform national approach. Regions with an industrial profile may focus on circular manufacturing, recycling, remanufacturing and energy efficiency. Agricultural regions may develop jobs related to sustainable agriculture, composting, biomass and food waste reduction. Urban regions may focus on green transport, waste management, environmental services, green public procurement and repair activities. Regional strategies should identify local opportunities, available skills and investment needs.

A fifth policy direction concerns the use of public procurement as an instrument for creating demand for green products and services. Public institutions can stimulate green jobs by including environmental and circular criteria in procurement procedures. For example, demand for recycled materials, repair services, energy-efficient buildings, electric transport, reusable products and sustainable public services can encourage companies to develop circular business models and create related jobs.

In addition to these policy directions, this article proposes an alternative public policy focused on the institutional recognition of green jobs in Romania. The main objective of this alternative policy would be the introduction of green occupations into the Classification of Occupations in Romania (COR) and the development of new occupational standards for these jobs. This measure is necessary because, at present, Romania does not have a separate official list of green jobs, and this limits the capacity of authorities to measure, finance and support green employment.

The Classification of Occupations in Romania (COR) is the official national system used for the identification, hierarchy and coding of occupations in the Romanian labour market. It is also used by the national statistical system and is harmonised with the international and European occupational classification ISCO-08. However, the current classification does not provide a distinct category for green jobs, although Romania has already adopted the National Strategy for Green Jobs 2018–2025, approved by Government Decision no. 594/2018.

The proposed alternative policy would include several stages. The first stage would consist of creating an interinstitutional working group involving the Ministry of Labour, the National Institute of Statistics, the National Agency for Employment, the National Authority for Qualifications, environmental authorities, employers' organisations, trade unions, universities and sectoral committees. This group would identify occupations with a strong green component and would define criteria for classifying them as green jobs.

The second stage would involve mapping existing Romanian occupations to European frameworks such as ISCO-08 and ESCO. This is important because the National Authority for Qualifications has already developed work related to the mapping between COR and ESCO, which could be used as a basis for identifying occupations with green tasks and green skills. The mapping should distinguish between three categories: fully green occupations, partially green occupations and occupations in transition. Fully green occupations would include jobs directly linked to environmental protection and circular economy activities. Partially green occupations would include traditional jobs that require green skills. Occupations in transition would include jobs affected by decarbonisation, digitalisation and circular economy requirements.

The third stage would be the introduction or updating of occupations in COR. Possible examples of occupations that could be introduced or better defined include: circular economy specialist, green skills trainer, waste prevention specialist, recycling process technician, renewable energy maintenance technician, energy efficiency technician, eco-design specialist, repair and reuse coordinator, environmental data analyst, circular procurement specialist and sustainability reporting specialist. The inclusion of such occupations in COR would improve statistical monitoring, labour market planning and the design of training programmes.

The fourth stage would consist of developing new occupational standards for green jobs. Occupational standards are essential because they define the competences, skills, knowledge and activities required for a specific occupation. In Romania, the National Authority for Qualifications manages occupational standards and publishes the list of occupational standards, including those valid for the period 2014–2026. The Authority also uses methodologies and guides for the elaboration, validation, approval and management of occupational

standards. Therefore, the development of green occupational standards could be integrated into the existing institutional framework. Here are some new standards proposed in the circular economy field:

Table 3. Proposed new occupational standards for green jobs in Romania

No.	Proposed occupational standard	Main area	Key green skills / competences
1	Circular Economy Specialist	Circular economy management	Designing circular economy strategies, analysing material flows, identifying waste prevention solutions, supporting circular business models
2	Green Skills Trainer	Vocational training and adult education	Designing and delivering green skills training programmes, assessing green competences, adapting training to labour market needs
3	Waste Prevention Specialist	Waste prevention and resource efficiency	Developing waste prevention plans, applying reuse strategies, monitoring resource consumption, supporting circular procurement
4	Recycling Process Technician	Recycling and material recovery	Operating recycling equipment, sorting and processing recyclable materials, quality control of secondary raw materials, workplace safety
5	Repair and Reuse Coordinator	Repair, reuse and product life extension	Coordinating repair centres, organising reuse flows, promoting product life extension, managing second-hand and refurbished goods
6	Renewable Energy Maintenance Technician	Renewable energy	Maintaining solar, wind or biomass systems, monitoring technical performance, applying safety procedures, identifying operational faults
7	Energy Efficiency Technician	Energy efficiency in buildings and industry	Monitoring energy consumption, supporting energy audits, implementing efficiency measures, using smart metering systems
8	Eco-design Specialist	Sustainable product design	Applying life-cycle thinking, reducing material use, improving reparability and recyclability, integrating environmental criteria into product design
9	Circular Public Procurement Specialist	Public procurement and circular economy	Developing green and circular procurement criteria, evaluating environmental clauses, promoting recycled and reusable products in public procurement
10	Sustainability Reporting Specialist	ESG and environmental reporting	Collecting environmental data, preparing sustainability reports, monitoring ESG indicators, supporting compliance with reporting standards
11	Environmental Data Analyst	Environmental monitoring and digitalization	Analysing environmental indicators, using digital monitoring tools, interpreting circular economy data, supporting evidence-based policies
12	Circular Logistics Coordinator	Reverse logistics and circular supply chains	Organising reverse logistics flows, coordinating collection and return systems, optimizing transport for recyclable and reusable products
13	Green Transition Adviser for SMEs	Business consultancy	Advising SMEs on circular economy, green investments, resource efficiency, funding opportunities and green compliance
14	Industrial Symbiosis Facilitator	Circular industrial cooperation	Identifying by-product exchange opportunities, connecting companies, reducing industrial waste, supporting circular industrial networks
15	Green Jobs and Skills Counsellor	Employment services and career guidance	Advising workers and jobseekers on green career pathways, identifying training needs, supporting reskilling and upskilling for green jobs

Source: Author's own proposal of Occupational Standards for green jobs in Romania

The proposed occupational standards could support the institutional recognition of emerging green jobs in Romania. Their introduction would help clarify the competences required by the circular economy and would create a stronger link between labour market needs, vocational training and public employment policies. These standards should not replace existing environmental occupations, but should complement them by covering new areas such as circular economy management, green skills training, eco-design, circular public procurement, sustainability reporting, reverse logistics and industrial symbiosis.

By developing such occupational standards, Romania could increase the number of workers with certified green skills and could improve the statistical visibility of green jobs. This would also support access to European funds, because projects aimed at creating green jobs or developing green skills would have clearer occupational references and measurable qualification outcomes.

The fifth stage would link the new occupational standards to vocational training programmes and qualifications. Once green occupations and occupational standards are defined, training providers could develop authorised programmes for these qualifications. This would allow more people to acquire certified green skills and would support the development of a qualified workforce for the circular economy. It would also help employers recruit workers with recognised competences and would support public authorities in monitoring the evolution of green employment.

The alternative policy would have several expected benefits. First, it would improve the statistical visibility of green jobs and allow better measurement of green employment. Second, it would help align education and vocational training with labour market needs. Third, it would support access to European funds, because projects that include green jobs and green skills would have clearer occupational references. Fourth, it would contribute to the professionalisation of circular economy activities. Finally, it would support the implementation of Romania's National Strategy for Green Jobs and of the National Strategy on Circular Economy.

However, the implementation of this policy would also require careful coordination. Green jobs should not be introduced into COR only as formal titles without real labour market relevance. The process must be based on consultation with employers, training providers, sectoral experts and public authorities. In addition, occupational standards should be updated periodically, because green technologies and circular economy practices evolve rapidly.

Overall, the development of green jobs in Romania requires both general public policies and targeted institutional reforms. Financing, training, investment and regional strategies are necessary, but they are not sufficient if green jobs remain statistically and administratively invisible. For this reason, the introduction of green occupations into COR and the development of new occupational standards represent a strategic policy alternative for increasing the number of qualified persons who acquire green skills and can contribute to the transition towards a circular economy.

8 Conclusion

The analysis carried out in this article shows that the development of green jobs in Romania is closely connected to the transition towards the circular economy and to the broader objectives of environmental protection, resource efficiency and sustainable employment. The circular economy creates the economic framework for new activities based on waste reduction, reuse, repair, recycling, recovery of resources, eco-design and energy efficiency, while green jobs represent the employment dimension of this transformation. Therefore, the transition to a circular economy should not be understood only as an environmental objective, but also as an important opportunity for labor market modernization.

A first conclusion of the article is that Romania has relevant potential for the development of green employment, especially in sectors where environmental objectives can be directly connected with economic activity and labor market needs. Waste management, recycling, renewable energy, energy-efficient construction, sustainable agriculture, green transport, repair, reuse and remanufacturing services can generate new jobs and can also transform existing occupations. However, this potential remains unevenly exploited and depends on the capacity to connect environmental policies with investment, infrastructure, vocational training, regional development and institutional coordination.

The analysis also shows that green jobs should not be understood only as new occupations created in environmental sectors. They also include existing jobs that are transformed through cleaner technologies,

environmental standards, resource efficiency requirements and the acquisition of green, digital and technical skills. In this sense, the circular economy does not only create additional employment opportunities, but also changes the content of work, the skills required by employers and the way in which professional training should be organized.

Another important finding concerns the structural limitations that affect the development of green jobs in Romania. The absence of a clear statistical classification of green jobs reduces the visibility of this employment area and makes monitoring and policy design more difficult. At the same time, insufficient circular economy infrastructure, uneven regional potential, limited direct investment, dependence on European funding, fragmented financing mechanisms and the still insufficient development of green skills restrict the pace of labour market transformation.

From a policy perspective, the article highlights that the development of green jobs requires an integrated approach. Environmental strategies alone are not sufficient if they are not connected with employment policies, education and training systems, investment programs and regional development strategies. Vocational training and lifelong learning are essential for preparing the workforce for circular economy activities, while support for circular enterprises and green SMEs can contribute to the creation of more stable employment opportunities at local and regional level.

The policy relevance of the analysis also lies in the need to better coordinate existing funding sources and institutional responsibilities. Green jobs are often supported indirectly, through European funds, environmental programs, regional investments or training initiatives. In order to increase their impact, these instruments should be better connected to labor market needs, sectoral priorities and regional economic profiles. Otherwise, green employment risks remaining fragmented, project-based and insufficiently visible in national employment policies.

One of the specific contributions of the article is the emphasis placed on the institutional recognition of green jobs in Romania. The clarification of green occupations, occupational profiles, qualifications and occupational standards could improve the statistical visibility of green employment and create a stronger connection between labor market needs, vocational training and public funding opportunities. Such an approach would also support employers in identifying relevant skills and would help training providers develop programs adapted to the requirements of the circular economy.

The article therefore contributes to the discussion on green jobs in Romania by linking three dimensions that are often treated separately: the circular economy as an environmental and economic model, green jobs as a labor market outcome, and green skills as a condition for workforce adaptation. This integrated perspective is important because the success of the circular economy depends not only on infrastructure and investment, but also on the capacity of workers, companies and public institutions to adapt to new forms of production, consumption and resource management.

In conclusion, green jobs can become an important instrument for connecting Romania's environmental objectives with employment growth and economic modernization. The circular economy offers a strategic framework for this transformation, but its employment potential depends on coherent public policies, stronger institutional coordination and cooperation between public authorities, employers, education providers and regional actors. For Romania, the development of green jobs is not only an ecological necessity, but also an economic and social opportunity that can support a more resilient and future-oriented labor market.

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