# CONTRIBUTION OF CIRCULAR ECONOMY STRATEGIES TO CLIMATE CHANGE

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***Abstract:***

*In the Paris Agreement, signatory countries committed to keeping global temperature rise below 2 °C and, if possible, to 1.5 °C and to present Nationally Determined Contributions (NDCs), and ways to approach each elements state on climate change.*
*This article examines how the circular economy (CE) can contribute to achieving climate goals at both country and EU level.*
*For this purpose, an analysis of the measures adopted by the EU member countries is carried out. and globally, towards reducing the effects of climate change, as well as the potential of circular economies for their mitigation.*

***Keywords:*** *circular economy, climate change, measure*

***JEL classification*:** Q54, Q56, Q58

## Introduction

In December 2016, countries around the world have committed through the Paris Agreement to keep global temperature rise below 2 °C and, if possible, to 1.5 °C.

Thus, all signatory countries of the Paris Agreement take an active part in global cooperation in the field of climate change, proposing ways to reduce greenhouse gas (GHG) emissions through Nationally Determined Contributions (NDCs). These NDCs contain mitigation targets that reflect each country's anticipated contributions to help keep the increase in global average temperature below +2◦C (UNFCCC, 2015a).

To achieve their proposed climate change goals, developed countries use a model that focuses heavily on long-term decarbonization strategies. Developing countries (defined by the UN based on geographic and economic criteria; United Nations, 2018), are directing their actions towards developing or revising ways to limit GHG emissions in their NDCs.

Thus, it was found that many countries still need to develop systematic political, legislative and financial mechanisms to support development and implementation of their NDC targets.

In this context, the implementation of circular economy (EC) strategies has been considered as a possible tool to help meet the NDC.

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## Description of the Problem

In the specialized literature, there is an absence of an approach that would allow the analysis of the EC's contribution to the climate objectives at the scale of a country, with the possibility of identifying its critical elements.

Until now, the link between EC and the reduction of GHG emissions has been highlighted through the results obtained as a result of the measures taken regarding the recycling of materials or waste management, their reuse, repair or remanufacturing. Assessments carried out in this context have often been partial, with limitations to certain materials and/or industrial sectors, and therefore do not cover the activities of an entire country.

## Methodology and Data

Based on information sources such as EUROSTAT, the European Commission's Joint Research Center (JRC), the International Energy Agency (IEA) and the World Bank, they identified which sectors have the most emissions and where they should concentrate circular economy efforts.

The article addresses the need to develop a methodological framework with which to assess the potential of implementing EC strategies to achieve mitigation goals as described in their NDCs.

Due to the difficulties encountered in planning and defining NDCs, a methodology is proposed to be used and applicable to any country in the world.

The proposed methodology has as its starting point the realization of GHG emissions projections from 2030 (Figure 1) of the country within a reference scenario, in which the year 2030 is chosen as the reference year.

The issues are then classified into different categories to identify the key issuing sectors.

From the specialized literature of EC strategies that have the ability to mitigate the emissions of those critical sectors, relevant measures are identified that form what we define as a set of GHG mitigation measures.

This set of measures is then applied to the baseline scenario, resulting in a new 'mitigation scenario' for 2030 (green box in Figure 1).

In a final step of the methodology), emissions from the developed mitigation scenario are compared to several defined benchmarks:

(1) 2030 mitigation target of NDC submitted by the country

(2) the maximum total GHG emissions that the country can allow to be in line with the 2-degree target specified in the Paris Agreement under different allocation principles and referred to as "2-degree benchmarks".

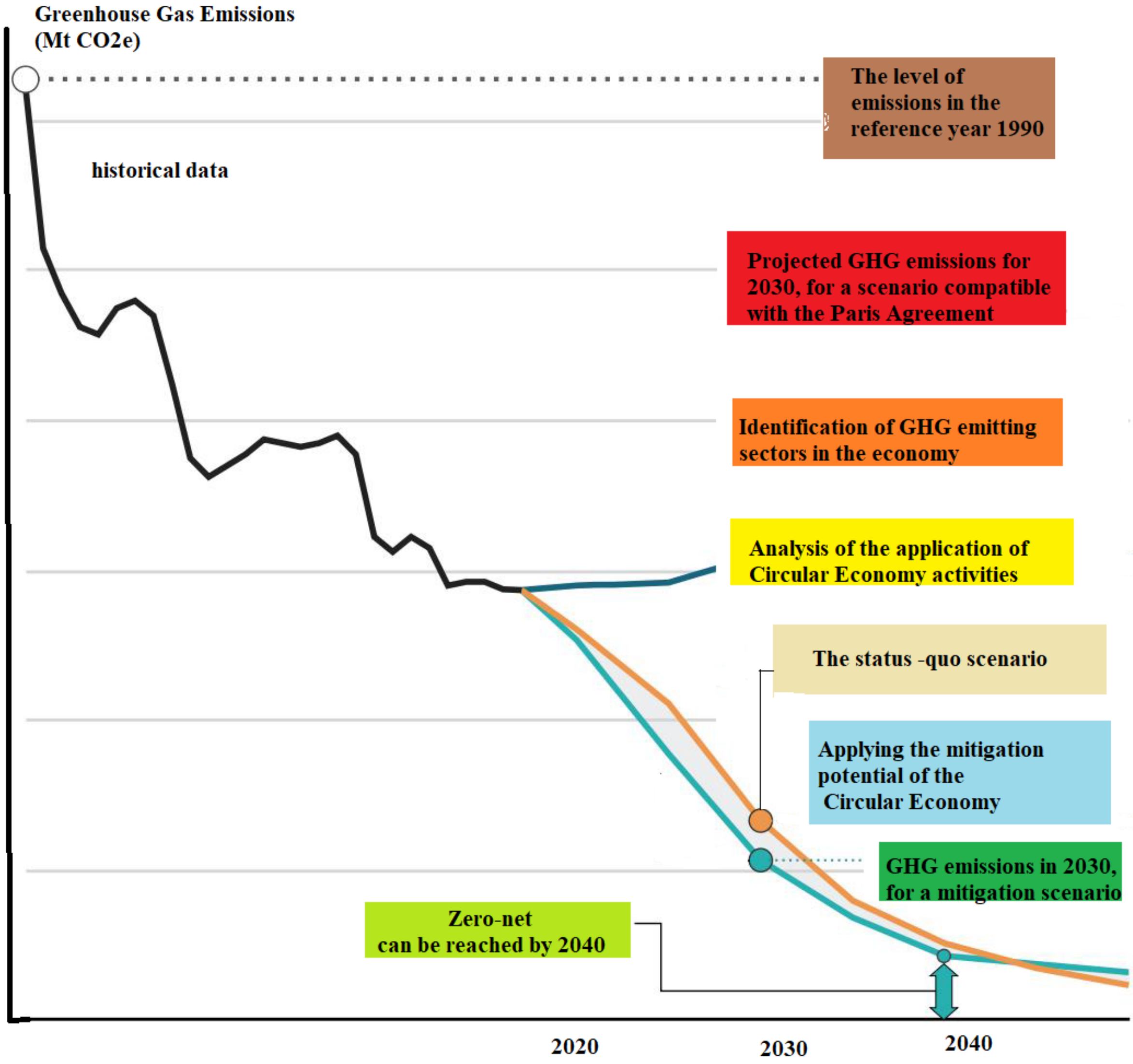


**Figure 1: GHG emissions projections**

*Source: own conception*

## Results

Paris Agreement signatory countries reported different categories and subcategories of GHG emissions and removals. Thus, the following categories of main polluting sectors in the economy were established:

(1) - Energy;

(2) -Industry;

(3) -Agriculture;

(4) -Constructions;

(5) - Transportation;

(6) Waste

(7) Land use change and forestry

The share of pollution of these sectors following the following GHG results can be found in Figure 2.

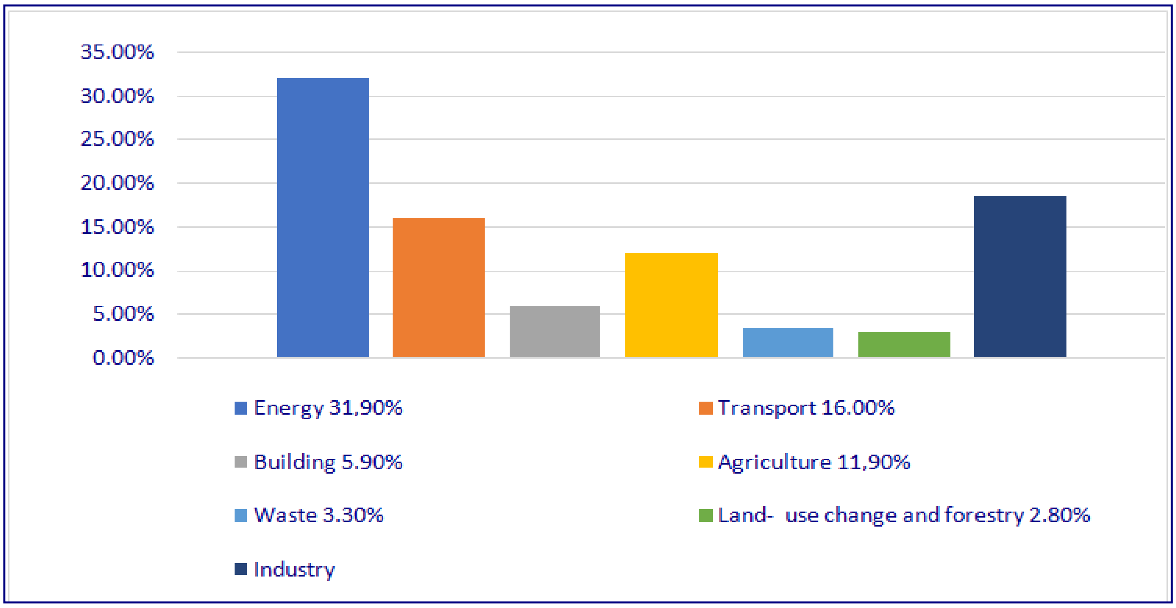


**Figure 2: Polluting sectors of the economy and the share of their GHG**

*Sursa: date EUROSTAT (2021)*

It can be seen that the sectors: Energy, Industry, Transport and Agriculture have the largest share and for this reason we use them in our analysis. These 4 main categories are divided into subcategories, providing different degrees of detail (Table 1). The 2030 estimates do not provide details on the distribution of emissions among those categories.

In the present methodology, it is assumed that the share of GHG emissions attributed to each (sub)category of emissions in the scenario for the year 2030 is the same as the emissions reports made by the country found in the EUROSTAT data.

To make the assessment of EC potential manageable, not all subcategories can be considered individually.

The relevance of this approach is also limited because only relatively few categories generally determine a country's GHG emissions.

This is the reason why in the methodology we propose to retain only the I categories for which the GHG emissions are considered significant in the 2030 reference scenario.

Thus, an algorithm was developed to short list these categories (Figure 1). This algorithm introduces a threshold, which is the minimum emission share of the total emissions that a category must meet in order to be retained.

The value of this threshold is obtained as the sum of GHG emissions of all selected categories and includes at least 90% of the total GHG emissions of the country.

The choice of 90% is an arbitrary compromise to overcome the difficulty of searching for data on certain individual sectors, while maximizing the accuracy of the assessment by considering as many detailed categories as possible.

The categories pre-selected after applying the algorithm are those that are subject to emission reduction through one or more EC strategies.

## Identifying EC strategies

We have conducted a review of various "R-frameworks", which identify and classify different CE strategies based on their ability to recycle a maximum of products, product parts and materials to minimize waste and resource demand.

The “9R” framework introduced by Potting et al. (2016) as the most detailed and nuanced classification, aiming to highlight as many types of possible EC strategies as possible.

**Table 1: "R frames"**

| CE strategy group | CE strategy type | | Description |
|---|---|---|---|
| Group 1 Smarter product manufacturing and use | R0 | Refuse | Make product redundant by abandoning its function or by offering the same function with a radically different product |
| | R1 | Rethink | Make product use more intensive (e.g., by sharing products or by putting multi-functional products on the market) |
| | R2 | Reduce | Increase efficiency in productmanufacture or use by consuming fewer natural resources andmaterials |
| Group 2 Extend lifespan of product and its parts | R3 | Reuse | Reuse by another consumer of a discarded product which is still in good condition and fulfils its original function |
| | R4 | Repair | Repair andmaintenance of defective product so it can be used with its original function |
| | R5 | Refurbish | Restore an old product and bring it up to date |
| | R6 | Remanufacture | Use parts of discarded product in a new product with the same function |
| | R7 | Repurpose | Use discarded product or its parts in a new productwith a different function |
| Group 3 Useful application of materials | R8 | Recycle | Processmaterials to obtain the same (high grade) or lower (low grade) quality |
| | R9 | Recover | Incineration of material with energy recovery |

*Source: Potting et al. (2016)*

In the proposed methodology, it was considered the most relevant reference system for the classification of EC strategies, since the boundaries between some of these types of strategies are sometimes difficult to stabilize; we opted to use a more aggregate level of classification, with three groups:

- Class 1: Smarter manufacturing and use of products;

- Class 2: Extending the life of the product and its markets; and

- Class 3: Useful application of materials.

Three criteria were defined to identify and select relevant CE strategies to be included in the methodology:

1) the CE strategy can be classified in one of the CE strategies from the 9R classification groups (Table 1);

2) the strategy can be applied in the country considered at local, regional or national level;

3) the EC strategy has been shown to potentially reduce GHG emissions of a given category and a mitigation potential of this strategy can be estimated (expressed as a percentage reduction of national emissions below 2030 reference levels).

Data availability can ensure that these three criteria are met. In particular, it is difficult to find all the specific data in question, thus requiring assumptions and extrapolations that must be transparently documented and justified.

When several circular economy strategies can be identified for the same category, they should be combined to calculate the reduction in GHG emissions, assuming that all strategies are applied at the same time. However, it is worth noting that the mitigation potential of the combined strategies may not be the sum of the individual mitigation potentials. This should be considered if the data allow providing the true mitigation potential of all strategies combined.

## Results

Identifying the greatest GHG mitigation potential, when potential EC strategies are reviewed, they are selected based on three criteria, two of which are the categories in Table 1, which indicate where they apply and the EC strategy group they belong to. The categorization of GHG emissions adopted in the methodology allows the reduction of GHG emissions according to the sectors of origin and the EC strategy group to identify where the greatest mitigation potentials lie.

Both perspectives can thus serve as strong support for policy makers in identifying where priority should be set for GHG mitigation.

## Conclusions

The methodological framework proposed in this study presents a systematic perspective, covering all activities and sectors in a given country, so that the evaluation results support the development of NDC.

The relevance of such an approach lies in the fact that it covers almost 91% of all GHG emissions. This requires urgent actions to implement the circular model targeting emission sources in these (sub)categories.

By developing and applying this methodology, it becomes possible to quantify the mitigation potentials of different GHG reduction measures.

Such results can support policy-making and NDC planning processes. The proposed methodology not only identifies the location of points in highly polluting economic sectors that can bring the most environmental and economic benefits, it improves sustainable development policies.

By reporting the data obtained following the application of the methodology, we obtain the broader perspectives of the promised contributions (NDC) and other benchmarks, such as: national carbon budgets. Such insights are necessary for measuring and anticipating the performance of EC strategies and drawing up NDC plans.

The use of benchmarks provides some aspects of environmental sustainability.

Incremental improvements, for example reducing the impacts of climate change, may not be sufficient if the overall magnitude of impacts remains at unsustainable levels

For climate change, sustainable levels can be defined using the planetary boundaries framework, which defines a safe operating space for humanity and includes two control variables for climate change: CO2 concentration and radiative forcing, or by reference to specific targets such as be the 1.5 or 2 degree objectives of the Paris Agreement (UNFCCC, 2015a).

By comparing the climate change mitigation potentials achieved by EC strategies against such benchmarks, policy makers are therefore strongly supported to assess the effectiveness of their NDC plans.

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