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Circular Economy and Environmental sustainability: a coherence analysis based on current Italian subsidies

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Supplementary Material 1 – Analysis of circular economy concepts and principles in the main European policy documents on circular economy

1 The first EU Action Plan for a circular economy

The European Union Action Plan for the Circular Economy published in 2015 [34] begins with this introductory statement, which is also a preliminary and programmatic definition of the circular economy: “The transition to a more circular economy, where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimized, is an essential contribution to the EU's efforts to develop a sustainable, low carbon, resource efficient and competitive economy.” [34] (p. 2)

In the development of the Plan, the following main guidelines are presented:

- promote, from the earliest stages of the product life cycle (design) the reparability, durability and possibility of refurbishment and recycling of products;
 - efficient and sustainable use of natural resources;
- in waste management, priority to waste prevention and reduction, followed by preparation for re-use, recycling, energy recovery and, finally, disposal;
- promote industrial symbiosis, whereby waste or by-products produced by one industry become production inputs for another;
- encourage responsible consumption choices also on circular economy issues (existing eco-labels and energy efficiency labels to be reformed)
- review of consumer protection legislation, including the legal guarantee system on product use, to facilitate product reparability and durability;
- review of waste legislation to boost preparation for reuse activities;
- encourage services enabling product or infrastructure sharing (collaborative economy) and the consumption of services rather than products;
- improve the administrative capacity for waste management, for example in planning and implementing the necessary investments in new treatment plants;
- promote the use of economic instruments such as environmental taxes or tariff structures to provide price signals coherent with the objectives of separate collection, recovery and recycling of waste (landfill tax, “pay as you throw” tariff);
- make greater use of the producer’s extended legal liability for end-of-life products;
- combating the illegal management and transport of waste;
- improve quality requirements of secondary raw materials, in order to facilitate the development of re-use markets;
- eliminate toxic or harmful chemicals from products and their materials, in order to enable their recycling.

In the last part of the Action Plan, dedicated to horizontal measures (research, innovation, education, professional skills, financial resources) reference is obviously made

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to subsidies, but with a one-way perspective (to promote the circular economy). The role of the pricing structure in deterring waste production or the role of environmental taxes to discourage forms of disposal from recovery is not highlighted.

The Plan also lacks of guidance on how to introduce taxes on the consumption of natural resource (to promote the secondary material markets) as well as guidelines aimed at verifying the absence of existing subsidies in conflict with the circular economy, both in the form of direct incentives and in the form of tax discounts.

2 The Commission Guidelines on the role of waste-to-energy in the circular economy

The main objective of the 2017 Communication [72] is to establish EU guidelines for energy recovery from waste to support the objectives of the Circular Economy Action Plan [34], consistently with European waste legislation. The Communication clarifies the positioning of the different energy recovery processes in relation to the waste hierarchy (prevention, re-use, recycling, energy recovery, disposal) and the resulting priorities for public financial support. The following processes are covered:

- anaerobic digestion of biodegradable waste (biogas production);
- co-incineration of waste in co-combustion plants (power plants that can use both fossil fuels and waste) and in cement and lime production plants;
- production of solid, liquid or gaseous fuels derived from waste;
- other processes, including indirect incineration after a pyrolysis or gasification phase;
- waste incineration in dedicated facilities, with high energy recovery or with limited / no recovery
- production of landfill biogas.

These processes have different environmental impacts and are placed in different ways along the waste hierarchy, ranging from "recycling" to "recovery" and "disposal". For example, processes such as anaerobic digestion, which involve the joint production of a biogas and a digestate from organic waste, are considered in EU waste legislation as a "recycling" operation. On the other hand, waste incineration with limited energy recovery and landfill biogas are related to "disposal" operations. The Communication gives priority to those energy recovery processes that are related to the recycling of materials, followed by optimization of energy performance in the energy recovery of those waste fractions that cannot be recycled. According to the Communication, public grants for investments in waste incineration plants with energy recovery can only be granted in limited and well justified cases, "where there is no risk of overcapacity" and the objectives of the waste hierarchy are fully respected. In assessing the risk of overcapacity, the use of waste in co-combustion plants for the production of electricity or in industrial plants for the production of cement and lime, must be preferred to incineration with energy recovery.

In summary, according to the Communication of the European Commission, energy recovery processes from waste can continue to play a role in the transition to the circular economy, provided that they are consistent with the principles of the Community waste management hierarchy.

3 The new EU Action Plan for a circular economy

The action plan for the circular economy published on 25 March 2020 [35] is, at the moment, the main reference for EU policies regarding the circular economy, which will inspire the launch of specific EU and national legislation. It is not an autonomous policy document, but is part of the European Green Deal [57], the vast strategic program to boost investments in the green economy launched at the end of 2019, currently "substituted" by the Next Generation EU [128], the new investment plan designed to boost the recovery due to the pandemic. The circular economy action plan is developed around three pillars: the design of products (reform of the current directive on eco-design); the strengthening of consumer powers (e.g. product labels); the circularity of production

processes. New measures are planned in several priority value chains, including batteries and vehicles, buildings and the construction sector, raw materials and waste.

As regards the basic question of how to "drive" the demand for secondary raw materials compared to virgin materials, the Plan leans towards a mix of instruments, which includes both traditional measures based on command and control (e.g. mandatory recycled content of specific materials used in products) and economic instruments. Economic instruments are mentioned among transversal actions: *"continue to encourage the broader application of well-designed economic instruments, such as environmental taxation, including landfill and incineration taxes, and enable Member States to use value added tax (VAT) rates to promote circular economy activities that target final consumers, notably repair services."*[35] (p.21) Apart this statement, the provision of economic instruments in the Plan appears weak, renouncing to systematically address the issue of economic incentives/disincentives to favour circular economy. As in the first plan of 2015, also in this new version there are no indications on how to re-establish an environmentally "fair" price regime (in application of the polluter pays principle) in the extraction and sale of "virgin" raw materials, and on how to address this issue in the international trade negotiations (World Trade Organization - WTO). Moreover, there is no mention of an overall problem of coherence with circularity of subsidies provided to economy sectors of activity. While, on the one hand, a policy of reforming fossil fuel subsidies seems to be emerging in Europe (driven by the climate policies) the extension of this reform approach to subsidies detrimental to the circular economy is far to turn into a policy reality.

In conclusion, even if the Plan appears rich of proposals in specific sectors, it does not provide a coherent framework to the various statements of principle that were formulated in its 2015 version, not without unresolved issues. The trade-off between the extension of the product life (reliability, repair, reuse), energy efficiency and CO₂ emissions remains unresolved in a context of continuous technological innovation; there remains an emphasis on recycling specific products (e.g. plastic plates and glasses designed for "single use") rather than discouraging or prohibiting their sale, or raising their quality to extend their useful life and re-use.

4 The EU Taxonomy for sustainable finance

An important step towards defining the principles of the circular economy has been taken in a different field than usual (strategies for the circular economy, regulations on waste, eco-design of products, etc.): the so-called legislative strand of the "sustainable finance" [109].

On this front, the European Commission has set itself the ambitious goal of achieving a taxonomy of environmentally sustainable activities, in order to promote the dissemination and credibility of financial instruments marketed as "environmentally sustainable"¹. In fact, the EU Regulation 2020/852 establishing the taxonomy [23] provides for the following list of environmental objectives, which also includes the transition to a circular economy:²

1. climate change mitigation;
2. climate change adaptation;
3. the sustainable use and protection of water and marine resources;
4. the transition to a circular economy;

¹ Financial operators such as investment funds will be able to label their financial products as "compliant with the EU taxonomy" if they meet the general requirements of the new EU Regulation 2020/852 and the technical specifications required by the Delegated acts of the Commission (the technical apparatus of the taxonomy).

² Art. 3 of EU Regulation 2020/852 establishes that an economic activity is considered environmentally sustainable if it meets four harmonized criteria: 1) if it substantially contributes to achieving at least one of six environmental objectives set out and regulated by specific articles of the Regulation; 2) if the activity does not cause significant harm to any of the aforementioned objectives (DNSH criterion); 3) if the activity respects the fundamental principles and rights stated in the eight conventions of the International Labour Organization (Declaration on Fundamental Rights and Principles at Work); 4) if the activity complies with the technical screening criteria related to each of the six environmental objectives and defined through the Commission Delegated Acts..

5. pollution prevention and control;
6. the protection and restoration of biodiversity and ecosystems.

The Regulation provides the following definition of the ‘circular economy’:

“an economic system whereby the value of products, materials and other resources in the economy is maintained for as long as possible, enhancing their efficient use in production and consumption, thereby reducing the environmental impact of their use, minimising waste and the release of hazardous substances at all stages of their life cycle, including through the application of the waste hierarchy” [15] (art. 2, 9).

Moreover, the Regulation states the principles of the circular economy with art. 13 par. 1:

“An economic activity shall qualify as contributing substantially to the transition to a circular economy, including waste prevention, re-use and recycling, where that activity:

(a) uses natural resources, including sustainably sourced bio-based and other raw materials, in production more efficiently, including by:

- (i) reducing the use of primary raw materials or increasing the use of by-products and secondary raw materials; or
- (ii) resource and energy efficiency measures;

(b) increases the durability, reparability, upgradability or reusability of products, in particular in designing and manufacturing activities;

(c) increases the recyclability of products, including the recyclability of individual materials contained in those products, inter alia, by substitution or reduced use of products and materials that are not recyclable, in particular in designing and manufacturing activities;

(d) substantially reduces the content of hazardous substances and substitutes substances of very high concern in materials and products throughout their life cycle, in line with the objectives set out in Union law, including by replacing such substances with safer alternatives and ensuring traceability;

(e) prolongs the use of products, including through reuse, design for longevity, repurposing, disassembly, remanufacturing, upgrades and repair, and sharing products;

(f) increases the use of secondary raw materials and their quality, including by high-quality recycling of waste;

(g) prevents or reduces waste generation, including the generation of waste from the extraction of minerals and waste from the construction and demolition of buildings;

(h) increases preparing for the re-use and recycling of waste;

(i) increases the development of the waste management infrastructure needed for prevention, for preparing for re-use and for recycling, while ensuring that the recovered materials are recycled as high-quality secondary raw material input in production, thereby avoiding downcycling;

(j) minimises the incineration of waste and avoids the disposal of waste, including landfilling, in accordance with the principles of the waste hierarchy;

(k) avoids and reduces litter; or

(l) enables any of the activities listed in points (a) to (k) of this paragraph in accordance with Article 16.”

Despite the long list, the Regulation does not go into detail on the issue of energy recovery from waste. Point (j), concerning waste incineration, does not exclude any form of incineration, on the contrary: it refers to compliance with the waste hierarchy and therefore confirms the 2017 Guidelines [72], which detailed the compatibility and the priorities of energy recovery from waste in the circular economy framework.

We can see that art. 13 of the Regulation does not innovate the principles of the circular economy, except from an institutional point of view, as it is the first EU legislative act to list them.

The activities that make a substantial contribution to the circular economy will be better defined by the Commission through the definition of the technical screening criteria (quantitative criteria such as indicators, limits or thresholds, as well as qualitative criteria) for specific types of activities fulfilling art. 13. In fact, the Regulation provides for the adoption of Delegated Acts that will constitute the technical apparatus of the taxonomy. The Delegated Act concerning the circular economy activities is expected by the end of 2021 (for its entry into force from 1 January 2023).

5 The categorization system for the circular economy developed by CEFEG

In order to contribute the European Commission work on the taxonomy of circular economy activities, another group of experts in support of the Commission, the Circular Economy Finance Expert Group (CEFEG), has recently published a first proposal, which

is useful to consider in our analysis of subsidies coherence with the circular economy: it is the “categorization system of the circular economy” [73]³.

The CEFEG system responds to 9 strategies/principles and is organized on 4 groups of models and 14 categories of activities, as reported in Table 1.

Table 1 – The CEFEG circular economy categorization system. Source: CEFEG 2020 [73]

Strategies	Principles
R1 Refuse	Make product redundant by abandoning its function or by offering the same function by a radically different (e.g. digital) product or service
R2 Rethink	Make product use more intensive (e.g. through product-as-a service, reuse and sharing models or by putting multi-functional products on the market)
R3 Reduce	Increase efficiency in product manufacture or use by consuming fewer natural resources and materials
R4 Re-use	Re-use of a product which is still in good condition and fulfils its original function (and is not waste) for the same purpose for which it was conceived
R5 Repair	Repair and maintenance of defective product so it can be used with its original function
R6 Refurbish	Restore an old product and bring it up to date (to specified quality level)
R7 Remanufacture	Use parts of a discarded product in a new product with the same function (and as-new-condition)
R8 Repurpose	Use a redundant product or its parts in a new product with different function
R9 Recycle	Recover materials from waste to be reprocessed into new products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations
Group of models	Circular Categories
Group 1 Circular Design and Production Models	1.a Design and production of products and assets that enable circular economy strategies, through e.g. (i) increased resource efficiency, durability, functionality, modularity, upgradability, easy disassembly and repair; (ii) use of materials that are recyclable or compostable 1.b Development and deployment of process technologies that enable circular economy strategies 1.c Development and sustainable production of new materials (including bio-based materials) that are reusable, recyclable or compostable 1.d Substitution or substantial reduction of substances of concern in materials, products and assets to enable circular economy strategies 1.e Substitution of virgin materials with secondary raw materials and by-products
Group 2 Circular Use Mod- els	2.a Reuse, repair, refurbishing, repurposing and remanufacturing of end-of-life or redundant products, movable assets and their components that would otherwise be discarded 2.b Refurbishment and repurposing of end-of-design life or redundant immovable assets (buildings/infrastructure/facilities) 2.c Product-as-a-service, reuse and sharing models based on, inter alia, leasing, pay per-use, subscription or deposit return schemes, that enable circular economy strategies 2.d Rehabilitation of degraded land to return to useful state and remediation of abandoned or underutilised brownfield sites in preparation for redevelopment
Group 3 Circular Value Re-	3.a Separate collection and reverse logistics of wastes as well as redundant products, parts and materials enabling circular value retention and recovery strategies

³ CEFEG – Circular Economy Financing Expert Group is a Commission working group created in early 2017 in the context of an initiative called “Circular Economy Finance Support Platform” [129]. It provides advice and expertise to stimulate the transition to a circular economy and necessary funding in the Member States. The current objective of the CEFEG action is to support the work of the Platform for sustainable finance, the new Commission’s technical body introduced by the Taxonomy Regulation, that is now substituting the TEG (Technical Expert Group). The Sustainable Finance Platform has been set up in October 2020 [130]. Among its tasks, there is also the drafting and updating of the technical apparatus for the six environmental objectives of the Taxonomy, including the circular economy.

covery Models	3.b Recovery of materials from waste in preparation for circular value retention and recovery strategies (excluding feedstock covered under 3.c) 3.c Recovery and valorisation of biomass waste and residues as food, feed, nutrients, fertilisers, bio-based materials or chemical feedstock 3.d Reuse/recycling of wastewater
Group 4 Circular Support	4.a Development/deployment of tools, applications, and services enabling circular economy strategies

The categorization system proposed by CEFEG has the advantage of including two natural resources generally neglected in the reflections on the circular economy:

- land: artificially degraded land and brownfield sites are not seen as “definitively consumed land”; on the contrary they are seen as resources that can be reused, after a proper environmental reclamation and restoration;
- water: water used and subsequently discharged (wastewater) is also seen as a resource that - especially in situations of scarcity - can be usefully treated and distributed for new uses.

However, in contradiction with this “open view” on soil and water recovery, CEFEG's proposal is highly restrictive with regard to energy recovery, contrasting with art. 13 of the EU Regulation 2020/852 and with the official position of the European Commission on waste-to-energy and circular economy [72].⁴

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⁴ While including the principle of efficient use of natural resources in general (therefore, implicitly also including energy resources), CEFEG excludes the recovery of energy from waste (both from the 9 Rs and the 14 categories in Table 1). Furthermore, in no principle of the CEFEG categorization system is energy efficiency explicitly mentioned (instead it is included as point a) of art. 13 of the Taxonomy Regulation [15]), nor the recovery of residual heat from the energy process, which should together constitute another cornerstone of the circular economy (they both allow savings of scarce energy resources). In justifying these positions on energy efficiency and energy recovery, in open contrast to the Regulation [15], CEFEG runs into several contradictions, admitting the existence of a conflict within the working group [73] (pp. 7–8).