THE DANUBE GOES CIRCULAR

Transnational Strategy to Accelerate Transition Towards a Circular Economy in the Danube Region

A stream of cooperation
Project co-funded by European Union funds (ERDF, IPA)

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About MOVECO – **“Your trash is my treasure”**

This is the motto of the project MOVECO – Mobilising Institutional Learning for Better Exploitation of Research and Innovation for the Circular Economy. Sixteen partners from ten countries of the Danube region (DR) want to promote transnational cooperation to accelerate the transition towards a circular economy.

The MOVECO consortium has focused on eco-design, extended producer responsibility, and green innovation; supporting best practices in these areas, promoting economic growth, environmental sustainability and social engagement. Under the framework of the Danube Transnational Programme, MOVECO is an Interreg project, co-funded by the European Regional Development Fund (ERDF) and the Instrument for Pre-Accession Assistance (IPA).

MOVECO responds to Pillar 1 **“Innovative and socially responsible Danube region”** and Pillar 4 **“Well-governed Danube region”** of the European Union Strategy for the Danube Region (EUSDR), by tackling several challenges this European macro region faces. Moreover, the European Commission communication regarding the added value of the macro regional strategy highlights the need to work for “better enforcement of EU environmental legislation” in the Danube region. The MOVECO project fully addresses the priorities of the Danube Cooperation Programme[1], by preparing a transnational strategy to harmonize the implementation of new EU waste legislation, including the establishment of a circular economy as a strategic objective in the very heterogeneous area of Danube region.

With this strategic document, it is our desire to stimulate and contribute to better cooperation among stakeholders, enhancing framework conditions to decrease socio-economic disparities between regions within the Danube region, and to boost competitiveness based on the implementation of circular economy principles.

To learn more about the Danube region and the EUSDR, please scan the QR code or visit the website:

www.danube-region.eu

[1] Danube Cooperation Programme: www.interreg-danube.eu.

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Abbreviations

7th EAP – 7th Environmental Action Programme

A, D, SI – Austria, Germany, Slovenia

B&A – Batteries and Accumulators

B2B – Business to Business

BG, RO, RS – Bulgaria, Romania, Serbia

CRM – Critical Raw Material

DMC – Domestic Material Consumption

DR – Danube Region

DTP – Danube Transnational Programme

EC – European Commission

EEE – Electrical and Electronic Equipment

EPR – Extended Producer Responsibility

EUSDR – EU Strategy for the Danube Region

GDP – Gross Domestic Product

GPP – Green Public Procurement

HR, HU, SK, – Croatia, Hungary, Slovakia

OECD – Organisation for Economic Cooperation and Development

PET – Polyethylene terephthalate

PPS – Purchasing Power Standard

PPW – Plastic Packaging Waste

PRO – Producer Responsibility Organisation

PW – Packaging Waste

R&D – Research and Development

SME – Small and Medium Enterprise

WABA – Waste Automotive Batteries and Accumulators

WBA – Waste Batteries and Accumulators

WEEE – Waste Electrical and Electronic Equipment

WFD – Waste Framework Directive

WIBA – Waste Industrial Batteries and Accumulators

WPBA – Waste Portable Batteries and Accumulators

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I. Summary

Within EU policy, the circular economy is increasingly recognised as a necessity rather than an option. The MOVECO project forged a strong transnational partnership to prepare a strategy to help accelerate a circular transition with roadmaps for the implementation of a circular economy in the Danube region.

The region displays a slow but constant **increase of competitiveness in the circular economy sector**. Spending on research and development has risen but is still rather low compared to the EU average. The eco-innovation index shows increased performance, although it is based on **incremental improvements to existing technologies** rather than radical base level innovations.

The Danube region is **resource poor** and dependent on imports of many raw materials that are crucial for a strong industrial base, highlighting the need for more secure access, diversification of supply, and **increased resource efficiency**.

Progress can be observed **towards more circular trends in consumption,** especially in terms of lower municipal waste generation, but **consumer trust** in products containing recycled materials and reused products **is low.** Producers have not yet accepted the necessity of better design for the environment (eco-design), requiring a need of increased awareness and knowledge on the part of both consumers and the business community regarding these issues.

Exchange of information and best practice, cooperation and learning are key aspects of the transition phase. The MOVECO consortium has launched a transnational platform (www.danube-goes-circular.eu) to support this exchange. **Transparency and communication** along the whole value chains needs to be facilitated to track material flows, especially additives, legacy and hazardous substances, which affect the quality of recycled materials.

Overall, the recycling rate of municipal waste is increasing, but relatively large amounts of municipal waste still go to landfills. **Incineration and combustion** of municipal waste, especially plastic packaging waste (PPW) and plastics from waste electrical and electronic equipment (WEEE), are still common practices.

The average recycling rates of PPW and WEEE in this region are higher than the EU average, but the quality of recycled plastic is low. Collection rates of WEEE and waste batteries and accumulators (WBA) from WEEE need to **increase significantly.** Many national activities still focus **on the improvement of municipal waste management infrastructure**, neglecting the need to support better design.

The contribution of recycled materials to overall material demand in the region **is low.** To protect raw material supply and increase resource efficiency, **waste management should be connected with resource management**.

To improve resource efficiency, **cooperation within the value chain** needs to be strengthened and transparency increased from product design onwards. This must be complemented with better **waste collection** and **higher quality pre-processing** and **dismantling,** contributing to the establishment of a market for **secondary raw materials through improved quality of these materials**, especially within our three designated waste streams. More resources need to be **invested in research and development** linked to market requirements. Future **European Union funding instruments** are ex-

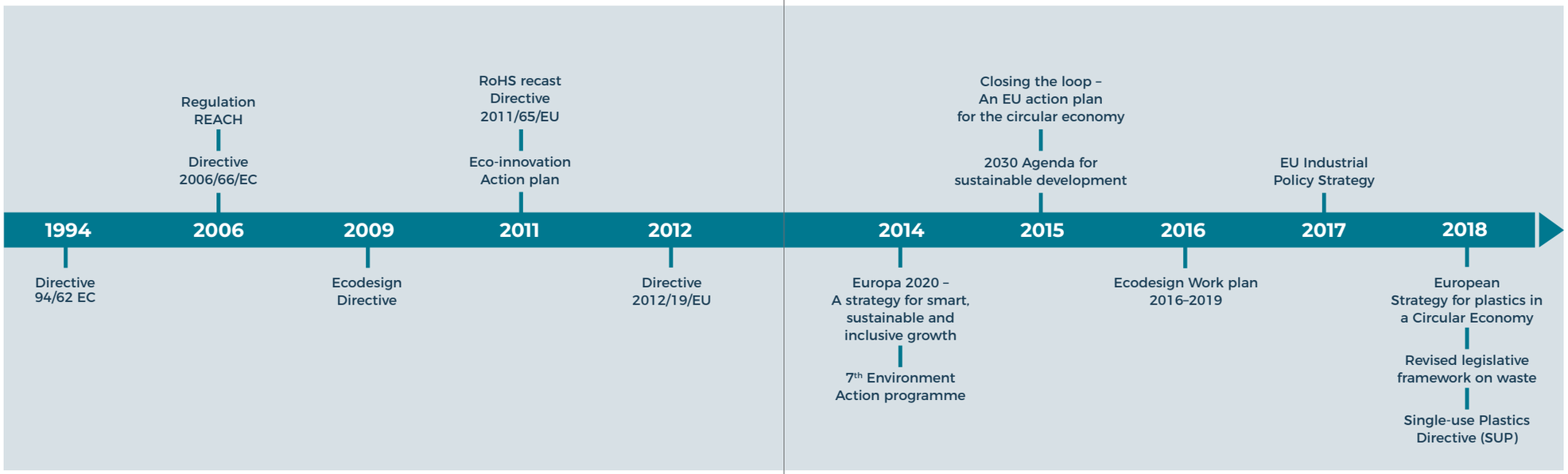
pected to continue to provide finance for waste management infrastructure implementing technological improvements in pre-processing and recycling.

Extended producer responsibility (EPR) was created as a strategy to support better design and boosting eco-innovation for managing post-consumer waste streams, but has fallen short of its objective within the region. Due to a large share of **component manufacturers** and foreign ownership, many small and medium enterprises **do not feel in control of design;** this process works against the establishment of a circular economy. **EPR schemes** can facilitate design for recyclability and disassembly through **eco-modulation of fees** payed by producers to producer responsibility organisations, reflecting actual waste management cost in a more transparent manner. EPR must **also support an** increase in consumer **awareness.**

Clearer eco-design requirements need to support eco-innovation in production and waste management value chains, facilitating cooperation.

In addition to recycling targets, the importance of **waste prevention will increase through quantified targets for improved product** durability, reusability, and repairability. These are additional requirements which will need to be mirrored within future EPR measures.

Figure 1: Timeline of relevant worldwide and EU environmental strategic documents.



II. Circular Economy: **The way forward!**

In contrast to the traditional and current modes of the linear ("take - make - consume - dispose") means of consumption and production in the circular economy, we can **design** and **create products** that are easy to share, lease, reuse, repair, refurbish and recycle, while using regenerative resources and renewable energy. The goal is to minimize waste and to keep products and resources in the economy for as long as possible through the so-called "closing the loops" approach, returning resources back into material cycles. Ideally, this approach should benefit both the environment and the economy.

This strategic document is in line with relevant worldwide and EU environmental strategic documents and other strategic documents influencing the EU environmental policies framework.

III. The transnational context – **Better together**

From the perspective of the Danube region (DR), reducing disparities can only happen through **transnational cooperation**, **capacity building** and **bringing new know-how to key actors** which take the Danube region's geographic, economic and cultural diversities into account.

The transnational strategy – with its objectives and set of recommendations – provides a framework for cross-country roadmaps and an action plan. It suggests transnational umbrella policy instruments for the research sphere, businesses, policy makers and civil society to support the transition to a circular economy in the DR. The most important stakeholder is the business community, which needs to commit to the task and become a frontrunner and driving force of change.

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IV. **The Danube region** identification card

Figure 2: Geographical area of DTP countries[1]

The Danube Region – one of four European Union (EU) macro regions – is a large, creative and diverse area defined by the EU Strategy for the Danube Region (EUSDR)[2] and home to one-fifth of the EU population. Its territory overlaps with the Danube Transnational Programme (DTP) country map. It has many attributes that can appear as challenges or present opportunities that interlink the Danube region countries with potential for further integration and growth. Geographically, the region stretches from the Black Forest (Germany) to the Black Sea (Romania-Ukraine-Moldova) and comprises the Danube river basin as well as its mountainous surroundings – Carpathians, Dinaric Alps and of the eastern end of the Alps. The Danube river basin is the most international river basin in the world, a major transport axis, a crucial interconnected hydrological basin, and a world-renowned ecological corridor[3]. The region is characterised by natural, historical, cultural, and political diversity.

The richly diverse Danube region is a vital link between eastern and western Europe. Having a strategic position, the macro region represents a huge market with the potential to develop into a **major supplier for European and global markets**. The Danube region has already developed into an important market of component producers for multinational and global final products.

*The MOVECO project consortium consists of nine Danube region countries and **3 innovation regions** according to the Innovation Union Scoreboard 2015: (i) **Innovation leaders and strong innovators** (A, DE, SI), (ii) **Moderate innovators** (HR, HU, SK), and (iii) **Modest innovators** (BG, RO, RS).*

[1] DTP participating countries; more on: www.interreg-danube.eu/about-dtp
[2] www.danube-region.eu
[3] Danube region strategy: success stories, 2016; ec.europa.eu/regional_policy/sources

V. **Framework methodology** for measuring circular performance of the Danube region

For the purpose of this strategic document **12 indicators**[4] were selected to present the current circular and sustainable performance of the Danube region countries. The indicators were selected from the Monitoring framework for the circular economy[5], the Eco-innovation Scoreboard[6] and relevant EUROSTAT official statistics. The indicators were further divided into **three stages of the circular economy** following the complete lifecycles of resources, products, and services, encompassed by **competitiveness and innovation**. Analyses of these indicators helped us to identify the **challenges,** prepare **strategic objectives** and formulate a **set of recommendations** based on the current circular performances of the Danube region countries.

Three stages of a circular economy encompassed by competitiveness and innovation

1. Production and consumption
2. Waste management
3. Secondary raw materials

The circular economy stages presented in the MOVECO circular economy scheme above can be linked with another MOVECO project deliverable – Cross-country Roadmaps – in the following way:

1. ***Production and consumption***
➔ ***Stakeholders in Cross-country Roadmaps:*** *(b) Procurers of secondary raw materials (producers and distributors) and (c) Household and B2B consumers.*
2. ***Waste management***
➔ ***Stakeholders in Cross-country Roadmaps:*** *(a) Providers of secondary raw materials (waste management operators).*
3. ***Secondary raw materials***
➔ ***Stakeholders in Cross-country Roadmaps:*** *(a) Providers of secondary raw materials (waste management operators) and (b) Procurers of secondary raw materials (producers and distributors).*

[4] For extensive explanation of the selected indicators see Appendix 2 (in online version of this document).
[5] COM(2018) 29 final
[6] European Commission, DG Environment, Eco-innovation Action plan

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Figure 3: The MOVECO circular economy scheme.

VI. **Key challenges identified** with regard to the transition of the **Danube Region towards a circular economy**

Being resource efficient means using the Earth's limited resources[7] in a sustainable manner. This allows us to **create more with less** and **deliver greater value with less material input**. With growth, global demand for a limited supply of natural resources becomes problematic. This trend must be slowed down and balance restored. A circular economy proposes measures driving a more efficient use of resources and waste minimisation, **turning waste into a resource** via recycling. Recently, **waste limitation through reuse** has been recognised as a necessary action requiring more emphasis in economic planning.

'Resource productivity'[8] is the lead indicator, being used as a proxy for resource efficiency by the European Commission; it measures the quantity of economic output (by GDP) produced using a certain amount of extracted resources (measured by domestic material consumption indicator – DMC). In other words, resource productivity measures whether we have created more with less.

During a 16-year period, DMC per capita has gradually been reduced and an improved resource productivity trend was achieved in the 1st DR innovation region[9]; but only Germany exceeded the EU-28 average in 2016. All three countries recorded the greatest improvements in a given period. However, improving resource productivity has not necessarily led to reduced overall material use. In the same period, the 2nd innovation region of DR together with Bulgaria and Serbia from the 3rd DR innovation region **improved resource productivity**, but also experienced an increase in demand for materials (between 5 and 36%[10]). Stagnating resource productivity over a period of time has not necessarily meant there was less material used but can rather be explained by the simultaneous growth of GDP and DMC or low GDP, and higher increase in domestic material use. Romania had the third lowest GDP (30% of EU-28 total per capita in 2016) compared to other Danube region countries, but the highest DMC of all Danube region countries. Romania is known to have the fastest growing GDP and industrial sector in the EU-28. To conclude, none of the Danube region countries, despite Germany's good performance in resource productivity, has yet decoupled the economy growth from the use of natural resources.

The main challenge: Increase of resource efficiency while creating a circular business environment in the Danube region.

In the following, conclusions of analysis of selected indicators will be presented.

7 Metals, minerals, fuels, water, land, timber, fertile soil, clean air and biodiversity.

8 For detailed explanations and data analyses for the Danube region see Appendix 2, Indicator I (in online version of this document).

9 Regarding all selected indicators, Danube region countries, again, can be grouped in three innovation regions**:** 1st innovation region (DE, A, and SI), 2nd innovation region (HU, SK, HR) and 3rd innovation region (RS, RO, BG).

10 EUROSTAT, Domestic material consumption per capita.

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1. The aspect of competitiveness and innovation

*Despite low contributions to national GDPs and job added value in the EU-28 including Danube region countries, slow but **constant increase of competitiveness** of a circular economy sector can be observed in the last six years. To date, **extended producer responsibility** as a policy instrument offers no incentives to support better product design for better resource management.*

Specific sectors that are closely related to a circular economy such as the **recycling, repair, and reuse sectors** (this is the so-called **'circular economy sector'**)[11] were recognised as particularly job intensive, contributing to **local employment** and growth. **Innovativeness of the sectors** is also vital to the competitiveness of European and national economies. Though innovation is regarded as an important aspect of modern business, the ability and willingness of business to tap into its potential differs from sector to sector. Circular economy sectors have been found to be especially successful when being **eco-innovative**, as eco-innovativeness is tightly correlated with **eco-design**, **waste management**, and the **extended producer responsibility concept,** the untapped potential to boost eco-design and eco-innovation of which has, after over twenty years, again come under the scrutiny of the EU Commission.

What is Eco-Innovation?

***Eco-innovation** and research and development (R&D) are special focuses of MOVECO project deliverables. Development of innovation can contribute to the increase of investment in R&D, and to better convert research into improved goods, services, or processes for the market. Let us investigate what the prefix eco- adds to innovation definition.*

*For the Community Innovation Survey, **an innovation** is defined as a new or significantly improved product (good or service) introduced to the market, or the introduction within an enterprise of a new or significantly improved process[12].*

***Eco-innovation** means being economically competitive, while **respecting the natural environment.** Therefore, eco-innovation is any innovation that reduces the use of natural resources and decreases the release of harmful substances across the whole life-cycle[13]. An understanding of eco-innovation has evolved over time towards the current, renewed, quite circular, understanding of innovating to minimise the use of natural resources and the release of harmfulsubstances **over the whole life cycle** - i.e., in the design, use, re-use and recycling phases of products, materials, and those services related to them.*

*Eco-innovation can be **an idea** for a new start-up or **product** as well as for **making improvements to existing operations and products.** One focus of eco-innovation is **new technologies, but creating new services** and **introducing organisational changes** are just as important. New concepts such as sharing (pooling), leasing, and remanufacturing are also eco-innovation efforts. The motivations behind these innovations are not necessarily restricted to the environmental; rather they often make good business sense as well, **with environmental benefits a favourable side-effect[14].***

The circular economy sector[15] contributed **to 1% of the overall GDP** in 2016 in DR-9[16], ranking the macro region just above the EU-28 average. The circular economy sector of Danube region countries' **'employment rate'** was higher than those of the EU, reaching 1.8% in 2016. A higher GDP contribution of the sector does not necessarily mean the highest employment rates and vice versa.

According to the analysis made within the scope of the MOVECO project, the **'eco-innovation index'** was proven to be a good mirror of how eco-design and eco-innovation is perceived in the individual DR-9 countries. Where the index for eco-innovation is higher, there is a positive correlation with a country's stakeholder **recognising eco-innovation as an economic opportunity and advantage**. Over a six-year period[17], the eco-innovation performance of DR-9[18] countries varied. In absolute terms, a **decrease** was registered in two countries and more countries noted more of a fluctuating increase than a steady one. Only in 2016 did the 1st DR innovation region countries exceed the EU-28 average performance.

Even though investment in innovation in general has been increasing, **lack of investment in eco-innovation and eco-design** was recognised for the whole Danube region. Development in recent years shows that most eco-innovations are to be understood as incremental **improvements to existing technologies** and that radical base innovations are rather the exception. Some of the more novel concepts of a circular economy approach, like remanufacturing and consumer perception, remain unrecognised in Danube region countries.

In 2016, the DR-9 average rate of **'research and development intensity'** indicator was below the European Union average; but it has been **continuously increasing**. Three countries noted steady increase during the whole given period, while in other countries the indicator values fluctuated or even decreased during the last few years. Two countries (Germany and Austria) have already reached the 2020 target of the Europe 2020 strategy[19] and exceeded the EU-28 average in 2016. In the majority of 2nd and the whole 3rd DR innovation region less than 1% of GDP were spent on R&D in 2016, lagging well behind the EU-28 average.

According to a second overview analysis prepared by the MOVECO partnership[20] all the main materials[21] are covered by the R&D within the Danube region; though

[11] 'Recycling sector' and 'repair and reuse sector' as defined and approximated in terms of economic activity branches of the NACE Rev. 2 classification after adjusting for operating subsidies and indirect taxes.

[12] EUROSTAT Glossary, Innovation.

[13] Eco-Innovation Observatory (EIO) annual report, 2016; ec.europa.eu/environment/

[14] Eco-innovation; A guide to eco-innovation for SMEs and business coaches (2017).

[15] For detailed explanations and data analyses of the indicators mentioned on this page, please see Appendix 2, Indicators from II to V (in online version of this document).

[16] No data for Serbia.

[17] 2010–2016

[18] No data for Serbia.

[19] The Europe 2020 strategy adopted in 2010 maintains a long-standing objective; namely, for the EU to devote 3% of gross domestic product (GDP) to R&D activities.

[20] Transnational Report on R&D Activities in Circular Economy (2017)

[21] Glass, composite materials, wood, polymers, metal, paper

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Competitiveness and innovation

not all countries have all the surveyed R&D capacities, confirming that there is **potential for collaboration** to better exploit existing resources and knowledge. Moreover, R&D mapping performed by the MOVECO project consortium has shown that organizations that have a tangent to the circular economy have been more involved in **waste reduction, recycling and environmental protection** projects. Only a few organizations (in countries belonging to the group with higher eco-innovation ranking) were involved in product and service innovation providing environmental benefits in eco-design and eco-friendly systems innovation.

Lack of cooperation between small and medium-sized enterprises (SMEs) and R&D institutes was identified as one of the biggest challenges. It was noted, though, that there has been some improvement in **public and private sector cooperation** due to the development of consortiums for common projects and clusters. However, this type of cooperation cannot necessarily be considered sustainable - after their funding resources are terminated. With regard to the R&D capacities, 1st and 2nd DR innovation region countries reported sufficient numbers of researches, while others like Romania, and Serbia mentioned a significant **decreased numbers of researchers**.

Challenge identified No. 1: Lack of co-operation between SMEs and research and development institutions and lack of funding for researching recycled and new alternative (plastic) material, eco-design and eco-friendly system innovation within the Danube region.

Extended producer responsibility or the so-called EPR principle should support eco-innovation and better circular and modular design for the environment (eco-design). By launching the Circular Economy Action Plan in 2015, the EU Commission recognized the potential of **EPR as a policy instrument** to induce more efficient eco-design, strengthen financial incentives for eco-design, and boost eco-innovation at the same time.

Extended producer responsibility in a nutshell

Extended producer responsibility (EPR) is not a 21st century novelty. Since the late 1980s it became an established principle (also seen as a strategy or a concept) of environmental policy, when end-of-life management of products emerged in a number of Organisation for Economic Cooperation and Development (OECD) countries.
*EPR policy sought to shift the burden of managing certain end-of-life products from municipalities and taxpayers to producers. It was hoped that the incentives it provided would stimulate producers **to redesign products and packaging** and as such reduce the share of waste destined for final disposal and increase recycling.*

According to the EU Commission and stakeholders, EPR schemes[22] are the main driver for reaching the statutory targets for collection and recycling of municipal waste, although in the absence of clear requirements their effectiveness varies a great deal.
*A 2016 report[23] by the OECD notes that while EPR schemes have helped **to reduce landfilling and increase recycling**, contributing a great deal to the development of the recycling industry, EPR schemes all around Europe have had **limited effects on promoting eco-design**. The MOVECO consortium study[24] from 2017 came to the same conclusions.*

To date, extended producer responsibility was created as a strategy, **to support better design** and boost eco-innovation for managing postconsumer waste streams, but **has fallen short of this objective** in the Danube region countries, with no incentives to support better product design for better resource management. With the amending European waste legislation package[25] it is expected this strategy will become more efficient due to more details regarding how EPR schemes should be operated and monitored. According to the amended Waste Framework Directive (WFD), producers should be responsible for **contributing to waste prevention** and **for reusability and recyclability of products[26].**

Other challenges referring to boosting competitiveness and innovativeness are incorporated in all stages of a circular economy and will be found in these chapters.

2. Production and consumption

Currently, not only the Danube region, but the whole EU is **resource poor** and dependent on imports of many raw materials that are crucial for a strong European industrial base. This highlights the need for **secure access and diversification of supply** and the necessity greater resource efficiency. Progress can be observed towards more circular trends in consumption - e.g., in terms of municipal waste generation.

The EU is largely self-sufficient in regard to most non-metallic minerals such as construction and industrial materials. The indicator on self-sufficiency[27] confirms that for the **EU's critical raw materials (CRMs)**[28] the EU relies to a large extent on imports.

Non-energy raw materials are linked to all industries across all supply chain stages. Its application is so broad; the future global resource use could double by 2030[29]. Although all raw materials are important, some of them, so-called critical raw materials (CRMs), are of more concern for EU industrial base than others in terms of **secure** and **sustainable supply**. CRMs are particularly important for **high tech products** and **emerging innovations**; thus waste electrical and electronic equipment (WEEE) and waste batteries and accumulators (WBA) are a potential source of CRMs.

Danube region countries can be found on a map of average EU production of primary critical raw materials and their share of supply to EU[30]. **Germany, Austria,**

[22] According to the amended Waste Framework Directive (2018/851), EPR scheme means a set of measures taken by Member States to ensure that producers of products bear financial responsibility or financial and organisational responsibility for the management of the waste stage of a product's life cycle.
[23] Extended Producer Responsibility; Updated Guidance for Efficient Waste Management (2016)
[24] MOVECO Transnational report: Extended Producer Responsibility Schemes and their influence on innovation in the TransDanube region report (2018)
[25] Amended 2008/98/EC Directive with Directive 2018/851, Amended 94/62/EC Directive with Directive 2018/852, Amended 2012/19/EC and 2006/66/EC Directives with 2018/849 Directive.
[26] Directive 2018/851, page 8
[27] EU Self-sufficiency for raw materials indicator from 'A monitoring framework for the circular economy'.
[28] European Commission, Critical Raw Materials; ec.europa.eu/growth/sectors/raw-materials
[29] UNEP report: Decoupling: natural resource use and environmental impacts from economic growth (2011)
[30] SWD(20118) 36 final; Commission staff working document, Report on Critical Raw Materials and the Circular Economy, part 1/3, page 7

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Hungary and **Bulgaria** from MOVECO relevant DR countries, as well as the Czech Republic, are EU producers of primary CRMs. Their shares of supply amounts to between 1 and 5% (excepting certain CRM extractions in Germany and Austria, which represent between 8 and 25% share of supply for the EU).

'Domestic material consumption' (DMC) is an indicator for **measuring material consumption** and is used as a complementary resource productivity indicator in the area of materials. It measures resource efficiency through the **total amount of material directly used in the economy**[31]. Domestic material consumption per capita varied in DR-9 countries in 2016 and was similar in countries grouped in the same innovation regions. Nevertheless, variation in tonnes of DMC per capita is not necessarily a sign of more efficient industry in one country compared to another, rather a reflection of the **type of material resources available** in the country and its **economic structures**.

In absolute terms, fluctuating trends **of increase of DMC per capita** in DR countries have been observed in the past 16-years[32]. Different trends between the three DR innovation regions can be observed. In total, a **decrease** of DMC per capita is noted for the 1st DR innovation region, a **small** and **fluctuating increase** of the indicator for the 2nd, and an **increase** for the 3rd DR innovation region. The pattern of decrease in DMC per capita in the 1st DR innovation region countries can be the result of dominant service-based economies[33], which typically have lower demand for material inputs. The majority of heavy industries using raw materials[34] and mining of raw material resources[35] are situated in the central and even more so in the eastern part of the Danube region; therefore the increase in domestic material use in the 2nd and more in the 3rd innovation region was expected.

'Municipal waste generation' is another indicator to measure progress towards more circular trends in the production and consumption. Reducing municipal waste generation is an indicator of the effectiveness of waste prevention measures and **changing patterns of consumption on the part of the citizens**[36].

Why does the circular economy focus mainly on municipal waste streams?

*Concentrating on municipal waste rather than on industrial waste has the advantage of **reflecting the consumption side** and is not affected by the presence or lack of strong manufacturing sectors in a country. Moreover, secondary raw material supply for producers and manufacturers can be provided through direct contracting with B2B customers, which return end-of-life product or its component back into their production system. Industries using **reverse-logistics** and **industrial symbiosis**, recycling of post-industrial waste in-house or sold in a market, is a well-established practice for some time now - e.g., for end-of-life automotive and industrial batteries, certain WEEE, etc.*

[31] For detailed explanations and data analyses for the Danube region see the Appendix 2, Indicator VI (in online version of this document).
[32] 2000–2016
[33] EUROSTAT, Structural business statistics overview
[34] Strong industries in 2nd and 3rd DR innovation regions: automotive industry, machinery industry, IT, electronics, chemicals, food industry...
[35] Romania is a big producer of copper, nickel, iron ore; Bulgaria is Europe's largest producer of lead, zinc and copper; Serbia: base metals
[36] For detailed explanations and data analyses for the Danube region see the Appendix 2, Indicator VII (in online version of this document).

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*Municipal waste accounts for only about **10% of total waste generated in the EU**. However, this waste stream in particular is amongst the most **complex ones to manage** and when managed improperly can be harmful to the environment and health. In the EU-28 47% of municipal waste is recycled and composted, 27% is incinerated and 23% still landfilled[37]. One of the challenges of municipal waste management results from its highly complex and mixed composition (different materials, impurities, non-recyclable components, etc.). The newly amended Waste Framework Directive[38] addresses these challenges.*

A strong correlation between municipal waste generation and prosperity has been observed. Countries with higher purchasing power tend to consume more and consequently generate more municipal waste. In general, countries from the 2nd and 3rd DR innovation regions **generate less** than the EU-28 and DR-9 countries.

During the 16-year period[39] the average municipal waste generation per capita in absolute terms **in the EU-28** countries **declined** by 7%, while in the **DR-9 countries it increased** by 1%. Differences between countries in municipal waste generation influenced the slight **increase of municipal waste generation** in total in the Danube region. After 2008, the more common trend in the DR-9 area is toward a decrease.

Better national waste management plans favouring waste prevention, with incentives for reduction of municipal waste generation (projects, campaigns), technologically advanced waste management infrastructure, etc., support the reduction of municipal waste generation in some Danube region countries more than others.

Challenge identified No. 2: Gaps in municipal waste generation performances among the Danube region countries should be narrowed, favouring prevention and reuse strategies.

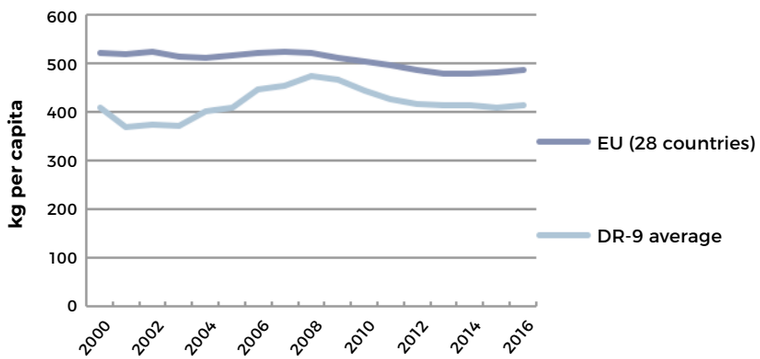

Figure 4: Generation of municipal waste per capita, 2016. Source: EUROSTAT.

[37] EUROSTAT, Municipal waste statistics, data for 2017
[38] Amended 2008/98/EC Directive with Directive 2018/851
[39] 2000–2016

3. Waste management

Waste management generally shows **positive developments**; yet with significant room for improvement among Danube region countries and across waste streams.

Efficient waste management systems are an essential building block of a circular economy. Even though the European waste hierarchy[40] favours waste prevention (e.g., reuse) and preparing for reuse (cleaning, repairing) prior to recycling and other recovery operations (e.g., thermal treatment with energy recovery), **increased recycling to improve resource efficiency** must be an essential part of a **circular economy transition** period.

The **'recycling rate of municipal waste'**[41] provides an indication of how **waste from final consumers**[42] is or can be **used as a resource** in the circular economy[43]. One of the success stories of the environmental policy in Europe is the increase in the rates of municipal waste recycling and declining rates of landfilling.

The 1st DR innovation region countries recycled at least **half of their municipal waste** in 2016; all three countries already exceeding the 2025 target (55% recycling rate). None of the 2nd and 3rd DR innovation region countries **exceeded the EU-28 recycling** rate (46%) in 2016. Overall, in all DR-9 countries, the **recycling rate of** municipal waste **increased**.

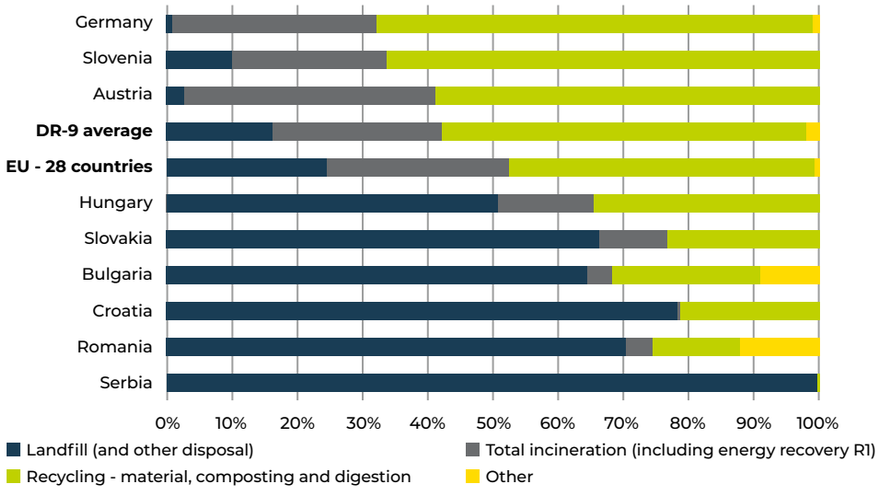

Figure 5: Municipal waste by waste management operations, 2016. Source: EUROSTAT[44].

[40] Waste Framework Directive 2008/98/EC

[41] Recycling covers recycling of inorganic and organic materials: material recycling, composting and digestion of bio-waste; Source.

[42] EUROSTAT; Households, and waste from other sources (services and trade) that is similar in nature and composition to household waste.

[43] For detailed explanations and data analyses for the Danube region see Appendix 2, Indicator VIII (in online version of this document).

[44] Note: "Landfill" (and other disposal) covers D1-D7, D12 and other, but without D10. "Total Incineration" covers D10 and energy recovery R1; where R1 represent at least 87 % of "Total incineration" in all DR-8 countries. There is No

Usually, landfilling declines much faster than the growth in recycling, as waste management strategies mostly move from landfill towards a combination of recycling and incineration. In **Germany** almost no municipal waste is sent to landfill and in **Austria** only minimal quantities are. However, municipal waste recycling rates in Germany exhibited only a slight increase and in Austria even a decrease over a nine-year period. On the other hand, **2nd** and **3rd DR innovation region countries** still landfill relatively large amounts of municipal waste (50% or more), and their recycling rates are the lowest of the DR-9 countries.

Challenge identified No. 3: In two-thirds of the Danube region countries, municipal waste is still poorly diverted from landfills or incinerated.

In efforts to make the transition towards a circular economy, the European Commission has focused on reducing overall municipal waste generation, redirecting municipal waste from landfills, favouring separate collection and increasing recycling and preparation for reuse of municipal waste[45]. **Targets for reuse** have not yet been proposed; although for the future legislative amendments **targets have been foretold**. Special focus has been given to two municipal waste streams – packaging waste (PW) and waste electrical and electronic equipment (WEEE), where recycling rates were determined for monitoring progress towards a circular economy. Because of familiarity with WEEE, the MOVECO project focuses largely on waste batteries and accumulators (WBA) as well as PW and WEEE.

[45] Amended 2008/98/EC Directive with Directive 2018/851

Packaging (waste)

Special focus on the **packaging waste stream** (PW) resulted in even higher statutory targets in the recently amended packaging waste legislation[46]. With the latest legislative changes and published strategic documents[47], **plastic waste derived from fast moving consumer goods** has been recognised as one of the most problematic waste streams for the environment in Europe. Special targets and measures for ten single-use plastic products have been marked in a new legislative proposal, titled the Single-Use Plastics Directive,[48] which proposes a binding target of at least 30% of recycled plastic in new single use plastic beverage bottles by 2030[49], and proposes market bans for certain products.

Why focus on plastics within the packaging waste stream?

*The most common application of plastics **by weight** is in industrial processes **producing packaging**, followed by producing textile, **electrical and electronic equipment**, and as well as in the automotive and construction sector[50]. Recent studies show that if current trends continue an estimated **26 billion tonnes** of plastics will be produced over the **next 30 years**[51]. From 2015's Circular economy package, plastics have now come within the scope of European environmental policies. In 2018, the plastic crisis increasingly became a*

[46] Amended 94/62/EC Directive with Directive 2018/852

[47] A European Strategy for plastics in a Circular economy; COM(2018) 28 final

[48] COM(2018) 340 final and Annex.

[49] Press release; Single-use plastics: Presidency reaches provisional agreement with Parliament (2018)

[50] OECD, Improving Markets for Recycled Plastics; Trends, Prospects and Policy Responses (2018)

[51] Geyer R., Jambeck J. R., Lavender Law K. Science Advances. Production, use and fate of all plastics ever made (2017)

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Waste management

globally alarming phenomenon. Of all materials, plastics have been the most exposed for their environmental burdens, resulting in an increased urgency to apply more circular economy models.

*Globally Europe has the highest recycling rate for plastics, as in the EU countries alone around **30%** of all plastics are recycled (elsewhere globally the figures tend to range from 14–18%). Other packaging materials such as paper and cardboard (the EU-28 material recycling rate in 2016 was 85%), metals (78%) and glass (73%) reach higher recycling rates in comparison to plastics, according to the latest EUROSTAT data[52]; this is partly because of their more traditional use, the relative maturity of their markets, and their economic attractiveness. The presences of problematic and/or hazardous additives, separation techniques and inefficient transport have resulted in uncertainty for establishing a market for recycled plastics.*

*Plastic packaging waste is the **most complex** packaging waste material stream, as it is a compound from various polymers, and as such poses a great variety of economic, technical, environmental and regulatory challenges. Furthermore, plastics in the packaging waste stream represents the **largest fraction of plastics waste generation** due to their relatively short use-cycle; the single **largest market for plastics by weight**, and is the **most commonly recycled type** of plastic (in the EU-28 in 2016, 42% of plastic packaging waste was recycled).*

The indicator measuring the recycling rate of packaging waste by type of packaging is used to monitor progress towards the packaging recycling target (newly amended to 65% and 70% by 2025 and 2030, respectively). In 2016, the **DR-9**[53] **countries** average **exceeded** the EU-28 average **'plastic packaging waste recycling rate'**[54]. However, countries' performances vary. In 2016, two countries already reached or were approaching the EU 2025 target threshold, but the majority lag behind the EU-28 average by 10 percentage points or less.

The **biggest increase** in recycling rate performance was reached by the 3rd DR innovation region countries and Slovakia from the 2nd DR innovation region. The overall recycling rate of plastic packaging waste in absolute terms **in the Danube region is higher** than the EU-28 average. With a harmonised methodology for recycling rate calculation, a decline in recycling rates for some countries is expected[55]. Therefore additional efforts will be needed to reach even higher amended recycling rate statutory targets.

The quality of recycled plastic material derived from all three waste streams (not only in WP, but also in WEEE and WBA waste streams) is even more inconsistent. **Hazardous additives** used in primary plastics can possibly make their way into recycled plastics where they may pose a health risk (e.g., particularly in products that are used for sensitive applications such as toys and food packaging) and **hinder the recycling process**. This concern is compounded by the **lack of transparency** in the use of additives in plastics. The content of the additives in plastics varies widely, **from less than 1% in PET bottles** and up to 50–60% in PVC[56].

Furthermore, plastic packaging waste collected as municipal waste is known to have a high level of impurities. As highlighted in the European Commission's strategy for plastic in the circular economy, collection has a great influence on the costs and quality of recycled plastics. When more selected **sorting** takes place **at the source**, the risk of contamination is reduced and consequently also the costs. For example, an uncontaminated waste material is one of the advantages of **deposit-return systems** for one-way beverage packaging for plastics recycling, a practice currently established in Germany and Croatia[57] and planned for Slovakia.

Challenge identified No. 4: The quality of plastic recycled material is low in all the Danube region countries.

A precondition for increasing recycling is **the existence of a market for the recycled materials and products** with prescribed rates of recycled materials in new products. Current policy measures in the DR countries do not focus enough **on establishing a separate demand for recycled plastics.** Virgin plastics are still cheaper than recycled plastics. **Illegal waste trade** and **ineffective verification systems** are issues in all of Europe. Managing the waste **is a big business**, but not, at this point, with the purpose of contributing to the progress towards the circular economy.

Globally, the market share of the recycled plastics industry is currently **less than 10%. The recycled plastic industry** is, unlike the primary plastics sector, smaller, more fragmented, and characterised by **numerous small actors** – mostly SMEs. In the Danube region, 99% of **waste management sector enterprises** are SMEs, contributing to **65% of the total turnover** of the waste management sector. **Plastics re-processors – recyclers** (even in the high-income DR-9 countries such as Germany and Austria) are **small and fragile** and as a result vulnerable to any price volatility. **Trade in recycled plastics** is global and the structure of the recycled plastics supply chain varies significantly among countries and regions.

Consumer trust in products containing recycled materials **is still low**. Lack of transparency and information about what additives have been used in different materials is common. This may **reduce the appeal of recycled plastics** use in products, especially those where they may be absorbed by human (e.g., baby products, food packaging).

Challenge identified No. 5: The market for secondary raw materials for recycled plastics is still not established, as it lacks stable quantities and qualities for procurers of these materials.

It is predicted that increased recycling of waste materials is still likely to be an essential part of a circular economy transition, even though the EU waste hierarchy ranks waste prevention and preparation for reuse ahead of recycling. Thermal treatment with energy recovery may still be used instead of recycling where reasonable. Plastics' characteristics, having a great caloric value speaks in favour of waste to energy recovery operations. These are used prior to recycling in many European, especially Nordic, countries as well as in Germany and Austria. Currently, **incineration facilities** with heat recovery to treat waste **compete for materials with recycling facilities** and may hinder the recycling and establishment of a market from secondary raw materials from recycled plastics. In a circular economy, thermal treatment of waste with energy recovery should be an option **for non-recyclable and non-reusable** municipal waste only.

[52] EUROSTAT, Rcycling rates of packaging material.

[53] No data for Serbia.

[54] For detailed explanations and data analyses for the Danube region see Appendix 2, Indicator IX (in online version of this document).

[55] Note: In Europe, Member States use different methods for calculating national recycling rates, making comparison difficult. Until recent amended waste legislation, countries could choose from among 4 methodologies.

[56] ECSIP consortium: Treating Waste as a Resource for the EU Industry. Analysis of Various Waste Streams and the Competitiveness of their Client Industries (2013)

[57] Arcplus. Deposit-refund systems in Europe for one-way beverage packaging (January 2019)

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Waste management

Discussion regarding where and how many incineration plants Europe needs[58], and how many fewer of these plants Europe will need when a circular economy prevails over the linear economy models are a hot topic right now. **Economic and environmental feasibility analyses** will need to be made to make such decisions in the future.

Challenge identified No. 6: Recycling, especially recycling of plastics from packaging waste, cannot compete with energy recovery from waste.

Additionally, other different **intrinsic complexities of plastics** in the packaging waste stream can raise the costs and hinder the recycling process:

- Colour and the possible wide variety of polymers used in one product of post-consuming plastic packaging waste, which makes it difficult to separate and recycle;
- Geographically dispersed nature of the waste flow, high transport costs but low value of plastics in municipal waste streams;

  In Europe, plastics were one of the last materials to be added to the materials collection portfolios of local authorities because of their low value and high transport costs. It is likely that they would not be collected if regulation was not in place to drive the process.
- Constantly evolving products (cosmetics, fresh food and drinks packaging) make adaptation of treatment schemes difficult, etc.

Challenge identified No. 7: Costs for plastics end-of-life treatment are higher than the costs related to the treatment of other packaging materials.

The 3rd DR innovation region countries' stated lack of infrastructure to support the efficient operation of waste management. Insufficient **waste management infrastructure for** separate collection and lack of recovery (recycling) facilities, especially hazardous waste management facilities, are general characteristics of the **Danube region countries.** Treatment facilities performing material recycling[59] of all three MOVECO relevant waste streams dominate in Germany. In other DR-9 countries, pre-treatment operations (R12 recovery operation) dominate over end-processing recycling treatment operations. Packaging waste is still largely either recovered for energy or incinerated or end-processed in other EU or non-EU countries, but not in the Danube region country of origin. If there is any such facility it is often a SME. Currently, in the Danube region attention is redirected from product design and prevention of waste generation and **centred on the improvement of municipal waste management** with adequate infrastructure and capacities at the end of the product cycle.

Challenge identified No. 8: Lack of investment in waste management infrastructure, especially in the eastern Danube region countries, diverts the focus from eco-design to waste and its management.

Extended producer responsibility compliance schemes, also known as producer responsibility organisations (PROs) in the Danube region countries are many in number and have different roles and responsibilities. In general, packaging EPR compliance schemes in the Danube region seem to be less transparent regarding electrical and electronic equipment (EEE) and batteries and accumulators (B&A). In most of the DR-9 countries, multiple collective PROs fulfilling the EPR obligations in the name of producers compete on the market. **Hungary and Croatia** are exceptions, having state-owned organisations, implementing EPR through product tax[60] and an environmental fund[61]. The prices for waste management are differentiated into material categories and then **administered according to weight.** According to the New Packaging Act, which came into force on 1st of January 2019, **Germany** is the only DR-9 country which has already established **modulated fees** paid by producers for packaging waste management according to recyclability.

Even though pricelists are often publically available, final costs for waste collection and treatments are determined at the PRO-company level, due to competitiveness between the multiple producer responsibility organisations. As PROs are competing for customers on the market, **costs for managing a tonne of waste may not reflect an actual waste management cost** per material category, which could actually lead to the collapse of the national waste management systems operation.

The EPR schemes are evolving to include separate registration and **coordination points** - i.e., clearing houses to coordinate the collective, competitive PROs, as well as compliance of companies. To date only Austria and Germany have established a clearing house for packaging. In Slovakia a coordination centre is planned for each EPR waste stream[62].

Challenge identified No. 9: Complicated and non-transparent EPR schemes, especially for packaging (waste) exist in the Danube region countries with no incentives for eco-design and eco-innovation.

(Waste) electrical and electronic equipment

Waste electrical and electronic equipment (WEEE) is a second waste stream of the MOVECO project. This stream is highlighted within the European monitoring framework for a circular economy. Figures show that WEEE is one the fastest growing waste streams in the EU. Furthermore, WEEE includes **precious materials,** the recycling of which **should be enhanced** if we aim at preserving as much as possible (critical) raw materials and increase resource efficiency in the future in the Danube region and the EU.

Why focus on WEEE?

Electrical and electronic equipment *(EEE) are becoming* ***smarter*** *and consist of an increasingly* ***complex and diverse*** *set of products and components, which are subject to* ***constant change and innovation****. The technology* ***lifetime*** *of these appliances is substantially* ***shorter*** *than the lifetime of their raw materials. When EEE lifetime ends, that complexity passes on to the waste management of end-of-life EEE and raises the question of how to preserve raw materials and especially critical ones, to prevent them from being discarded before their lifetime ends.*

Materials *moving to the* ***WEEE*** *stream are, as in packaging waste,* ***complex*** *and* ***multiple****. Fun fact: most of the end-of-file EEE consists of more than 50 raw materials[63]. The quantity and quality of these materials within the same product group can be very diverse and increase in complexity through time.*

[58] Currently there are around 500 incineration facilities in Europe.

[59] Recovery operations R3, R4, R5

[60] Hungarian 'The Product Fee Act'

[61] Croatian Environmental Protection and Efficiency Fund

[62] For detailed analysis please see the MOVECO report: Extended Producer Responsibility Schemes and their influence on innovation in the TransDanube region (2018)

[63] Inter alia precious, base, and rare earth materials, different type of plastics and ceramics

*Essential constituents of much WEEE include so-called **critical metals** from the list of critical raw materials (CRMs) of the EU[64]. Currently, only a small fraction of CRMs remains inside Europe's socio-economic system through functional recycling[65], as the supply of CRMs from secondary sources is limited and the recycling input rate is low, even for materials for which overall recycling rates are relatively high.*

***Improving the recycling** rates of WEEE has still not yet been used to its full potential to improve the competitiveness of European industry sustainability, increase its resource efficiency, and reduce the negative impact on environment.*

The study of the **market for WEEE**[66] from 2013 concluded that of the WEEE being generated every year only a minor part reaches the final recycling step where critical materials are recovered for secondary use.

According to the indicator '**recycling rate of e-waste'**[67] of the DR-9[68] countries **has been constantly increasing** and exceeded the EU-28 average in the observed last six-year period. In general, though with exceptions, the 2nd and 3rd DR innovation region countries registered a **greater increase** of recycling rates in comparison to the 1st DR innovation region countries. Looking into 'reuse and recycling rate'[69] as set out in the WEEE Directive all countries reached the statutory targets[70] of separately collected WEEE classified in ten product categories in 2016. However, there is still much room for improvement, especially for **increasing collection rates,** which will be reflected in the increased recycling of WEEE.

This indicator can be misleading for the perception of **domestic treatment activities**. Recycling rates are calculated including the quantity of WEEE sent to material recovery to other EU and non-EU treatment facilities. **Treatment of WEEE in DR-9 countries is limited mostly to R13 and R12**[71] recovery operations, which are not considered recovery to a final processed product/material but rather **pre-processing** and **dismantling of WEEE**. Separation of WEEE by EEE product categories[72] is usually performed at the collection sites. Further dismantling (e.g., hazardous liquids from refrigerators or hazardous materials from lamps) may or may not happen in a country of origin; as for dismantling of components with hazardous substances, special technologies are needed that are currently located in a small number of countries, mostly outside the Danube region.

Dismantled WEEE is then exported to be further pre-processed or recycled (R4) in other EU and non-EU countries. According to the conclusions of one report[73], the collection of WEEE generally takes place at the local and regional level while dismantling and pre-processing typically takes place at regional and national levels, depending on the size of the country. As opposed to collection and pre-processing, **end-processing of WEEE is a globalised service**, with only a few current facilities located in Europe: Belgium, **Germany** and Sweden.

As mentioned, **increasing the collection of WEEE** is one of the key factors to assure the improvement of recovery of secondary CRMs from WEEE. There are some currently known barriers that need to be overcome to increase the collection rates of WEEE. One of them is the more or less significant **time lag** between a new product entering the market and its introduction into the waste stream. Although there is a general tendency towards decreasing lifespans of the EEE, material flows are going to stock and they are not available for recycling for several years. Recycling of precious materials can also be delayed if the **final consumer retains the WEEE** even after appliance is no longer in use. The recycling of CRMs embodied in WEEE largely depends on the type of application and value of the raw materials (economic feasibility of recycling of certain CRMs).

There is a difference of collection rates among EU Member states. Collection rates also **differ from WEEE category to category**. The ECSIP consortium study showed that incentives to collect relatively low-weighted EEE (e.g., small IT equipment, telecommunication equipment or consumer equipment), even if they contain a lot of valuable materials, is low compared to the incentive to collect larger household equipment. Collection from **final household consumers** and **their awareness** have an important role in increasing WEEE recycling. **Landfills** represent an accumulation of a large amount of very different, still potentially usable, materials, including CRMs. According to a JRC background report[74], the concentration of metal in mine ores is often less than 1%, while in landfills their concentration can be as high as 20%.

No incentives exist to support producers of EEE **to improve design** (e.g., design for disassembly and design for recycling) **beyond eco-design directive requirements,** where current provisions mostly address **design for energy efficiency** of the appliances. Improving product design is especially challenging for the Danube region's SMEs, a large share of which are **component manufacturers.** Due to the large share of foreign ownership these companies **do not feel in control of design,** a factor that, if changed, could support transition to a circular economy.

An additional challenge identified is that used but working products **do not require notification before shipment** and can be shipped to non-OECD countries legally, where they may not be treated in an environmentally sound manner. With transboundary movements of used EEE and WEEE in third world countries, valuable raw materials for possible secondary use in Europe and the Danube region are lost. The amount of WEEE shipped out of the EU cannot be properly estimated, as the results of studies carried out differ considerably.

Extended producer responsibility schemes can contribute greatly to improving the supply of CRMs from waste streams. Analysis of EPR compliance schemes (PROs) in the Danube region shows that for WEEE schemes are **less complicated**, usually fewer in number and **more straightforward and transparent** as packaging EPR compliance schemes. Austria and Germany[75] are the only Danube region countries that have established so-called 'clearing houses' for WEEE, founded by producer associations taking care of registration, authorisation and provision of collection and equipment for collection.

[64] Last amended in 2017; COM(2017) 490 final
[65] Commission Staff Working Document, Report on critical Raw materials and the Circular Economy Part 3/3
[66] ECSIP consortium: Treating Waste as a Resource for the EU Industry. Analysis of Various Waste Streams and the Competitiveness of their Client Industries (2013)
[67] For detailed explanations and data analyses for the Danube region see Appendix 2, Indicator X (in online version of this document).
[68] No data for Serbia.
[69] Statutory 'reuse and recycling rate' targets set out in WEEE Directive represent the percent of a product classified in an EEE product category that needs to be recycled according to material composition of this product and the best available technics (BAT).
[70] EUROSTAT, Waste electrical and electronic equipment (WEEE) by waste management operations
[71] R 12 – pre-processing such as, inter alia, dismantling, sorting, crushing, compacting, pelletising, drying, shredding, conditioning, repackaging, separating, etc.
R 13 – Storage of waste (excluding temporary storage, pending collection, on the site where the waste is produced).
[72] According to Annex III in Directive 2012/19/EU
[73] ECSIP consortium: Treating Waste as a Resource for the EU Industry. Analysis of Various Waste Streams and the Competitiveness of their Client Industries (2013)
[74] JRC; Critical raw materials and the circular economy, background report (2017)
[75] In Germany there are no PROs for WEEE, as producers of EEE comply with EPR requirements individually.

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Challenge identified No. 10: The supply of CRMs from secondary sources (waste) in Europe including the Danube region countries needs to be improved.

The lack of data on quantities of different (hazardous) materials and **insufficient monitoring** also diminishes the attractiveness for WEEE recycling, especially for complex multi-material products such as EEE and batteries and accumulators. Plastics in WEEE and waste batteries have been found economically unattractive for recycling, due to cost. **Incineration and combustion** are currently used practises of managing plastics from WEEE[76].

Challenge identified No. 11: Insufficient information on chemicals, so-called legacy elements and harmful additives (e.g., brominated flame retardants) in EEE and WEEE, especially in recycled plastic materials from WEEE, hampers monitoring and trust in secondary use of recycled materials.

There is concern that repair and preparation for reuse of WEEE may have a negative impact on the sales of new equipment (market cannibalism), with the possible handicap of equipment which is repaired or prepared for reuse not living up to equipment safety standards.

Current **EPR requirements for WEEE** did not support **design for disassembly, reuse or recyclability** with additional barriers to enhance the use of some recycled materials due to higher contents of hazardous substances in old appliances entering the waste material streams and requirements imposed by chemical legislation (Regulation REACH[77]). With recently defined minimum requirements for EPR in amended waste legislation in 2018, greater influence of EPR schemes on eco-design is expected. Some aspects of design to protect intellectual property, such as difficulty of disassembly and repair are in direct opposition with the goals of a circular economy.

Challenge identified No. 12: Poor framework conditions for reuse of EEE in the EU and the Danube region countries.

Waste management

(Waste) batteries and accumulators

The MOVECO project also focused on **waste batteries and accumulators** (WBA)[78]. As with WEEE, the WBA stream has a wide range of valuable materials and CRMs. Even though they represent small shares of the mass of the batteries, the recovered amounts of metals are the most valuable outputs of the battery recycling process. Most notably, cobalt (a CRM), cadmium and lead are metals that can be used by the B&A industry to make parts of new batteries. Data on trade in WBA is lacking. According to a recent EU Commission report[79] implementation of the Batteries Directive[80] is perceived as a major contribution to the positive functioning of the single market for batteries. Analysis made under the scope of this project showed that the market for waste automotive batteries and accumulators (WABA) and waste industrial batteries and accumulators (WIBA) is well established in the Danube region, while trade in waste portable (WPBA) is rather low.

The Batteries Directive sets collection targets for WPBA and recycling targets for all WBA, differentiated by type (lead-acid WBA, nickel-cadmium WBA, and other WBA). A recent European Commission study[81] has found that more than half of WPBA in the EU are not collected or recycled. Nevertheless, the **trend regarding the amount of collected WPBA has been positive**. One third of the Danube region countries had insufficient, inconsistent or unavailable data on WPBA collection for 2016. However, **recycling efficiency targets**[82] were reached in all of the DR-9 countries in 2016, except Croatia.

The obligation to ensure that batteries (WPBA) are removed from WEEE remains vague, which hinders sorting and recycling efficiency; too many waste batteries are **lost during treatment of WEEE.** The Batteries Directive has been effective in ensuring that PBA and ABA are labelled. However, improvements are needed to ensure that information reaches end-users [83]. This can prolong the lifetime of EEE and other products once a battery reaches its end-of-life.

Large waste management companies – multi-national, public or private – seem to dominate the collection of industrial and automotive WBA. However, despite the fact that the role of SMEs in the WBA collection market seems to be small compared to the treatment and processing stage in the WBA stream, **most SMEs are active in the collection stage of the waste stream** as the capital investment costs in this stage are smaller than in the battery processing stage.

Recycling of WBA is highly concentrated in three EU member states, including **Germany** (for primary and secondary WBA). Relevant production and accompanying recycling facilities **of waste lead-acid batteries** (industrial and automotive WBA) are located in almost all Danube region countries. Similar to **EPR compliance schemes** (or PROs) for WEEE**,** PROs for WBA are **more transparent** than those for packaging waste in the Danube region. To date no clearing house for WBA exists in the Danube region.

Challenges identified No. 13: The supply of CRMs from secondary sources (WBA) in Europe including the Danube region countries needs to be improved.

The current Batteries Directive **does not specify provisions** for **collection rates for industrial and automotive WBA**. As the B&A sector is regarded as a strategic imperative for Europe in the context of clean energy transition, **separate recycling targets for Lithium-ion WBA**[84]**,** addressed as a **specific category**, should be established. Of all the DR-9 countries, only Germany had recycling plants for Lithium-ion batteries in 2016.

Challenge identified No. 14: Existing waste legislation for WBA is insufficiently equipped to easily incorporate technical novelties in applications for renewable energy and electric mobility especially for Lithium-ion batteries and battery reuse.

Waste management

[76] Buekens A., Yang J. Journal of Material Cycles and Waste Management. Recycling of WEEE plastics; a review (2014)
[77] Regulation (EC) No 1907/2006 – Regulation REACH
[78] All three types of WBA: portable, industrial and automotive batteries and accumulators.
[79] COM(2019) 166 final
[80] Directive 2006/66/EC
[81] Stahl H., Baron Y., Hay D., et al. Study in support of evaluation of the Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators (2018)
[82] Percentage of recycled batteries from those collected.
[83] COM(2019) 166 final
[84] Lithium-ion batteries can be classified as PBA or IBA.

4. Secondary raw materials

The contribution of recycled materials to the overall material demand is relatively low. Imports of secondary raw materials to the DR countries both from EU-28 and non-EU countries are increasing. Exports to non-EU countries are decreasing.

The **'circular material use rate'** (CMU) indicator measures the **contribution of recycled material to overall material demand**[85]. A higher CMU rate value means that more secondary materials substitute for primary raw materials, thus reducing the environmental impacts of extracting primary material. **The contribution of recycled materials to overall materials demand is relatively low.** In 2016, recycled materials on average met less than 12% of EU and around half that (6.5%) in the Danube region demand for materials. Moreover, of these 6.5% only 29%[86] were recycled materials from so-called **recyclable waste**[87] and recycled materials from **WEEE and WBA** contributed only **0.6%** to overall material demand in the Danube region.

A circular economy aims to **increase the amount of material recovered** from waste and feed it back into production. In reaching this aim, DR-9 countries lag behind the EU-28 average, with the exception of Germany and the rapidly growing CMU rate in Austria. In the latest observed six-year period, the CMU rate of the Danube region countries has been **slowly increasing**, but none of the countries reached the EU average. **Increasing the contribution of recycled materials** from so-called recyclable waste to overall circular material use rate should be a priority of the EU and the DR countries in the coming years.

Challenge identified No. 15: The contribution of recycled materials to satisfy the demand for raw materials is still small to negligible for many materials, including almost all CRMs.

Material flows through countries are indirectly hidden in cross-border waste shipments, representing potential added value that could be held up in domestic economies when recognised, contributing to these countries' (or regions') higher resource efficiency. Hence, another indicator of this stage is **'trade in recyclable raw materials'**[88]. The indicator reflects the importance of the internal market and global participation in a circular economy and provides an estimate of which valuable materials that have the potential to be re-injected back into domestic economies are currently being shipped across borders[89].

Data for DR-9 countries[90] displays that in 2016 **over 50% more** of the secondary raw materials were transported **within the EU-28 countries**, compared to the amount that was shipped across European boundaries. In all the Danube region countries, except Austria, **exports** of recyclables to non-EU countries **exceeded imports** from non-EU countries.

Trends in trade in recyclable raw materials in the DR-9 show a **decrease in export** to non-EU and **increased import** from non-EU countries during the same period. **Both trends are contrary to those for the EU-28 average.** Intra-EU import to the DR-9 is also greater than this in the EU-28. The import of waste containing recyclables in the Danube region is increasing, but this varies from country to country. **The increase of import** was apparent mostly in the 3rd DR innovation region and in Hungary (2nd DR innovation region country). Unfortunately, the selected indicator does not contain information on the treatment (recycling, incineration or disposal) the imported recyclables are destined for. The trend of an increase of trade of recyclables (import) in the Danube region can be a positive development when imported secondary raw materials embodied in shipments of waste are controlled and indeed are sent to the corresponding recycling facilities and not landfilled or incinerated.

EUROSTAT data do not show the trade of recyclables among Danube region countries. According to the analysis made under the scope of the MOVECO project, trade in secondary raw materials hidden in transboundary shipments of waste among DR-9 countries **is rather strong**. Unfortunately, information on more detailed trade statistics was generally difficult to obtain. When available, data in general showed that packaging waste is traded almost equally among all DR-9 countries, and **more so among neighbouring countries**. WEEE and WBA are shipped to 1st and 2nd innovation region DR countries more than to 3rd innovation region countries.

Challenge Identified No. 16: Trade in recyclables both within the Danube region and with EU and non-EU countries, is still low, though increasing.

[85] For detailed explanations and data analyses for the Danube region see the Appendix 2, Indicator XI.
[86] More than 50% present the construction and mineral waste.
[87] Ferrous and non-ferrous metal waste and non-metallic waste (possible recovered materials: plastic, glass, paper and cardboard, rubber, wood, textile)
[88] EUROSTAT, Trade in recyclable raw materials
[89] For detailed explanations and data analyses for the Danube region see Appendix 2, Indicator XII (in online version of this document).
[90] No data for Serbia.

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Secondary raw materials

VII. A Vision – **The Danube Goes Circular**

In 2030, the Danube region is an innovative, socially responsible and well-governed European macro region with evident progress towards a circular economy.

The vision is a **collaborative Danube region**, where the transfer of transparent **sustainable know-how** and 'good policy practices' creates level playing fields that enable the formation of markets for secondary material streams from **strategically recognised waste streams**. **Disparities** among regions in the Danube region **are reduced**, as the **new business models** and concepts drive the Danube region towards a smooth transition to a circular economy.

In the Danube region, civil society, enterprises, R&D institutions and policy makers cooperate and foster **eco-innovation** and **eco-design** through extended **producer responsibility schemes** as enablers and boosters for transition towards a circular economy. The Danube region's **governments support** a circular economy. The Danube region **is resource efficient** and **innovative** in waste prevention and treatment.

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VIII. **Strategic objectives** and set of recommendations

The main objective:
Increase of resource efficiency while creating a circular business environment in the Danube region

According to the resource productivity indicator, **Germany** is on a good path toward decoupling growth from the use of natural resources. **Other Danube region countries**, especially those with a prevailing heavy industry should work on using fewer domestic and imported natural resources (especially critical materials) and strive to provide **as much secondary raw material recovered** from waste streams as possible to reach statutory targets for recycling and preparation for reuse. Recovered secondary materials **should be used again in new products**.

In the following pages, we propose a set of recommendations to achieve an **increase of resource efficiency** in the Danube region and to meet in this document the proposed vision and strategic objectives for **creating an encouraging circular business environment for SMEs in the Danube region**.

To create a stimulating and coordinated **business support environment** and **normative framework,** which should contribute to accelerating the transition towards a circular economy in the Danube region, **three groups of recommendations** are proposed:

1) Support, expand, and upgrade existing and/or create **new circular value chains** to include waste management operators (recyclers) to close material loops and include researchers so they are more involved in production value chains.
2) Support and award **circular business models**.
3) Educate and **raise awareness**.

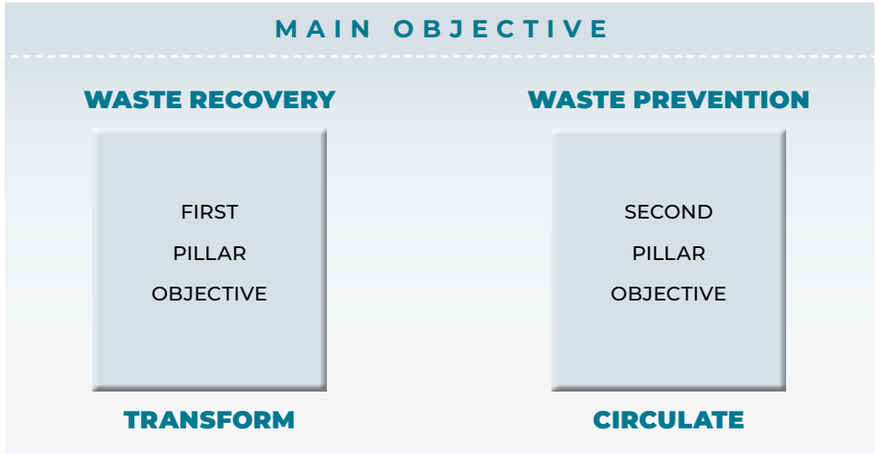

Figure 6: Structure of the strategic objectives to accelerate transition towards a circular economy in the Danube region

The first pillar objective:
Connecting waste management and resource management in the Danube region

Experience has shown that **efficient waste management systems can help to achieve a circular economy**. To protect raw material supply, and to increase the resource efficiency of Europe and the Danube region, **waste management should be connected with resource management**. A European secondary raw material **market for plastics** and other secondary raw materials, especially critical metals (CRMs) derived from WEEE and WBA should be established in the Union to improve **sustainable material management**[91]. This also applies to the Danube region.

Good practice examples in efforts connecting waste management and resource management:

1) EU COMMISSION
Four actions proposed in Interface document between waste, product and chemical legislation.

2) ROMANIA
Company: SC ROMBAT SA – Valuable lead recycling from used Batteries.

3) SLOVAKIA
KURUC – recovery of multilayer beverage packaging material into sound-insulation, construction and packaging material.

1. NEW CIRCULAR VALUE CHAINS

Actions taken to improve recycling rates and resource efficiency should include **strengthening of the value chain** cooperation with **increasing transparency** through the entire value chains from production of packaging, EEE and B&A, to the collection and recovery of secondary materials (plastics, ferrous and non-ferrous metals, CRMs). Improvements should start at the stage of **product design**, complemented by improving performance of **collection schemes** and **higher quality pre-processing** and **dismantling**. These collaborative improvements should contribute to the establishment of a European **secondary raw materials market**.

Key recommendations: *Connect and network the whole value chain* ***to improve design*** *for better waste management.*

- ➔ *Recognise the* ***EPR schemes*** *as facilitators for* ***design for recyclability and disassembly.***
- ➔ ***Award*** *innovativeness and environmentally friendly design.*

Challenge identified No. 8: Lack of investment in waste management infrastructure, especially in the eastern Danube region countries, diverts the focus from eco-design to waste and its management.

Challenge identified No. 9: Complicated and non-transparent EPR schemes, especially for packaging (waste) exist in the Danube region countries with no incentives for eco-design and eco-innovation.

Challenge identified No. 10 and 13: The supply of CRMs from secondary sources (waste) in Europe including the Danube region countries needs to be improved.

Challenge identified No. 14: Existing waste legislation for WBA is insufficiently equipped to easily incorporate technical novelties in applications for renewable energy and electric mobility especially for Lithium-ion batteries and battery reuse.

[91] Directive 2018/851, page 2

From the regulatory point of view requirements for design as well as for the use of secondary raw materials could be included in **product polices**. Measures to put forward **specific design for recycling standards** and **labelling** would create more homogeneity of the streams, and thus promote high quality recycling. In general, **extended producer responsibility schemes** can contribute greatly to improving the supply of plastics and CRMs from municipal waste streams. **EPR schemes** are in a good position to facilitate design for recyclability and disassembly (eco-design) through **eco-modulation (bonus/malus system)** of fees payed by producers to producer responsibility organisations (PROs). In 2019, the EU Commission will issue guidelines to help the Member States to prepare such eco-modulated fees.

Good practice examples of implementing extended producer responsibility as an economic instrument:

1) GERMANY
The New German Packaging Act – entered into force 1st of January 2019

2) FRANCE
CITEO private state accredited company for EPR – **Modulated fees for packaging recycling**

As the B&A sector is regarded as a strategic imperative for Europe in the context of clean energy transition[92] and is a key component of the automotive sector, the EU must secure access to the supply chains for raw materials from B&A, especially as a great number of them are listed as critical materials.

Better **design and labelling for replaceable and removable B&A** is important for extending the lifetime of products, once a battery reaches its end-of-life. In this regard, the European Commission is preparing a proposal for an amendment of the Batteries Directive 2006/66/EC by the end of 2020. The Commission will propose new, ambitious **collection targets for PBA and minimum recycling targets** to increase material recovery. The provisions supporting the reuse phase of WBA with the introduction of a definition for "second life" B&A will be proposed.

Business support organisations should offer valuable guidance on legislation (changes, amendments) and other information support to SMEs. **Innovation tenders** and **calls for projects** co-financed by respective government bodies should award the efforts toward eco-design.

Good practice example of good information support and innovation tenders:

1) AUSTRIA
Austrian Chamber of Commerce – extensive information support for waste management sector SMEs.

2) SLOVENIA
Chamber of Commerce and Industry of Slovenia: **Annual Innovation Awards** and its **circular criteria** incorporated into a process of selecting the best innovation of the year.

3) GERMANY
International Design Centre Berlin (IDZ): **German Federal Eco-design Award** - recognises innovative products and concepts that embody

[92] COM(2018) 293 final

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high ecological and aesthetic aspirations.

4) SLOVAKIA
Regional Chamber of Slovak Chamber of Commerce and Industry based in Banská Bystrica: **Zelený Merkúr** – competition assessing sustainable behaviour of companies that follow principles of the circular economy.

Key recommendations: *Keep product* ***value chains clean*** *to increase the recycling quality and quantity by establishing support* ***to enable better collection*** *of waste.*

- ➔ *Amend* ***waste legislation*** *to support the faster redirection of municipal waste from landfills and establish an efficient* ***control system****, especially in 2nd and 3rd DR innovation region countries.*
- ➔ *Promote European and national* ***financial instruments*** *for investing in waste management eco-innovative technology and waste management infrastructure.*
- ➔ *Recognise and enforce* ***EPR schemes as financial instruments*** *for establishing efficient municipal waste management systems.*

Challenge identified No. 3: In two-thirds of the Danube region countries, municipal waste is still poorly diverted from landfills or incinerated.

Challenge identified No. 10 and 13: The supply of CRMs from secondary sources (waste) in Europe including the Danube region countries needs to be improved.

All countries' governments, but especially those of the 2nd and 3rd DR innovation region countries will need to offer extensive support to waste management sectors **to increase recycling** and reach the 55% overall municipal and the 65% packaging waste (50% for plastic packaging waste) recycling rates targets by 2025 - especially as indexes of good performance in some countries are expected to decrease due to the introduction of a new harmonised method for recycling rate calculations. The new EU methodology is based on the **proportion of material actually recycled** (at the entering point of the end-processing plant) and a percentage of total material placed on the market.

2nd and 3rd DR innovation region countries should learn from 1st DR innovation region countries and propose **legislative changes** and other political measures (e.g., by establishing or increasing landfill taxes) for redirecting **recyclable municipal waste** (and especially plastic packaging waste, WEEE and WBA) from landfills and other forms of disposal. When waste is disposed, **efficient control** to comply with environmental standards will be necessary for all countries to reduce **municipal waste disposal rates to lower than 10% by 2035**. Regulatory provisions for redirecting municipal waste from disposal should enlarge the source of plastics and CRMs for recycling, as well.

Challenge identified No. 7: Costs for plastics end-of-life treatment are higher than the costs related to the treatment of other packaging materials.

Improved or newly established EPR schemes for packaging (waste) by 2024 should cover the cost for collection, pre-processing, and end-processing of all packaging waste. All Member states should plan all necessary economic and regulatory incentives to **make the EPR schemes for packaging more efficient,** taking under consideration their national, regional, and local political and business environments.

After the so-called Single-Use Plastics Directive[93] is adopted and comes into force, costs for adapting working lines in waste management and production lines in certain manufacturing sectors are expected to be even higher. **EPR, through fees**, can contribute to financing the costs of such adaptations in waste management. For **adaptation of production lines** governments' and EU incentives will be important in coming years when the Single-Use Plastics Directive will be implemented.

[93] COM(2018) 340 final

Challenge identified No. 4: The quality of plastic recycled material is low in all the Danube region countries.

Challenge identified No. 8: Lack of investment in waste management infrastructure, especially in the eastern Danube region countries, diverts the focus from eco-design to waste and its management.

Challenge identified No. 1: Lack of cooperation between SMEs and research and development institutions and lack of funding for researching recycled and new alternative (plastic) material, eco-design and eco-friendly system innovation within the Danube region.

The quality of the recycled materials, especially plastics from municipal waste streams, needs to be improved through **better separate collection,** as well as an **improved waste management infrastructure** and **system organisation**. All countries need to ensure **minimum required performance of separate collection** of municipal waste, including biowaste. The European Commission's proposal to **measure recycling rates at input to the final recycling** process should incentivize better separate collection and sorting, increasing thereby the quality of material and decreasing contamination.

It is crucial to identify and trace material streams along the recycling value chain to obtain real recycling targets. Thus, to allow verifiable statistics the **stakeholders** in the recycling value chain **should deliver data at each step of the process**. This will allow the differentiation of waste received from, for example, municipal and industrial sources as well as the country waste has originally been sourced from.

The recycling of plastic packaging waste from consumer goods is hindered - and not attractive for the market - due to production characteristics (multiple materials in one product, lack of eco-design, etc.), and consumption and collection systems of plastic packaging. Collection systems vary greatly among Member States in the Danube region as well. As the 1st DR innovation region countries have the required collection infrastructure, and separate municipal waste at the source, 2nd and especially 3rd DR innovation region countries mostly lag behind with insufficient waste management infrastructure and inefficient organisation of municipal waste collection. **Collection of municipal packaging waste** especially must be taken under consideration in the Danube region countries, supporting quality recycling as much as possible. Setting **mandatory recycling targets for municipalities** with measures in cases of non-compliance (e.g., fines) can help toward compliance with national statutory targets.

Further actions aside from improving the product design and ensuring higher collection rates, should focus on **improving pre-processing** of packaging waste and WEEE, **and dismantling** of WEEE, as well as **supporting technological innovation** in end-processing. To achieve higher collection and recycling rates of the WBA better enforcement is necessary to avoid **battery losses during treatment of WEEE**.

Pre-processing and recycling infrastructure capacities should grow to support the processing of larger amounts of WEEE. All of the **Danube region countries** should focus on improving the collection and pre-processing activities (e.g., incentivise manual labour, which is expensive in many European countries). National governments should support **cross-local government cooperation** in planning such infrastructure and in forming and

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offering **public tenders**. **Germany** should consider expanding end-processing capacities for recycling of WEEE and Lithium-ion batteries, as Germany is the only country from the Danube region with existing recycling treatment facilities for those two waste streams. If feasible, **new end-processing treatment facilities** for all three waste streams (PW, WEEE and WBA) in the Danube region and/or in the EU should be considered.

Improved collection and pre-processing technologies should ensure more effective recycling processes. Therefore the promotion of **financial resources** for investing in waste management eco-innovative technology and waste management infrastructure is necessary. **Horizon 2020** funding is available for research to support the transition towards a circular economy, **with better recycling processes**. After 2021, the **Horizon Europe** programme is continuing the funding and financing of circular economy projects. A circular economy will remain a pillar of the Cohesion Policy over the 2021–2027 programming period and on a list of priorities of the Cohesion fund, which will **prioritise investments in the regeneration of landfills** and **facilities for the treatment of residual waste,** but will not support the treatment of waste for incineration (D10 and R1 recovery operations).

Good practice examples of financial resources for eco-innovative waste management technologies:

1) GERMANY – BAVARIA
- Horizon 2020 project: **CloseWEEE** – Closing the loop of post-consumer high-grade plastics, whilst recovering critical raw materials including antimony and graphite.
- Bavarian State Ministry of the Environment and Consumer Protection: **ForCYCLE** – Bavarian project network for resource efficiency, extended product responsibility, innovative business models, substitution of materials.

2) SERBIA
EC FP7 project: **HYDROWEEE** – Innovative hydrometallurgical processes to recover metals from WEEE including lamps and batteries.

Challenge identified No. 5: The market for secondary raw materials for recycled plastics is still not established, as it lacks stable quantities and qualities for procurers of these materials.

Challenge identified No. 6: Recycling, especially recycling of plastics from packaging waste, cannot compete with energy recovery from waste.

***Key recommendations: Create a market** for recycled plastic materials and CRMs.*

- ➔ *Adopt and implement **minimum content of recycled materials** in new products.*
- ➔ ***Plan the implementation** of newly amended and increased targets, preparing for re-use and recycling.*
- ➔ *Incorporate Green Public Procurement (**GPP**) in national legislation.*
- ➔ ***Exchange** information.*

In order to ensure the circular use of plastics, the market uptake of **recycled materials needs to be promoted**. Through enabling the conditions for establishing a functioning market for innovative services and products containing recycled materials, the **development of** necessary **new technologies** can be influenced.

A **demand for the mandatory minimum content of recycled materials in new products** would help to ensure such circular use of materials. On the European parliament's suggestion one such provision was included in the Commission's Single-use plastics Directive from May 2018. According to this proposal, by 2030 all plastic bottles will have to respect a target of at least **30% recycled content** and a 90% separate collection target by 2029, when the proposal will be adopted[94]. The first such **waste management target proposal** for recycled content **in certain products** will increase the demand for at least one of the recycled plastic materials (PET). Following this example, **requirements for a mandatory minimum content** of recycled materials (not only plastics) in other products should be taken into consideration.

Focusing on **waste management targets for product categories** could capture hidden, rare, valuable and critical materials (metals) from WEEE and WBA streams, as well. One of the steps in this direction, already under the scope of the European Commission, is a proposal for amending the **Ecodesign Directive** proposing upgrading of **labelling for energy efficiency** of the EEE[95].

Challenge identified No. 15: The contribution of recycled materials to satisfy the demand for raw materials is still small to negligible for many materials, including almost all CRMs.

Challenge Identified No. 16: Trade in recyclables both within the Danube region and with EU and non-EU countries, is still low, though increasing.

Enforced **increased targets for preparing for the reuse and recycling** in a new amended waste legislation package can contribute **to boosting the demand for recycled materials in new products**. Increasing the supply of recycled materials should stimulate the market for them as with the economy of scale, prices of recycled raw materials shall drop. When incentives are applied correctly, this can increase demand for recycled materials on the producers' side, creating a positive loop of demand-supply. An example of such an intelligent market incentive is encouraging national and local government authorities and public administration organisations to purchase products and services following the circular economy principles. Therefore, **green public procurement (GPP), stipulated by law** can encourage the producers to use raw materials that can be recycled, reused, disassembled, or easily repaired.

Good practise examples of GPP and government as a role model:

1) SLOVENIA
Government of Slovenia: **Decree on green public procurement (2018)** - Slovenia is one of the few Member States that makes green public procurement (GPP) mandatory. Between 2013 and 2015 GPP increase from 8% to17% of the total value of tenders.

2) GERMANY
Federal Government of Germany: **The Blue Angel** - the ecolabel sets high standards for environmentally friendly product design and has proven itself over the past 40 years as a reliable guide for a more sustainable consumption

[94] Circular Economy: Commission welcomes European Parliament adoption of new rules on single–use plastics to reduce marine litter (March, 2019)

[95] The Commission shares the objective of longer product lifetime and better repair options, as expressed by Parliament e.g. in 2016/2272(INI) (February, 2019)

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The high quality recycled materials can contribute to overall material demand and reduce the generation of waste while limiting the extraction of primary raw materials. In the future, the Danube region countries should strive to increase the uptake of secondary raw materials in overall material demands (CMU indicator). The circular material use rate could increase, if the objective of A European Strategy for Plastics in a Circular Economy is implemented and 'all plastic packaging placed on the EU market by 2030 is reusable and recyclable'. If it is economically feasible, the added value of the secondary raw materials recovered from domestic waste should remain inside the country, the Danube region or the EU.

The exchange of information on best practices, new technologies, financial instruments, policy incentives and measures, know-how, etc., is of vital importance when trying to minimise the circular performance gaps between Danube region countries in the time of transition towards a circular economy.

Good practice examples of exchanging information through existing platforms:

1) EUROPE
- European Circular Economy Stakeholder Platform – a virtual open space that aims at promoting Europe's transition to a circular economy by facilitating dialogue and networking among stakeholders and by disseminating activities, information, good practices, and strategies on the circular economy.
- European Resource Efficiency Knowledge Centre (EREK) - EREK Resource Efficiency support programmes and tools database.

2) DANUBE REGION
Project MOVECO: **'Danube goes circular'** – a transnational platform providing information about extended producer responsibility schemes, R&D organisations, funding instruments for the circular economy and the virtual market place.

3) GERMANY
Chamber of Commerce and Industry: **Recycling market** - Inter-company mediation scheme for recyclable waste and production residues.

In 2017 the European Commission created a political tool facilitating **peer-to-peer learning**[96] between Member States authorities implementing environmental policy and legislation in the form of expert missions, study visits and workshops. Since 2018, many Danube region countries have already used this tool, to assess closing landfills in Romania and prepare of a National Circular Economy action plan in Hungary. All Danube region countries are encouraged to use this tool in the future.

*Key recommendations: Enable **transparent framework** conditions for **tracking material flows** inside production value chains to **increase the quality** of recycled materials and encourage all involved stakeholders to collaborate.*

Challenge identified No. 4: The quality of plastic recycled material is low in all the Danube region countries.

Challenge identified No. 11: Insufficient information on chemicals, so-called legacy elements and harmful additives (e.g., brominated flame retardants) in EEE and WEEE, especially in recycled plastic materials from WEEE, hampers monitoring and trust in secondary use of recycled materials.

During the preparation of this document, the European Commission have been reviewing the study on the **safety of recycled materials** to be used in food-contact packaging products. With the proposal of an initial waste management target regarding the content of recycled plastic in new products (in the Single-use Plastic Directive), the **quality standards** for plastics products containing recycled materials needs to be developed.

The business support organisations should facilitate **transparency** and enhanced **communication** throughout the whole products' life cycle. The loopholes in EU legislation allowing products made from recycled waste to contain higher levels of dangerous legacy substances or harmful additives must be reconsidered.

Incineration and combustion are currently used practises in managing plastics from WEEE: these are harmful to both the environment and health. Currently this is the only cost-efficient solution. Therefore, additional focus needs to be directed to supporting **R&D efforts to overcome technical barriers** and **allow the recycling of residual plastics** waste from WEEE.

Harmful additives, substances of concern and legacy substances should be tracked and removed from the circular economy material flow with **specially developed technologies** and **design demands**. The European Commission future endeavours and activities should improve regulation of chemicals, products and waste legislative interface for the circular economy, and not only focus on waste legislation amendments.

Good practice examples regarding tracing systems of materials in products and products' components:

1) SLOVENIA
Iskraemeco: **FAIR Smart Meter** – tracing of materials along the whole production-distribution value chain.

2. AWARENESS RAISING

*Key recommendations: **Educate and raise awareness** among wider society (consumers), in public administration and the business community.*

- ➔ ***Incentivise the consumers** to raise the demand for recycled content.*
- ➔ ***EPR scheme** contributions to awareness raising of final consumers should be increased and monitored.*
- ➔ *Raise awareness **among producers of eco-design importance.***

Challenge identified No. 5: The market for secondary raw materials for recycled plastics is still not established, as it lacks stable quantities and qualities for procurers of these materials.

Consumers trust in products containing recycled materials **is still low**. As there is no balance of offer and demand for recycled materials yet, **incentives for consumers** (e.g., through refund take-back schemes) could speed the demand.

Challenge identified No. 3: In two-thirds of the Danube region countries, municipal waste is still poorly diverted from landfills or incinerated.

Challenge identified No. 10 and 13: The supply of CRMs from secondary sources (waste) in Europe including the Danube region countries needs to be improved.

[96] More about TAIEX-EIR PEER 2 PEER tool: ec.europa.eu/environment/eir/p2p/index_en.htm

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Quantity and quality collection from **final consumers** and **their heightened awareness** play an important role in increasing the amount of material becoming available from products reaching their end-of-life stage. For example, **smaller EEE appliances** are less feasible to collect and recycle. Therefore, **incentives for their collection and recycling** need to be foreseen.

The role of regulators on national, regional and local levels is to provide good framework conditions to final consumers for an effective collection system (efficient network of bring-in collection centres and/or mobile collecting points). **EPR compliance schemes** should increase the share of EPR fees for investment in raising awareness of consumers for **better separate collection** at source, and educating them about the environmental, social, and economic benefits of changing their behaviour.

Good practice examples of awareness raising campaigns and education programmes about circular economy:

1) SERBIA
Recan Foundation: **"Can by can"** – an action for collecting cans and educating young people regarding how cans can be recycled.

2) HUNGARY
Ministry for Innovation and Technology: **"Pick up!"** ("TeSzedd!" – in Hungarian) – is an annual awareness raising campaign and the largest volunteer action in Hungary.

3) ROMANIA
ENVIRON Foundation: **Romania is Recycling** - is an annual awareness campaign that aims to increase the awareness of the population about the need to selectively collect WEEE and WBA and the creation of mobile collection points.

4) AUSTRIA
Federal Waste Utilising Company (LAVU): **"Separating is a Hit"** ("Trenna is a hit" – in German) – is an information campaign on separating waste and collecting it in decentralised areas.

Raising awareness among producers is needed in regard to the importance of product design that eases disassembly and increases recycling. When designing the EEE, the company **should focus on the level of products** rather than materials. When designing a packaging product, producers should think about the recyclability of the products not only on the weight reduction of the product.

Good practice examples of raising awareness through online or organised in-organisation courses and study programmes:

1) DANUBE REGION
Project MOVECO: **Circular economy toolbox** – toolbox, including information, collaboration, qualification, and financing tools to promote the transition towards a circular economy.

2) BULGARIA
Cleantech Bulgaria and the Higher School of Insurance and Finance: **Master programme** "Circular Economy and Sustainable Management - Innovations, Entrepreneurship and Clean Technologies" – study programme launched in the autumn 2018, designed for middle and high-level business executives, start-up companies, the NGO sector and the state administration.

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The second pillar objective: Creating new business models for the circulation of products and components as long as possible in the Danube region

Material recycling plays an important role in circular economy transition. In July 2018, a revised waste legislative framework reinforces rules to **strengthen waste prevention.** Efforts toward increasing the recycling quota should not be compensated by the growth of the total rising of municipal waste.

Future waste management will therefore not be oriented only toward recycling targets but will also be reinforcing waste prevention measures such as durability, reusability, and repairability. However, some of the products, when handled properly at the end-of-life (e.g., EEE, secondary batteries, and plastic bags) are more appropriate to be used again than others (e.g., food-contact plastic packaging).

1. NEW CIRCULAR BUSINESS MODELS

***Key recommendations: Establish circular business models** promoting re-use and refurbishment.*

➔ *Award circular business models.*

Challenge identified No. 2: Gaps in municipal waste generation performances among the Danube region countries should be narrowed, favouring prevention and reuse strategies.

To overcome the identified challenge No. 2, continuous additional support and incentives will be needed **to favour prevention and reuse in the Danube region.** The first step would be the preparation and implementation of the measures planned in National Waste Management prevention plans/programmes.

Governments should award business efforts to incorporate **circular business models** in their business strategies. Business models such as "access instead of ownership", sharing, or repair and refurbishment services can prolong the application of products and services, provide added value and prevent waste generation in absolute terms.

***Key recommendations:** Make **regulation clearer** for new circular business models.*

➔ *Propose separate waste management targets for **preparation for reuse**.*

➔ *Support the preparation of **harmonised standards** for reused EEE (warrants issuing).*

Challenge identified No. 12: Poor framework conditions for reuse of EEE in the EU and the Danube region countries.

Clearer regulation and the formation of a normative framework for waste prevention is an important future task for European and national regulators. While statutory targets for recycling and preparation for reuse have been elevated in 2018, adopted amended waste legislative framework, **separate targets for preparation for reuse**, nevertheless, have not yet been proposed. For the future legislative amendments, **separate targets for preparation for reuse** have been identified.

Regulators and business support organisations **should collaborate** and prepare harmonised **standards for reused EEE** in cooperation with European and national organisations for standardisation.

The prolongation of products' lifespans and **better repair options** are especially important for EEE. The European Commission is considering aspects related to the durability, repairability, upgradability, and recyclability of products in preparing (revisions of) eco-design implementing measures (the so called Ecodesign Package). This is evident in revised measures for **five consumer products** planned for adoption in July 2019[97]: lighting, refrigerating appliances, displays including televisions, dishwashers, and washing machines, including washer-dryers. A joint CEN/CENELEC technical committee[98] is preparing a number of deliverables, inter alia **generic standards on material efficiency** aspects of products, including **reusability, repairability and upgradability**. The deliverables are planned for adoption in 2019 and 2020[99].

2. AWARENESS RAISING

Key recommendations: *Promote the importance of* ***circular economy principles*** *among consumers.*

➔ *Increased public awareness of reused product specifications (e.g., quality labelling schemes) and gaining consumer trust (e.g., Green public procurement).*

Challenge identified No. 2: Gaps in municipal waste generation performances among the Danube region countries **should be narrowed, favouring prevention and reuse strategies.**

The lack of consumer confidence in reused products is directly linked to purchasing decisions[100]. **Education** (from children to elderly people) **and awareness raising** (e.g., with national and/or local, and targeted awareness raising campaigns) among consumers are among the key measures for a circular economy to really become a way of living. **Changing habits and mind-sets** is one of the most time-consuming and difficult steps; but without a doubt a crucial one to take on the path to becoming circular. **The procurement (GPP)** of remanufactured information and communication technologies in public administration, for example, can stimulate a change in wider consumer confidence in reused EEE products.

Good practice examples of financing the awareness raising campaigns:

1) SLOVENIA:
Ministry of the Environment and Spatial Planning with 14 partners: **"I have my own carrier bag!"** – Campaign on the impact of excessive use of lightweight plastic carrier bags on the environment was launched in September 2018. The campaign focuses on teaching prevention of waste – material for teachers was prepared and all Slovenian primary schools and most of kindergartens are included.

[97] European Commission; New energy efficiency labels explained (March, 2019)

[98] Two European Standardisation Organisations (ESOs): CEN: European Committee for Standardization; CENELEC: European Committee for Electrotechnical Standardization

[99] The Commission shares the objective of longer product lifetime and better repair options, as expressed by Parliament e.g. in 2016/2272(INI) (February, 2019)

[100] I. Gåvertsson & L. Milios & C. Dalhammar, Quality Labelling for Re-used ICT Equipment to Support Consumer Choice in the Circular Economy (2018)

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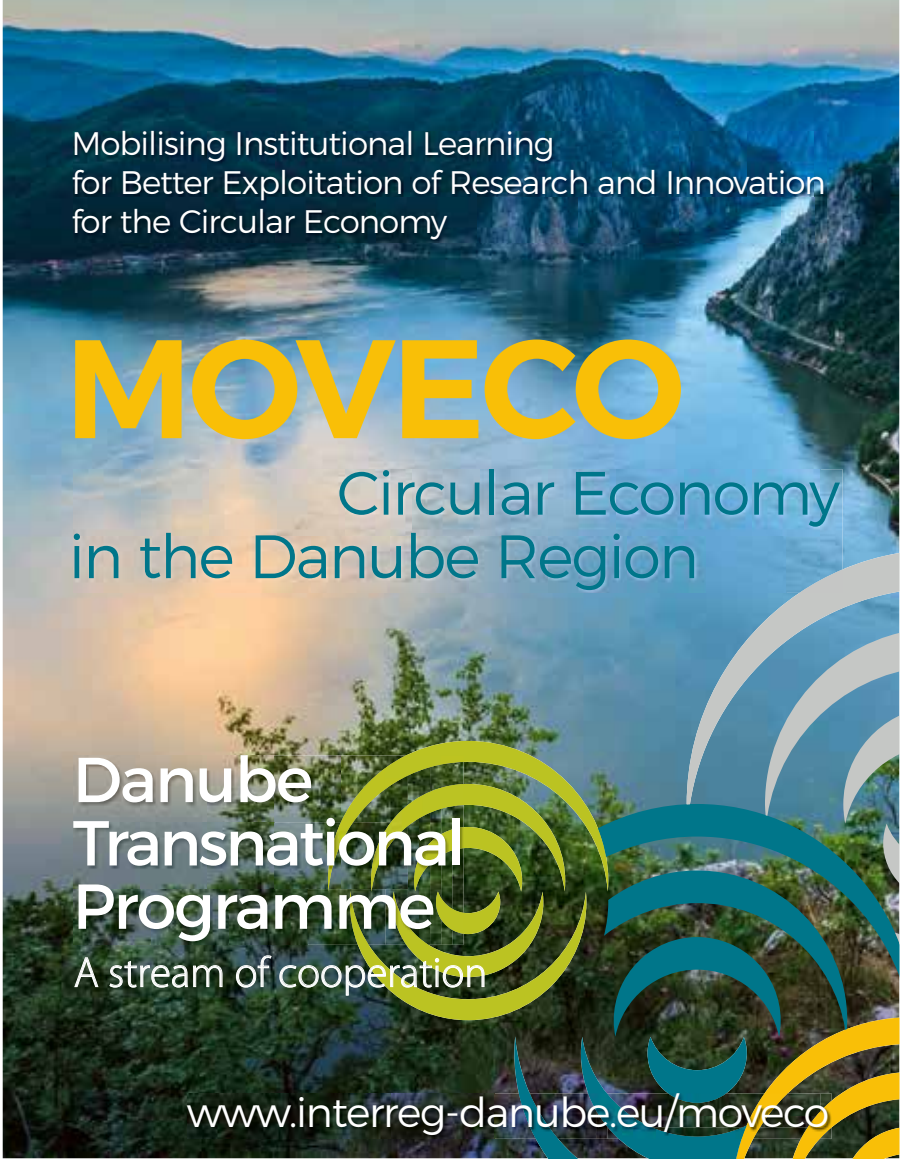

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