

# Informační články

## Implementation of Circular Economy Principles into Industrial Practice

### Implementace principů cirkulární ekonomiky do průmyslové výroby

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*The Czech Republic, like other EU countries, has only limited raw material resources. From a geopolitical point of view, the availability of natural resources is becoming increasingly difficult. On the other hand, the development of society is putting pressure on the growth of consumption. The need to seek measures to mitigate the need for natural resources is thus obvious. The problem presented can be addressed by implementing the principles of circular economy. The need to extend the life cycle of resources is also a topical issue at the European level. In the short term, companies will face increased challenges in this area. The present paper focuses on the principles of the circular economy and provides a brief overview of the plans by which the state intends to support the implementation of the circular economy in the practical functioning of society.*

**Key words:** Circular economy; sustainable development; waste management

*Česká republika, podobně jako další země Evropské unie, disponují pouze s omezenými surovinovými zdroji. Dostupnost přírodních surovin se stává z geopolitického hlediska obtížnější. Na straně druhé rozvoj společnosti vytváří tlak na růst spotřeby. Nutnost hledat opatření zmírňující potřebu přírodních zdrojů je tak zřejmá. Představený problém je možno řešit implementací zásad cirkulární ekonomiky. Nezbytnost prodlužování životního cyklu zdrojů je zároveň aktuálním tématem na evropské úrovni. V krátké budoucnosti budou firmy v této oblasti čelit zesíleným výzvám. Předložený příspěvek se věnuje zásadám cirkulární ekonomiky a přináší stručný přehled plánů, kterými chce stát podpořit implementaci oběhového hospodářství do praktického fungování společnosti. Práce se věnuje situaci v metalurgickém průmyslu, kdy jeho vysoká energetická a materiálová náročnost přináší dobrou příležitost pro praktické uplatnění zásad cirkulární ekonomiky.*

**Klíčová slova:** Cirkulární ekonomika; udržitelný rozvoj; odpady

## Introduction

The company's development is moving towards a gradual transition away from conventional production methods, towards production with a high degree of automation and thus, of course, the application of digitalisation. Production processes that meet the criteria of Industry 4.0 are becoming part of the newly developed technologies. In addition to seeking to increase the efficiency of production and reduce the proportion of human labour involved in its implementation, manufacturing companies are also forced to incorporate into their plans requirements arising from objectives that seek to reduce the environmental burden of their activities. The changes and new challenges that are coming in this area are very rapid.

The nature and scope of modernisation measures, as well as the normal decision-making processes in company management, are not only based on the perspective of strengthening the company's market position, but they

must also respect legislative requirements. In the European Union, the activity of issuing regulations of various kinds is notorious, and it is appropriate to have a discussion about the reality of fulfilling the requirements presented and the effectiveness they bring. This is a symbolic theme in these days when we are celebrating the 20th anniversary of membership in this organisation.

The sustainability of the EU's development is a major issue. This is not a recent innovation that should inevitably be associated with the main document that sets the framework for a new direction in the environmental field, the European Green Deal. The concept of sustainability has been appearing in environmental textbooks since the last century. For example, the World Conservation Strategy which was prepared in 1980 by the International Union for Conservation of Nature and Natural Resources, declared one of its goals to ensure the sustainable use of ecosystems [1].

It is important to recall that sustainable development seeks to improve the material standard of the population, but of

course it is equally important that the capacity of ecosystems must be maintained for future generations. At the same time, it is essential that development must be accessible to all population groups. There is a great need to strike a balance between economic progress, environmental protection, and the social aspect. Economic progress must stand on the pillars of environmental sustainability and social cohesion.

The importance of paying systematic attention to responsible and sustainable growth is clear. It is possible to point out global population growth and, at the same time, global growth in living standards. The urgency of addressing the issue of sustainable growth is well illustrated by the global growth in crude iron and steel production, Fig. 1. It is obvious that the self-regulatory capacity of the market mechanism cannot be relied upon in this area, but an acceptable consensus is needed. The good news here is that European society perceives that its progress can be achieved by increasing competitiveness, i.e. by promoting competitiveness.

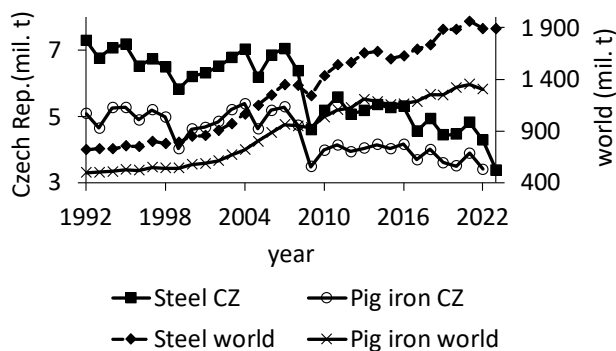


Fig. 1 Pig iron and steel production in the Czech Republic and in the world [2]

Obr. 1 Produkce surového železa a oceli v ČR a ve světě [2]

There are many ways to ensure sustainability. One strong component of the activities carried out in this interest is the so-called circular economy. The need for its implementation should be seen not only as a response to a coercive instrument from the state, but also as a means of demonstrating social responsibility and, last but not least, it is necessary to look for economic opportunities in circular economy activities.

## Circular economy

The circular economy is an economic system that preserves the value of products, materials and other resources for as long as possible and seeks to maximize resource efficiency in production and consumption, thereby creating pressure to reduce waste. Where waste is generated, circular economy seeks to return it to the production cycle and seeks to reduce its negative environmental impacts. It is argued that circular economy changes the linear model of materials management - make, use and throw away - to a circular model - make, use, discard and reuse.

The circular economy does not only concern waste management, but also extends to a wider range of activities

and aims to minimise the consumption of natural resources. It represents the management of production, consumption and use of not only products but also services. The circular economy is implemented, for example, by extending the life cycle of products, recycling opportunities, repairing products, promoting their reuse or renting and sharing. Adapting these principles ultimately reduces waste.

The application of circular economy principles is specific to scarce raw materials. The European Union defines critical and strategic raw materials of a non-energy nature. Critical raw materials are those that are indispensable for the development of society and whose supply can be easily disrupted, by imports. These raw materials are particularly important for developing new technologies such as digitalisation, electro-mobility or are indispensable for producing renewable energy equipment, semiconductor production, and meeting other needs, including fertiliser production. Finally, these raw materials are important for the defence and aerospace industries. Strategic raw materials are those that are likely to have strong growth in consumption and, again, are raw materials where supplies can easily be constrained. The list of strategic and critical raw materials is contained in [3]. For strategic raw materials, at least 10% of their extraction should take place within the EU, while at least 40% of the annual consumption of the raw materials in question must be processed in the EU and imports from one country must not exceed 65% of consumption. In the case of these raw materials, the circular economy policy becomes clearly defined, with the requirements formulated primarily with geopolitical considerations in mind.

An overview of the changes that the company expects to see in connection with the introduction of the circular economy is provided in an action plan that has been prepared specifically to address this issue [4]. It defines the principles for sustainable products (increasing their lifetime, reducing the carbon footprint of their production, allowing the refurbishment and recycling of used products, prohibiting the disposal of unused non-perishable products, limiting the single use of products, promoting the use of products through sharing, promoting easy information on product parameters through digital means and, finally, pricing products on the basis of their sustainability). These rules apply in particular to products for which a significant environmental impact has been indicated, either in terms of the intensity of their production or the quantities placed on the market. For now, these include electronics, communication tools, batteries, vehicles, plastics, textiles and furniture. But also commodity-type products such as steel, cement and chemicals. Similarly, rules will be defined for services. The issue of packaging is treated separately (intention to reduce its quantity, its ease of recycling, the proportion of recycled components).

Consumer empowerment is a specific chapter of the Circular Economy Action Plan. In this respect, in addition to consumer involvement in the circular economy process, the social dimension of the whole system is also pursued. The EU declares that its efforts towards sustainable development also take this aspect into account. The right

to repair and the availability of spare parts are becoming an important element in the life cycle of products. Information about the product in terms of its relationship with the environment will be guaranteed [4].

Circular economy enters the life cycle of a product at the production stage. Here, it is envisaged that BAT documents will be revised to give preference to technologies that support the circular economy, for example by applying waste in production [4]. In this respect, ecodesign rules for products with higher energy requirements have been in force for more than a decade [5]. A uniform system for auditing activities is to be promoted to examine the degree of involvement of manufacturing companies in the circular economy and compliance with the system will be verified by certification. The EU itself wants to pay attention to the measurability of the effectiveness of the circular economy measures implemented, and to the progress of the process of achieving climate balance. The scheme focuses primarily on controlling CO<sub>2</sub> [4].

Circular economy policy does not forget food as a source of much waste. It introduces, for example, a system of water reuse in food cultivation and production. In the area of waste, the EU aims to halve the production of non-recyclable municipal waste by 2030. One of the steps to achieve higher recycling rates will be to require the application of waste materials in new products. A major theme of the circular economy is the upgrading of waste to a marketable raw material. A related issue is the tightening of EU waste export rules [4]. The preference is for waste to be treated or better used as close as possible to its place of origin.

For industrial companies, the plans to reduce the use of hazardous substances are important. Efforts will be made to reduce their production and to remove them from systems where they are applied. There are plans to tighten the rules on the registration of substances of very high concern.

The construction industry and building operations are coming under the spotlight. The construction industry is the sector with the highest waste production. There is a need to promote the reuse of non-functioning built-up areas, to increase the rate of recovery of demolition waste, and to make public procurement in this sector more focused on the whole life cycle of the construction project.

It is clear that a number of clarifying documents for the circular economy rules will be adopted in the near future. This will put pressure on companies to demonstrate compliance with these new rules. In the recent past, it was not uncommon for manufacturers to define their own environmental standards and claim their products to be 'green', without the need to verify this objectively. Practices where the information presented in this way was deliberately misleading were no exception. This practice is called 'greenwashing' or 'green sheen'. These manipulative practices should no longer occur. There is a document on the obligation to truthfully substantiate environmental claims (Green Claims Directive). Information in this sense must be based on scientific knowledge, and there is an obligation to inform users of products about the principles

of correct use, so that their use minimises damage to the environment [6].

A mechanism is being set up to monitor the implementation of commitments linked to the circular economy. This is the ESG process (Environmental Social Governance), which both oversees and helps to set and implement the sustainability of the company's business in the areas defined by the acronym in its designation. Since this year, selected companies have been obliged to submit non-financial reporting, which also makes a binding statement on sustainability issues. The ability to present the company positively in these indicators will be necessary, for example, to obtain public support or banking services. The range of companies subject to the non-financial reporting obligation will gradually expand from large companies to smaller ones [7].

The obligations will also apply to companies involved in iron and steel production and other related industries. It is appropriate to comply with the principles of circular economy in a sector characterised by a massive demand for the movement and processing of raw material. On the one hand, the steel industry boasts a high recycling rate, while on the other hand, the high energy intensity of the sector can be highlighted. Pig iron production is the activity that consumes the most energy of all the manufacturing sectors surveyed. According to the Czech Statistical Office, the production of approximately 4 million tonnes of pig iron requires 70 PJ of energy [8]. In the Czech Republic, this amount of energy is clearly the highest of the manufacturing sectors studied. A comparison of the energy intensity of selected manufacturing sectors is documented in Tab. 1.

Tab. 1 Energy consumption for selected technologies, Czech Republic [8]  
Tab. 1 Spotřeba energie pro vybrané technologie, ČR [8]

Product	Energy Consumption [PJ]	Production [mil. T]
Pig Iron	71	4,0
EAF Steel	0,051	0,07
Cold Rolled Strip Steel	8,2	3,5
Steel Tubes	1,7	0,47
Steel Wire	0,77	0,53
Aluminium and Aluminium Alloys	1,38	0,21
Polypropylene and Copolymers	6,70	0,37
Cement Clinker – Dry Process	13	3,5
Lime	4,6	1,1
Prefabricated Structural Components	0,49	1,39
Fired Bricks	2,53	1,28
Drawned Sheet Glass	5,03	0,68

High energy consumption in today's energy mix directly indicates high CO<sub>2</sub>. Global statistics indicate the production of approximately 2 t CO<sub>2</sub> per tonne of steel, Fig. 2.

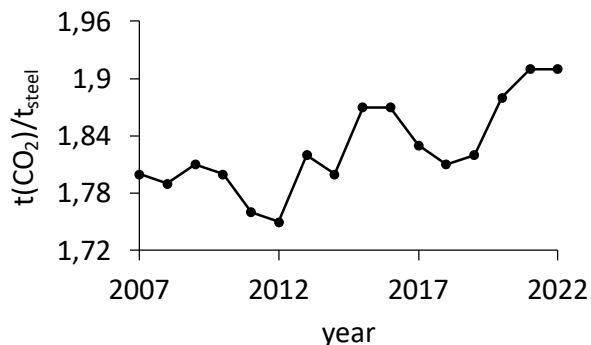


Fig. 2 Specific CO<sub>2</sub> production in relation to steel production [2]  
Obr. 2 Měrná produkce CO<sub>2</sub> vztažená na výrobu oceli [2]

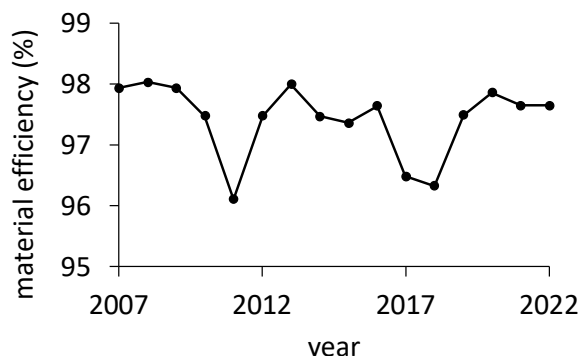


Fig. 3 Share of materials converted to solid and liquid products and co-products [2]  
Obr. 3 Podíl hmotnosti využitelné produkce vztažený na hmotnost vstupu pro výrobu oceli [2]

Similarly, the production of waste in metallurgical processes has not been reduced. The value of the material yield of steel and the associated usable by-products (e.g. granulated blast furnace slag, slag aggregate, etc.) in relation to the amount of waste produced, again over the last decade, has not changed significantly, Figure 3 [2]. The metallurgy sector is key to the sustainability of the EU's competitiveness and will need to make the impacts of climate policy bearable for the sector. The preparedness of the European steel industry for the expected changes can be illustrated by the figure for the share of iron production by direct reduction process. This currently amounts to around 0.6 million tonnes per year in the EU. This is not the share of modern hydrogen reduction technology; contemporary direct reduction processes are recorded. This technology is largely neglected in Europe. In the world, iron production by direct reduction exceeds 125 million t/year. The transition to decarbonised production will be very long and difficult. It is true that the interim progress towards the intended targets is dividing the EU countries. There are countries with a traditionally strong environmental orientation whose attitudes reflect a willingness to meet the commitments (Austria, Slovenia, the Netherlands are examples) and, on the other hand, there are countries that have legitimate objections to the planned activities in this area.

## Conclusion

Society will encounter the term circular economy more often in the near future. Meeting the obligations expected in this area will bring a number of complications, increasing the administrative and financial burden on companies. On the other hand, it is understandable that society's consumption should be moderated, and that the basic premises of the circular economy have a real basis in reality. It will also depend on the wording of the specific implementing regulations whether the newly imposed obligations will produce the desired results. If the development of European society can be made sustainable, then this is also good news for businesses, which will have the prerequisites for their future operations. Certainly, activities linked to the circular economy are a new opportunity in the development of the future direction of companies. The success of the process will depend on the ability to strike a healthy balance between plans and the capacity to implement them.

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