"Future is not an extrapolation of the past" (CK Prahalad) – The way to global resource management

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Abstract

Based on own Prognos analyses the article shows the so far achieved recovery rates for selected waste streams within the 27 EU member states as well as the still existing resource potential - a potential that can also contribute significantly to climate protection.

Looking back from the future the article describes the major challenges of our time and for our future and develops visions for a global resource management system.

Inhaltsangabe

Auf der Grundlage eigener Forschungsergebnisse zeigt der Beitrag für ausgewählte Stoffströme den bisher innerhalb der EU 27 Mitgliedsstaaten erreichten Verwertungsstand und das noch bestehende Ressourcenpotenzial. Ein Potenzial, das auch einen bedeutenden Beitrag zum Klimaschutz leisten kann.

Über einen fiktiven Blick aus der Zukunft zurück beschreibt der Beitrag die großen Herausforderungen der Gegenwart und Zukunft und entwickelt Visionen für ein globales Ressourcenmanagement.

Keywords

waste, global resource management, climate protection, secondary raw materials, resource conservation, waste stream, Life Cycle Analysis (LCA), sustainability

Abfall, Globales Ressourcenmanagement, Klimaschutz, Sekundärrohstoffe, Ressourcenschonung, Abfallstoffstrom, Life Cycle Analysis (LCA), Nachhaltigkeit

1 Reykjavík 2040

It is the year 2040. In Reykjavík, the International Energy and Resources Organisation (IERO) is celebrating its 20th anniversary.

With great anticipation, many international guests and representatives are awaiting the commemorative speech of the General Secretary – let's say her name is Ms. Ingibjörg Önnudóttir - reviewing 20 years of IERO history and the eventful 15 years leading up to its establishment.

2 Crisis as an Opportunity

The new millennium did not get off to a good start. The “dark year” 2009 had plunged the world economy into a global financial and economic crisis. The European resource economy – back then it was still misleadingly called ‘waste management’ – was also deeply affected by this crisis. Plummeting prices in the secondary raw material markets, drastically reduced demand for secondary raw materials, collapsing production capacities, and heavily decreasing industrial and commercial waste volumes all resulted in significant revenue and turnover losses and burdened waste management companies for many years to come. The crisis of the banking sector, which deteriorated conditions on the financial markets, became an additional problem.

At the end of the millennium’s first decade people wondered whether the crisis had been predictable. The general consensus was that it had not. Even the most respected analysts had not anticipated this deepest of recession.

But not enough: The climate summit in Copenhagen 2009, awaited with hope, failed. The industry complained of significant bottlenecks in the supply of raw materials. And the past waste management was not able to implement the announced paradigm shift from waste to resource management comprehensively and sustainably. Short-term economic aims and particular interests pushed the real problems and targets aside.

2.1 Waste? – No, just badly recycled raw materials

General Secretary Önnudóttir recalled that in 2006 the so called waste generated in the 27 member states of the European Union amounted to nearly 2.94 billion tonnes. For every EU resident this translates into a total amount of nearly 5,950 kg annually. Or to make it even clearer: in 2006 the European Union generated approx. 5,600 tonnes of waste per minute.

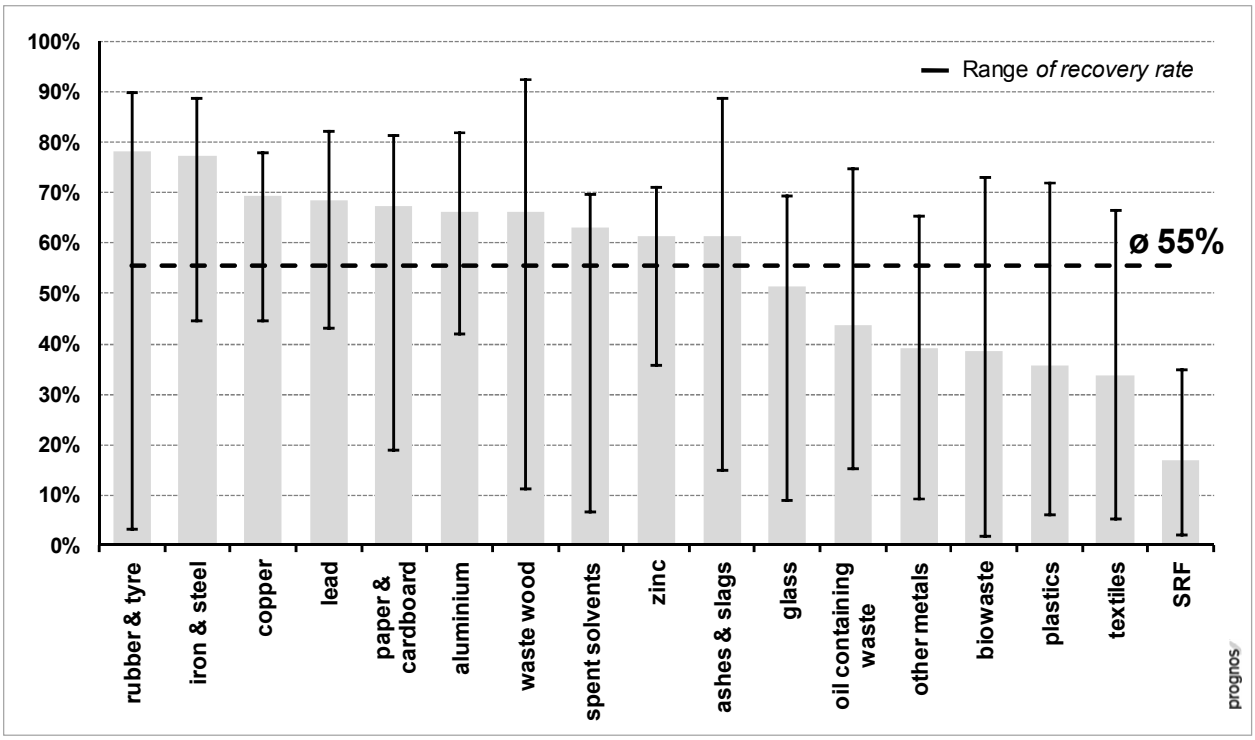
The repeatedly announced decoupling of waste generation from the gross value added occurred only with hesitation.

However, slowly it was recognized that many of the waste fractions have a high material or energy value and thus could contribute to resource, environment and climate protection. During the process of implementation of respective EU directives the share of separately collected waste fractions steadily increased, even if not always at the expected pace. The implementation of the recycling oriented EU directives was mainly driven by the increasing global demand and the developing market value for selected waste fractions, e.g. paper or steel.

Based on data from 2006, a 2009 analysis calculated for 17 selected waste streams with a high resource substitution potential showed that a total potential of 675 million

tonnes could be recovered as secondary materials by means of material or thermal recycling. This represented 23% of the total generated waste potential. In 2006, a total of 375 Mt of the analysed waste streams was material or energy (R1-procedure) recovered as secondary raw material. This volume amounted to merely 55% of the estimated total potential, while 45% remained unused, often with far-reaching consequences for the environment.

The recovery rates, however, differed between the individual waste streams as well as between the individual member states, which were at a different stage of waste management development.



Note: The calculation is based on the in 2006 applied classification of incineration plants as disposal plants (D10 procedure). Taking into consideration that several incineration plants are able to achieve the energy efficiency criteria the share of mainly plastic waste recovered increases with the classification as waste-to-energy plant. In 2006, several countries have already classified incineration as recovery.

Figure 1 EU 27 average recycling rates for the analysed waste streams in 2006

In 2006, the highest (material and energy) recovery rates within the EU member states could be found for rubber & tyres with an average of 78%, iron & steel (77%), copper and lead (69% and 68%, respectively). Waste paper and cardboard could also be included in the group of secondary raw materials whose potential was recognized and used. The recovery rate amounted to 67% across the EU.

But it became also evident that information on many of the waste fractions - particularly for end-of-life-vehicles, batteries as well as electrical and electronic equipment - was not comprehensively collected and their resource potential therefore remained partly unknown and unused.

Electrical and electronic equipment, in particular, contains noble metals such as tantalum, lithium, or germanium, which various scientific studies at the beginning of the 21st century counted among the so called “critical” raw materials. The demand for these was growing worldwide. Their deposits and involved companies, however, were limited and partly situated in politically unstable regions. In addition, many experts estimated that deposits would dry up within a few years and called the attention to the risks of future supply.

Limited availability on the one hand and growing cost when accessing previously unused deposits on the other led to a real price increase. This particularly concerned raw materials whose limited availability could hamper the development and industrial use of future technologies. Tantalum, for example, was an important raw material for microcapacitors and medical technology, germanium was used for optical technologies.

Significant deficits also existed in the area of biowaste. The EU recovery rate in 2006 was an average of only 39%. From country to country, the recovery rate ranged between 2% and 73% - these findings indicated already at the beginning of the millennium, that biowaste could help protect the climate as well as resources.

But it took another couple of years before a cascade utilisation of biowaste was implemented - that is the parallel production of renewable energy and the conservation of resources through preservation of nutrients and organic matter (fermentation, followed by further treatment [fertilizer, peat substitutes, compost, pellets]), added Mrs Ingibjörg Önnudóttir and continued in her historical review.

2.2 Contribution to CO_2 emission reduction

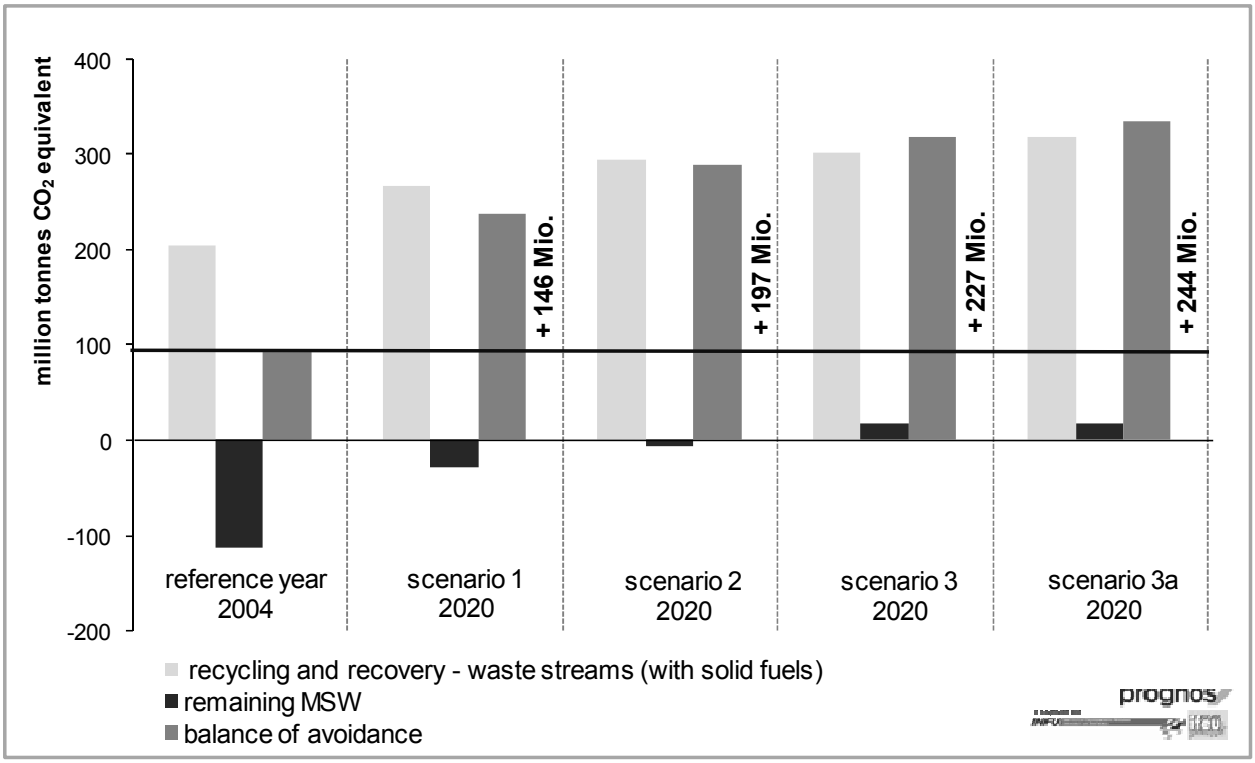
At the beginning of the 21st century it was no longer disputed that waste is an important resource and that a sustainable waste (or better: resource) management could significantly contribute to climate protection. In several studies carried out by national and international organisations this became evident.

„We have a common responsibility and we could complement each other!” This was the motto of a unique coalition of European waste management associations with quite different aims related to material or energy recovery, financing a Prognos-IFEU-INFU study to identify the resource savings and CO_2 reductions potential within the EU 27. The key aim of this study was to present first general results in time for the second

reading of the EU Waste Framework Directive in June 2008 – results, that would support and guide the decision-making process with essential detailed information and data.[1]

Even without remaining waste from households, in 2004 the use of the resource potential of 12 analysed waste streams in the EU 27 achieved CO_2 emission reductions of 206 Mt CO_2 equivalents. However, the high share of disposed remaining residual waste (responsible for 114 Mt CO_2 equivalents) has to be counted as a burden against these results.

Back then, experts developed several scenarios for Members of the EU Parliament calling on their willingness and capability to take decisions on waste management; decisions focussed on diverting from landfill and returning waste fractions as secondary raw material or energy to the production process.



Note: negative data : CO_2 emission burden, positive data : CO_2 emission savings)

Figure 2 CO_2 balance for recycling/energy recovery of selected waste streams and remaining municipal waste

[1] Considered were the following waste streams, usable as secondary raw material by means of recycling or energy recovery and thus with a positive impact on resource and energy use: glass, paper & cardboard, plastics, iron & steel, aluminium, copper, waste wood, textiles, biowaste, rubber & tyres, mineral construction waste and secondary fuels.

Scenario 1 described the status quo of the development of waste management, limited to the implementation of the existing legal framework. Importantly, these experts confirmed that political decisions were going in the right direction. Through the achievable additional reduction of emissions by a minimum of 146 Mt CO_2 equivalents in 2020 (compared to 2004) waste management would contribute significantly to climate protection. The total savings corresponded to 19% of the European climate protection targets until 2020.

The experts further deducted that a significantly higher use of secondary resources – based on recovery targets for municipal solid waste (scenario 2: 50%, scenario 3-3a: 60%), construction and demolition waste (scenario 2: 70%, scenario 3-3a: 80%) and biodegradable waste (80%) as well as a strict ban on landfilling for biodegradable and high calorific waste would further increase the contribution waste management can make towards the EU climate protection targets to up to 31%.

2.3 From the Mind to the Heart

The EU Waste Framework Directive adopted in 2008 set fixed recycling targets that were a positive signal to ban more of the so-called waste from landfills and improved the conceptual maturity. It was formally implemented in due time (December 2010) into national legislation by most of the member states, but not all. The willingness to continue in the right direction was there, but – according to Ingibjörg Önnudóttir in her historical review – not all opportunities were used.

Again waste was understood as waste. Conflicts of competence between material and energy recovery flamed up and led to compromises. There was a lack of sufficiently clear decisions, which would help to avoid disputes on interpretation. Only few of the member states dared to tackle further targets for the implementation process. Due to the principle of self sufficiency, more than once strictly confirmed, not all member states managed to achieve the Landfill Directive targets in time.

One the one hand, lack of funding for the construction of a sufficient number of waste treatment facilities caused the disposal of valuable secondary raw materials, on the other hand substantial financial resources were invested in the deconstruction of landfills to recover secondary raw materials that were previously disposed there and now urgently needed by the industry. The export-oriented European industry was faced with another problem: Many of the valuable secondary raw materials ended up in landfills in developing and emerging market countries where they were – in the best case – recovered and used by local industry.

The focus continued to be on the collection of “traditional” waste fractions like glass, light packaging and paper & cardboard. Also electrical and electronic equipment, batter-

ies or end-of-life vehicles were more and more centred. But other waste fractions remained in the shadow, their potential underutilized.

The need to advance waste management towards resource management was accepted in people's minds, but still had not arrived in their hearts.

But in 2020 the major challenges of the future could no longer be ignored.

2.4 Great Challenges of the Future

Climate change had already become an irreversible part of life. Consistent efforts to prevent greenhouse gas emissions could only limit the extent of climate change to a degree tolerable for humans and nature. The orientation was given by the EU climate protection target - the 2° limit. Global warming had become a key driver of upcoming decisions in policy, economy, technology, and also waste management.

Globalization – merely interrupted by the financial and economic crisis at the end of the first decade – continued. However, for many years differences continued to exist between individual, mainly European, American and Asian countries in terms of their resource availability. The economic engine began to shift to then leading, mainly Asian, economies.

Globalization also affected the raw and secondary raw material markets, but did not automatically lead to better waste management. For many years to come, worldwide the most valuable resources were lost after single use, energy was wasted and all environmental media was burdened. An increasing level of industrialization was not automatically followed by a higher standard of waste management or better use of waste as a resource.

The demographic development also shaped the world significantly. In Germany the decline in population was tangible even in 2010, and the impacts became noticeable also in waste management. A significant reduction of waste volumes and plants with low utilization were only few results of the demographic development. A similar trend could be seen in most of the industrial countries in the following years.

On the other side, the population in developing countries grew, resulting in a global population growth. This, in turn, led to an increased use of raw materials (without water) and energy.

3 Change of Thinking

And then came 2016.

Ingibjörg Önnudóttir fell silent. She did not need to speak any further. Everybody in the auditorium knew only too well what had happened …

That the worst could be avoided was due to a European conference in the Czech town of Kroměříž in 2016.

Only a consistent change of thinking will rescue the future. The Indian economist CK Prahalad said, "The future is not an extrapolation of the past". With this in mind, representatives from industry, energy and waste management came together to intensely discuss present and future challenges and to develop the right measures. At the end of exhausting marathon negotiations, the conference agreed on a European Resource Directive. Finally the paradigm shift towards resource management within the framework of climate protection resource conservation and supply security prevailed. “Waste” became the taboo word of the year.

Many in the audience smiled. They could well remember that their mothers asked them to take out not the waste, but the resource bin. And many a little boy began to ask for an orange “resource car” for Christmas.

The decisions made in Kroměříž and their subsequent implementation was far reaching. The so-called life cycle approach that had been discussed for many years would finally be implemented.

The paradigm shift also reached the industry. The regulatory framework was so added by important practical initiatives, known e.g. from paper industry in the beginning of the 21st century. The industry committed to a voluntary product responsibility and accepted complete material responsibility. In the following years clear targets for resource-saving, material efficient product design and production technology were set and implemented. Products containing critical raw materials with strategic importance had to be labelled by the respective producer or trader. A voluntary product return concept insured that products containing raw materials with strategic importance could be distributed only with a guarantee of recovery at the end of the product life and re-use on a European level. The product return system was further supported by a scheme that would lease or rent (rather than sell) many products to the customer only for the period product use. The lease/rent-system was for the first time successfully used worldwide for mobile phones. This way, “real” material cycles were closed.

Apart from the further improvement and correct and complete implementation of legal framework conditions and regulations it was also necessary to create a relevant infrastructure for a sustainable resource management.

Funding, however, was scarce. And while previously some countries did not have sufficient financial resources to establish necessary recovery capacities, other countries saw costly plants stand idle due to under-utilization.

Finally, the pilot project of a resource park in the Polish – German - Czech triangle – co-financed by the European Regional Development Fund (EFRE) between 2014 and 2017 – was the breakthrough away from national self-sufficiency towards regional cross-border concepts.

To obtain the necessary funding a scheduled deconstruction of an existing landfill in Saxony, Germany, was assigned less priority and postponed. As a result of a mutual dialogue, everyone involved agreed, that it is not sensible to, on the one hand, invest in the deconstruction of a landfill holding secondary raw materials, when, at the same time and in the immediate vicinity secondary raw material potential remains unused or scarcely tapped.

Important raw materials could thus be returned to the material cycle. At the same time the energy supply for existing and new industry in the region was secured.

The concept proved that regions that are environmentally and economically effective must not end at otherwise open borders. In the following years the concept behind this pilot project was further improved and successfully implemented in other European regions. Implementation was particularly successful when protagonists were able to put aside their own particular interests and competence conflicts for the sake of linking economic cycles and coordinating their actions.

It became evident, however, that such a scheme that focuses only on the European member states soon reaches its limits.

That is why in 2020 the world witnessed the establishment of the International Energy and Resource Organisation (IERO). The IERO successfully assisted in the re-organization of global economic relations on the basis of consistent and systematic resource savings to expedite climate protection, conservation of resources and security of supply.

Shortly afterwards, the “certificate scheme” that was introduced worldwide made it possible to pay compensation rather than recover raw materials back in their country of product origin, thereby avoiding needless transport. The international “certificate scheme” also prevented that the rules protecting raw materials would be used to establish protectionist markets. At the same time it was possible to avoid an ecologically unnecessary return of raw materials to their country of origin while ensuring the general recyclability and re-usability of critical raw materials worldwide.

The General Secretary of the IERO, Ms. Ingibjörg Önnudóttir ended her commemorative speech with the following words of appreciation:

> "The generation of the early 21st century identified with the responsibility it inherited and distinguished themselves with personal commitment, sense of duty, readiness, reliability and personal initiative, going far beyond what might be expected. It quickly adapted to new challenges and combined excellent analytical-conceptual thinking with practical and operational solutions, implemented with great determination. With its motivated work and team-oriented culture this generation contributed in creating a global resource management system."

Is this only a dream?

What will our grandchildren and great-grandchildren say about us? That we might have tried to do our best … but sadly it was not enough?

It is in our hands to shape history. Let us act – **NOW!**

4 Literature

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