

TEXTE

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Sustainable resource use in the health care sector – exploiting synergies between the policy fields of resource conservation and health care

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On behalf of the German Environment Agency

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Abstract

The aim of the project was to develop synergies and potentials between the policy fields of resource conservation and health and to develop options for stakeholders and policy recommendations. At the beginning of the research project, a quantitative analysis of the raw material consumption of the German health sector and its cost structures revealed areas with significant impact on raw material consumption. The German health care sector, i.e. inpatient and outpatient healthcare provision, accounts for an annual raw material consumption of about 107 million tons, of which about one third comes from domestic raw material extraction and two thirds from imports. This means that healthcare services account for about 5% of the total raw material consumption in Germany. Between 1995 and 2016, raw material consumption increased considerably by about 80 percent. Despite this quantitative significance, the topic currently plays a rather subordinate role for the majority of stakeholders in the German healthcare system. The analyses in this research project show possibilities for both improving resource efficiency and reducing costs. Based on a screening of the healthcare system, which includes not only outpatient and inpatient services but also other health-related intermediate input and infrastructure sectors, the structures and institutions in the healthcare system with regard to resource conservation were analysed on the basis of desk research, interviews and a written survey. Relevant stakeholder groups were characterized and four priority areas were identified: pharmaceuticals, medical devices, construction and supply of food and beverages. In order to identify specific approaches for increasing resource efficiency, these were examined in more depth including the involvement of relevant stakeholders and an analysis of examples of good practice. On this basis, strategic options for stakeholders and policy recommendations were derived, i.a. regarding agenda setting, information and training, implementation support and considerations on the establishment of a round table on "Resource conservation in the healthcare system".

Summary

Preliminary note: The German Federal Environment Agency (UBA) has commissioned the Fraunhofer Institute for Systems and Innovation Research ISI (**Fraunhofer ISI**) with this research project as part of the departmental research plan of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). Preparations and research took place long before the beginning of the COVID-19 pandemic, which is why the present final report does not cover this important topic in detail. However, the study provides some indications of possible synergies between the management of the pandemic and the increase of resource efficiency in the healthcare system.

The aim of the project was to develop **synergies and potentials** between the policy fields of **resource conservation and health** and to derive policy options and recommendations for their advancement. The nexus "resource conservation in the health sector" entails special challenges: Conflicting goals at the interfaces of different policy fields are to be expected, but they require particularly careful consideration where human health is concerned. Approaches to resource conservation in the healthcare system must therefore not reduce the quality of healthcare (effectiveness of therapies, compliance with hygiene requirements, etc.). In addition, effects on the economic efficiency of healthcare provision must be considered.

The public debate on resource conservation has gained considerable momentum both nationally and internationally in recent years. According to the United Nations Resource Panel (IRP), **global consumption of raw materials has more than tripled since the 1970s¹**. Worldwide, it already causes about half of the greenhouse gas emissions, more than 90 percent of the loss of biodiversity and numerous other environmental and health problems - and this trend is increasing. At 16.1 tons per capita, Germany's consumption of raw materials is very high by international standards. The conservation of resources therefore plays a central role in environmental protection and in achieving the "Sustainable Development Goals" to which the German government has committed itself.

With comprehensive studies on resource consumption, the IRP and the OECD provide an important knowledge base for resource policy. They also developed guidelines for policy-making. At the multilateral level, both the G7 countries ("Alliance for Resource Efficiency") and the G20 countries ("G20 Resource Efficiency Dialogue"²) pursue activities that are specifically dedicated to resource policy. At the European Union (EU) level, the "European Green Deal", announced in late 2019, contains ambitious goals for a climate-neutral and circular European economy, which are addressed by the "New Circular Economy Action Plan"³. All of these activities to conserve resources tend to focus on product groups with high primary material use or particularly large or problematic waste streams.

With its focus on the health sector, in contrast, this project focuses on a service sector. This opens a **new perspective on the drivers of resource consumption** and on the relationship between environmental protection and health. So far, the debate has mostly focused on health risks resulting from a deterioration of the environmental situation, both globally and locally. Examples include health consequences of climate change and the link between the destruction of natural habitats and the spread of infectious diseases such as COVID-19.

¹ International Resource Panel (IRP) (2019): Global Resources Outlook 2019. Natural resources for the future we want. UNEP - International Resource Panel. Nairobi.

² <https://g20re.org>, last audited on 11.06.2020.

³ European Commission (2020): A new Circular Economy Action Plan for a cleaner and more competitive Europe (Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM (2020) 98 final).

However, the understanding of the interfaces between environment and health and also the self-perception of the healthcare system is changing. With the healthcare system being directly affected by the effects of climate change (heat waves, new infectious diseases, etc.), relevant actors are advocating climate protection: Among other things, the CO₂ footprint of the health sector is increasingly being researched. The healthcare system is also becoming more aware of its responsibility to contribute to a healthy environment, as good health depends on a healthy environment. These **interdependencies are becoming increasingly clear** in the debates on "**Planetary Health**"⁴. The Ostrava Declaration of the World Health Organization (WHO)⁵ points out initial approaches for translating this responsibility into actual change.

In principle there are two approaches on how the healthcare system can contribute to the conservation of natural resources: On the one hand, the reduction of pollutant emissions relieves natural sinks, for example the earth's atmosphere as a sink for CO₂ (output side). On the other hand, the environment can be protected by using natural resources more efficiently (input side). Since studies have shown that the health sector plays a significant role in the German consumption of resources and the resulting environmental impacts, this project focuses on resource conservation on the input side. Its focus is on raw materials as natural resources (biomass, fossil fuels, metal ores, non-metallic minerals).

New territory has been entered with this project, as the healthcare system had to date been only rudimentarily examined for interfaces with resource conservation. This means that more detailed analyses of the nature and drivers of its use of resources are not available. A more in-depth examination of the potential for resource conservation in the healthcare system is therefore urgently needed.

Quantitative analyses of the consumption of raw materials in the German health sector

The first part of the research project comprises a quantitative analysis of the raw material consumption of the German health sector. The focus of the analysis is the raw material consumption induced by the provision of healthcare in inpatient facilities such as hospitals and by outpatient services⁶. Other areas of the healthcare system play a role as intermediate input sectors. Since the health sector does not use raw materials directly but only indirectly through their embodiment in products, an environmentally-extended input-output database (EXIOBASE) was used. This database covers almost 50 countries or world regions and can thus map international supply chains. It thus allows for the tracing of all the raw materials required for the provision of final goods and services.

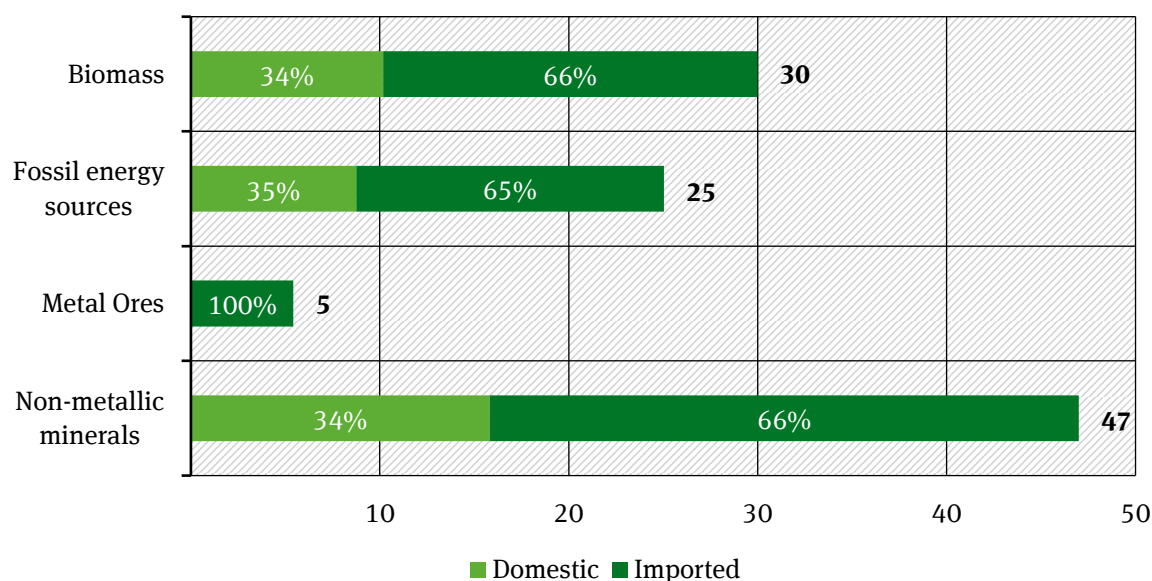
According to our calculations, the total raw material consumption of the German health sector amounts to about 107 million tons per year (as of 2016), or about 1.3 tons per capita and year. This means that around **5 percent of the total German raw material consumption (RMC)** is directly or indirectly attributable to healthcare services, with non-metallic minerals accounting for the largest share at 47 million tons (see Fig. Z.1). About one third of the raw materials used come from Germany, two thirds are traced back to imports - only in the case of metal ores the import quota is 100 percent.

⁴ Whitmee, Sarah et al (2015): Safe-guarding human health in the Anthropocene epoch: report of The Rockefeller Foundation-Lancet Commission on planetary health. In: The Lancet 386 (10007), S. 1973-2028. DOI: 10.1016/S0140-6736(15)60901-1.

⁵ World Health Organization (WHO) (2017): Ostrava Declaration of the Sixth Ministerial Conference on Environment and Health. Online http://www.euro.who.int/__data/assets/pdf_file/0007/341944/OstravaDeclaration_SIGNED.pdf, last access 31.03.2020.

⁶ In the statistical classification of economic activities in the European Community, which plays a role in particular in the quantitative analyses in Chapter 2, the sector concerned is sector No 85 of NACE Rev.1.1 (Nomenclature statistique des activités économiques dans la Communauté européenne).

Figure Z.1: Consumption of raw materials (million tons) in the health sector in 2016, broken down into categories of the federal government's environmental-economic accounts (UGR)



Source: Calculations by Fraunhofer ISI based on EXIOBASE v.3.3, Lutter et al (2018) und Destatis (2020c)

In a comparison of all 200 production areas depicted in EXIOBASE, **the health sector is thus in fourth place** after construction, public administration and processed foods. It is therefore responsible for a significant share of German raw material consumption.

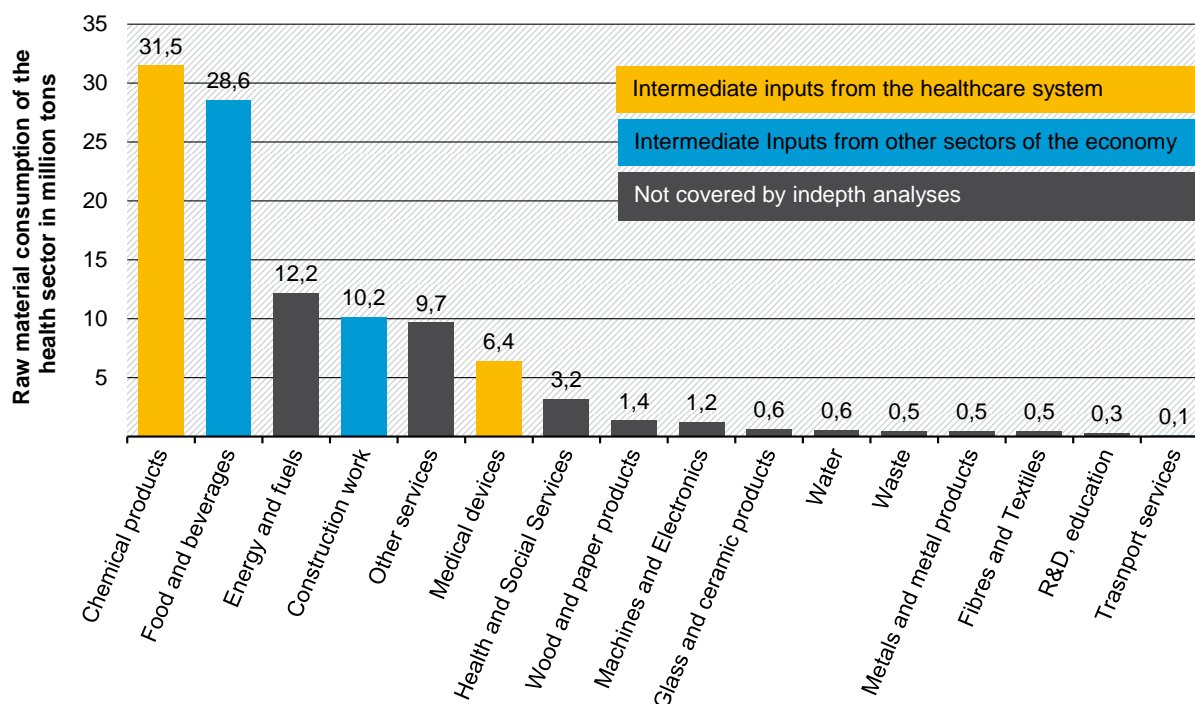
Between 1995 and 2016, the consumption of raw materials in the health sector rose from around 60 million tons to 107 million tons, i.e. by about 80 percent. Because the health sector is likely to continue to increase its economic output, its consumption of raw materials is likely to rise further. The sector's contribution to the sustainable use of natural resources in Germany is therefore becoming increasingly important.

In the second part of the research project, we examined the influencing variables of raw material consumption in the German health sector, in particular the role of different intermediate input sectors (see Fig. Z.2). The most important raw material relevant **intermediate inputs** of the health sector come from the following sectors: chemicals (including pharmaceuticals), food and beverages, energy, construction and medical devices.

The quantitative analyses show where the German health sector has a high demand for raw materials and which approaches are suitable for more efficient and sustainable resource use. The results on **raw material consumption** were compared with figures on healthcare **costs**: Besides the healthcare services that are primarily associated with personnel costs (medical, therapeutic, nursing services), services with high cost shares are in particular attributable to pharmaceuticals, accommodation and catering, medical aids and other medical supplies (e.g. implants, instruments, anaesthetics and other surgical supplies, laboratory and dialysis equipment). This points to significant potential **synergies** between improved resource efficiency on the one hand and cost savings on the other. The selection of the priority areas examined in depth focuses on those sectors and product groups, which entail particular synergies. The energy sector was included only in the good practice examples thus privileging less explored approaches to resource efficiency in the in-depth examinations.

In the interest of focusing the project, the energy sector was not examined in depth in the follow-up work, but was included in the collection of examples of good practice.

Figure Z.2: Consumption of raw materials (million tons) by the health sector in 2016, broken down by intermediate input sectors



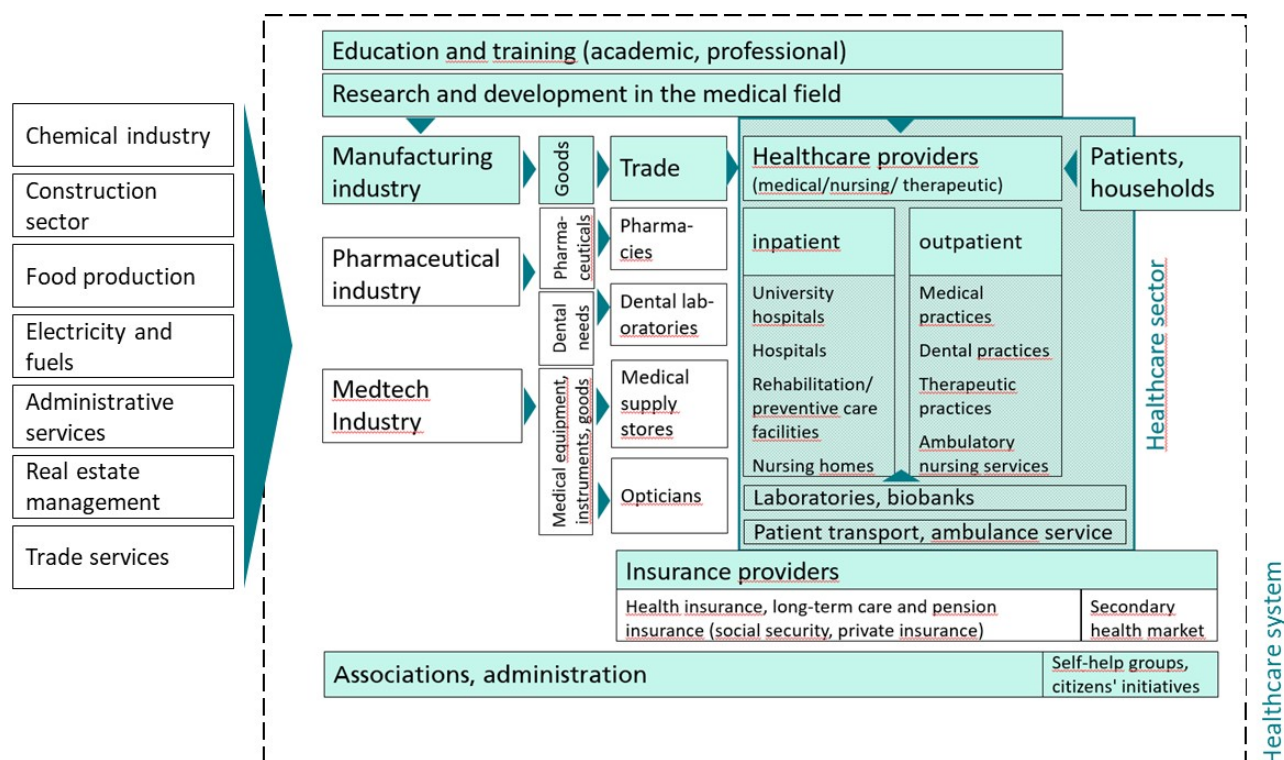
Source: Calculations by Fraunhofer ISI based on EXIOBASE v.3.3

Screening of the German healthcare system

In addition to the health sector in the narrower sense, other areas related to healthcare are also relevant to the consumption of raw materials, for example the medical technology industry, the pharmaceutical industry and the medical trade industry. Together they form the healthcare system (see Figure Z.3 below). Based on a screening comprising desk research, interviews and a written survey, the research team has compiled an overview of the most important stakeholder groups in the German healthcare system (see Fig. Z.3) and examined the current significance of the topic of resource conservation: The focus is on healthcare providers of inpatient and outpatient care. They collaborate within an infrastructure of healthcare suppliers, service providers, laboratories and insurance providers. In addition, they are intertwined with economic sectors outside the healthcare system, such as food production.

Our screening provides a relatively clear picture of the current status of the topic of resource conservation in the healthcare system, including the obstacles and drivers: The topic currently plays a rather subordinate role for the majority of stakeholders in the German healthcare system. Although stakeholders view resource conservation positively on a general level, they perceive no urgency to go significantly beyond the status quo. This is also due to competing priorities (e.g. **economic constraints, time pressure, staff shortages**). Furthermore, they occasionally view resource conservation as being in conflict with the quality of care, hygiene regulations or economic requirements.

Figure Z.3: Structures and institutions of the healthcare system in Germany



Source: Own illustration by Fraunhofer ISI

According to the interviews carried out, the importance of the issue in general and activities for environmental protection and resource conservation in the health sector have declined since their heyday in the 1980s and 90s. Many of the then ambitiously set up responsibilities and bodies no longer exist.

However, even today there are still highly committed individuals and institutions, some of whom have been dealing with the issue for decades and have a **great deal of experience and knowledge** that must be incorporated into the further debate on the subject. Renowned and well-connected stakeholders have launched numerous initiatives, most of which aim at informing and sensitising the healthcare system and at implementing measures - mostly in hospitals. However, the initiatives have little influence at the political and strategic level.

In addition, the **survey** carried out in this research project (159 responses) shows that there are other important stakeholders in addition to the known players. Although the visibility of these supporters is lower, they are initiating important changes within their organisations. These tend to be employees of larger organisations rather than smaller ones: for example, inpatient healthcare service providers such as hospitals participated in the survey significantly more often, and they were also more likely to be involved in resource conservation than outpatient healthcare providers such as surgeries. The interviews showed that the importance resource conservation is given in an institution or region depends to a large extent on committed individuals.

Based on the results of the screening, the researchers recommend that the topic of resource conservation in the health sector should be higher up on the **political agenda** and be positioned more strategically in order to increase resource efficiency in the healthcare system. There is no lack of relevant knowledge for the implementation of concrete resource conserving measures, but rather a lack of consolidation of the available but scattered information. Measures are needed to **sensitise** decision-makers in the relevant organizations and to **motivate** them to implement concrete measures. Synergies

with cost savings, the quality of care or staff recruitment and retention can provide important incentives.

Priority areas and strategic options for resource conservation in the German health sector

From the quantitative analysis of resource consumption and the results of the screening, four priority areas emerge that are particularly suited for promoting resource conservation in the health sector. They are related to the most relevant intermediate input sectors of the health sector: chemicals, medical devices, construction, food and beverage supply⁷.

For each priority area, we identified technical and organisational approaches which allow for the development of potentials for resource efficiency. We examined processes, stakeholders and incentive structures and identified options on how to better implement resource conservation. In addition, resource conservation in the healthcare system should be further strengthened based on strategic options applicable across and beyond individual priority areas.

1. Priority area: Chemicals with a focus on pharmaceuticals

According to the quantitative analysis, chemicals account with 31.5 tons for a large proportion of the raw material consumption of the health sector. For the in-depth analysis, this very heterogeneous field was narrowed down to pharmaceuticals. Although the exact share of pharmaceuticals in the use of chemicals is unclear, they account for a high proportion of healthcare expenditure (2016: around 15 percent), and the excessive use and inappropriate treatment with pharmaceuticals has negative health effects. In terms of both medical and expense aspects, there are therefore reasons to reduce the consumption of pharmaceuticals in Germany.

Manufacturers are interested in resource-efficient pharmaceutical production not least for economic reasons. The current focus is on water and energy efficiency, and only rarely on raw materials or other resources. Healthcare provision continues to offer unused potential for resource conservation in the pharmaceutical sector: By keeping people healthy and resorting to non-pharmacological approaches such as sports, nutrition and psychotherapy, the need for pharmaceuticals can be reduced in the first place. Healthcare provision therefore likely entails even greater potential than the production of pharmaceuticals. In both areas the project identified various options on how to better implement the conservation of resources.

Research into the consumption of resources of pharmaceuticals: Value chains in the pharmaceutical sector are complex. There is a lack of knowledge about the quantities of raw materials required for the production of individual drugs. It is therefore important to create a knowledge base about the composition of the resource consumption of a drug and to use this knowledge to derive measures for resource conservation.

Promoting the development of resource-conserving active ingredients and manufacturing processes: Approaches to replace scarce or environmentally harmful substances in pharmaceutical production with more resource-efficient alternatives or to promote the development of biodegradable active substances already exist. These approaches should be expanded. At the same time, politics could provide incentives to intensify research into resource-conserving active substances, for example by expanding research funding in this area. Similar measures already exist to promote antibiotics research.

⁷ Energy and fuels is another important intermediate input sector, but was omitted from further analysis in this project in favor of focusing on more understudied areas.

In addition, those in charge could revise the public procurement law on discount contracts between health insurance funds and drug manufacturers (regulated in § 130a of the Social Security Code V) in such a way that in addition to economic considerations, resource conservation and environmental compatibility are included as award criteria. Finally, a strengthening of pharmaceutical production in Germany could contribute to a more resource-efficient production, as it would entail more influence over production conditions. At the same time, this would reduce dependence on production facilities abroad and the risk of supply bottlenecks, which could be seen during the COVID-19 pandemic.

Promoting the efficacy of medicines and reducing pharmaceutical waste: The expiry date of medicinal products is freely determined by the manufacturers, but must not exceed a maximum of five years. Often this expiry date is well below the actual shelf life, especially for solid drugs⁸. Therefore, requirements to base the expiry date on the actual stability of active substances could be an important step towards avoiding pharmaceutical waste, while at the same time saving costs.

Manufacturers can also contribute to the correct intake of medicines and thus improved efficacy and greater therapeutic safety by designing labels and leaflets in a way that is easy to read and understand (font size, understandable language, etc.), in accordance with legal requirements. When starting a new therapy, the individually most effective drug is often found by trial and error. If the patient is prescribed large packages at this stage, the risk of pharmaceutical waste is high. Small "starter packs" can help to reduce this waste.

Increased focus on prevention and health promotion: A lower proportion of frequent chronic diseases such as cardiovascular disease and diabetes in the population would probably open up considerable potential for resource conservation and significantly reduce healthcare costs. Incentives are therefore needed to strengthen prevention and health promotion. So far untapped potential lies in better coordination between different healthcare providers, for example doctors' surgeries and hospitals, in order to avoid unnecessary multiple examinations. This also includes making better use of the competence of pharmacists, for example by involving them more closely in medication management.

In order to provide guidance for diagnosis and therapy, national disease management guidelines exist for selected diseases. Their adaptation would be useful in order to reduce overmedication of people with several diseases, for example, by indicating possibly dispensable drugs or by explicitly addressing the treatment of diseases that often occur in combination. Such adaptations would be important both for reasons of medication safety and with regard to resource effects.

Promoting resource-conserving prescription and intake behaviour: health care providers can reduce unnecessary resource consumption by prescribing resource-saving and environmentally compatible substances where available and appropriate, prescribing only appropriate quantities, not issuing prescriptions simply due to patients' expectations and by participatory decision-making for better compliance. Health insurance funds could use their discretion in the reimbursement of non-prescription drugs to give priority to reimbursing resource-conserving drugs and thus increase demand for such drugs.

Overall, existing initiatives to reduce pharmaceutical consumption and its negative consequences (polypharmacy, antibiotic resistance, micropollutant problems) can be brought together at a Round Table (see below), to coordinate them, taking into account resource aspects, and to derive and further develop good practice.

⁸ See eg Cantrell, Lee; Suchard, Jeffrey R.; Wu, Alan; Gerona, Roy R. (2012): Stability of active ingredients in long-expired prescription medications. In: Archives of internal medicine 172 (21), S. 1685–1687. DOI: 10.1001/archintern-med.2012.4501.

2. Priority area: Medical devices

According to the Medical Devices Act, medical devices are defined as "all instruments, apparatus, appliances, devices, software, substances and preparations made of substances or other objects, whether used individually or in combination, including software specifically intended by the manufacturer to be used for diagnostic or therapeutic purposes and used for the proper functioning of the medical device". Examples are dressings, medical aids, surgical material, implants or devices for diagnostics, surgery, intensive care and patient care. With 6.4 million tons, medical devices alone account for about 6 percent of the total raw material consumption of the health sector (see Fig. Z.2).

There has been ongoing scientific and practical debate about the use of resources for medical devices. However, they have been overshadowed by other developments in the healthcare system, especially discussions around costs. The interviews and analyses for this project have shown that there is little awareness of the resource consumption of medical technology beyond the energy consumption of devices.

Both for complex medical devices (e.g. for imaging such as X-rays, computer or magnetic resonance tomography) and for simple disposable products, there are suitable approaches for resource conservation along their respective life cycles. Beyond product-specific measures, changes in processes and procedures of healthcare provision can also be used to make resource consumption more efficient. One example is the "Weaning Centre" at the Otto Wagner Hospital in Vienna: it shows how existing personnel, financial and material resources can be used more efficiently by changing internal processes.

The following options reflect both the potential for increasing resource efficiency and their feasibility in the German healthcare system:

Extending the lifespan of medical devices: The lifespan of medical devices can be extended and resources can be saved through more intensive refurbishment - something that is already offered by many device manufacturers and healthcare providers. The advantage is that users benefit from progress in medical technology through the replacement of individual components and updated software without having to purchase a new device. In order to facilitate the refurbishment of large medical devices, they should be designed in a more modular fashion so that defective or outdated components can be replaced more easily.

Intensifying the use of medical devices through sharing and product-service-systems: With a view to intensifying use, manufacturers and healthcare providers should give more thought to product-service-systems and sharing approaches. An important option are innovative product-service-systems in which manufacturers remain the owners of the equipment. For example, if the manufacturer of a computer tomography device received a fixed fee per examination from their customers, this would reduce the incentive to sell new devices. Instead, it would create incentives for higher capacity utilisation and lifespan extension.

Reusing and recycling of medical devices: The survey and stakeholder discussions showed that the use of disposable products such as surgical instruments or catheters is increasingly being seen as a major environmental problem. Resource efficiency can be increased, for example, by promoting reuse, but also by establishing recycling cycles. In reuse, the products are collected, cleaned, disinfected and sterilised after use - after which they can be used again safely. This process can be carried out both by the central sterile services department of a hospital and by external service providers. In recycling circuits, the products used, such as surgical instruments made of stainless steel, are collected and recycled in closed loops to maintain the quality of the material. The recovered special alloys are then used to manufacture new instruments.

Resource-efficient purchasing: In order to procure medical devices more efficiently, the purchasing departments of hospitals could incorporate ecological criteria in their procurement processes. The prerequisite is that the manufacturers provide the necessary information and that the purchasing department is qualified in or develops basic competencies for ecological assessment (e.g. interpretation of life cycle assessments). In order to reduce the complexity of decision-making, many sectors and independent institutions provide appropriate information about environmental or sustainability seals.

3. Priority area: Construction

In 2016, construction in the health sector generated a resource consumption of 10.2 million tons or 9.5 percent of the total resource consumption of the health sector. This priority area is quantitatively significant for various flows of raw materials: non-metallic minerals are dominant, followed by fossil fuels, which are used in the manufacture of building products. In addition, the construction method is key for a building's resource requirements in the use phase, for example in terms of energy and cleaning agents.

The priority area focuses on buildings for inpatient care, because special requirements and conditions apply, compared to residential and non-residential buildings. The construction volume has seen little fluctuation over the years, with 626,000 square metres of usable space being completed in 2018. Most of the construction activities are in the field of preventive care, rehabilitation and nursing facilities. Although the number of hospitals has decreased significantly over the past 25 years, the construction volume has been relatively stable since 2014, with around 90 buildings completed per year. This is so, because closures often lead to construction activities at the replacement location. Certain segments of the healthcare sector - in particular private operators as well as preventive care, rehabilitation and nursing facilities - are often more open towards resource conservation, because they can use such activities for fostering a positive image.

The design of the building infrastructure hardly affects the core processes of healthcare (diagnosis, therapy, etc.), so that conflicts with the quality of care are not to be expected. Some approaches to resource conservation in construction in the healthcare sector are similar to those for buildings in general: sound analysis of requirements to optimise the use of space and resource-sensitive selection of materials, construction methods and (also technical) building equipment. Specific challenges in the health sector arise from the high complexity of construction projects, which is due, among other things, to the very different user groups and requirements. However, there are examples of good practice that reconcile ecological and economic concerns with the requirements of healthcare. With foresighted and holistic planning, resource efficiency can be increased without increasing overall investment expenditure.

We identified the following options to implement resource conservation more effectively:

Building up competencies across the board: A great deal of knowledge - partly general, partly health sector-specific - already exists for resource-efficient construction. This knowledge must be disseminated even more widely. To this end, those responsible must provide and market information in a user-friendly form. In the manufacturing industry, efficiency agencies already exist for this task, and something comparable would have to be established for the health sector.

In addition, (further) training measures are necessary on both the supply and demand side, especially for technical management personnel and the management of inpatient facilities. In order to promote the continuous acquisition of knowledge, associations and chambers of commerce could set up expert groups for resource-efficient construction in the health sector, for example for functional construction methods and climate-friendly construction. The exchange of knowledge could be further promoted by stronger networking between the federal, state and local governments and with other stakeholders such as social insurance funds.

Create incentives for voluntary action and strengthen demand: Existing support programmes for construction and refurbishment - in particular by the German state-owned development bank “Kreditanstalt für Wiederaufbau” (KfW), but also programmes by the federal states - should provide incentives to implement sustainability standards to a greater extent, for example the sustainability standards for healthcare buildings of the German Sustainable Building Council (DGNB)⁹. The awarding agencies should check whether their programmes offer suitable conditions for all healthcare providers and take sufficient account of resource efficiency as a funding criterion. They should consider supporting healthcare providers not only financially for construction measures but also with financial resources for additional medical and nursing staff during the planning and construction phase. If the federal states were to set incentives for energy- and resource-efficient construction for regular flat-rate funding for hospitals, this would be a major intervention, but would have a broad impact. One obstacle is that different bodies are responsible for investment and operating costs. These split incentives resulting from dual financing would need to be overcome.

Adapt the legal framework and standards: To a certain degree, existing standards and building regulations favour a lock-in into conventional construction. Examples from abroad (e.g. Switzerland) show that standards (including those for fire and noise protection) can be set in such a way that they are more compatible with innovative construction modes such as timber construction or using recycled concrete, for example. Several state building codes (including those in Baden-Württemberg, Berlin, Hamburg and Hesse) now permit timber construction in multi-storey buildings. Such adaptations of legal instruments to promote resource-efficient construction are very ambitious and not specific to the health sector. They should therefore be pursued on a broad basis also outside of healthcare construction.

4. Priority area: Supply of food and beverages

In 2016, 28.6 million tons of resources were consumed by catering services in inpatient facilities and by catering companies and meal delivery services, which corresponds to 26.6 percent of the total resource consumption of the health sector. Ways to increase the efficiency of resource consumption in communal catering include reducing food waste, increasing the proportion of resource-conserving food and avoiding unnecessary food and beverage packaging. The following options show how these approaches to resource conservation can be promoted.

Health sector as a pioneer of resource-saving catering and healthy nutrition: There are significant synergies between a healthy diet and a sustainable and resource-saving catering. Community catering in the health sector is predestined to tap into these synergies and play a pioneering role in healthy, resource-conserving nutrition. It should therefore become a strategic priority to promote relevant activities and measures.

Implementing good practice on a broad scale and setting targeted incentives: For community catering in the health sector to fulfil this pioneering role, existing examples of good practice must be implemented on a broad basis and become the rule. This is where community catering facilities - in dialogue with suppliers, employees and caterers - are called upon to get involved and make real use of available instructions, aids and tools that have already been researched, prepared with practitioners in mind and proven in practice. In order to create incentives, we recommend promoting the conservation of resources in catering as an element of sustainability reporting. This allows early adopters to distinguish themselves from their competitors in the public image.

⁹ <https://www.dgnb-system.de/de/projekte/>.

Associations and professional societies as well as specialist media and service providers can act as initiators, motivators and supporters by putting the topic of resource conservation on their agenda, explicitly building a bridge between resource conservation and health promotion in catering. They can also provide information and platforms for sharing experiences between hospital catering managers, for example through events and further training.

Other possibilities of encouraging broad implementation include financial incentives, such as investment grants for resource-efficient production systems when furnishing or modernising kitchens. The management or owners of community catering facilities should set binding targets for a minimum proportion of resource-conserving food, set quotas for reusable packaging, promote compliance with guidelines for a healthy, resource-conserving diet and demand that bidders implement these targets in public tenders for catering and delivery services. In public institutions, these impulses and incentives could also come from (local) politics and administration. Dialogue processes with stakeholders can help to develop appropriate targets and implement appropriate measures.

Improve framework conditions: The full exploitation of this potential is hampered by obstacles that cannot be removed by catering facilities or their owners alone. To improve the framework conditions under which the facilities operate, those responsible at the regional and local level must design supply chains accordingly: Above all, it must be possible to purchase resource-conserving food and beverages in the required quantity, quality and in returnable packaging. In addition, it is important to support and promote cooperation between community catering facilities in the health sector and actors in the recycling of leftover food (e.g. food savers). At the inter-institutional level, the establishment and regular updating of monitoring systems for the consumption of resources related to catering would support the measurement of success and the analysis of weaknesses as well as the benchmarking of institutions.

Community catering in the health sector is governed by the Social Security Code and by food and beverage-related hygiene and packaging regulations, which only the legislator can change or which call upon the administration responsible for enforcement. One option is to adapt the framework conditions set by the Social Security Codes in such a way that full board daily rates in health sector facilities are sufficiently high to cover the costs of seasonal and regional fresh produce from organic farming. Some of the food waste could be avoided by replacing the best-before date with a consumption date and harmonising the often regionally inconsistent and sometimes overly tight enforcement of hygiene regulations. Efforts at the legal level to reduce packaging in the food and beverage sector would also help to conserve resources in community catering in the health sector.

5. Strategic options across and beyond individual priority areas

Across the four priority areas considered in depth, several cross-cutting issues are relevant, and we have developed a separate set of strategic options for these cross-cutting issues.

A basic prerequisite for increasing resource efficiency in the healthcare system is to create more visibility for the issue of resource conservation. During the COVID-19 pandemic, priorities were shifted towards acute crisis management. In connection with the efforts to increase resilience in the health sector, those responsible must now give the necessary priority to resource conservation. In order to establish resource conservation permanently in the health sector, it is important to put it on the agenda of all stakeholders.

This **agenda-setting** should take place in different contexts - national and international - and be carried out by different groups, for example by associations, chambers of commerce or politics, but also by the research community and the healthcare providers themselves. At organised events or as members of programme advisory boards, these groups can address the issue of resource conservation in

the healthcare system at conferences and meetings. This can help target groups of the events to develop knowledge on this issue. Furthermore, this could contribute to the issue entering the strategy development processes of professional and sectoral associations and healthcare providers.

Inform, network and qualify: Our investigations show that a great deal of knowledge is already available on how to make the consumption of resources in the healthcare system more efficient. However, since this knowledge is not yet sufficiently widespread, information, networking and qualification are important levers. Institutions that are already working on the topic for the manufacturing industry, such as the VDI Centre for Resource Efficiency at the federal level, the Environmental Technology Agency of Baden-Württemberg or the Efficiency Agency of North Rhine-Westphalia, can serve as models.

Acceptance of such offers requires highly specific qualifications of staff, which are at the interface of clinical aspects and resource issues. The information material provided must be user-friendly and embedded in an overall concept. This concept must specify the objectives of the activities, define and prioritise target groups and ensure a minimum level of activities in order to achieve high visibility.

Networking activities can model themselves on event forms from the promotion of resource efficiency in the manufacturing industry, for example annual network conferences that provide a platform for role models and lighthouse projects, or after-work events that convey specific topics in a hands-on fashion. Equally useful are training courses, for example on "calculating" resource efficiency measures, and initial consultations conducted by advisory staff specifically qualified for the health sector. In the longer term, appropriate content should be incorporated into the curricula of healthcare professions.

Promote implementation: Beyond agenda-setting and measures for information, networking and qualification, implementation should also be promoted directly. The discussion on this is still relatively new. For this reason, it is necessary to create acceptance for the various options discussed above and to specify and adapt them, for example as part of further stakeholder dialogues.

One approach is the stronger **institutionalisation of resource conservation activities** through targeted promotion of the introduction of environmental management systems (e.g. ECOPROFIT, ISO 14001, EMAS). Experience to date has shown that strong incentives or - above a certain institutional size - an obligation to use such management tools are needed if the number of certified institutions is to increase significantly. A second path towards institutionalisation is to add a person responsible for resource conservation tasks to the management teams of healthcare facilities.

When implementing resource-conserving measures, conflicting objectives can arise if the business and economic perspectives diverge or if there is conflict between economic and environmental requirements. Such conflicting objectives must be analysed in order to **correct** the underlying **incentive structures**. For example, health insurance funds might have to be authorised by law to increase the reimbursement amounts for meals in order to facilitate a changeover to resource-conserving foods, which are often more expensive than conventional ones. This is, however, a lengthy process that requires further research.

Policy recommendations

As this study shows, there is a wide range of options to increase resource efficiency in the healthcare system. Many synergies exist between the two policy areas of resource conservation and health that can be used to increase resource efficiency without compromising the quality of healthcare. However, there are many obstacles to this, so that an **active role of politics is required**. The issue of resource conservation in the healthcare system belongs on the political agenda and must be better anchored, not only operationally but also strategically.

Within the priority areas examined in depth, this research project already shows many possible political options for action - but it also shows that these synergies can only be developed insufficiently and "patchwork-like" if activities are initiated at the level of the priority areas alone. Here, politics must above all break through persistent routines, address conflicting goals and ensure the strategic and productive interaction of different measures and activities.

The interaction between resource and health policy has already been mentioned in the second edition of the German Resource Efficiency Programme and is now being backed up by a measure in the third edition: The expansion of specific advisory services for actors in the health sector is to be supported. In addition, it is proposed to set up a Round Table, "...in which important stakeholders and experts from both policy fields will jointly discuss resource efficiency measures"¹⁰.

The importance of advisory services is also evident from the results of this project; we have already outlined the recommendations for the design and anchoring of such services above. Our results also fully support the idea of **initiating a round table**. However, this should not be limited to joint consultation on resource efficiency measures, but should aim at developing an overall strategy. In order to exploit the synergies between the policy areas of resource conservation and health, those in charge of resource policy should set up the Round Table as an **interdepartmental activity** and implement it together with the Federal Ministry of Health (BMG). This is an important prerequisite for adequately addressing conflicting goals.

The current situation is favourable for intensifying cooperation between the BMU and the BMG, as the healthcare system increasingly perceives itself as a polluter responsible for negative environmental impacts. The Ostrava Declaration of the WHO mentioned above therefore calls upon the healthcare system on an international level to take action to conserve resources. Climate protection plays a special role in this context because the health sector is directly affected by the effects of climate change, including heat waves and new infectious diseases.

It is therefore advisable to **explicitly address the synergies between resource conservation and climate protection at the Round Table** and to address the possible contributions of the healthcare system to both policy goals. The Round Table should bring together the various stakeholders of the healthcare system at association level with political **actors from both policy fields**.

On the healthcare system side, these are primarily the various groups of healthcare providers (hospitals and university clinics, preventive/rehabilitation facilities, nursing homes, outpatient care), the insurance providers (social security, private health insurance funds, nursing care and pension insurance funds) and the pharmaceutical and medical technology industry. These should be supplemented by institutions that already actively support resource conservation in the healthcare system.

On the political side, care should be taken to ensure that other departments such as the Federal Ministry of Education and Research (BMBF) and the Federal Ministry of Economics and Energy (BMWi) are involved in addition to the BMU and BMG. In addition, the federal states should be represented, because they play a central role in financing hospitals, for example.

In order to credibly and reliably ensure the high significance of the quality of healthcare in the process, the **patient perspective** should also be represented at the Round Table.

All participants will be required to work out a common problem and goal definition, develop **roadmaps** with activities and schedules for different priority areas and combine them into an **overall**

¹⁰ BMU (2020): German Resource Efficiency Programme III (2020 - 2023). Programme for the sustainable use and protection of natural resources; Measure 31, p. 44.

strategy. In addition, the Round Table should carry out impact monitoring, evaluate progress and initiate any necessary adjustments.

Further research needs

An important future field of research will be further **detailed analyses of resource consumption**. In this project, the intermediate input sectors of the health sector formed the grid according to which the resource consumption of the healthcare system was broken down. This level of observation is quite aggregated. More detailed analyses of resource consumption should, among other things, examine further substance groups from the intermediate input sector "chemicals" (e.g. disinfectants and cleaning agents) as well as take a closer look at individual facilities, sub-sectors and therapeutic approaches.

Within the priority areas, certain aspects should be developed in greater depth. For example, the **role of nursing and outpatient care** for the resource-conserving use of pharmaceuticals and medical devices has not yet been given much attention. However, the processes there are central to developing synergies between health and resource conservation. We were unable, in this project, to fully address the general conditions and incentive structures which would explain why the number of medical devices in use is so high in Germany compared to other countries. A third field of research is related to the options cutting across the priority areas: Here there is a need for further development and research in order to **design and evaluate information and advisory services** specifically for the health sector.

Finally, it is important to further develop the research topic as a whole. The aim of this project was to identify the product groups that contribute significantly to the consumption of resources in the health sector and to examine approaches to make their use more efficient. In the future, research should also address the synergies that can be exploited between health and resource conservation when processes are completely changed and **other ways of providing healthcare are** adopted. There is already clear evidence that **disease prevention** is central to this. Further options can be expected to be found in the organisation of procedures and treatment processes and in incentive structures, including cost reimbursement principles.

Particularly far-reaching research questions arise in connection with **digital transformation in the healthcare system**. In January 2020, the Federal Ministry of Health broadened the basis for the digital transformation of the healthcare system with the Digital Healthcare Act (DVG). However, the services made available by this (including preventive apps on prescription, telemedical consultations) are not being considered from a resource perspective.

The economic stimulus package to mitigate the economic consequences of the COVID-19 pandemic launched by the Federal Government at the beginning of June 2020 will give a further boost to the digital transformation in the healthcare system: Among other things, the "Future Programme for Hospitals" is intended to promote necessary investments in a better digital infrastructure for hospitals¹¹. In order to optimise these investments in terms of synergies with resource conservation, it must be accompanied by targeted research. In view of the interdepartmental relevance of the issue and the high potential for resource conservation, research funding should be integrated into the **funding programmes of various departments (BMU, BMBF, BMG, BMWi)**, as well as being funded by foundations and at the level of the federal states.

¹¹ Federal Government (2020): Combating corona effects, securing prosperity, strengthening sustainability. Result Coalition Committee 3 June 2020 - Key elements of the economic stimulus package, paragraph 51.