

# The Advisory Board for Circular Economy Recommendations for the Danish Government



Advisory Board for  
Circular Economy

**“The time is now  
for action and  
a rethink of our  
business models  
and welfare society  
based on the  
following formula:  
Reduce. Reuse.  
Recycle. Rethink.”**

— **Flemming Besenbacher**

Chairman of the government's Advisory Board for Circular Economy

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More technical and detailed descriptions of the 27 recommendations are given in separate appendices:

Appendix on the circular value chain

Appendix on design and production

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# Foreword

**Ever since the industrial revolution, world industry has mainly produced according to a linear approach: We extract raw materials, produce, consume and throw away. This 'linear economy' has generated considerable wealth in the world, but has also resulted in severe over-exploitation of global resources.**

If everyone were to live the way we do in Denmark, three complete Planet Earths would be required. It already takes nature a little over 18 months to restore the resources consumed by the world population in just one year. That's why we need to rethink the way we consume. And there's no time to lose, because the world population will grow from the current 7 billion to around 10 billion by 2050. Meanwhile, the global middle class will expand, causing a further increase in the consumption of goods and services which is already eating up our limited resources.

The time is therefore ripe to transform our current linear economy into a circular economy. An economy in which we keep products and materials in circulation, using their value for as long as possible. What we used to consider as waste must become valuable input in new products.

That requires a complete paradigm shift. Our ambition is for Denmark to become a pioneer within this transformation by rethinking the way we design, produce and consume.



That will give Danish enterprises a competitive advantage, opening new markets as we develop new solutions and acquire know-how that we can export.

That's why we have formulated a vision for Denmark's transformation to a circular economy with five specific objectives, four general signposts and 27 recommendations for specific things we can do to boost the transformation.

The time is ripe for action and to rethink our business models and welfare society based on the following formula: Reduce. Reuse. Recycle. Rethink.

A handwritten signature in gold ink, reading 'Flemming Besenbacher'.

**Flemming Besenbacher**

Chairman of the government's Advisory Board for Circular Economy

# Vision

**Our vision is, that by 2030 Danish industry is a global leader within development, implementation and export of circular solutions, and that Denmark is world-renowned as a hub for the circular economy.**

**Danish enterprises** have integrated the circular economy as part of their business and strategy. Enterprises are bolstering their competitiveness on the global market through technological development, circular design of products and services, better resource efficiency, use of recycled materials in production, more reuse, maintenance and repair, plus circular business models.

**The public authorities** have provided the frameworks and removed barriers to the circular economy. The state, regions and local authorities are incorporating the circular economy into their procurement, and using lifecycle perspectives when investing and for new procurement.

**The public** can make informed choices and choose products and services that promote a circular economy.

**Our objectives for the transformation of Danish industry to a circular economy by 2030 include**

- A** Denmark gaining greater economic value from materials by boosting resource productivity by 40% based on amount of materials, and by 15% based on their value.
- B** Denmark increasing circularity by boosting overall recycling to 80% and reducing the amount of waste generated by 15%.
- C** Denmark retaining its leading position in Europe by developing circular technologies and solutions, and increasing the exports of both.
- D** Denmark utilising surplus capacity better by 50% of the population becoming active in the 'sharing economy'.
- E** Denmark boosting circular consumption by quadrupling overall turnover of eco-labelled products and services.

# Rethink

A circular economy is all about common sense when designing, producing, consuming and disposing of what we no longer need. There's money to be made from sharing and having access to products without owning them, by designing them so that they can be repaired and maintained, whilst making reuse and recycling the norm. Waste should no longer be the end of our consumption, but the start.

Every country in the world will be forced to go through this transformation, which will generate growing global demand for circular technologies and solutions. Denmark needs to exploit its advantage of being a small country with a high level of education, and the ability to transform itself into a pioneer country. This requires the public and private sectors working together to create the right framework and invest in the circular transformation. By rethinking the way we design, produce, work and consume, we can create new opportunities and jobs. This will give Danish enterprises a competitive advantage, opening new markets as we develop new solutions and acquire know-how that we can export. The circular economy will be of key importance to continued growth and wealth in Denmark

It is the goal that by 2050 Denmark will be a society that recirculates materials and products to the extent that waste no longer exist. A society that solely uses the resources that our one and only planet can replace.

## **An international agenda**

At the international level, initiatives have already been set in motion designed to promote the transformation to a circular economy. This is a clear indication that the circular economy approach is already catching on globally – and why it's important that Denmark is well ahead.

The UN has recently adopted 17 Sustainable Development Goals (SDGs) designed to lead the world in a more sustainable direction. The circular economy is a key and consistent means of achieving them, because it can facilitate continued economic growth and wealth in a manner that the globe is able to cope with. The transformation to a circular economy will therefore help implement the Government's new Action Plan for the UN's SDGs. Furthermore, it will help support engagement of enterprises in pursuit of the 17 SDGs with an eye to new business opportunities and higher expectations for local and global sustainability.

### The UN's 17 Sustainable Development Goals



A circular economy will also help fulfil the targets of the Paris Accord on reducing global warming to 2 or 1.5 degrees by limiting the exploitation of new minerals and cutting the use of landfill.

The circular economy is also high on the EU's political agenda. The European Commission launched an ambitious action plan for the circular economy in December 2015, entitled 'Closing the Loop'. It is designed to ensure that the EU moves in a circular direction within e.g. waste management, product standards, public procurement, agriculture, research and financing. The Commission's action plan will also help create a better functioning European market for circular technologies and solutions. A market in which there can be confidence in circular products, services and recycled materials. The EU can define the overall parameters and help create a functional single market for the circular economy. That is why it is essential that we adopt an approach to the Danish transformation to a circular economy in line with the European transformation.

### **Denmark must be the circular leader**

Denmark has already taken significant steps towards a more circular economy. 46% of household waste was recycled in 2015, an increase of 6 percentage points since 2013. The recycling of industrial waste has also risen. In fact, we use more and more of our waste, and are one of the countries that sends the least to landfills.

But for Denmark to really become an international front runner within the circular economy, enterprises, the authorities and the public all need to work closely together to create value that is not just in their own interests, but for the benefit of society as a whole. Enterprises must take social responsibility and not just create value based on narrow, short-sighted goals.

The public need to adopt change to a greater extent towards sharing instead of owning, which will have a major impact on their lives and consumption habits. And the authorities need to take responsibility for the promotion of new solutions across sectors and institutions, and to adapt legislation to the benefit of initiatives able to promote a circular economy.

A transformation to a circular economy must be built on known technologies, but investment is also required in the development of new technologies and thus new business models.

Transformation to a circular economy is an all-encompassing process that will have to be phased-in over a number of years. The scope of the effort needed should not be underestimated, and moving away from silo mentality is essential. Transformation requires cooperation between each link of the value chain – from designers and manufacturers, through distributors and retailers to consumers and waste treatment facilities. It requires new forms of cooperation – such as between the financial world and manufacturing industry, or between finance and development departments within enterprises. It will also require new skills and research in smarter use of resources and materials. The linear economy should not just be bent into a circular one within Danish enterprises. For Denmark to be able to transform into a circular economy, every member of the public and authorities have to be prepared to accept major change in consumer habits. The throwaway culture must be replaced by a new mindset.

Denmark stands on the threshold of transformation to a circular economy that will bring a host of challenges and require massive investment, but that will also open new opportunities for Danish society. Circular economy has massive business potential – even with a growing global market, and the potential for Danish circular solutions is big. Many Danish enterprises are already well on the way, but we need more to get going.

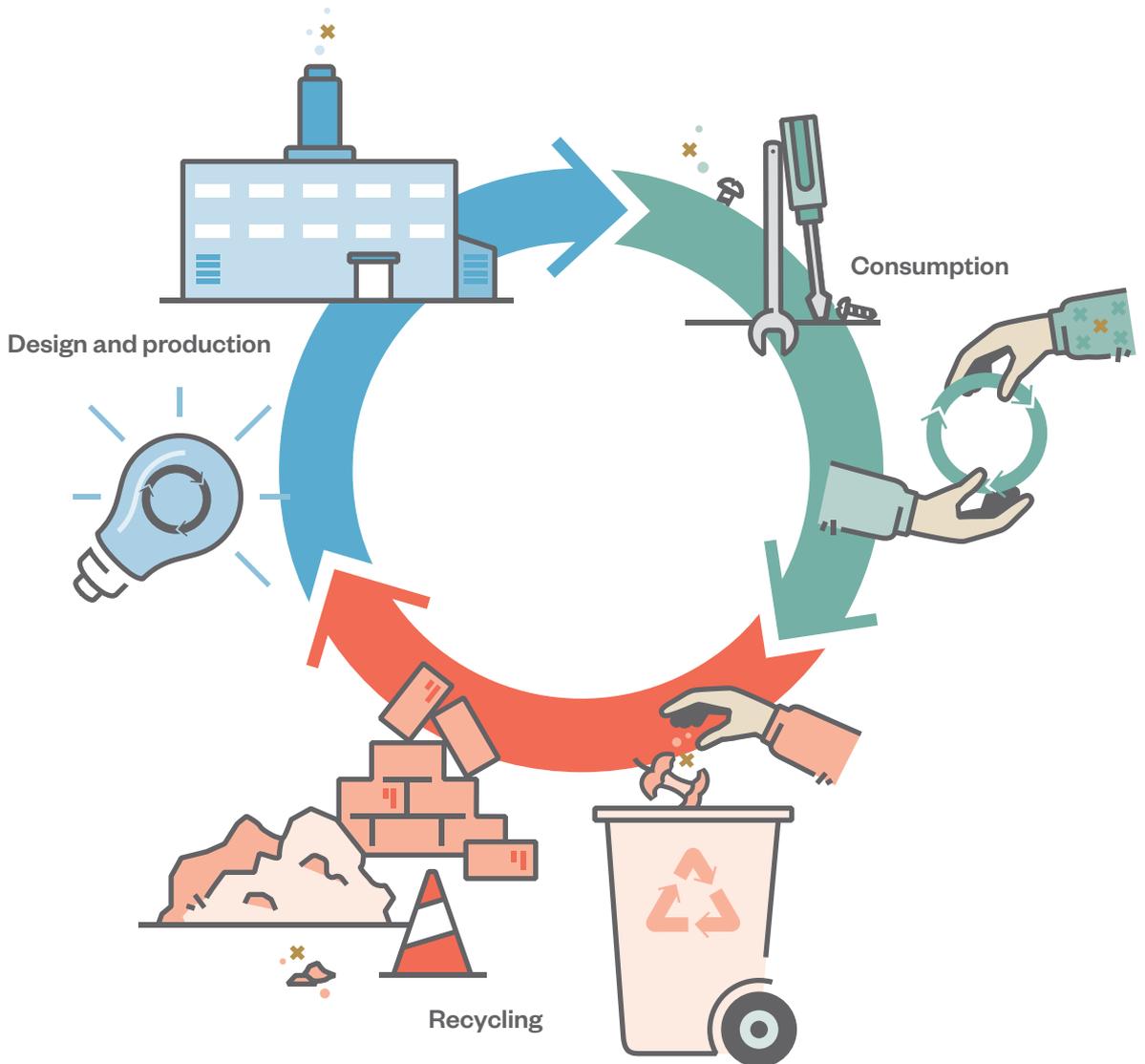
# Danish industry needs to lead the way

**The circular economy is a golden opportunity for the Danish industry to be the first to develop new circular technologies and solutions able to accelerate transformation. The beneficiaries will be industry, society and the environment.**

It makes sense for industry to recirculate materials and products, exploit their value to the full and minimise waste. There are excellent business opportunities, such as designing building components and products to be repaired, recycled and reused – instead of just throwing away. In sharing and having access to services – without ownership. In biomass being used for medicine, bioplastics and food ingredients – rather than for simple energy production.

There are already ideas and solutions for how we can use the circular economy to make our enterprises better and more profitable. The Ellen MacArthur Foundation, a British think tank, published highly inspirational reports in 2015 and 2017, both of which highlighted investment opportunities in new technologies and business models for European enterprises as part of the transformation to a circular economy.

## THE CIRCULAR VALUE CHAIN



The 2015 report used Denmark as a specific case to show that transformation to a circular economy will be able to create economic growth, new jobs, more export, plus a reduction in material consumption and CO<sub>2</sub> emissions. An intelligent transformation of Danish society from a linear to a circular economy will give an annual profit of DKK 45 billion by 2035, according to the Ellen MacArthur Foundation.

We have the ideas and the abilities. What we need to do now is to put words into action and invest in circular solutions so that we can reap the rewards to the benefit of our economy, society and environment.

To follow are descriptions of the 27 recommendations for specific initiatives able to boost transformation to a more circular economy. The recommendations can be put into practice immediately, and implemented towards 2020, 2025 and 2030 to realise our vision and objectives for a more circular economy in Denmark.

For a more detailed look at the recommendations and a general introduction to circular economy, please see the appendices.

## Seven dogmas for a circular economy

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**We have defined seven dogmas for a circular economy. They are intended as a compass to help set a common course for everyone working with the circular economy.**

**Circular design.** We seek to ensure that all materials retain their potential as a resource for something new. Nothing goes to waste.

**Healthy materials.** We only use materials that are healthy for the environment and the people who produce, build and use them.

**Dismantable design.** We produce and build in such a manner that everything can be dismantled and reused. We prefer components that retain or increase in value.

**Horizontal collaboration.** We collaborate in partnerships that promote the circular economy. From supplier to manufacturer and from investor to lender.

**Material passport.** We must always know and appreciate the most important materials in a product and in a building.

**Framework conditions.** We will seek to continuously develop and implement clear requirements and standards for circular development.

**Better information.** We will seek full transparency for the consumer on content and potential for the recirculation of any product.

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# The circular value chain – think horizontally



## Benchmark

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**The circular economy must become an integrated part of any enterprise's core business and any public services.**

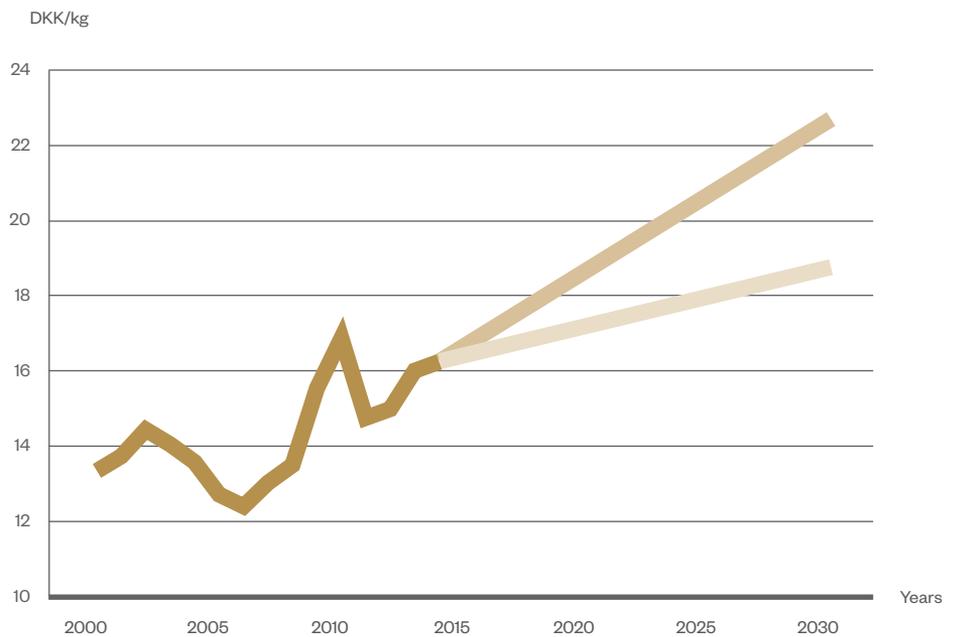
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The value chain in a circular economy has neither beginning nor end. The important thing is to think through the entire repetitive lifecycle before even starting to design a product or service. The circular value chain consists of three main links: 1) design and production, 2) consumption and 3) recycling. They are closely related in the chain. For example: leasing-based business models will give enterprises an incentive to design products with long service lives, that are easier to repair and recycle. And more high quality recycling gives manufacturers more chances to design and produce products from recycled materials.

Transformation to a more circular economy will therefore require strong collaboration between all actors in the value chain – from designers and manufacturers to consumers and recyclers.

The circular economy must become a natural and integrated part of the mindset at all levels of our society – from education and research to financing and regulation. Our economic models must also take into account the materials we use as input, and not just look at the economic output.

**FIGURE 1.** Development and objectives for resource productivity in Denmark



**Source:** Statistics Denmark, Eurostat (historical data), the Danish Environmental Protection Agency, Environment Project no. 1838 (2016)

**Note:** Resource productivity is a benchmark for how much economic value can be extracted from materials used in the production of products and services. Resource productivity is presented here based on Domestic Material Consumption (DMC) in relation to economic growth (GDP).

- Target (+ 40%)
- Business as usual (+ 16%)
- Historical



## Case

### **From product to service – heat pumps and new business models**

Best Green finances, installs and runs heat pumps. The company offers subscriptions with a fixed price per heating unit when customers switch from oil or gas to heat pump. That removes uncertainty for customers and the unknown factor of overall running costs when using heat pumps for heating.

And society benefits by better utilisation of wind energy and CO<sub>2</sub> savings of 100%. A heat subscription will mean a saving of 10-25% on costs excluding initial investment for enterprises and local authorities.

## The Advisory Board for Circular Economy recommends:

- #1** Make circular economy the driving force behind Danish industry
- #2** Set up a single point of entry to the authorities for enterprises that encounter barriers to circular transition
- #3** Create circular municipalities
- #4** Incorporate circularity into the macroeconomic models and statistics
- #5** Develop standards that support the circular economy
- #6** Incorporate circular economy into the entire education system
- #7** Promote research, development, testing, demonstration and market development for circular solutions and technologies
- #8** Boost financing for the acceleration of circular enterprises
- #9** Exploit the leading position of Denmark within digitalisation and new technology to support circular transformation

# Design and production – fewer materials and more circularity



## Signpost

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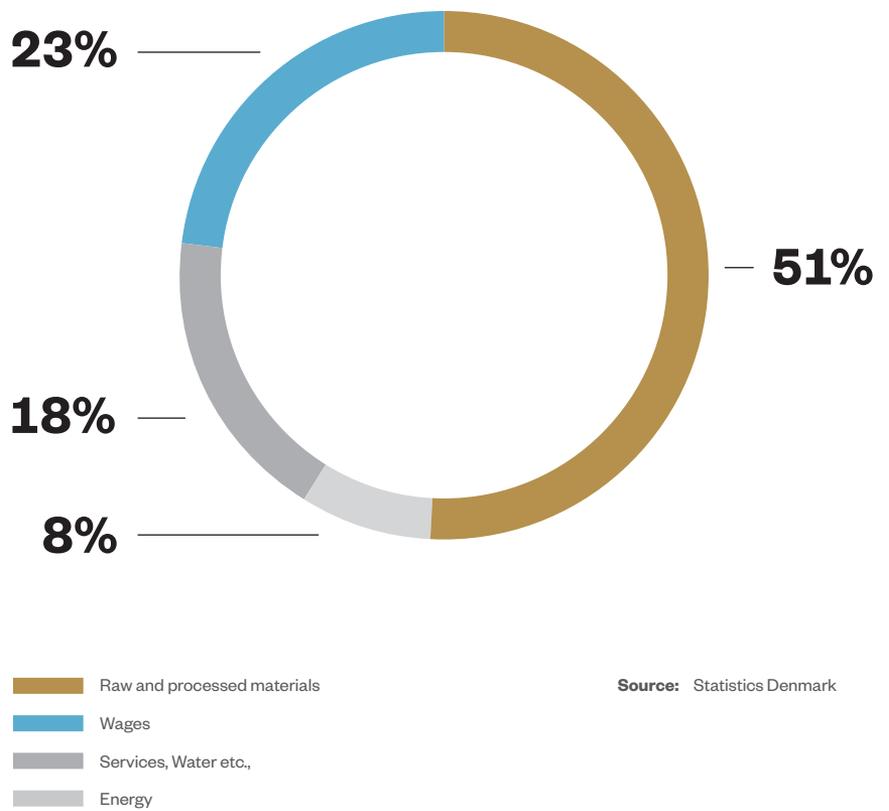
**75% of Danish industrial and service enterprises must work actively with the circular economy.**

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The amount Danish industrial enterprises spend on raw and processed materials is higher than their overheads for wages, energy and services combined. By thinking the circular economy into design and production, they can maximise the value of materials, products and services by focusing on limiting material consumption and waste, plus increasing lifetime, reparability and recyclability.

Better conditions and incentives are needed for working with circular design and production, and to increase awareness and skills levels. Product design and quality must make it possible for materials to be used repeatedly, and there must be more information on the circularity of products and materials. The legal framework must encourage resource effectiveness and circular production processes, whilst the supply of sustainable raw materials from farming to biorefining and cascade exploitation must be increased significantly to create the raw material basis of high value products and substitution of fossil sources.

**FIGURE 2.** Production costs in Danish industrial enterprises, 2013





## Case

### **New products made of recycled raw materials**

More and more of IKEA's products are made of recycled and recyclable raw materials. For example, IKEA has designed kitchen elements made of recycled plastic bottles and wood waste, without having to compromise on either quality or design, and without making the product more expensive.

Using recycled materials helps cut production costs, but does not mean having to lower standards for content of harmful substances or durability. IKEA has also focused on internal waste management in its stores, turning a 7-figured overhead into revenue totalling around DKK 800,000 in its Danish stores.

The Advisory Board for Circular Economy recommends:

- #10** Strengthen circular product policy, e.g. in the Ecodesign Directive
- #11** Incorporate circular economy into manufacturing industry
- #12** Create a circular building regulation
- #13** Develop standardised building and product passports
- #14** Improve the framework condition for biorefining
- #15** Establish new value chains for agricultural crops that make better use of photosynthesis
- #16** Optimise the use of animal products

# Consumption – optimising with lifecycle perspective



## Signpost

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**The private and public sectors must be able to procure on circular principles.**

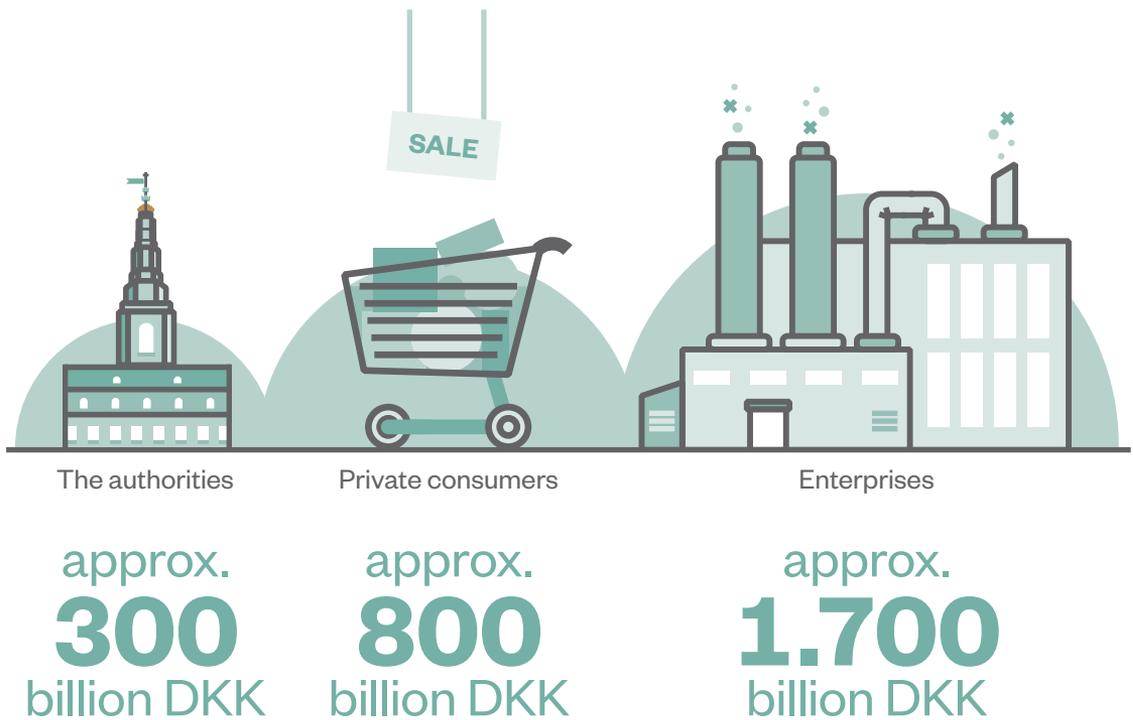
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By changing consumption and consumer habits, industry, the public and the authorities can accelerate the transformation towards a circular economy. By renting and sharing products – or buying the product as a service – the degree of utilisation can be increased. By demanding circular products via procurement requirements, money can be saved and recyclability increased. The market for circular products and services will also be expanded and it becomes more attractive for designers and manufacturers to think circular. By continuously repairing and maintaining things, the lifetime of a purchase can be extended.

To accelerate the transformation to a more circular economy, the public sector needs to generate market pull. The purchasing habits of consumers must be more circular, and they must have better opportunities to choose products that support the transformation to a more circular economy.

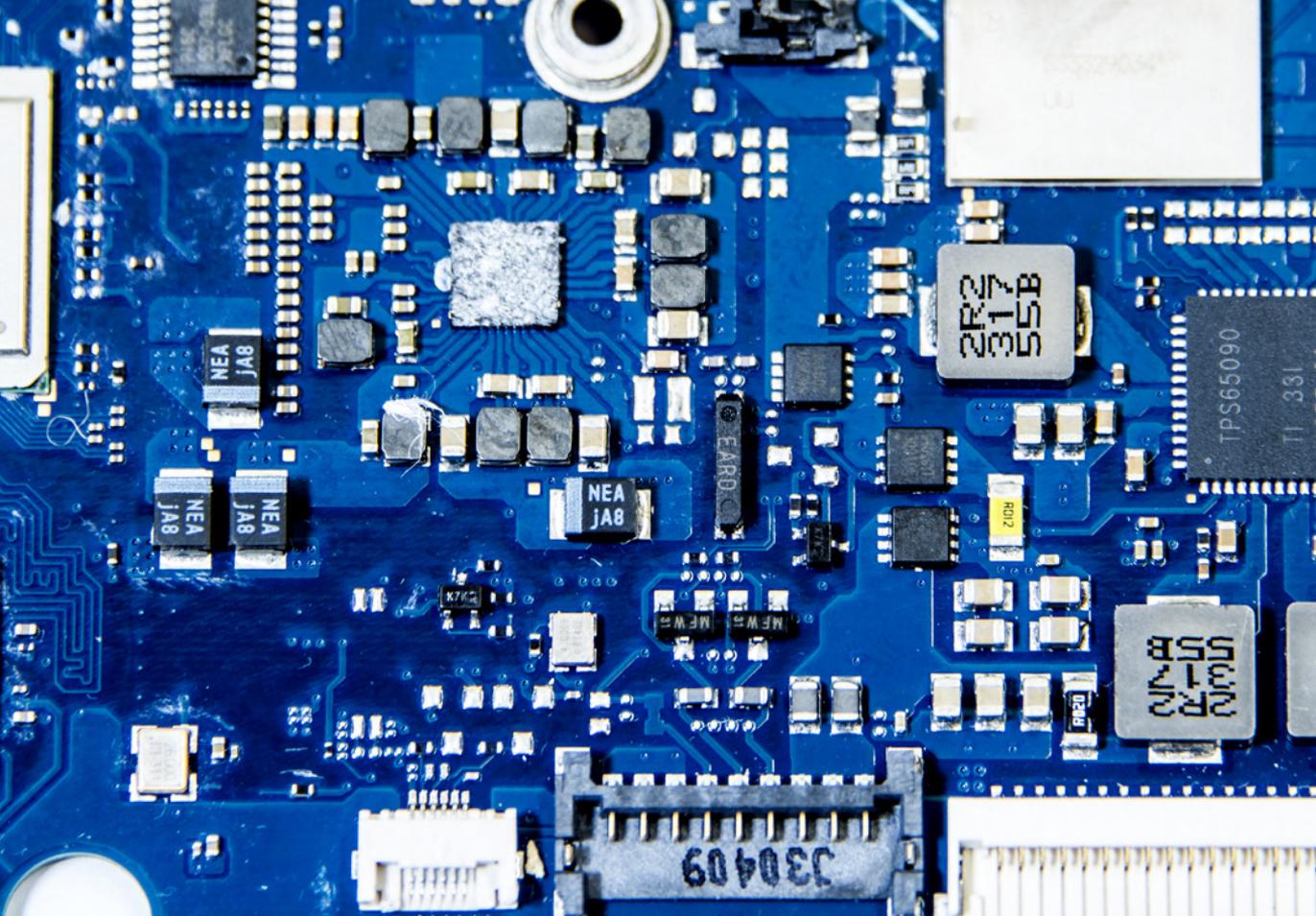
The need to make use of surplus capacity, e.g. of cars and buildings exists in the public authorities, in enterprises and for private consumers. A functional market for circular business models also needs to be created.

**FIGURE 3.** Annual purchasing by the authorities, private consumers and enterprises



**Source:** Statistics Denmark (2013/2015): Production overheads and annual domestic consumption, the Danish Competition and Consumer Authority (2016): Status of public procurement by competitive tender

**Note:** The figures include the purchase of goods and services.



## Case

### **Electronic products can be used again and again**

It takes 442 kg of resources to produce a new laptop computer. Many consumers replace electronic products after 3-4 years – way before they are worn out.

Tier1Asset buys PCs, tablets and smartphones. It deletes data, cleans, upgrades and sells the products again with a new guarantee. By doing so, it doubles the product's lifetime, reduces impact on the environment and at the same time is a sound profit.

## The Advisory Board for Circular Economy recommends:

**#17** The public authorities should build and procure on the basis of total costs and life-cycle calculations

**#18** Promote the circular economy through the way enterprises and the public authorities make their procurements

**#19** Develop circular aspects by relevant labelling schemes, and expand their use

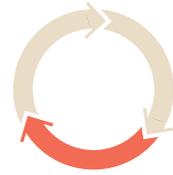
**#20** Promote use of surplus capacity, e.g. through sharing economy business models

**#21** Prevent food waste

**#22** Promote repair and reuse

# Recycling

## – greater value through clear framework conditions



### Signpost

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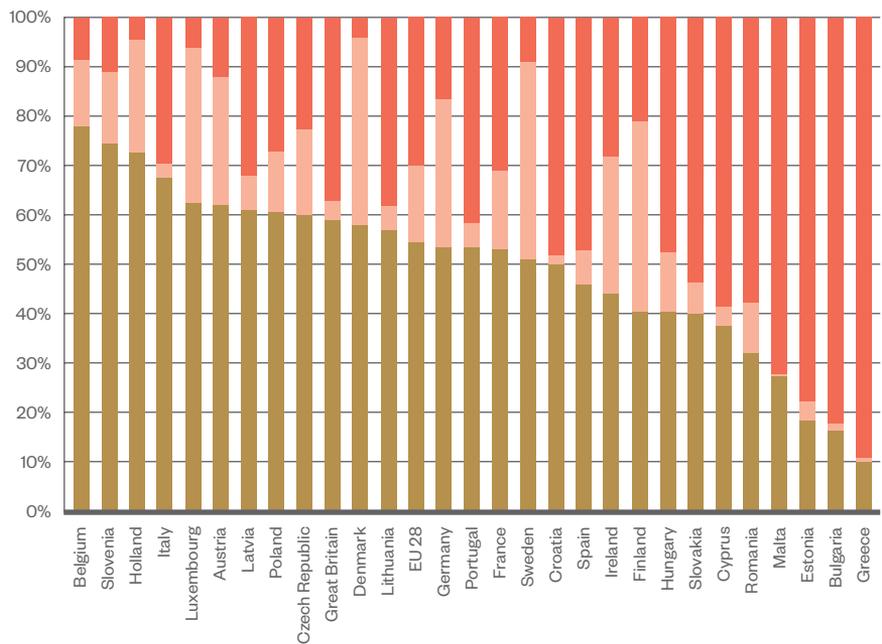
**Clear framework conditions are needed for a well-functioning market for waste and recycled materials.**

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Even though we design, produce and consume according to circular principles, waste will still be generated for many years to come. When waste cannot be avoided, the important thing is to recycle it with the maximum possible value and least possible impact on the environment. This could be achieved, for example, by improving waste separation, creating industrial symbioses and improving the options enterprises have for taking products back when they are discarded.

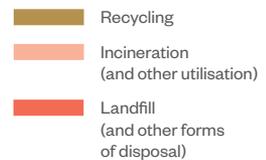
What's needed is organisation and rules that support waste being recycled into raw materials again. Waste separation and traceability of materials helps promote high quality recycled materials without hazardous substances. More and better recycling can improve the supply reliability of recycled materials for new production and enhance competitiveness, because it reduces costs for enterprises incurred on the procurement of raw materials and waste management.

**FIGURE 4.** Waste treatment in the EU in 2014



**Source:** Eurostat

**Note:** The figures shows total waste excluding soil and mineral waste according to Eurostat's waste indicator. Figures from Germany are from 2012, whilst other figures are from 2014. The figures on total waste in Denmark in 2014 have been adjusted by the Environmental Protection Agency, and the updated figures are not yet available in Eurostat's database. "Landfill (and other means of disposal)" include all forms of landfilling and incineration without energy use. "Incineration with energy use (and other utilisation)" includes incineration with energy use and backfilling (backfilling is limited, as soil and minerals are not included in this dataset). "Recycling" includes the recycling of inorganic and organic materials.





## Case

### Herning Vand

Herning Vand's new "struvite plant" benefits the environment, saves on maintenance and provides a totally new form of revenue in the form of phosphor production. The struvite plant extracts phosphor from waste water to the benefit of the local aquatic environment, and the sale of phosphor provides a revenue stream to the benefit of Herning Vand. The lower levels of phosphor in purified waste water also mean a significant saving on the maintenance of pipes and pumps at the sewage plant.

The partnership running the struvite plant believes that there is potential for between 30-40 new plants nationwide. The export potential is deemed to be worth DKK 1.6 billion over a ten-year period.

**The Advisory Board for Circular Economy recommends:**

- #23** Harmonise the collection of household waste by the local authorities to promote recycling
- #24** Clarify the framework conditions for the waste sector, and create a better supply of recycled materials
- #25** Improve competitive conditions on the market for waste and recycled materials through harmonised classification and more rigorous, risk-based inspection of the industry
- #26** Disseminate selective demolition of buildings
- #27** Introduce an expanded, circular producer responsibility scheme for waste of electronic products

# The food sector can increase the amount and value of products

The food sector has enjoyed considerable success converting biomass into high value products, and therefore represents a significant and important part of the Danish economy and export. There is massive economic and environmental potential in getting better at high-value exploitation of Danish biomass, currently used for low-value purposes, or not used at all. Biorefining enables the conversion of biomass into biological components that can be rebuilt and used for numerous purposes, a process known as 'cascade utilisation'. The results of biorefining include sugar, lignin, methane, fats and proteins that can be used in the production of e.g. medicines, foods, animal feed, materials and energy.

Cultivation systems and crops must be revised to make use of photosynthesis for longer periods of the year. That will significantly increase the range of high-value sustainable biomass products from agriculture and forestry, and thus help substitute fossil materials. The basic conditions and incentive structures for biomass utilisation must be adjusted to promote biorefining that leads to cascade utilisation and high value growth. Prevention and recycling of food waste throughout the value chain shall ensure greater economic value from food production and recirculation of nutrients.



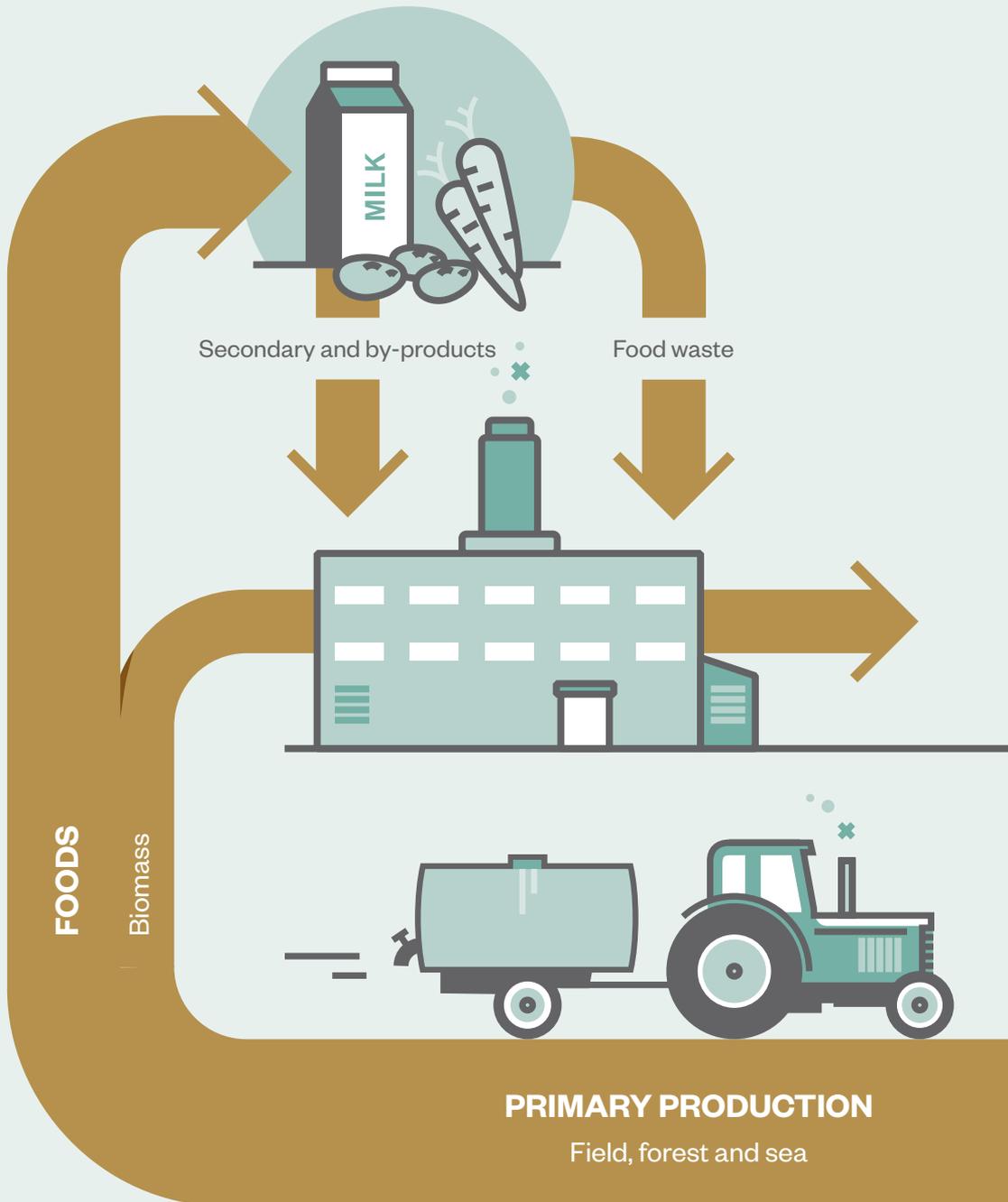
## Case

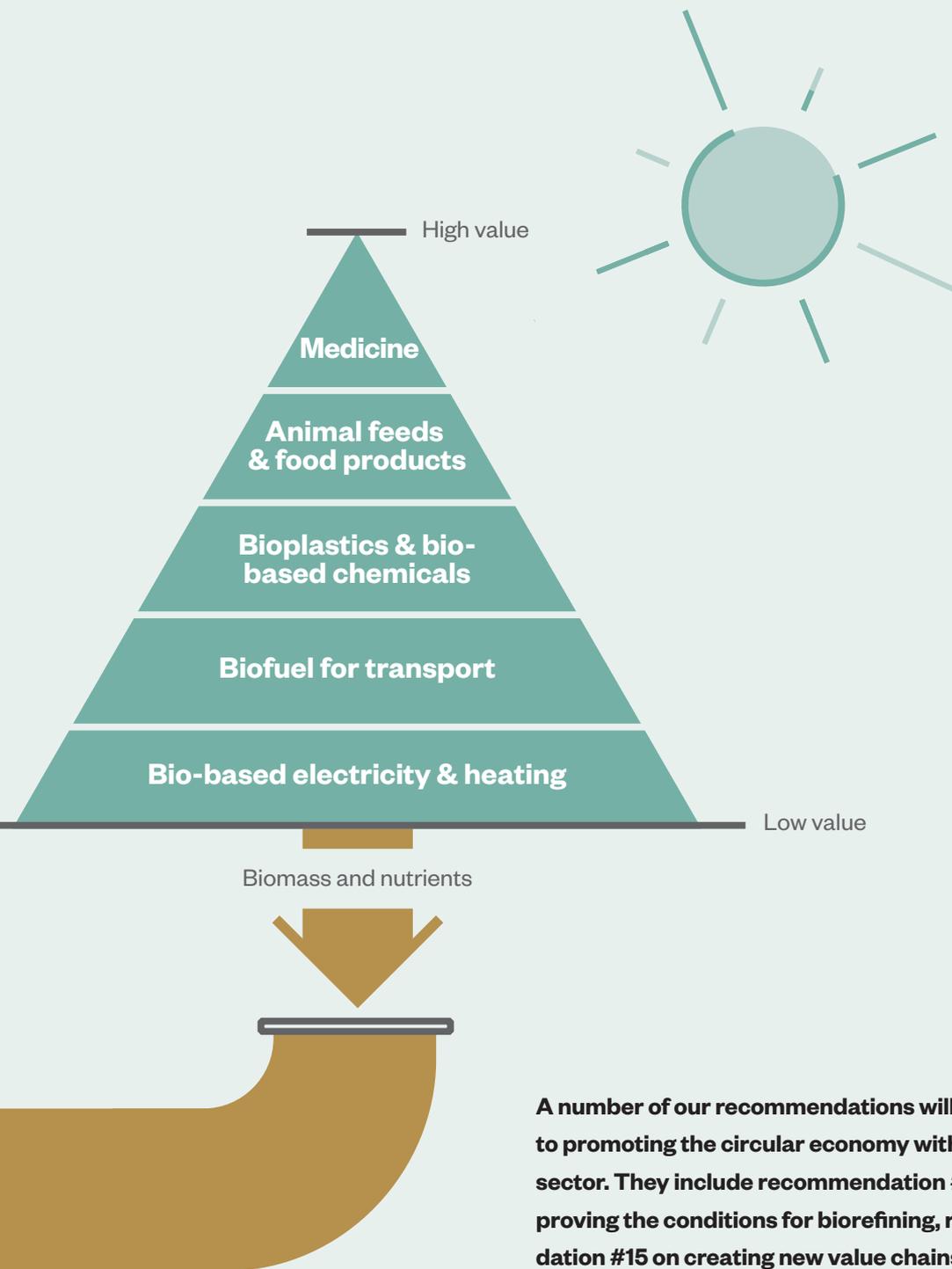
### **From fertiliser to valuable protein**

Arla Foods has developed high-value products from whey since the 80s. Whey is a by-product from the production of cheese, and used to be used as animal feed.

5 million tonnes whey from home and abroad are now converted into such products as dietary supplements, infant formula milk and ingredients such as carbohydrates, proteins and minerals used in the food sector and medicine industry.

## Circular economy in the food sector





**A number of our recommendations will contribute to promoting the circular economy within the food sector. They include recommendation #14 on improving the conditions for biorefining, recommendation #15 on creating new value chains for agricultural crops, recommendation #16 on optimising the use of animal products, and recommendation #21 on preventing food waste.**

# The building and construction sector can pull a heavy load

**The building and construction sector alone accounts for a third of the total amount of waste in Denmark. And large amounts of waste from the sector are currently recovered at low value. There is massive economic and environmental potentials in making this sector more circular.**

**Rules and financial incentives shall promote resource efficiency and circular building and demolition processes without compromising health, safety and durability. The public sector must stimulate the demand for circular building solutions by using the principles of total cost of ownership, in which the building's running costs, income and expenses from waste management and sales are factored in. The market for recycled materials must be enhanced by separating hazardous substances, and preserving valuable materials when buildings are demolished and dismantled. The use of surplus capacity in buildings must also be optimised. By doing so, the value of both buildings and construction and demolition waste can be increased while realising long-term socio-economic gains.**



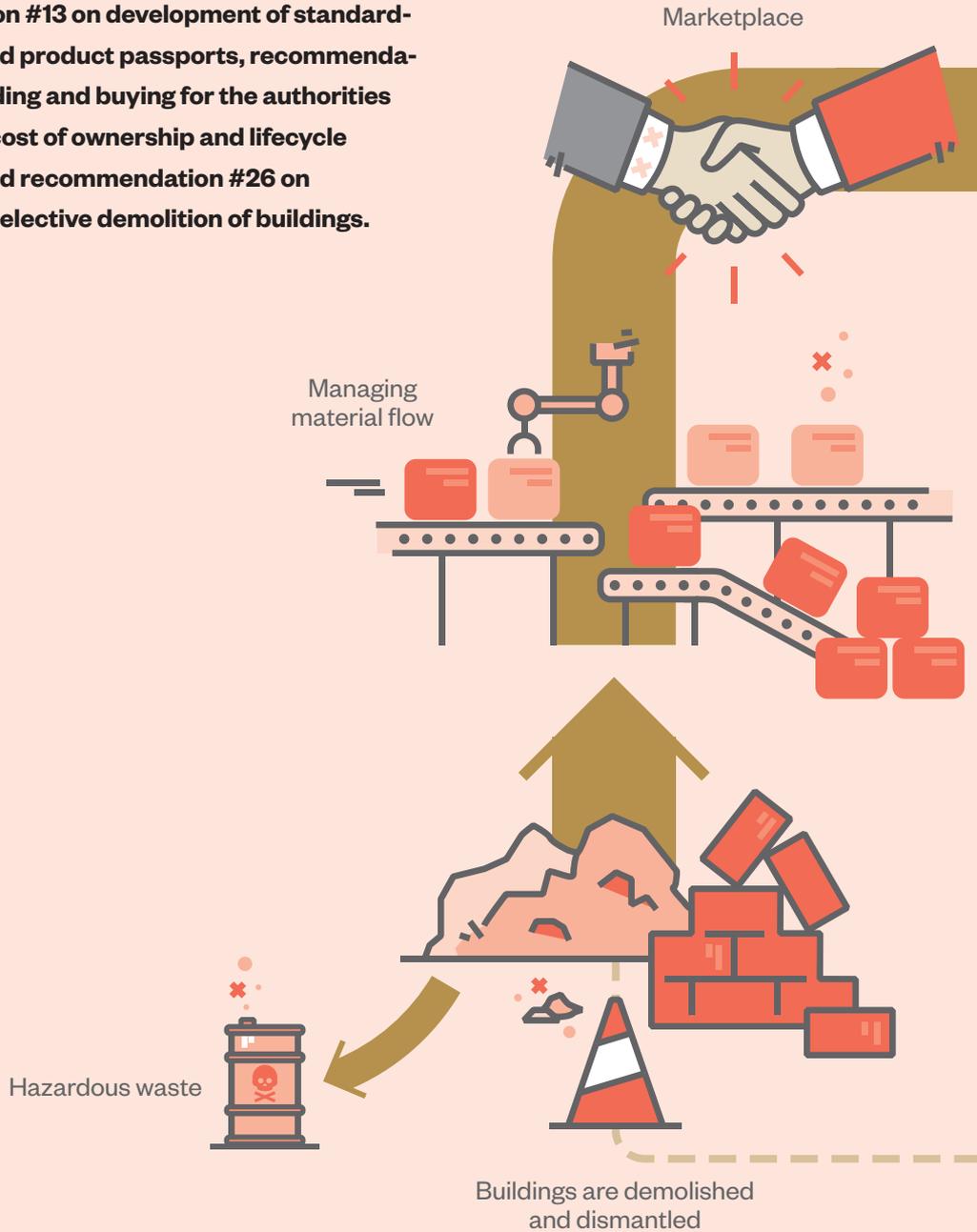
## Case

### **Building with used materials**

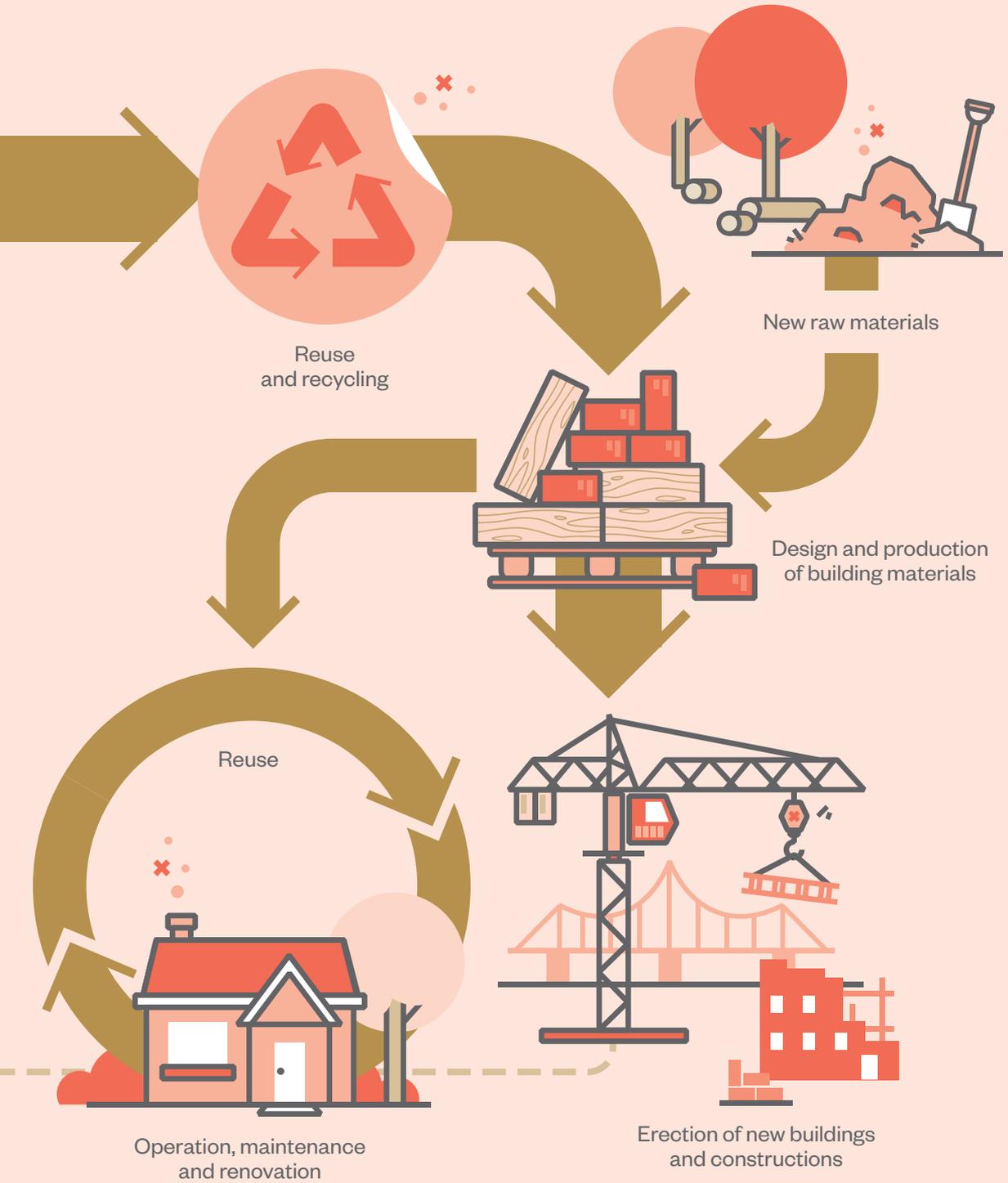
The walls of Copenhagen Towers should originally have been clad with glass and aluminium. But instead the Lendager Group used heartwood from old windows as an innovative form of panelling. The acoustic ceilings are made of recycled plastic bottles converted into a grey felt in a waffle pattern designed to absorb sound. Discarded carbon fibre sails from America's Cup racing yachts have been cut and used for covering elevator towers instead of glass, a more attractive, interesting and eco-friendly result.

Reused and recycled materials have overall reduced the energy need for material production by two thirds. And the actual building has not been more expensive than if virgin materials had been used.

**A number of our recommendations contribute to promote the circular economy within the building and construction sector. They include recommendation #12 on rules for circular Building Regulations, recommendation #13 on development of standardised building and product passports, recommendation #17 on building and buying for the authorities based on total cost of ownership and lifecycle calculations, and recommendation #26 on disseminating selective demolition of buildings.**



# Circular economy in the building and construction sector



# The industrial sector can cut costs and change business models

**The industrial sector in Denmark, which includes the manufacture of machinery, furniture, metal, plastic, textile, electronic and medicinal products, already has a high degree of resource efficiency, recycling 71% of its waste in 2015. But there's still plenty of room for improvement. The costs of raw and processed materials account for around half of production costs in Danish industrial enterprises. The optimal use of existing technologies can help industry reduce material costs by DKK 5-11 billion annually, equivalent to payroll savings of between DKK 9 and 19 per working hour.**

**A more transparent market needs to be created in relation to the circularity of products and materials. Industry's business models need to focus more on circular solutions and services instead of solely on the manufacture of products. The value utilisation of waste must also be enhanced through high quality and greater scale of collection and separation. Together, they will increase access to new markets and boost competitiveness through reducing costs for materials, products and waste management.**



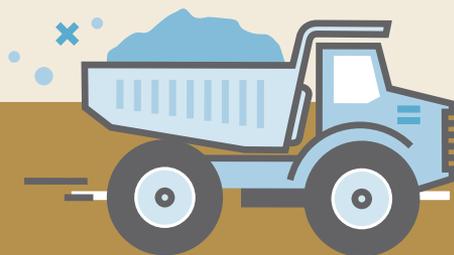
## Case

### **From waste to product**

The enterprise convert transforms waste from industrial production into products. Examples include textiles or wood waste which can be broken down to fibres or granules bound together by thermoplastic materials. The material is then formed into two mats that can be paper thin or as thick as insulation mats.

The mats can be used for many purposes, including as insulation or for furniture, when they are pressed into the shape of a chair, for example. The concept is that the enterprise generating the waste can take it back as a product.

## Circular economy in the industrial sector



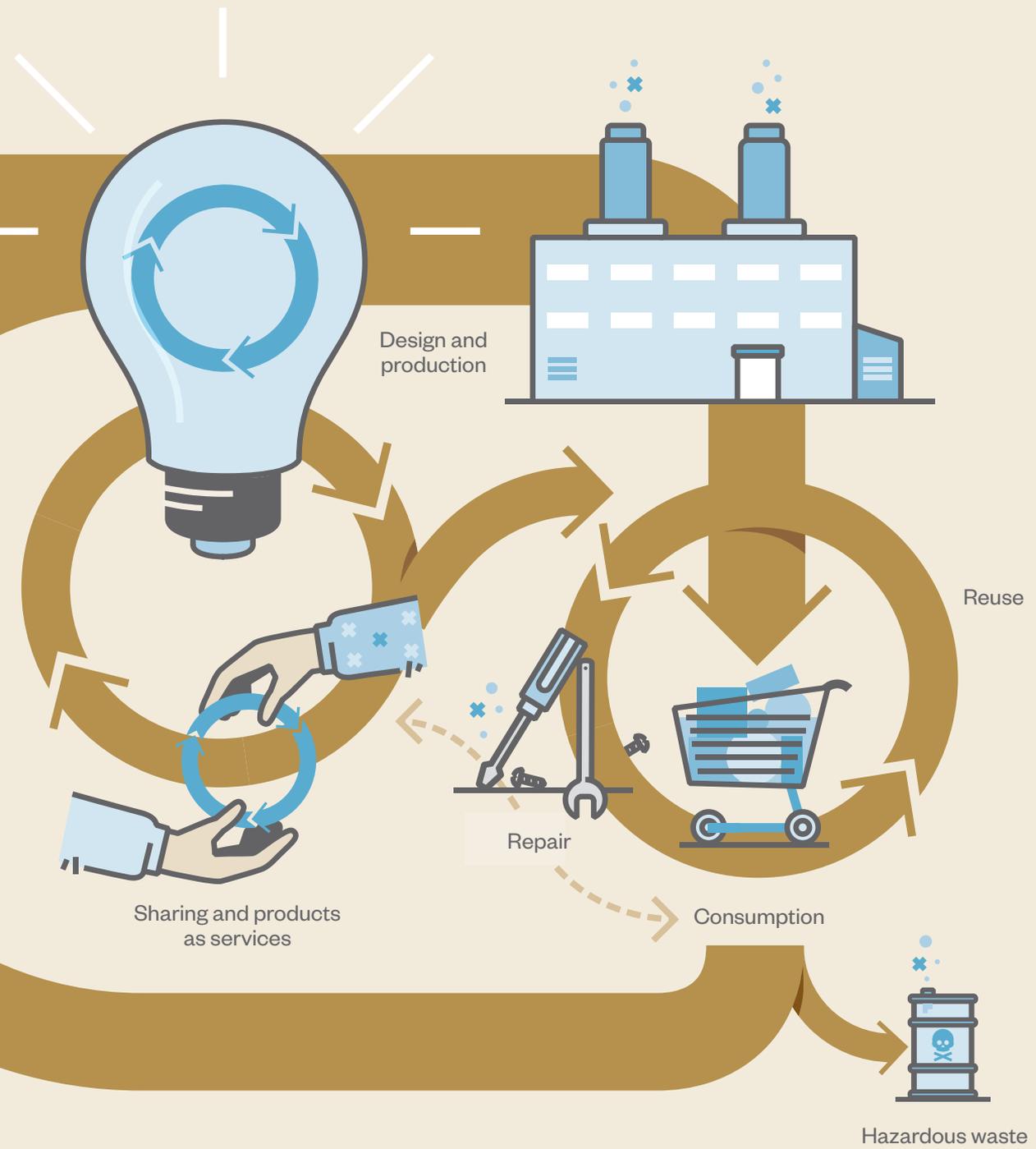
NEW RAW MATERIALS

**A number of our recommendations will contribute to promote circular economy within the industrial sector. They include recommendation #10 on enhancing a circular product policy in the Ecodesign Directive, recommendation #11 on integration of circular economy in the environmental permits of manufacturing industry, recommendation #22 on promoting repair and reuse, and recommendation #27 on a more circular expanded producers responsibility scheme for electronic products.**

Recycled materials



Recycling



# Recommendations

# # 1

## Make circular economy the driving force behind Danish industry

Many Danish enterprises – particularly SMEs – lack the skills, network and capacity to reap the potential benefits of circular product design, production processes and business models. It is a challenge for enterprises to incorporate circular economy into their core business and strategic management, because their existing networks, culture and know-how are based on linear business partnerships. It is the same for SMEs when assessing the business case of using new circular business models and technologies. **The Advisory Board recommends** the setting up of a national forum – "Circular Denmark" – able to bring together industry, the authorities and academic institutions to collaborate on applicable knowledge across sectors and value chains, to help bring about the circular transition of the Danish business community. Circular partnerships should also be set up for phosphor, electronic products, building/engineering, plastics, textiles and financing able to bring enterprises together in new installations across value chains. Finally, an initiative to promote circular business development should be created, from which SMEs can draw information on circular business opportunities and joint financing for specific consultation on their circular potential and the practical implementation of circular business models. The initiative will build know-how and skills in SMEs, create a network across the entire value chain and supply expert consultancy on circular business models.

# # 2

## Set up a single point of entry to the authorities for enterprises that encounter barriers to circular transition

Enterprises working with the circular economy encounter new and often more regulatory barriers than others. This is due to the fact that circular business models are innovative, and that regulations do not accommodate enterprises working across existing value chains and regulation. The consequence can be a long wait before a regulation is clarified. Such a waiting period can often impede the development of new circular solutions. **The Advisory Board recommends** that the government sets up a single point of entry to the public authorities, where circular enterprises and partnerships encountering barriers to the development of new circular solutions and business models can enter into contracts – known as "Green Deals" – with the authorities to remove such barriers. A Green Deal commits the relevant authorities to work with the enterprise or partnership to find solutions that can accelerate the development of circular solutions within existing regulations.

# #3

## Create circular municipalities

Local authorities play an important role in the transformation to a circular economy, as they are often the first contact with the public authorities – for enterprises and the public. They are also a large service organisation, which uses and procures large volumes of products and services. But they are bound by a number of rules, which can be a barrier to the circular economy. **The Advisory Board recommends** the setting up of a number of circular municipalities committed to accelerating the transition to a more circular economy with quantitative targets and specific efforts within procurement, building, waste, sewage and utilisation of surplus capacity. They should have the status of 'free municipalities' able to be exempted from specific government rules by agreement. The circular municipalities will act as inspiration for others, and form the basis for possible adjustments to government regulations.

# #4

## Incorporate circularity into the macroeconomic models and statistics

When calculating economic growth and the consequences of political initiatives in economic macro models, the consequences for the environment linked to the consumption of natural resources are not factored in. **The Advisory Board recommends** incorporating environmental data from the green national accounts in the macroeconomic REFORM model and using the expanded REFORM model in the government's official calculations and publications. Better statistics on resource productivity and the development of the circular economy in general should also be produced. Expanding the macroeconomic models will make it possible to identify short- and long-term effects on the environment of structural policies.

## #5

### Develop standards that support the circular economy

There is a lot of uncertainty surrounding the qualities and amounts of recycled raw materials on the Danish market. International standards are vital to create confidence in content, traceability, quality and price, plus scale and security of supply on the market for recycled raw materials. Similarly, there is a lack of standards able to support the circular economy within product design and production processes, functional requirements, remanufacture, reuse, waste management, digital solutions and service contracts. **The Advisory Board recommends** that Danish Standards sets up and runs secretariats for the development of certain international standards designed to promote the circular economy, and that Danish enterprises and other stakeholders will actively participate in greater transparency through standards that will help create a more efficient market for circular solutions by increasing confidence between those involved. By taking part in the development of standards, enterprises can enhance their own competitiveness and improve access to new markets.

## #6

### Incorporate circular economy into the entire education system

The education system does not provide the necessary know-how and courses on the circular economy. Employees in enterprises lack the skills and know-how to realise the economic and environmental potential of a circular economy. **The Advisory Board recommends** that skills and know-how on the circular economy are integrated into all levels of the education system. This applies to primary education, vocational and upper secondary education and relevant higher education courses. Public and private sector bodies should also set up further education courses on the circular economy with special focus on the needs of SMEs. A higher education level on the circular economy will give productivity and wealth gains for society. When employees are qualified with skills and know-how on the circular economy, they will help to ensure the competitiveness of their enterprises.

# #7

## Promote research, development, testing, demonstration and market development for circular solutions and technologies

Transformation to a circular economy requires investment in research, innovation, development, testing, demonstration and market development of technologies and solutions within product design, production processes, remanufacture, recycling, bio-based materials, circular business models and products without problematic chemicals. **The Advisory Board recommends** the allocation of new funding to the circular economy through long-term grants made to Innovation Fund Denmark, the Eco-innovation programme (MUDP) and the Market Development Fund, whilst existing subsidies and research grants are screened with regard to integration of the circular economy within them. Collaboration between enterprises and research institutions will ensure that research results in solutions can easily be put into practice, and thus accelerate the transition to the circular economy and contribute to growth, employment and export of the environmental approvals.

# #8

## Boost financing for the acceleration of circular enterprises

There are a number of problems facing circular enterprises in terms of finding the necessary financing. This is due to some circular enterprises having a technical approach rather than a commercial one, and that the use of some circular business models can lead to a relatively strong balance sheet but low liquidity, and that there can be greater uncertainty and limited experience in the financial world when it comes to financing and investing in circular initiatives and enterprises. **The Advisory Board recommends** researching ways of setting up a circular investment fund under private control, or under The Danish Growth Fund. The Danish Green Investment Fund should also be given the chance to provide equity and guarantees, and to generally be able to increase lending. New financial instruments should also be developed aimed specifically at circular enterprises. All-in-all, this will help boost the financing of circular enterprises through more effective use of existing capital and enhanced attraction of capital to a circular economy.

# #9

## Exploit the leading position of Denmark within digitalisation and new technology to support circular transformation

A large number of technological and digital quantum leaps have been made within Block-Chain, Internet of Things(IoT), BigData, 3D printing, robot technology and sensors, with massive potential for enhancing circular business models. **The Advisory Board recommends** that the government sets up a partnership of well-established enterprises and small digital market leaders with the emphasis on combining know-how and experience within circular design and digitalisation to support circular business models, and to create a program able to match SMEs with a designer with relevant circular experience. Denmark is an international leader within digitalisation and design, something which Danish enterprises can exploit via targeted investment in the development of digital solutions within the circular economy.

# #10

## Strengthen circular product policy, e.g. in the Ecodesign Directive

The relevant product regulation does not boost the market for circular solutions, but primarily focuses on energy consumption in the use phase. That means that enterprises do not have sufficient incentives for circular design, and the public has limited choice of circular products and services. The result is that products are not designed to be repaired, dismantled, reused and recycled. **The Advisory Board recommends** that the government actively seeks to promote circular design via the EU Ecodesign directive, which could be gradually expanded to accommodate extra product groups. Denmark should also participate actively in the EU's development of a new method to quantify product environmental footprint (PEF), which gives Danish enterprises the chance to differentiate themselves on the international stage in relation to circular economy. International demand for circular product design and standardised accounting methods can boost resource productivity, promote innovation and strengthen Danish exports of circular technologies and solutions.

# # 11

## Incorporate circular economy into manufacturing industry

National and European regulation of industrial enterprises does not support the circular economy sufficiently. Potential savings of over DKK 20 billion p.a. have been estimated in more resource-effective and circular production in Danish industrial enterprises. But SMEs in particular often lack the know-how, skills and tools for practical and commercial aspects of the circular economy to be able to realise such potential. **The Advisory Board recommends** that environmental permits are made more flexible to promote the transition of enterprises to the circular economy, that the government permanently strengthen Danish efforts to promote the circular economy in the BAT reference documents for specific industry sectors, and that inspection personnel promote the circular economy through Guides should also be produced on the circular economy for environment and sewage permits. Strengthened Danish input concerning the EU's environmental terms will benefit the competitiveness of Danish enterprises and result in more standardised rules in the EU. More flexible environmental permits will allow enterprises to switch to more circular production faster and easier.

# # 12

## Create a circular Building Regulation

The building industry is challenged by relatively low productivity improvements, high waste production, heavy demand for new resources and widespread use of hazardous substances. The construction and running of buildings accounts for 40% of society's consumption of materials and energy. **The Advisory Board recommends** the introduction as from 2020 of an information requirement for all new buildings and large-scale renovation projects covering material content, the amounts of reused, recycled and recyclable materials, plus the amount and number of undesirable substances used in the building. As from 2020, a voluntary sustainability classification system should be introduced that forms the basis for a mandatory sustainability classification class from 2025. Greater focus on the circular economy in the Building Regulations will ensure greater productivity in the building, lower costs for renovation and maintenance, less extraction of new raw materials, lower CO<sub>2</sub> emissions and better indoor climate, external and working environments.

# # 13

## Develop standardised building and product passports

We do not know the actual composition of materials and hazardous substances in many buildings and products. That makes it expensive to maintain and renovate buildings or repair products while they are still in use. When a building or product reaches the end of its life and has to be demolished or dismantled, the lack of knowledge of material composition and content of hazardous substances means the loss of considerable value. **The Advisory Board** recommends the development of a standardised, digital and freely available building passport, plus a product database for suppliers with digital fact sheets for building products. Danish Standards should also work to set up and run a secretariat for the development of an international standard for product passports. Standardised building and product passports will ensure that awareness of content can be maintained and traced, which makes it cheaper to maintain, repair and renovate, and making it possible to get more value out of materials and products in connection with reuse and recycling. Better identification of hazardous substances will promote healthy indoor climates and reduce negative impact on the environment by making greater reuse and recycling possible, whilst waste with hazardous substances will be landfilled to a greater degree.

# # 14

## Improve the framework conditions for biorefining

Through biorefining biomass is turned into high-value products. But the existing framework conditions encourage the use of biomass for energy use through subsidies and tax exemptions at the expense of biorefining and its high-value products. **The Advisory Board recommends** drawing up a National Bioeconomy Strategy able to form the basis for future prioritisation of biomass production and high value use of different types of biomass, and that the framework conditions and incentive structures for biomass use are revised to promote biorefining. A coherent strategy and adjustment of the framework conditions will make it possible to develop a commercially-sustainable biorefining sector in Denmark able to contribute to optimising value-exploitation of biomass.

# # 15

## Establish new value chains for agricultural crops that make better use of photosynthesis

Better use of cultivation systems and crops that make use of photosynthesis for longer periods of the year will make it possible to get 50% more biomass out of the biological circuit in Denmark, while reducing impact on the environment. Higher production of green biomass can only become commercially attractive when the proper biorefining plant is also set up, which can produce e.g. protein concentrate, green pellets and grass juice for high value purposes in animal production. The challenge is to set up the entire value chain simultaneously to avoid the risk of any individual enterprise becoming too big. **The Advisory Board recommends** giving subsidies for the building of a number of small, decentralised biorefineries; using animal feed components produced from previously unexploited biomass as fed for animal production, and that the government campaigns for the reform of the EU's agricultural policy promoting biorefining. Setting up biorefineries and demand for their products will create a cohesive value chain, which is essential for the increased cultivation of crops with high profit and reduced impact on the environment. A change in EU agricultural policy will also help to ensure the necessary regulatory framework for the new value chains.

# # 16

## Optimise the use of animal products

Animal by-products include leftovers from slaughterhouses and the animal feeds industry that cannot be consumed by animals or humans because of the risk to food safety. Large volumes of biomass are therefore used for low value purposes, such as biogas and biodiesel. But there is potential to exploit those elements of animal by-products for higher value purposes, without any risk to animal and human health. **The Advisory Board recommends** making it possible to feed pigs with processed animal protein from poultry and vice versa, and that further high value potential is exploited in line with the development of new technological methods, and when there is sufficient scientific documentation for the food safety aspects. By updating legislation in line with the latest technological developments, Danish enterprises will be better able to maximise the value in such animal products, e.g. by developing new products within medicine, animal feeds and protein sources.

# # 17

## The public authorities should build and procure on the basis of total costs and lifecycle calculations

Public building contracts and procurement often focus solely on the purchase price instead of the total lifecycle costs, as operation and construction budgets are often not looked at together. Moreover the total costs calculations made do not include income and expenses linked to waste management and onward sale. **The Advisory Board recommends** that the government develops new lifecycle and total cost of ownership tools, expands existing total cost of ownership tools to incorporate income and expenses linked to waste management and onward sale, and introduce a requirement on the use of total cost of ownership tools as the primary economic award criteria when procuring certain products and for all public buildings costing over DKK 5 million to build. Increased use of total costs and lifecycle calculations as the basis of decisions for public building contracts and procurement can reduce the overall costs for the public authorities and boost market pull for circular solutions to the benefit of the environment.

# # 18

## Promote the circular economy through the way enterprises and the public authorities make their procurements

The public sector and private enterprises spend around DKK 300 and 1,700 billion respectively each year on goods and services, making it possible for them to promote a market for circular solutions. But purchasers often lack any knowledge of how to incorporate relevant requirements for suppliers to promote circular products and services. **The Advisory Board recommends** that the public authorities and private enterprises lay down requirements when buying in certain product areas that promote the circular economy, and expand their use of function tenders focusing on effect rather than activities. The government should also encourage circular procurement in local and regional authorities, state institutions and enterprises drawing inspiration from cases, codex, mobile task forces and the development of the partnership for green procurement for the public authorities, and the forum for sustainable procurement. More demand for circular solutions will lead to benefits for the environment, promote innovation through focus on the procurement of services instead of products and can mean a reduction in total costs of procurement based on total cost of ownerships.

# # 19

## Develop circular aspects by relevant labelling schemes, and expand their use

It is hard for consumers and enterprises to choose products that support the circular economy, as Danish enterprises lack a tool enabling them to clearly communicate on circular products. **The Advisory Board recommends** that the government develops existing official eco-labels (the Swan and the Flower) further, to bring further focus on circularity, and develops new eco-label criteria for more services. A drive to promote the use of eco-labels within product areas with a limited market share should be initiated, along with an information campaign on how eco-labels support the circular economy. Doing so will give Danish enterprises better opportunities to market circular solutions and give consumers a better chance to choose circular products. Expanding eco-labels will ensure a smaller environmental footprint and positive socio-economic consequences, including as a result of less hazardous chemicals.

# # 20

## Promote use of surplus capacity, e.g. through sharing economy business models

Utilisation of the full potential of sharing economy is hindered by uncertainty surrounding legislation, insurance and a lack of confidence in sharing economy solutions. Fluctuations in surplus capacity, uncertainty over whether the business model is viable, and a shortage of digital solutions are preventing enterprises from being able to exploit the full potential. **The Advisory Board recommends** launching a pilot scheme concerning sharing economy business models between enterprises, providing more guidance for enterprises on the rules in force, advising public institutions to a higher degree on how to exploit surplus capacity and introduce sharing economy basic allowances contingent on paying tax via digital tax returns. Provision of guidance and economic incentives will make surplus capacity the objective of value-creating sharing economy activities to a greater degree.

# #21

## Prevent avoidable food waste

We throw away around 700,000 tonnes of food in Denmark every year that could have been eaten. Food is wasted at every stage of the food product value chain from farm to table. Household waste is around 260,000 tonnes p.a., whilst retailers and enterprises within the food product sector waste 227,000 tonnes p.a. The potential savings are not realised at the moment because enterprises are unaware of the economic potential represented by reducing food waste, and the effect of a range of initiatives. **The Advisory Board recommends** the development of information material and guides targeted at food enterprises and consumers, the establishment of stronger collaboration between the public and private sectors across the food value chain, and encouraging food enterprises to avoid setting use-by dates that are unnecessarily short. By reducing food waste, enterprises can reduce their overheads and impact on the environment.

# #22

## Promote repair and reuse

Consumers find it hard to determine the quality and lifetime of various products. Meanwhile, spare parts often become unavailable after a relatively short period, and repairs are often expensive. The VAT scheme on used goods is created to ensure paying double VAT for used goods in production is avoided, but enterprises often fail to use the scheme, which they perceive as being very bureaucratic. **The Advisory Board recommends** that enterprises inform consumers better on the expected lifetime of products, and the availability of spare parts within certain product areas. The greater use of VAT regulation scheme should also be promoted and their administration simplified. Better information will expand the market for products with long lifetime and products that can be repaired, and better use/administration of the VAT scheme used on goods rules will promote reuse, remanufacture and repairs etc.

# #23

## Harmonise the collection of household waste by the local authorities to promote recycling

We have a non-harmonised waste system, in which local authorities themselves devise their collection schemes for household waste and their own separation criteria. The result is a lack of economies of scale for waste treatment, and sub-optimal solutions for waste collection. **The Advisory Board recommends** the introduction of national separation criteria for household waste and the development of a limited number of local authority collection programs from which individual local authorities can choose. Such programs must take into account the differences between rural and urban areas, multi-storey dwellings and single-family housing. By harmonising the collection of household waste, the amount and quality of recycling can be increased whilst gaining socio-economic benefits and saving money for the consumer by cutting the average waste collection charge.

# #24

## Clarify the framework conditions for the waste sector, and create a better supply of recycled materials

Uncertainty over the framework conditions of the waste sector has hindered development and innovation within recycling. The assignment right over the waste of local authorities has discouraged investment in separation facilities. Over-capacity at local authority-owned waste incineration plants also gives them an economic incentive to assign waste to their own incineration plants rather than for recycling. **The Advisory Board** recommends scrapping the municipal assignment right, so that enterprises have a free hand to decide where their waste is sent. The Advisory Board also recommends that the local authorities continue to be responsible for collection and should expand their household waste treatment, whilst the public are allowed to use other schemes as a supplement to local authority waste collection. Opening the waste sector up to competition will lead in time to more recycling, because the capacity of incineration plants will be reduced. It will also encourage the establishment of a number of large, private separation facilities for e.g. plastic, and ensure grounds for realising the benefits of making waste incineration more efficient.

# #25

## Improve competitive conditions on the market for waste and recycled materials through harmonised classification and more rigorous, risk-based inspection of the industry

The administrative practice of classification of waste and recycled materials etc. varies from one local authority to another, and a number of them do not inspect how enterprises deal with their waste. The result is barriers for enterprises due to different classifications between local authorities, and unequal competitive terms for industry between local authority boundaries. **The Advisory Board recommends** to gather administration and inspection related to classification of waste and recycled materials etc. on a single authority, working for international criteria for the End of Waste phase and the introduction of more robust and risk-based supervision. By creating more standardised and predictable rulings, fairer competition regardless of local authority boundaries and by giving enterprises the same opportunity to deal with their waste anywhere in the country, recycling can be increased and a better-functioning, large-scale market for waste and recycled raw materials created, improving the business case for recycling.

# #26

## Disseminate selective demolition of buildings

In the event of rapid, unplanned demolitions, the building materials are often so mixed up that it is difficult to separate the valuable parts of the waste. The risk is also greater of hazardous substances being recycled or recovered as hardcore rather than being properly processed for landfill. "Selective demolition" minimises the value loss of building materials. **The Advisory Board recommends** conducting an analysis to define criteria for selective demolition covering entire buildings and large-scale renovation projects. A demolition plan should be drawn up prior to selective demolition, which identifies materials and the content of hazardous substances, assesses the recycling/reuse value of the materials and specifies how demolition is to be performed. The plan should be compiled by a certified enterprise or specially-qualified person. Selective demolition increases the value of building materials, and improves protection of the environment through waste management.

# #27

## Introduce an expanded, circular producer responsibility scheme for waste of electronic products

Electronic waste products contain a number of valuable metals and materials, but the market potential of around DKK 9 billion is hardly utilised today. Among other factors this is due to the indication that up to 50% of items being collected outside the official collection system, recycling value is lost in collection that focuses on recycling, and that there is little enthusiasm in the current market structure for investment in the necessary technology. **The Advisory Board recommends** that certified enterprises are allowed to collect waste electronic products from households for reuse and recycling. Collection should also be optimised to retain the reuse potential, and a certification scheme should be introduced for the reuse of waste electronic products. The revised and circular producer responsibility scheme for waste electronic products can help realise the market potential for electronics and waste electronics to keep value in circulation longer, and achieve a savings in resources of around 5,000 tonnes p.a.



# The Advisory Board for Circular Economy

**The government set up the Advisory Board for Circular Economy in October 2016, consisting of 12 industry leaders. The Advisory Board's aim is to devise a vision and targets for the transformation of Danish industry to a more circular economy by 2030, and to make recommendations for specific initiatives able to encourage the transformation, including those that industry is able to launch itself. This report contains the main results of the work of the Advisory Board for Circular Economy.**

Between November 2016 and May 2017, the board held four meetings and six committee meetings focusing on certain sectors with the greatest potential (food products, building and construction plus industry) and the different links of the value chain – design, consumption and recycling.

During the process, the board consulted a wide range of stakeholders and set up an open web portal to receive external input. Over 120 suggestions for ideas were received as a result of dialogue.

Qualified feedback was given on 23 March 2017 to initial thoughts on the circular economy from 300 delegates to a conference held at The Confederation of Danish Industry.

A large number of private individuals, enterprises and organisations have thus contributed valuable and constructive input to the board's work. We would like to thank them all.

## The Advisory Board for Circular Economy consists of



**Flemming Besenbacher**  
(Chairman)  
Chairman of the Board,  
Carlsberg Group



**Aja Guldhammer**  
CEO, Reshopper



**Anders Byriel**  
CEO, Kvadrat



**Pernille Blach Hansen**  
Senior Director, LEGO



**Christian B. S. Christensen**  
CEO, Solum Gruppen



**Mik Kristensen**  
CEO, Nykredit Leasing



**Franz Cuculiza**  
CEO, Aage Vestergaard Larsen



**Martin Petersen**  
CEO, EcoXpac



**Matias Møl Dalsgaard**  
CEO, GoMore



**Jais Valeur**  
CEO, Danish Crown



**Kasper Guldager**  
CEO, GXN



**Jeanett Vikkelsøe**  
CCO/CSO, Marius Pedersen

## The circular value chain

- #1** Make circular economy the driving force behind Danish industry
- #2** Set up a single point of entry to the authorities for enterprises that encounter barriers to circular transition
- #3** Create circular municipalities
- #4** Incorporate circularity into the macroeconomic models and statistics
- #5** Develop standards that support the circular economy
- #6** Incorporate circular economy into the entire education system
- #7** Promote research, development, testing, demonstration and market development for circular solutions and technologies
- #8** Boost financing for the acceleration of circular enterprises
- #9** Exploit the leading position of Denmark within digitalisation and new technology to support circular transformation

## Design and production

- **#10** Strengthen circular product policy, e.g. in the Ecodesign Directive
- **#11** Incorporate circular economy into manufacturing industry
- **#12** Create a circular Building Regulation
- **#13** Develop standardised building and product passports
- **#14** Improve the framework condition for biorefining
- **#15** Establish new value chains for agricultural crops that make better use of photosynthesis
- **#16** Optimise the use of animal products

## Consumption

- **#17** The public authorities should build and procure on the basis of total costs and lifecycle calculations
- #18** Promote the circular economy through the way enterprises and the public authorities make their procurements
- #19** Develop circular aspects by relevant labelling schemes, and expand their use
- #20** Promote use of surplus capacity, e.g. through sharing economy business models
- **#21** Prevent food waste
- **#22** Promote repair and reuse

## Recycling

- #23** Harmonise the collection of household waste by the local authorities to promote recycling
- #24** Clarify the framework conditions for the waste sector, and create a better supply of recycled materials
- #25** Improve competitive conditions on the market for waste and recycled materials through harmonised classification and more rigorous, risk-based inspection of the industry
- **#26** Disseminate selective demolition of buildings
- **#27** Introduce an expanded, circular producer responsibility scheme for waste of electronic products

## The Advisory Board for Circular Economy's Recommendations to the Government

June 2017

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relevance to individual sectors

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- Building and Construction
- Industry

