

(The following text is the summary and background analysis of the plan for growth. The full version of the plan is available in Danish at www.evm.dk)

DENMARK AT WORK PLAN FOR GROWTH FOR WATER, BIO & ENVIRONMENTAL SOLUTIONS

The Danish Government
March 2013

Summary

For many years, as a result of increasing efficiency in raw materials extraction, global market raw materials prices were falling. In more recent years, however, this situation has been reversed as a result of the population increase and economic growth across the globe. The growth in demand for global raw materials is now increasing so rapidly that we are transitioning from an abundance to a scarcity of natural resources.

In the light of the increasing resource shortfall worldwide, it is set to become more attractive to develop and use water, bio and environmental solutions that have the potential to ease the pressure on scarce resources. Danish companies, in competition with foreign companies, stand to gain a share of a burgeoning global and European market for these solutions as long as the opportunities are exploited and Denmark's competitiveness improves.

Denmark already enjoys strong standing on the international market in a number of sub-areas. It is estimated that in 2010, some 53,000 people were employed in water and other environmental solutions. Denmark is producing technologies and solutions which in many different ways are serving to boost water and resource efficiency, improve the environment and reduce air pollution.

In 2010, enterprises within water, bio and environmental solutions accounted for value added worth just over DKK 30 billion, corresponding to just under 5% of total value added in the private sector.

The greater part of this value added worth stems from industrial production, but knowledge services also make a substantial contribution to the Danish economy in the shape of export revenue and jobs. With the right impetus, increased resource efficiency will serve to strengthen Denmark as a manufacturing country.

With this growth plan, the Danish Government, in partnership with enterprises and institutions, intends to pave the way for Denmark to unlock the commercial potentials within water, bio and environmental solutions with a view to safeguarding growth, employment and green transition. The Government's growth plan was drawn up on the basis of recommendations from the Growth Team for Water, Bio & Environmental Solutions.

The growth plan addresses areas in which Denmark has distinct strengths and potentials. However, in recent years, our capacity to translate this potential into growth and employment in Denmark has faltered owing to the declining trend in employment, especially in the manufacturing industry. The growth plan is designed to provide inputs on how Denmark can better retain both development and production jobs, while translating global growth in these business and indus-

try areas into new jobs in Denmark. From a multi-year perspective, it is believed that the potential exists for the creation of several thousand jobs in these sectors.

It is important to bear in mind that not all resource prices increase at the same rate, and that the technical capabilities for recycling and recirculation, for example, are at different stages. These factors are determinative for both private and national economic profitability. The Government thus attaches importance to a nuanced approach to promoting resource efficiency where the focus is on growth potentials.

The growth plan adopts 40 initiatives for promoting growth conditions for water, bio and environmental solutions.

The growth plan aims to strengthen and cultivate the Danish and European markets for resource-efficient solutions within water, bio and environmental solutions. The object is to facilitate new business opportunities, strengthen product and technology development by enterprises and support for this mission is drawn from focused interventions in the shape of research, demonstration, testing and international marketing of Danish strengths, etc.

Overall, the goal is for the growth plan to give Danish enterprises a stronger platform for claiming a greater share of the growing international market within the areas in which we possess strengths and competitiveness, and hence make a positive contribution to growth and job creation.

Initiatives within water solutions

Within water solutions, Denmark lays claim to strong competencies and established technologies, along with its potential to forefront new fields of technology.

The Government wishes to strengthen Denmark's growth conditions by promoting efficiency in the water sector. This in itself will free up dynamism and resources, while also benefitting technology suppliers who will be met by more discerning demand. It will also support the emergence of commercially oriented holistic solutions.

The Government's aim is thus to drive further efficiency gains in the water sector. This in turn will make it possible to reduce the waste water charges for high-volume water consumers by means of gradual reduction in step with improvements in sectoral efficiency, while compensating households as one.

The high cost of wastewater drainage weakens Denmark's competitiveness and capacity to establish and retain production in Denmark. Meanwhile, water technology suppliers regard the price for wastewater drainage as unpredictable, which they find inhibitive for technology development and innovation.

The Government intends to bring down wastewater charges for high-volume water consumers in such a way that the m³ price for drainage is split into two bands for water consumption exceeding, respectively 500 m³ and 20,000 m³ per year. The reduction in the wastewater charge will be phased in over a five-year period for all wastewater companies.

Once the scheme has been fully phased in, large water consumers all told will benefit from a reduction of DKK 700 million per year in step with efficiency improvements in the water sector. For the large water consumers, this corresponds to a reduction of 50-60 per cent relative to the current rate. Given that the reduced charge is supported by efficiency improvements in the sector, Danish households as a whole will not be in a different position than they are now.

The Government will also be presenting proposals concerning a special charge for highly polluted wastewater.

The current rate is typically set according to the volume of wastewater and its constituents. Greater clarity surrounding determination of the special charge will serve to increase transparency and awareness of the financial benefits companies stand to achieve from increased use of alternative water treatment techniques, etc.

With this growth plan, the Government is also seeking to create better opportunities for commercial exploitation of the extensive know-how that exists in Denmark on how systems solutions may be developed and operated efficiently and intelligently. In order to realise this potential, Denmark needs to develop its position as a growth point for efficient and intelligent technologies and services geared to the extensive water challenges faced.

To that end, the Government will be intensifying initiatives for testing, demonstration, market maturation and global marketing. It also intends to give impetus to the market introduction of innovative climate adaptation solutions.

Initiatives within water solutions

Theme 1: A more efficient water sector

1. The Government's aim is for the water sector to undergo further efficiency improvements, based on an evaluation of the Water Sector Act in 2013
2. Barriers to involving private-sector enterprises in wastewater treatment must be identified and eliminated where doing so would be profitable for society
3. Funds will be earmarked for the purpose of accelerating the ongoing digitisation within the water sector
4. Dialogue with technology suppliers and water companies on the possibilities of stepping up innovation within the prevailing frameworks

Theme 2: Increased water efficiency in industrial production

5. Wastewater charges will be changed in order to reduce the costs incurred by high-volume water consumers and to promote efficiencies and innovation in the water sector
6. A pilot partnership will be launched for better utilisation of alternative sources of water – secondary water – with special focus on water efficiency in industrial processes
7. A targeted effort for the EU and UN to create well-functioning markets for water-saving solutions and energy-efficient water treatment technologies for industrial processes
8. Efficient water treatment as a component of the drive for innovation, growth and exports in connection with planned hospital new-builds

Theme 3: State-of-the-art testing, demonstration and global marketing

9. New test facilities for drinking and wastewater are to strengthen the conditions for technology development by small and medium-sized businesses
10. Funding calls will be made for state-of-the-art demonstration plants to show how new Danish technology improves and boosts the efficiency of drinking water and wastewater treatment
11. A strengthened public-private global marketing initiative will raise the profile of Danish water solutions internationally

Theme 4: Innovative climate change adaptation solutions

12. Wastewater treatment companies will be given the opportunity to co-finance municipal investments in climate change adaptation to be carried out as PPPs
13. Funds will be earmarked for supporting municipal works' and utility companies' procurement of innovative climate change adaptation solutions
14. A pilot partnership will be implemented for innovative climate change adaptation solutions

Initiatives within biobased solutions

Today, fossil raw materials such as oil are utilised not only as fuel, but also as the basis for plastics, chemicals and a wide range of products. However, the scarcity and rising prices of fossil raw materials make it attractive to find alternatives. In fact, it is already today possible to produce biobased plastics and chemi-

cal. Yet the market for these solutions still needs to be matured, and the most sustainable techniques based on organic by-products, which are not in competition with foodstuffs, are not yet able to compete with fossil alternatives.

Denmark enjoys strong standing in industrial biotechnology and also has potential in relation to the production of biobased materials based on its agricultural sector. The Government encourages efforts to realise these commercial potentials in step with the maturation of the technologies and demand for them.

The present growth plan consequently establishes a strategic framework for strengthening the potential for future market pull for biobased solutions to generate growth and employment in Denmark.

The Government will be working for EU requirements for admixture of biofuels to fossil fuels from 2020 to be based on renewable biomass. The creation of a European market for renewable biofuels is regarded as being of great importance for Danish technology suppliers and crucial in achieving profitability within Danish industrial-scale production of biobased products.

For the present, the Government will take measures to prepare Denmark for the market pull. The Government will work to ensure that Denmark is at the leading edge of research, technology and know-how by supporting the testing and market maturation of biobased products. The Government will at the same time be promoting development work for plants and production methods and methods for harvesting, transporting and pre-processing biomass for biorefining in order to reduce the costs of producing renewable Danish biomass.

Within this strategic framework, the Government will be driving a consolidated and coordinated initiative in the years ahead.

Initiatives within biobased solutions

Theme 5: Promotion of a European market for biobased, renewable products

15. Stimulation of demand for biobased, renewable products by means of common renewability requirements within the EU and via the international standardisation programme

Theme 6: Opportunities for research, testing and market maturation of new bioproducts

16. Excellent opportunities for research, testing, development and market maturation of new biobased high-value products such as bioplastics and other advanced biotech products
17. Promote market maturation of renewable materials within product design
18. Secure EU funding for Danish innovation and development of biobased products on the basis of long-term public-private partnerships between research and industry

Theme 7: Preparing supply chains for market pull in the biobased economy

19. Increased accessibility of renewable biomass from agriculture, fisheries, food production and waste by, for instance, developing and testing plants and production methods
20. Promotion of technologies to bring down the cost of biomass where the focus is on harvesting, transportation, pre-processing and refining produce into cellulosic sugar and proteins
21. Review of nature, environmental and energy regulation with a view to reducing inexpedient barriers to Danish business opportunities within biobased solutions

Initiatives within resource efficiency and waste

Environmental solutions within areas such as resource optimisation and waste technology hold great potential for allying green Danish jobs with the commitment to better protection of the environment.

Danish companies, like their counterparts abroad, have for an extended period been confronted with rising prices for key resources involved in production. Resource efficiency has thus increasingly emerged as a competitive parameter for industrial firms. Equally, there will be global export potential for Danish companies capable of developing new solutions for the global market within more efficient utilisation of the resources.

In a world of scarce resources, Danish companies should excel in producing more using less – the LEAN approach to resources being a sound business.

Measures will therefore be instituted to promote solutions for more resource-efficient production and to achieve a more competitive and innovative waste sector.

Initiatives within resource efficiency and waste

Theme 8: Solutions for a more resource-efficient production

22. 2013 will see the launch of a national initiative to promote industrial symbiosis between companies
23. The Government will be working for regulation in the EU and Denmark to generate market pull for Danish resource-efficient solutions
24. The Government will be preparing a waste prevention strategy over the course of 2013, which will place focus on resource efficiency and waste prevention

Theme 9: A competitive and innovative waste sector – from waste to resource

25. The Government will be preparing a resource strategy to modernize the waste sector, and set specific targets for recycling, efficiency improvements in waste treatment and stimulation of technology development
26. Inexpedient regulation and other barriers to expansion of the recycling industry in Denmark will be removed
27. Additional funds will be earmarked in 2013 in support of testing and demonstration projects for recycling and for strengthened involvement of new players in utilisation of waste flows

Initiatives within clean air solutions

Denmark is regarded as being a frontrunner in technologies for reducing air pollution in a number of areas. This covers technological contributions to reducing air pollution from shipping and power plants together with catalytic converters for reducing emissions to the atmosphere. It also covers the design of low-emission power plants, particle filters for vehicles and technology for controlling the additives needed to remove nitrogen from diesel vehicles.

Global economic growth and the rapid rate of urbanisation create a need for intensified efforts to reduce air pollution. This applies not least within the major urban centres worldwide, where the concentration of air pollution from energy production and the transport sector is causing mounting adverse health impacts forcing politicians to intervene with new initiatives and new solutions.

In response to this, efforts will be made to promote demonstration of solutions for reducing air pollution in urban centres.

Initiatives within clean air solutions

Theme 10: Danish development and demonstration of environmental technology for reducing air pollution in urban centres

28. One or more partnerships will be established with municipalities and private-sector enterprises to establish frameworks for development and demonstration of new technologies for clean air in major urban areas
29. Partnerships between environmental authorities and the developers of environmental technology for reducing air pollution from road transport and non-road mobile machinery in order to influence the provisions of legislation within the EU and internationally

Other initiatives to strengthen green solutions

Denmark's strengths in water, bio and environmental solutions are based to a significant extent on the high knowledge component of products and services. This makes it crucial for research and training to sustain a high international level, and for there to be close interaction between the public and private sectors in order that research results may be rapidly translated into business innovation and growth.

The growth plan represents an initiative to improve regulation of the water and waste sector, which will serve to strengthen the domestic market for Danish technology suppliers to this sector. Meanwhile, intelligent public procurement should help to drive innovative demand on the domestic market.

Denmark is acclaimed for its strong green sector expertise, but there is a need for sustained marketing, export and investment promotion targeted at the green sector.

Finally, it must be emphasised that the opportunity for companies to supply cost-efficient solutions is key to exploiting the potential of the globally expanding market and hence to boosting Denmark as a production country.

Other initiatives to strengthen green solutions

Theme 11: Research at a high international level and more science and technology graduates

30. Strengthen and develop strong green research environments and prioritisation of production research
31. Continued boost to intake of science and technology students
32. Meet demand for education with specific competencies within water, bio and environmental solutions
33. Give impetus to options for developing special talent programmes, distinction degrees, etc. on study programmes
34. Efforts to attract international students and post-graduates will be intensified

Theme 12: Intelligent public demand

35. Promotion of the market for green products and solutions via cost-efficient green purchasing with greater involvement of lifecycle assessments and functional requirements

Theme 13: Increased marketing, export and investment promotion of green solutions

36. Export of green SMEs' innovative technology solutions is to be supported
37. Strategic B2B partnerships in the export market are to be promoted
38. Enhanced public-private marketing of Danish green expertise under the aegis of State of Green
39. Danish specialities are to be marketed in connection with export drives and investment promotion
40. Promotion of green trade and industry participation in Denmark's development cooperation through synergies with export promotion activities



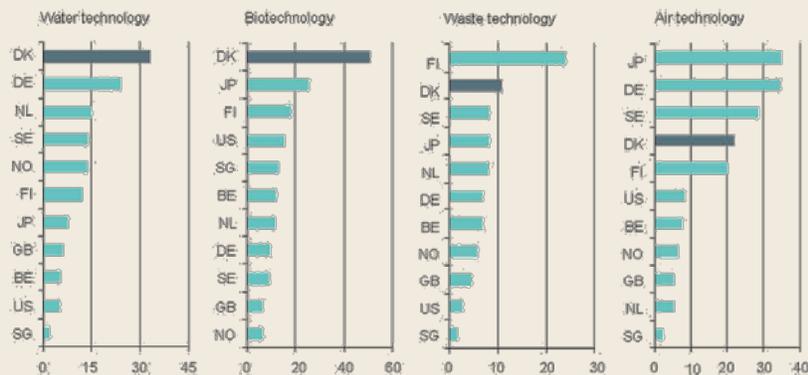
**POTENTIALS AND CHALLENGES
FOR WATER, BIO & ENVIRON-
MENTAL SOLUTIONS**

Denmark excels in green expertise. Across its sectors, Denmark is producing technologies and solutions which in many different ways are serving to boost water and resource efficiency, improve the environment and reduce air pollution. There is also extensive research and development in the bio segment.

Even now, green solutions are making a significant contribution to the economy in the shape of substantial export revenues and export-related jobs, and by paving the way for resource efficiency improvements in domestic production. With the right impetus, increased resource efficiency will serve to strengthen Denmark as a manufacturing country.

Know-how and its protection is a key competitive parameter within water, bio and environmental solutions, and Denmark's strong standing in these segments is consequently reflected in the nation's high patenting activity. Within the water and bio segments, Denmark is the country that applies for the largest number of European patents relative to its size. Within waste and air technology, Denmark is also engaged in high-level patenting, and ranks among the top 5; see Figure 1.

Figure 1: European patent applications within water, bio and environmental solutions per million capita, 2005-2010



Source: Danish Patent and Trademark Office, 2012

Water, bio and environmental solutions are crucial business segments for Denmark's position among the countries that lay claim to the strongest expertise in green technologies and solutions. In relation to the countries we usually compare ourselves with in Europe, Denmark is the country in which the largest share of total goods exports is made up of green products; see Figure 2.

Figure 2: Green product share of total goods exports in the EU15 countries, 2011



Source: Den grønne erhvervsstatistik (Green business statistics), 2012.

For a number of years, this leading position was attributable largely to Danish exports of renewable energy technologies, notably wind turbines, as is still the case today. Recent years, however, have seen a shift towards a greater range of green technology exports from Denmark. This should be seen in the context of the internationalisation of production which has characterised the wind turbine segment, and the steadily rising demand from Danish export markets for water, bio and environmental solutions.

In 2010, green production of technologies, products and services accounted for value added of DKK 64 billion, corresponding to 9 per cent of total value added in the private sector.¹ The majority of the value added derives from industrial production, which accounts for DKK 40 billion, while knowledge services made a substantial contribution of close to DKK 8 billion.²

Around half of the value added is assessed as being attributable to water treatment and other environmental solutions. In the years leading up to the economic crisis, the significance of green production for value added in Denmark as a whole showed an increase, but during the crisis tended towards a decline. A number of the green technology solutions are in the nature of investments, and as such have generally slumped heavily during the crisis. This could explain why the significance of green production has been declining. Nonetheless, the pre-crisis trend indicates that the significance of green production may take an up-turn.

The green segment as a whole can be broken down into environmental technologies, which include water, waste and air technology, and green energy technologies. In addition to these are the biobased solutions, which span a range of businesses and products. The overall potential for biobased products exists in

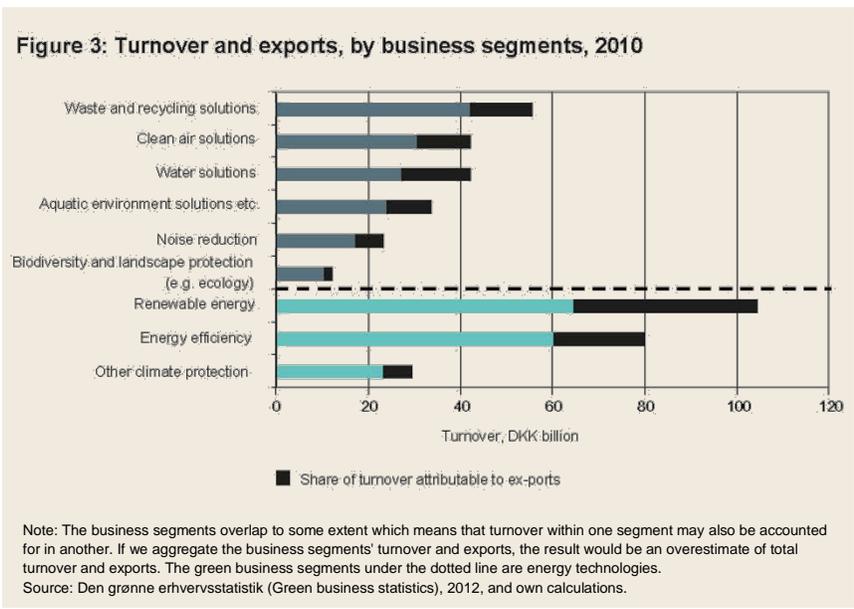
¹ Den grønne erhvervsstatistik (Green business statistics), 2012. Raw materials extraction together with financial services and insurance are not represented in the figures.

² In this calculation, trade is aggregated with industry, since the lion's share of value added within trade is thought to derive from the trading entities of industrial firms. In 2010, the value added within trade amounted to DKK 9 billion.

primary production of foods, industrial manufacturing, the pharmaceutical industry and others. Biobased solutions can only to a very limited extent be placed in the context of the existing trade and export statistics and are therefore not as yet included in the figures for green production.

Green production generally is highly coherent. It is not possible to produce a distinct breakdown of figures for the individual categories within green production, since a number of technologies and solutions are generic or components of both environmental and energy technologies. Energy-efficient water pumps are a point in case.

Environmental technologies constitute around half of Denmark's green production measured by the sale of products and services, while green energy technologies account for the other half. Green energy technologies are made up largely of renewable energy technologies and energy-efficiency technologies, whereas environmental technologies span a somewhat wider field. Within environmental technologies, water, waste and air control solutions are the largest segments, accounting for half of Danish exports. Water, which spans two categories in the figure below, is the most export-intensive segment, and generates the highest total turnover. Waste management and recycling solutions and clean air solutions account for an equal share of the export markets, while for the domestic market, the waste segment is largest; see Figure 3.



The production of green technologies, products and services occurs within a broad cross-section of sectors and creates green jobs nationwide. Green production is greatest within the engineering industry and the plastics, glass and concrete industries, where it accounts for close to 40 per cent of total production in each sector.

In 2011, goods exports from Denmark's green production came to DKK 64 billion, corresponding to 10.5 per cent of total goods exports, of which around half is attributable to water and other environmental solutions. Since 2005, goods exports have increased by 10 per cent both for water and other environmental solutions and for energy technologies, while total goods exports have declined slightly. The success of water and environmental solutions was particularly appreciable in the period 2006-2008; see Figure 4.

Figure 4. Trend in goods exports, 2006-2011

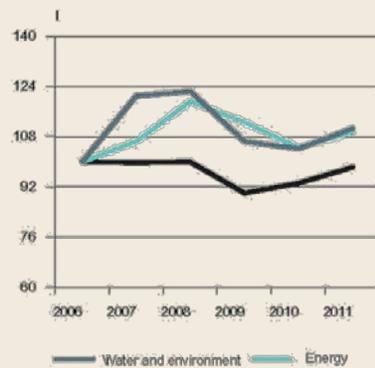
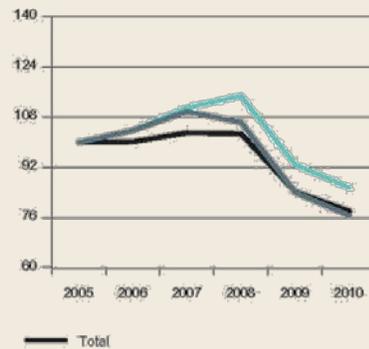


Figure 5: Employment trend in the manufacturing industry, 2005-2012



Note: Figure 4: Index 2006 = 100.

Note: Figure 5: Index 2005 = 100.

Source: Den grønne erhvervsstatistik (Green business statistics), 2012, and own calculations.

The largest export markets for Denmark's green exports are Germany, the USA and the UK. The increase in exports is attributable partly to the increase in exports to the BRIC countries. As a result, the BRIC countries account for a larger share of green goods exports than for Danish goods exports as a whole.

It should be noted that, in this context, figures are provided solely for the value of goods produced at Danish-owned facilities located in Denmark. The value of exports from Danish-owned production facilities outside of Denmark geared to the international market – which is now substantial in scale – is not included in the export statistics. There may thus have been substantially higher growth among the large Danish-owned green businesses. If so, this has not had the same effect on employment here in Denmark as had been the case if all production had remained in Denmark.

It is estimated that some 106,000 people were employed in green production in 2010. Of these, around half were employed in the segment for water and other environmental solutions, that is, approx. 53,000, while the remainder were employed in the sector for energy technologies. When employment was highest in green production in 2008, just over 120,000 were full-time employees in green production, of whom 50,000 were employed in the manufacturing industry, among other things as a result of goods exports. From 2005 and up to the financial crisis, green manufacturing trades followed a more positive employment trend than the manufacturing trades as a whole. However, the crisis was a contributory factor to the overall fall in employment of up to 25 per cent from 2005 and until 2010; see Figure 5.

The consequence of the financial crisis has thus been an adverse effect on the previous positive trend in employment within water and other environmental solutions seen in the years post-2005. Denmark's competitiveness over the same period has deteriorated significantly due to high wage growth and poor progress on productivity.

The rise in exports coinciding with the decline in employment reflects the shift within water and other environmental solutions towards a stronger export orientation. The jobs that might potentially be created in the years ahead will thus largely have to be export-related. The trend in the rate of employment from 2005 to 2008 demonstrated the significant potential for Denmark in this segment. But since this potential is highly contingent on export-related and production jobs, a positive realignment would require an improvement in the conditions governing

Denmark as a manufacturing country. If this improvement is realised, however, it is reckoned that the potential exists for retaining and creating several thousand jobs within water, bio and environmental solutions.

The potential for retaining and creating jobs is especially high in the green segments in which Denmark has particular strengths. For a number of years, Denmark has enjoyed strong standing on the international market for water treatment, while the country's strengths in waste management and air technology are less in evidence. However, recently, the trend in air technology appears to have shown a positive trend; see Figure 6.

