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Preface

Technological change, globalisation, ageing populations and climate change dramatically increase the pace of change in labour market and skill needs, for new and current jobs alike. The growing importance of sustainable development and the shift to a low-carbon economy imply structural changes across sectors and occupations. This shift leads to new 'green' jobs and 'greening' of existing ones that translate to new skill sets, update of curricula or even new qualifications; for example, the adoption and dissemination of clean technologies requires skills in technology application, adaptation and maintenance.

Skills gaps are already recognised as a major bottleneck in sectors closely linked to 'green economy', such as renewable energy, energy and resource efficiency, renovation of buildings, construction, environmental services, manufacturing. At the same time, the 'greening' of the economy creates skill needs across other sectors, as businesses, workers and entrepreneurs have to rapidly adapt to changes as a consequence of environmental policies.

Given the challenges, Cedefop and ILO joined forces in 2010 and produced the report *Skills for green jobs: a global view* (ILO, 2011). The research was based on 21 country studies with a primary focus on good practice examples of how national policies for greening economies are complemented by identification of skills needs and efficient skills response strategies. Cedefop covered country studies (Cedefop, 2010a) in six EU Member States: Denmark (Cedefop, 2010b), Estonia, France, Germany, Spain and the UK. All studies were conducted based on the same research methodology and criteria for selection of case studies, and following identical structures.

In 2017, these studies were updated for the ILO flagship report *World employment and social outlook (WESO) 2018: greening with jobs*, published in May 2018 ⁽¹⁾. The country studies were used as background material for chapter 5 of the report on *Skills for the green transition* with the objective to analyse the trends towards decent work and environmental sustainability since 2010; and assess the impact of a transition towards a low-carbon, resource-efficient economy on the world of work.

This country report was produced by Cedefop, Department for skills and labour market, under the supervision of Alena Zukersteinova. Stelina Chatzichristou, Cedefop expert, was responsible for the research conducted from April 2017 to October 2017.

Cedefop would like to acknowledge the research team of the consortium led by Fondazione Giacomo Brodolini who conducted preliminary analysis and drafted their findings under project team leader Andrew McCoshan.

The full country reports are unedited and available only electronically. They are used as background information for Cedefop's synthesis report *Skills for green jobs: 2018 update* ⁽²⁾.

⁽¹⁾ Available from: https://www.ilo.org/weso-greening/documents/WESO_Greening_EN_web2.pdf

⁽²⁾ Available from: <http://www.cedefop.europa.eu/en/publications-and-resources/publications/3078>

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Executive summary

The issue of green skills still plays a significant role on the Danish skills agenda. However, the greening of skills is typically conceived as a process that cuts across occupations and sectors and should be integrated in a wider range of educational and training activities.

Furthermore, since 2010 the 'burning platform' of environmental concerns has been somewhat overshadowed by an increasing focus on the consequences of robotisation and digitalisation. The skills demanded by the fourth industrial revolution have come more in focus.

The greening of skills is also a question of changing attitudes at every level of the organisations and institutions involved in the process. A related challenge is the pace of technological change, which calls for a constant update of the qualifications of teachers and the physical facilities of vocational schools.

Against this background, two general policy recommendations are emphasised:

- (a) consideration should be given to the creation of a national forum for skills analysis and coordination that has the competences to work across existing institutional boundaries;
- (b) knowledge about the green (including the circular) economy should be integrated into all parts of the education system. This applies to elementary school, vocational and upper secondary education and relevant higher education.

1. Introduction

This report updates the Danish country report on 'Skills for green jobs', which was based on information gathered until the beginning of 2010. The main aim of the present report is therefore to inform the reader about recent developments with respect to green employment, the assessment of the skills needed for green jobs and the national efforts to fill the skills gaps in Denmark.

The focus of the report is on the VET system. However the provision of green skills in other parts of the educational system is also touched upon. This goes for the role of green skills in bachelor programmes and in academy profession programmes, but also in master programmes. 0 gives a general overview of the Danish educational system.

The information in the report is based primarily on a desk study of the relevant literature and other documents. The desk study was supplemented by eight interviews with selected informants in order to fill knowledge gaps identified in the written material. Statistics from national sources are used wherever relevant. The gathering of information for the update took place from June to August 2017. In addition the update took inspiration from previous research by the author (Madsen, 2009; 2012; 2013; 2014a).

2. Major changes in the economy and employment shifts in the green transition after 2010

2.1. Overall economic development

The Danish economy took a hard blow from the 'great recession' in 2008-09. Thus the gross domestic product (GDP) fell by about 7% from the highest level in 2007 to mid-2009. The main explanation was that the international economic crisis coincided with a bursting bubble on the national housing market. From 2010 the national economy recovered, albeit slowly. In particular, domestic demand stayed weak, while exports increased more rapidly towards their pre-crisis level. Thus GDP only reached the pre-crisis level in 2014. From 2014 and onwards the economy started growing more rapidly and at present growth rates around 2% are expected for the period 2017-19 (Det Økonomiske Råd, 2017, p. 15).

Employment was also hit hard by the crisis and declined by almost as much as GDP. This high elasticity of employment with respect to production is not surprising given the low level of employment protection, which is one of the key features of the Danish flexicurity model (Madsen, 2014b; Madsen and Bjørsted, 2016). In the public sector the development of employment was also negatively influenced by the tight budgets that followed from the recession and the need to respect the budgetary rules both from the European Union (EU) and the national Danish legislation stipulating limits to public deficits.

However from 2014 private employment started to increase more rapidly, and it is now almost back to its pre-crisis level, while public employment is still lagging behind. A notable observation is that the increase in private employment has taken place across all sectors including manufacturing, which had experienced declining employment also before the economic crisis.

Expansionary fiscal policy mainly in the form of increased public investments contributed to the recovery during the first years after the crisis. In recent years fiscal policy has been gradually tightened in response to the more positive development in the economy. As also noted in the Danish country report from 2010, the stimulus packages were not specifically targeted at the green economy or green employment.

One exception was the so-called 'housing-job'-scheme, which was introduced in 2011. It gave private households a tax deduction for expenses that covered among other things energy-saving renovations. In 2015 the scheme became more focused implying that only 'green' renovations were deductible. The overall employment effects of the scheme were moderate and estimated at around 1 000 to 1 500 jobs. (Skatteministeriet, 2015).

2.2. Employment in the green economy

In 2017 Statistics Denmark published the first Danish 'green national accounts', which aimed at providing a comprehensive and systematic overview of the green economy in Denmark

(Danmarks Statistik, 2017)³. The green economy is defined as covering goods and services that are produced in order to either protect the environment or save resources. Green employment is the employment involved in the production of these goods and services.

The definition is thus in line with the one applied in the ILO Green Jobs report (ILO, 2011), which defines 'green employment' as work in agriculture, industry, services and administration that contributes to preserving or restoring the quality of the environment. The ILO report (ILO, 2011) also adds that green employment should meet requirements of decent work – adequate wages, safe conditions, workers' rights, social dialogue and social protection (ILO, 2011, p. 4). This aspect is not specifically included in the Danish concept of green jobs, but given the highly organised and regulated character of the Danish labour market, this issue can be considered of lesser importance.

Measured by the share of total 'green' production, the major activities in the green economy are related to renewable resources (49%), saving of energy and heat (14%), handling of waste water (10%) and handling of other waste (10%). A number of sectors contribute to the green economy. The major contributors are manufacturing (57%), renovation and recycling (14%), construction (11%), knowledge services (9%) and energy production (8%) (Danmarks Statistik, 2017, pp. 110-111).

Table 1 shows the development in green production and employment from 2012-15. The table also presents data on green exports.

Table 1: Green production, exports and employment 2012-14

	2012	2013	2014	2015
Green production (bill. DKK)	170	164	173	192
Green exports (bill. DKK)	72	69	73	70
Green employment (1 000 people)	60	58	60	67

Source: Danmarks Statistik, 2017, p. 11.

Note: Green production is measured by total turnover and not value added. According to Statistics Denmark, the increase in both production and employment from 2014 to 2015 is probably due to a break in the data.

Measured as a share of total Danish employment in 2015, the green economy amounted to 2.4%. The share has been rather constant during recent years. The same goes for the green share of total exports, which in 2015 amounted to 6.3%.

⁽³⁾ The 'green national accounts' from Statistics Denmark were not the first attempt to gather statistical information about the green economy in Denmark. See for instance Energistyrelsen (2012), DAMVAD (2013), LO (2014b) and CEVEA (2017).

3. Key policies and regulations

Since 2012 the so-called energy-agreement has been the cornerstone of Danish policies directed at moderating climate change and supporting the transition to a greener economy. The agreement is supported by all political parties and covers the period 2012-20. The ambitious target is that the entire Danish energy supply shall be covered by renewable energy by 2050. The agreement also sets more detailed targets for 2020 and specifies a number of initiatives to be implemented in order to reach them. The targets of the agreement are thus to reduce gross energy consumption by 12% by 2020, to increase the share of renewable energy to 35% by 2020 and to cover 50% of the production of electricity using wind-energy – also by 2020. The main initiatives in the agreement include the renovation of buildings in order to reduce energy consumption, a large scale expansion of wind-power, substitution of coal by biomass, more emphasis on energy-efficiency and electricity-powered means of transportation.

Yearly reports to Parliament gives the status for the implementation of the agreement and points to the need for further initiatives (Klima-, Energi- og Bygningsministeriet ⁽⁴⁾, 2012, 2013, 2014, 2015; Energi-, Forsynings- og Klimaministeriet, 2015, 2016). A characteristic feature of these reports is the omission of any analysis of green employment and skills. One explanation hereof is probably that they are drafted in the ministry responsible for energy and climate and without any inputs from the ministries responsible for employment or education. As further discussed in the subsequent chapter, policies with respect to green jobs and skills are on the agenda, but mostly developed separately from the overall strategy towards supporting the transition to a greener society. In addition, gender is rarely if ever explicitly mentioned in policies concerning 'green skills'.

In addition to the national policy developments, a number of regional and local initiatives have been taken to promote the green economy. One example, which involves both national, regional and local authorities, aims at promoting green public procurement in two regions and nine municipalities. The public partnership for green public procurement dates back to 2006. A related forum for sustainable procurement started in 2011 and involves professional procurers in both the public and the private sector (Bech et al, 2015).

A prominent example of regional cooperation is the so-called Gate 21 initiative, which in 2009 was created as a partnership between regions, municipalities, companies and knowledge institutions working together to create green change and growth in the Greater Copenhagen area. (OECD ⁽⁵⁾, 2012, p. 57; Damvad Analytics, 2017). Similarly, promoting green growth and green employment is part of the work of the regional growth forums (Vækstforum Nordjylland, 2017).

⁽⁴⁾ New name: Energi-, Forsynings- og Klimaministeriet [Danish Ministry of Energy, Utilities and Climate].

⁽⁵⁾ Organisation for Economic Co-operation and Development.

With respect to the social partners, no particular forum for social dialogue has been established focused on green growth and employment. However there are several examples of initiatives discussing green growth from both trades unions and business organisations. Not surprisingly the trades unions typically take the issue of the green economy as a starting point for discussing the promotion of green jobs as a combined strategy for job creation and greening of the economy (LO, 2014a; Fagligt Fælles Forbund, 2015; IDA, 2016). The trade union 3F, which organises mainly unskilled workers, has a special website focused on green jobs (www.groennejobs.dk).

On the other hand the business organisations focus more on the green economy as an important element in promoting both responsible economic growth and export (Dansk Industri, 2015). At the same time the issue of green skills is typically not seen by the business organisations as a separate agenda, but integrated into their argument for a general increase in the supply of workers with technical competences.

4. Skills development measures for the green economy

4.1. Skills needs identification and anticipation

4.1.1. Formal qualifications in the green economy

As outlined in Section 2, Statistics Denmark recently published information about the size of the green economy including employment. These data have no information about skills demand. However, the Danish Energy Agency (Energistyrelsen) has published a national statistical survey of the green economy in Denmark, which also has information about the formal qualifications (measured by educational attainment) related to employment in the green sector compared to the rest of the economy (Energistyrelsen, 2012; Damvad, 2013; LO, 2014b). The methodology follows Eurostat's guidelines (2009) and the information covers only the private sector. The data show that companies with green production have only a slightly lower share of unskilled employees and a slightly higher share of skilled employees than other firms. Also, they are similar to other firms, when it comes to the employment of persons with short-, medium- or long-cycle further education (including PhDs). In addition, they are similar to other firms in having increased the share of persons with a long-cycle education from 2005 to 2010.

There is, however, a difference, when the content of the education is taken into account. Thus, in firms with green production 42% of the employees with further education have a technical education, compared to an average of 32% in other firms. A lack of graduates with backgrounds in natural sciences and technology could thus affect firms with green production to a greater extent than other firms. In addition a significant difference in the wage level between employees in the green sector and other employees can be seen: in the green sector, the average wage level in 2010 was 9% higher than the average for all firms.

4.1.2. Skills anticipation in general

A wide range of activities can be identified ⁽⁶⁾, which in one way or another aim at assessing the future demand for skills and the potential future imbalances on the Danish labour market (Madsen, 2012 and 2016). The activities differ both with respect to purpose and methodology.

With respect to purpose, some are intended to feed into the more general debate about educational policy, while others are more practical ventures fulfilling the specific needs of, for instance, the public employment service. Also with respect to methodology, one can identify a wide range of approaches, from quantitative econometric modelling to qualitative case studies in specific sectors or focused on specific groups on the labour market.

⁽⁶⁾ For a detailed description of skills anticipation in Denmark see: [Skills Panorama](#) (2017).

When it comes to the adaptation of skills formation to skills gaps, there is no comprehensive national system in place, which is also illustrated by the fact that the responsibility for vocational education and for higher education is divided between two ministries.

In order to continuously update the competences provided by the system of Vocational Education and Training (VET), an Advisory Council for initial vocational training (REU) is appointed by the Minister of Education and provides guidance, for example, on the structure of routes, framework for content and assessment, and for accreditation of vocational colleges ⁽⁷⁾. The Council works with around 50 trade committees with representatives from trades unions and employer's organisations. The committees describe the standards for each VET programme, determining the outcomes, assessment methodology, and programme durations. In addition, the Ministry of Education can establish ad hoc committees to swiftly investigate emerging occupations and, if appropriate, develop new standards. Finally, a separate Council for Adult and Further education (VEU) provides guidance with respect to labour market training (AMU) ⁽⁸⁾ and other forms of adult education ⁽⁹⁾.

For higher education a similar comprehensive system is not in place and the individual universities and university colleges have some discretion in determining the intake of students and the curricula. However the Ministry of Higher Education and Science in some cases sets quotas for the number of students based on assessments of the labour market situation of the candidates. Also an independent Accreditation Council accredits all higher education programmes and institutions. Without accreditation an educational programme cannot be offered ⁽¹⁰⁾.

4.1.3. The demand for and supply of green skills

While there are detailed assessments of the number of green jobs in Denmark, there are no examples of more detailed and comprehensive analyses of what this means for the demand for qualifications or on imbalances in the labour market ⁽¹¹⁾. There can be several reasons for this (Madsen, 2014a, pp. 31-32).

⁽⁷⁾ For more information on the Council for Initial Vocational Education, see: <http://uvm.dk/erhvervsuddannelser/ansvar-og-aktoerer/raad-og-udvalg/reu/om-reu>

⁽⁸⁾ For more information on AMU, see: <http://eng.uvm.dk/adult-education-and-continuing-training/adult-vocational-training>

⁽⁹⁾ For more information on the Council for Adult and Further Education, see: <http://www.uvm.dk/ministeriet/organisationen-i-ministeriet/raad--naevn-og-udvalg/veu-raadet/om-veu-raadet>

⁽¹⁰⁾ For more information on the Accreditation Council, see: <http://akkrediteringsraadet.dk>

⁽¹¹⁾ Two reports prepared for the Ministry of Employment by the consultancy firm NIRAS (2011 and 2012) aimed at preparing the ground for such more ambitious analysis of the future supply of and demand for 'green employment', but they did not lead to any further initiatives.

First, one can point to the ambiguity of the concept of green jobs, which makes it difficult to provide more exact assessments of the labour market effects of climate change or the implementation of green investments and technologies.

Secondly, the Danish labour market already contains labour with the relevant qualifications for a wide variety of 'green activities', spanning from sustainable energy (windmills) to waste handling and energy saving. In many of these areas, Denmark has had the advantage of being an early mover in green technologies. An important factor has been the widespread use of 'green taxes' in the form of high indirect taxes not only on energy for heating and transport, but also on other environment-related goods like drinking water and waste water. Furthermore, rather strict regulations are in place, when it comes to the environmental effects of waste water and emissions from both the public and the private sector. This situation has led to a rather high level of awareness on behalf of both private households and companies of the needs to invest in energy saving equipment and other environmentally-friendly technologies, thus over time gradually creating the demand for the relevant skills. The adaptation to climate change and the deliberate promotion of green jobs therefore comes as less of a challenge than would otherwise have been the case.

Thirdly, in some cases, like the wind-turbine sector, the worry is not so much the lack of qualified labour, but the tendency to offshore many of the lower-skilled jobs that are directly related to the manufacturing process. As the production of windmills is becoming more standardised, competition from low-wage countries has significantly increased. An appropriate strategy would therefore be to further develop the more advanced skills required in this sector. The focus of Danish technical universities on the special qualifications required for engineers in the windmill sector is an example of this approach.

Fourthly, Denmark already has a flexible vocational training system in place, which is quite developed in comparison to the rest of Europe. It does not include many examples of special training programmes explicitly targeted at the green economy. However, programmes such as those aimed at the installation of energy-saving equipment in buildings could be included under such a heading. Many of the vocational training programmes include skills that are relevant for 'green technology', also due to the long-lasting influence from the demand side that was mentioned above.

Finally, one should of course point to the fact that the economic crisis from 2008 led to massive lay-offs in the construction sector and also in manufacturing, thus leaving many skilled workers unemployed. Hence, when it comes to the ambitions with respect to investments to save energy in public and private buildings, the challenge became not the lack of (skilled) labour, but the lack of jobs to employ the existing qualified workforce. With the significant increase in employment since 2014, this situation has again been reversed, thus moving the issue of a general shortage of skilled labour to the top of the political agenda.

4.2. TVET provision for new green occupations and for greening established jobs and occupations

4.2.1. The greening of VET programmes

As also noted in the previous report on green skills (Cedefop, 2010a, P. 25) the adaptation of existing occupations to the rising demand for green skills to a large degree takes place through the recommendations from the 50 trade committees that are advising the Ministry of Education on the need for reforms in the VET system. An important part hereof takes the form of a yearly development plan for the VET programmes overseen by each committee.

An examination of the latest development plans alone indicates that several of the trade committees have competences related to energy-saving high on the list of qualifications to be promoted (Styrelsen for Undervisning og Kvalitet, 2016). This goes not surprisingly for education related directly to the construction industry (including masons, roofers and insulators). Also the adaptation of skills to handling new 'green' materials is mentioned, for instance for skilled workers in the plastics industry. The programme for refrigeration engineers has been adapted to the new forms of energy saving and environmental friendly technologies that are being developed. For the education of skilled property caretakers, the skills with respect to energy management play an increasing role. There are also examples of programmes that have been more thoroughly overhauled as a response to the changing demand for skills. In 2015 the programme for skilled plumbers was given a comprehensive update and renamed 'energy-plumbing'. Box 1 sums up the main elements of this education.

In addition Box 2 and Box 3 give examples of entirely new lines of vocational education that are directly related to emerging jobs in the green economy. One such example is the vocational education as wind turbine operator that was introduced in 2010 and is described in more detail in Box 2.

The other example is education as environmental technologist presented in Box 3. This full-time education programme was introduced in 2013 and in 2017 was supplemented by a part-time programme targeted at persons already having some relevant competences (like laboratory technicians). Institutionally, education for an environmental technologist is not located in the VET system, but is an example of an 'academy profession programme'; see the overview in 0. It is therefore not under the auspices of the advisory council for initial vocational training (REU).

Box 1: VET for energy-plumber

The new education programme as 'energy-plumber' takes about four years. The students start at a vocational college with a basic introductory course lasting 20 weeks. Hereafter the student begins education as 'energy-plumber' with a specialised course, which also lasts 20 weeks. The remaining part of the education programme combines further theoretical education with a traineeship (apprenticeship) in a firm. Here the student chooses between four specialisations:

1. plumbing installation technician (three years, nine months) - here the focus is on service and installation work, welfare technology and welding;
2. plumbing specialist (four years) - here the focus is on energy and energy saving;
3. ventilation technician (four years) - focuses on indoor climate and comfort in buildings such as hospitals and workplaces;
4. exterior plumber (four years) - here the focus is on roofs and facades.

Further information in Danish: <http://vvs-energiuddannelsen.dk/>

Box 2: Wind turbine operator

The wind turbine operator works with tasks relating to the production, repair and installation of wind turbines. The areas may be in the field of wing production, mechanics and assembly production or service functions in connection with assembly production, depending on the company in which the operator is employed.

The special mechanics and assembly include tasks to install and mount wind turbines. The wind turbine operator specialising in mechanics and assembly works primarily with installation, assembly, disassembly, as well as performing quality measurements, troubleshooting and documentation in connection with the work.

Wind turbine operators specialising in wing production work primarily with moulding processes as well as manufacture, preparation and maintenance of moulds. The work also includes some repair and finish of wing parts to ensure quality.

The education programme lasts for two and a half years.

Further information in Danish:

<https://www.ug.dk/uddannelser/erhvervsuddannelser/teknologibyggeriogtransport/vindmoelleoperatoer>

Box 3: environmental technologist

This education programme provides the students with knowledge of environmental technology in water, soil and industry. They also learn about production, supply and development as well as advice and management. In the energy field, for example, energy optimisation and different energy forms are worked out.

On the degree programme in environmental technology they are trained to carry out tasks of a technical professional nature within the environmental field. For example, they learn to plan and execute environmental improvements, apply wastewater, soil and air treatment methods and optimise waste handling.

The education programme lasts two years and includes a subject-specific part where different topics are dealt with. The themes are divided into the areas of water, soil and industry. In addition there is an optional specialisation in a specific business-relevant subject. The programme also has an internship.

Further information in Danish:

<https://www.ug.dk/uddannelser/erhvervsakademiuddannelser/tekniskeogteknologiskeuddannelser/miljoeteknolog>

4.2.2. Adult labour market education and training

The greening of skills also takes place through adult labour market training (AMU). This is business-oriented adult continuing education with centrally defined education goals, which provides competences that are recognised nationwide. The 3 600 programmes under AMU last from one day to six weeks - and usually alternate between theory and practice. AMU is offered by about 100 schools all over Denmark approved by the Ministry of Education to provide adult vocational training programmes. Mainly public, but also a number of private schools provide adult vocational training programmes. The providers are adult vocational training centres, vocational technical colleges, commercial colleges, agricultural colleges, social and health service schools, etc. AMU is targeted at unskilled and skilled workers.

The Council for Adult and Further Education (Section 4.1) in its strategic plan from 2014, underlines that there must be focus on special competence requirements in relation to energy optimisation and sustainability. It is estimated that there will be an ever increasing need for craftsmen who can advise on energy and climate/environmental technology (Rådet for Voksen- og Efteruddannelse, 2014, p. 38). A large number of AMU-programmes are offered related to energy, environment and handling of waste. Box 4 gives a few examples.

Box 4: Examples of green skills offered in AMU

Environment and energy in manufacturing: at a basic level, the participants can map environmental impacts and perform simple energy assessments in their own workplace in an industrial company in energy and climate/environmental technology (six days).

Energy-saving driving techniques: the participants obtain knowledge of the environmentally harmful substances and particles emitted through engine exhausts. The participants learn about the factors that affect the energy consumption in practical driving and how to achieve a reduction in the consumption of fuel (one day).

Environmental care for property caretakers: the participants learn to contribute to the implementation of both technical and behavioural preventative environmental measures in homes and institutions. They also learn to describe, plan, implement, evaluate and maintain environmentally friendly actions in collaboration with, among others, residents, users and colleagues at the workplace (four days).

Waste handling in parks and other public green areas: participants learn to perform proper environmental management of waste in public green areas based on applicable waste management rules, including knowledge of essential elements of waste, as well as knowledge of the instances and resources involved in the waste (three days).

The climate-friendly professional kitchen: the participants develop and manufacture climate-friendly food based on environmental and climate conditions and seasonal issues. The participant learns to apply knowledge about local production, quality, ecology and sustainability to purchasing and cooking in order to develop a climate-friendly professional kitchen. The participant learns to apply knowledge about economic sustainability and potential customer groups in developing concepts for climate-friendly food (two days).

4.2.3. Green skills in higher education

As mentioned above, the institutions offering higher education (like university colleges and universities) have some discretion in both offering new study programmes and changing the curricula of existing programmes. Not surprisingly the increased focus on the green economy

and the demand for green skills has led to a number of initiatives in this direction. Given the bottom-up approach applied in this sector it is difficult to obtain a comprehensive overview of the extent of 'greening' of existing study programmes and of the number of new programmes that have been initiated. Based on an examination of various study guides, a number of examples of study programmes focused on green skills can be identified ⁽¹²⁾:

- (a) a three-year bachelor programme in environmental technology dealing with how to technically solve problems with soil, water and air pollution; key subjects are mathematics, physics, chemistry, statistics, hydrology and geology. In addition, the students learn about environment and sustainability from a future and development-oriented perspective (Aalborg University);
- (b) a three-year bachelor programme in energy technology and planning focused on the development of existing and new energy technologies and systems as well as alternative energy sources and their interaction with energy networks and consumers. The education is interdisciplinary, and combines the engineer's insight into environmental technology with economics and legislation in the field of energy technology (Aalborg University);
- (c) a two-year master programme in water and environment focused on sustainable use and safe management of the world's freshwater resources (Aalborg University and University of Copenhagen);
- (d) a two-year master programme in environmental and natural resource economics, which develops understanding about how we as a society can best use natural resources in a sustainable manner (University of Copenhagen).

In addition 'green skills' plays an increasing role in lifelong learning activities aimed at upgrading the skills of graduates. For example the Danish Society of Engineers (IDA) is active in this field by publishing a catalogue of relevant training programmes and setting up peer-to-peer training activities in cooperation with the different professional networks in the organisation. Both educational institutions and companies are involved.

4.3. ALMPs and retraining measures

Danish active labour market policy plays an important role. Thus in 2015 Denmark had the highest cost of Active Labour Market Policy (ALMP) among the OECD-countries measured as a share of GDP. A characteristic feature of ALMP is its uniformity in the sense that most unemployed follow the same general scheme, when becoming unemployed. Thus during the first six months emphasis is on counselling. Thereafter mandatory activation sets in. The

⁽¹²⁾ The list is far from exhaustive and only aims at providing some characteristic examples. The list is based on an examination of the study guide from the Ministry of Education (www.ug.dk) and the private study guide (www.studentum.dk).

specific programme will depend on the needs of the individual unemployed. For the unemployed at risk of exhausting their benefits, intensive counselling and activation is used.

Private service providers play a minor role in the delivery of ALMP – typically caring for less than 20% of the clients. There is however a wide variation between municipalities (Ramboll, 2012, p. 10).

Within this framework, training and education for the unemployed has a long tradition in Denmark and especially came into focus with the series of labour market reforms from the early 1990s and onwards. In particular, the reform of active labour market policy, which was implemented from the start of 2015, had a strong focus on education and training for the unemployed (both young people and adults) (Beskæftigelsesministeriet, 2014). An aim of the reform was to ensure that especially low-skilled unemployed were given pathways to more stable employment.

Important training elements in the reform were:

- (a) all unskilled and skilled unemployed people were given access to six weeks of training from the first day of unemployment; the content of the training has to be approved by the local job centre based on an assessment of the relevant skills gaps;
- (b) the pre-existing schemes of adult apprenticeships and job rotation were maintained, but targeted more directly at the unskilled unemployed;
- (c) an opportunity was given to unemployed unskilled workers to use the two-year benefit period to train to become skilled workers, the condition being that they had already acquired the necessary practical experience;
- (d) more options were given for improving skills in reading, writing and arithmetic.

An important cross-cutting aspect of the reform was the emphasis on increasing the quality of the training activities within ALMP by offering the unemployed courses and programmes within the ordinary education system. Less emphasis was put on projects designed specifically for the unemployed (Ekspertgruppen, 2014). Therefore the training activities within ALMP to a large degree are identical to the activities within the VET system and the AMU system that were described in the previous section. Based on the available data it is not possible to assess whether there is a greater emphasis on green skills in the training activities offered to the unemployed than is the case for other students.

Finally one should mention that training measures in the form of ordinary education is only part of the overall activities within Danish ALMP. Other important elements are traineeships and wage-subsidies for temporary employment with private or public employers. A traineeship will typically last for four weeks, during which the unemployed person receives the normal unemployment benefit. A job with a wage subsidy will normally last for six months in the private sector and four months in the public sector. In both cases the main aim is to provide the unemployed with practical job-training and the social networks of a workplace. Information on the share of unemployed getting traineeships and employment with wage subsidies in the 'green economy' is not available.

4.4. The role of the private sector in skills training

The private sector plays several important roles when it comes to skills training.

First of all the Danish share of employed persons having taken part in education and training during the last four weeks is the highest among the EU-28. In 2016 the share was 33.1% compared to 14.6% in the EU as a whole ⁽¹³⁾. This number includes both formal external training (typically in AMU programmes) and training arranged at the workplace.

The AMU programmes are publicly financed. In addition there are user fees on most of the programmes. The user fee for adult vocational training programmes is on average about 15% of the total expenditure. The fee is normally paid by the employers. Unskilled and skilled workers are entitled to an allowance during the education programme. The allowance corresponds to the level of the unemployment benefit rate. Companies may choose to pay regular wages to their employees during the programme. In this case it will be the company that receives the allowance as compensation. The allowance is financed through a fund called the employers' reimbursement scheme (Arbejdsgivernes Elevrefusion, AER). All employers are obliged to pay an annual contribution of approximately EUR 400 per full-time employee to AER regardless of levels of participation in adult education and continuing training activities.

No targeted subsidies are offered for training in 'green skills', and the data unfortunately does not allow for an analysis of the role of training for 'green skills' in Continuing Vocational Education and Training (CVET).

Secondly the Danish system of vocational education as described in Section 4.2 has training in enterprises (apprenticeships) as a core element. The element of green skills provided through apprenticeships is therefore reflected in the curricula of the VET system as described above. For all programmes of vocational education the students will spend 50-70% with a public or private employer. The use of apprenticeships is widespread. A study from 2014 showed that 26% of private enterprises had at least one apprentice (Arbejderbevægelsens Erhvervsråd, 2014).

Collective agreements define the wages paid to trainees, and the employer receives a subsidy during the periods that the students are in formal college education. This reimbursement is also financed by the employers' reimbursement scheme (AER). In spite of the subsidies offered there is a shortage of employers offering apprenticeships. The main reason is probably that the costs of employing an apprentice are not fully compensated by the reimbursement.

Thirdly, as just mentioned, both public and private employers play an important role in providing short-term traineeships and subsidised employment for the unemployed. Again the concrete element of green skills in these activities is not known.

Finally one can add that none of these activities involving the private sector has a specific 'green' profile in the sense that they are explicitly targeted at providing green skills to

⁽¹³⁾ Source: Eurostat Databanks table trng_ifs_04.

the participants. A general impression from the present research is that this reflects a general view that green skills as defined in the present context cut across sectors and occupations. As the example from the town of Sønderborg described in the following section shows, this does not rule out concrete local activities being focused on green qualifications.

4.5. The role of the institutional set up

As described in more detail in Sections 4.1 and 4.2 several bi- and tripartite councils and committees are involved in the design and development of vocational education including lifelong learning. They typically have members from the social partners, which thus again reflects their large involvement in all aspects of Danish labour market policy. This also goes for the vocational colleges, where the board of each college will have a majority of representatives from the social partners.

When it comes to higher education the social partners are less involved. However one should mention that the boards of all universities and also the Accreditation Council are composed of members that are appointed by the Ministry of Education and often have a background in private enterprises or organisations.

The existence of different steering mechanisms for different parts of the educational system may lead to problems of coordination and overlap. This can be the case between both the individual trade committees within the VET system and between the larger building blocks of the overall educational system. There is thus a risk of lack of coordination between the Ministry of Education, the Ministry of Employment and the Ministry of Energy, Utilities and Climate. How these coordination problems can be handled will be further discussed in Section 5.

Local initiatives often involve several public and private actors. A prominent example of the local greening strategy is the small island of Samsø, which in 1997 won a competition launched by the Danish Ministry of the Environment to become Denmark's Renewable Energy Island. Today, the island with its 4 000 inhabitants is self-sufficient and covers its need for energy from sustainable sources like wind, sun and biomass. In 2007, Samsø opened its so-called Energy Academy, which has drawn international attention⁽¹⁴⁾. The academy arranges exhibitions and workshops, which every year attract more than 5 000 politicians, journalists and students from around the world.

The previous example involves the creation of green jobs, but not an explicit focus on green skills. However 'Project Zero' in the municipality of Sønderborg in Southern Jutland is a local activity that directly aims at providing both new graduates and adults with green skills. The project was established by the city council in 2007 and has the goal of making Sønderborg CO₂-neutral by 2029. It is a public-private partnership, which in addition to the municipality involves a wide range of actors including trades unions, business organisations,

⁽¹⁴⁾ See www.energiakademiet.dk

individual private enterprises and educational institutions. The project initiates activities targeted at citizens (e.g. energy saving), enterprises (e.g. the development of climate strategies) and transport (e.g. electrical cars). With respect to green skills, the local Vocational Education Centre South (EUC Syd) has included 'sustainability' in its mission statement and aims at providing green skills in all its 75 study programmes, whether it is for machine workers or hair dressers. The topic of energy saving techniques plays a large role. But, in addition, creation of awareness with respect to food waste and use of organic products is emphasised for instance in the education of cooks and other kitchen workers. Often the school cooperates with, for instance, private producers when it comes to organic products. The focus on sustainability is also reflected in the physical environment of the school, where the aim is to minimise the emission of CO₂ and other compounds that are harmful to the surroundings ⁽¹⁵⁾.

The EUC Syd also takes account of green skills in all its activities targeted at adult education. An important element herein is a special adult education centre for construction workers focused on new energy saving techniques ⁽¹⁶⁾. The centre provides more traditional classroom training, but also has a test facility, where the participants become familiar with concrete tools or materials that can lead to the saving of energy.

⁽¹⁵⁾ More information about Project Zero can be found at www.projectzero.dk.

⁽¹⁶⁾ More information about the adult training programmes targeted in the construction sector can be found at www.zerobyg.dk

5. Conclusions and recommendations

Based on the research realised for this report the following main points can be emphasised.

Firstly, the issue of green skills still plays a significant role on the Danish skills agenda. However, the greening of skills is typically conceived as a process that cuts across occupations and sectors. Therefore it should be integrated in a wider range of educational and training activities. In addition sectors like construction and waste handling are especially emphasised – also supported by a revitalisation of parts of the green agenda under the new heading of ‘circular economy’ ⁽¹⁷⁾.

Furthermore, there is a sentiment among some observers that the ‘burning platform’ of environmental concerns that was high on the general political agenda a decade ago has in recent years been somewhat overshadowed by an increasing focus on the consequences of robotisation and digitalisation. Thus the skills demanded by the fourth industrial revolution (Industry 4.0) have increasingly become the focus of policy concerns with respect to skills formation and skills gaps.

Thirdly, the cross-cutting nature of many ‘green skills (like competences with respect to energy management) entails the risk that some needs requiring the provision of skills training may fall between two chairs and thus may not be catered for. There is also a risk of fragmentation and lack of coordination, which is to some degree handled by the present coordinating bodies like REU and the VEU-Council, but coordination between the VET system and, for instance, further education is less developed.

A fourth barrier for successful implementation of a strategy focused on green skills is lack of knowledge and weak support from both the teachers of the VET system and from the students and employees. As is emphasised for instance by the Project Zero in Sønderborg, the greening of skills is also a question of changing attitudes at every level of the organisations and institutions involved in the process.

A related challenge is the pace of technological change with respect to for instance energy saving technology, which calls for a constant update of both the qualifications of the teachers and the physical facilities of the vocational schools.

A final observation is that the gender aspect is rarely if ever explicitly included in the considerations concerning ‘green skills’. There are of course significant differences in the gender composition of the work force for instance, when comparing the construction sector and parts of the service sector (e.g. hair dressers). However greening of skills is again considered as a cross-cutting issue irrespective of the gender balance in each occupation or sector.

⁽¹⁷⁾ Advisory Board for Cirkulær Økonomi (2017)

Recommendations

A general impression from the research realised for this report is that the strengthening of green skills to a large degree has been successful within the existing institutional framework – in spite of the obstacles mentioned in the previous subsection. The revisions of the curricula for VET and AMU within the construction sector are often mentioned in this context.

However one must also point to the risk of insufficient coordination between the many actors involved in designing and implementing the adaptation to changing demands for skills. This is also the case for green skills. One could therefore consider the creation of a national forum for skills analysis and coordination that has the competences to work across the existing institutional boundaries. Such an overarching system could be inspired for instance by the Irish model for skills monitoring ⁽¹⁸⁾.

One can add that recently an expert group commissioned to make proposals for reforms of the Danish adult educational system (including AMU) had similar considerations, when it stated that:

For society it is vital that competence development is on a solid foundation of knowledge, which ensures effective use of employers, employees and the state's time and money. The labour market is expected to change with increasing speed, and it is therefore important that these changes are captured effectively – even when crossing industries – so that they can be more quickly converted into continuing education. Therefore, the expert group proposes establishment of a national analysis and monitoring system. At the decentralised level, it is important to develop stronger cooperation between actors within adult and continuing education, business promotion and employment. There must be a stronger coordination with one clear entrance so the companies experience a focused, qualified and coherent contact. In this connection, the expert group recommends the establishment of partnerships for adult continuing education covering all actors, which can ensure better cooperation and synergy between the various efforts. (Ekspertgruppen, 2017, p. 6 [Translation by the author]).

The expert group specifically suggests that the partnerships could be implemented through close cooperation between enterprises and educational institutions focused on specific cluster of competences.

Another issue concerning green skills is related to the need for a profound change in the knowledge about the need for a greener economy. Here one can note that the Advisory Board for a circular economy in its recent report recommends that competencies and knowledge about the circular economy is integrated into all parts of the education system. This applies to elementary school, to vocational and upper secondary education and to relevant higher education. In addition, public and private actors should jointly establish continuing education that is targeted at the circular economy with particular focus on SMEs' needs (Advisory Board for Cirkulær Økonomi, 2017, p. 47).

⁽¹⁸⁾ Reference can be made to Madsen (2016).

List of abbreviations

AER	Arbejdsgivernes Elevrefusion [employers' reimbursement scheme]
ALMP	Active Labour Market Policy
AMU	Labour market training
Cedefop	European Centre for the Development of Vocational Training
CVET	Continuing Vocational Education and Training
DKK	Danish kroner
EU	European Union
EUC Syd	Vocational Education Centre South
GDP	Gross domestic product
IDA	Danish Society of Engineers
ILO	International Labour Organization
OECD	Organisation for Economic Co-operation and Development
REU	Advisory Council for initial vocational training
TVET	Technical Vocational Education and Training
VET	Vocational Education and Training
VEU	Council for Adult and Further education

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ANNEX 1.

Overview of the Danish educational system

