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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, Estonia, France, Germany, Spain (Cedefop, 2010b) 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

This report provides up-to-date information on skills for green jobs in Germany since 2010, based on desk research and 11 expert interviews. It presents information on environmental employment and on the development of green policies. It reports on regular and occasional studies to anticipate green skill needs. It shows that vocational education and training (VET) for new green occupations plays a minor role compared to 'greening' VET for established occupations and that continuing vocational education and training (CVET) offerings are manifold, but participation is low because of weak incentives and low transparency. Programmes to promote skills for green jobs, including efforts within the framework of the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Action Programme, are described. It is noted that many previous programmes did not have a persistent impact. With few exceptions, skills for green jobs are not a focus of Active labour market policies (ALMPs).

The report shows that the private sector plays an important role in skills training and that the federal set-up and the tradition of consensus-oriented social partners constitutes a complex and elaborate institutional setting although this is not an obstacle to green skills development. The report concludes with some recommendations.

1. Introduction

In a strategy of greening the economy, i.e. reducing the environmental impact of production and consumption, the development of appropriate skills has been acknowledged as an essential element. In previous reports, the International Labour Organization (ILO, 2011) and the Cedefop (Cedefop, 2010a) presented good practice examples of policies to identify and promote skills for green jobs (green skills), based on a number of country studies. The country report on Germany (Cedefop, 2010b) provided an overview of responses in the country as of 2010.

The present report represents an update of the German country report of 2010. It aims at providing up-to-date information on policies, programmes, and initiatives related to the promotion of skills for green jobs. To collect this information a combination of interviews and desk research was used interactively. The interviews were conducted either face-to-face or via telephone with representatives of organisations involved in skills development policies. The desk research relied on internet resources, publications, and statistical information, including own research of the authors.

2. Major changes in the economy and employment shifts in the green transition after 2009-10

Since 2010 the German economy displayed consistent growth (Destatis, 2017a). After having shrunk by 5.6% in 2009 compared to 2008, gross domestic product at constant prices grew by 1.6% per year on average between 2010 and 2016.

A distinct feature of the German economy is its high share of manufacturing: in 2016, its share of gross value added (at current prices) was 22.6%, slightly higher than 2010 (22.2%).

Employment increased by 2.6 million persons in 2010 to 43.6 million persons in 2016 ⁽³⁾. The unemployment rate decreased from 7.7% of total civil employment in 2010 to 6.1% in 2016. The share of long-term unemployment (one year and more) remains significant although it decreased from 46.1% in 2010 to 36.9% in 2016. The youth unemployment rate was slightly lower than unemployment overall. The same observation applies to the unemployment rate of women.

Contrary to the previous period there has been no general shortage of offers of initial vocational training opportunities since 2010. In 2015-16 supply matched demand of training opportunities, although mismatches remained with respect to regional and occupational characteristics (BA, 2017a).

According to the German Federal Agency for Labour (BA) [Bundesagentur für Arbeit], no extensive shortage of skilled labour prevails in Germany, but there are shortages in some technical and health related occupations, more so for non-academics ⁽⁴⁾. The environmental sector is affected more severely than other sectors (Horbach, 2014).

By the end of 2016 a total of 10 million persons with only foreign citizenship were living in Germany (Destatis, 2017b). In 2015, some 1.5 million foreign citizens migrated to Germany, posing a challenge for labour market and other institutions. Specific programmes have been set up to educate immigrants on sustainability.

‘Environmental’ employment trends and occupations

The German Federal Agency for the Environment (UBA) [Umweltbundesamt], bi-annually reports on the gross employment effects of environmental protection (environmental employment). It should be noted that many of these jobs – although attributable to

⁽³⁾ Bundesagentur für Arbeit Statistik: Arbeitslose und Arbeitslosenquoten - Deutschland und West/Ost (Zeitreihe Monats- und Jahreszahlen ab 1950).
https://statistik.arbeitsagentur.de/nn_31892/SiteGlobals/Forms/Rubrikensuche/Rubrikensuche_Form.html?view=processForm&resourceId=210368&input_=&pageLocale=de&topicId=17722&year_month=aktuell&year_month.GROUP=1&search=Suchen

⁽⁴⁾ Bundesagentur für Arbeit Statistik: Engpassanalyse.
<https://statistik.arbeitsagentur.de/Navigation/Footer/Top-Produkte/Fachkraefteengpassanalyse-Nav.html>

environmental protection efforts – do not require specific green skills. Results for 2010 and 2012 show an increase in environmental employment from 1 953 million jobs to 2 198 million jobs, corresponding to 4.8% and 5.2% respectively of overall employment (Edler and Blazejczak, 2014); (Edler and Blazejczak, 2016). Unpublished preliminary results for 2014 suggest a further increase of environmental employment proportional to the rise in overall employment.

Of environmental employment in 2012, 62.8% represent jobs through environmental services provision, 19.3% are due to the production of environmental goods, and 17.9% are connected to the use of renewable energies. Of the employment related to the production of environmental goods (excluding insulation of dwellings) 62% represent indirect employment due to the production of intermediate inputs in upstream sectors, often requiring little or no green skills. Of environmental employment related to the production of goods and the provision of services (1.8 million jobs), 57% can be attributed to service sectors, and 18.4% to basic industries (mining and quarrying, energy and water supply), and to waste and waste water disposal and environmental clean-up. Approximately 10% of jobs are in construction, 11% in manufacturing, and 4% in agriculture and forestry.

The BA defines a set of environmental occupations (BA, 2014), which directly contribute to environmental protection, resource conservation, sustainable use of nature, recycling or similar purposes, but excluding jobs – like marketing, trade, or IT – which are not substantially concerned with environmental regulation. Contrary to the estimates of environmental employment reported above, they represent only jobs that require specific green skills. A total of 31 occupational types (Berufsgattungen) on the 5-digit-level of the classification of occupations KldB [Klassifikation der Berufe] (BA, 2014) are identified as environmental occupations. They are pooled into six subgroups: conservation of nature and landscape (four occupational groups), environmental technology and renewable energy use (nine), water supply and waste water management (three), waste management (four), biology, geology, and meteorology (three), and environmental administration and consulting (eight).

In 2016, 107 377 persons were employed in environmental occupations of which 92% were subject to social security contributions (sozialversicherungspflichtig Beschäftigte), the others receiving minor payment (geringfügig entlohnte Beschäftigte) ⁽⁵⁾. The highest share of environmental occupations (27.5%) is observed in water supply and waste water management. Of slightly lesser importance with a share of 22.2% are jobs in environmental technology and renewable energy use. Jobs in waste management comprise 17.9%, in environmental administration and consulting 13.6%, in conservation of nature and landscape 12.1%, and in biology, geology, meteorology 6.7% of environmental occupations.

⁽⁵⁾ Bundesagentur für Arbeit Statistik: Engpassanalyse.
<https://statistik.arbeitsagentur.de/Navigation/Footer/Top-Produkte/Fachkraefteengpassanalyse-Nav.html>

Since 2012 employment in environmental occupations has increased insignificantly by some 5 000 persons. Changes in the composition by subgroups between 2012 and 2016 also seem to be rather insignificant, the highest decrease of 1.3 percentage points being recorded in the share of jobs in waste management, mirrored by an increase by 0.9 percentage points in the shares of jobs in environmental technology and renewable energy use as well as in biology, geology, and meteorology.

An analysis of job offerings reveals that some 8% overall refer to green economy concepts (Helmrich et al., 2014). An above average share of job offerings with green economy relevance was recorded in water supply, waste and waste water management, and environmental clean-up (>50%), in energy supply, agriculture and forestry, construction, and mining and quarrying (20 to 30%), in enterprise related services and in manufacturing (around 10%).

3. Key policies and regulations

Germany is by constitution a federal state. In many policy fields a consensus-oriented policy process between federal government and the sixteen federal states is necessary. Many new federal laws also need a majority in the Bundesrat, the constitutional body representing the governments of the federal states. In addition it should be noted that the responsibility for education policy in Germany lies with the federal states and not with the federal government. With respect to environmental law, implementation is the responsibility of federal states or lower bodies. Many policies and regulations relevant for the development of green skills require an interaction and coordination between the federal level and state level.

In general, Germany has a tradition that for all labour market policies and measures the social partners are consulted and involved in the process of establishing new laws and regulations (cooperative model). In the field of defining the content of basic VET (Berufsausbildung) social partners play the decisive role; new VET or revised basic VET regulations (Ausbildungsordnungen) require a consensus proposal of social partners.

Since 2010 the main focus of green policies in Germany has been on climate protection. Compared to this the modernisation of laws governing nature protection and waste management has been of only secondary importance. Already in 2000 a law aiming at the enforced expansion of renewable energies, the Renewable Energy Sources Act (EEG) [Erneuerbare-Energien-Gesetz] was introduced. The law has since been modified and adapted several times, the latest modification taking place in July 2017. A core element was a technology-specific feed-in tariff assuring priority feed-in to electricity from renewable energy (RE) sources.

Since 2010, there has been a dynamic increase in the share of electricity based on RE sources. In recent years new instruments have been introduced, e.g. auction schemes for specific RE technologies. As a consequence of the Fukushima accident in 2011 the government enforced policies to decarbonise the energy system. The Energiewende (Energy Turnaround; Energy Transition) was postulated based on two pillars (a) expansion of renewable energy sources in the electricity and heat market and (b) increasing energy efficiency in all parts of the economy. At the same time the phase out of nuclear energy in Germany by 2022 was determined. For some period following 2011, Energiewende was at the forefront of political debate in Germany before being substituted by new topics like e.g. migration policy. Although there exists no coherent strategy targeted at the needs of a greening economy, political activities have been undertaken to address the question of sufficient supply of required green skills at different qualification levels, e.g. VET and university education. Most of these activities have been focused on skill requirements in the context of Energiewende.

In Germany, activities to develop skills for green jobs are often embedded in the larger context of education for sustainable development (EDS), comprising social and economic in addition to environmental objectives, the latter ones being broadly defined to include e.g.

resource management and sustainable consumption. Experts highlight that narrowly defined environmental protection is routinely observed in curricula because it is codified in laws. In recent years, efforts have been increased to integrate broader environmental as well as social objectives into education and training, not least with the aim to motivate young people for qualification. Employer organisations tend to emphasise that (broadly defined) environmental objectives must also be economically justified. Despite increased efforts to integrate more green skills in initial vocational education and training (IVET) and CVET no explicitly declared green skills development strategy has been identified.

Germany adopted its first national sustainable strategy (Nachhaltigkeitsstrategie) in 2002. Since 2004 the strategy has been updated every four years. Responsibility for the strategy has been located in the Federal Chancellery, a committee for sustainable development at the level of permanent undersecretaries that acts as a steering committee. A monitoring process was installed in which on a regularly basis over 60 quantitative indicators are evaluated. Since 2009 there has been an obligatory sustainability check for all new laws and regulations. Against the background of the United Nations' 2030 Agenda for Sustainable Development ⁽⁶⁾, the national sustainable strategy was fundamentally revised in 2016 (Deutsche Nachhaltigkeitsstrategie) ⁽⁷⁾. The formulation of the new strategy included a dialogue-oriented process to involve stakeholders. The existence of the sustainability strategy strengthens in many aspects the incentives to include green and 'sustainability oriented' skills and content in different schemes and programmes.

Gender issues are not especially addressed in policies and programmes in the context of greens skills development. In a broader sense there are activities to increase the participation of female students in school classes and university courses which have content related to mathematics and natural sciences.

Currently major activities are underway in Germany within the framework of the UNESCO World Action Programme 'Education for Sustainable Development'. In particular, a National Platform 'Education for Sustainable Development' (NP BNE) [Nationale Plattform 'Bildung für nachhaltige Entwicklung' has been established. It assembles decision makers from politics, business and civil society. Recently a National Action Plan 'Education for Sustainable Development' (NAP BNE) [Nationaler Aktionsplan 'Bildung für nachhaltige Entwicklung' has been adopted by the (see below).

Given the strong development of employment in Germany no fundamental reforms of the labour market have been on the agenda, except for implementing for the first time in Germany a general minimum wage. The new regulation became effective on the 1st of January 2015. The level of the minimum wage is changed according to recommendations of a commission, whose members represent social partners (six members with voting rights) and two members representing the scientific community (no voting right).

⁽⁶⁾ <http://www.un.org/sustainabledevelopment/development-agenda/>

⁽⁷⁾ https://www.bundesregierung.de/Content/DE/Infodienst/2017/01/2017-01-11-Nachhaltigkeitsstrategie/2017-01-10-Nachhaltigkeitsstrategie_2016.html

4. Skills development measures for the green economy

4.1. Skills needs identification and anticipation

A recent overview of the skills anticipation process in Germany is given by Cedefop in 2017 in the context of the Skills Panorama ⁽⁸⁾. The skills anticipation process in general is characterised as established and well-developed. Anticipation activities include skill forecasts, skill assessments and studies as well as surveys (employer, employee). Primary data and intelligence producers are the Federal Institute for Vocational Education and Training (BIBB) [Bundesinstitut für Berufsbildung] and the Institute for Employment Research (IAB) [Institut für Arbeitsmarkt und Berufsforschung]. In addition a variety of research institutions and (government) agencies are active in this field.

Of importance is the project 'Qualifications and occupations in the future' (QuBe) [Qualifikation und Beruf in der Zukunft], a joint ongoing project with partners BIBB, IAB, the Institute of Economic Structures Research (GWS) [Gesellschaft für wirtschaftliche Strukturforschung] and the Fraunhofer-Institut for Applied Information Technology (FIT) [Fraunhofer-Institut für Angewandte Informationstechnik]. Using modelling exercises, qualifications and occupations in the future are investigated giving hints to possible bottlenecks and labour market areas with increased activity in the future. Methods and data include updating previously observed records, transitions, trends and behaviours in the education and training system and in the labour market. By taking into account career changes and differences between learned and practised occupations, demand and supply can be considered at occupational level in addition to qualification level (QeBE) ⁽⁹⁾. Recent results are given in the fourth wave of the BIBB-IAB qualification and occupational field projections (QuBe - Germany 4th wave/2016) ⁽¹⁰⁾. It points to the risk of shortages for skilled tasks and to the future implication of digitalisation for skills and occupations.

With respect to green skills it should be noted, that – with few exceptions (see below) – these topics are not in focus in regularly produced data and intelligence for skill identification and anticipation. Nevertheless it can be noted that the topic of greening the economy and its implications for skills has some prominence in the political and scientific debate. It has been investigated in some specialised studies (see below). According to experts, in recent years the topic of digitalisation has dominated the debate on skill requirements and needs. Given the strong industrial basis in Germany for this topic, the term 'Industrie 4.0' has been coined.

⁽⁸⁾ Analytical highlights: skills anticipation in Germany.
http://skillspanorama.cedefop.europa.eu/en/analytical_highlights/skills-anticipation-germany

⁽⁹⁾ <https://www.bibb.de/en/11727.php>

⁽¹⁰⁾ <https://www.bibb.de/en/57490.php>

Studies referring to green skills are discussed in the following sections.

4.1.1. Regular studies on green skill need identification/anticipation

IAB conducts on a regular basis a representative survey of firms in order to measure labour demand and analyse recruiting processes (IAB, 2017a). In 2016, environmental employment was addressed for the first time; results have not been published yet. Questions were directed at the number of employees who have as their task to:

- (a) ensure that energy and material are used efficiently;
- (b) produce environmental goods;
- (c) provide environmental services.

For filled vacancies firms had to report on specific knowledge and skills required beyond those usually required in the profession in question, inter alia concerning environmentally sound dealing with goods and services.

4.1.2. Occasional studies on green skill need identification/anticipation

In accordance with the importance of climate policies and the focus on Energiewende in Germany most commissioned studies on green skills have concentrated on the topics of expansion of RE or increased energy efficiency (especially in the housing sector).

The UBA funded early on a study on skill requirements and the need for CVET for energy-related building refurbishment (Mohaupt et al., 2011). The study concluded that there was a need for CVET to cope with new requirements in traditional occupations given the complexity of energy-related refurbishment. The development of specific modules for CVET and the coordination of different occupations (Gewerke) are seen as key elements while it seems to be inadvisable to develop new VET regulations.

Concerning the identification of the demand for skills in the building and construction sector, the EU-funded Build Up Skills initiative ⁽¹¹⁾ played an important role (for more details see next Section). In the first project phase supply and demand for skilled workers was analysed and projected up to 2020 resulting in a National Skill Development Roadmap (NSDR).

Spangenberg et al. (2016) identify – from the perspective of companies active in the RE sector – the requirements for commercial-technical occupations and the respective qualification needs. As there is not one specific vocational scheme that fits the variety of needs of the RE sector, job offers are analysed in order to find out which occupations are in demand. Although there is a long list of vocational skills in demand, electronics technicians (Elektroniker/innen) are especially required. As additional skills, capacity for teamwork, a high level of independence and computer skills are asked for. Companies are looking for experienced workers often with high qualification levels.

⁽¹¹⁾ <http://www.buildup.eu/en/skills>

In a study funded by the Böckler foundation (Dröschel, 2017; Dröschel et al., 2017) a closer look has been taken at the qualification needs of companies that are doing business in the changing electricity market. In this market especially traditional companies are under pressure due to a disrupted business model. An online survey of companies indicated that companies expect a change of qualification needs; in general an increase in the level of qualification is expected. This is remarkable as already today employees in the energy sectors of the economy have an above average qualification level. The companies are undecided as to the question of whether there is a need for CVET to have new content or not (52% no, 48% yes).

Given the dynamic expansion of RE in Germany, BIBB conducted a study analysing the impact of this development on the system of vocational training and on the labour market (Helmrich et al., 2016). Looking from the perspective of employees working in firms in the RE sector, there is no need for immediate change of the content of VET or for defining completely new occupations. More than 70% of the employees see their own qualifications as sufficient for the job. It should be noted, however, that many of the employees acquired additional qualifications and enjoyed specialised CVET in their jobs. Companies report problems hiring people with sufficient qualifications; they are looking for people who already have specialised additional qualifications. Looking to the future, there are signs of a scarcity of skilled workers in general, but most of the foreseeable required occupations attributable to RE expansion indicate demand in occupational fields (Berufsfelder) where no specific bottlenecks are expected.

Looking beyond the specifics of Energiewende at the broader picture of greening of the economy, Helmrich et al. (2014) formulate four central theses to address the question of how the green economy impacts jobs and qualification needs:

- (a) companies of all sectors are already taking – smaller or bigger – steps towards a green economy;
- (b) the transformation towards a green economy is already taking place and accordingly job profiles are changing as well;
- (c) for a new, ‘greener’ economy generally additional expertise and skills are needed, not new job profiles;
- (d) academics and skilled workers are relevant for a green transformation process. Therefore education, training and qualification of employees are of outstanding significance. (Helmrich et al., 2014, p. 7).

Bauer et al. (2017) look at the greening of the economy from a sectoral approach and try to analyse from this perspective the future demand for green occupations. The goal is to establish a methodological basis for an ongoing monitoring of the impacts of greening on occupations and skill requirements.

As more and more job offerings are posted on the internet, analysing their content with modern (lexical) tools will be one methodological focus in the future. A current IAB project investigates the impacts of the greening of jobs (increasing importance of green job tasks) on employability (Beschäftigungsverläufe) and payment (IAB, 2017b).

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

In this report, we use the following nomenclature: vocational education and training (VET) [Berufsbildung] which is the overarching system of VET preparation [Berufsbildungsvorbereitung], basic VET [Berufsausbildung], continuing vocational education and training (CVET) [berufliche Fort-/Weiterbildung], and vocational retraining [berufliche Umschulung]. Basic VET is most often an initial vocational education and training (IVET) [berufliche Erstausbildung]; therefore, IVET is used as a synonym for basic VET.

Several studies confirm that new vocational training trades or university programmes are not needed for a green transformation of the economy (Mohaupt et al., 2011; Helmrich et al., 2014). In a recent survey by Helmrich et al. (2016) 57% of respondents did not see the need for new IVET or CVET regulations with respect to renewable energy expansion; earlier requests for newly created specific IVET regulations (e.g. 'Solateur') are no longer raised; instead, additional qualifications should be integrated into existing curricula. CVET is to play an important role. In the field of renewable energies, advances in CVET [Aufstiegsfortbildungen] regulations are not required; rather adjustments in CVET [Anpassungsfortbildungen] can provide the necessary skills (Helmrich et al., 2016). In addition, a general sensitisation for sustainability issues is required.

4.2.1. Vocational Education and Training

Vocational Education and Training (VET) [Berufsbildung] – comprising VET preparation [Berufsausbildungsvorbereitung], IVET [Berufsausbildung], CVET [berufliche Fort-/Weiterbildung], and vocational retraining [berufliche Umschulung] – are governed by IVET und CVET regulations [Aus- und Fortbildungsordnungen] (BIBB, 2015). These regulations are developed or revised in a formalised process based on the cooperation of employers' organisations, labour unions, regional administrations (Länder; playing a lesser role in CVET regulations), and the federal government, supported by inputs from BIBB projects (see below). Currently there are some 330 IVET regulations. Since 2010, 2 (48 since 2001) have been newly established and 51 (203 since 2001) have been revised. As early as 1988 a formal recommendation was given by the BIBB's board [Hauptausschuss], to include green skills in new or revised IVET and CVET regulations, to be supplemented by suitable learning materials, adequate training of the teachers, relevant research, and close cooperation between schools and firms (BIBB, 1988); (BIBB, 1991). BIBB established a focus on VET for Sustainable Development (BBNE) [Berufliche Bildung für Nachhaltige Entwicklung] in 2001.

Between 2010 and 2013, BIBB implemented several pilot schemes for vocational training for sustainable development (BMBF, 2017a). They represented a key contribution to the UN Decade of Education for Sustainable Development and were funded by the Federal Ministry of Education and Research (BMBF) [Bundesministerium für Bildung und Forschung] with some EUR three million. This activity is continuing from 2016 to 2019 with funds of some

EUR six million in the framework of the NP BNE, which implements the UNESCO World Action Programme 'Education for Sustainable Development'.

The pilot schemes from 2010 to 2013 were directed at identifying qualification requirements, developing curricula, and elaborating learning modules for training courses. They addressed as sectors metalworking and electrical engineering (in the renewable energy sector; more specifically offshore wind, electric cars and energy efficiency), construction and housing, catering, and chemistry (BMBF, 2017a).

Pilot schemes to be funded in the 2016 to 2019 period focus on the development of teaching and learning strategies and instruments (like digital tools) for sustainability in various sub-sectors of the trade sector (retail and wholesale trade, external trade, logistics) (BIBB, 2017a). A second funding line aims at promoting sustainability with respect to working conditions in vocational training establishments; this includes the development of an appropriate set of indicators.

Because of the difficulties of integrating sustainability issues into formal VET regulations attempts are now being made to take existing elements related to sustainability in VET regulations as a point of departure and strengthen their role.

No provisions exist to formally link the process of developing VET regulations to attempts to identify and anticipate green skills.

4.2.2. Specific programmes

The NAP BNE (BMBF, 2017b) states with respect to BBNE that the results of numerous projects have spread only to a small extent beyond their respective contexts. This refers to the transfer of results beyond the sectors under study and to their structural integration into binding VET regulations. Therefore, it poses as an important goal the collection and evaluation of existing knowledge and experiences. So far, the outcomes of many projects concerned with more broadly defined sustainability issues have not been structurally integrated into education and training; instead, integration has depended on the motivation of individual trainers.

4.2.2.1. NAP BNE

With respect to VET the NAP BNE includes five fields of action, each transmitted into a number of specific measures:

- (a) take stock of and evaluate existing knowledge and experiences;
- (b) spread existing concepts and materials, establish networks of actors, and disclose additional potentials for integrating sustainability in VET;
- (c) transform firms and schools into places of sustainable learning, including the development of suitable indicators for such places, the collection of eminent examples;
- (d) define the competencies which allow people to act in sustainable ways in occupations;
- (e) integrate sustainability competences into the development of curricula and elaborate suitable didactic materials.

4.2.2.2. *Build Up Skills*

Major activities in initial and continuing vocational education and training (IVET and CVET) in the building sector were undertaken in Germany between 2011 and 2016 in the framework of the EU-funded Build Up Skills initiative (Build Up Skills 2017). Project partners were the German Confederation of Skilled Crafts (ZDH) [Zentralverband des Deutschen Handwerks], the BIBB, the German Energy Agency (DENA) [Deutsche Energieagentur], the German Building Association (ZDB) [Zentralverband des Deutschen Baugewerbes], and three institutes specialised on the crafts sector: FBH [Forschungsinstitut für Berufsbildung im Handwerk], HPI [Heinz-Piest-Institut für Handwerkstechnik], ZWH [Zentralstelle für Weiterbildung im Handwerk].

The first project phase had as its objectives to analyse and project to 2020 supply of and demand for skilled workers and, on this basis, to develop a NSDR, integrating all important sectoral players. The second phase focused on the implementation of actions listed in the NSDR deemed as being of prime importance:

- (a) the establishment of a VET early warning system, which unifies and links existing activities in different sectors and institutions;
- (b) the development of a six-month cross-trade CVET curriculum (including teaching materials), which addresses the lack of overall understanding and resulting interface problems of building projects;
- (c) a ‘training of trainers’ one-day-workshop (that includes supporting materials and an e-learning module) to raise awareness of teaching staff about the interface problems that might exist between different crafts (Gewerke) in building projects;
- (d) the provision of support for human resource development in small and medium-sized enterprises (SMEs) such as guidelines for owners for finding and retaining staff and for implementing career development measures;
- (e) establishment of a CVET offerings database for the building sector which helps in increasing transparency in the CVET market ⁽¹²⁾.

4.2.2.3. *BilRess*

The BilRess (Education for resource conservation and resource efficiency) [Bildung für Ressourcenschonung und Ressourceneffizienz] -programme and -network are specifically focused on resource management issues. It has been funded by the Federal ministry for the environment, nature conservation and nuclear safety (BMU) as a contribution to the German National Resource Efficiency Programme (ProRess). BilRess covers all educational contexts. The project phase from 2012 to 2016 comprised stock taking of offers and identifying actions needed and resulted in a roadmap. It also prepared for the network phase. The BilRess-network is funded for 2015 to 2019. It aims at establishing a permanent platform for cooperation between agents from politics, the economy, social partners and civil society.

⁽¹²⁾ <http://www.karriereportal-handwerk.de/>

4.2.2.4. *GreenSkills4VET*

GreenSkills4VET is an international cooperation project in the framework of the Erasmus+ programme (BiBB, 2017b). Its particular features are: the integration of ecological, economic, and social competences; the development of Open Educational Resources; and a focus on care-related occupations.

4.2.2.5. *BBNE*

The focus of the BBNE programme (Über grüne Schlüsselkompetenzen zu klima- und ressourcenschonendem Handeln im Beruf), an ESF (European Social Fund) co-funded project of BMU⁽¹³⁾ is to promote employment and social integration and to facilitate the transition between school and IVET. In its first phase (2015 to 2018) 14 projects are being supported with funds of EUR 19 million. The projects primarily address youths and young adults and cover two fields of action: information on green jobs and modes of production through work camps, roadshows, courses etc.; and development and tests of new training modules, inter-firm learning partnerships and exchange programmes, including training of trainers. This programme is complementary with respect to objectives and participants to programmes in VET and cooperation has been established between BiBB and BMUB⁽¹⁴⁾ concerning the selection of projects to be funded.

4.2.3. **CVET**

In Germany, CVET takes place on a voluntary basis. It is much less regulated compared to other fields of education. Very many agents are active in CVET. The Build Up Skills project identified 500 CVET centres in the crafts sector. BilRes found more than 60 organisations (excluding chambers of Skilled Craft [Handwerkskammern]) engaged in CVET with relevance to resource efficiency issues.

There is a distinction between ‘advancement’ CVET [Aufstiegsfortbildung] and ‘adjustment’ CVET [Anpassungsfortbildung]. The former leads to higher level of qualification (Meister, Fachwirt); e.g. it is often a prerequisite to set up a business in the respective trade and to supply VET. Adjustment CVET imparts additional skills. Formal government supervised examinations and certificates dominate in advancement CVET and retraining [Umschulung]. In advancement CVET chambers of Industry and Commerce (IHK) [Industrie- und Handelskammern] and of Skilled Crafts [Handwerkskammern] and other employers’ organisations as well as labour unions play a major role. Retraining is generally publicly financed through the BA. In adjustment CVET informal private certification (of participation) schemes are most common.

⁽¹³⁾ <http://www.esf.de/portal/DE/Foerderperiode-2014-2020/ESF-Programme/bmub/berufsbildung-entwicklung-bbne.html>

⁽¹⁴⁾ BMUB is the new name of the BMU since December 2013.

The German Federal Statistical Office (Destatis) regularly reports on CVET (Destatis, 2017c), although information on specific subjects such as green skills is not collected. Overall CVET activities are at a high level: of persons in the labour force some 7.4 million participated in CVET within a year before 2015, some 48% being women. In 2014, 58% of employees and 33% of non-employed persons took part in non-formal education activities, with an emphasis on CVET activities of firms.

Of a total of some 750 advancement CVET courses identified by BilRess, 13 were found to directly bear relevance to environmental objectives, but in nine of them no certificates had been issued during the preceding three years (before 2013).

The take-up level of CVET offerings in the building sector is low and decreasing. One reason may be that there is not enough transparency in the CVET market (Build Up Skills 2016, p. 20). Experts consider that the low priority that firms and employees give to CVET is more of an impediment than a lack of transparency. The views have been expressed that it is necessary to have more financial and regulatory incentives to increase participation in CVET.

The offer of adjustment CVET courses, projects, media, teaching and learning materials, and internet links is difficult to overlook. The BilRess project identified (and scanned) 15 search engines of private suppliers, seven Länder-data banks, and three websites for further education and training of trainers.

Selected actors in CVET:

- (a) Environmental Centres of the Chambers of Skilled Crafts: the chambers of skilled crafts maintain 10 environmental centres throughout Germany, eight of which have been established with financial aid from the German Foundation for the Environment [Deutsche Umweltstiftung]. Besides being engaged in CVET activities, they are also engaged in environmental consulting and research and in development and transfer of projects.
- (b) Association of education on nature and environment (ANU): ANU [Arbeitsgemeinschaft Natur- und Umweltbildung] represents some 1 300 institutions, initiatives, and individuals that offer non-school continued environmental education. Since 2010 their number has increased by more than 40%. The association offers data banks of institutions, trainers, and further qualification programmes. A recent ANU project focuses on environmental education of refugees.

4.3. ALMPs and retraining measures

The provision of private employment services has been liberalised in Germany since 2002. The BA issues vouchers to unemployed people for these services. On their websites service firms usually offer a possibility to search for specific occupations, among them green jobs.

The BA uses 10 different instruments of ALMPs for different groups, among them the long-term unemployed, the low qualified or elder employees, or unemployed people intending to set up a business (BA 2017b, p. 36). However, ALMPs are not targeted at

specific purposes like environmental protection, although they can be ‘utilised’ by institutions in the framework of green initiatives.

For example, the BMUB has launched a programme ‘Power saving – check’ which combines labour market and environmental as well as social objectives (Stromspar-Check) ⁽¹⁵⁾. Under this programme long-term unemployed persons are qualified to instruct low-income households on power-saving opportunities; vouchers for energy efficient light bulbs or refrigerators are available to eligible households. Since 2009 some 210 000 households have been visited; up to 2019 another 125 000 shall be targeted. The programme includes funds for supervisors and coaches, training, and administration. In 2016, more than 900 previously unemployed people participated in the programme. They were financed through various existing instruments of active labour market policies (Dünnhoff et al., 2010). In 2016, of some 1 400 previous participants (with known further careers) almost 40% had been integrated into the labour market: 20% had found a job, another 20% had remained in occupations of the second-labour market (jobs supported by public funds) or participated in qualification measures, and a small share of 1.4% had become self-employed.

Apart from specific initiatives, participation rates of various groups of employees in retraining and other ALMP measures focusing on green skills or green occupations are unknown.

4.4. The role of the private sector in skills training

One core characteristic of the German basic VET system is the involvement of the private sector in the so-called dual system of VET (dual VET). In this system VET takes place at two learning locations: at a vocational school and in a (certified) company in the form of an apprenticeship. From this perspective involvement of the private sector in skills training is to a certain extent intrinsic to the German system.

There are examples for sectoral approaches in Germany, such as the Build Up Skills initiative (Section 4.2) and Chemie³ ⁽¹⁶⁾, the sustainability initiative of the German chemical industry. The latter was jointly initiated by the Federation of Chemical Industry (VCI) [Verband der Chemischen Industrie e.V.], the Industrial Mining, Chemistry, Energy Union (IG BCE) [Industriegewerkschaft Bergbau, Chemie, Energie] and the respective Employer’s Federation for Chemical Industry (BAVC) [Bundesarbeitgeberverband Chemie]. In the chemical industry there is a close connection between green skills, workplace safety and improving resource efficiency.

Several experts stress the role of Überbetriebliche Bildungszentren (inter-company vocational training centres) (BIBB, 2017c). Some of these centres have a special focus on

⁽¹⁵⁾ <https://www.bmub.bund.de/pressemitteilung/hendricks-foerdert-neue-stromspar-checks-fuer-einkommensschwache-haushalte/> and <https://www.stromspar-check.de/>

⁽¹⁶⁾ <https://www.chemiehoch3.de/de/home/impressum.html>

environmental issues (Section 4.2). Due to the increasing specialisation of SMEs it was necessary to provide additional programmes at educational centres, which allow for the complete coverage of all elements of vocational education and training as often not all elements can be provided by SMEs during the apprenticeship. However, these centres have by now further developed into multifunctional centres of education. For instance, they are increasingly active in the field of advanced training and continuing education, including master craftsman programmes. In this context they play an important role in the promotion of green skills (and related technologies). Very often new advanced content for green skills programmes are developed in such centres and brought to a large number of firms, especially SMEs. Besides there are no support measures in place for offering green skills training to SMEs.

Large companies often provide their own vocational school training and use centralised education centres [Lehrwerkstätten] for VET according to relevant regulations. These companies often have formal rules and programmes for CVET using modules internally or and externally developed. External institutions may sometimes monitor and evaluate the measures and suggest green skill development to these companies. In the case that individualised CVET plans per employee are in place, green skills are included.

Experts underline the positive impact of companies who act as frontrunners with respect to green production processes or green products. Setting ambitious standards also in green skills for their employees, they set incentives for other companies to follow.

Some experts highlight that the overall provision of CVET (not specifically relevant to green skills) is not optimal, with the lack of incentives for companies to provide or engage in CVET as a possible reason. Others hint at the lack of awareness amongst employees for the increasing need of CVET.

4.5. The role of the institutional set up

No bodies for inter-ministerial coordination or for coordination between federal and state level in the field of green skills have been detected.

However, the consensus principle, prevalent in Germany, is considered of great influence regarding the development of TVET programmes. In many advisory boards of programmes and projects social partners (trade unions and industry associations) are acting in way that allow for compromise and for finding agreed-on advice.

Regarding fundamental matters of TVET overall, it is the Board of the BIBB that acts as the government's statutory advisory body. Representatives of employers, trade unions, federal states and the federal government work together on the Board, with each group having an equal share of votes. The Board adopts the agenda of BIBB and makes recommendations for fostering and progressively developing vocational education and training and therefore also influences the development green skills.

A central element of the institutional set-up of green education and green skills development is the NP BNE ⁽¹⁷⁾, implemented as the supreme steering body in the framework of the UNESCO World Action Programme Education for Sustainable Development with the BMBF as lead ministry. The platform brings together high-level representatives of politics, science, industry and society. The platform is supported by a scientific and an international adviser. Six Expert Forums are consulted by the National Platform in developing a National Plan of Action:

- (a) early childhood education;
- (b) school;
- (c) VET;
- (d) higher education;
- (e) informal and non-formal learning/youth;
- (f) local authorities.

The expert forums (15 to 20 members) provide corresponding expert reports and analyses, and formulate recommendations for action and promote the discourse on the establishment of Education for Sustainable Development (ESD) in the respective areas. Of special relevance is the expert forum for Vocational Education and Training. In addition all working groups involved in the previous UN Decade of ESD have decided to continue to participate as Partner Networks in the Global Action Programme (GAP). The 10 Partner Networks link stakeholders and experts. They cooperate closely with the Expert Forums.

Building on the platform, in June 2017 a national plan of action (BMBF, 2017b) was adopted. The national plan of action defined fields of action, with detailed proposals to be implemented in the future.

⁽¹⁷⁾ <http://www.bne-portal.de/en/education-sustainable-development-germany/gap-implementation-structures-germany>

5. Conclusions and recommendations

In Germany, the focus of green policies is on climate protection. Despite the uptake of significant policy documents, such as the Energiewende and the German sustainability strategy, there is scope for the broader concept of sustainability to play a larger role in green skills development, in order to include green skills in different contexts. In particular, demonstrating the economic benefits of green skills would increase acceptance of green skills development. A broader perspective beyond narrowly defined environmental protection would also contribute to motivating youths to take up VET in green trades.

In general, skill needs anticipation is well-developed in Germany. With respect to green skills there are mostly occasional study-based activities and only very few regular activities. Against the background of German priorities in green policies there is a focus on studies of renewable energies expansion and energy efficiency measures. The establishment of a regular monitoring process (biannual) to observe green skill development and potential bottlenecks would be beneficial. Experts indicated that agreeing on a clear, international definition of skills for green jobs would assist matters. In this context, the relationship of environmental protection in a narrow sense to environmental protection in a broader sense (including resource management activities) and to social and economic sustainability objectives needs to be clarified.

New green occupations play a minor role compared to greening established occupations. Since 2010, 54 (of some 330) VET regulations have been newly created or revised, under the guideline of green skills to be incorporated. In order to overcome resistance to the integration of sustainability issues into such regulations, existing elements in VET regulations that are related to sustainability could be taken as a point of departure.

A variety of programmes seek to define qualification requirements and develop curricula and training materials as well as establishing networks. Because of the one-time nature of many projects, the results are at risk of being lost. Therefore, experts suggest the provision of major financial support to projects could be beneficial with the objective of broadening the application of existing knowledge and experiences on a comprehensive scale. Besides developing curricula, the training of trainers and the creation of appropriate learning environments should be a focus of programmes for education for sustainable development.

CVET is also recognised as being as important to the greening of IVET. However, participation in CVET, particularly by small enterprises, is low because of weak incentives and a lack of transparency. Some experts expressed the view that the position of Germany is better in basic VET compared to CVET, due to insufficient incentives or awareness both for employers and employees in the latter. Therefore, support should be given – specifically for small enterprises - to increase participation in CVET. Greater transparency of non-formal CVET offers could also be beneficial.

In general, ALMPs are not specifically targeted at environmental protection. In principle, however, they can be utilised in initiatives which focus on green objectives and the

corresponding skills. There seems to be scope to extend the role of ALMPs in the development of skills for green jobs corresponding to the example of the Power Saving-Check programme.

The private sector plays an important role in skills training, a feature intrinsic to the dual system of VET. With respect to green skills there exist some sectoral approaches, e.g. in the construction and the chemical industries. Intercompany vocational training centres, serving SMEs on the one hand and large companies on the other hand by using their own centralized education centres, play their part in involving the private sector in green skills development. Increased financial support for intercompany vocational training centres would make it possible to involve a larger number of (small and medium sized) companies which often lack the capacity to provide all required content of VET on their own. The strengthening of intercompany vocational training centres would help to promote new and advanced green skills.

Due to its federal structure and its consensus-oriented social partners, Germany has an elaborate and complex institutional set-up which seems to work sufficiently. Better visibility of existing coordination activities and more inter-ministerial coordination might be helpful to improve the green skills development process.

List of abbreviations

ALMP	Active labour market policies [Aktive Arbeitsmarktpolitik]
ANU	Association of education on nature and environment [Arbeitsgemeinschaft Natur- und Umweltbildung]
BA	Federal agency for labour [Bundesagentur für Arbeit]
BAVC	Employers' Federation for the Chemical Industry [Bundesarbeitgeberverband Chemie]
BBNE	VET for Sustainable Development [Berufliche Bildung für Nachhaltige Entwicklung]
BIBB	Federal Institute for vocational education and training [Bundesinstitut für Berufsbildung]
BilRess	Education for resource conservation and resource efficiency [Bildung für Ressourcenschonung und Ressourceneffizienz]
BMBF	Federal ministry of education and research [Bundesministerium für Bildung und Forschung]
BMU	Federal ministry for the environment, nature conservation and nuclear safety [Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit] to December 2013
BMUB	Federal ministry for the environment, nature conservation, building and nuclear safety [Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit] since December 2013
Cedefop	European Centre for the Development of Vocational Training
CVET	Continuing vocational education and training [Berufliche Fortbildung]
DENA	German Energy Agency [Deutsche Energieagentur]
Destatis	Federal statistical office [Statistisches Bundesamt]
EEG	Renewable energy sources act [Erneuerbare-Energien-Gesetz]
ESD	Education for sustainable development [Bildung für nachhaltige Entwicklung]
ESF	European social fund [Europäischer Sozialfond]
FBH	[Forschungsinstitut für Berufsbildung im Handwerk]
FIT	Fraunhofer Institute for Applied Information Technology [Fraunhofer-Institut für Angewandte Informationstechnik]
GAP	Global Action Programme [Globales Aktionsprogramm]
GWS	Institute of economic structures research [Gesellschaft für wirtschaftliche Strukturforschung]
HPI	[Heinz-Piest-Institut für Handwerkstechnik]
IAB	Institute for employment research [Institut für Arbeitsmarkt- und Berufsforschung]

IG BCE	Industrial Mining, Chemistry, Energy Union [Industriegewerkschaft Bergbau, Chemie, Energie]
ILO	International Labour Organization
KIdB	Classification of occupations [Klassifikation der Berufe]
NAP BNE	National action plan education for sustainable development [Nationaler Aktionsplan Bildung für nachhaltige Entwicklung]
NP BNE	National Platform 'Education for Sustainable Development' [Nationale Plattform 'Bildung für nachhaltige Entwicklung']
NSDR	National Skill Development Roadmap
ProRess	German National Resource Efficiency Programme
QuBe	Qualifications and occupations in the future [Qualifikation und Beruf in der Zukunft]
RE	Renewable energy [Erneuerbare Energien]
SME	Small and medium-sized enterprises [Kleine und mittlere Unternehmen]
TVET	Technical and vocational education and training [Berufsbildung Synonymous with VET]
UBA	German Environment Agency [Umweltbundesamt]
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VCI	Federation of chemical industry [Verband der Chemischen Industrie e.V.]
VET	Vocational education and training [Berufsbildung]
ZDB	German Building Association [Zentralverband des Deutschen Baugewerbes]
ZDH	German Confederation of Skilled Crafts [Zentralverband des Deutschen Handwerks]
ZWH	[Zentralstelle für Weiterbildung im Handwerk]

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