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TVET for a Green Economy

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Abbreviations

BABC	Agência Brasileira de Cooperação (Brazilian Agency for International Cooperation)
APCI	Agência Peruana de Cooperação Internacional (Peruvian Agency for International Cooperation)
ASEAN	Association of Southeast Asian Nations
BBE	Bundesverband BioEnergie e.V. (German Bioenergy Association)
BBS	Berufsbildende Schule(n) (Qualifying Vocational School)
BDW	Bundeverband Deutscher Wasserkraftwerke e.V. (German Hydroelectric Power Plants)
BDZ	Bildungs- und Demonstrationszentrum (Training and Demonstration Centre)
BEE	Bundesverband Erneuerbare Energie e.V. (Federal Renewable Energy Association)
BFW	Berufsförderungswerk (Vocational Training Promotion Organisation)
BIBB	Bundesinstitut für Berufsbildung (German Federal Institute for Vocational Education and Training)
BLK	Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (Commission for Educational Planning and Research Development)
BMBF	Bundesministerium für Bildung und Forschung (German Federal Ministry for Education and Research)
BMU	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (German Federal Ministry for Environment, Nature Conservation and Reactor Safety)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
BSW-Solar	Bundesverband Solarwirtschaft (Federal Solar Industry Association)
BWE	Bundesverband WindEnergie e.V. (German Wind Energy Association)
BZEE	Bildungszentrum für Erneuerbare Energien e.V. (Training Centre for Renewable Energies)
CBT	Computer Based Training
CEDEFOP	European Centre for the Development of Vocational Training
CIS	Commonwealth of Independent States
CPSC	Colombo Plan Staff College
DBU	Deutsche Bundesstiftung Umwelt (German Federal Foundation for the Environment)
DEDEAT	Department for Economic Development
Dena	Deutsche Energie-Agentur GmbH (German Energy Agency)
DGS	Deutsche Gesellschaft für Sonnenenergie e.V. (German Solar Energy Society)
DHET	Department of Higher Education and Training
DST	Department of Science and Technology
DWA	Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall (German Association for Water, Wastewater and Waste)
ESD	Education for Sustainable Development
EFA	Education for All

Abbreviations

EFA	Effizienz-Agentur Nordrhein-Westfalen (Efficiency Agency North Rhine-Westphalia)
EFQM	European Foundation for Quality Management
EMAS	Eco Management and Audit Scheme
ESD	Education for Sustainable Development (Bildung für nachhaltige Entwicklung)
ETF	European Training Foundation
EU	European Union
EWEA	European Wind Energy Association
FATA	Federally Administered Tribal Areas
FET College	Further Education and Training College
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
GPA	Good-Practice-Agentur (Good Practice Agency)
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
GWEC	Global Wind Energy Council
HBfZ	Hessisches Biogas Forschungszentrum (Hessian Biogas Research Centre)
HCD	Human Capacity Development
HRD	Human Resource Development
IDZ	Industrial Development Zones
IFAT	Internationale Fachmesse für Wasser – Abwasser – Abfall – Recycling (International Trade Fair for Water-Sewage-Waste-Recycling)
ILO	International Labour Organization
INRULED	UNESCO International Research and Training Centre for Rural Education
InWEnt	Internationale Weiterbildung und Entwicklung gGmbH (Capacity Building International)
IT	Information technology
ISO	International Organization for Standardization
IUB	Institut für Umweltschutz in der Berufsbildung e.V. (Institute for Environmental Protection in Vocational Education)
KfW	KfW Entwicklungsbank
LMIS	Labour Market Information System
MDGs	Millennium Development Goals
MINT	Mathematics, Information Technology, Natural Sciences and Technology
NGO	Non-governmental Organisation
NiBA	Nachhaltigkeit in Berufsbildung und Arbeit (Sustainability in Technical Vocational Education and Training and at Work)

Abbreviations

OECD	Organisation for Economic Cooperation and Development
OSZ TIEM	Oberstufenzentrum für technische Informatik und Energiemanagement (Upper Level School Centre for Computer Engineering and Energy Management)
OTP	Office of the Premier
PC	Personal computer
PIUS	Produktionsintegrierter Umweltschutz (Production-integrated Environmental Protection)
QCTO	Quality Council for Trades and Occupations
RENAC	Renewables Academy AG
SENAI	Serviço Nacional de Aprendizagem Industrial (National Service for Industrial Training)
SENATI	Servicio Nacional de Adiestramiento en Trabajo Industrial (National Service for Industry Training)
SETA	Sector Education and Training Authority
SEZ	Solar Energie Zentrum Stuttgart (Solar Energy Centre Stuttgart)
SIJ	Solar-Institut Jülich
SME	Small and Middle Sized Enterprises
SRU	Sachverständigenrat für Umweltfragen (German Advisory Council on the Environment)
TIA	Technology Innovation Agency
TVET	Technical and Vocational Education and Training
TQM	Technical-Quality-Management
UNCED	United Nations Conference on Environment and Development
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEVOC	International Centre for Technical and Vocational Education and Training
USAID	United States Agency for International Development
VET	Vocational Education and Training
WAB	Windenergie-Agentur e.V. (Wind Energy Agency)
WBGU	Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen (German Federal Advisory Council for Global Environmental Changes)
WWEA	World Wind Energy Association

Summary

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Summary

In the context of **sustainable development**¹, the concept of **green economy** has established itself on a global level as the new environmental guiding principle. The key message of the concept is that environmental protection should be considered as more than just a general cost factor; on the contrary, it may offer opportunities for more economic growth, increased prosperity and social justice.

Beyond the main idea – namely, that environmental protection, economic growth and poverty reduction can go hand in hand – discussions are very heterogeneous. On the one hand there are representatives of the concept of **weak sustainability** who consider natural resources and outputs of ecological systems to be replaceable by human resources and physical capital. On the other hand there are the supporters of **strong sustainability** who consider functioning ecosystems essential for human societies and point out that, as a matter of principle, unlimited growth cannot take place in limited systems.

With this background, it is of no surprise that there is no commonly accepted line of argument about green economy, especially since the concept is confronted with a variety of demands, as shown in the final report of last year's Rio+20 Conference.

Despite these limitations, a greening economy seems indispensable, because continuing “business as usual” will inevitably lead to an ecological and social dead-end. In response, the German Government supports the further development and implementation of the concept of green economy. This could be particularly helpful to better utilise and realise the value of resources, to create income and employment and to reduce poverty.

Technical and Vocational Education and Training (TVET) is being ascribed a central role in the discussion about implementation of **sustainable development** and green economy, as it prepares people to consider environmental and sustainability aspects for appropriate application in their professional practice. By now, manifold concepts, measures and activities have been developed and implemented in order to integrate environmental and resource protection or requirements of sustainable development into TVET. However, both approaches – **green skills development** and **(Vocational) Education for Sustainable Development (ESD)**, exist side by side in international as well as national discourse without being conceptually linked at all.

Within the context of green economy, international organisations, such as the International Labour Organization (ILO), the European Centre for the Development of Vocational Training (CEDEFOP) and the United Nations Environmental Programme (UNEP) have researched through empirical studies how green skills requirements are being addressed by national TVET systems and derived lessons learnt. Amongst others, the following findings were presented:

1 Bold terms are explained in the glossary.

Summary

- TVET has not been integrated into national sustainability strategies and programmes; environmental and vocational training policies are often not harmonised.
- There is no common understanding of the terms **green jobs** or environmental professions.
- Improving existing vocational skills is more important than developing green jobs and green TVET separately.
- Reliable data collection with respect to green skills needs is a considerable global challenge
- A shortage of skilled labour seriously impedes the transition to a green economy.
- Competences in the fields of mathematics, information technology, natural sciences and technology are preconditions for green economic growth.

TVET plays a crucial role in the promotion of education by the German Federal Ministry for Economic Cooperation and Development (*Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung*, BMZ). Substantial expansion of TVET is one of the 10 objectives of their education strategy, especially with respect to industries set to become more important in the future, such as **renewable energies** and natural raw materials. In order to open up more employment opportunities in the context of greening economies, job profiles and curricula are to be revised and expanded in development cooperation with respect to energy and resource protection as well as renewable energies. Two approaches are being employed: Firstly, integrating green skills into vocational training courses and existing continuing education. And secondly, supporting partner countries of the BMZ as required, in building skill profiles for independent environmental professions. What can provide orientation in this process? Where are the connecting factors?

Germany has a longstanding tradition as far as environmental policies are concerned. Additionally, the environmental economy has developed into a significant economic factor. Approximately two million people in Germany are employed in the environmental sector. There is a continuing upward trend, particularly in the field of renewable energies. Environmental protection, using resources efficiently and the use of renewable energies are established components of vocational training in general and continuing vocational education and training. TVET institutions are in the process of becoming sustainable competence centres. At the macro, meso, and micro levels, existing strategies and programmes, concepts and activities, as well as concrete training offers, teaching and learning materials and experiences will be presented systematically in this publication.

Environmental and sustainability issues have been part of the *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH* projects in the areas of TVET and the labour market since the mid-1990s. They range from short-term projects with a dialogue format, to complex human capacity development (HCD) projects that operate on different system levels and comprehensive long-term development projects that aim at fundamental improvements in the TVET systems of the respective partner countries. A selected number of such projects will provide an overview of the different formats.

Summary

What can be derived from these experiences for development cooperation? The recommendations that speak out on taking into account environmental and sustainability requirements within development projects in the area of TVET are relevant in this context. These recommendations aim at improving the coherence between national sustainability strategies and policies and TVET by developing green vocational training strategies and increasing the participation of the private sector within this process. Furthermore, environmental protection, resource efficiency and renewable energies should be anchored in curricula on the level of vocational training and continuing education, supporting the process with human resource measurements and greening TVET institutions.

Introduction

] 1



Introduction



Placing the Topic in Development Discourse

The beginning of the 21st century is marked by a number of big challenges for the environment and for international development: Mitigating the impact of climate change, fighting poverty, providing fair opportunities for development and an existence worth living for a world population that is anticipated to pass the nine billion mark by 2015, putting an end to the dramatic loss of biodiversity and effectively addressing environmental pollution which is on the rise globally.

Challenges for the environment and international development: agreement in terms of diagnosis, disagreement in terms of consequences

At the beginning of the 1970s, the Club of Rome in its first report had already drawn attention to the „limits to growth“. It has, however, taken a long time to reach this understanding and accept those limits, namely that the resource-intensive and growth-oriented economic model of the industrialised West and its corresponding consumer patterns are not sustainable and cannot be extended endlessly without pushing beyond the biophysical limitations of the earth. Which consequences should result from that understanding, however, is still a controversial matter.

Despite numerous conferences, negotiations and debates, breaking with the established path to development has not yet taken place (BMZ 2011, 8).

1987, that is 15 years after the “The Limits of Growth” was published by the Club of Rome, the World Commission on Environment and Development formulated the concept of sustainable development. This initiated a global discourse on sustainability as well as related global agreements, all of which took on a more concrete shape in the **Agenda 21** in the 1992 World Summit in Rio de Janeiro, as well as in the 2002 Johannesburg Plan of Action.²

Principles of sustainable development

Box 1: Sustainable Development

“Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs.” It contains within it two key concepts:

- The concept of ‘needs’, in particular the essential needs of the world’s poor, to which overriding priority should be given; and
- The idea of limitations imposed by the state of technology and social organisation on the environment’s ability to meet present and future needs.

Source: World Commission on Environment and Development, 1987, Our common future, chapter 2: Towards sustainable development

² Principles of sustainable development were subsequently adopted in various national and international policy areas and were rendered more precisely within the scope of sustainability strategies. Relevant are here, first and foremost, the United Nations (UN) Millennium Development Goals (MDGs) adopted in 2002, as well as the sustainability strategy of the European Union (EU) and the German federal government. Various federal states and municipalities, as well as enterprises have compiled sustainability reports which illustrate how they address their responsibility towards sustainable development. In addition, International Organization for Standardization (ISO) standards on social responsibilities of organisations are available.

Since 2008 the United Nations Environmental Programme (UNEP) has been advocating in favour of the concept of a green economy, meaning a low-carbon, resource-efficient and socially inclusive economy. When put in relation to the guiding principle of sustainable development, green economy is considered an addition and represents a more specific wording within each respective sector, seeking to increase prosperity, mitigate environmental impact and promote social justice. Its expectation is that an ecologically-relevant remodelling of the economy triggers a push in innovation in environmentally friendly technologies beneficial to all: the environment and climate, economy and employment and last but not least, society. "With smart public policies, governments can grow their economies, generate decent employment and accelerate social progress in a way that keeps humanity's ecological footprint within the planet's carrying capacity," says UN Secretary-General Ban Ki-moon when presenting an UNEP study on the topic in November 2011 (Kürschner-Pelkmann 2012, 1).

Green economy: Linking economic growth, environmental protection and social justice

The Federal Government of Germany supports the concept of green economy, considering it an economic approach oriented towards sustainability that can make a decisive contribution to sustainable growth (Bundesregierung 2012, 120). Together with the EU, the Federal Government advocates for further elaborating the concept and implementing it worldwide. In light of the criticism from developing and emerging countries stating that the propagated ecologically oriented economy is rather an attempt of industrialised nations to put up trade barriers ("eco-protectionism"), the Federal Government stresses the chances and potentials of a green economy: "With the help of green economy approaches, it is exactly the developing countries which can use their resources better and increase their value. Many approaches are decentralised in character, and they promote primarily local industries and markets. All these steps can help to reduce poverty and to generate income, especially in rural areas, without damaging the local living environment. This potential, here theoretically posed, must be underpinned with practical examples." (BMZ 2|2011, 10).

The Federal Government of Germany supports the concept of green economy

Together with the postulated actions and development in the so-called UN Millennium Declaration in the year 2000, the Agenda 21 and the Johannesburg Plan of Action form the overarching goals of German development policy.

The Agenda 21, the Johannesburg Plan of Action and the MDGs form the overarching goals of German development policy

Box 2: The Eight Millennium Development Goals

- MDG 1: Eradicate extreme poverty and hunger
- MDG 2: Achieve universal primary education
- MDG 3: Promote gender equality and empower women
- MDG 4: Reduce Child mortality
- MDG5: Improve maternal health
- MDG6: Combat HIV/AIDS, malaria and other diseases
- MDG 7: Ensure environmental sustainability
- MDG 8: Develop a global partnership for development

Source: www.un.org/millenniumgoals/

Education takes on a prominent role in this context. This is reflected in many documents, especially in the current sustainability report of the BMZ which is dedicated to the topic of “Promoting education for sustainable development in developing and emerging countries – a contribution of the German development cooperation” (BMZ, 2011). This report calls education a strategic key to sustainable development, arguing that a well-educated population is a fundamental prerequisite for poverty reduction, sustainable economic growth, societal development, good governance, understanding of democracy and a committed civil society (ibid., 3). Furthermore, the report states that **Education for Sustainable Development (ESD)** can make a contribution to securing ecological sustainability (MDG 7).³

Education is the strategic key
to sustainable development

TVET takes on a significant role in the BMZ promotion of education, ensuring that labour market relevant competences are acquired, maintained and further developed. Furthermore, TVET facilitates improved access to social participation, and by teaching core skills, enables people to take an active part in shaping the environment in which they live and work (ibid., 6). One of the ten strategic objectives of the Education Strategy of the BMZ is to further expand vocational education and training, particularly with respect to industries that are set to become more important in the future, such as renewable energies or natural raw materials.

TVET takes on a significant
role in the BMZ promotion of
education

³ However, it needs to be noted that ESD only refers to children and school education, not TVET (see BMZ, 2001, 4 as well as the BMZ Education Strategy, strategic objective 2: “Promote education on a holistic basis”). With this objective, the strategic relevance of TVET for sustainable development, which is about enabling young people to actively participate in the economy and the working world, is undervalued. In comparison, the Bonn Declaration of 2004 considers TVET to be the master key for sustainable development (chapter 2.2).

This approach is elaborated in the 2012 BMZ Strategy Paper “Technical Vocational Education and Training in International Development”. Here too, the significance of TVET is stressed in terms of poverty reduction, personal development and in participating in and shaping social and political structures. Furthermore, the paper highlights the contribution of vocational education in the development of society as well as in the enhancement and stabilisation of structures that are the foundation of democracy (ibid // (BMZ 8|2012, 5, 8f, 18ff.)).

The BMZ Strategy Paper: TVET in International Development

When reforming TVET systems, German development cooperation applies a multi-level approach (ibid., 20f):

Multi-level approach: linking macro, meso and micro level

- The macro level (policy level) establishes a consistent and transparent framework for TVET.
- On the meso level (institutional level) TVET institutions are strengthened
- On the micro level (implementation level) the content of vocational education and training is improved.

The necessity of skills training for sustainable development is highlighted explicitly in the strategy paper just mentioned (ibid., 16). The paper additionally reasons that in order to create new employment opportunities within the context of an ecologically oriented transformation of the economy, occupational profiles and curricula need to be expanded and renewed with respect to the protection of the environment and resources as well as renewable energies. In order to accomplish this, qualified teaching personnel, close collaboration with the private sector as well as adjusting the vocational training infrastructure are necessary.

Skills training for sustainable development is highlighted explicitly in the strategy paper

There are two relevant approaches here: Firstly, integrating green skills in existing vocational training and (continuing) education courses. And secondly, supporting partner countries of the BMZ as required, in building skill profiles for independent environmental professions.

Goals and Structure of this Publication⁴

On the international level a discussion is taking place on the role and function, as well as approaches and concepts of vocational education and training with respect to sustainable development and the transition to a low-carbon and low-emission economy. This discussion is outlined at the beginning of this publication (chapter 2). Following that, the issue is further illuminated by looking at Germany, which has a longstanding tradition as far as environmental policies are concerned. Also, Germany can rely on rich experiences in integrating environmental requirements into TVET, a process which started in the end of the 1980s. In order to make these experiences useful for development cooperation, this publication systematically examines relevant strategies, concepts, and initiatives, but also further education, training offers and related experiences (chapter 3).

GIZ⁵ has been implementing projects since the mid 1990s in the fields of green jobs and green skills development, addressing environment and sustainability aspects in the area of Technical and Vocational Education and Training and the labour market. Relevant examples are given in Chapter 4. Building on those examples, chapter 5 formulates recommendations on how to respond to environment and sustainability requirements in projects in the area of TVET. The appendix includes a glossary, references to recent literature and links which are commented upon. In addition, relevant TVET institutions and occupations are presented.

Structure: Existing experiences, international discussions on green economy, green skills development and development projects

4 This publication builds on previous GIZ publications on the same subject and elaborates further upon it (Hilgers/Mertineit 2004; GIZ 2009).

5 On January 1, 2011, the German Development Service (*Deutscher Entwicklungsdienst, DED*), the German Society for Technical Cooperation (*Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH*) and Capacity Building International (*Internationale Weiterbildung und Entwicklung (InWEnt) gGmbH*) were all combined under the name *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH*. For simplicity's sake, hereafter only the *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)* will be referred to, even if the projects in question were carried out under the umbrella of the predecessor institutions.

International Strategies for Green Skills

12



International Strategies for Green Skills

] 2

2.1 Key Concepts and Strategies for the Economy and International Development

Green Economy, Green Growth and Green Jobs

The term green economy has established itself as the new environmental guiding principle on a global level and plays an increasingly important role in strategic development processes on the national and international levels. The concept green economy refers to an economy that is oriented towards ecological sustainability, economic profitability and social inclusion. The concept considers itself an addition to the concept of sustainable development.

The international discussion about green economy goes back to the 1980s. In the UN Agenda 21, chapter 8 “Making effective use of economic instruments and market and other incentives” as well as “Establishing systems for integrated environmental and economic accounting” is being postulated (United Nations 1992, 64). The 1992 UN Framework Convention on Climate Change suggests market-oriented measures for reducing the emissions of greenhouse gases. Ten years later there is a chapter on “Changing unsustainable patterns of consumption and production” in the operational plan (Resolution 2), elaborating on related issues in 23 paragraphs (United Nations 2002, 5). The current term green economy appeared for the first time in an expert report for the British government in 1989. It finally emerged onto the global agenda in 2008, through the Green Economy Initiative of the United Nations Environmental Programme. Particular attention was paid to the concept of **green growth** during the latest economic and financial crisis. In 2008 and afterwards, numerous suggestions for a green new deal were made. By promoting environmentally friendly infrastructure measures in the context of investment programmes it was hoped the green new deal would lead to economic stabilisation policies. Besides the basic institutional requirements for sustainable development, green economy was one of the two main themes of the UN Rio+20 Conference in 2012.

The key message in the present discourse on green economy is that environmental protection should be considered more than just a general cost factor, instead it offers great economic opportunities. Ecological sustainability and economic progress are no longer opposites. However, until now, no commonly accepted definition of the term green economy exists. A literature research of the United Nations Department of Economic and Social Affairs (UNDESA) prior to the Rio+20 Conference revealed at least eight different definitions (UNDESA 2012, 9). Most commonly used is the working definition of the UNEP that defines green economy as an economy which “results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one which is low-carbon, resource efficient and socially inclusive. Practically speaking, a green economy is one whose growth in income and employment is driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services” (UNEP 2011, 16).

Green economy: oriented towards ecological sustainability, economic profitability and social inclusion

In 2008 the concept emerged on the global agenda through the Green Economy Initiative of UNEP

Key message: Environmental sustainability and economic progress are no longer opposites

Numerous institutions and organisations are engaged in the discussion. The most important stakeholders in the debate are the UN organisations, in particular the United Nations Environmental Programme as well as the Organisation for Economic Cooperation and Development (OECD). Yet, both organisations represent different emphases of the concept of green economy (see also SRU 2012, 609). The UNEP concept of green economy is based not only on an analysis of economic and ecological crises; it also takes into consideration their social causes and effects. For instance, the significance of stable ecosystems with respect to poverty alleviation is stressed, not least because rural communities in developing countries are heavily dependent on local environmental conditions. The analysis of the OECD, on the other hand, follows a tradition of promoting efficient and market-friendly economic policies and expands them merely with a debate about **ecological limits**. The objective is to sustain global economic growth despite limited raw materials and ecosystems which are under pressure. Economic growth therefore remains the main benchmark for economic success, despite the recognition that it is necessary to develop a “broader concept of progress” (OECD 2011, 22).

Different emphases

Box 3: Core Elements of the Green Economy from a Development Perspective

Without seeking to pre-empt the efforts under way at the international level to clarify terminology, core elements of a pro-poor green economy can already be identified. From a development perspective, the following elements must be a part of all practical strategies for action:

“Inclusive growth is a prerequisite for development and poverty reduction. Future growth strategies should no longer focus solely on quantitative aspects of growth. Instead, the aim must be to achieve qualitative growth that benefits broad sections of society.

Sustainability of economic growth means taking account of the absorptive and regenerative capacities of ecosystems and the climate. As a central element, economic growth must be decoupled from resource consumption and greenhouse gas emissions. This can be achieved, for example, by promoting innovation and clean technology, and also by introducing agricultural techniques which conserve natural resources. The true value of environmental services must be recognised in the economy and by policy-makers, and the general public, too, must be made aware of the importance of sustainability and the green economy.

Inclusive sustainable growth must ultimately aim to reduce poverty. Not all measures to promote sustainable growth necessarily reduce poverty. The transition to a green economy must therefore be managed in a way which makes a positive contribution to socioeconomic development in the developing countries. It must create more jobs and improve access to essential services such as a water supply, basic sanitation, and energy. Compensatory measures are required to offset any additional burdens on poor population groups resulting from this economic restructuring”.

Source: BMZ 2011 (2), 10

6 This is clearly pointed out in UNEP/ILO/IOE/ITUC 2008, 45; ILO 2011, 4, 103.

Closely related to the concept of green economy is the concept of green growth. The term originated in the Asia-Pacific region (UNDESA 2012, 33) and was later taken up and disseminated by the World Bank, the OECD and others. Similarly to green economy, green growth is not defined consistently. The OECD (2011, 4) defines it as follows: “Green growth means fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies. To do this, it must catalyse investment and innovation which will underpin sustained growth and give rise to new economic opportunities.”

Green growth: Promoting economic growth while protecting resources and ecosystem services

According to the BMZ, the term green growth is particularly relevant in current development discourse. “Promoting qualitative economic growth is a key building block for sustainable development as well as for poverty reduction in developing and emerging countries” (BMZ 2|2011,8). Based on the legitimate concerns of developing and emerging countries, it is particularly valid to demonstrate the opportunities and potential of green economy.

Green growth is gaining importance in current development discourse

“Green economic strategies can help developing countries in particular to make more efficient use and enhance the value of their resources. Many strategies adopt a decentralized approach and therefore primarily support local industries and markets. All these steps can help to reduce poverty and generate incomes, especially in rural regions, without damaging local habitats. Mapping out these theoretical potentials is helpful, but the message must be reinforced with practical examples.”

(BMZ 2|2011, 10)

Economic structural change towards a green economy therefore encompasses the following opportunities:

Chances of green economy

- Investments in ecological change are able to stimulate the development of technologies and innovation.
- Optimising energy and resource efficiency leads to significantly improved competitiveness of enterprises.
- By introducing new (greener) production procedures as well as by producing environmentally friendly products, new jobs can be created.

On the other side of the coin, jobs in economic sectors that are less environmentally friendly will disappear. In many sectors skills requirements will change and/or will be redefined taking into account that knowledge, working methods and job descriptions become greener (e.g. in the fields of plumbing and electricity, in the metal manual trades, in the building sector or in the automobile industry). In developing and emerging countries, there is the additional fundamental problem that the use of new technologies, also in the fields of environmental protection and energy and resource efficiency, is impeded due to a lack of basic vocational skills. Moreover, many people cannot participate in economic growth and social development processes because they do not have access to green skills development measures.

Risks and challenges for labour markets

Forging a closer link between a greening economy with technical vocational education and training and the creation of green jobs can counteract the expected negative effects and strengthen positive effects (see chapter 2.2). But what are green jobs? As yet there has been no consistent definition of green jobs and how they are different from conventional jobs. Using a broad definition, they can be described as jobs that contribute to environmental and climate protection. Similarly, the UNEP defines green jobs as “positions in agriculture, manufacturing, construction, installation, and maintenance, as well as scientific and technical, administrative, and service-related activities that contribute substantially to preserving or restoring environmental quality” (UNEP/ILO/IOE/ITUC 2008, 35). The International Labour Organization (ILO) refers to jobs as green if they “reduce the environmental impact of enterprises and economic sectors, ultimately to levels that are sustainable” (ILO 2011, 4).

What is an environmentally friendly job? The debate on green jobs

Box 4: What are Green Jobs?

Green jobs are defined as jobs that reduce the environmental impact of enterprises and economic sectors, ultimately to levels that are sustainable. This definition covers work in agriculture, industry, services and administration that contributes to preserving or restoring the quality of the environment while also meeting the criteria for decent work – adequate wages, safe conditions, workers’ rights, social dialogue and social protection. It also covers activities related to both mitigation of and adaptation to climate change. This is a working definition. It implies in its inclusivity and breadth that every job can potentially become greener. As time goes on and the transition to a green economy intensifies, what is considered a green job today might not continue to be so regarded. The understanding of green jobs also varies from one country to another. Ultimately, countries will need to compose their own national definitions and set thresholds for practices considered green or non-green.

Source: ILO/CEDEFOP 2011, 4

Attempting to differentiate between green and non-green jobs and skills appears to be artificial to a certain extent and may under certain circumstances be of little use. This quickly becomes clear when looking at the various economic sectors and their close relationship all along the value chain. Environmentally friendly products such as wind energy converters, solar cells, electric vehicles, sewage plants or waste collection containers are not necessarily produced according to ecological production standards. Enterprises that extract raw materials for the manufacturing of environmentally friendly raw materials don't necessarily provide their workforce with humane working conditions. Similarly, environmentally friendly facilities use preliminary and intermediary products such as generators, poles (for windmills), electric engines, measurement and control technologies etc. that also are not necessarily considered green. On the contrary, they can even cause ecological damage, as it is the case for biomass production in monocultures (palm oil, corn etc.).⁷ The authors suggest therefore, speaking of a more general process of ecological remodelling of the workplace – otherwise called the “greening of jobs”.

There is also no common understanding about whether or not a particular occupational activity can be considered a new green job, or rather an old job with new or additional components. For instance, an energy auditor is considered a new, green job in Estonia, whereas in Germany it is viewed as a particular specification of a long established occupation (auditor). On the whole, however, a consensus is building on how to successfully manage the transition into a green economy. What is required, it is argued, is that crucial competences are promoted primarily by making additions or modifications within already existing jobs, rather than developing new green curricula and training courses.

This lack of clarity in the definition is not coincidental. It is rather a result of the fact that “environmental protection” is not a clearly distinguishable industrial sector. What is meant by an economy with a green jobs concept is extremely heterogeneous. Activities can range from waste management to work in agriculture and forestry, from employment in organic supermarkets or a car-sharing establishment to the development of windmills or marketing sustainable equity funds (BDA 2009, 2).

Furthermore, many enterprises of the mentioned industries manufacture products or provide services which are only partially relevant for the environment. The various areas of employment pooled under the term green jobs cannot be clearly differentiated from traditional economic sectors. What is more, the scope of the concept even seems to be too narrow, as environmental protection is especially concerned with products and processes. This concern, however, is not included in today's common concept of green jobs. Environmental industries are furthermore dependent on the products and innovation services of the “traditional” industries⁸.

Differences amongst EU countries

“Environmental protection” is not an easily distinguishable industrial sector

7 Compare with findings in chapter 2.3.

8 See also final report of the Rio+20 Conference 2012 that outlines 16 requirements with regard to green economy (United Nations 2012, 14f).

Critique on the debate on growth

Despite the fact that the concept of green economy is being supported by many countries and international organisations, it is not without controversy. The following arguments are raised in disfavour of the concept (see also Brunnengräber 2012; Kürschner-Pelkmann 2012; Maier 2012):

- The expectations and requirements that the green economy is facing are too high
- Not enough questions are asked as to which interests and powerful stakeholders are opposing the great transformation and how to overcome obstacles.
- The expectations and requirements that the green economy is facing are too high
- Not enough questions are asked as to which interests and powerful stakeholders are opposing the great transformation and how to overcome obstacles.
- The concept adheres to current ideas on growth.

The two final arguments have been appropriated by the German Advisory Council on the Environment (*Sachverständigenrat für Umweltfragen*, SRU) in their Environmental Report of 2012. Therefore, they need to be elaborated on in this section.

The concept
is debatable

Criticism by the German
Advisory Council on the
Environment

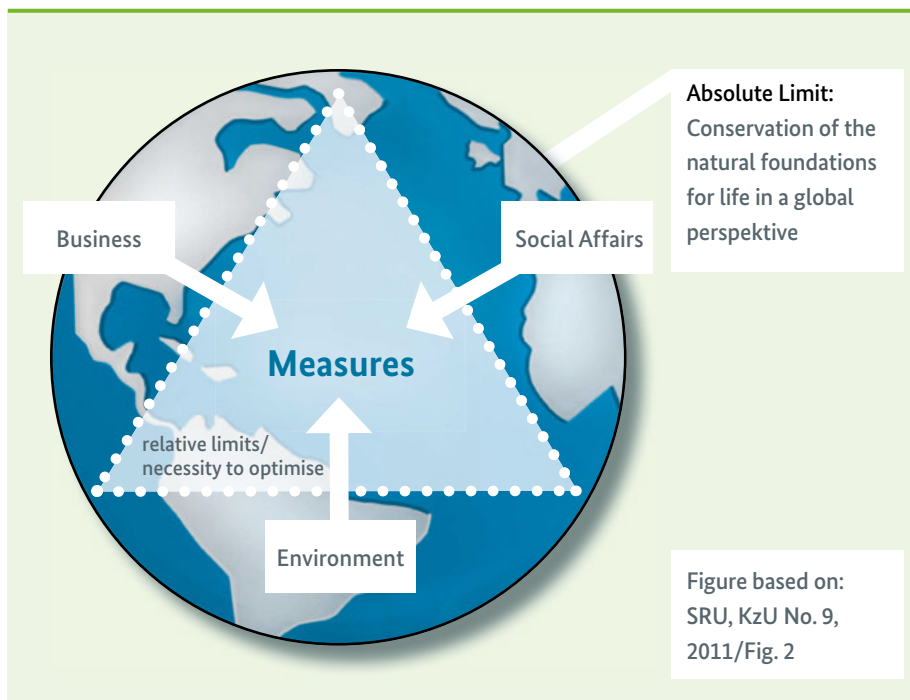


Figure 1: Sustainability Goal Triangle (SRU 2012, 38)

9 See also final report of the Rio+20 Conference 2012 that outlines 16 requirements with regard to green economy (United Nations 2012, 14f).

The SRU emphasises (SRU 2012, 36) that the natural environment, especially the climate and biodiversity, provide the foundation for all of human life. Without functioning ecosystems and the preservation of natural capital, stable social and economic systems are unthinkable. They assert that, despite the fact that there have been partial successes and issues of the environment on the international agenda, in the 20 years after the Rio conference, we have had no success in effectively counteracting threatening ecological trends. Consequently, they argue, it is necessary to more strongly position ecological assets at the centre of environmentally relevant actions. In the conventional model of sustainability, which allows equal consideration of economic, environmental and social objectives as a matter of principle, the bigger picture of ecological capacity is not given sufficient consideration. As a consequence, what is called for is reworking the model to determine ecological limits and crash barriers that must not be crossed (compare with figure 1).¹⁰

More strongly positioning ecological assets at the centre of environmentally relevant actions

Given the fact that there is now much less leeway for the use of nature, the focus can no longer be on the traditional questions of the use of natural resource, such as efficient allocation and fair distribution. It is rather about managing the extent of use and the scale of environmental pollution and damage which need to be addressed as a priority. An overloaded ship cannot be saved from sinking by shoving the freight around, but only by reducing the load to a bearable amount. This means that it is not primarily a question of striving for efficient use and distribution of natural resources. First and foremost, absolute limits must be set for the use of the environment (ibid., 38 ff).

Whether or not green growth strategies are sufficient to allow for a development path within ecological limits depends on, according to the SRU, how far economic performance can be detached from ecological impact. What is meant by this is the absolute uncoupling of the use of energy and materials from environmental damage¹¹. The so-called rebound effect works against this, in the sense that improvements in efficiency often lead to increased demand and consumption. Under certain circumstances, these in turn undo any savings achieved. Empirical evidence for this **rebound effect** exists, especially in the fields of **energy efficiency** as well as in the use of raw materials (ibid., 51). Generally, the SRU sees great potential in uncoupling economic activities, energy and material input. Making use of this potential by increasing efficiency, substituting energy sources and changing consumer patterns is imperative to avoiding an otherwise inevitable crisis and consequently, should be promoted on a political level (ibid., 54). However, it remains open whether complying with scientifically proven and politically determined ecological limits is compatible with economic growth in the long run. The SRU argues that there are serious indications that keeping within ecological limits can no longer be reconcilable with economic growth in the long run, even with conceivably radical decoupling and substitution strategies (ibid., 75).

In a limited world there can be no unlimited growth

10 This perspective is also shared by the German federal government (Bundesregierung 2012, 24).

11 Complete decoupling is only accomplished if the total amount of ecological impact is decreasing despite economic growth.

Summary

Criticism of the green economy concept shows that it exhibits clear weak points. Nevertheless, the concept can serve as a foundation for remodelling global economic relationships, and for dealing with nature and social relationships. After all, the green economy is also a political concept. In this sense, the concept can serve as a formula for terminology which represents long standing political efforts and already existing environmentally friendly economic concepts that can be used for international discourse. For the time being, lack of clarity in terminology and concept is not a hindrance. What is more important is that attention is raised on a global level and that the international discourse on sustainable development is given a new impulse. On the other hand, this conceptual lack of clarity gives the misleading impression that a consensus exists, which actually is not the case – one only has to look at the different positions of international organisations. Everybody talks about green economy, but they ultimately mean different things. In addition, not all expectations attributed to the concept can possibly be met. Unlimited economic growth is not possible on a limited planet – even if this growth would mainly take place in the environmental sector. The number of jobs that can be ascribed explicitly to the environmental sector will have limits. Consequently, not all global poverty problems will be solved through the green economy.

The concept of green economy possesses weaknesses, but also potential

However, the concept of green economy has given an important new impulse to the international discourse on socially just and environmentally compatible economies within the context of sustainable development. The challenge will be to retain the term's inherent strength for integration, which it definitely contains, and to increase its credibility and respectability through terminological clarity. What this also entails is identifying and addressing economic, environmental and social (**dimensions of sustainability**) grievances and their causes, as well as revealing cases where enterprises exploit nature and human beings while trying to present a pure image through **greenwashing**. "Business as usual" will lead ecologically and socially to a dead end. The future of our economy is either green – or dark black (Kürschner-Pelkmann 2012, 2).

Greening the economy is essential

2.2 The Role and Tasks of Technical Vocational Education and Training

Transforming the economy and society in line with the concept of sustainable development is only possible if people embrace the inherent values and attitudes of this idea, and if people possess the needed skills and are able to apply them in practice. From this perspective, it is not surprising that education in general and Technical Vocational Education Training in particular are ascribed a significant role in this transformation process. However, it is noticeable in this discussion that the concepts are overwhelmed by demands to such an extent that the implementation of compatible training or education measures either seems impossible or that the concepts are not further operationalised and remain blurred (green skills development).

Green skills development and (Vocational) Education for Sustainable Development exist side by side without being conceptually linked

What is also striking is that both education concepts currently under discussion are not dealt with in relation to each other – discussions tend to run parallel to one another. Just as the concept of green economy is not identical with sustainable development, green TVET is not identical with (Vocational) Education for Sustainable Development. Sustainability as a concept is in both cases more far-reaching and at the same time more ambitious. The green concepts only form a subset of sustainability, albeit an important one.

The role of education in promoting sustainable development is emphasised in chapter 36 of Agenda 21: Promoting Education, Public Awareness and Training. TVET is given a dual function here. Firstly, training “should have a job-specific focus, aiming at filling gaps in knowledge and skills that would help individuals to find employment”. This refers to the key task of TVET in the way it is understood in Germany. The second function is to promote competences that are required for sustainable development. In this context, Agenda 21 speaks of education as being “critical for promoting sustainable development and improving the capacity of the people to address environment and development issues” (Agenda 21, chapter 36).

The tasks of TVET have already been described in Agenda 21

This makes clear that integrating sustainability into TVET cannot be reduced to individual vocational subjects or occupations. Training for sustainability competences is at the core of a person’s vocational coping skills, and developing these skills is the goal of vocational education.

Which competences are we talking about? This discussion within the German discipline of Vocational Studies and Economic Education is still very hesitant and won’t be retraced here. As a means of providing orientation it may be sufficient here to outline the position which was adopted as the Education for Sustainable Development self-concept during the conference of the Northern German Alliance to support the UN Decade of Education for Sustainable Development 2005-2014 (NUN) in Hamburg on the 22nd of November 2007 (see box 5).

How Education for Sustainable Development sees its role

Box 5: (Vocational) Education for Sustainable Development

Acting in a sustainable way is of significance in every job and sector. Competences for sustainable occupational actions are therefore an integral component of an individual's overall vocational coping skills. What is meant here are skills, abilities and the willingness to recognise and to assess the direct and indirect effects of occupational activities on the environment as well as on the living and working conditions of other human beings (of present and future generations) and to avoid negative effects as much as possible. These competences are not static in nature. It is rather a dynamic process that manifests itself in an individual's continuous dealing with the effects on the environment caused by occupational activities in a context of constantly changing occupational, organisational, political and ecological conditions.

Teaching and learning processes in the context of general education address the responsibility of an individual as a consumer. In contrast to that, considering aspects of sustainability in an integrative way in the context of TVET requires that individuals take on producer responsibility in areas where they can act and make decisions.

Producer responsibility aims at increasing resource and energy efficiency in manufacturing products and providing services as well as socially responsible living and working conditions alongside the entire value chain (including downstream processes).

Since sustainable occupational actions are normally carried out in concrete situations within a company or organisation, where other people, groups, institutions or departments are involved, communication and cooperation skills as well as the ability to participate in organisational and social dialogs about sustainability are required apart from expert skills.

Source: NUN 2007, 6f

In December of 2002, the General Assembly of the United Nations declared the time period 2005 – 2014 the UN Decade of Education for Sustainable Development and called on all member states to integrate sustainable development into all educational levels, from primary education to higher education. United Nations Educational, Scientific and Cultural Organization (UNESCO) was put in charge of implementing the decade, and under the organisation's leadership and support numerous activities have taken place and still are taking place on all continents.

UN Decade of Education for Sustainable Development

The particular significance of TVET in the context of Education for Sustainable Development as well as Education for Sustainable Development's specific focus were emphasised in two "Bonn Declarations". They cover the findings of two international expert conferences: One on the topic "Learning for Work - Citizenship and Sustainability", which was held in 2004 in Bonn and organised by the UNESCO education unit in Paris, the UNESCO-UNEVOC International Centre in Bonn and the German Federal Ministry for Education and Research (*Bundesministerium für Bildung und Forschung, BMBF*). The second one was the UNESCO World Conference on Education for Sustainable Development, which was also held in Bonn in the middle of the UN Decade.

Recommendations for Education for Sustainable Development in the Bonn Declaration

The Bonn Declaration of 2004 declares: “Since education is considered the key to effective development strategies, technical and vocational education and training (TVET) must be the master key that can alleviate poverty, promote peace, conserve the environment, improve the quality of life for all and help to achieve sustainable development” (UNESCO-UNEVOC 2006, 29).

TVET: master key for sustainable development

The following recommendations, among others, were made during the UNESCO World Conference on Education for Sustainable Development, in the middle of the UN Decade (UNESCO 2009):

Half time conference calls for concerted efforts

- “Reorient education and training systems to address sustainability concerns through coherent policies at national and local levels. Develop and implement ESD policies through co-ordinated inter-sectoral/inter-ministerial approaches that also involve business and the corporate sector, civil society, local communities and the scientific community.
- Support the incorporation of sustainable development issues using an integrated and systemic approach in formal education as well as in non-formal and informal education at all levels, in particular through the development of effective pedagogical approaches, teacher education, teaching practice, curricula, learning materials, and education leadership development, and also by recognizing the significant contribution of non-formal education and informal learning as well as vocational and work-place learning. Sustainable development is a cross-cutting theme with relevance to all disciplines and sectors.
- Reorient curriculum and teacher education programmes to integrate ESD into both pre-service and in-service programmes. Support teacher education institutions, teachers and professors to network, develop, and research sound pedagogical practice. Specifically support teachers to develop ESD strategies that can work with large class sizes, and to evaluate ESD learning processes.
- Develop and extend ESD partnerships to integrate ESD into training, vocational education and workplace learning by involving civil society, public and private sectors, non-governmental organisations (NGOs), and development partners. ESD should become an integral part of the training of leaders in business, industry, trade union, non-profit and voluntary organisations, and the public services. Re-orient TVET programmes to include ESD.
- Intensify efforts in education and training systems to address critical and urgent sustainability challenges such as climate change, water and food security by developing specific action plans and/or programmes within the UN Education for Sustainable Development umbrella and partnership framework.”

The significance of TVET for green economy and green economic growth has already been established in the 2008 UNEP study “Towards a Green Economy”. However, how to carry out specifics remains very broad. The study does not bring up concrete competences that need to be promoted and developed, and instead highlights the importance of a skilled work force as well as the relevance of competences in MINT subjects¹². Individual countries, such as the United Kingdom or Australia, have in fact attempted to create lists of specific green skills. However, the lists are oriented purely toward occupational fields (e.g. waste, energy, construction) and do not contain comprehensive skills across occupations (core skills).¹²

There is no one-size-fits-all skills catalogue for environmental competences

12 The OECD study “Towards Green Growth” follows a similar line of argument (OECD 2011).

The ILO-CEDEFOP study “Skills for Green Jobs” (2011) points out that it is difficult to determine specific green skills that apply for all countries. Instead, the report derives core skills that appear to be relevant for green jobs from the 21 country studies (see box 6)¹³.

Box 6: Core Skills for Green Jobs

Aside from specific vocational skills, the following core skills are necessary for green jobs:

- Strategic and leadership skills to enable policy-makers and business executives to set the right incentives and create conditions conducive to cleaner production, cleaner transportation etc.
- Adaptability and transferability skills to enable workers to learn and apply the new technologies and processes required to green their jobs;
- Environmental awareness and willingness to learn about sustainable development;
- Coordination, management and business skills to facilitate holistic and interdisciplinary approaches incorporating economic, social and ecological objectives;
- Systems and risk analysis skills to assess, interpret and understand both the need for change and the measures required;
- Entrepreneurial skills to seize the opportunities of low-carbon technologies;
- Innovation skills to identify opportunities and create new strategies to respond to green challenges;
- Communication and negotiation skills to discuss conflicting interests in complex contexts;
- Marketing skills to promote greener products and services;
- Consulting skills to advise consumers about green solutions and to spread the use of green technologies; and
- Networking, IT and language skills to perform in global markets.

Source: ILO/CEDEFOP 2011, 107

The BMZ is concerned that the TVET systems of most partner countries are not yet or not sufficiently able to meet the requirements of green labour markets flexibly with demand-oriented supply of vocational training and continuing education. There is considerable pressure to act in order to:

- Create new education and training possibilities (e.g. in the solar, bioenergy and geothermic sectors).
- Adjust job descriptions in conventional fields (greening of jobs).
- Adjust the skill set of those workers affected by the green transformation to the technical change by providing further education or retraining.
- Provide qualified teaching personnel and adequate technical equipment.

TVET systems of many development cooperation partner countries are being challenged

13 Please note that these core skills are formulated like guidelines; in order to refer to actual competences, the phrase “to be able to” would need to be added.

2.3 Empirical Findings¹⁴

In developing countries, changing environmental conditions, national environmental policies and corresponding legislation are the most important factors for driving demand for green skills.

The 2011 ILO-CEDEFOP report identified four key driving factors that have changed skills requirements: “changes in the physical environment itself and changes induced by government regulations, more efficient technologies and changes in consumer demand” (ILO-CEDEFOP 2011, xvii). These drivers of transformation are interrelated. However, the study showed that their relative importance differs among countries. While consumer behaviour and market forces are the most important drivers for change and consequently changed skills requirements in industrialised countries, the most important factors in developing countries are environmental changes, policies and regulations (ILO-CEDEFOP 2011, 7).

Driving factors for changed skills requirements

TVET has not been integrated into national sustainability strategies and programmes; environmental and vocational training policies are often not harmonised.

Most of the countries examined see the potential to create employment in a low-carbon economy. However, TVET is not included in any national sustainability or environmental strategies or programmes (ibid., 163). The study further discovered that environmental policies are often dealt with in isolation. Many countries have developed and implemented an environmental policy; however, without any corresponding vocational policies. Similarly, there are also cases where training programmes are launched that are relevant to environmental issues but not coordinated with the national environmental policy. The results are disastrous, because close coordination of environmental and vocational training policies is a key factor in achieving a successful transition to a green economy.

Coherence amongst different policies

The study examined different countries’ policy responses and grouped them into three broad categories (ibid., 32):

Three categories

- “Sound and comprehensive policies in countries where policies for the environment and/or skills are internally sound and comprehensive but not always well aligned;
- Fragmented policies in countries where policies for the environment and skills are somewhat weaker and generally not well aligned; and
- Policies under development in countries that do not have either a well-developed environmental policy or skills development policy for a greener economy”.

¹⁴ This section summarises important findings of the ILO/CEDEFOP 2011 report as well as of the UNEP/ILO/IOE/ITUC report from 2008.

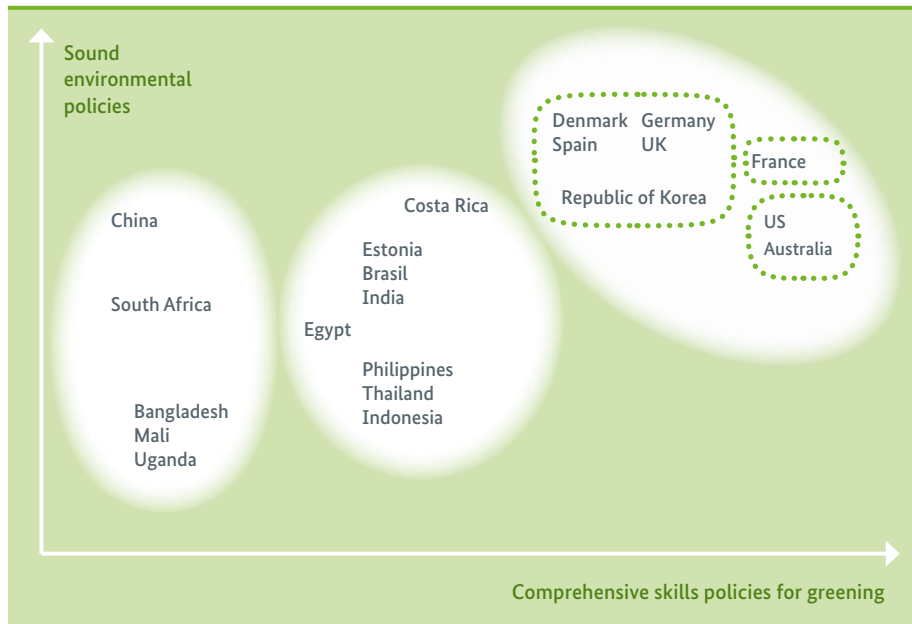


Figure 2: Coherence between Environment and Vocational Training Policies
(ILO/CEDEFOP 2011, 33)

The results of the study are illustrated in figure 2. In the upper right-hand corner are EU countries. These countries have comprehensive “skills policies for greening”, which are conducive for a green transformation of the economy. European countries have a long-standing tradition when it comes to environmental policies and are therefore global pioneers in this area. Australia and the United States are strong in the area of addressing environmental concerns within TVET. On the other hand, there are countries that have environmental policies of varying degrees of soundness, but whose policies may not effectively intersect with vocational education policies, strategies and programmes.

Christine Hofmann, co-author of the report, points out that the response to the new environmental requirements is not gender neutral. Most technology-oriented professions are dominated by men. Women are also underrepresented in science and technical subjects at schools on the secondary or tertiary level. Exceptions to this trend are a number of developing and emerging countries such as India and Bangladesh, where NGOs specifically train women in solar technology and engineering in order to install and maintain thousands of so-called solar home systems in rural areas.

Coherence is highest in developed countries

Green jobs are not gender neutral

Green jobs do not necessarily also mean respect for workers' rights

The study “*Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World*” (UNEP/ ILO/IOE/ ITUC 2008) points out that a narrow definition of green jobs based primarily on the ecological aspects of the respective occupational activity is not holistic enough. The report emphasises that green jobs also need to be decent jobs, meaning they have to respect workers' rights, pay decent salaries, offer job security, safety and humane working conditions etc. The green economy also needs to comply with minimum standards for employment. According to the authors, a job that exploits workers, is potentially unsafe and/ or does not allow the employee to make a living cannot be called green (compare with figure 2).¹⁵ While jobs within the environmental economy, jobs such as those on organic oil plantations or in recycling sectors (reprocessing electronic scrap or dismantling ships etc.), comply with regulations in richer countries, they do not meet minimum social standards in poorer countries or countries with medium income. Additionally, many of these jobs are within the informal sector and therefore by definition “irregular” (ibid., 299f).

Requirements for green jobs

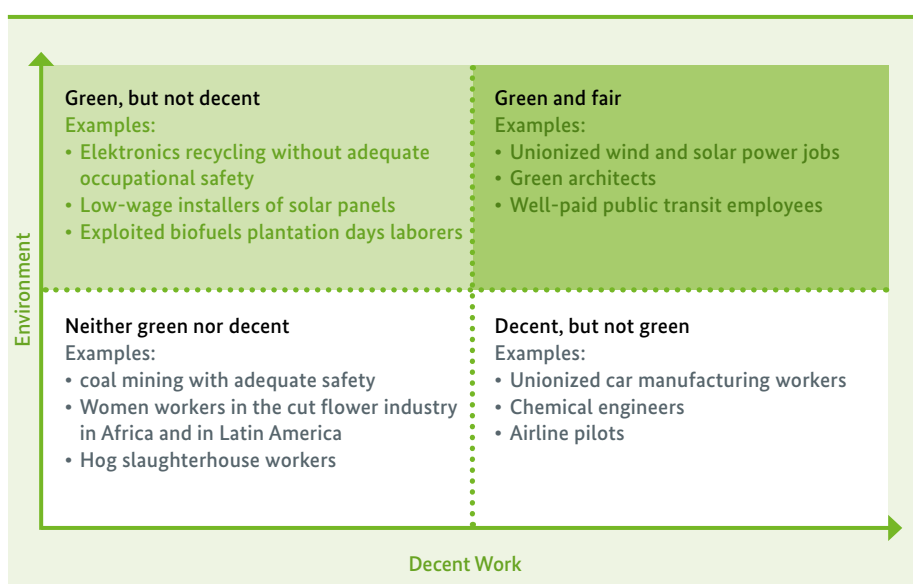


Figure 3: Green and Decent Jobs: an Overview (UNEP/ILO/IOE/ITUC 2008, 40)

Improving existing vocational skills is more important than developing new specialised, green jobs and green TVET

Many of the skills needed in a green economy can be covered by already existing jobs. “A balance of generic skills (for example autonomy and communication), generic green skills (such as reducing waste and improving energy and resource efficiency) and ‘topping up’ existing job-related skills is much more important to developing a low-carbon economy than more specialised, green skills” (CEDEFOP 2010, 1) (see also Figure 1).

Integrating green skills in existing jobs rather than developing new green jobs

¹⁵ This illustrates the problem with respect to the terms green economy and green jobs, both of which may be “overstretched” by this (legitimate) demand. The question is why they are not simply called sustainable economy and sustainable jobs.

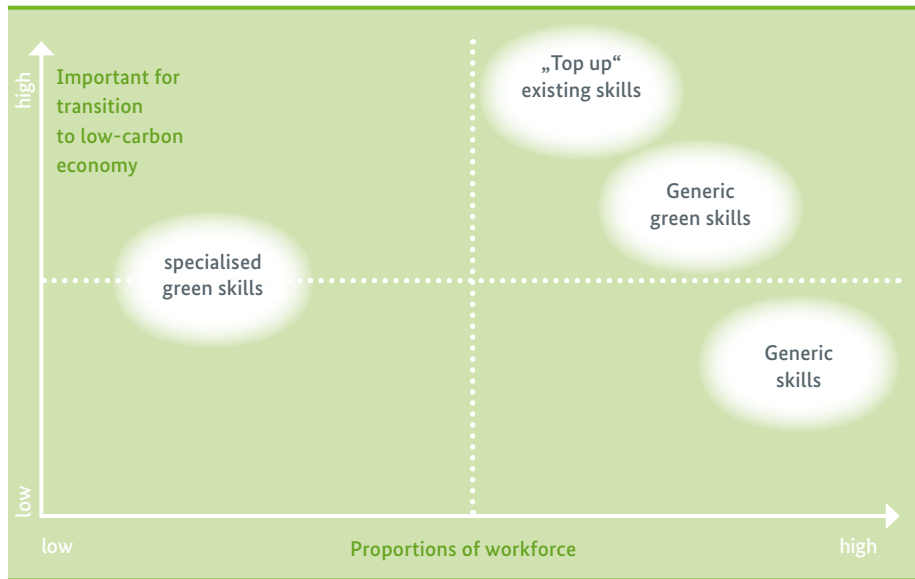


Figure 4: Skill Needs for the Low-carbon Economy (CEDEFOP 2010, 2)

There are signs that, similarly to today's IT-related skills, green skills will significantly gain in importance in almost all economic sectors in the future. However, this does not mean that the transition into a greener economy necessarily also needs to entail extensive skill-adjusting programmes. On the contrary, the ILO-CEDEFOP study shows that specific vocational skills such as welding, surface treatment and outfitting as well as more basic skills are also required in green employment. These additional skills for specific sectors or technologies can be acquired relatively easily and quickly through "upskilling" with training, seminars or on the job (see figure 5).

The fact that the new required green skills are not necessarily considered particularly challenging, does not, however, mean that the investments required for green upskilling should be neglected. The building industry may serve as a good example. Energy efficiency and construction of zero-carbon homes are heavily driven by national legislation in various countries, meeting increasingly high efficiency standards. Here too, it will not be necessary to create new jobs, but rather to integrate new skill requirements into existing training courses (mason, carpenter, tiler etc.) and to further train existing workers. The latter represents a considerable challenge for the industry on the sole basis of the high number of persons requiring training (working hours, training costs).

Green upskilling on the basis of solid vocational skills

Green upskilling can lead to considerable costs

Member State	Occupation(s)	Core Training	Upskilling	New Occupation
Denmark	Industry electrician; energy technologist	VET qualifications; tertiary engineering qualifications	Knowledge of energy sources ability to integrate energy systems, project management	Manager in renewable energy
	Industrial operator; industry electrician	VET qualifications; upper secondary qualifications	Assembly, installation of parts, use of tools	Wind turbine operator
Estonia	Construction worker	No professional standard	Knowledge of energy systems, data analysis, project management	Energy auditor
France	Recycling sector worker	General certificate of vocational qualification	sorting and reception techniques, knowledge of conditioning and storage	Waste recycling operator
	Product design and services	22 initial training courses with varying specialisation	Integrating environmental criteria in design process, integrated assessment and life cycle analysis	Eco-designer
Germany	Elektronic/mechatronic technician	Initial vocational training	Electronics and hydraulic systems, safety procedures, operation and services	Wind power service technician
	Plumber; electric and heating installer	Initial vocational training	Technical training, knowledge of administrative procedures, entrepreneurial skills	Solar energy entrepreneur; Installations project designer
United Kingdom	Engineer in energy sector	Tertiary engineering qualifications	Installation and maintenance of low-carbon technologies, customer service skills	Smart energy expert; smart energy manager
	Commodity trader/broker	Tertiary qualification	Practical skills on functioning of carbon market, understanding of trading tools	Carbon trader/broker

Figure 5: Examples of Upskilling to New Occupations in Member States, CEDEFOP 2010, 3

Reliable data collection of green skills needs represents a considerable global challenge

As there is no uniform definition of green skills, they cannot easily be integrated into existing occupational and industrial classification systems. As a consequence, forecasting employment trends and corresponding skill requirements creates difficulties. Countries that have a long track record of well-established and refined labour market information systems (LMIS) have advantages. However, they still need to adjust to the new skill requirements of the low-carbon economy. Countries that don't have such procedures rely on ad-hoc surveys and initiatives supported by donor countries which often remain one-time events and are not sustainable. The ILO-CEDEFOP study points out that the most effective approaches for "anticipating and monitoring needs for green skills are those that are built on social dialogue at sectoral or grass-roots level". The report also emphasises that there is a need for greater coordination across economic sectors (ILO-CEDEFOP 2011, 145).

Analysing data collection
of green skill needs

The International Consultation Meeting 2011 in Bonn called for green qualification measures that align themselves closely with the skill needs of the economy and by doing so create adequate employment opportunities for graduates. Creating a divide between a greening TVET on the one hand and employment on the other needs to be avoided (UNESCO-UNEVOC/GIZ/CPSC 2011, 23). However, this can only be accomplished if TVET and the economy are closely linked. With this background, it is thus not surprising if school-based TVET systems are facing greater challenges than workplace-related programmes such as the one in Germany. Apart from that, basic green skills required for different variations of specific occupations can be determined in practically all cases, even without analysing education needs in detail. This entails knowledge, skills and abilities in the context of energy and resource efficiency, avoiding waste and waste management, knowing about the potential environmental impact of a respective occupational activity as well as knowing means to avoid risks by acting adequately in a work-related context, and finally, the ability and willingness to take on producer responsibility for one's own actions within the boundaries set by the employer or line manager.

Linking the economy
and TVET

A shortage of skilled labour is a serious barrier to the transition into a green economy

Strategies, programmes and measures for environmental and resource protection can only be carried out if a sufficient number of employees with the required skills are available to develop, install and operate environmentally friendly and effective technologies and processes. A shortage of skilled labour represents a serious barrier to the introduction of green technologies in many countries (for instance, biofuel in Brazil, renewable energies in Bangladesh, the building industry in Australia, China and South Africa). As a consequence, the potential for climate protection cannot be fully realised. Thus, building standards for passive or low energy houses are often not met, and facilities for renewable energies cannot be maintained or repaired properly (UNEP 2011, 572 ff).

Competences in the fields of mathematics, information technology, natural sciences and technology are preconditions for green economic growth

The development and application of environmentally friendly technologies – such as solar and wind technology, energy and resource efficient energy, process engineering and building services as well as control and measurement technologies – require competences in the so-called MINT (mathematics, information technology, natural sciences and technology) subjects. These fields offer good corresponding career opportunities to graduates of training programmes. However, especially within the EU, a decreasing interest of young people in secondary or tertiary schools in MINT subjects is evident. In the long run this will not only lower the productivity and competitiveness of the EU as a whole, this could also turn out to be a major inhibiting factor for growth of the green economy. As a result of the demographic change within a number of EU member states (e.g. Germany), there is already a shortage of technicians and engineers, amongst others, causing great problems to enterprises operating in the environmental sector. Dropping numbers of engineering students and graduates of training programmes for technical occupations of the past years will worsen this situation in the future.

Competences in the MINT subjects form the basis for employment in a green economy

The informal sector remains ignored to a large extent

It is particularly in developing countries that a large part of the population is employed in the informal sector, mostly without any access to formal vocational training. The inclusion of these groups by providing them with opportunities to participate in the social and economic transformation process and by facilitating access to the green market represents a great challenge.

The informal sector and access to formal vocational training

Green Skills Development in Germany

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Green Skills Development in Germany

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3.1 Political and Economic Framework

An economy oriented towards sustainability needs skilled employees who are in a position to shape occupational situations in the spirit of the guiding principles of sustainable development. Consequently Technical Vocational Education and Training is of essential importance for sustainable development. The prospective employees will be indispensable, since it is a qualified workforce that is necessary to implement organisationally and technically efficient improvements in businesses, and to negotiate appropriately in areas where they can act and make decisions.

TVET is considerably significant for sustainable development

The beginning of German environmental politics goes back to the early 1970's. Over time, serious environmental problems and public pressure led to a political sphere independent in its own right. The central issues have changed over the years: Whereas the topics of sewage treatment, waste management and emission control were high on the agenda of the 1970's and 1980's, what is in the foreground now are the expansion of renewable energies, the transformation of the energy system, the increase in energy and resource efficiency as well as reshaping the economy along ecological lines.

The beginning of German environmental politics goes back to the early 1970's.

Box 7: Energy Concept 2010 – Goals and Development Paths

In their Energy Concept, the German Government has determined the following goals and development paths:

- Reduce Germany's greenhouse gas emissions by 40% by 2020, 55% by 2030, 70% by 2040 and 80 to 95% by 2050.
- Complete a nuclear phase-out by 2022.
- Increase the share of renewables of gross final energy consumption from around 10 % in 2010 to 60% by 2050; the share of renewable energy in electricity supply is to reach at least 80% by 2050.
- Long-term reduction of energy consumption: By 2050, reduce primary energy consumption by 50% compared to 2008. This requires an annual increase in energy productivity of, on average, 2.1% based on final energy consumption.
- By 2050, reduce power consumption by 25% compared to 2008, and by 10% by 2020.
- Double the rate of energy-saving renovation from currently about 1% of the building stock annually to 2%.
- In transport, cut back final energy consumption by 2050 by around 40% compared to 2005.

Source: Bundesregierung 2012b, 5

A national strategy for sustainability was drafted by the German federal government for the Post-Rio Conference in 2002 in Johannesburg. The strategy entailed 21 goals and indicators for sustainable development. This strategy was re-examined and further developed in 2004, 2008, and 2012.

Box 8: Management Rules for Sustainability

Basic rule

- (1) Each generation must solve its own problems and not burden the next generations with them. It must also make provisions for foreseeable future problems.

Rules of sustainability for individual areas of action

- (2) Renewable natural goods (e.g. wood or fish populations) should, on a long term basis, be used only within the bounds of their ability to regenerate.
Equally, non-renewable natural goods (e.g. minerals or fossil energy sources) should only be used to the extent that their function can be replaced by other materials or energy sources.
- (3) The release of materials into the environment should, in the long run, not exceed the adaptability of the eco-system – e.g. the climate, forests and oceans.
- (4) Dangers and unjustifiable risks to human health should be avoided
- (5) Structural change triggered by technical developments and international competition should be shaped in a way that is economically successful as well as ecologically and socially sustainable. For this purpose, political fields should be integrated so that economic growth, high employment, social cohesion and environmental protection go hand in hand.
- (6) Energy and natural resource consumption and the provision of transport services should be decoupled from economic growth. At the same time, we should aim for growth-related increases in demand for energy, resources and transport to be more than offset by efficiency gains. In this context, adding to the body of knowledge through R&D and disseminating it through education have a decisive role to play.
- (7) Public budget are to take account of intergenerational equity. The Federal Government, the Länder and the municipalities should present balanced budgets and take the further step of continually reducing their debt position.
- (8) Sustainable agriculture needs to be compatible with nature and the environment and to take into account the requirements of livestock farming in a way that is fair to the animals and provides consumer protection, particularly concerning health matters.
- (9) In order to strengthen social cohesion
 - poverty and social exclusion should be prevented as far as possible,
 - opportunities for participating in economic development should be open to all sections of society,
 - necessary adaptations to demographic change should take place at an early stage at the political and economics levels and in society,
 - everybody should take part in social and political life.
- (10) General international conditions should be shaped jointly in a manner which ensures that people in all countries can lead a life worthy of a human being and according to their ideas, and in unison with their regional environment while at the same time profiting from a unit. Sustainable global action is based on the Millennium Development Goals of the United Nations. An integrated approach should link the fight against poverty and hunger with:
 - the respect of human rights,
 - economic development,
 - environmental protection, and
 - responsible action by governments (good governance)

Source: Bundesregierung 2012b, 7

The area of environmental protection/sustainability in Germany has developed into a significant economic sector since the 1980s. In 2011, about 2 million people were employed in this sector¹⁶, 380,000 of them in the area of renewable energies. Meanwhile almost five per cent of all the workers in Germany owe their employment to environmental protection efforts. However, it is difficult to distinguish between green and non-green sectors and jobs in individual cases. This is because in addition to the classic environmental protection areas of water and sewage with 100,000 workers, as well as waste and recycling management with 200,000 workers, there are also large industries (e.g. building, machine and factory construction, electronics, woodworking or retailing), which are active in conventional as well as green sectors. The difficulty of categorisation is evident also on the level of individual enterprises.

In Germany, about 2 million people are employed in the environmental sector.

Renewable energies are right in the forefront of growth dynamics. In 2011, around 380,000 people were employed in this sector. This is more than double the figure of the first inquiry in 2004 which recorded 160,500 employees in this field. Seen relatively, the strongest surges in growth since 2004 have been evident in geothermal energy. In contrast, in absolute numbers it was solar energy (with around 100,000 almost five times as many) and biomass (with 68,000 almost doubled) that were clearly leading. Wind energy, which had already reached a greater degree of maturity in 2004 with 61,600 employees, could show an increase of a good 60 per cent. Biomass (with a total of around 124,400 jobs) and solar energy (125,000 jobs) each contributed to a third of the gross employment. Wind energy follows with 101,100, geothermal energy with 14,200 and water power with 7,300 jobs (BMU, 2013, 16).

Renewable energies exhibit the highest growth dynamic.

According to estimates approximately 20,000 companies are active in renewable energies. The spectrum ranges from appraisal and planning offices to trade and agricultural businesses, to solar corporations and large wind turbine manufacturers who are active all over the world. This branch of the economy is influenced by young, small and middle sized enterprises (SME) that are developing dynamically.

Approximately 20,000 companies are active in renewable energies, predominantly small and medium sized enterprises

In the wind energy segment 20 per cent of the jobs are allotted to the eight large and medium-large wind plant manufacturers as well as to their subsidiary service enterprises or independent service enterprises in assembly, installation and maintenance. The majority of employees in this branch are found with delivery firms, especially in machine and plant manufacture (generators, turbines and their components). In the solar energy segment big heating firms as well as specialists for solar thermal plants have established themselves in the solar heating branch. In spite of several big and strongly expanding enterprises, the renewable energy market is characterised predominantly by SME. The majority of the approximately 5,000 companies of the biomass utilisation segment are small businesses with up to ten to fifty employees. The companies with the most employees are found

16 The last statistical data were provided in 2006. At that time 1.8 million people were employed in the environmental sector. Experts assume that the number has increased significantly since then (BMU 2011, 33; Brüdgam 2011). In evaluating the employment relevance of an environmental economy, a difference between gross and net effects on employment has to be taken into account. As a rule, only numbers of gross employment are given in official reports. However, the entire value chain has to be included in the overall picture. Over 50 percent of existing jobs are in the area of intermediary input and tasks. Traditional branches such as factory and machine construction are as much a part of the big picture as service personnel for building, running, and maintaining energy producing plants. In Germany, the net employment effect of the environmental economy overall, and in the area of expansion of renewable energy use are clearly positive. In countries which are less export-oriented than Germany, the net employment effect of the changeover to renewable energies would not show itself as clearly (Lutz 2012).

predominantly in the biogas field. The segment of geothermal energy includes heat pump manufacturers, drilling firms along with drilling equipment manufacturers, planning offices and building firms, energy supply enterprises and the related skilled crafts and trades companies which do the installing and maintenance. The majority of the companies in this segment are small and very small companies with up to ten employees. The utilisation of water power looks back on a long tradition in Germany and was the strongest segment of renewable energies until it was replaced by wind power as recently as 2004. The plant manufacturing firms are predominantly active in business with foreign countries; the export quota is at 80 per cent. The number of employees of the approximately 1,000 companies in this segment has remained the same for years at 9,400 people.

Jobs in the renewable energy sector are marked by being sustainable (because of the environmentally sound use of renewable resources), challenging (technical innovations, high qualification requirements) and secure (employment growth especially in SME). Since the broad spectrum of enterprises stretches over all the individual stages of the value chain, this creates a highly diversified and especially stable jobs structure. And since the utilisation of renewable energies is not centralised, jobs can permanently be created, especially in structurally weak regions.

All signs indicate that the environmental sector, with its good prospects for growth, will remain a job motor for the next several years. The business consultant Roland Berger has predicted that the business volume of environmental protection goods will increase to 16 per cent of the total business volume in the German industry (BMU, 2009, 85).

However, many firms complain already that training positions and jobs can't be filled because of a lack of applicants. This is particularly the case for the segments of geothermal heat and biomass. This problem – as in other economic areas – will become more drastic in the future because of the changes in demographics. And for the whole sector of renewable energies which is tending towards growth, the inadequate availability of skilled workers represents a possible braking of growth.

Jobs in renewable energies are regarded as being sustainable, challenging and secure.

Germany expects an increase of approximately 500,000 jobs in this segment by 2030

Lack of skilled workers is a potential brake to growth

3.2 Vocational Education for Sustainable Development

Concept of (Vocational) Education for Sustainable Development

20 years after the Rio Conference of 1992, the establishment of sustainable development processes in the areas of production, consumption and lifestyles are globally more urgent than ever. In this connection, the German Federal Advisory Council for Global Environmental Changes (*Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen*, WBGU) refers to a necessary “fundamental transformation of global society” (WBGU 2011, 1). The needed innovations in technology, economics, participatory politics, crossover financial processes between the wealthy and developing nations, as well as the transformation of consumption and lifestyle patterns aren’t going to develop on their own, according to the WBGU. Nor are they going to be the result of a gradual cultural evolution. What is necessary is a systematically facilitated, large-scale mental/psychological transformation. This doesn’t mean just raising awareness in general. Rather, every person must use the opportunity to acquire the special values and knowledge, also the skills and abilities which everyone will need to shape a future worth living. We have to learn sustainability – in formal educational institutions, out-of-school settings and informal daily situations. Education is a necessary and substantial contribution toward the preventive measure of setting sustainable development in motion. Sustainable development processes cannot be implemented without the appropriate education.

Environmental protection and efficient use of resources are not the job of specialists, male or female. Energy and resource efficiency matter to all of us! Of course, energy and resource efficiency mean different things in the framework of different occupational activities of the different industries, professional fields or occupations. However, every profession has a relation to the subject of energy and resource efficiency, either directly or indirectly. This applies to the following professions and equally to men or women:

- Industry and office managers, who are in production, administration or controlling;
- Electricians, mechanics, or mechatronics technicians, who work in industrial and manual jobs, with the installation and/or maintenance and repair of plants, motors etc.;
- Chemists and people with laboratory jobs, who are in research or technical production jobs; as well as those with
- Commercial professions in which the workers are familiar with the products and who have to be in a position to be able to advise their customers.

The advancement of energy and resource efficiency is an important pillar of justification for (Vocational) Education for Sustainable Development. Since sustainable behaviour is crucial for every occupation and every branch of industry, skills for sustainable professional practice need to be an integral component of vocational coping skills in general (**environmental expertise**).

This priority opens up opportunities for quality improvement and modernisation of TVET: the aim of sustainable development is to shape the future and provide skills for that future. This goal expands the spectrum of vocational coping skills to include (Hahne 2007):

The WBGU calls for a fundamental transformation of the global community for which education plays an indispensable role

Every profession has a direct or indirect relation to the subject of energy and resource efficiency

Skills for sustainable professional practice are an integral part of vocational coping skills

Required competences in the context of sustainable development

- Reflection upon and evaluation of the direct and indirect effects of occupational activity on the environment, on the living and working conditions of this and future generations;
- Expert contributions in determining work, economy, and technology matters;
- Implementation of sustainable energy and resource management with a sound foundation in scientific knowledge of the relationships between occupational and life circumstances;
- Communication and cooperation across all professions along the value chain;
- Participation in business and societal dialogues about sustainable development.

Developing vocational skills for sustainable development has to do with the improvement of all aspects of running a business, which means: energy, raw materials, contracts, operations and management as well as the development of vision, personnel and the organisation itself. In terms of the economic market, the development and production of sustainable products and services can be viewed as featured selling points and competition advantages for the businesses, along with advantages for customer consulting in sustainability.

Contrary to general education, where the individual is approached as a consumer, taking on producer responsibility is required of individuals when aspects of sustainable development are considered in an integrative way in TVET. This demands new skills of those involved. Above all: system expertise for sustainable actions in complex technological and social systems. In addition, it requires problem solving and shaping skills for working situations and processes, products and customer orders in the manual crafts and trades.

Taking on producer responsibility, system expertise and shaping skills

Education for Sustainable Development falls short when it limits itself to instruction and teaching processes. More essential is the encouragement of deeper insights into how to safeguard the future through sustainability, into justice, ecological compatibility, economic achievement potential and social responsibility. There is already conflict about what goals should be within these dimensions of sustainability. But apart from that, every person has her/his own concept of sustainability, justice, economic necessity and responsibility of individuals, businesses and society. Education processes should allow for expression of these convictions and for reflection through dialogue with fellow learners. Conflicts of interests are also foreseeable in the attitudes and values of customers, supervisors and colleagues. This will certainly require the emergence of a higher degree of commitment and motivation for addressing resistance caused by currently accepted values and acquired attitudes. The way to a sustainable future, as opposed to sticking to a seemingly simpler but unsustainable path, will have to be shown through participation and dialogue.

Dialogue as a didactical principle of ESD

System expertise and shaping skills as well as the willingness to take producer responsibility as an integral component of vocational coping skills cannot be simply taught or verbally transmitted. Successful training has much more to do with creating and carrying out active learning concepts and situations, in which relevant skills of the trainees can be acquired through self-sufficient, hands-on activities. The ideal environment for learning skills is one which creates the closest reality to the professional demands of running a business.

Design practice oriented learning situations

UN-Decade in Germany, Education Policies, Models and Other Funding Projects

Giving support for model trials and providing scientific monitoring for them belongs to the responsibilities of the German Federal Institute for Vocational Education and Training (*Bundesinstitut für Berufsbildung*; BIBB). As early as in the 1990s, the BIBB sponsored 16 model trials and the Federal-State-Commission for Educational Planning and Research Development (*Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung*, BLK) sponsored 20 model trials in order to provide support for the integration of environmental protection into TVET. In these models, new approaches to learning, didactical materials, concepts of qualifications and implementation strategies were designed and tried out. Most of these were carried out at the level of vocational training. As early as 2001, the BIBB placed work emphasis on ESD with the goal of designing and carrying out innovative research and development projects and to transfer their results.

36 model trials for environmental protection in TVET

The United Nations designated the years 2005 to 2014 as the “Decade of Education for Sustainable Development”. On July 1, 2004, the German Parliament decided unanimously to initiate an action plan for the UN Decade. It is to be an inherent part of the sustainability strategy of the German federal government. The action plan stipulates four strategic goals:

Action plan for the UN Decade 2005-2014 “Education for Sustainable Development”

- Further development of activities and pooling experiences as well as wide transfer of examples of good practice;
- Networking of people in ESD;
- Improvement of public perception of ESD;
- Strengthening of international cooperation.

While spreading the principles of sustainable development throughout the TVET system, the BIBB and other organisations utilised different process and transfer oriented instruments such as

Instruments for spreading the principles of sustainable development in TVET

- Stakeholders conferences,
- An internet platform,
- A good-practice collection and
- Centrally managed steering and monitoring.

Aspects of sustainability relevant to different branches of industry and to specific topics, and their consequences for TVET, were presented in more than 20 stakeholders’ conferences¹⁷ sponsored by the BIBB. The purpose of the conferences was to make the principles of sustainability concrete for the respective occupations and to identify areas of potential action.¹⁸

Stakeholder conferences, model trials and expert meetings

17 Occupations in the recycling economy; recyclable building groups in the automobile supplier industry; renewable energies; renewable raw materials; supply-oriented occupations; global learning in TVET; vocational training for disadvantaged groups; international cooperation etc.

18 An overview can be found in the Portal Sustainability of the BIBB under: http://bbne.bibb.de/de/nh_8958.htm

The conferences were financed by the German Federal Ministry for Education and Research (BMBF) and were guided by the BIBB with major focus on sustainability in 10 different economic models.¹⁹ They form the core of innovative implementation of an Education for Sustainable Development nationwide. Intermediary results were presented and discussed in two nationwide expert conferences (BMBF 2003; BIBB 2005).

In the BMBF framework programme Research for Sustainability (*Forschung für Nachhaltigkeit*, FONA), the BIBB was engaged in the cross-sectional project “TVET for a Sustainable Forestry and Woodworking Economy” from 2004 to 2010.

In 2010, a further BMBF Support programme began, “TVET for Sustainable Development”, with six cooperative and individual projects in the metal and electronics industries, with emphasis on renewable energies, building, and housing, as well as on chemistry and nutrition. An essential element is the transfer of results into practice.²⁰

The German Federal Foundation for the Environment (*Deutsche Bundesstiftung Umwelt*, DBU) has been sponsoring for several years a series of projects which could be allocated to Education for Sustainable Development. In one of these projects a Good Practice Agency for “Sustainability in TVET and at Work” (*Good-Practice-Agentur Nachhaltigkeit in Berufsbildung und Arbeit*, GPA NiBA) was established.²¹ This can be understood as information and communication power-wheel and it also takes on extensive design tasks. Through these functions, the active transfer of the concept and the systematic networking of the stakeholders in this particular field take on a central meaning. The GPA NiBA had three specific, core assignments:

- Documentation: The GPA NiBA documents the state of the art of Education for Sustainable Development. The main focus is the improvement of information about successful practices, relevant materials, and already existing courses for vocational training in general as well as further or continuing education. They use the sustainability portal of the BIBB in the internet as a basis.
- Active transfer: In addition to gathering and presenting practice examples, teaching and learning aids, face-to-face events about ESD and learning from good practices, “Initiative New Quality of Work” (www.inqa.de) are held.
- Networking of the stakeholders: Building on existing communication structures, for instance, the German Work Community for Training and Further Education (*Bundesarbeitsgemeinschaft Aus-und Weiterbildung*) during the UN Decade as well as stakeholders’ conferences and thematic work groups, the creation of possibilities for direct discussion and job opportunities, along with the construction of a virtual community all take on a special relevance.

19 An overview of these model attempts can be found in the portal Sustainability of the BIBB under: <http://bbne.bibb.de/de/56342.htm>

20 Further information in the portal Sustainability of the BIBB under: <http://bbne.bibb.de/de/56741.htm>

21 The GPA was built under the auspices of the BIBB by the Institute for Environmental Protection in Vocational Education (*Institut für Umweltschutz in der Berufsbildung e.V.*, IUB). Since the BIBB took it over, the GPA is no longer in operation. The portal Sustainability which the IUB assembled is, however, still accessible: <http://bbne.bibb.de>

These and the activities mentioned in the following text appear at first glance comprehensive and extensive. But the picture becomes considerably modified if the statement of the German Federal Advisory Council on Global Change (WBGU) is accurate: that there is a great need for transformation, and that sustainable development processes cannot be carried out without appropriate “transformation in education and training”. So it came to the point where the WBGU even today, toward the end of the on-going UN Decade, had to discover that education should “take on greater importance in the German sustainability strategy” (WBGU 2011, 26). Everything in the area of education that had been accomplished because of and during the UN Decade, showed however, according to the WBGU, that transformation has to be “rapidly sped up” (ibid.), if the necessary awareness of responsibility and shaping skills are going to stand a chance against the global problem of non-sustainable development. This is especially true to a great extent in TVET. Because although TVET has theoretically been given an ever higher place in the context of sustainable development and in the great transformation, in the context of the UN-Decade “Training for sustainable development 2005-2014”, it has been neglected in a “stepmotherly” way. The attempts so far to perpetuate the multifaceted individual initiatives, to combine them and develop them systematically, have failed.

In spite of its many varied activities, ESD was treated in “stepmotherly” fashion during the UN Decade

3.3 Activities at the Level of Vocational Training

Because of the prominent position of the economy in relation to TVET, the technological and economic changes in Germany have always been reflected quite quickly in TVET systems. Instead of always developing new occupations, the integration of new requirements into already existing occupations has been preferred (setting new emphases, adding qualifications). The guideline has been the guarantee of job opportunities for the individual through qualification on a broad spectrum of applicability.²² Specialisation occurs as a rule only at the level of continuing vocational education and training, which in the context of the concept of lifelong education is vital to TVET in Germany. In the framework of continuing education, reaction to changes in skills requirements can be a great deal more flexible than within vocational training where a change in occupational requirements can only be approved with the consent of the contractual partners, which takes a longer time. However, whenever suitable, additional qualifications reflect the “state of technology”, it can be counted on that they will be assimilated into the training plan in the course of reorganisation and revision.

Vocational training: integration instead of specialisation; specialisation on the level of continuing vocational education and training

The demands of sustainable development and of a green economy will also be perceived and assimilated in this same way. The central focus is upon competent use of technologies and processes, for example, the assembly of wind turbines or solar collectors, efficient manufacturing processes in industry, building or renovating buildings according to low-energy standards, as well as the installation, maintenance and repair of solar collectors in the area of manual skills, and trading with environmentally friendly and fair produced goods in retail.

The competent handling of technologies and processes is in the foreground

22 In this context, the recommendation for the acknowledgement of occupations requiring formal training (Board of the Federal Institute for Vocational Education and Training 1974) is also relevant. According to this document, when a new occupation that requires training is decided upon, criteria have to be adhered to, such as sufficient need for the relevant skills independent of individual businesses, training for conducting occupational activities in an independently responsible manner in as wide an area as possible, permanent occupational activity and sufficient differentiation from other training occupations.

Integration vs. New Occupations: Projections and Forms of Integration at the Level of Vocational Training

Ground-breaking recommendations for further progress in Germany came in 1988 from the BIBB Board on environmental protection for vocational education and training (*Hauptausschuss 1988*).²³ Here it was clear that the federal government, the federal states and their social partners all recognised the relevance of environmental protection for vocational education and training (VET), in that every occupation has at least an indirect effect on the environment. Furthermore, there were strong recommendations to promote a deeper comprehension of the concrete connections between VET and possible environmental impact, and to support a mind-set of responsible conservation of nature's assets and means of livelihood.

Transmitting these skills and abilities should proceed in an integrative fashion, that is, during the entire training period and as much as possible in direct connection with specific occupational activities. Beyond these general remarks, environmentally relevant occupations and environmentally relevant learning goals were named in immediate connection with occupation-specific learning goals and content. Similar relationships were pointed out in the guidelines for vocational instruction, where learning goals with respect to environmental protection were likewise given special attention.²⁴

Consequently, a standard job profile for a position "environmental protection" was added to all of the revised and newly organised jobs that require training and continuing education (BMBF 1998, 78). This document demanded that trainees, at the end of their apprenticeship, should be in a position to contribute to the prevention of business-related environmental damage in the affected area at their place of work. In detail, they should:

- Explain the possible impact on the environment and explain the contributions of their training company to environmental protection.
- Apply regulations for environmental protection valid for the training company.
- Utilise the possibilities of economic and environmentally friendly energy and materials.
- Avoid waste and dispose of materials in an environmentally sound manner.

In order to meet sufficiently the specific needs of public and private sector employers in utilities and waste management, four new occupations in the technical aspects of environment were developed based on the forerunner "utilities and waste disposal contractor":²⁵

- Skilled worker for water supply technology: maintenance and monitoring machines and plants for water production, preparing, routing, laying and repairing water pipes.
- Skilled worker for wastewater technology: preparing wastewater and attending wastewater pipe systems, as well as monitoring and steering the operations in sewage treatment plants and canal systems.

Recommendations of the BIBB Board for Environmental Protection in Vocational Education and Training were ground-breaking

Integration means: throughout the entire training period and as much as possible in direct connection with specific occupational activities

Standard job profile position "environmental protection"

Four technical environmental occupations

23 A few years previous to this the Ministry of Culture conference had already acknowledged the relevance of the topic environmental protection for general educational and vocational school instruction (*Ständige Konferenz 1980*).

24 As a supplement, learning goals which are oriented toward personality are found here along with those having to do with occupation.

25 These and the other most important jobs that require training, additional qualifications and full-time school-based training will be more closely examined in the appendix.

- Skilled worker for recycling and waste disposal management: organising the collection and sorting of waste, its reuse or environmentally sound disposal.
- Skilled worker for pipe, canal, and industrial services: cleaning, monitoring and attending wastewater pipelines and canals, tanks and waste structures in businesses and also in the private and public sphere.

However, this is something of an exception in Germany. Consistent with the integration principle, technologies and methods relevant to environmental and climate protection have so far been integrated into existing relevant occupations.²⁶

In the skilled crafts and trades (consultation, building, maintenance and servicing) the following occupations are relevant:²⁷

Relevant occupations in the skilled crafts and trades

- Plant mechanic for sanitation, heating and air-conditioning: installation, upkeep and repair of household solar thermal and photovoltaic collectors and systems.
- Electricians with specialisation in energy technologies for buildings: installation of smart-home systems.
- Electricians for buildings and infrastructure systems: building automation.

In the area of industrial production of photovoltaic, solar thermic, wind and water power plants, the following industrial metal and electrical occupations are especially important:

Relevant occupations in industry

- Industrial mechanic: Involvement in erecting wind, solar and water power plants and in well digging companies (geothermic) in the building of machines and plant construction.
- Mechatronics technician: Possibilities for involvement in the entire area of renewable energy technologies and a good entry job for further education for the position of a service technician for wind turbines.
- Production technician: Energy and material efficient design of production processes.
- Process mechanics for synthetics and rubber technologies, with a specialisation in fibre composite technology: the production and repair of rotor blades for wind turbines.

Completed job training in the three skilled crafts and trades named above (as in other main and subsidiary construction trades) provides good formal prerequisites for further education in skilled manual jobs; for example, as a specialist for solar technologies or as a specialist for renewable energy technologies. On the other hand, the skilled occupation of mechatronics technician offers an excellent foundation for entering into further skilled jobs, such as a service technician for wind turbines.

Entry into the area of renewable energies

26 In addition to these there are also the so-called green jobs. All training courses in agriculture and home economics are included in this category, such as occupations having to do with farms, fisheries, gardens, forests, horses, animals, also agrarian specialists, mechanics for agricultural and building machines, milk technologies, milling processes and feed plant processes, veterinary doctors and assistants, hunters, distillers, vintners, home managers.

27 In Germany, because of regulative policies, there is as yet no occupation requiring job training specifically geared to renewable energies (like, for example, the job of solar technologist/“Solarteuer” in Austria).

Environmental Protection and Resource Efficiency in Additional Qualifications

An increasing number of additional qualifications which are relevant for sustainability are being offered at the level of vocational training.²⁸ These are exemplary:

- Energy and resources assistant in skilled manual occupations
- Management assistant in the energy and water sectors
- Solar technician

Additional qualifications
on the training level

Full-time School-based Training

In spite of the undeniable importance of renewable energies, there is still no specialised occupation in the dual system of technical vocational education and training. In this situation, appropriate full-time school-based training takes on a significant purpose. It must be said, however, that this full-time school-based training has the reputation in the economy more as a suitable entry into a dual TVET system than a career entry.

Full-time school-based
training with relevance for
renewable energies

Currently, skills in the areas of environmental protection, renewable energies and resource efficiency are transmitted primarily through the following full-time school-based training:

- Technical assistant for renewable energies technology and energy management
- Technical assistant for renewable raw materials

3.4 Activities at the Level of Further and Continuing Vocational Education and Training

The continuing education market in Germany is large and not clearly organised. The spectrum of offers ranges from workplace-related learning concepts, to highly regulated advanced training professions. Learning goals for environmental protection have been integrated for more than 10 years as part of the process of adapting and revising further training regulations; all of the examination systems contain in their cross-sectional part the topic of environmental law. Along with knowledge about environmental law, prospective industrial foremen and -women should be able to provide information about the effects environmental protection measures will have on the business. They should also be able to demonstrate knowledge about the possibilities for keeping the water and air clean, for waste disposal and recycling, and noise protection.

Learning goals for environ-
mental protection in further
education regulations

In addition, some gainful occupations and continuing education diplomas are becoming established for skilled specialists with a traditional vocational training, as well as specific additional qualifications for certain tasks in the areas of environment, renewable energies and resource efficiency. Such occupations come partly out of regional or sectoral continuing education initiatives adhering to informal standards and organisational regulations until they are recognised officially by the various chambers.

There are plenty of opportunities for further education and training from the Chamber of Industry and Commerce, the Chamber of Skilled Crafts and Trades and from guild associations. By way of example, a few are named here:

Selected further training
opportunities

²⁸ An overview of all additional qualifications which are offered in the dual system occupations can be found under: www.ausbildungplus.de/html/106.php

Continuing education in the area of renewable energies:

- Specialist for photovoltaics;
- Specialist for solar thermal energy;
- Solateur/sales engineer for renewable energies;
- Skilled worker for environmentally sound energy technologies;
- Service technician and service assembly fitter for wind generators.

Continuing education in the area of energy and resource efficiency:

- Energy officer;
- Energy manager

Continuing education in the area of sustainable construction and building energy efficiency:

- Specialist for heating pump systems;
- Construction energy consultant;
- Passive house construction with wood or massive structures;
- System technician for building automation;
- Skilled worker for heat insulation.

3.5 Sustainable Development of Educational Facilities

If TVET is given a key role in the context of green economy and sustainable development, then extensive demands will be made of state and private TVET institutions. It is here at the micro level of training programmes that the principles and concepts of sustainability developed at the macro level would be manifest. Here it would be shown through practice which competences have to be promoted and trained among young people (but also older people) in order for them to be able to make professional contributions to societal transformation – or not. Sustainable development, environmental and resource protection would become core concentrations of qualifying vocational schools. They would become much more than an added on, temporary issue which is left to isolated committed teachers and trainers or which is given attention only on the periphery through individual projects.

Sustainable development, environmental and resource protection are core tasks for qualifying vocational schools

Concrete references to ecological transformation and new orientation of schools can be found in documents from as early as the 1990's (State Ministry for Pedagogy and Educational Research 1991, Buddensiek 1993). A two-volume guide from the school authorities in Hamburg (the Free and Hanseatic City of Hamburg, 1996) contains specific recommendations for action toward an environmentally compatible school, along with tips and practical examples for everyone involved in the school. A new legal ordinance, Eco-Management and Audit Scheme (EMAS), issued by the EU in 1993, was used in the late 1990's as a basis for establishing school environment management systems. Under the auspices of the programme "21" of the Federal-State Commission for Educational Planning and Research Development this concept was further developed to become the so-called "sustainability audits" and was implemented in several schools. However, these audits were applied primarily in schools of general education, meaning that the area of TVET was to a large extent – with the exception of a few sites of implementation – unaffected by this initiative.

Approaches and entry points

More instrumental for the sustainable development of educational institutions was the BIBB feasibility study entitled “Sustainability Indicators in Vocational Education Institutions” (Mertineit/Hilgers, 2005). This study explicitly referred to the Excellence Model of the European Foundation for Quality Management (EFQM).²⁹ This will be used as the definitive management model for many vocational education and training institutions, so that interconnectivity is assured. With its focus narrowed down to the specific requirements of qualifying vocational schools, this concept will serve as the foundation for a school-wide sustainable development project in qualifying vocational schools. This project is currently being carried out very successfully in a few schools in Lower Saxony and it is supposed to be more broadly applied in up to 100 qualifying vocational schools of that whole area of Germany in 2013.

Sustainable development of
qualifying vocational schools
in association with the EFQM
Excellence Model

Box 9: Characteristics of Sustainable Qualifying Vocational Schools

Sustainable qualifying vocational schools

- Take responsibility for a sustainable future: they see themselves as role models for sustainable development and take responsibility for their actions. They orient their profile according to the principles of sustainable development and give sustainability a public image.
- Are led by vision, inspiration and integrity and are committed to process. Sustainable development of schools is a leadership task. It is born by the school management and is anchored in the organisation by attributing official responsibility and personal responsibility. A sustainability profile specific to each school is developed on the basis of both a market/field analysis and a strength/weakness analysis, and is then codified into the organisational mission. With this foundation, sustainable qualifying vocational schools develop strategic development goals, which will be carried out in defined processes and through strategic projects. Sustainability becomes a part of the integrated school quality management.
- See themselves as a source of impetus, a service for skills training, and a recognised strategic partner for the sustainable development of their region: through local, regional and supra-regional partnerships they build on their skills and make them available to their municipalities, the local economy and other regional stakeholder groups. Sustainable qualifying vocational schools join with others to form a network. They use the network for exchange of knowledge and experience as well as for gaining other educational institution for alignment alongside sustainability principles.

29 The EFQM was founded in 1988 with support from the EU Commission, to develop a European concept for comprehensive quality management – Total Quality Management (TQM). The EFQM is a non-profit organisation which has around 600 members (companies – some of them global, public institutions, national quality organisations). As a TQM concept, the Excellence Model offers a framework for the integration of the total spectrum of section-management systems, such as quality, environment, energy, health and safety and hygiene management. It allows for the governance and evaluation of organisations and their management with a view to sustaining outstanding achievement of all stakeholders.

- Promote the commitment and the competences of their staff and involve their internal stakeholders in the development of the school: Competent teachers are needed who understand the relevance of sustainability for their area of work, who are willing and in a position to initiate putting this knowledge into the teaching and learning processes. This is supported by personnel planning and development. Sustainable qualifying vocational schools take the concept of participation seriously. They promote individual responsibility of staff members and apply the concept of participation to teachers, pupils, and administrative staff by connecting top-down and bottom-up approaches.
- Are an exemplary space for living and learning. They have a value orientation which embodies reciprocal respect, esteem, and acceptance of responsibility. The school provides a healthy workplace and promotes maintaining health among the teachers and pupils. The operation of the buildings, machines, equipment, tools and materials, as well the design of the school grounds are environmentally and resource friendly. Environmentally and socially acceptable technologies are used in offices and workshops. Appropriate technological and organisational measures are instituted into instruction and made known to the school public.
- Orient themselves toward characteristics of good instruction and promote sustainability skills. Sustainability requirements are integrated as much as possible into existing training programmes. System expertise and shaping skills as well as the capability and willingness to take on producer responsibility are measurably promoted. Needs of the economy and requirements of Education for Sustainable Development are systematically taken into account in the development, implementation, and further development of training programmes and in instruction. The school as a whole as well as the individual training programmes are used as fields for learning, research and experimentation, in order to test different technologies, to develop adaptive technologies and to improve the social, economic and ecological accomplishments of the school. To this end, the school cooperates with research and economic institutions.
- Are an adaptive place for teaching and learning. As continually developing teaching and learning sites, sustainable qualifying vocational schools regularly and systematically assess the results of their activity. They evaluate the results and derive from them consequences for future action, in the spirit of on-going improvement.

With reference to Mertineit, 2011

According to the model, intervention possibilities for sustainable development in qualifying vocational schools are located in the following areas:

Intervention possibilities

- Leadership: the mission statement and management of the TVET institutions.
- Strategy: market and field analyses, organisational diagnosis, strategy development and implementation.
- Employees: personnel planning, promotion and development, internal communication and cooperation.
- Partnerships and resources: cooperation with strategically important partners (companies, communities, research institutions), environmentally and resource friendly business management of buildings, machines, equipment, tools and materials as well as landscape architecture and knowledge management.
- Training opportunities and products: integration of sustainability requirements in existing training courses, development of special, specific training courses for sustainability where needed; projects and measures to improve the ecological or social settings of the school; teaching and learning materials and interior facilities.

Even though this issue has been discussed in Germany for already more than 20 years, there are hardly any TVET institutions which fulfil to any complete extent the features described here, in the sense of a total concept. However, there are numerous examples which do cover several aspects of the concept and could serve as role models. It would be helpful if a systematic catalogue could be put together to list these institutions and their sustainability features. With the permission of the institutions, this catalogue could then serve to assist in planning and conducting occupational study tours, where TVET experts from cooperation countries of the BMZ can gather information on site about sustainable settings in TVET institutions in Germany.³⁰

Some qualifying vocational institutions do cover partial aspects of the concept

On the international level, a concept for greening TVET institutions was issued by Majumdar (2010, 2011)³¹, with five dimensions:

Concept on the international level: greening TVET institutions

- *Green campus*: reducing the ecological footprint by environmentally friendly management of energy, water and other resources, waste management and reducing emissions.
- *Green technology*: integration of sustainability requirements in existing training courses, where needed development of new courses; cooperation with commerce; expansion of use of the institutions as a laboratory for sustainability.
- *Green community*: spreading the activities to the community through cooperation with regional stakeholders, transfer of knowledge and projects in common.
- *Green research*: carrying out, testing and comparing adapted sustainable technologies in the form of experiments and research projects in cooperation with production companies and research institutions.
- *Green culture*: promoting sustainability values, attitudes and behaviours.

Even if there is still no detailed analysis, it can be said that both approaches seem to be compatible with each other. Both see TVET and sustainable TVET institutions as two sides of the same coin. While Majumdar focuses on thematically oriented suggestions for action, the Excellence Model presented previously in this document, which has been applied in Germany, is dynamic. Its elements are linked with each other, and its intent is upon innovation and learning through the targeted setup of feedback loops. It features a strong strategy component and is – and this appears to be an advantage which should not be underestimated – compatible with all the current management concepts that are pertinent: quality, environment, energy, hygiene, health and safety or sustainability management.³² Since Majumdar's proposal for greening TVET institutions is being spread all over the world by UNESCO-UNEVOC, it seems to be worthwhile to bind together both approaches we have discussed here – or at least to make existing cross-overs known – and to fill the approaches with practical examples.

30 A first overview of green TVET institutions can be found in the Appendix under "Institutions".

31 Prof. Dr. Shyamal Majumdar is the Director of the UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training with its headquarters in Bonn, Germany.

32 It should be mentioned that since 2010 there has been an ISO (International Organization for Standardization) manual for socially responsible conduct of organisations together with ISO 26.000.

3.6 Teaching and Learning Aids and Examples of Successful Practice

Teaching and Learning Aids of Providers of Teaching Materials

All large German providers of teaching materials also have products to offer for vocational training in general, continuing education and training as well as in the areas of renewable energies and resource efficiency. The selection ranges from instructional or subject textbooks and simple experiment boxes, to interactive instructional programmes and films, to furnishings for specialist rooms and small equipment for training purposes. The table on the following page will give a preliminary overview of the range of offerings. There is no claim that it is complete. For detailed information or questions about the products, the contact information for the listed providers of the teaching materials is given below.

Offerings by large German
providers of teaching materials

Type of product Topics	Subject Textbooks/ Instructional Books	Experiment Boxes	Interactive Learning Programmes	Instructional Films	Specialist Room Furnishings	Small Equipment
Solar heat	Chr.		Chr./Fest	Chr./Sch	Chr./GU/Hor/ LU/Sch	Hor
Photovoltaics	Chr.	Chr/Frei/Hel/ IKS/Sch	Chr/Fest	Chr/Sch	Chr/GU/Hel/ her/Hor/IKS	Hor
Windenergy technologies	Chr	Drei/Hel/IKS	Fest	Chr/Sch	GU/Hel/LU	Drei/LU
Biomass	Chr		Fest	Chr	GU	GU
Geothermal energy	Chr		Fest		GU	
Water energy	Chr			Chr/Sch	GU	
Combined heat and power unit (CHP)	Chr					
Water heat pump	Chr		Chr		Chr/GU/ Hor/Sch	
Fuel cells	Chr	Drei/IKS/Sch	Chr		Chr/GU/ Hor/Sch	
Building automation	Chr.				ELA/GU	
Drinking water	Chr.				Chr	
Sewage systems	Chr				Hor/LN	

Legend:

Chr Dr.-Ing. Paul Christiani GmbH & Co. KG, Hermann-Hesse-Weg 2, 78464 Konstanz, Germany, Phone +49 (0)7531/5801-26
info@christiani.de, www.christiani.de

Drei Dreibein GmbH, Hohenesch 82, 22765 Hamburg, Germany, Phone +49 (0)40/33310390
info@dreibeinlehssysteme.de, www.dreibeinlehssysteme.de

ELA ELABOTrainingsSysteme GmbH, Im Hüttental 11, 85125 Kinding/Haunstetten, Germany, Phone +49 (0)8467/8404-0 vertrieb@elabo-ts.com, www.elabo-ts.com

Fest Festo Didactic GmbH & Co. KG, Rechbergstraße 3, 73770 Denkendorf, Germany, Phone +49 (0)711/3467-0,
did@de.festo.com, www.festo-didactic.com

GU G.U.N.T. Gerätebau GmbH, Division 2E, Hanskampring 15-17, 22885 Barsbüttel, Germany, Phone +49 (0)40/670854-0, sales@gunt.de, www.gunt2e.de

Hel Heliocentris Energiesysteme GmbH, Education, Training & Research, Rudower Chaussee 29, 12489 Berlin, Germany
Phone +49 (0)30/340601600, di-dactic@heliocentris.com, www.heliocentris.com

hera hera Laborsysteme GmbH, Hermann-Rapp-Straße 40, 74572 Blaufelden, Germany, Phone +49 (0)7953/882-0, info@hera.de, www.hera.de

Hor Berthold Horstmann GmbH, Hermann-Rapp-Straße 40, D-74572 Blaufelden, Germany, Phone +49 (0)7953/97897-0
info@horstmann-essen.de, www.horstmann-essen.de

IKS IKS Photovoltaik GmbH, An der Kurhessenhalle 16B, 34134 Kassel, Germany, Phone +49 (0)561/95-8050
info@iks-photovoltaik.de, www.iks-photovoltaik.de

LN Lucas-Nülle GmbH, Siemensstraße 2, 50170 Kerpen-Sindorf, Germany, Phone +49 (0)2273/567-0, www.lucas-nuelle.de

Sch Schreiner-Didaktik KG, Stephanstraße 30, 42859 Remscheid., Germany, Phone +49 (0)2191/464499-0
info@schreiner-didaktik.de, www.schreiner-didaktik.de

Figure 6: Teaching and Learning Aids of German Providers of Teaching Materials

Guide for Energy and Resource Efficiency in TVET and Employment

On the educational server of the German Federal Ministry for the Environment (*Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit*, BMU) an assistance page is offered on the topic of energy and resource efficiency in TVET. The guide is meant for teaching and training personnel in enterprises and TVET institutions. The publication is a good first orientation about areas of appropriate action specifically for vocational education and training. Possibilities for energy and material efficiency are dealt with over the whole occupational spectrum – but especially for the metal industry – for, among other areas, electrical generators, air compressors, space and hot water heating. Additionally, tips are given for office equipment and materials as well as mobility, transportation and logistics. Plentiful information, concrete recommendations for action in company practice as well as tips and examples of successful initiatives by trainees at their workplace provide insights for understanding how this issue can be implemented in professional business practices.³³

Guide providing plentiful information, recommendations for action and tips and examples

Computer-based Training in Environmental and Resource Efficiency in TVET

On behalf of GIZ (Mannheim, Germany) a computer-based training (CBT) programme for environmental and resource efficiency was worked out. It is meant for teaching and training personnel in vocational training centres and businesses, in that it provides an illustrated overview with many examples of the most important areas of action, points of entry, measures and procedures for including environmental protection and resource efficiency at different TVET training sites. The CBT was conceived for self-learning, but it can also be applied as a foundation for the formation of corresponding training and instructional units. The CBT is available in German and Arabic and an operable demonstration version in English can also be obtained.³⁴

CBT provides an overview of action areas, entry points, measures and procedures

Good Practice Examples

The internet portal of the BIBB provides an overview of existing practice examples. More than 120 examples are presented here from programmes of technical vocational education and training in general as well as continuing technical vocational education and training; sorted by topic areas. This webpage has unfortunately not been actively applied for quite a while. Many of the documented examples there are therefore older, but that doesn't diminish their value as a source of incentives and ideas.³⁵ Further practice examples, as long as they have been recognised and characterised as official projects of the UN Decade, can be found in the corresponding data bank in the portal of the UN Decade in Germany.³⁶

33 The guide is available for downloading under: www.bmu.de/bildungsservice/doc/45995.php

34 Contact: tvvet@giz.de

35 The BIBB's portal "Nachhaltigkeit" (sustainability) includes more than one documentation of good practices. See also the explanations in chapter 3.2.

36 BIBB internet portal: <http://bbne.bibb.de>; UN Decade portal: www.bne-portal.de

3.7 Lessons Learnt

In view of the experiences in Germany, the following conclusions can be drawn:

TVET is an integral component of a strategy for modernising society.

Re-structuring the economy in the direction of sustainability is not possible without the correspondingly qualified employees. Or to put it another way: green economy and green skills are two sides of the same coin.

Recommendations of the BIBB Board laid the foundation.

Activities in TVET must in the final analysis be oriented toward the needs of the economy. In this respect, the corresponding commitment of the essential stakeholders is indispensable.

Occupationally specific and integrative procedure has proven itself.

The transmission of green skills is just possible in a close connection with vocational activities. Any future approaches in promoting insights and changes of values and attitudes (see below) will prove to be too general and ineffective, if they don't show how these values can be realised in the working life of the learners (at least in the set-up).

Anchoring the demands of sustainability, environmental protection and resource efficiency in regulations (vocational education and training and continuing education regulations) is in itself not enough.

This is a necessary but not sufficient prerequisite for implementing this issue in vocational education and training practice. The few current empirical research studies included here show clearly that expectation and reality – especially for occupations with indirect relation to the environment – are very separate matters.

Therefore, more attention has to be paid to formulating specific environmental goals within vocational education and training and continuing education regulations. Respectively, environmental learning goals need to be explicitly identified and determined as part of the development of competence standards.

Sustainability/climate protection is usually considered to be “technical” and is oriented towards the requirements of corresponding businesses.

More broad requirements, as they are expressed in the recommendations of the BIBB Board and in the demands for promoting producer responsibility have so far found little resonance, at least on the business side of education. The demand for change in attitudes and behaviour has only been promoted in a very limited way. It is too little acknowledged that the ability to act in the spirit of sustainable development is intimately connected with an orientation toward human rights and the ability to participate in the democratic process, and belongs to comprehensive international education goals. It is not only the expert skills and methodological competences which have to be focussed upon. Competences for being able to act independently in the spirit of sustainable development and to interact with heterogeneous groups are also necessary.

Sustainability can become a valued feature of quality, especially in vocational training centres.

Qualifying vocational schools, for example in Lower Saxony but also in other German states, are expected to develop into regional competence centres. But the question occurs: competence centres for what? Vocational education and training as a feature is not enough, because besides the qualifying vocational schools there is a whole variety of other half public or fully public (such as vocational training centres for the skilled crafts and trades across occupations) and private TVET institutions which also consider themselves to be competence centres. To develop into a competence centre doesn't mean only fulfilling certain quality requirements, but also fostering a specific profile. Many schools are unable to cope with this necessity. The priority of sustainability, that is, the mission of making an active and lasting contribution to sustainable development in their respective regions, can function as a compass for guidance. Sustainability is a quality feature of organisational development for vocational training centres. It can be the motor as well as the object for their further development into regional sustainability competence centres.

In spite of a variety of activities, the efforts up to now have not been sufficient.

Even today, at the end of the on-going UN Decade of Education for Sustainable Development, the German Federal Advisory Council for Global Environmental Changes has declared that education should "take on greater importance in the German sustainability strategy" (WBGU 2011, 26). This applies especially to TVET. Because although it has theoretically been given an ever higher place in the context of sustainable development and in the great transformation, in the context of the UN Decade it has been neglected in a "stepmotherly" way and remains too insignificant. The attempts so far to perpetuate the multifaceted individual initiatives, to combine them and develop them systematically, have failed (see also chapters 2.2 and 3.2).

Experiences from the Work of the GIZ

] 4



Experiences from the Work of the GIZ

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4.1 Overview

Plans in the area of green jobs/green skills development were carried out as early as the middle of the 1990's. In addition, environmental and sustainability aspects were taken into consideration in all projects in the area of TVET and labour market. Topics of environmental protection, accident prevention and health and safety were integrated into practically all curricula and teacher training, in order to heighten sensitivity and capacities for the issues. The goals for this are comprehensive:

- Improve people's employability;
- Increase the production, competition and innovation capacities of the economies in the partner countries of BMZ; as well as
- Foster sustainable and ecological economic growth in the partner countries and at the same time work against climate change.

Adequate qualifications for skilled workers and leaders (primarily the teaching and management personnel) are at the heart of all activities in the areas of climate and environmental protection and resource efficiency. For that, already existing training programmes were or are being reworked and extended with sustainability aspects, new curricula and educational programmes developed, educational materials re-worked or new ones developed, and competence centres for environmental and climate protection as well as for transmission of technologies in the economy built.

In the following section examples will show how GIZ includes sustainability requirements into projects in the area of TVET.

First of all, references with formats for human capacity development (HCD) from the GIZ green skills development facilities (Mannheim and Magdeburg, Germany) are introduced. These are dialogue formats of short duration, in which aspects of the issue are discussed in regional, national or international settings with representatives of different stakeholder groups. Another effort involves applying complex, multiple system levels of HCD formats, in which development goals of partner countries are supported through special study tours, skilled worker and leadership trainings (short-term and long-term), internships, press coverage, curriculum development, online coaching and follow-up during implementation.

Afterwards, on-going projects in the area of TVET which had been initiated in part under the auspices of the former *Deutsche Gesellschaft für Technische Zusammenarbeit* (GTZ) are introduced³⁷. These are more encompassing and longer-term and aim for basic improvements in the TVET systems of the respective partner countries. It is striking that the intensity of activity in the development of green skills is in great measure dependent upon the sensitisation of the respective partner country toward environmental questions. If sensitisation is insufficient, then the German partners responsible for the programme suggest working in corresponding content to the project leader.

The described measures represent a broad scope of interventions: they span from individual continuing training offers and revising curricula to the qualifying of teaching personnel and building of TVET institutions to systematic changes in national TVET systems.

Occupational and employment aspects of environmental protection have already been taken into account

Qualifying skilled workers and management is central

Examples from development cooperation

HCD measures

Project

³⁷ See footnote 5.

4.2 Projects of the Ministry for Economic Development and Cooperation/ Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

4.2.1 Dialogue-Formats

Title	1st Roundtable Discussion in the Field of Development Policy: TVET for Sustainable Development
Country	Germany
Time period	2009
Initial situation	How do we want to live? What kind of economic activity do we want? How can we protect our environment? Questions such as these also have an impact on TVET. Concepts of the economy, concepts for education and continuing education, job profiles that have to do with sustainable development are being sought after. Education must make people fit for the future, must equip them for climate change. In order education could meet these challenges, the United Nations declared the years 2005-2014 as the UN Decade “Education for Sustainable Development”. The goal of this global education campaign is to convey sustainability thoughts and actions to kindergartens and schools, universities and other educational institutions.
Target group	Representatives from the economy, politics and education
Questions asked	Where and in which form and level is TVET asked for its (specific) contribution to achieve sustainable development? How should initial vocational training experiences and vocational continuing education be designed to meet the challenges? What are the current developments in job profiles and revision of vocational training regulations? What have experiences in theory and practice shown?
Method	• Input contributions in plenary sessions • Discussions and exchanges of experience • Deriving recommendations for action from best practices
Cooperation partner	Porsche, Inc.; Catholic relief organisation MISEREOR e. V.

Title	TVET Action Days
Country	Germany
Time period	2009 – 2011
Initial situation	Strengthening international competences of enterprises and future leaders, strengthening regional cooperation internationally, expanding cooperation in the subject field of green skills/green jobs – these intentions are of great importance in the context of (Vocational) Education for Sustainable Development. In a framework provided by the TVET action days, relevant topics could be discussed and experiences exchanged with key players and relevant stakeholders in such areas as ESD in general (2009), TVET and climate protection (2010) and demographics and qualifications (2011).
Target group	Representatives from ministries, enterprises, chambers, qualifying vocational schools, educational institutions, NGOs and unions
Goal	Implementations of concrete measures and steps toward global development and (Vocational) Education for Sustainable Development relevant to the target groups. Motivate stakeholders and actors from the economy, institutions and the media to initiate and to strengthen options for action which fulfil an obligation to uphold the guiding principles of sustainable development. Make a contribution to local and international discourse and to the exchange of information for the benefit of new local, regional and international planning and programme ideas, thereby strengthening sustainable possibilities for cooperating and networking.
Method	• Regular meetings and roundtables among partners for planning, implementing and evaluating the measures

Cooperation partner	<i>Otto-von-Guericke-University of Magdeburg; Stiftung Umwelt, Natur- und Klimaschutz des Landes Sachsen-Anhalt</i> (Foundation for the Environment, Nature and Climate Protection of the Federal State Saxony-Anhalt); the State Government of Saxony-Anhalt (Culture Ministry, Ministry of Agriculture and Environment)
Result	• Intensive substantive discussion with a variety of stakeholders • Presentation and exchange of best practice examples • Deriving entry-points for building on future business relations and development of sketches for future cooperative projects • Building and strengthening of networks in the interface of TVET and sustainable development/ green jobs • Documentation of the TVET Action Days: i.e. for representatives from ministries, industry or science as well as multipliers in TVET
Title	International Expert Workshop: Capacity Development Needs for Water Education
Country	Germany
Time period	2010
Initial situation	The event was based on an analysis and description of current trends and international discourse about TVET in the water sector, as well as on country-related perspectives and best practices with regard to a re-orientation of TVET towards the support of sustainable development, innovative entry points and appropriate technologies in the context of TVET in the water sector, and strategies for capacity development in green TVET, especially in the water sector.
Target group	Representatives from ministries and from research and vocational training centres in Afghanistan, Bangladesh, Bhutan, Fiji, India, Korea, Malaysia, the Maldives, Myanmar, Mongolia, Pakistan, the Philippines, Sri Lanka, Thailand, Kenya, the Ivory Coast, Gambia and Germany
Goal	To compare the situation of TVET in the water sector of the different countries (17 participating countries of the Asian-Pacific region) with the international state of the art, e.g. at the <i>Internationalen Fachmesse für Wasser – Abwasser – Abfall – Recycling</i> (International Trade Fair for Water-Sewage-Waste-Recycling, IFAT) in Munich, Germany.
Method	Derive entry points/possibilities for the north-south cooperation for TVET in the water sector through a dialogue-oriented project design, • With input from partner institutions and other participating institutions • Preparation of national case studies from the participating countries • Attendance of the trade fair (IFAT Munich) • Workshop sequences with presentations and discussion of the national case studies • Deriving general recommendations for action
Cooperation partner	UNESCO-UNEVOC International Centre Bonn, Germany; Colombo Plan Staff College; <i>Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V.</i> (German Coalition for Water Economy, Sewage and Waste)
Result	Recommendations for • General approaches and activities concerning TVET for sustainable development; • Approaches to TVET in the water sector; and; • Approaches regarding north-south cooperation's in TVET for sustainable development (core topic: water and sewage sector)

Title	Commonwealth of Independent States (CIS) Regional Network Meeting: Networking and Capacity Building for TVET and Education for Sustainable Development in the CIS
Country	Germany
Time period	2010
Initial situation	The phenomenon of ESD is difficult to identify in the CIS countries. Clarifications of the different dimensions of sustainable development are a relevant basis for deriving action strategies.
Target group	Representatives from UNEVOC centres in the CIS countries as well as from UNEVOC centres in Germany, Norway, Georgia and the Ukraine
Goal	Support of decision-makers in UNEVOC centres in identifying and addressing the challenges of (Vocational) Education and Sustainable Development in the CIS countries
Method	• Analysis of current trends and the state of international discourse with regard to (Vocational) Education and Sustainable Development • Analysis and presentation of national perspectives and best practices • Deriving of orientation and strategies for implementation of approaches to ESD in national TVET systems with support through the UNEVOC network
Cooperation partner	UNESCO-UNEOC International Centre Bonn, Germany; UNESCO Moscow Cluster Office, Russia
Result	• Draft of recommendations for coordinating regionally oriented initiatives through the UNEVOC network, to integrate sustainable development into TVET of the CIS region
Title	International Expert Meeting: Transforming TVET to Meet the Challenges of the Green Economy
Country	Germany
Time period	2011
Initial situation	In the Asian-Pacific region the issues of sustainable development currently play a minor role in TVET. There is minimal evidence of their consideration in vocational education processes. The availability and the discussion of international experiences of (Vocational) Education for Sustainable Development are of great interest to the Asia-Pacific region and are relevant for both the formulation of national strategies and the conceptualisation of models for regional cooperation in this area.
Target group	TVET representatives from 21 countries in the Asia-Pacific region as well as international TVET institutions (such as ILO; European Training Foundation, ETF)
Goal	Exchange of information and experiences as a basis for deriving action and national policy recommendations
Method	• Lectures in plenary sessions • Presentation and discussion of case studies • Study excursions • Discussions in work groups • Exchange of experiences and deriving recommendations for action from best practices
Cooperation partner	UNESCO-UNEVOC International Centre Bonn; Colombo Plan Staff College; <i>Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V.</i> (German Coalition for Water Economy, Sewage and Waste); German Ministry for Education and Research (BMBF)
Result	• Recommendations for the formulation of national policy strategies • Recommendations for the development of a UNESCO strategy for the improvement of TVET in the area of green skills development • Recommendations for the development of a tool kit for green TVET

Title	Roundtable Discussion in the Field of Developmental Policy: Vocational and Continuing Education as a Motor for Environmental and Climate Protection
Country	Germany
Time period	2012
Initial situation	In view of the energy crisis and climate change, governments worldwide have obligated themselves to ambitious climate goals. Developing and emerging countries have also been encouraged through bilateral and multilateral initiatives to make their contributions toward preventing the pending climate catastrophe. The increase in energy efficiency is a primary focus of environmental efforts, alongside the promotion of renewable energies. Green technologies and investment in energy and environment could create a motor for growth and employment. Planning, installation, supervision and administration require, however, expanding and ever more complex qualifications of the personnel. Even now there is a shortage of skilled workers nationally and internationally in the traditional environment and energy professions, as well as in those areas of employment that are indirectly connected to environmental concerns. Vocational and continuing education will be a decisive factor as to whether the challenges of the future in these crucial areas will be met.
Target group	Representatives from the economy, politics, and TVET
Questions asked	What contribution can technical vocational and continuing education make to the solution of complex environment and energy questions? How must they be organised to be fit for the challenges? Which competences can Germany as an innovative country bring to these efforts? How can national and international capacities be combined?
Method	• Lectures in plenary sessions • Discussion and exchange of experiences • Deriving recommendations from best practices
Cooperation partner	<i>Ministerium für Kultur, Jugend und Sport Baden-Württemberg</i> (Ministry of Culture, Youth and Sports); Goldbeck GmbH
Title	International Consultation Meeting: Networking and Developing the Capacity for TVET and Education for Sustainable Development in the CIS
Country	Russia
Time period	2011
Initial situation	Sustainable development currently plays an insignificant role in TVET in the CIS region. TVET stakeholders and actors need to be sensitised to the issues and need support for forming strategies to integrate sustainable development into vocational education processes.
Target group	TVET experts from Russian federal and regional ministries for education and research as well as representatives from 12 national UNEVOC centres of the CIS region (Armenia, Azerbaidzhan, White Russia, Moldova, Russia, Kazakhstan, Kyrgyzstan, Uzbekistan, the Ukraine) and from Germany
Goal	The exchange of information and experiences along with the identification of approaches and structures for cooperation are the main objectives with the goal to mobilise expertise and resources in order to utilise them for the improvement of cooperation.
Method	• Dialogue forum • Workshop/discussion groups
Cooperation partner	UNESCO-UNEVOC International Centre Bonn, Germany; UNESCO Institute for Technologies in Education; Commission of the Republic of Bashkortostan for UNESCO; Russian Academy for Education; Bashkir Institute of Social Technologies; UNESCO International Research and Training Centre for Rural Education (INRULED)
Result	• Development of a regional network of the CIS countries with focus on (Vocational) Education for Sustainable Development • Derivation and formulation of national policy recommendations for adjusting TVET to a green economy
Cooperation partner	<i>Ministerium für Kultur, Jugend und Sport Baden-Württemberg</i> (Ministry of Culture, Youth and Sports); Goldbeck GmbH

4.2.2 Complex Formats for Human Capacity Development

Title	Integration of Green Skills in Selected Occupational Fields
Country	Egypt, Jordan and Syria
Time period	2009
Initial situation	In TVET institutions of the partner countries Egypt, Jordan and Syria there are deficits in the integration of vocational skills relevant to environmental protection concerning the curriculum development and teaching practice. The programme supports skilled workers in these institutions in designing curricula correspondingly and in formulating recommendations for the practical curriculum development in selected occupational fields.
Target group	Skilled workers from TVET institutions who have responsibilities in curriculum development/teaching plan design; skilled workers from the areas of vehicle, sanitation, heating and air-conditioning, metal and electrical technologies; skilled workers from environmentally relevant organisations and technical ministries.
Goal	The development of specific materials and teaching plan elements to implement green skills into the areas of vehicle, heating and air-conditioning, metal and electrical technologies which are adapted to the needs of the partner institutions. Prepare a virtual forum on the GIZ platform Global Campus 21 for the continuing exchange of the participants and support the active utilisation of materials and good practice examples. Support the work of the participants in integrating green topics through the medium of additional methods and instruments.
Method	The programme is divided into three parts: • Short term programme of three weeks in Germany split in two parts: one part for cross-subject contents and the other for specific practical/technical contents in the areas of vehicle, heating and air-conditioning, metal and electrical technologies • Setting-up and moderating a virtual expert forum for the participants to transmit further professional content, to foster learning and sharing of experiences among the participants and to coach the participants in their implementation of their projects for organisational change • Follow-up workshops in the region and coaching participants in order to intensify the exchange of experiences in order to identify good practices in the region and to mobilise people in partner institutions who may serve as support
Cooperation partner	<i>Institut für Umweltschutz in der Berufsbildung e.V.</i> (Institute for Environmental Protection in TVET); <i>Bildungsakademie der Handwerkskammer Mannheim Rhein-Neckar-Odenwald</i> (Academy of the Chamber of Skilled Crafts and Trades Mannheim Rhein-Neckar-Odenwald, <i>Internationales Institut für Berufsbildung</i> (International Institute for Vocational Training))
Result	• An expert network of the participating institutions has been initiated • Recommendations for taking environmental protection issues into consideration in curricula development have been formulated • Examples for teaching and learning aids for specific occupations have been compiled • Organisational structures for curriculum development and implementation have been initiated and supported

Title	Computer Based Training (CBT): Environmental Protection and Efficient Use of Resources in TVET
Country	Egypt, Jordan and Syria
Time period	2010 – 2011
Initial situation	This initiative was carried out in association with the project “Capacity Development for Sustainability in VET (MENA)” in Egypt, Jordan and Syria. The goal of the project was to qualify local partners on the different levels of responsibility for the development and implementation of sustainability strategies and to create a network. Partner TVET institutions were supported in orienting their training offers more strongly toward the needs of the job market and in improving their quality, especially accounting competences relating to sustainability and social skills.
Target group	Teaching personnel from TVET institutions in Arabic-speaking partner countries
Goal	The teachers should be sensitised by the CBT to the necessity of transmitting certain training contents, be motivated and be animated to implement practically what they learn. Specifically, they should know the meaning of environmental protection and of sustainable use of resources in TVET; know the most important issues and areas for action; be familiar with the possibilities for instigating environmental and resource protection at their different vocational training locations; and know procedures for implementation of environmental and resource protection in vocational education practice.
Method	• Drafting a detailed course description (including learning contents and goals) • Creating a storyboard and drafting a beta version of CBT in English • Introduction and discussion of the beta version within the framework of a workshop with specialists from partner institutions in Egypt, Jordan and Syria • Preparation of final version in English with a translation into Arabic • Carrying out several one-day events for introduction to one or two representatives from the participating vocational training centre Online test to check the benefit of the CBT and posing questions to the participants about their learning and implementation experiences
Cooperation partner	<i>Institut für nachhaltige Berufsbildung & Management Services GmbH</i> (Institute for Sustainable Vocational Education and Management Services); <i>Institut für Bildungstransfer</i> (Institute for Educational Transfer)
Result	• Great interest among the participants in the issues and the learning medium (Those questioned were very satisfied with the CBT and the personal learning successes.) • More than half of those questioned had introduced the CBT to colleagues with success (The positive response of these colleagues, who represent a broad spectrum of occupations, leads to the assumption that they also would use the CBT if a PC and PC abilities were available to them.) • More than a third of those questioned had introduced the CBT to trainees (Although the CBT was expressly designed for trainers and teachers – and not for trainees – the response to the trial was so positive that half of the group declared their intention to use the CBT in future training courses, mostly in metal and electronics occupations.)

Title	International Leadership Training (ILT): TVET, Climate Change and Green Jobs
Country	Korea, Germany
Time period	2012 – 2013
Initial situation	In the contexts of national strategies and also regional agreements of the Association of Southeast Asian Nations (ASEAN), players responsible for national politics in Laos, Indonesia and Vietnam have in the recent past clearly articulated intentions of developing a green economy and the necessity for creating green jobs. However, there is hardly any evidence of experience in TVET for this purpose.
Target group	Rising young leaders and specialists in TVET and business HR development in Laos, Indonesia and Vietnam
Goal	Make information, knowledge and skills available about international developments and interconnectedness of green economy and green jobs as well as best practices with focus on the areas of water/sewage, renewable energies (efficient use of energy in building).
Method	• Introduction to the basics about green growth, green economy and green jobs and their interdependency as well as approaches to developing green jobs • Transmission of practical experience in selected focus areas of green jobs • Transmission of knowledge and methodological competences for the analysis of skill requirements in the focus areas of a green economy, deriving training concepts and contents as well as curriculum planning, training in methods of skill needs analysis and utilisation of these methods in selected focus areas (water/sewage, renewable energies) • Training in methods of curriculum development and utilisation of these methods in selected focus areas (water/sewage, renewable energies) • In-company apprenticeships and vocational training for the selected focus areas • Creating a transfer project in alignment with the individual employment area • Mentoring the implementation of the transfer project in the home country
Cooperation partner	Ministries, subordinate institutions, research and TVET institutions as well as enterprises in Laos, Vietnam and Indonesia; GIZ projects in Laos, Vietnam and Indonesia; Department Human Resource Development, Korea
Result	• Curricula, teaching and learning materials, trainings concepts and modules for the needs and development requirements in the home countries are expected in the selected focus areas (water/sewage, renewable energies)

Title	Skills Development for a Green Economy in South Africa
Country	South Africa
Time period	2011 – 2013
Initial situation	For the government in South Africa, green economy is an economic sector from which a growth potential for the creation of 300,000 jobs is expected (New Growth Path). The need for a transfer of knowledge, especially about making renewable energies usable and about increasing resource and energy efficiency, is growing. Especially in this connection the development of green skills is a precondition for successful energy policy transformation and for companies' change and innovation capabilities. The identification of green skills and their integration into curricula of TVET institutions is therefore an important task for the education and continuing education systems of South Africa.
Target group	Representatives of the Department of Higher Education and Training (DHET); Directors and management personnel of state and private TVET sponsors; Teachers and trainers of Further Education and Training (FET) Colleges and private providers; management personnel from the Sector Education and Training Authorities (SETAs)
Goal	Integration of green skills into existing occupational fields (wind and solar technologies) through Human Capacity Development measures that build upon each other and the development of appropriate training opportunities which meet the requirements of the job market in the green economy.
Method	• Carrying out operative planning workshops and coming to an agreement about HCD measures for awareness raising and competence development of South African skilled workers and administrators on the macro, meso and micro levels, as well as strengthening the institutions. • Carrying out several training and dialogue measures in Germany and South African, which take place in several phases and build upon each other and complement each other's impact. • Training of political representatives by giving them information about sustainability and renewable energies in TVET through excursions in Germany, concluding with agreements for transfer of further strategic procedures to integrate green skills. • Carrying out, for several weeks at a German training site, a continuing education event in which the teaching personnel of the participating institutions can deepen their knowledge of the technical knowledge, methodology, didactics and vocational pedagogy in wind and solar technologies ("solateur"). A follow-up and coaching event to be held in South Africa in a later phase will deepen the acquired knowledge and directly apply it matched to the teachers' respective places of work. • Integration of environmental issues into the school administration and procedures of Further Education and Training (FET) Colleges to reduce the ecological footprint within the framework of the pilot initiative "Greening Colleges".
Cooperation partner	DHET; FET Colleges; SETAs
Result	• The inclusion on all levels of experience (political representatives, skilled workers and administration, teaching personnel) in a complementary HCD green skills concept, which contributes to broadening green skills in the target groups in renewable energies and TVET.

4.2.3 Projects in the area of Technical Vocational Education and Training

Title	Programme for the Development of Human Resources, TVET Albania
Country	Albania
Time period	2010 – 2017
Initial situation	The programme includes the support of the TVET sector at the macro, meso and micro levels: the Work and Education Ministry will be supported in the development of the Albanian TVET Strategy 2013-2020. The Work and Statistics Ministry will be advised by establishing a labour market information system. In Kamza, a multifunctional vocational training centre is being built (with aid in the following tasks: educational needs assessment, development of concepts for subject rooms and their technical furnishings, continuing education needs assessment and development of an education and continuing education concept for technical teaching personnel and drafting occupational standards and curricula). Six vocational schools in four regions of the country are being supported in the revision of the curricula, further education for teachers and in acquiring material resources. Assistance in the development of a new educational model has resulted in combining basic education with special skills training in six job profiles. In the process of the planned changes just now in progress, an integration of the topics green jobs/green skills is anticipated.
Target group	Graduates of primary and secondary schools; employed, unemployed and underemployed workers
Goal	Emphasis is laid on getting environmentally related topics across: in, particular the environmentally compatible use of materials and their disposal. With the aim to enclose skills development and production methods for sustainability into curricula and teaching.
Method	• Support of the Work and Education Ministry in the formulation of the Albanian TVET Strategy 2013-2020 and • Advising the Ministry of Statistics by establishing a labour market information system • Organisational counselling, educational needs assessment, teacher training, drafting occupational standards and curricula
Cooperation partner	Ministry of Work and Education Ministry of Statistics and six vocational schools

Title	Reform of the Vocational Education System and Labour Market
Country	Kyrgyzstan
Time period	2004 – 2013
Initial situation	Introduction of energy efficiency laws in Kyrgyzstan in 2011. Green activities are desired by the partner.
Target group	School graduates of all ethnicities; university graduates; unemployed workers in self-help initiatives
Goal	Introduction of the course “Heat insulation in outside walls”, which is modularly constructed and can be integrated into existing job descriptions as a short term course.
Method	• Needs analysis • Curriculum analysis for existing building occupations • Course development (theory and practice) • Publishing a teaching and learning handbook • Qualifications of teachers/trainers • Accreditation of courses (theory and practice) and of teaching and learning materials • Pilot programmes to introduce courses
Cooperation partner	Ministry for Youth, Work, and Employment; TVET Agency

Title	Promotion of Vocational Education Centres of Competences in the Context of Vocational Education Reform
Country	Kosovo
Time period	2011 – 2013
Initial situation	The environmental situation in Kosovo proves to be very problematic in every major sector (waste disposal, water/sewage, energy, air pollution, etc.). Next to the lack of technological infrastructure, the lack of environmental awareness in the general population is seen as a major cause. At the same time, a market for different environmental technologies is developing. Educational institutions which display special attention to the issues of environmental protection and technologies hardly exist. For this reason the present vocational education and training offers should be expanded to enable the establishment of competence centres, forming a new environmental centre which will be integrated into the existing organisational structure of the Diaconate Kosova in Mitrovica. At the diaconate, training centre education and further education courses, mostly in various technical areas, are already offered, and they are of high quality, practice oriented and much in demand.
Target group	Enterprises, craftsmen and women, teaching personnel and pupils from different school forms, public employers, schools of higher education, private citizens
Goal	Construction of a training centre (demonstration buildings as well as course offerings) for green issues, such as energy-efficient construction, renewable energies and their concrete application possibilities, energy-saving technologies, waste disposal management and environmental protection measures. Construction of a network made up of the relevant stakeholders (institutions, ministries, trainers, companies, etc.) as well as making available an “mobile environmental and energy teaching unit” to be taken to schools and communities.
Method	• Harmonisation with the national concept of competence centres in Kosovo • Train-the-Trainer • Demonstration teaching paths
Cooperation partner	Ministries, communities, GIZ partner projects, NGOs, companies, international development organisations such as the United Nations Development Program (UNDP) or the United States Agency for International Development (USAID)

Title	Programme for Basic and Technical Education and Vocational Training
Country	Mozambique
Time period	2003 – 2015
Initial situation	The impetus for the introduction of green activities in Mozambique can be attributed to the country's government when they passed the 2006 TVET system reform bill, which has since been implemented. Within the framework of this reform bill, TVET should be adapted to the demands and needs of the production sector. According to this, graduates should have training skills which meet labour market requirements. GIZ supports the reform of a demand-oriented TVET system, at first in two occupational fields: metalwork and electronics. In addition, GIZ was commissioned in 2011 to promote capacity building in renewable energies/photovoltaics.
Target group	Teaching personnel along with school principals (directors) in general and vocational education, educators in universities and other educational institutions; enterprises and their federations; management staff of participating ministries; educational planners, administrators and executives at the province, district and local levels.
Goal	GIZ has developed curricula for renewable energies/photovoltaics within the framework of the reform of the TVET system in Mozambique. Students will be qualified to maintain and repair the equipment necessary for these curricula.
Method	• Continuing education of teachers in Germany and Mozambique in renewable energies • Curriculum development • Pedagogical and organisational consultation

Cooperation partner	Ministry of Education and Ministry of Energy; Energy Fund Mozambique; GIZ/Holland Programme Access to Modern Energy Services Mozambique
Result	The project ran through two cycles of continuing education each with 12 currently employed teachers and multipliers. This contributed considerably to the preparation of qualified teachers for the reform programme. The teachers and multipliers trained in Germany could bring their technical and didactic knowledge into the development of the curricula. The first Mozambique photovoltaic laboratory was built at the <i>Instituto Industrial de Maputo</i>. This has become a frame of reference for a good quality and practice oriented training programme. It is used not only as a training centre for students, but also as a site for solar technology qualification for technicians in the private sector.

Title	Promotion of the TVET Sector Reform in Pakistan
Country	Pakistan
Time period	2010 – 2015
Initial situation	The programme management was convinced that green skills in general, but especially in view of the advanced degree of pollution – most particularly in Pakistan – are essential. There are two entry points for promoting green skills in the programme: For one, a national qualifications framework needs to be developed and curricula for the priority areas of agriculture, energy and services must be checked and revised. Curriculum development is still in the preparation phase. Secondly, there is a fund which is designated for project proposals for innovative vocational education and training for TVET institutions, businesses, NGOs, etc. This fund has four project themes, and one of them is green skills.
Target group	Agriculturalists
Goal	Every agricultural occupation inherently contains a module for ground and water protection. In the area of energy three occupations in renewable technologies should be developed. With support of the fund, two of 12 pilot green skills programmes were developed: “Pest Control by Organic Means in Agriculture”, “Organic Vegetable Growing with the Use of Greenhouse Tunnels and Water Drop Irrigation”. Further projects are in preparation. In addition, a learning region has been organised in the tribal areas (Federally Administered Tribal Areas, FATA), the goal of which is to enable small farmers to use resource-efficient agriculture in order to increase their yield, to stop and partly reverse soil erosion, to protect the ground-water and to contribute to environmental protection.
Method	- Introduction and training of multipliers in organic pest control - Training in organic vegetable growing and support of business start-ups (applications for credit and start-up capital etc.) - Introduction to resource-saving agriculture and training of farmers in the learning region by trainers and managers of the region - Documentation of the effects with special software for collecting socio-economic data
Cooperation partner	Sector associations and curriculum specialists; government of the regions Azad Jammu and Kashmir; Technical Education and Vocational Training Authority (TEVTA) of the province Punjab; 25 local community organisations in the tribal region, Federally Administered Tribal Areas (FATA) secretarial office, Research Institute Tarnab, Agricultural University Peshawar, GIZ FATA Livelihood Project, NGO DEWAH.

Title	Tripartite Cooperation Brazil-Peru-Germany: Construction of a Centre for Environmental Technology in Lima
Country	Peru
Time period	2010 – 2013
Initial situation	Due to the environmental standards in the new Peruvian laws and the criteria of the international export market, a big need for skilled workers and services in environmental technologies has developed.
Target group	Trainees, skilled workers, companies
Goal	Support for the construction of a Centre for Environmental Technology through consultation in building up a new international network and partnerships and a range of services offered and in the training of skilled workers, with the focus on the clean development mechanisms, on soil and regeneration of degraded land areas, on energy efficiency and on innovations in environmental technology.
Method	• Building a network • Educational needs assessment and curriculum development • Technical consultation
Cooperation partner	Peruvian Agency for International Cooperation (<i>Agencia Peruana de Cooperacao Internacional, APCI</i>); National Service for Industry Training, Peru (<i>Servicio Nacional de Adiestramiento en Trabajo Industrial, SENATI</i>); Brazilian Agency for International Cooperation in the Foreign Ministry (<i>Agencia Brasileira de Cooperacao, ABC</i>); National Service for Industrial Training, Brazil (<i>Servicio Nacional de Aprendizagem Industrial, SENAI</i>)
Result	National and international skilled workers have meanwhile been employed. Since the end of 2011, the Centre for Environmental Technology has been offering training courses in socio-ecological communication, energy efficiency, disposal of residual materials, management and evaluation tools for environmental effects and preventive environmental protection for businesses. In April of 2012 postgraduate studies for environmental technology started up. They are offered by the Centre for Environmental Technology in cooperation with the Catholic University of Peru. The buildings for the main office of the Centre for Environmental Technology, including space for advisement, laboratory analyses and applied research, are gradually being enlarged.

Title	Skills Development for Climate and Environment Business: Green Jobs South Africa
Country	South Africa
Time period	2011 – 2014
Initial situation	To support reaching the energy and climate goals of South Africa, a new emphasis in development cooperation between South Africa and Germany was agreed upon in 2008 intergovernmental negotiations with regard to the topic “Energy and Climate”. Since a transition to a green economy is only possible with a growing number of appropriately qualified workers, in 2010 an accompanying project was agreed upon: “TVET for Climate and Environmentally Relevant Occupations – Green Jobs”.
Target group	People without adequate vocational qualifications; jobholders who wish to acquire green skills; companies and their employees.
Goal	The programme consists of two parts: The part entitled “TVET in Green Occupational Fields” deals with the introduction of green sub-qualifications in existing technical job descriptions as well as promoting the development of new jobs for which a demand in a green economy is predicted. For this purpose, the project works closely with partners on the national and province levels. The part entitled, “Technology Transfer, Innovation and Distribution” supports technology centres in the introduction and development of innovations, along with distribution of green technologies in industry. Horizontal technology and knowledge transfer (from German to South African institutions) as well as vertical transfer (from South Africa universities and research institutions to local companies) are promoted.
Method	• Participatory needs assessment • Strategic and operational implementation planning • Continuing education and vocational training of managers and experts • HCD formats such as study tours, dialogue forums, workshops and seminars
Cooperation partner	TVET in green occupational fields: Department of Higher Education and Training (DHET); Quality Council for Trades and Occupations (QCTO); Sector Education and Training Authorities (SETA); Further Education and Training (FET) Colleges; Master Artisan Academy; Office of the Premier (OTP) Department for Economic Development (DEDEAT); Industrial Development Zones (IDZ) Technology transfer, innovation and distribution: Department of Science and Technology (DST); Technology Innovation Agency (TIA) Technology Stations (technology centres at universities)

Title	Labour Market-Oriented Promotion of TVET in the Uzbekistan Construction Sector
Country	Uzbekistan
Time period	2006 – 2013
Initial situation	For the last several years, flats in the Republic of Uzbekistan have been outfitted one after the other with gas and water meters, to keep the population using these resources sparingly. New buildings have to be isolated correspondingly to reduce the need for heating energy. Environmental protection and environmentally friendly use of resources were not included in the curriculum of initial vocational education and training at the beginning of the project. These issues were also only rudimentarily dealt with in institutions of higher education.
Target group	Specialist subject teachers; instructors; trainees in construction
Goal	The subject “Ecology” was introduced, in which the trainees received instruction about the finiteness of natural resources and the necessity for the economisation of resources. In the occupation of “drywall builder” various methods of effective heating and cooling isolation were added to the curricula. An important local partner is the German company KNAUF, which has built a factory in Uzbekistan, where it has actively supported the project. In occupations in the area of “gas, water and sewage fitter”, the function and effectiveness of meters in theory and practice as well as the reusability of wastewater were taught. At the same time partner companies were sought out, who would supply flats with meters under contract with the city administration and who would add practical application for these issues into internships for their trainees. In every subject-oriented seminar for the teachers and instructors of pilot programmes took place in vocational schools and the topics named above were included in the instruction. (These were supplementations to the topic of environmental protection).
Method	• Integration of basic green skills in curricula • Two-week seminar “Energy Efficiency in Construction”

Title	Regional Programme for Modernizing Education Systems in Central Asia I
Country	Central Asia
Time period	2010 – 2013
Initial situation	As a downstream area of primary agricultural production, the growing and further processing of food has extraordinary significance for the economic development of the Central Asian region, especially for the rural and suburban areas. However, there is a lack of skilled workers who are trained in economically efficient, up-to-date or ecological sustainability technologies. In close cooperation with the partner institutions the programme developed pilots of study and training courses, which renewed the didactical approaches and methods and drafted teaching materials that were suitable for the demands of a modern and professional working world.
Target group	People who will be employed as skilled workers in the agriculture sector, in the further processing of agriculturally produced foodstuffs and in rural development.
Goal	The programme's goal is to adapt vocational education and training in agriculture and food processing to the demands of the labour market developing in the region. Special emphasis is laid on the adaptation to modern technologies, to the economic and ecological requirements of the private sector and to the utilisation of modern teaching and learning methods. In the framework of improving the education of vocational school teachers several modules of modern vocational pedagogic themes were developed and tested. One of these modules "Didactics in Agriculture" aimed to impart improved teaching methods of prospective teachers for subject-related instruction. Here in particular: the adequate consideration of ecological as well as specific subject-related requirements. In the framework of improving the academic and vocational education and training in food technology, theoretical and practical instruction should be shaped to be more practical and closer to real conditions of production. The installation of solar dryers supports food processing procedures in a simple, but for local purposes in a manageable and efficient way. The integration of solar dryers into the instruction of exemplary teachers and pupils shows how environmentally friendly technologies can be used in professional and economically sound ways. The Private Sector Cooperation Offices, which have been integrated into the project, transmit this technology to small and middle sized companies, especially in rural areas. In this manner a knowledge and technique transfer of green technology will be accomplished.
Method	• Teacher training • Trainee and student training • Knowledge and technology transfer in cooperation with the private sector • Adaptation of solar dryers to local needs
Cooperation partner	The University of the Humanities and Technology in Almaty (Kazakhstan National Agriculture University); National Scientific-Methodological Centre of the Vocational Education Agency (Kyrgyz State Agricultural University); Technical and Economic College in Kara-Balta; State Technical University in Bishkek; National Institute for Continuing Education and Re-training of Educational Personnel (Tadzhikistan); Isfara Branch of the Technological University of Dushanbe; State Technical University in Tashkent (Engineer-Technical University for IT in Buchara); Vocational College for Agricultural and Economics in Kogon; Kensoy Professional College of Agroindustry and Business; State Agrarian University Tashkent.

Title	Sustainable Economic Development through TVET
Country	Indonesia
Time period	2010 – 2014
Initial situation	In the last 15 years remarkable developments in Indonesian education have been observed: Today's generation is the best educated in Indonesia's history. In spite of this, there is still a lack of qualified skilled workers for the economy. German expertise is in high demand in the area of TVET in Indonesia. German development cooperation supports the Indonesian government in seven provinces in improving the quality of TVET and in the transition from school to profession. It should be easier in the future for young people to find a good job. The development programme "Sustainable Economic Development Through TVET" (SED-TVET) combines the improvement of legal structures and the quality control systems in TVET on the national level with the use of better information about the job market and innovative approaches to promote youth employment. In addition, 23 pilot institutions are being modernised with equipment suitable for the job market and are being supported in the improvement of teaching and learning quality. Through these initiatives, the projects of technical cooperation are closely interlocked with the assistance measures of the financial cooperation. The core element of the German consultation is stronger cooperation between schools and businesses.
Target group	Unemployed, underemployed and/or youth at risk of unemployment and adults; employees of businesses
Goal	The goal of the project is to enhance the employability of workers in selected regions of Indonesia through the improvement of formal and informal skills training offers in selected TVET institutions.
Method	Various good practices in the field of environmental protection were developed and field-tested. • Green school: environmentally friendly behaviour was explained to all members of the school and this was integrated into the school's everyday routine. In the long run-, what was learned in school will be taken home and carried on and reinforced into further aspects of life. In a sense it makes the school members multipliers. • Integrated environmentally friendly initiatives: environmental aspects and themes were integrated into the curricula to generate environmental knowledge and awareness. • Turning waste into marketable products: this approach resulted from the fact that in the furniture industry, a lot of residual material and waste is left over which, with the right guidance and the appropriate means, could be re-used. Various TVET institutions participated in this idea (school internal trade shops and workshops) and are working primarily on a concept to keep the costs of reuse down.
Cooperation partner	TVET institutions such as <i>VEDCA Cianjur</i> (Integrated Environmentally Friendly Initiatives); <i>SMKN Jenangan Ponorogo</i> (green school); <i>SMK & Akademi PIKA Semarang</i> (Turning Waste into Marketable Products) among others.

Recommendations

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The examples presented in the previous chapter reflect, on the one hand, the diversity of approaches to the promotion of green skills in development cooperation. On the other hand, they show clearly how difficult it can be in individual cases to integrate ecological elements into already existing programmes, especially when the local partner doesn't possess the needed awareness and is trapped in the "old" way of thinking. Apart from having to be aware of the specific context in the respective partner country, it makes sense to derive recommendations for including sustainability requirements from development projects in the area of TVET and labour market, which can serve as an orientation for further cooperative work. As will be shown, not all of the suggestions are new. Some have been derived from national and international discussions, others are found in earlier planning aids and concept papers (Hilgers/Mertineit, 2004; Mertineit, 2009; Brinkhaus/Meininger, 2011) or have already been implemented in development cooperation projects. The value of the recommendations lies in the fact that they provide a systematic, general framework in which existing approaches and measures can be positioned and, where applicable, be further developed. The structure of the text follows the logic of the well-established multilevel approach, which combines the system level with the institutional and the individual levels (see the introduction).

Assistance with positioning and further development of existing development cooperation approaches and measures

Make sustainability the cornerstone for modernising national TVET systems.

Many BMZ partner countries are currently facing the imperative task of reforming their TVET systems to prepare for the challenges of the 21st century. To do this, new structures are being created, qualifications are being redefined, existing curricula are being revised or newly developed, new or reformed training courses are being introduced and so on. Sustainability, or more specifically, (Vocational) Education for Sustainable Development, can provide the framework to be referred to for the required modernisation strategy. Two things can be achieved: On the one hand, TVET will be obligated to make a contribution to sustainable development. On the other hand, ESD will take on a positive connotation as a meaningful instrument for the active transformation into a green economy.

Combine national TVET systems with sustainability

Support the national sustainability strategies of the partner countries through complementary ecological TVET strategies.

Many of the BMZ partner countries already have a green growth strategy or are in the process of developing one.³⁸ Not only are national development goals for environmental protection, efficient use of resources and renewable energy enumerated in them, but there are fields of action and partly relevant industries named, too. As experience shows, TVET is not mentioned in these strategy papers, or only very generally, and is not tied in with the relevant spheres of activity and initiatives. This is problematic, because all of the political and strategic goals mentioned in those papers may have an effect on the economy and will create a need for corresponding qualifications within the workforce of a country.

Tie in with national sustainability strategies

38 This applies to the countries of El Salvador, Ghana, Jordan, Cambodia, Columbia, Mali, Mozambique, the Philippines, Serbia, South Africa, Togo and Vietnam (UNDESA, 2013).

The potential that TVET possesses for supporting national sustainability strategies and policies can only be completely utilised when relevant aspects of the respective strategies are methodically worked out and implemented. The results of such an analysis should be discussed with the most important stakeholders concerned with TVET, from (at least) politics, research and the economy/industry, in order to answer as concretely as possible the following questions:

- How will skills requirements change in the future? What will TVET have to deal with?
- Where, in which form and level is TVET asked for its (specific) contribution to achieve the development goals?
- Concerning the topic “employment”: What are decisive factors of excluding or promoting the creation and occupation of green jobs?
- What contribution can TVET make concerning the integration of the population into the process of political change and to increase the social acceptance of sustainability measures?

The stakeholder conferences which have been carried out on behalf of the BIBB might serve as an example for this kind of discussion.

What should be emphasised also in this connection is the combination of TVET with research and development. As experience shows, there is an incredible loss of time in many countries when innovations are transferred from research into practice. This process could be sped up, if TVET could be included in early stages of research activities. Then it would be more in a position to adapt its training offers even to midterm results of the research. Since TVET institutions reach many people in many different regions and industries, technical innovations and new knowledge can be transferred very quickly into professional and thus into economical practice.

The results of these measures should be a green TVET strategy which is agreed upon amongst the most important stakeholders and harmonised with national sustainability strategies.

Integrating the economy into green TVET activities on the national, regional and local level.

Especially those countries which have full-time, school-based training systems run the danger of training their students in the wrong qualifications with respect to the true needs of the economy. Therefore, it is all the more important to create organisations on all levels (national, regional and local) to facilitate a regular exchange among representatives of enterprises/chambers and trade associations/unions and ensure an appropriate flow of information in both directions. This interchange is always important; but it is inevitable for the desired transformation toward a green economy.

Analyse sustainability strategies and policies and discuss results with affected groups

Stakeholder conferences as an example

Include TVET in early stages of research activities

Green TVET strategy as a result

Cooperation with the economic system

A TVET strategy, just like a national sustainability strategy, can only be implemented when it is accepted and supported by the relevant stakeholders – not only by the government and public administration, but most importantly by the enterprises and unions. This last group plays the key role in the transition to a sustainable economy. It is the duty of the enterprises to invest in sustainable technologies and business models. They know best which qualifications are required in which industries. As an acknowledgement of this role, and to sustain acceptance of green TVET activities, a joint declaration from representatives of government, TVET and economy should be pursued, in which the self-concept and the tasks of TVET would be formulated as part of the national sustainability strategy. The role model for this could be the recommendations of the BIBB Board that came out at the end of the 1980s to the beginning of the 1990s, which established the basics and set the trend for inclusion of environmental questions into TVET in Germany.³⁹

A joint declaration from representatives of government, TVET, and economy

An important task within the German TVET system falls to the chambers, e.g. the Chamber of Skilled Crafts and Trades or the Chamber of Industry and Commerce. They coordinate the private training companies in close cooperation with the responsible public authorities, and they insure the quality of the training, along with keeping the training content up-to-date. The partner countries could in a similar way to Germany provide for stronger participation of their chambers and unions in TVET. This plan should also be used for the identification of green skills requirements and their integration into workplace-oriented curricula for continuing vocational education and training. Whenever reasonable, the German enterprises represented in the respective partner country and the corresponding Foreign Chamber of Industry and Commerce should be involved.⁴⁰

Inclusion of chambers and associations

Tie TVET in with environmental and energy policy guidelines, standards and projects.

The primary precondition for enclosing (Vocational) Education for Sustainable Development in practice is – next to the required business conditions, technological innovations and a demand for environmentally friendly products and services – that a minimum of governmental environmental policies exist. This is especially true for developing and emerging countries, in which consumer demand and the market are not sufficient to promote a green economy to an adequate degree, contrary to the situation in industrial countries. Studies (e.g. ILO/CEDEFOP, 2011, 7) show that laws and regulations, as instruments of direct or indirect influence on business behaviour, have a positive effect on the rise of markets for sustainable products, services and processes, which leads in turn to a demand for the corresponding sustainability skills. Additionally, a standard structure created in the context of governmental environment and energy policies, together with the technical and organisational procedures that follow, can function as an indispensable point of reference for (Vocational) Education for Sustainable Development. If there are no appropriate standards, activities in the context of (Vocational) Education for Sustainable Development hangs “in the air”. They have hardly any effect on practice worth mentioning and are not well accepted. This situation was very explicitly described in some of the GIZ programmes presented in chapter 4.

Environmental policies as the tie that binds

39 Admittedly, in Germany there is no equivalent recommendation in the context of sustainable development.

40 With reference to BMZ, 2012, 25.

Environmental law standards are important in many ways for skills training for environmental protection and in professional life in general, because they

Environmental law standards apply to green skills training

- Need to be directly considered in occupational activities such as handling toxic materials or sorting waste;
- Are the basis for certain green skill activities (measuring emissions in the chimney sweep trades, exhaust surveys in vehicle and sanitation, heating, and air-conditioning trades etc.);
- Create a new need for specialised occupations or occupational specialisation, for example, agents for emission control or new environmental technical occupations etc.

Environmental law standards are of great importance for green skills training. Certain regulations that apply to specific countries must be considered during the transfer.

Another example is the promotion of energy efficiency of buildings or the use of renewable energy through subsidies, tax breaks, low interest loans or an increase in compensation for electricity fed into the grid through solar or wind plants. If the incentives are attractive enough, they lead to an increase in demand, which in turn has a direct effect on the skills profile of the trades in practice.

Further examples

Environmental Protection, Resource Efficiency and Renewable Energies in the Curricula on the Level of Vocational Training and Continuing Education.

In the future every job will be a green job. The concept of environmental impact of an occupation must become a regular component of curricula in the TVET systems. The inclusion of sustainable development and environmental questions within existing qualifications is far more effective than introducing new training standards.

Anchoring green skills in the curricula

Correspondingly, green skills requirements will apply to all occupations. A basic knowledge of environmental protection, emission control, land and water protection, handling toxic materials, waste management as well as energy and resource efficiency belongs in all forms of vocational training. Every jobholder should know how her/his job effects the environment, what risks there are and what should be done to minimise these risks and to keep negative environmental effects as minimal as possible. The newly established German occupational profile “Environmental Protection” could serve here as orientation. As the German example shows, it isn’t sufficient to limit the efforts just to develop a new position. More important is that a corresponding curriculum is developed. To make the implementation easier, guidelines should be drawn up in which the issues can be clarified with examples from the field.⁴¹ The introduction of a new position should be coupled with a systematic skills training of the teaching and training personnel.

Basic skills for environmental and resource protection belong in all forms of vocational training

41 The teaching and learning aids presented in chapter 3.6 can be tied into this suggestion.

In already existing occupations it is essential to identify where environmental protection, energy and resource efficiency and renewable energies can tie into basic skills and to anchor them in the curricula of technical vocational training in general and on the level of continuing education and training. Here it would be appropriate to relate to the specific occupational field. In metal and electronic technologies, for instance, it would be mostly about energy and resource efficiency and the handling of toxic materials. In the building industry and its side-line occupations, energy and resource efficiency, and when applicable technologies in the utilisation of renewable energies (such as heating and cooling, photovoltaics), would be high on the agenda. The integration of technologies for the use of renewable energies can be accomplished through new focus and additional qualifications (e.g. skilled trades in solar technologies for sanitation, heating, air-conditioning occupations, wind energy technologies for mechatronic technicians). Immersion in skills and specialisation should be offered on the level of continuing education. The development of separate occupations in environmental protection, energy and resource efficiency and renewable energies is only advisable when there is an expressed need for them in the economy and when there are clearly defined job profiles.

Immersion in relevant occupations

Education and Vocational Training in the MINT Subjects.

In many sectors of the green economy, basic knowledge in the so-called MINT (mathematics, information technology, natural sciences and technology) subjects is a precondition. Graduates in these subjects generally have good employment prospects in this area. At the same time, it can be observed that interest in these subjects among young people in secondary schools and higher education is fading. An important strategy for promoting opportunities for entering into the green job market and helping to develop a low emission economy would be to win over pupils and students in the secondary and tertiary levels for the MINT subjects and to train them in the related core skills.

Relevance of the MINT subjects

Greening FET Colleges.

TVET institutions, especially qualifying vocational schools or Further Education and Training (FET) Colleges, play an important role not only for offering skills training in environmental protection, energy and resource efficiency and renewable energies, but also for spreading the vision and setting an example for the integration of the principles of sustainable development. Still the “fundamental transformation” (WBGU) is not only a technological challenge which can be confronted simply with expert vocational skills. Reflection about values, attitudes and lifestyles is also required, along with space for learning and experiencing where looking outside the box is encouraged and dealing with resources sustainably can be put to the test. TVET institutions have special opportunities in this regard, because they reach many young people who in turn can act as multipliers in their respective fields.

Organisational development

The characteristics of green TVET institutions and the entry points for beginning corresponding development processes are described in chapter 3.5. Certain activities could be facilitated when appropriate programmes are established on the regional or national level and interested FET Colleges would receive support in the form of financial or technical resources, consulting services of experts and if the exchange among them would be promoted. This could be coupled very well with countrywide or regional campaigns and competitions. The announcement and honouring of good practices may have a double effect: Role models would be motivated by the recognition to continue working on the issue, and others could see that it is worthwhile to be involved.

Tie in activities with countrywide campaigns and competitions

Training Experts and Managers

Teachers and trainers play a key role when it comes to integrating environmental protection, resource efficiency and renewable energies into TVET measures. They are the ones who have to teach corresponding skills with the help of appropriate methods to insure that the trainees acquire the necessary vocational coping skills. At the same time, they are role models in their teaching and corporate actions. The skills training of this stakeholder group is thus of crucial importance, which means that programmes addressing them should cover three aspects: expert skills, didactic-methodological know-how and knowledge of the respective sustainability policy context.

Human resources
development

Germany had good experiences in this connection with the cascade approach: At the end of a skills training event, the participants develop transfer ideas and obligate themselves to implement and document them by a certain deadline. The practical examples which are implemented and documented are then presented in the next class to other participants for guidance, and so on. In this way, the training programme becomes stronger and stronger with practical examples. And the best examples of implementation can be prepared to be made available in teaching or learning aids or in the internet.

Enriching skills training
measures with practical
examples

In addition, skills training for other groups are important:

- Examiners need knowledge about how sustainability skills can be properly tested in an examination. They need knowledge not only about the relevance of environmental and sustainability aspects for certain occupations and the state of the art implementation in businesses, but also about adequate forms of examination.
- School directors and school board members have to know how sustainability aspects can be integrated into TVET institutions, which role they themselves need to play in this implementation process and how they can determine skill requirements of the labour market and implement findings by adapting training offerings.
- Staff of education ministries, government agencies, chambers, certification agencies etc., who are entrusted with greening TVET training programmes and are responsible for their condition. It is important for this group to know how green skills training requirements can be determined and adequately acted upon in the TVET system.

Besides teachers and trainers,
examiners, school directors
and relevant administrators
need to be qualified

Accompanying green TVET activities with support measures.

Support measures

As mentioned implicitly above, the process for development and implementation of green TVET activities – as long as it has to do with a programme that goes beyond a one-off measure – should be accompanied by support actions. The following, for instance, would be suitable:

- The design and implementation of an internet platform
- Networks and roundtables
- Stakeholder conferences tailored for the different branches
- Collection, care of and dissemination of good practice examples (Good Practice Agency)
- Drafting and dissemination of didactical materials
- Campaigns and competitions on national, regional and local levels

No matter which individual measures are carried out to accompany the process: it is important for a central institution, which is accepted by all the important stakeholder groups and equipped with the required resources, to steer and actively accompany the process. All of the measures should fulfil a strategic function, which emerges from former experience, to evaluate and further develop what exists, to motivate involvement and support transfer.

Involve a universally accepted coordinating body

Using the potential of Germany as a place of learning.

Germany as a place of learning

Germany offers a great deal of potential as a place of learning for development cooperation. This applies to both greening economic activity and greening TVET. Certainly not all that glitters is gold, and there are some shortcomings in the details. Even so, there is also a lot which is worthwhile to showcase: state environmental and sustainability policies which go back as far as the 1970s, a heightened awareness of environmental issues among the population, the development of a prosperous green economic sector with high employment potential, a TVET system geared to the requirements of the economy, experience of many years in integrating environmental protection, resource efficiency and renewable energies into vocational training and continuing education and so on. For all of the recommendations offered here, there are examples and experiences in Germany from which a great deal can be learned.



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7.1 Glossary

Agenda 21 is an action plan for development and environment policy which maps out concrete recommendations for the 21st century. It is a product of the UN Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992, outlining in 40 chapters all policy areas relevant to environmentally friendly and sustainable development. The agenda defines (→) sustainable development as the overarching political objective and calls for a new partnership between developing and industrialised countries with respect to aspects of development and environment. Development objectives such as poverty reduction and sustainable management of natural resources (water, soil, forest) are as much part of the agenda as are political objectives (e.g. reducing greenhouse gas emissions).

Source: www.unep.org/Documents.Multilingual/Default.asp?documentid=52

Agenda 21

The German Advisory Council on the Environment (*Sachverständigenrat für Umweltfragen*, SRU) emphasises that the natural environment, especially the climate and biodiversity, provide the foundation for all human life. Without functioning ecosystems and the preservation of natural capital, stable social and economic systems are unthinkable. Ecosystems such as healthy forests, oceans and swamps provide important raw materials, energy and food – they contribute considerably to climate change and provide a myriad of other types of benefits as well as habitats for many species. These contributions are not acknowledged or valued in the labour market and are therefore at risk when the economic pressure to use them is not reduced. The SRU argues that in the conventional model of sustainability, which calls for equal consideration of economic, environmental and social objectives as a matter of principle, the bigger picture of ecological capacity is not sufficiently considered. As a consequence, what is called for is re-working the model to determine ecological limits and crash barriers that must not be crossed in order to permanently save vital ecosystems. Staying within such limits should be a priority in the national, European and international discourse on environmental protection.

Source: SRU 2012, 36ff.

Ecological limits

Education for Sustainable Development (ESD) enables people to make decisions about the future and at the same time evaluate the impact of planned actions on future generations or life in other regions in the world. ESD intends to convey knowledge about global interrelations and challenges, such as climate change or global justice, as well as the complex economic, ecological and social causes of these issues. Apart from that, ESD promotes skills in individuals that enable them to shape their environment and future. This is, in other words, the ability to apply the knowledge about sustainable development and to be able to recognise the shortcomings of development that is not shaped in a sustainable way. This includes skills such as forward-looking thinking, interdisciplinary knowledge, problem solving competence, acting autonomously as well as the ability to participate in social decision-making processes.

Source: Deutsche UNESCO-Kommission 2013 (German Commission of UNESCO)

Education for Sustainable Development

Energy efficiency is the most important precondition for developing a sustainable energy system. Energy must be produced, transferred and used in a way that creates as much output as possible with as little energy consumption as possible. Low efficiency of old power plants must be addressed as much as energy loss due to old cables and power lines, waste through inefficient terminal devices or incorrect user behaviour. There is a huge (theoretical) potential for saving energy through these avoidable losses, which, however, is practically almost completely offset by (→) rebound effects.

Energy efficiency

Source: BMZ 2013

Environmental expertise is an integral part of vocational coping skills. It refers to the ability to recognise, assess and minimise direct and indirect negative impact on the environment. Environmental expertise is not static in nature. It is rather a dynamic process that manifests itself in an individual's continuous dealing with the effects on the environment caused by occupational activities in a context of constantly changing occupational, organisational, political and ecological conditions.

Environmental expertise

In detail, environmental expertise entails the following areas:

- (Environmental) knowledge relating to specific occupations or across occupations;
- The willingness to take responsibility for and take steps towards the preservation of the environment; and
- The ability, commitment and willingness to take environmental protection into consideration in professional practice.

Since any occupational activities requiring environmental expertise are normally carried out in concrete situations within a company or organisation, where other people, groups, institutions or departments are involved, communication and cooperation skills are further essential elements of environmental expertise.

Source: Jungk/Mertineit 1999

The concept green economy has established itself on a global level as the new environmental guiding principle and also takes on an increasingly significant role in strategy development processes on the national and international levels. The key message in the present discourse on green economy is that environmental protection should be considered more than just a general cost factor. Instead it offers great economic opportunities. Ecological sustainability and economic progress should no longer be seen as opposites. However, until now, no commonly accepted definition of the term green economy exists. Most commonly used is the working definition of the UNEP that defines green economy as an economy which “results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one which is low-carbon, resource-efficient and socially inclusive”. Whereas UNEP bases their concept of a green economy on an analysis of economic and ecological crises, their social causes and impact, emphasising the role of stable ecosystems for poverty reduction, the OECD sees the possibility of continuing global economic growth despite limited raw materials and ecosystems which are under pressure.

Green economy

Sources: SRU 2012, 609; Wikipedia 2013

Green or environmentally sound growth means promoting economic growth while at the same time protecting the environment and resources. There is no commonly accepted definition. The OECD defines green growth as: “Green growth means fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies. To do this, it must catalyse investment and innovation which will underpin sustained growth and give rise to new economic opportunities.”

Source: OECD 2011, 4

Green growth

There are many diverging opinions as to what constitutes a green job. UNEP defines green jobs as “positions in agriculture, manufacturing, construction, installation, maintenance as well as scientific and technical, administrative and service-related activities, which contribute substantially to preserving or restoring environmental quality”. The ILO considers a job green as one that helps to reduce negative environmental impact and contributes to environmental, economic and social sustainability of enterprises and economic sectors.

Sources: UNEP/ILO/IOE/ITUC 2008, 35; ILO 2011, 4

Green jobs

Green skills are specifications of (→) environmental expertise. Generally speaking, green skills refer to the knowledge, abilities and skills that are needed to meet environmentally relevant requirements of a particular enterprise and in the workplace. A uniform catalogue for related competences does not exist. Individual countries, such as the United Kingdom or Australia, have in fact attempted to create a list of specific green skills. However, they are categorised by fields (e.g. waste, energy, construction) and do not contain skills across occupational fields (core skills). The ILO-CEDEFOP study “Skills for Green Jobs” presents a list of core skills that are relevant for green jobs.

Source: ILO/ CEDEFOP 2011, 107

Green skills

The concept of green skills development in Germany is based on the 1988 recommendations of the Board of the German Federal Institute for Vocational Training (*Hauptausschuss BIBB*). According to this concept, TVET has the function of facilitating learning processes that demonstrate the concrete relations between vocational training and potential environmental impact, as well as fostering responsible attitudes towards the environment and its natural assets and resources. Teaching such competences is supposed to take place in an integrative manner, meaning throughout the entire period of training and, if possible, in direct relation to specific occupational activities.

What this means in concrete terms is defined in the individual job profiles for “environmental protection”, which are part of all training regulations. Accordingly, trainees at the end of the apprenticeship should be able to contribute to avoid work-related environmental impact within their sphere of influence. In detail, they should be able to explain, by using examples, what impact their training company might potentially have on the environment, or how the training company could contribute to environmental protection. They should apply existing regulations for environmental protection, make use of energy and material in ways that are efficient and environmentally friendly, avoid waste and dispose of material in an environmentally sound manner. These learning objectives can serve as references for green basic skills.

In addition, green skills development promotes knowledge, skills and abilities that are relevant to the environment and are specifically applicable to occupational fields, such as installation and maintenance of solar systems; handling of heat pumps, construction of energy-efficient buildings etc.

Sources: Hauptausschuss 1988; BMBF 1998, 78

Green skills
development

Greenwashing is a critical term describing public relations methods that are deceptively used to promote the perception that an organisation's aims and policies are environmentally friendly, without having sufficient basis for this claim.

Source: Wikipedia

Greenwashing

As a management tool for their sustainability strategy, the German Government has determined management rules for sustainability. The basic rule is: "Each generation must solve its own problems and not burden the next generation with them. It must make provisions for the foreseeable future problems". This is valid for the preservation of natural resources, economic development and social cohesion and demographic change. Additionally, there are rules for individual areas of action. For the environmental dimension of sustainability it says: "Renewable natural goods (e.g. wood or fish populations) should, on a long term basis, be used only within the bounds of their ability to regenerate. Equally, non-renewable natural goods (e.g. minerals or fossil energy sources) should only be used to the extent that their functions can be replaced by other material or energy sources. The release of materials into the environment should, in the long run, not exceed the adaptability of the eco-system – e.g. climate, forests and oceans."

Source: Bundesregierung 2012, 28

Management rules
for sustainability

In September 2000 in New York, the UN General Assembly adopted what is known as the Millennium Declaration. Later, eight international development objectives were derived from it. By 2015 they aim to:

MDG 1: Eradicate extreme poverty and hunger

MDG 2: Achieve universal primary education

MDG 3: Promote gender equality and empower women

MDG 4: Reduce child mortality

MDG 5: Improve maternal health

MDG 6: Combat HIV/AIDS, malaria and other diseases

MDG 7: Ensure environmental sustainability

MDG 8: Develop a global partnership for development

Source: www.un.org/millenniumgoals/

Millennium
Development Goals

The responsibility of producers and distributors throughout the lifecycle of a product from development to disposal. With the Packaging Ordinance of 1991, Germany introduced for the first time a comprehensive approach to product responsibility in waste management as part of waste legislation. In the 1996 law for life cycle management and waste, producer responsibility was determined to be a precondition for constructive life cycle management and was consequently expanded to cover all consumer goods. This also means that the producer is obligated to avoid, utilise and dispose waste that is created by a product.

Source: Der grüne Punkt – Umweltschutz auf den Punkt gebracht (www.gruener-punkt.de)

Producer or product
responsibility

The rebound effect describes the phenomenon in which the energy savings of potential and efficiency improvements (for instance, as a result of isolation of buildings, efficient lighting or low fuel engines in cars are hardly ever or only partly achieved by consumers and, on the contrary, may lead to an even higher consumption of energy. This is the case, for instance, if an individual purchases a more fuel-efficient car but uses it for additional trips or even purchases an additional car because of the low consumption values. More examples: Heating the home more because the price of heating is lower after having improved the insulation. People that use energy-saving lamps tend to leave the light on longer reasoning that this would be cheaper. This effect is called direct rebound. Indirect rebound refers to all other effects: For example, after efficiency has been improved, the consumer has leftover purchasing power that can be used for all kinds of categories of products and services imaginable. In the extreme case, this can lead to a backfire effect: Ultimately more resources are used up through the use of more efficient technologies.

Source: Madlener/Alcott 2011, 6f

Rebound effect

Renewable energies are derived from resources that are continually replenished or come from resources that are not depleted by use. This includes energy from sunlight, wind, rain, tides, waves, and geothermal heat, as well as biomass which comes from renewable raw material. Utilising renewable energies does not contribute to an increase in the amount of greenhouse gases in the atmosphere. Consequently, they are one of the most important instruments against climate change. In many cases, small power stations using sunlight, water, biomass or geothermal heat are able to meet communal energy needs in a decentralised, economically and environmentally sound and climate friendly way. In developing countries they can thus make a significant contribution to meeting energy supply and reducing poverty.

Source: BMZ 2013

Renewable energies

The definition today most commonly used came from the UN World Commission on Environment and Development, the so-called Brundtland Commission (1987). According to this definition, "Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs". Sustainable development was proclaimed the key guiding principle for global action at the UN Conference for the Environment and Development in Rio de Janeiro in 1992. Since that time, sustainable development has indeed been accepted as the global guiding principle, with concrete approaches for its implementation adopted as part of (→) Agenda 21, also in Rio. The key concept of sustainable development is to keep the world in balance. The key thought is that, in the long run, we cannot live at the expense of people in other regions of the world or at the expense of future generations. The environment, economy and society mutually affect each other. There will be no long term economic or social progress without a healthy and intact environment. At the same time, it will not be possible to protect the environment efficiently, if people have to fight for their economic livelihoods. There are many different notions about how much weight should be given to each of the three **sustainability dimensions** [see also (→) weak sustainability and (→) strong sustainability].

Sources: Deutsche UNESCO-Kommission 2013; BMZ 2013; Bundesregierung 2012, 21

Sustainable development

The concept of sustainability is based on the realisation that protecting the environment on a global scale is only possible, if economic and social aspects are equally taken into consideration on a policy level. According to the three pillar model, economic, environmental and social development goals are to be seen as equally important on the entire economic and political level as well as on the global and business level. This understanding of sustainability corresponds to the concept of (→) weak sustainability, wherein natural resources and outputs of ecological systems are considered replaceable by human resources and physical capital. Those advocating the concept of (→) strong sustainability, however, criticise the equal ranking of all three dimensions and call for giving stronger weight to the significance of the environmental aspect, for instance by recognising (→) ecological limits.

Source: Aachener Stiftung Kathy Beys 2013

Sustainability dimensions

In contrast to general education where the individual is addressed as a consumer, taking on producer responsibility is required of individuals when considering aspects of sustainable development in an integrative way in TVET. This requires new skills of those involved, above all system expertise that enables the individual to act in a sustainable way in complex technological and social systems. It also requires skills for shaping sustainable working situations and processes, products, and customer orders in the skilled crafts and trades.

Sources: Hahne 2007; NUN 2007

(Vocational) Education for Sustainable Development

Representatives of the concept of weak sustainability consider natural resources and outputs of ecological systems to be replaceable by human resources and physical capital. According to this approach a system is sustainable, if the entire capital (consisting of natural resources, human resources and physical capital) remains the same or grows. A decrease in natural capital, meaning the extraction of raw materials or the decline of natural habitats, is still considered to be sustainable, as long as it is balanced by an increase of capital in the other areas. The preservation of the environment is not at the centre of this system, rather it is the maintenance and increase of overall prosperity which is central. This is why weak sustainability is also called anthropocentric. In contrast, the concept of strong sustainability places ecological aspects above all others, since natural resources are considered the basic precondition for all other areas of development. Substituting one type of capital for another is also possible in this system – however, only as far as human resources and physical capital are concerned. Exchanging or substituting natural resources with human resources or physical capital is not possible – due to ecological limits. The SRU endorses the concept of strong sustainability and explicitly argues in its latest Environment Report in favour of determining ecological limits and crash barriers for social and economic development that must not be crossed. The German Government has integrated the concept of strong sustainability into its sustainability strategy: “Economic performance, environmental protection and social responsibility should be combined in a way that enables sustainable decisions based on all three aspects to be considered in a global context. The absolute limit is reached when the earth’s capacity to sustain life is involved. It is within this framework that the realisation of the various political goals should be optimised” (Bundesregierung 2012b, 2).

Sources: Aachener Stiftung Kathy Beys 2013; Bundesregierung 2012b; SRU 2012, 36ff.

Weak and strong sustainability

7.2 Selected Literature

7.2.1 International

GIZ (Ed.) (2009): Ecological Sustainability in TVET.

Planning Aid to Initiate and Implement Environmentally Relevant Topics in Selected Programmes and Offers of the Development Cooperation. (Beiträge aus der Praxis der beruflichen Bildung, No. 21.) Mannheim.

http://star-www.inwent.org/starweb/inwent/docs/Lehrbrief_21_engl.pdf [03.10.2012]

This publication investigates with reference to the situation in Germany how environmentally relevant topics can be integrated into programmes and offerings of development cooperation. Based on country studies, the publication demonstrates how potential training needs for green skills can be determined and which strategies, programmes and experiences available in Germany can principally be transferred into partner countries.

ILO/ CEDEFOP (Ed.) (2011): Skills for Green Jobs.

A Global View. Synthesis Report based on 21 Country Studies. Genf.

www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_159585.pdf [17.12.2012]

This report investigates how and with which experiences industrial and developing countries organise their TVET systems to meet the requirements of a greening economy. The report shows that only few new jobs are being created and instead existing jobs are expanded by new skills requirements. TVET must respond to this adequately and see to the continuing education of the groups who are employed in industries intensely involved with resources and emissions, where in the long term employees could get lost in the process of transformation. In order to increase the labour market potential of green growth, the report argues in favour of linking social and economic development strategies with the corresponding education and TVET policies on the national level.

Maclean, R.; Jagannathan, S.; Sarvi, J. (Ed.) (2012): Skills Development for Inclusive and Sustainable Growth in Developing Asia-Pacific. Dordrecht, Heidelberg, New York, London.

www.adb.org/sites/default/files/pub/2012/skills-development-inclusive-growth-asia-pacific.pdf [22.12.2012]

If emerging economies in Asia and the Pacific are to maintain their robust economic growth rates, they need to respond to the challenges posed by the ascent of knowledge economies. Cost advantages made possible by a cheap workforce will not be sufficient on a continuing basis. In order to confront these challenges, a modernisation of TVET is required, which would have to adjust to the higher skills requirements and to a greening economy.

OECD (Ed.) (2011): Towards Green Growth. Paris.

www.oecd.org/greengrowth/48224539.pdf [18.12.2012]

This publication includes a strategy for green growth combining economic, ecological, social, technological and development-specific aspects, which are combined into an overall conceptual framework. It shows that ecology and economic growth are compatible and that job growth, prosperity, environmental protection and improved quality of life can all go hand in hand. This strategy was a component of the OECD contribution to the Rio+20 Conference in June, 2012.

UNDESA (Ed.) (2012): A Guidebook to the Green Economy.

Issue 1: Green Economy, Green Growth, and Low-Carbon Development – History, Definitions and a Guide to Recent Publications. New York.

www.uncsd2012.org/content/documents/528Green%20Economy%20Guidebook_100912_FINAL.pdf [22.12.2012]

This publication provides an overview of current literature on the topics green economy, green growth and resource-friendly/low-carbon development. Additionally, a brief overview is given on the history of these concepts and their entrance into current economic and socio-political strategies. The individual chapters contain links to websites and references to the original sources for further reading.

UNEP (Ed.) (2011): Towards a Green Economy:

Pathways to Sustainable Development and Poverty Eradication.

www.unep.org/greenconomy/Portals/88/documents/ger/ger_final_dec_2011/Green%20Economy_Report_Final_Dec2011.pdf [15.12.2012]

This report is a key contribution of the UNEP to the Rio+20 Conference 2012. It offers a comprehensive overview of the concept of a green economy in the context of sustainable development and makes recommendations about measures that help political decision-makers to promote and utilise the development and employment potentials of a green economy.

UNEP/ILO/IOE/ITUC (Ed.) (2008): Green Jobs:

Towards Decent Work in a Sustainable, Low-Carbon World. Nairobi, Kenya.

www.unep.org/PDF/UNEPGreenjobs_report08.pdf [18.12.2012]

This report is the first comprehensive data-supported publication on a range of topics such as global environmental and climate change, as well as employment. It shows that the global transition to a low-emission, resource-saving, sustainable economy possesses great potential for employment in many economic sectors and can become a job motor in industrialised, as well as developing and emerging countries.

UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training, Bonn, Germany (Ed.) (2006): Orienting Technical and Vocational Education and Training for Sustainable Development. Discussion paper series 1. Bonn, Germany.

www.unevoc.unesco.org/fileadmin/user_upload/pubs/IntLib_DiscP_ESD_e.pdf [18.12.2012]

This publication was prepared by the UNESCO-UNEVOC International Centre, in consultation with a number of UNEVOC Centres and partner agencies and several leading researchers, policy-makers and practitioners working in the field of TVET. It gives an overview of key concepts, topics and developments in the area of (Vocational) Education for Sustainable Development. The paper reflects upon the findings of the International Experts Meeting on “Learning for Work, Citizenship and Sustainability” hosted by UNESCO in Bonn, in October of 2004.

7.2.2 National

BMBF (Hrsg.) (2007): Duale Berufsausbildung im Bereich erneuerbarer Energien. Ein expandierender Wirtschaftsbereich braucht qualifizierten Nachwuchs. Bonn, Berlin. (Dual Vocational Training and Education in Renewable Energies. A Booming Economic Activity which Needs a Qualified Future Workforce)
www.bmbf.de/pub/duale_berufsausbildung_erneuerbare_energien.pdf [23.08.2012].

The various sectors of renewable energies (sunlight, wind, hydropower, biomass and geothermal energy) have been expanding by leaps and bounds for several years. The necessary training occupations are at hand, and almost all training regulations for the pertinent occupations have been newly developed or adjusted to technological or work-related standards in the past years. They are formulated in a flexible way allowing each enterprise to independently train the necessary skilled workers for specialised tasks. The publication shows with examples of enterprises in different areas of renewable energies which occupations require training in their specific fields of application.

BMBF (Hrsg.) (2011): Ausbildungsberufe für die Elektromobilität. Ein dynamisches Innovationsfeld bietet spannende Perspektiven. Bonn, Berlin. (Jobs Requiring Training for Electromobility. A Dynamic Area of Innovation Offers Exciting Perspectives)
www.bmbf.de/pub/ausbildungsberufe_elektromobilitaet.pdf [23.08.2012].

The expansion of electromobility spans across the entire value chain and goes hand in hand with a myriad of technological and technical changes. Resulting from that is an increasing need for adequately trained skilled labour and specialists. How is TVET positioned with regard to these new challenges? This publication presents a selection of jobs requiring training for electric mobility which, because of their job descriptions, cover specific requirements in one of five areas: vehicle technology, infrastructure facilities and networks, system services, vehicle servicing and retail.

BMU (Hrsg.) (2009): Energie- und Ressourceneffizienz in Berufsbildung und Arbeit. Berlin. (Energy and Resource Efficiency in TEVT and at Work)
www.bmu.de/fileadmin/bmu-import/files/pdfs/allgemein/application/pdf/broschuere_berufsbildung_bf.pdf [02.01.2013].

Consuming a minimum level of resources and recycling products and raw materials are key challenges for future enterprises and therefore important topics for TVET. This guide targets teaching and training personnel in enterprises and TVET institutions providing guidance on relevant fields of action specifically for vocational education and training. The guide explores possibilities for energy and material efficiency across occupations, for instance electric engines, compressors, space heating and domestic hot water, office equipment and supplies as well as mobility, transportation and logistics. Besides basic information, concrete recommendations for actions for business practices are provided and examples of successful actions in workshops are presented by trainees.

BMU (Hrsg.) (2013): Erneuerbar beschäftigt. Kurz- und langfristige Arbeitsplatzwirkungen des Ausbaus der erneuerbaren Energien auf den deutschen Arbeitsmarkt. Berlin. (Renewable Employment. Short and Long-term Effects on Employment in the Context of the Expansion of Renewable Energies on the German Labour Market)
www.bmu.de/fileadmin/Daten_BMU/Pool/Broschueren/EE_beschaeftigt_bf.pdf [28.01.2013].

Expanding the sector of renewable energies in Germany has considerable effects on economic growth and employment. This is confirmed by a study which was carried out by a team of well-known and appreciated research institutes for the BMU between 2008 and 2012. According to this study, employment in the sector of renewable energies was at 381.600 employees in Germany in the year 2011. This is significantly more than double in comparison to 2004 (around 160.500 jobs). Until 2030, the gross employment – depending on the export scenario – could increase to between 520.000 and 640.000 employees. The brochure provides for the first time an estimation of the gross employment based on the manufacturing renewable energy facilities as well as the operation, maintenance and supply of biogenic fuels.

7.3 Selected Links

7.3.1 International

www.cedefop.europa.eu

The European Centre for the Promotion of Vocational Training (CEDEFOP) supports the development of European TVET policies and contributes to their implementation. To identify and anticipate future skill needs and potential skill mismatches, CEDEFOP undertakes various European level research activities on the European level, among them also studies in the area of green jobs/green skills.

www.ilo.org

The International Labour Organization, an institution of the United Nations, deals with the core issues of labour rights, decent working conditions and social protection, as well as strengthening work-related dialogue processes. With great emphasis the ILO participates by contributing studies and inputs on conferences in the discourse about the challenge of the transformation to a greener economy. The ILO runs a portal on the topic of green jobs under: **www.ilo.org/global/topics/green-jobs/lang--en/index.htm**.

www.oecd.org

The Organisation for Economic Cooperation and Development (OECD) – an association of 34 states (the majority of them with high per capita income) – pursues the goals of promoting economic growth in their member states and developing countries, and of contributing to spreading global trade on a multilateral basis. The OECD represents the concept of green growth. It designed a strategy for this concept in 2011 and is among its most important promoters.

www.unep.org/greenconomy/

The United Nations Environmental Programme (UNEP) brought the so-called Green Economy Initiative into being in 2008. Their goal is to promote investment in green economy sectors or in the renewal of sectors damaging the environment, through collection and analysis of data, as well as supporting policy development. UNEP has made an encompassing report on the subject and runs a website where diverse information is made available.

www.unevoc.unesco.org

The UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training supports UNESCO in implementing the UN Decade of Education for Sustainable Development as well as the Education for All (EFA) programme, with the focus on TVET. Since the beginning of the UN Decade, the centre has been active in publishing studies and reports and organising conferences on the international level in the area of (Vocational) Education for Sustainable Development. A current and urgent subject is to further sharpen the concept of TVET towards sustainability and a green economy.

www-wds.worldbank.org

On their website the World Bank provides information on the topics green growth and sustainable development. Besides information on various sectors (fisheries, agriculture, transport, energy etc.), the website also offers specific country information and a data base with indicators for green growth and various relevant publications.

7.3.2 National

Ministries, Public Authorities, Agencies and Institutes

<http://berufenet.arbeitsagentur.de/berufe/>

BERUFENET is an online site of the German Federal Employment Agency, which provides encompassing and systematic information about approximately 3,200 current and a further 4,800 archived descriptions of occupations.

http://bbne.bibb.de/de/bbne_index.htm

The Sustainability portal of the German Federal Institute for Vocational Training (*Bundesinstitut für Berufsbildung*, BIBB) provides an overview of funding projects, best practice examples and teaching and learning materials.

www.bibb.de/de/26171.htm

On this webpage the BIBB provides an overview of all the regulated jobs that require training and continuing education in Germany, including job profiles, training regulations and framework curricula.

www.bmu.de

The website of the German Federal Ministry for Environment, Nature Conservation and Reactor Safety (*Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit*, BMU) provides information about all areas having to do with the protection of nature and the environment. Educational materials and studies, for example on the effects of renewable energies on employment, are included.

www.dena.de

The German Energy Agency (*Deutsche Energie-Agentur GmbH*, dena) is a centre of excellence for competences having to do with energy efficiency, renewable energies and intelligent energy systems. In the consumption sectors, buildings, electrical power and traffic, they initiate model projects, present awards to pioneers, advise politicians, manufacturers and service providers, qualify multipliers, inform consumers, build networks, evaluate technologies, analyse foreign markets and develop future scenarios. Dena partners are the Federal Republic of Germany, the *KfW Entwicklungsbank*, the multinational financial services company *Allianz SE*, the *Deutsche Bank AG* and *DZ BANK AG*.

www.efanrw.de

The Efficiency Agency (EFA) of North Rhine-Westphalia (NRW) was founded in 1998 under the initiative of the NRW Environmental Ministry. Since its founding, the EFA has been a competent, reliable and neutral partner for small and medium-sized businesses and the first contact for producer enterprises in NRW for product-integrated environmental protection and resource friendly economic activity.

www.unendlich-viel-energie.de

This information portal of the Agency for Renewable Energies (*Agentur für Erneuerbare Energien e.V.*) provides a comprehensive overview of the energy policies of the German federal government and the German federal states. It illustrates the contribution each kind of renewable energy makes to sustainable energy systems, employment effects and export potential and it provides a well-structured media centre.

www.erneuerbare-energien.de

The BMU runs this information portal which provides a comprehensive overview of the possible uses and potentials of renewable energies in Germany.

www.solarteur.net

This is the homepage for skills training for solar technologists, including domestic and foreign solar technology schools.

www.wilabonn.de/de/arbeitsmarkt-und-qualifizierung/arbeitsmarkt.html

The Bonn Science Shop has run this internet portal on the topics of labour and education and training in renewable energies for several years. It displays advertisements for jobs in this sector regularly and arranges jobs and training fairs.

Federations and Associations

www.bee-ev.de

The Federal Renewable Energy Association (*Bundesverband Erneuerbare Energie e.V.*, BEE) is the umbrella organisation for all of the renewable energy industries in Germany and represents their interests in politics and in the public. It was founded in 1991 and functions as a consortium of trade associations in the fields of water, wind, biomass, solar and geothermal energies.

www.bioenergie.de

The German Bioenergy Association (*Bundesverband BioEnergie e.V.*, BBE) is the umbrella organisation for the nationwide bioenergy market in Germany. It was founded in 1998 and organised the market stakeholders along the entire value chain of biogenic electricity, heating and fuel markets. Research institutions and universities complete the field of competence of this network and contribute to an on-going transfer of know-how.

www.dgs.de

The German Solar Energy Society (*Deutsche Gesellschaft für Sonnenenergie e.V.*, DGS) is a recognised consumer protection federation through the General Terms and Conditions Act §22. It represents the interests of consumers and users of renewable energies and efficient use of energy. The DGS has over 3,000 individual members and has comprehensive offerings for further and continuing training in its decentralised solar schools.

<http://de.dwa.de>

The German Association for Water, Wastewater and Waste (*Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall*, DWA) is a politically and economically independent organisation with expertise in the areas of water and wastewater management and soil conservation. The DWA works to influence the regulations for its respective area of expertise and is active in further and continuing education and training.

www.fbr.de

The German Association for Rainwater Harvesting and Water Utilisation (*Fachvereinigung Betriebs- und Regenwassernutzung e.V.*) is a nation-wide professional association of people, companies, local authorities, offices, specialised trading companies and institutions interested or already actively involved in water recycling and rainwater utilisation.

www.forum-elektromobilitaet.de

The association Forum Electromobility focuses on skills nationwide and systematises production-oriented technology transfer between science and economic activity. In this function, it promotes the accumulation of system expertise for the German economy and drives forward the scientific discourse about further development of electromobility.

www.geothermie.de

The German Geothermal Association (Bundesverband Geothermie e.V.) with its 900 members covers the whole range of geothermal technologies, from surface geothermal energy to deep, hydrothermal or petro-thermal power, heating/cooling generation and geothermal electricity generation.

www.solarwirtschaft.de

With more than 800 member companies, the Federal Solar Industry Association (*Bundesverband Solarwirtschaft*, BSW-Solar) is the interest group of the German solar energy industry. Forming a strong community of companies, GSW-Solar acts as an information source and intermediary between business and the political and public sectors. It represents the common commercial interest of businesses within the solar energy value chain.

www.wab.net

The Wind Energy Agency (*Windenergie-Agentur*, WAB) is the network of the wind energy industry in Germany's northwest region and serves as a nationwide contact for the offshore wind industry. Since 2002, more than 300 companies and institutes have become members of WAB; they cover all areas of the wind energy industry, from research and production to installation and maintenance.

www.wasserkraft-deutschland.de

The Federal Association of German Hydroelectric Power Plants (*Bundesverband Deutscher Wasserkraftwerke e.V.*, BDW) is the interest group representing the German water power plant managers. It supports and promotes the legal, economic, expert, and other issues of its members in Germany and abroad.

www.wind-energie.de

With some 20,000 members, the German Wind Energy Association (*Bundesverband WindEnergie e.V.*, BWE) is one of the world's largest associations in the renewable energy sector. For years, the BWE has been increasingly successful in efficiently expanding wind power in Germany for the long term. Furthermore, their experts work in such international associations as the European Wind Energy Association (EWEA), the Global Wind Energy Council (GWEC) and the World Wind Energy Association (WWEA) in developing wind energy within Europe and worldwide.

www.vdi-zre.de

The VDI-Centre for Resource Efficiency and Climate Protection (*VDI-Zentrum Ressourceneffizienz und Klimaschutz*) offers consultation, facilitation and technical expertise for efficient use of resources in business operations.

7.4 Selected Institutions

7.4.1 Renewable Energies

Berufs- und Technikerschule Butzbach

Emil-Vogt-Straße 8
35510 Butzbach, Germany
Phone +49 (0) 6033/92460-30
poststelle@bsbz.butzbach.schulverwaltung.hessen.de
www.bsbz-wetteraukreis.info

The Vocational and Engineering School Butzbach is known nationwide for its competence in environmental technologies. Many environmental protection technologies are visible on the school grounds and/or integrated into the buildings. The buildings are not finished. They are continuously being adapted to the current state of technology and serve as a place for the students to experiment and for exhibits of changing environmental technologies. In the two-year specialised vocational school⁴² The students are educated to be state recognised technicians for sustainable energy technologies, with a concentration on those for environmental protection. In addition, full-time school-based instruction is offered in the context of a specialised vocational school to train technical assistants in renewable raw materials, solar thermal energy and photovoltaics and environmental protection.

Bildungszentrum für Erneuerbare Energien e.V. (BZEE)

Johannes-Mejer-Straße 8
25831 Husum, Germany
Phone +49 (0) 4841/78059033
info@bzee.de
www.bzee.de

In the year 2000, the BZEE (Training Centre for Renewable Energies) in Husum, Germany, was founded together with the German Wind Energy Association, the Chamber of Industry and Commerce in Flensburg, and numerous wind energy enterprises. Since then it has been providing further training for personnel in service, maintenance and repair of wind turbine power plants. In close association with around 80 member enterprises from the wind industry, the BZEE has become the leading provider of operative skills training services for the wind energy sector. It has also acquired a certification and standardisation training programme. The BZEE is active internationally and offers its programmes at 25 different locations. In addition to the training site in Husum, which will concentrate in the future more strongly on the development and manufacture of equipment for training purposes, starting in the summer 2013, the complete BZEE training programme will be offered in Hamburg, too.

⁴² The specialised vocational school is part of the further vocational training scheme in Germany (German term: *Fachschule*). It deepens the vocational further education and promotes general education. Having successfully passed a vocational training final examination, having already exercised the respective trade or having a practical experience of several years are preconditions for attending a specialised vocational school. The Vocational and Engineering School Butzbach is a technical school and a form of specialised vocational school, which offers application-oriented training programmes on a technical basis (see also GTZ *Fachglossar: Deutsche Berufsbildung*, 1999).

Bildungs- und Trainingszentrum für Windenergietechnik

Knurrhahnstraße 25-27
27572 Bremerhaven, Germany
Phone +49 (0) 471/30 98 730
info-bremerhaven@windzentrum.de
www.windzentrum.de

The Education and Training Centre for Wind Energy Technology is an institution of the nationwide *bfw-Unternehmen für Bildung* (an institution for advanced job training), and since its founding in 2003, it has offered tailor-made further education courses for the wind industry, in cooperation with wind energy companies. In addition, further education courses are offered for service technicians for wind power plants (onshore and offshore), skilled workers for wind power plant manufacture, skilled workers for building wind power plants (onshore and offshore) and skilled materials testers.

Edwin Academy

Hüttenstraße 20A
28237 Bremen, Germany
Phone +49 (0) 421/620 421 0
info@edwin-academy.de
www.edwin-academy.de

The Edwin Academy, founded in 2009, trains skilled workers for the wind industry according to the motto “Skills Training by the Industry for the Industry”. Numerous further education programmes are offered (among others, programmes for service technicians, construction engineers, and manufacturers for wind power plants), as well as programmes in occupation health and safety and technical training (e.g. basic qualifications in wind energy technology).

Hessisches Biogas Forschungszentrum (HBFZ)

Schloss Eichhof
36251 Bad Hersfeld, Germany
Phone +49 (0) 561/72 94 0
hbz@iwes.fraunhofer.de
www.iwes.fraunhofer.de

The HBFZ (Hessian Biogas Research Centre) belongs to the collective of the Fraunhofer-Institute for Wind Energy and Energy Systems Technologies along with two state companies in Hesse. The whole spectrum of energy production from biogas is researched here. The research ranges from raising energy crops to the adequate preparation of substrates, to the actual process of extraction of biogas in the biogas plant through anaerobic digestion and through digestates back into the ground. The production and processing of the gas is also studied in connection with other energy sources and their different forms of application. Direct power generation belongs in this category, along with the combined supply of electricity and heat, also the production of natural gas substitutes and fuels and the supply of carbon in the context of the “power to gas” process. Several photovoltaic plants, a biogas plant with combined heat and power station, a microgas turbine and a woodchips heater provide electrical and/or thermal energy.

Oberstufenzentrum für technische Informatik und Energiemanagement (OSZ TIEM)

Goldbeckweg 8-14
13599 Berlin, Germany
Phone +49 (0) 30/35 49 46 66
roske@energie.be.schule.de
www.osztiem.com/osz/schule/solar/s15.html

Technical assistants for regenerative energy technologies are trained at the OSZ TIEM (Upper Level School Centre for Computer Engineering and Energy Management). Since the beginning in 2008 this training programme teaches with the most modern technologies; a unique “solar pavilion” which was specially built for this programme. The building is a learning site with laboratory and workshop character, where energy management through process measuring and control technology can be learned and practiced under optimal conditions in their own building. Individual technical components, e.g. thermal solar collectors or photovoltaic modules, can also be built and tested here. This integration is possible for the most part without disturbances to the basic functions of the building. Technical modifications are possible to allow the current state of technology to become a part of the training.

Renewables Academy AG (RENAC)

Schönhauser Allee 10-11
10119 Berlin, Germany
Phone +49 (0) 30/526 89 58 70
info@renac.de
www.renac.de

RENAC specialises in the transmission of experience and knowledge about the production, planning and engineering of renewable energy technologies, including the financing, marketing and management as well as entering international markets for renewable energies and energy efficiency. The RENAC has its own training centre in Berlin and is demand-oriented in its skills training. Their training in renewable energies and energy efficiency is offered worldwide. In order to make seminars available also outside of their Berlin training facility, the RENAC can fly in trainers and mobile training centres (transport boxes on wheels with corresponding equipment of solar thermal energy, photovoltaics and wind energy) to target countries. In addition, the RENAC also offers support in building training centres tailored to specific customers.

Solar Energie Zentrum Stuttgart (SEZ)

Krefelder Straße 12
70376 Stuttgart, Germany
Phone +49 (0) 711/95 59 16 - 31
info@sez-stuttgart.de
www.sez-stuttgart.de

The SEZ (Solar Energy Centre Stuttgart) is a training centre for regenerative energies, building energy consultation and energy efficiency technologies. It was formed in 1996 out of the Electro-technology Centre Stuttgart and since then has trained skilled workers in municipal energy management, decentralised energy technology, building energy consultation, regenerative energy technology and solar technology – for instance, solar technologist (“Solarteuer”)/skilled workers for solar technology and solar sales engineers for renewable energies. The facilities are state of the art and in 2003 the training centre was given a best practice award by the Adolf Grimme Institute for its blended learning concept. The SEZ is active in nationwide knowledge networks, is a member of the German Society for Sun Energy (DGS), is engaged in TVET through nationwide and international expert committees and offers experience of many years in national and international projects.

Solar-Institut Jülich (SIJ)

Heinrich-Mußmann-Straße 5
 52428 Jülich, Germany
 Phone +49 (0) 241/60 09 53 532
info@sjj.fh-aachen.de
www.sij.fh-aachen.de

The SIJ (Jülich Solar Institute) is a central scientific institution of the University of Applied Sciences in Aachen. The goal of the institute is the development of applied technical solutions in regenerative and efficient uses of energy. The work of the institute is in the categories of solar low-temperature and process heat collectors as well as high temperature absorbers for solar thermal power stations. The institute can boast a distinctive, one-of-a-kind feature in their exclusive access to the solar thermal demonstration and experimental power station of Jülich. In addition, they are developing components for desalination of seawater, thermal storage and modern solar architecture. Comprehensive laboratories and outside facilities for testing new technologies and entire systems are at their disposal for carrying out research and development work. The SIJ participates in worldwide cooperations, among others, one for the dissemination of solar technologies in developing countries.

7.4.2 Sustainable Construction and Efficient Construction Technologies

Bau-Medien-Zentrum GmbH & Co. KG

Mirweilerweg 22a
 52349 Düren, Germany
 Phone +49 (0) 2421/40 77 85
a.leroy@bmz-dueren.de
www.bau-medien-zentrum.de

The Construction Media Centre in Düren is an exhibition of seven half-houses in a scale of 1:1. It is unique in an all-inclusive way: the examples of construction materials, structural designs and energy systems are almost totally complete. The Construction Media Centre is a learning space which, through its wall cross-sections and openings makes a view of construction possible that would only otherwise be feasible on construction sites themselves. Building errors and their consequences are made visible. Construction materials are considered along with structural designs and building facades. All the different crafts and trades are taken into consideration. As a supplement wiring techniques are demonstrated. Universally applied wiring systems as well as corresponding application examples are shown and can be practically tested and combined with each other.

Berufsbildende Schule (BBS) 3 der Region Hannover

Ohestraße 6
 30169 Hannover, Germany
 Phone +49 (0) 511/220 68 0
bbs3@region-hannover.de
www.bbs3-hannover.de

The qualifying vocational school for the region of Hannover, BBS 3 offers vocational training around the topics of the main construction occupations and construction's secondary occupations. In the "carbon workshop", prospective plant mechanics for sanitation, heating and air-conditioning technologies are made familiar with the issues of climate protection and solar technology, in cooperation with the Chamber of Skilled Crafts and Trades Hannover. A centre for energy-efficient construction and building technologies is run together with the neighbouring Otto-Brenner-School (metal and electrical engineering). In the instructional rooms the pupils are confronted with typical everyday situations for which they work out solutions. Experiments and measurements take place in laboratories for electricity, process control and logistic technologies. In three teaching and learning pavilions the pupils can observe, touch, test and analyse various construction standards. Diverse parameters (e.g. outdoor temperature) can be simulated and the effects measured.

Demonstrationszentrum Bau und Energie der Handwerkskammer Münster

Echelmeyerstraße 1-2
 48163 Münster, Germany
 Phone +49 (0) 251/705 13 18
gabi.beerhorst@hwk-muenster.de
www.demozentrum-bau.de

The competence centre for construction and energy in the educational centre of the Chamber of Skilled Crafts and Trades in Münster presents the concept of sustainable and trendsetting construction according to the "Structures = Teachers" principle. The focus is on a permanent exhibit of renewable construction and insulation materials as well as a transparent presentation of higher insulation standards and diverse regenerative energies for heating and cooling, which are being applied in the conference and teaching building. The visualisation of comprehensive measurement technology in the internet makes it possible to observe physical construction behaviours of diverse structures and operational conditions and techniques. The courses for further and continuing education and training offered to construction workers, engineers and architects on the topics of physics, construction and ecology are conceptually bridged with experiential possibilities in the building itself.

7.4.3 Wastewater Technologies

Bildungs- und Demonstrationszentrum (BDZ) für dezentrale Abwasserbehandlung

An der Luppe 2
 04178 Leipzig, Germany
 Phone +49 (0) 341/44 22 979
info@bdz-abwasser.de
www.bdz-abwasser.de

The BDZ (Training and Demonstration Centre for Decentralised Sewage Treatment, DBZ) is an initiative for the promotion of decentralised wastewater treatment and has the largest concentration of forces for decentralised wastewater technology in all of Germany. It presents an independent platform with neutrality toward producers in the field of decentralised wastewater, bringing together skilled workers from science, economy and politics. It offers information and consultation about questions of wastewater disposal, it organises tours of diverse decentralised wastewater disposal plants and supports public authorities and associations in the design and realisation of concepts for wastewater treatment.

7.5 Relevant Occupations in Germany⁴³

7.5.1 Occupations that Can Be Learnt in Dual and School-based Training

State-recognised Occupations with Relevance to Energy and Resource Efficiency or Renewable Energy

Skilled Crafts and Trades Occupations

Plant Mechanic for Sanitation, Heating and Air-Conditioning Technologies

Plant mechanics for sanitation, heating and air-conditioning technologies work in skilled trades enterprises and install heating and ventilation systems as well as sanitary facilities. During the vocational training, the trainees acquire the skills and knowledge in at least one of the work areas of water, air, or heating technology and/or environmental/renewable energy technology. Plant mechanics for sanitation, heating and air-conditioning technologies install water and ventilation systems, mount sanitation facilities and connect them up, put in central heating boilers and get them running. They work with pipes, laminations and profiles out of metal or plastic with machines or manually. They assemble electrical modules and components for process control and regulating mechanisms. They plan and install solar systems for used water heating and heating pumps and connect them into existing systems. After mounting them, they test whether the system functions flawlessly. They advise customers and guide them in the use of the equipment and systems. They maintain and overhaul the installations and systems.

- Occupational information:
http://berufenet.arbeitsagentur.de/berufe/berufId.do?id=15164_15625&resultListItemsValues=15164_15625&suchweg=&lv=true&doNext=forwardToResultShort
- Occupational profile, training and apprenticeship regulations, curriculum:
www2.bibb.de/tools/aab/aab_info.php?key=55577532

Electrician for Energy and Building Technologies

Electricians with the specialisation of energy and building technologies are specialists for electro technical installations for energy supply and building infrastructures. They plan, install, maintain and repair e.g. fuse links and connections for washing machines and stoves, lightning rods or solar installations and control systems. They mount smart meters, building guidance systems and data nets or control and regulation mechanisms for heating, ventilation and air-conditioners. For these systems, they set up the control programme, define parameters, measure electrical quantity (voltage) and test the systems. Electricians with the specialisation of energy and building technologies work mainly in businesses having to do with electro technical trades, but also in real estate companies or in custodial services, e.g. facility management. Further employment possibilities exist with manufacturers of electricity distribution equipment and switching units or electric generator plants, for instance, wind energy plants.

- Occupational information:
http://berufenet.arbeitsagentur.de/berufe/berufId.do?_pgnt_act=goToAnyPage&_pgnt_pn=0&_pgnt_id=resultShort
 - Occupational profile, training and apprenticeship regulations, curriculum:
www2.bibb.de/tools/aab/aab_info.php?key=fhsdkhj&modus=1&statistik=1
-

⁴³ Please note that all of the occupations and qualifications listed in this section are in reference to both women and men.

Electrician for Building and Infrastructure Systems

Electricians for building and infrastructure systems maintain, supervise, control and optimise technical building infrastructures, that is, ventilation, heating, electricity and security systems. They diagnose malfunctions or field reports of malfunctions and address any defects. They integrate the building's technical management system and configure it with bus wire systems (European Installation Bus). Electricians for building and infrastructure systems play a central role in facility management, which has to do with smart house technologies, smart metering and, in the future, also with power charging stations for electric vehicles. They work primarily in real estate/property sector firms or in janitor/caretaker services. They can also be employed in technical building services and in enterprises which install lighting and signalling systems (e.g. traffic lights), or for wind power plant manufacturers.

- Occupational information:
http://berufenet.arbeitsagentur.de/berufe/resultList.do?resultListItemsValues=15621_15622&duration=&suchweg=begriff&searchString=%27+elektroniker*+%27&doNext=forwardToResultShort
 - Occupational profile, training regulations and curriculum:
www2.bibb.de/tools/aab/aab_info.php?key=ffsdhk99
-

Industrial Training Occupations

Industrial Mechanic

Industrial mechanics produce equipment parts, machine components and assemblies and mount them onto machines and technical systems. They install them, get them running and inspect how they are functioning. They maintain the systems and keep them in running order. If there are malfunctions, industrial mechanics find the source of the disturbance and make the required repairs. They order the correct substitute parts or make them themselves, when appropriate. If they work in the assembly of machines and precision technical instruments, industrial mechanics produce parts primarily out of metal or plastic. They turn, mill, drill and file the material, weld or screw the parts and mount and fit them. Industrial mechanics can be employed in practically all economic sectors. They can, for instance, be employed to build the machines and installations for manufacturers of wind, solar and water power plants, or for well drilling companies that are active in geothermics. In such positions as these, their broad, basic, technical training and their flexible range of applicable skills are valued.

- Occupational information:
http://berufenet.arbeitsagentur.de/berufe/berufId.do?id=29055_29056&resultListItemsValues=29055_29056&suchweg=&lv=true&doNext=forwardToResultShort
 - Occupational profile, training regulations and curriculum:
www2.bibb.de/tools/aab/aab_info.php?key=211007
-

Mechatronics Technician

Mechatronic technicians build mechanical, electrical and electronic components. They mount them in complex systems and facilities. They complete plant or systems installation, get them running, program them and install the related software. In addition, they maintain mechatronic systems, repair or retrofit them. Mechatronics technicians are above all active in machine and plant installation and in automation technologies. They can work in airplane, air or space travel equipment as well as in information, communication or medicine technologies. Training for mechatronic technician opens employment perspectives in the whole area of regenerative energy technologies and provides a good entry into subsequent continuing education for wind power plant service technicians. Because of their system expertise with respect to linking together mechanical, electrical and electronic system components, the function of which they understand in their overall effect on the entire system, mechatronic technicians play a significant role in the improvement of energy and resource efficiency in industrial enterprises as well as in electromobility.

- Occupation information:
http://berufenet.arbeitsagentur.de/berufe/resultList.do?resultListItemsValues=2868_2862&duration=&suchweg=begriff&searchString=%27+mechatroniker*+%27&doNext=forwardToResultShort
- Occupational profile, training regulations, curriculum:
www2.bibb.de/tools/aab/aab_info.php?key=mech201

Production Technician

Production technicians plan industrial production processes, install production plants and put them into operation. They run series of tests, apply the results to the installation and set-up process parameters. In order to intercede quickly when there are departures from the expected quality and to remove potential mistakes consistently, to optimise functions, they monitor the production process constantly. In addition, they document their work and keep data for on-going production planning and control. Production technicians work primarily in machine and plant installation, in vehicle production as well as in enterprises that offer production support services, or in those which use production technology. Here they can play a role in calling attention to efficient energy and raw material use in manufacturing processes.

- Occupational information:
http://berufenet.arbeitsagentur.de/berufe/resultList.do?resultListItemsValues=67789_67788&duration=&suchweg=alpha&searchString=P&doNext=forwardToResultShort
 - Occupational profile, training regulations, curriculum:
www.gesetze-im-internet.de/bundesrecht/prodtechausbv/gesamt.pdf
www.kmk.org/fileadmin/pdf/Bildung/BeruflicheBildung/rlp/Produktionstechnologie.pdf
-

Process Mechanic for Plastic and Rubber Technologies, Fibre Composite Technologies Field

The training for process mechanics for plastic and rubber technologies was up-dated in 2012 and adapted for technical or structural changes in the industry. Since then, the training is part of one of the seven fields of mould parts, semi-finished products, multi-layered rubber parts, master batch and compounding applications, components, fibre composite technologies and plastic windows. Process mechanics for plastic and rubber technologies in the field of fibre composite technologies produce fibre composite components out of polymer materials and other materials such as ceramics and glass fibres. They plan the manufacture of fibre composite components according to order data and technical sketches. For this purpose, they choose the appropriate production and hardening methods as well as suitable reaction agents, fibre types, semi-finished fibre products, along with support, filling and separating agents. They determine process-specific parameters and adapt them to the production machines and installations. They monitor the entire run of production, intercede when there are mistakes or malfunctions and control the quality of the products manufactured. Process mechanics for plastic and rubber technologies work mainly in companies which process plastic and rubber for industry as well as in rotor blade manufacture and repair of wind power plants.

- Occupational information:
http://berufenet.arbeitsagentur.de/berufe/berufId.do?_pgnt_act=goToAnyPage&_pgnt_pn=1&_pgnt_id=resultShort&status=T01
 - Occupational profile, training regulations, curriculum:
www.gesetze-im-internet.de/bundesrecht/kstoffverfmausbv_2012/gesamt.pdf
www.kmk.org/fileadmin/pdf/Bildung/BeruflicheBildung/rlp/VerfahrensmechanikerKuk12-03-22-E.pdf
-

State-recognised Training Occupations in the Sector of Technical Environmental Protection

Skilled Worker for Wastewater Technologies

Skilled workers for wastewater technologies prepare wastewater and maintain wastewater pipe systems. They monitor, control and document the processes of drainage networks and wastewater and sludge treatment in municipal and industrial sewage treatment plants. Skilled workers for wastewater technologies control automated installations and machines at the control stations. When there are abnormalities, they intercede immediately with the necessary corrective measures. In sewage treatment plants they monitor the mechanical, biological and chemical stages of the water processing. They analyse the wastewater and sludge tests, document the results, evaluate them and use the findings to optimise the processes. They monitor canal networks and dischargers. They inspect, clean and maintain piping systems, shafts and other plant sections. Known as “electro technically skilled people”, they can also carry out electrical installations and repair them.

- Occupational Information:
http://berufenet.arbeitsagentur.de/berufe/resultList.do?resultListItemsValues=14755_14756&duration=&suchweg=alpha&searchString=F&doNext=forwardToResultShort
 - Occupational profile, training regulations, curriculum:
www.bibb.de/de/ausbildungsprofil_1836.htm
-

Skilled Worker for Recycling and Waste Management

Skilled workers for recycling and waste management insure that waste is collected, sorted, re-used or disposed of. In the area of city cleaning they organise, for example, the use of vehicles in waste collection and optimise their routes. They make sure that containers for recycling waste are placed at collection sites and are regularly emptied. In waste management businesses, recycling centres, recycling and preparation plants they control all the processes of handling recyclables and make sure that there is no burden or damage to the environment through waste and sewage. They instruct employees or monitor machines and plants where the waste is sorted, separated or burned. Through inspections or laboratory tests they determine which waste can be recycled and which must be disposed of. Glass, white tinplate or old paper can be used as secondary raw material, while building scrap or hazardous waste has to be stored in special landfills. Skilled workers for recycling and waste management regularly inspect these special disposal sites, analyse the seepage and carry out special measurements to insure that no pollutants enter the environment.

- Occupational information:
http://berufenet.arbeitsagentur.de/berufe/resultList.do?resultListItemsValues=14757_14758&duration=&suchweg=alpha&searchString=F&doNext=forwardToResultShort
- Occupational profile, training regulations, curriculum:
www.bibb.de/de/ausbildungsprofil_1847.htm

Skilled Worker for Pipe, Canal and Industrial Services

Skilled workers for pipe, canal and industrial services work mainly in waste management and industrial cleaning operations or in waste management companies, for instance in waste disposal operations. They monitor and maintain sewers and canals, containers and wastewater structures in businesses as well as in the private and public sectors. They utilise special cameras and leak testing systems. They seal up damaged areas with the aid of remote controlled robots. When needed, they climb into the sewers themselves, wearing protective suits. They determine the condition of land parcel drainage systems. Those with a concentration in industrial service clean and maintain pump plants, tanks, waste plants and tank vehicles, but also fermentation and beverage containers. Residues, deposits or impurities are removed with special instruments like high pressure water or vacuum equipment and subsequently disposed of.

- Occupational information:
http://berufenet.arbeitsagentur.de/berufe/resultList.do?resultListItemsValues=14759_14760&duration=&suchweg=alpha&searchString=F&doNext=forwardToResultShort
 - Occupational profile, training regulations, curriculum:
www.bibb.de/de/ausbildungsprofil_1858.htm
-

Water Supply Engineering Technicians

Water supply engineering technicians service and monitor machines and plants which extract, prepare or distribute water. They extract water from wells, rivers or lakes with the help of diverse installations, at first raw (untreated) water. Then they steer the water into filter plants or reaction pools and take out undesirable accompanying substances. They get rid of bacteria with ozone or chlorine. They take care of the storage of water in elevated water tanks and its flow into the pipe system. Skilled workers for water supply technologies test the water for quality and document their results. They mostly monitor and control automated plants. When there are disruptions, they immediately find the right remedy. As so-called “electro technically capable people” they can also install or repair electrical fittings in their area of responsibility. They lay pipes, mount or dismount fittings. They also carry out maintenance and repair work on pumps, pipe systems and other operational fittings. Skilled workers for water supply technologies work mainly in municipal supply operations or industrial water works, water preparation enterprises or pump stations. They can also be employed in underground construction, for example in well or hydraulic construction, pump water power plants or in laboratories for the analysis of the water quality.

- Occupational information:
http://berufenet.arbeitsagentur.de/berufe/resultList.do?resultListItemsValues=14754_14753&duration=&suchweg=alpha&searchString=F&doNext=forwardToResultShort
 - Occupational profile, training regulations and curriculum:
www.bibb.de/de/ausbildungsprofil_9669.htm
-

Full-time School-based Training Programmes in Technical Environmental Protection

Environmental Protection Technical Assistant

Environmental protection technical assistants provide environmental data (water, air, ground and waste investigations, noise and vibration measurements), record their results and evaluate them partly on their own. They work in test departments of public administration offices as well in research institutions. They are also employed in enterprises for water supply or waste and wastewater disposal management. They can also be employed in chemical and pharmaceutical industry operations. Training for environmental protection technical assistants is school-based and regulated by Federal and Federal State laws in (specialised) vocational colleges, and takes two to four years.

- Information:
http://berufenet.arbeitsagentur.de/berufe/resultList.do?resultListItemsValues=6045_6037&duration=&suchweg=alpha&searchString=U&doNext=forwardToResultShort
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Full-time School-based Training Programmes in Renewable Energies

Technical Assistant for Renewable Raw Materials

Technical assistants for renewable raw materials work primarily in enterprises in which raw materials are either processed or produced. They monitor, control, care for and maintain installations for the production of energy or industrial goods from renewable raw materials. They set up production machines or installations, prepare work processes, check machine functions at control stations and make the machines operational. They maintain and care for installations, carry out small repairs, monitor the production process and serve and control the flow of materials. Training for technical assistants for renewable raw materials is school-based and regulated by Federal and Federal State laws in (specialised) vocational colleges, and takes two years.

- Information:
http://berufenet.arbeitsagentur.de/berufe/resultList.do?resultListItemsValues=76531_76529&duration=&suchweg=begriff&searchString=%27+Technischer+Assistent*+%27&doNext=forwardToResultShort

Technical Assistant for Regenerative Energy Technologies and Energy Management

Technical assistants for regenerative energy technologies and energy management are involved in research and development work and manufacturing planning and execution in the area of regenerative energy. They work with energy providers, for example in wind, water or solar power plants, manufacturers of electric engines, pumps and compressors, regenerative energy engineering offices and in electric installations operations. For instance those specialised in the mounting of solar panels on roofs of houses. Training for technical assistant for regenerative energy technologies and energy management is school-based and regulated by Federal State laws in (specialised) vocational colleges. It takes two to three years and awards different qualification designations depending upon the federal state.

- Information:
http://berufenet.arbeitsagentur.de/berufe/resultList.do?resultListItemsValues=6045_6037&duration=&suchweg=alpha&searchString=U&doNext=forwardToResultShort

Renewable Energies, Environmental Protection and Resource Efficiency in Additional Qualifications

Assistant for Energy and Resources in Skilled Crafts and Trades

This additional qualification targets trainees in their first apprenticeship year for all skilled trades and crafts occupations. The trainings should lead to facilitating the support of management in handling energies and resources in an efficient and environmentally friendly way. In order to be able to provide this facilitation, they need to be able to analyse the as-is-condition in the company and develop alternatives for optimising structures and procedures. The training content comprises three learning areas: energy (electricity, heat, transport), resources (purchasing, water/wastewater, and disposal) and communication (communication and motivational techniques). The additional qualification comprises 240 hours of instruction within two years, meaning three hours on a weekly basis, is concluded with a certificate from the Chamber of Skilled Crafts and Trades and is offered by a variety of (specialised) vocational colleges in Westphalia.

- Information:
www.ausbildungplus.de/webapp/index.php/suche/detailZusatzquali/abid/422650/zqid/6719
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Utilising Heat Pumps

This additional qualification targets trainees in the professional training programme for plant mechanics in sanitation, heating and air-conditioning technology. The goal of the training is for the trainees to familiarise themselves with and implement in practice regulations for utilising heat pumps. The training comprises 45 hours and is offered by the Chamber of Skilled Crafts and Trades in South Thuringia. It contains instruction on the different types, structures, and applications of heat pumps, as well as their dimensioning and selection, also hydraulic features when using heat pumps, their installation and maintenance.

- Information:
www.ausbildungplus.de/webapp/index.php/suche/detailZusatzquali/abid/5542/zqid/2561
-

Business Administrator in the Energy and Water Economy

This additional qualification was developed in a joint effort by the Federal Association of the German Gas and Water Industry (*Bundesverband der Deutschen Energie- und Wasserwirtschaft e.V.*, BDEW), the Institute of Vocational Studies and Economic Education at the University of Leipzig as well as the Chamber of Industry and Commerce of Leipzig to prepare trainees for the unique requirements of the energy and water economy. The focus of this training is on national and international change processes in the energy and water economy as well as on adapting employees' skills to current developments in this field. This involves, amongst other things, changes in legislative and regulatory conditions, trade in liberalised markets, unbundling, benchmarking, Shared Services, international accountability as well as customer service and advising. The training comprises 230 hours of instruction and concludes with an examination before the Chamber of Industry and Commerce of Leipzig.

- Information:
www.ausbildungplus.de/html/838_2439.php
-

Solar Technology

This additional qualification targets future plant mechanics for sanitation, heating and air-conditioning technology and is offered by the Technical-Vocational Training Centre of the Skilled Crafts and Trades in Lingen (*Berufsbildungs- und Technologiezentrum des Handwerks GmbH*). The training comprises 80 hours of instruction in the modules photovoltaics and solar thermal energy (in each case including theory, practice and counselling).⁴⁴

- Information:
www.ausbildungplus.de/webapp/index.php/suchezusatzquali/detailZusatzquali/page/1/abid/101577/zqid/1049#anbieter
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⁴⁴ Similar additional qualifications in the field of solar technology are also offered by other institutions.

7.5.2 Relevant Further Education and Training

Renewable Energies

Skilled Worker for Environmentally Friendly Energy Technologies

Prerequisites:	Successful completion of further training for skilled worker for solar technologies
Learning objectives:	The graduates of this training further deepen their knowledge of energy technologies based on their first training (skilled worker for solar technologies) and learn important aspects in the field of environmentally friendly energy technologies: ranging from combined heat and energy production, utilisation of biomass and wind power to ecological business management.
Content:	Combined Heat and Power Sustainable construction Energy generation through biomass Controlled ventilation and heat recovery Fuel cells Ecological marketing Project work
Duration:	200 hours
Degree/completion:	Certificate of the Chamber of Skilled Crafts and Trades
Provider:	Chambers of Skilled Crafts and Trades
Reference:	www.hbz-bildung.de/seminare/5/de/k,3\$s,17269\$show,seminar/weiterbildung/fachkraft-fuer-umweltschonende-energietechnik-fue-teil-ii.html?

Skilled Worker for Solar Technology

Prerequisites:	Individuals who have completed their vocational training as well as master craftsmen and women in the fields of sanitation, heating, air-conditioning and construction technologies as well as electrical engineering
Learning objectives:	Graduates of this training have acquired further qualifications in planning, monitoring and running solar installations. They learn how to give professional advice to customers and successfully sell solar technology. With the certificate “specialist for solar technology” they are authorised to market solar power as well as photovoltaic systems across trades.
Content:	Basics in energy technology, heating, construction and electrical engineering Photovoltaic systems – theory/practice Marketing of solar technology – theory/practice
Duration:	200 hours
Degree/completion:	Certificate of the Chamber of Skilled Crafts and Trades
Provider:	Vocational Training centres of the skilled crafts and trades
Reference:	www.energietechnik-hwk.de/78,1285,1103.html

Specialist for Solar Thermal Energy Systems

Prerequisites:	Completed vocational training in sanitation, heating, air-conditioning technologies or electrical engineering
Learning objectives:	The specialist for solar thermal energy systems intensively deals with the different solar collectors and storage and control technologies. He/she has knowledge on how to professionally complete roof covering and sealing, as well as sub-structures and critical connection points. By using planning skills, he or she is able to plan and implement customised solar solutions. Maintenance and customer service are just as much a part of the services to be provided as dealing with relevant laws, norms and regulations.
Content:	Energy and environmental engineering Energy-efficient construction Financing and funding Marketing new energy installations Basics in heating technology and sanitation technology Solar thermal energy systems System training (provider) Specialist examination
Duration:	160 hours
Degree/completion:	Certificate of the Chamber of Skilled Crafts and Trades
Provider:	Centre for Solar Energy Stuttgart (<i>Solar Energie Zentrum Stuttgart</i>)
Reference:	www.sez-stuttgart.de

Sales and Distribution Technician for Solar Technologies/Renewable Energies

Prerequisites:	Completed vocational training in sanitation, heating, air-conditioning technologies or electrical engineering
Learning objectives:	The participants in this training acquire the required skills for gaining new customers and writing quotes in a professional way. After being trained extensively in system technology (photovoltaics/solar thermal energy/heat pump), participants are trained in conducting sales conversations, consultation and care of customers, drawing up calculations and proposal systems. Other training contents are contract management, managing tenders, signing contracts and management of delivery dates and conditions.
Content:	System technology – photovoltaics, solar thermal energy, heat pump Basics in energy and construction technology Energy and environmental engineering Developing a distribution/selling concept Financing and funding Cost effectiveness Active sales, advising and persuading customers Strategic sales; attract and retain customers Finding and determining prices Order management
Duration:	240 hours
Degree/completion:	Certificate of the Centre for Solar Energy Stuttgart
Provider:	Centre for Solar Energy Stuttgart (<i>Solar Energie Zentrum Stuttgart</i>)
Reference:	www.sez-stuttgart.de

Specialist for Photovoltaic Systems

Prerequisites:	Completed vocational training in sanitation, heating, air-conditioning technologies or electrical engineering
Learning objectives:	Participants learn basics of electrical engineering, electronics and photovoltaics as well as the diversity of different photovoltaic systems and mounting types. Configuring and planning photovoltaic island systems are part of the skills that are acquired through the training, as well as project planning of grid-connected photovoltaic systems and their installation. Additionally, skills on how to professionally complete roof covering and sealing, as well as sub-structures and critical connection points are part of the training.
Content:	Energy and environmental engineering Energy-efficient construction Financing and funding Marketing of renewable energy systems Basics in electrical engineering and electronics Photovoltaic systems System training (provider) Specialist examination
Duration:	160 hours
Degree/completion:	Certificate of the Chamber of Skilled Crafts and Trades, Stuttgart Chamber
Provider:	Centre for Solar Energy Stuttgart (<i>Solar Energie Zentrum Stuttgart</i>)
Reference:	www.sez-stuttgart.de

Skilled Worker in Offshore Wind Turbine Construction

Prerequisites:	Completed vocational training in the area of metalworking and electrical engineering, one year working experience, physical and medical fitness, basic skills in English
Learning objectives:	Participants of the training are enabled to facilitate the setting up of offshore wind turbines. The training comprises all areas of wind energy, giving participants a good overview on the technique, the functioning and construction of wind turbines.
Content:	First aid and wind power Dealing with personal protection equipment, rescue Basic English vocabulary of the wind power industry Basics on wind turbines and processing of plastics Basics in electrical engineering, hydraulics, fastenings (screws and bolts etc.) Electrically skilled staff Electrician for specified activities Securing transport, attachment and lifting, ladder systems Screw techniques Hydraulic tools Offshore module: Introduction, requirements with respect to offshore work safety and environmental protection as well as offshore safety training
Duration:	3.5 months
Degree/completion:	Certificate for the participation from the Vocational Training Promotion Organisation (<i>Berufsförderungswerk, bfw</i>) Bremen
Provider:	bfw Wind Centre – Bremerhaven
Reference:	www.bfwbremen.de

Wind Energy Assembly Technician

Prerequisites:	Completed vocational training in the area of metalworking and electrical engineering or proven working experience of at least three years in one of the two fields
Learning objectives:	Building on already existing skills acquired in the fields of metalworking or electrical engineering or a related area. The participants of the training are prepared for specific activities in the context of wind turbine production.
Content:	Introduction wind turbines Mechanical engineering: materials science, mechanics, hydraulics Electrical engineering Data processing Logistics: merchandise management, connector and hoisting technology, forklift trucks and cranes Environmental protection Health and safety Introduction Quality Management Technical and corporate communication Internship Examination
Duration:	4.5 months
Degree/completion:	Certificate of the Centre for Education on Renewable Energies (<i>Bildungszentrum für Erneuerbare Energien, BZZE</i>)
Provider:	BZZE, bfw Wind Centre – Bremerhaven
Reference:	www.bfwbremen.de

Service Engineer (Service Technician) for Wind Energy Technology – Onshore/Offshore

Prerequisites:	Completed vocational training in the area of metalworking and electrical engineering, one year working experience, physical and medical fitness, basic skills in English
Learning objectives:	Building on already existing skills acquired in the fields of metalworking or electrical engineering or a related area, the participants of the training are prepared for specific activities in the context of the installation, maintenance and overhauling of wind turbines onshore/offshore.
Content:	Introduction wind turbines Mechanical engineering: materials science, mechanics, hydraulics Electrical engineering Data processing Fabrics and composites Legal foundation Health and safety and environmental protection Basics in business management Technical and corporate communication Technical English Special components Offshore: living and working on an offshore wind farm; specific requirements for the construction and service of offshore wind farms Internship Examination
Duration:	8.5 months (without offshore module), 9,5 months (with offshore module)

Degree/completion:	Certificate of the Chamber of Skilled Crafts and Trades of Bremen; Chamber of Industry and Commerce of Bremerhaven (without offshore module), BZEE certificate
Provider:	BZZE, bfw Wind Centre – Bremerhaven
Reference:	www.bfwbremen.de

Basic Course in Biogas

Prerequisites:	Completed vocational training in building, construction and related occupations
Learning objectives:	none given
Content:	Energy-related and environmental framework conditions for the use of biogas Technical basics Basics of fermentation biology and substrates for fermentation Starting biogas plants Techniques for harvest, silage and storage for renewable raw materials Safety guidelines for agricultural biogas plants Managing the process and monitoring process stability within the fermenter Combined heating and power station technologies Network connection of the power stations Site visits to the plant Financing biogas plants Optimising biogas plants – factors influencing economic success Legal matters relating to the plant: private construction law, contractual law, energy law Licensing procedures and emission control of biogas plants Use of fermentation residues Obligations of operators according to emergency regulations (Regulation 12 on the implementation of the Federal Emissions Laws) Legal matters with respect to animal diseases and the running of biogas plants Tax issues Use of heating and gas in biogas plants Requirements from the perspective of the environmental verifier Energy crop cultivation taking water conservation into consideration Practical regulations of the FOS/TAC value⁴⁵ Visualising gas leaks
Duration:	64 hours
Degree/completion:	Certificate of attendance
Provider:	Rural Adult Education Lower Saxony (<i>Ländliche Erwachsenenbildung Niedersachsen</i>) in collaboration with the Academy for Renewable Energies Lüchow-Dannenberg (<i>Akademie für Erneuerbare Energien Lüchow-Dannenberg GmbH</i>)
Reference:	www.nds.leb.de

45 In bio analysis, the FOS/TAC-value measures the ratio of the volatile organic acids to the carbonate buffering capacity. This ratio is an important parameter for stabilizing the control processes of a biogas plant.

Energy and Resource Efficiency

Energy Officer

Prerequisites:	Experts and managers of small and middle sized enterprises (SME) and institutions
Learning objectives:	The graduates of this course are able to collect relevant energy data in enterprises and to roughly analyse energy flows. They acquire the knowledge necessary for doing this as well as the basic understanding necessary for creating an operational energy management system and for developing strategies on how to save energy.
Content:	Operational energy management and efficiency Energy law Use of renewable energies Consulting and funding programmes Energy procurement in SME Approaches for collecting data on energy consumption and costs in businesses Calculations of cost effectiveness and energy saving projects Basics on energy technology Energy-efficient buildings Heating technology Lighting technology Data collection and calculation of costs (individually in each enterprise)
Duration:	54 hours
Degree/completion:	Certificate of the Chamber of Skilled Crafts and Trades
Provider:	Chambers of Industry and Commerce and private educational institutions
Reference:	http://klimaschutz.ihk.de/qualifizierungsoffensive/energiebeauftragter-ihk/

Energy Manager

Prerequisites:	Experts and managers of companies that have, amongst others, the following roles and tasks: operations manager, production manager, energy officer, environment officer, energy manager, head of maintenance, process engineer, operations technician, energy consultant and energy service provider
Learning objectives:	The graduates of this course are able to collect relevant energy data in enterprises and to roughly analyse energy flows. They acquire the knowledge necessary for doing this as well as the basic understanding necessary for creating an operational energy management system and for developing strategies on how to save energy.
Content:	Basics on energy technology Measuring, controlling and regulating techniques Building physics/heat consumption of buildings Building construction and design/assessment of building shells Energy Saving Ordinance/energy certificate for building Energy-conscious building/restoration Energy efficiency of buildings, DIN 18599 Heating technology/geothermal energy Process heat Energy from biomass Ventilation and air-conditioning technology Refrigeration technology Combined heating and power stations

Combined heat, power and cooling production
 Electrical drives
 Lighting
 Compressed air
 Solar hot water production/solar heating
 Photovoltaic
 Energy procurement/energy law
 Energy trade/emissions trading
 Data collection and analysis, controlling
 Calculations of cost effectiveness
 Contracting
 Process/load management
 Project management

Duration: 240 hours
 Degree/completion: Certificate of the Chamber of Skilled Crafts and Trades
 Provider: Chambers of Industry and Commerce
 Reference: <http://klimaschutz.ihk.de/qualifizierungsoffensive/energiemanager-ihk/>

Resource Efficiency 2012

Prerequisites: Consultant engineers as well as energy and business consultants, having completed technical vocational training and several years of work experience

Learning objectives: This course offers basic insight into the topic of efficient energy use, thereby creating a basis for the participants to manage projects for material efficiency.

Content: Basic theoretical background
 Introduction
 Resource efficiency through product-based measures: potential of the value chain and integrated product policies; product design, methods and instruments for the analysis and optimisation of resource efficiency within the production process: analysis and management of the substance flow; cost calculation of material flow; cost calculation of resources; analysis and support: resource efficiency checks; systematic provision of information; production-integrated environmental protection (PIUS) check according to the VDI 4075 guideline; maintenance
 Innovation coaching
 Resource efficiency on site
 Practical application of and reflection on the course contents: tour of the company; assessment of the as-is-situation; follow-up: deriving measures for resource efficiency and documentation of results
 Notes on the practical implementation: potential and obstacles when initiating resource efficiency projects; project and time management;
 Funding possibilities
 Guided expert discussion
 Summary and concluding discussion

Duration: 5 days

Degree/completion: Certificate of attendance

Provider: VDI-Centre for Resource Efficiency
 (VDI-Zentrum Ressourceneffizienz GmbH)

Reference: www.vdi-zre.de/fileadmin/user_upload/BQ/18-01-2012-FLYER_Mitarbeiter_neutral.pdf

Sustainable Construction and Efficient Building Energy Technology

Specialist for Heat Pump Systems

Prerequisites :	Further training for journeyman/woman or master craftsman/woman in the sanitation/heating/air-conditioning trades and electro technologies
Learning objectives:	Specialists for heat pump systems determine advantages and limits of heat pump technology. They have in-depth knowledge of cooling cycles and the risks of handling refrigerants. They determine professionally which heating sources can be used for the customer. They undertake the project planning for heat pump systems in accordance with the parameters of the building and its surroundings. Due to their extensive knowledge, they are the first point of contact for installing energy saving heat pump systems.
Content:	Energy and environmental engineering Energy-efficient construction Financing and funding Marketing of plants generating electricity under the Renewable Energies Act (EEG) Basics in heating technology Basics in sanitation technology Heat pump systems System training (provider) Specialist examination
Duration:	160 hours
Degree/completion:	Certificate of the Chamber of Skilled Crafts and Trades
Provider:	Centre for Electro Technology (<i>Elektro Technologie Zentrum, etz</i>) of the guild for electro and information technology, Stuttgart
Reference:	www.etz-stuttgart.de

Building Energy Consultant

Prerequisites:	Title of master craftsman or woman in construction and related occupations or knowledge and experience of many years in one of these occupations
Learning objectives:	The participants of this course learn how to analyse a building from an energy point of view and how to implement measures for saving energy. Successful completion of the class authorises graduates to use the title "Building Energy Consultant in the Skilled Crafts and Trades".
Content:	Structures and construction: building material science; building construction, environmental protection/building material recycling Building physics: heat insulation, humidity protection, sound insulation, fire protection Air tightness measurements with blower door and thermography Technical facilities: Energy and environmental technology; plant technology, heating, ventilation, heat pump, use of regenerative energies Energy Saving Ordinance: Requirements and verification Planning modernisation: Recording of buildings and technical facilities as well as documentation for assessing building physics; calculations for assessing building physics and energy consumption; development and illustration of concepts for improving the energy balance and for establishing a cost-benefit analysis for the planned modernisation measure.
Duration:	240 hours
Degree/completion:	Certificate of the Chamber of Skilled Crafts and Trades
Provider:	Solar Energy Centre Stuttgart (<i>Solar Energie Zentrum Stuttgart</i>)
Reference:	www.sez-stuttgart.de

Skilled Worker Specialist in Building with Earth

Prerequisites :	Completed vocational training in building, construction and related occupations, architecture, construction engineer
Learning objective :	This is an officially recognised training course for qualification as "Specialist in Building with Earth"
Content:	The course is made up of modules and contains a module on basics, four technical modules and one construction site module: Clay masonry Techniques with wet clay Dry clay constructions Clay plasters Matters relating to the construction industry and practice construction site Practice construction project Examination
Duration:	120 hours
Degree/completion:	Certificate of the Chamber of Skilled Crafts and Trades Ulm
Provider:	Competence Centre Wood Building Construction and Finishing (<i>Kompetenzzentrum Holzbau und Ausbau, Biberach</i>)
Reference:	www.kompetenzzentrum-bc.de

Passive House Wood Construction

Prerequisites:	Completed vocational training in building, construction and related occupations
Learning objectives:	This course deals with the specifics of passive house wood construction. Many different designs are possible, but all have to be examined and planned in great detail, as well as executed fulfilling the high quality standards, in order to reach the energy saving goals. The entire building shell, from base plate to the ridge of the roof needs to be taken into account.
Content:	Wood-framed housing Installation level Façade cladding Wooden double I-joists Wood protection Airtightness Fire and sound protection Façade curtain elements
Duration:	40 hours
Degree/completion:	Certificate of attendance
Provider:	Vocational Training Centre – Construction in Hamburg (Ausbildungszentrum – Bau in Hamburg GmbH)
Reference:	www.azb-hamburg.de

Passive House Solid Construction

Prerequisites:	Completed vocational training in building, construction and related occupations
Learning objectives:	This course deals with the specifics of passive house solid construction. Many different designs are possible, but all have to be examined and planned in great detail, as well as executed adhering to high quality standards in order to reach the energy saving goals. This is also valid for underground components.
Content:	Insulating brickwork Sand-lime Aerated concrete Concrete Facing walls Basement walls Basement ceiling Foundations
Duration:	40 hours
Degree/completion:	Certificate of attendance
Provider:	Vocational Training Centre – Construction in Hamburg (Ausbildungszentrum – Bau in Hamburg GmbH)
Reference:	www.azb-hamburg.de

System Technology for Building Automation

Prerequisites:	Completed vocational training in the areas electrical engineering, information technology as well as in business administration
Learning objectives:	The course teaches how to roughly estimate energy consumption of buildings and categorise them accordingly. The participants of the course acquire basic knowledge of building physics and technical building equipment as well as about weaknesses in buildings, thereby gaining an overview on important principles of energy efficiency in buildings. Consequently, they know which construction methods and building materials ensure sustainable building and renovation and how to use building automation systems in an energy-efficient way.
Content:	Energy-efficiency of buildings – the influence of building automation and building management Infrastructure systems Home-networking/system integration Building automation with provider specific systems Project planning of intelligent building networks
Duration:	120 hours
Degree/completion:	Certificate of the Electro Technology Centre
Provider:	Centre for Electro Technology (<i>Elektro Technologie Zentrum, etz</i>) of the association for electro and information technology Stuttgart
Reference:	www.etz-stuttgart.de

Skilled Worker For Insulation Technology

Prerequisites:	Completed vocational training in building, construction and related occupations
Learning objectives :	The participants are qualified to professionally perform insulation work and are able to correctly apply highly complex materials. They acquire in-depth knowledge of the rapidly increasing technological developments, current requirements and new building materials. They learn about professional planning and application of insulation work while at the same time taking the context of building physics into consideration, in order to ensure energy-efficient building and renovation.
Content:	Structures and construction – physical, technical and ecological aspects Materials and insulation – their characteristics and ways to apply them Energy Saving Ordinance Restoration and modernisation planning with respect to insulation technology as well as rules and regulations (engineering practice) Assessment and selection of insulating materials Building law Ecological aspects
Duration:	184 hours
Degree/completion:	Certificate of the Chamber of Crafts Dresden
Provider:	Centre for Education for the Skilled Crafts and Trades (<i>Bildungszentrum Handwerk Dresden</i>) and other education centres of Chambers for Skilled Crafts and Trades
Reference:	www.bih-bildung.de

Wastewater Technology

Practical Training – Maintenance of Small Treatment Plants

Prerequisites:	Basis knowledge on wastewater treatment and small treatment plant technology
Learning objectives:	Working in a small treatment plant is the focus of this two-day practical training course. The participants acquire practical, process based and typical plant knowledge in relation to the maintenance of a small treatment plant.
Content:	The different functional features of plant components such as air vents, compressors and pumps Control systems and their maintenance
Duration:	16 hours
Degree/completion:	Certificate of the Training and Demonstration Centre for Decentralised Wastewater Treatment (<i>Bildungs- und Demonstrationszentrum für dezentrale Abwasserbehandlung</i>)
Provider:	Training and Demonstration Centre for Decentralised Wastewater Treatment (<i>Bildungs- und Demonstrationszentrum für dezentrale Abwasserbehandlung e.V., Leipzig, BDZ</i>)
Reference:	www.bdz-abwasser.de

Course on the Basics of Wastewater Technology and Treatment (Sewage Work Technician)

Prerequisites:	Expert seminar for people seeking lateral entry or a career change into systematic training in wastewater technologies
Learning objectives :	None given
Content:	Basics and principles of wastewater treatment Characteristics and contents of wastewater Separation and mixing systems, pipes, canals, shafts Mechanical and biological wastewater treatment procedures Sludge treatment Operational indicators and control parameters Measuring, steering, regulating Electrical facilities in wastewater treatment plants Work safety, hygiene, working conditions in the laboratory
Duration:	40 hours
Degree/completion:	Certificate of the education centre <i>Bildungswerk BAU Hessen-Thüringen e.V.</i>
Provider:	<i>Bildungswerk BAU Hessen-Thüringen e.V.</i>
Reference:	www.biwbau.de

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Sector Programme Technical and Vocational Education and Training	
Friedrich-Ebert-Allee 40	Dag-Hammarskjöld-Weg 1-5
53113 Bonn	65760 Eschborn
Germany	Germany
Tel. +49 (0) 228 44 60 – 0	Tel. +49 (0) 6196 79 – 0
Fax +49 (0) 228 44 60 – 1766	Fax +49 (0) 6196 79 – 1115

tvvet@giz.de

www.giz.de

Author

Dr. Klaus-Dieter Mertineit, Institute for Sustainable TVET & Management Services GmbH, Hannover

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Addresses of the BMZ offices

BMZ Bonn	BMZ Berlin
Dahlmannstrasse 4	Stresemannstrasse 94
53113 Bonn	10963 Berlin
Germany	Germany
Phone +49 (0) 228 99 535 – 0	Phone +49 (0) 30 18 535 – 0
Fax +49 (0) 228 99 535 – 3500	Fax +49 (0) 30 18 535 – 2501

poststelle@bmz.bund.de

www.bmz.de

