

Beiträge aus der Praxis der beruflichen Bildung – Nr. 21

# Ecological Sustainability in TVET

Planning aid to initiate and implement environmentally relevant topics in selected programmes and offers of the development cooperation



On behalf of  
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## Introduction

Division “Technological Cooperation, System Development and Management in Vocational Training” of InWEnt is seated in Mannheim and conducts on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ) advanced training programmes. Under the banner of “sustainable development” its work focuses on questions of technology cooperation, system development and management in the field of technical and vocational education and training. Its dialogue and training programmes are targeted at decision-makers from the public and private sectors, junior managers and multipliers from vocational training systems.

In 2003, the Division has begun to present a series on everyday practice in vocational training. The intention of this series is described in the title itself (“Beiträge aus der Praxis der beruflichen Bildung” – series on everyday practice in vocational training). The Division aims to support its programmes of international personnel development in the above-mentioned areas with technical documentation in both printed and electronic form.

These reports

- originate in the partner countries, taking into account specific situational demand

- will be tested with and for experts in vocational training in partner countries in conjunction with respective practice-oriented training programmes on offer, and
- with a view to global learning will be improved and adapted prior to publication according to the recommendations of the partners or the results of the pilot events.

Thus, the Division “Technological Cooperation, System Development and Management in Vocational Training” is applying the requirements of InWEnt’s training programmes to its own products in the above faculties: i.e., these can only be as good as their practical relevance for the experts of vocational training systems in the partner countries.

To this effect, we look forward to critical and constructive feedback from all readers and users of this special series.

Our thanks go to Dr. Klaus-Dieter Mertineit who is the author of the present report.

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# Contents

	<b>Introduction</b>	<b>3</b>
➔	<b>1 Initiation and implementation of environmental protection aspects in programmes and offers of the development cooperation (DC)</b>	<b>6</b>
	1.1 Context	6
	1.2 Concept of the planning aid	8
➔	<b>2 Implementation strategies and instruments</b>	<b>10</b>
➔	<b>3 Vocational training offers, teaching and learning aids and practical examples</b>	<b>16</b>
	3.1 Environmental protection in general	16
	3.2 Energy efficiency/use of renewable energies	21
	3.3 Drinking water supply and wastewater disposal	24
➔	<b>4 Key questions</b>	<b>26</b>
➔	<b>5 Points of contact for initiation and implementation activities in selected partner countries</b>	<b>28</b>
	5.1 Egypt	28
	5.1.1 Renewable energies/efficient use of energy	28
	5.1.2 Drinking water supply and wastewater disposal	30
	5.2 Jordan and Syria	35
	5.2.1 Renewable energies/efficient use of energy	35
	5.2.2 Drinking water supply and wastewater disposal	36
➔	<b>6 German experiences and qualification offers to meet demand in the selected partner countries</b>	<b>41</b>
	6.1 Renewable energies/efficient use of energy	41
	6.2 Drinking water supply and wastewater disposal	43
➔	<b>7 Abbreviations</b>	<b>45</b>
➔	<b>8 Sources</b>	<b>46</b>
➔	<b>9 Literature</b>	<b>47</b>
➔	<b>10 Endnotes</b>	<b>49</b>

## List of figures

Figure 1:	Implementation strategies and instruments	11
Figure 2:	Starting points to encourage environmentally conscious behaviour	14
Figure 3:	Key questions	27

## List of tables

Tab. 3-1:	Selected vocational education and training providers and demonstration facilities in the areas of renewable energies/energy efficiency	23
Tab. 3-2:	Selected training providers and demonstration facilities for drinking water supply and wastewater disposal	25
Tab. 5-1:	Demand potentials in Egypt for vocational education and training in terms of renewable energies/efficient use of energy	31
Tab. 5-2:	Demand potentials in Egypt for vocational education and training in terms of drinking water supply and wastewater disposal	34
Tab. 5-3:	Demand potentials in Jordan and Syria for vocational education and training in terms of drinking water supply and wastewater disposal	40
Tab. 6-1:	Demand in the selected partner countries and German experiences and qualification offers in the areas of renewable energies/efficient use of energy	41
Tab. 6-2:	Demand in the selected partner countries and German experiences and qualification offers in the areas of drinking water supply and wastewater disposal	43



# 1. Initiation and implementation of environmental protection aspects in programmes and offers of the development cooperation (DC)

## 1.1 Context

### Environmental protection: one of the key tasks of development cooperation

In view of the critical ecological problems and the continuing poverty in large parts of the world, in 1992, within the framework of the United Nations Earth Summit in Rio de Janeiro (Brazil), the community of states agreed on the Sustainable Development model. The vision is to live together better and more fairly (globally) while ensuring minimum means of subsistence. At the subsequent conference in 2002 in Johannesburg (South Africa) the representatives agreed on a plan of implementation and a political declaration for sustainable development. In the declaration the heads of state and government confirmed the world-wide importance of sustainable development, poverty reduction, climate and resource protec-

tion, changes in production processes and consumer habits, and the necessity of structuring the globalisation process in a socially and ecologically responsible manner. In addition to eliminating hunger and extreme poverty, the development goals included protecting natural resources, improved access to clean water and basic sanitation as well as increasing the share of renewable energies in global primary energy consumption.

This close bond between poverty reduction and environmental protection also applies to the German government's development policies. These are based on the United Nations Millennium Declaration and the principles and common goals agreed in the Monterrey Consensus and in the Johannesburg Plan of Implementation, and are committed to the model of global Sustainable Development, which is expressed equally in economic efficiency, social justice, ecological sustainability and political stability.



With an eye on the *ecological dimension of the sustainability postulate*, the German development cooperation (DC) promotes projects aimed at protection and sustainable use of natural resources, sustainable management of water resources, sustainable and local technologies for energy generation, energy supply based on renewable energies, and efficient and economical use of energy. At present, energy projects are being sponsored in about 45 countries (more efficient generation of energy, more rational use of energy, use of renewable energies) with a total volume of some 1.6 billion euros.<sup>1</sup> In the water sector, Germany counts among the world's biggest bilateral donors with an annual sponsorship volume of roughly 350 million euros for bilateral measures.<sup>2</sup>

### Vocational education and training as a tool for implementing the sustainability goals

In addition to its original purpose – teaching professional qualifications in order to help people become employable and gain an income and thus reduce poverty and encourage economic growth – vocational education and training makes a significant contribution towards ensuring ecological sustainability. This happens when aspects of ecological sustainability – such as efficient use of resources, ecological management, emission protection and occupational safety – are made an object of vocational and advanced training programmes. The people who complete these programmes can contribute and use the corresponding knowledge in their working and home environments and pass it on to others.

The lack of trained staff limits the implementation of political guidelines. This also applies to environmental and resource protection programmes. They lose their effect or fail when the personnel do not have the necessary qualifications for the installation, operation and maintenance of new technologies and processes to fulfil the new tasks and responsibilities adequately.

Forecasts and (environmental) political decisions would suggest that the need for qualification in the environmental area will increase considerably. Linking vocational training with environmental protection requirements on a structural level offers the opportunity for targeted action against structural poverty as well as against increasing impacts on the environment, caused – in many cases – by poverty, population growth, the wrong underlying conditions and a lack of knowledge as regards alternative ways of handling resources.

The importance of developing human resources for sustainable development through training and education was highlighted at the World Summit for Sustainable Development in Johannesburg in 2002. The education sector, including vocational training, was judged to play a key role in making people aware of ecological connections. A better understanding of ecological connections is deemed to be the basis for responsible handling of natural resources and sustainable management. Vocational training could play a major communication role at the interface between mankind, nature and technology. Developing countries are promised support in these areas. Within the scope of the UN Decade of Education for Sustainable Development 2005 - 2014, sustainable development is to be integrated into the education systems at all formal levels and into informal education measures in order to promote the competencies needed for sustainable development and to encourage the corresponding values and behaviour.<sup>3</sup>

The Federal Republic of Germany supports the integration of ecological aspects into training and advanced training. In addition to ecological sensitisation for everyday life and qualification for eco-efficient management, qualification for the introduction, installation, operation and maintenance of more environmentally friendly technologies will play an increasingly important role.<sup>4</sup>

In Germany, increasing international demand for environmentally relevant qualification services is met with extensive, long-term experience and a comprehensive range of qualifications. The planning aid presented here aims to provide a general structure for 'resource and environmental protection in vocational training as a contribution towards realising the ecological dimension of sustainable management' and render some key experiences and offers from the German context transparent and thus suitable for international cooperation, especially regarding cooperation between InWEnt and its partners.

## 1.2 Concept of the planning aid

### Goals

This planning aid aims to provide answers to the following questions:

- Under which conditions and with the help of which tools and procedures can environmentally relevant topics be integrated systematically into the programmes and offers of the DC?
- Which specific points of contact or what potential demands are there in selected DC partner countries for environmentally related qualification offers?
- Which existing German qualification offers provide points of contact within the scope of the DC?

### Geographical and topical priorities

The planning aid was created on the basis of examples. The partner countries Egypt, Jordan and Syria were chosen and processed as countries with potential demand. The subject of environmental protection was restricted to the areas of renewable energies/efficient use of energy, drinking water supply and wastewater disposal.

### Procedure and structure

After this introduction an overview of implementation strategies and instruments will be given. This is derived from the situation in Germany within the course of establishing the environmental policy and a market for environmental protection and environmental qualification, which is deemed to be a suitable orientation for corresponding activities within the framework of the DC. Among other things, the approach is based on studies drafted several years ago for the DC and in particular the German Technical Cooperation (GTZ), partly in cooperation with the German Federal Institute for Vocational Education and Training (BIBB), by the Institute for Environmental Protection in Technical Vocational Education and Training (IUB).<sup>5</sup> The respective sections were updated and adapted to suit the requirements of the planning aid presented here.

The third section contains a description of selected vocational training offers in Germany that could be made accessible for the DC. For this purpose, limited research, descriptions and analyses were made in respect of existing German vocational training offers, teaching and learning aids, with successful practical examples for the selected topics in terms of the level of specialisation and the extent to which they could be transferred to the specific needs of the DC.

This is followed by a heuristic process in which the extent to which the requirements exist for initiation or implementation of the chosen topics in the DC can be ascertained. Key questions are asked to create a structuring aid in order to

- determine potential qualification requirements in the selected topics,
- anchor these in vocational training and
- link them with existing German qualification offers and experiences that appear basically suitable.

The following section contains a situation analysis of the selected partner countries based on the previously described question matrix. Internet research and document analyses were carried out to determine possible points of contact and potentials for environmentally relevant vocational training. Essentially, the research includes publicly accessible German and English websites from selected national and international donor organisations and – where accessible – in the selected countries. From the German DC side, the German Federal Ministry for Economic Cooperation and Development (BMZ), GTZ, the KfW Entwicklungsbank (KfW) and InWEnt were involved; the World Bank Group and the European Union were considered as representatives of the international donor organisations. In particular, suitable country, programme and project concepts, reports and descriptions were recorded.

The focus of this interest was information

- about the environmental situation in the respective countries and priorities, programmes, legal regulations and infrastructure in the field of environmental protection – especially as regards the selected topics;
- about the economy, employment and qualification situations and
- about strategies and concepts, priorities and projects of the donor organisations in the selected areas and in the vocational training and employment systems.

As regards anchoring specific qualification potentials in vocational training for the topics, a distinction was made between the didactic levels a) system level: education/order policies, teaching curricula and test requirements, b) institutional level: management of training facilities, training of teachers and trainers, and c) individual level: informal education as well as formal training and advanced training.

In the last section, relevant German qualification offers are linked with the demand potentials determined in the selected partner countries.



## Working with plausibility

It should be pointed out that because of the data situation, which is very meagre in parts, in some areas key questions like whether and to what extent the selected topics are perceived by the economy so that today or within a foreseeable time qualifications will (could) be required for certain employee groups, simply cannot be answered satisfactorily without insider knowledge of the respective country.

On the other hand, being limited generally to information that is accessible on the Internet has the advantage that within a relatively short time and with relatively little effort a lot of information could be researched and put together. Thus, the information does not

claim to be complete. Rather, the focus was placed on developing a transferable range of questions that enables justified evaluations and decisions to be made in the specific consulting business. This procedure is similar to the usual consulting situation in the DC. Here, too, decisions have to be made although the data situation sometimes leaves a lot to be desired. In view of this, it is important to work with plausibility and to mention this at the respective point according to the motto: Based on the available information, the situation seems to be as follows... If the situation actually should be like this, the following procedure is suitable... This is also the case in this planning aid.

We assume that the procedure described in this planning aid can also be transferred to other regions and countries.



Adel El-Shafei participated in the InWent training programme “Instruments of Environmental Management”. He heads the Department for Hazardous Substances and Wastes of the Egyptian Environmental Affairs Agency (EEAA) in Cairo (2007).

## 2. Implementation strategies and instruments<sup>6</sup>

Primarily, energy and environment issues are integrated into vocational training or professional qualification and job profiles in Germany via the following instruments:<sup>7</sup>

- environment policy guidelines;
- political order regulations;
- environmental law regulations;
- government promotion instruments;
- education policy priorities and programmes, pilot schemes and other promotion projects;
- media development and information, and
- qualification of the instructors and teachers.

On the training facility level environmental protection requirements are also considered in terms of

- organisational and human resources development processes in the course of ecologising organisations.

### Environment policy guidelines

A requirement for sustainable vocational environmental training is the existence of a minimum level of governmental environmental policy. In Germany, environmental policies have developed into a separate field of politics at federal and state levels as well as in local municipalities since the start of the 1970s due to ecological problems and political pressure (action groups, environment associations, the Green Party). The guidelines of government environmental policies (laws and ordinances, in other words, instruments to influence behaviour directly or indirectly) have resulted in the formation of “environment markets” from which a demand for environmentally relevant qualifications has evolved. In addition, the set of standards created in the course of government environmental policies, together with the technical and organisational processes derived from these, form an indispensable point of reference for vocational environmental training.



## Political order regulations

Because employees receive basic qualifications in environmental protection during their vocational training, it has been necessary to include learning goals for environmental protection in all regulated training and advanced training occupations. Every one of the roughly 340 recognised trades in Germany – whether producing, providing services or maintenance – has environmental relevance to varying degrees. Because of this, since the middle of the 1980s existing occupations and professional structures have been supplemented with environmentally related professional qualifications in the course of being modernised and in accordance with their relevance for the environment. This is expressed formally in the corresponding goals of the respective training regulations for the vocational part and also in the teaching curricula of the school part in professional training. It is implemented in the training regulations in the form of a largely standard section “environmental protection” of the occupational profile similar for all occupations (formerly “Occupational safety, environmental protection and rational use of energy”).

Because environmental protection qualifications were integrated into the dual system of vocational training in Germany in the course of modernisation and re-classifying occupations with the agreement and participation of employer and employee organi-

sations, trade associations and their experts – in other words, in close connection with the production and employment system – in principle, it is guaranteed that the environmental qualifications defined in the training regulations correspond to the vocational requirements. Environmental protection is thus part of correct professional conduct.

However, the few empirical investigations that are available for this area make it clear that the claims and reality diverge considerably, especially in jobs with indirect relationships to the environment. Insofar, integration of environmental protection into training and advanced training regulations is a necessary but ultimately inadequate requirement for practical implementation. Therefore, when environmental protection topics are being implemented in the vocational training systems of other countries, special attention should be paid to the following aspects:

- more substantiation of environmental learning goals in the training regulations, respectively in environmental learning goals should be named explicitly within the course of developing competency standards;
- improved integration of environmental protection aspects in the vocational examination system;
- broad-based qualification of the teaching and training staff;
- better transfer of results from pilot schemes and research.

## Implementation strategies and instruments

- Environment policy guidelines
- Political order regulations
- Environmental law regulations
- Government promotion instruments
- Education policy priorities and programmes, pilot schemes and other promotion projects
- Media development and information
- Qualification of the instructors and teachers
- Organisational and human resources development processes in the course of ecologising organisations

Figure 1: Implementation strategies and instruments

## Environmental law regulations

Environmental law regulations are relevant for vocational qualification in environmental protection and jobs in several respects. They

- must be considered directly at the workplace, such as when dangerous materials are being handled, when heat protection standards are being considered, and when waste is being sorted;
- are the basis for certain environmentally relevant jobs (chimney sweeps measuring emissions, exhaust gas tests in car repair shops, heating technology in the plumbing, heating, refrigeration and air conditioning trades, energetic building refurbishment in the building trades, etc.);
- make special occupations or professional specialisation necessary, such as the new technical environmental occupations, immission control officers, building energy consultants, etc.

Environment law regulations thus form an important basis for environmentally related qualifications. Hence, when these are being transferred, the respective specific country regulations must be taken into account.

## Government promotion instruments

Primarily, this means government promotion in the course of introducing future-proof environmental technologies. In the energy sector, this includes direct subsidies and increased feed-in tariffs for wind and photovoltaic systems that lead to more demand, which has direct effects on the qualification profile of the trade that carries out the work. As regards transfer, the respective specific country regulations must be considered here too.

## Education policy programmes, pilot schemes and other promotion projects

To promote integration of environmental protection into vocational education and training the German Federal Institute for Vocational Education and Training (BIBB) sponsored 16, and the Federal and State Commission for Educational Planning and Research Promotion 20 pilot schemes in which new learning approaches, didactic materials, qualification concepts and implementation strategies were developed and tested. Most of these related to the vocational training level. While it is difficult to measure the direct and indi-

rect effects of pilot schemes, according to Kutt, however, “one can, on the whole, assume an intensification of the following effects:

- general stimulus to modernise training and workplace;
- promotion of functional, methodological and environmentally related competencies;
- promotion of cross-occupational competencies (e.g., communication and cooperation);
- promotion of networked thinking;
- improved motivation among trainers and trainees;
- improved environmental protection in the training and at the workplace.”<sup>8</sup>

Within the scope of disseminating the guiding principles of sustainable development in the vocational training system process and transfer-oriented tools are used increasingly:<sup>9</sup>

- feasibility study,
- actors’ conferences,
- Internet platform,
- pilot scheme focus (with 10 pilot schemes),
- Good Practice Agency.

## Media development and information

Didactically prepared teaching and learning aids play an important role in encouraging the integration of environmental protection and sustainable development into vocational training and in how people behave at their workplace. They should be related to the vocational field and the job and, in addition to basic knowledge relevant to the job, should also contain special job-related knowledge about environmental protection. In vocational environmental training there are now suitable materials for almost all professional fields, mainly as printed media but also as videos and CD-ROMs.

Apart from the topicality of the content, the scope and didactic-methodological references are always a problem for transferring media, as they can never be transferred 1:1. Teaching and learning aids always have to be adapted to the respective situation of application. In favourable cases they can be an initiator and stimulate people to create/implement their own material. The teachers’ and trainers’ own media development can also be integrated very well into their qualifications.

## Qualification of the instructors and teachers

If you accept that people have a broad understanding of environmental protection and then investigate the training plans and the curricula, a wealth of other environmental protection learning goals and content can be found.<sup>10</sup> In practice it is the job of the teachers and instructors to carry out this interpretation and implementation task. This makes it clear just how important this group of actors is, since it is their attitude, value orientation, skills and knowledge that decide whether and to what extent environmental protection aspects are handled in vocational training.<sup>11</sup> In most education policy statements and recommendations on environmental protection in vocational training, the significance of the instructors and teachers for implementing the environmental protection learning goals is stressed in the training regulations and teaching curricula of vocational colleges. After all, it is these instructors and teachers who “have to teach the environmentally-related functional knowledge with the help of suitable methods and thus ensure that young employees are able to act accordingly in their jobs. At the same time, they are always models as regards how they teach and work.”<sup>12</sup>

## Organisational and human resources development processes in the course of ecologising organisations

The issue here is how and under which conditions it is possible to ecologise vocational training facilities. In other words, activities that aim to a) avoid or reduce actual, organisation-related environmental impacts and b) organise suitable measures and anchor these in the organisational structure.<sup>13</sup> This requires extensive organisational (OD) and human resources (HRD) development processes in which the principles and processes known from the general debate about OD and HRD are applied, such as

- *Combining top-down and bottom-up approaches:* Initiatives from the “grassroots”, i.e., from trainers and trainees or employees, are necessary and must be encouraged. However, this strategy must be supplemented with statements of willingness, the provision of resources and acknowledgment of the activities at the “bottom” by the head of the organisation (motto: environmental protection is a matter for the boss). As experience has shown, organisations can be largely ecologised only if both approaches are pursued simultaneously.
- *Promoters:* Without committed individuals who are dedicated to the topic and press ahead with it in their organisation, environmental protection will remain a marginal issue. If it involves more than individual measures that are relevant to the organisation, it is important that a person is found who can support and promote the project as a functional and process promoter in terms of the content and the organisation. On the other hand, it must be ensured that the project has a power promoter who is sufficiently accepted and who has enough decision-making authority to implement the system.
- *Orientation to management standards:* In the area of environmental management DIN EN ISO 14.001 and EMAS are established management standards that could also be used in vocational training facilities.<sup>14</sup> Facilities that also want to consider sustainability aspects will find stimulus in a concept on sustainability indicators in vocational training facilities that was drafted for the German Federal Institute for Vocational Education and Training (BIBB)<sup>15</sup>, and in the CSR criteria.<sup>16</sup>
- *Creation of a suitable organisational structure:* Generally, to plan, organise, coordinate and document coordinated measures for ecologising an organisation, temporary cross-status project groups are formed to look after the implementation process and to report directly to management as an advisory committee. Often an environmental affairs manager is also appointed, who has a spokesperson function and handles coordination tasks. It has also proven useful to appoint contacts for environmental protection, both in the training area and in the other organisational units of the vocational training facility.
- *Highlight the benefits:* Particular effects can be expected if the environmental learning of the employees and the environmental learning of the organisation are linked with each other. For this to succeed it is important that the benefits for the organisation are made clear.
- *Orientation to guiding principles:* So that everyone in the vocational training facility knows the aims of and the idea behind ecologising the organisation and the value this has, it is practical for the management of the facility (if possible, with the participation of the employees) to decide on suitable guiding principles. These are then the basis for aligning the organisation’s environmental training measures.
- *Involve the trainees in ecologising the organisation:* Environmental protection should not remain an abstract learning goal; instead



it should be presented to the trainees as specifically and as close to practice as possible. In Germany, good experiences have been made when the training facility itself was turned into an ecological learning object.

- *Integration of environmental protection aspects in the curricula:* In the first step, environmental protection is often considered in addition to the “normal” training content. However, if they are to be included permanently in the teaching and learning process, environmental protection references must be anchored systematically in the curricula.
- *Systematic qualification of the teaching and training staff:* Teachers and instructors are the important key group when it comes to integrating environmental issues into education and training measures, and employing suitable teaching and learning methods.
- *“Live” the ecologising process:* An environmentally friendly vocational training facility cannot be created from one day to the

next. It is a long-term process that, on the one hand, needs a high level of commitment, timely and financial resources and expertise, and on the other hand, is basically open and potentially at risk. The creation of guiding principles and organisational structures and orientation to environmental management systems are important pre-requisites. But that alone cannot ensure that the corresponding measures will be permanent. The system freezes in its routine if it is not filled with life and revived time and again with more or less spectacular actions.

### Fundamentals of learning about the environment

On the basis of empirical findings, social psychologists Fietkau and Kessel developed a relatively simple behavioural model. It illustrates how environmental behaviour can be influenced or encouraged with certain factors.<sup>17</sup>

The behavioural model contains different factors and shows how they influence human behaviour. The model does not claim to have

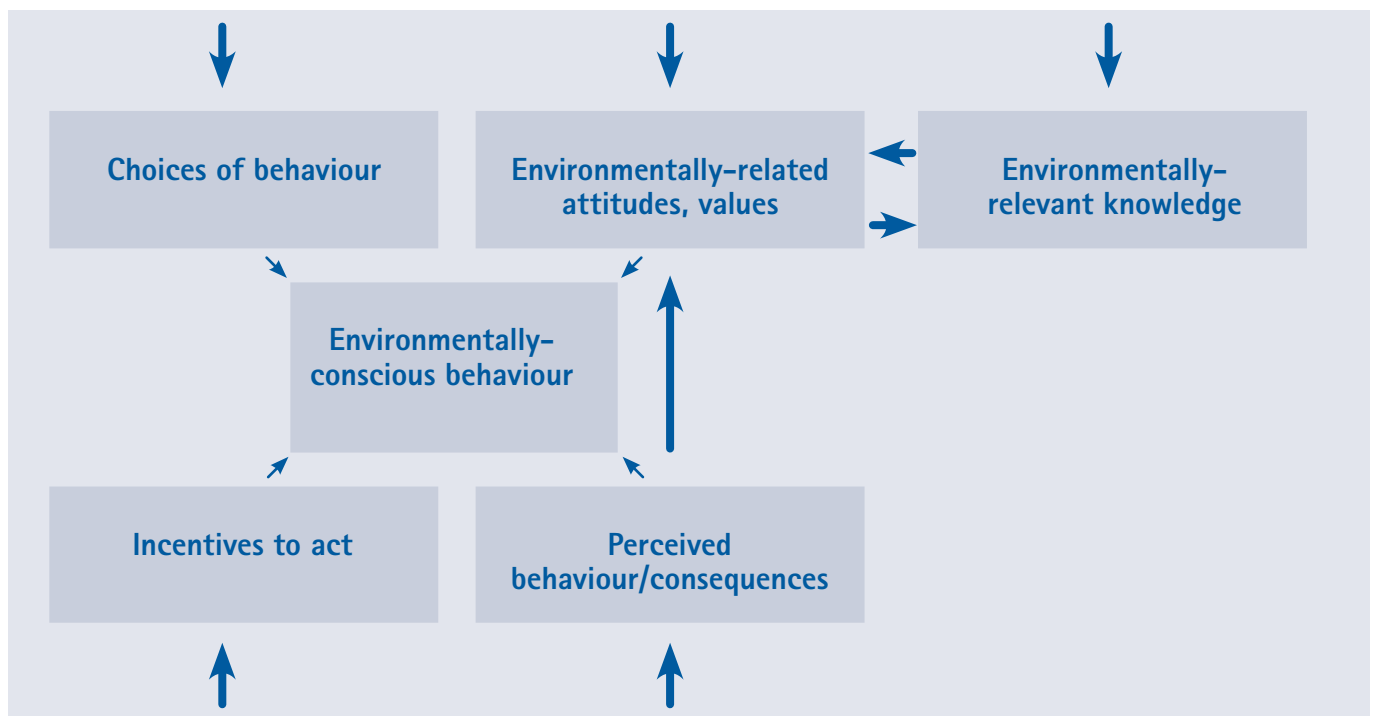


Figure 2: Starting points to encourage environmentally conscious behaviour | Acc. to Fietkau/Kessel 1982, p. 10

found an automatism to control human behaviour. However, it describes five requirements that – if they work together – increase the probability that a person will behave as desired. These are:

- environmentally-relevant knowledge;
- environmentally-related attitudes and values;
- choice of behaviour;
- incentives to act;
- perceived behaviour/consequences.

Accordingly, there are five starting points to promote environmentally conscious behaviour:

- *Impart environmentally relevant knowledge*: Usually accepted as being in the focus of vocational teaching and learning processes. But: knowledge alone does not have a direct effect on behaviour. This socio-psychological perception is not new and also not limited to the subject of environmental protection. There are many areas of learning where people do things that they know are unreasonable or even harmful. The respective knowledge affects how we act only if the associated attitude and values are there, if possible supplemented by the other behaviour-influencing factors. When knowledge is imparted, concrete training, workplace or job-related aspects of environmental protection should be stressed.
- *Impart environmentally-related attitudes and values*: The requirements for this are that environmental knowledge affects how the person acts, that he or she sees environmental protection as a high priority issue and that they are not indifferent to the subject. Also important is that the person believes it is important to improve the environmental situation at the workplace or in the training facility.

Instructors and teachers should not attempt to intensify the concerns of the trainee in terms of so-called disaster education; generally some concern already exists and too much affective concern can increase existing fears so much that they have a crippling effect and encourage avoidance reactions and resignation. It is better to increase the trainees' sense of responsibility and, for example, stress the importance of their own contribution towards improving the environmental situation in the training facility or at the workplace. It must be made clear that the trainee has specific possibilities of acting and can also help to improve

the overall situation. They must also discover that they are not alone, but that others are acting just like them.

- *Create possibilities for environmentally conscious behaviour (choices of behaviour)*: At first glance this aspect seems trite. However, it is not very promising if you educate someone about environmental risks, highlight the importance of environmental protection but, for example, do not stress the importance of avoiding and sorting waste at the workplace if there are no behavioural alternatives for the materials that are used or no suitable disposal possibilities.
- *Create incentives*: Environmentally conscious behaviour must be rewarding for the respective person. This could be economic benefits or also public praise and recognition. In this sense, it is conceivable that the employee suggestion programme could also be extended to include environmental protection aspects, or trainees' environmental protection activities could be announced at the workplace in notices, company publications, etc. Another type of incentive is to actively involve the employees in the process of identifying and eliminating environmental problems at the workplace and giving them corresponding tasks. In this way they accept responsibility in a real situation, which shows that they are also taken seriously.
- *Visualise the consequences of particular actions*: "What is the point of separating our waste here? It has no purpose." This statement shows how important it is to inform those concerned about the consequences of their actions. Examples: Which problematic working materials could we do without within a certain period of time or what quantity reductions could we achieve, what environmental impacts would this prevent? How has the waste volume developed, what cost savings have been achieved through collecting and disposing of waste separately? - But also: What additional costs have been incurred because, for example, foreign materials were deposited in certain containers? What do the disposal companies do with the sorted waste?

By continuously informing the people who are concerned about the consequences of their actions they see that "it is worthwhile" behaving in an environmentally conscious manner. This, in turn, influences attitudes and values so that the willingness to behave in an environmentally conscious manner is also strengthened via this channel.

## 3. Vocational training offers, teaching and learning aids and practical examples

### 3.1 Environmental protection in general

On the whole, the German vocational training system has responded very flexibly to the challenges of environmental protection. The flexibility and scope are major advantages of the German vocational training system for the international market. The guiding principle is the basic approach of integrating environmental protection aspects into existing occupational profiles as systematically as possible and in a specific manner, and of developing new environmental protection occupations only where this seems absolutely necessary due to specific requirements. The reason for this is that the long-term employment opportunities for specialists are estimated to be much lower than those for generalists with sound competencies in one specialist area (e.g., regenerative energies). Besides, environmental protection aspects are generally taught in the form of specific additional qualifications at an advanced train-

ing level (to a lesser extent at the basic training level). This is due to the fact that within the scope of advanced training it is possible to react much more flexibly to changes in qualification requirements where a change in the occupational profile always needs the agreement of the social partner and happens only over a relatively long period. Only when corresponding additional qualifications reflect the “state of the art” can we expect that they will be included in the training plans in the course of reorganisation or revision processes.

#### Integrative environmental training

In the section “environmental protection” of the occupational profile in the training regulations the following skills and knowledge are formulated as basic qualifications - to be taught during the entire vocational training:



Mrs Li Chunhua participated in Germany in a InWEnt training programme on environmental protection. She heads the Quality Control Department of the pipe branch of the Hebei Baoshuo Group Ltd. in Baoding (2007).

“To contribute to the avoidance of workplace-related negative environmental impacts, and especially to

- a) explain possible negative environmental impacts from the workplace and its contribution to environmental protection using examples;
- b) apply applicable environmental protection regulations in the workplace;
- c) use possibilities of economic and environmental friendly energy and material consumption;
- d) avoid waste; dispose of substances and materials in an environmentally-friendly manner.”<sup>18</sup>

These skills and knowledge should be taught integratively; in other words, throughout the entire training and, if possible, in direct connection with specific professional activities. In addition to these general formulations, depending on the environmental relevance of the job, other environmentally relevant learning goals are mentioned in direct connection with job-specific learning goals and content. The situation is similar in the plans for job-related teaching where learning goals for environmental protection are also prioritised separately.<sup>19</sup> For “Education for Sustainable Development in Schools” the Standing Conference of Ministers of Education and Cultural Affairs (KMK) in Germany together with the German Commission for UNESCO (DUK) made a recommendation in the middle of 2007.<sup>20</sup>

For more than 10 years, learning goals for environmental protection have been integrated into advanced training regulations in the course of revision and redefinition measures; all examination regulations contain the subject of environmental protection in their cross-disciplinary part. Besides knowledge about environmental law, future industrial foremen should be able to provide information about the effects of environmental protection measures on the workplace. They should also show that they have knowledge of the alternatives for keeping water and air clean, for disposal and recycling, and noise control.<sup>21</sup>

### Environmental protection in additional qualifications and new occupations

Besides integration of environmental protection aspects into vocational training in the form of basic qualifications, new fields of activity in environmental protection and specialised environmental jobs have also evolved due to new environment-related legal,

technical and/or economic requirements in Germany. On the one hand, these are extensions to existing occupations with additional environment-specific training objectives or advanced training measures (so-called “mixed environmental jobs”), such as chimney sweeps and chemical and biology laboratory technicians, and on the other hand, independent new jobs (so-called “core environment jobs”). In 2002, certain new environmental technology trades evolved in the German dual vocational training system from the first skilled trade to be established in technical environmental protection in 1984, i.e., “supply and disposal expert”. These included “sewage engineering technician”, “recycling and waste management technician”, “pipe, sewer and industrial service technician” and “water supply engineering technician”, and at the vocational college level, jobs such as “environmental protection-technical assistant” or occupations with special environmental relevance, such as “biological-technical assistant”, all of which conclude with a state examination.<sup>22</sup>

Apart from that, the plumbing, heating, refrigeration and air conditioning trades are often seen as typical environmental protection trades. For example, gas and water installation technicians use leading edge technology and precise craftsmanship to ensure that we have clean drinking water and that wastewater is disposed of in an environmentally friendly manner. Central heating and air conditioning technicians ensure that we are comfortably warm or cool with modern heating, ventilation and air conditioning systems that use as little energy as possible.

In addition, more occupations and advanced training diplomas are becoming established for specialised experts with a traditional training and specific additional qualifications for environmental protection tasks. Some of these jobs evolve from regional, sectoral advanced training initiatives via informal standards and trade association regulations until they are eventually accepted by the chambers of crafts and industry & commerce.

Germany has a large, confusing advanced training market. The German Research Institute for Vocational Education and Training estimates that there are 28,000 to 35,000 advanced training providers in the field of vocational training in Germany.<sup>23</sup> The offers range from workplace-related concepts to regulated advanced training occupations.

The German employment agency’s database for training and occupational profiles<sup>24</sup> lists under the keyword *Environmental protection*<sup>25</sup> as

“advanced training jobs, specialised experts and specialisations” 35 occupational profiles with direct reference to environmental protection or that have the term “environment” in the job title. They can be categorised under four general headings:

- environmental technician (e.g., waste technician/environmental technology/water supply technician, technical environmental administrator);
- environmental consultant (e.g., environmental consultant - trade);
- environmental officer (e.g., company officer for environmental protection, water protection/dangerous materials/immission control officer);
- environmental auditor (e.g., environmental auditor/environmental valuator).

In addition to the jobs that have been listed here, the above occupational profiles mainly include

- traditional trades and advanced training in the trades where extended environmental competencies are in demand due to further advances in technology and elevated awareness of the environment (customer demand), such as chimney sweep, hydraulic technician, heating, air conditioning, ventilation technician and
- continued technical training occupations in laboratories where, in some cases, increased monitoring and investigation of environmental parameters resulted in a change of the occupational profile or the required competencies (e.g., cleaning and hygiene technician).

The biggest offer in the environmental protection segment is in advanced training courses that are based on a completed vocational training. A distinction can be made between:

- foreman training courses (sewage engineering foreman);
- technician training courses (waste technician);
- other advanced vocational training courses where the trainees get a certificate or sit a chamber (of crafts/ commerce & industry)

examination (e.g., environmental expert, in-house environmental protection technician);

- advanced and contact training courses (e.g., environmental law or European environmental management).

### Teaching and learning aids and practical examples

An overview of the practical examples mentioned here can be found on the BIBB Internet portal at <http://www.bibb.de/nachhaltigkeit>. Other practical examples and an overview of the material on environmental protection in vocational training issued by BIBB can be found on the CD-ROM “Ausbildung fördert den Umweltschutz im Betrieb - Vocational training promotes environmental protection in the workplace”.<sup>26</sup>

### Qualification of the teaching and training staff

Within the scope of an economic pilot scheme sponsored by BMBF and supported by BIBB, the working group on environmental protection and vocational training at Hanover University developed and tested a three-module concept for instructors. It is split into basic seminar, working group and implementation phases, although these modules can be varied and modified depending on the practical requirements. This concept is also especially suitable for identifying environmental protection relationships in certain occupations and for developing concepts and materials to integrate environmental topics into these occupations. Because of this, the concept is described in more detail here.

#### Basic seminar<sup>27</sup>

The one- to three-day basic seminars, which are designed not to refer to specific occupations or workplaces,<sup>28</sup> aim to sensitise participants for the topic, identify environmental protection aspects in vocational training, impart knowledge about ecological connections, encourage networked thinking, show participants action-oriented methods and educational materials and encourage them to reflect on their own sphere of influence. The basic seminars have been tested in different variants. For example, it is possible to single out certain priorities (such as dealing with energy), to link the subject of environmental protection in vocational training with ecological aspects at the workplace, or to work on the basis of a specific occupational field.



In the traditional form, the basic seminar is split into six phases:

1. *Personal relationship to the topic*: Right from the start, a relationship to the instructors' occupational and/or private experiences with the subject of the seminar should be created. At this point it should also be made clear that, as active participants, the instructors can largely influence how the seminar proceeds. In the middle of the seminar room is a heap of environmentally relevant objects. (This could include paints and varnishes, detergents, all types of waste as well as plants and environmentally friendly products; it is important that these objects have a negative or positive relationship to the environment and that there is some connection to the occupations of the participants). The participants take their seats, which are arranged around the heap. After the facilitator has welcomed them and given them a brief introduction to the objectives, nature and individual blocks of the seminar, the participants are told to take a closer look at the objects, pick one of them that is relevant to them and then present this to the rest of the group. Besides naming the object and its origin, and describing the training tasks, the participants should choose the object because of its relationship to the environment, and also justify their choice by explaining its relationship to their occupational and/or private experiences. In the second round the participants are asked to describe what they expect from the seminar; these expectations are written down on cards, sorted, and compared with the planned material that was to be handled in the seminar.
2. *Comparability and systematisation of the experiences*: The special feature of groups put together from different occupations is that the participants contribute completely different, personally shaped ideas about the objective of the seminar. This subjective orientation should be used for comparison, reflection and systematisation. Working groups are formed from different occupations and workplaces. These groups are asked to systematise and graphically present the objects they selected in the first phase according to self-chosen classification criteria (e.g., use, properties, health risks, environmental protection aspects, etc.). The results from the groups are then presented and evaluated in the plenary session.
3. *Functional aspects of a company's environmental problem*: In this phase, the basic content and the reference points for the rest of the seminar work are established by using examples. The participants should largely develop this functional information themselves. They may also be supported by experts, media or

training material. The use of case studies has proven to be a suitable method.

4. *Networks*: For a complete consideration of the selected subject matter and for the participants to assess their responsibilities and what they can actually do, it is important to explain and evaluate how the topic is interconnected with other topics. For this purpose, a network of the elements that make up the topic is created. In the next step the paper computer developed by F. Vester is presented and tested as a tool to evaluate the influence of the different elements in networked systems. Based on the active, critical, passive and buffering elements identified with the help of the paper computer, starting points for possible intervention are discussed.
5. *Action options and barriers*: Instructors can influence the situation in their company - indirectly via training measures and by acting as a role model, or directly through their own actions. This depends, among other things, on how they see their own role and how they estimate the options and barriers for action. A discussion about the viewpoints of instructors from other occupational fields and other companies can be very useful here. Role playing can be used to start the discussion. In this case, an imagined training situation in a fictitious company is specified, which the participants can act out relatively spontaneously. Those participants not taking part in the role-playing are asked to pay attention to their view of typical behaviour of and typical statements from the actors, especially the instructor. After a short evaluation, working groups are formed and asked to develop options and barriers for action in the situation that was played out (or in a similar situation). The results from the groups are then presented and discussed in the plenary session.
6. *Environmental protection in in-house vocational training*: In the seminar, content and methods are used that could also be used in vocational training. In the phase following this seminar, suggestions and assistance are given for handling environmental protection content in vocational training. In addition, leeway is also given for participants to describe their own implementation ideas. Firstly, the participants who already have experience in teaching environmental protection content in vocational training are given the opportunity of presenting these ideas. There are some requirements when it comes to considering other practical examples and claims that are formulated in literature as regards implementing environmental protection in vocational training.

In the subsequent group work, the participants have the opportunity to describe their initial ideas about concrete training projects for in-house environmental education and training.

### Developing and implementing training concepts and materials in working groups

The development phase focuses on occupation-related, yet cross-professional, working groups of instructors.<sup>29</sup> Here, instructors develop a training and environmentally relevant topic in a functional and didactic-methodical manner largely on their own, where they learn competencies to integrate environmental protection into vocational training by example. The third phase aims to implement the training material into practical training and to structurally anchor the training staff's integration efforts in the context of the underlying conditions in the workplace or educational institution. The latter is decisive for the continuation and also for the coverage of the qualification efforts. As an alternative to working groups, training material can also be developed in professional and subject-related advanced training seminars. Good experiences have also been made with this method; however, the preparation effort is relatively high.

“These three stages (from the basic seminar to systemic organisation development) describe the conceptual framework of environmentally-related advanced training for instructors from companies, which is basically found in all other pilot schemes - modified and adapted - and which could probably be used widely.”<sup>30</sup> One example of modification is the qualification approach, “Action-oriented learning in environmental training and improving the learning venue cooperation (MODUM)”, tested by Bildungswerk der Sächsischen Wirtschaft e.V., in which the first two stages of the qualification concept developed in Hanover were transferred to the joint qualification of instructors and teachers from vocational institutions. On an international level, the qualification concept proved its suitability within the framework of the German-Brazilian cooperation project *Horizons 21*.<sup>31</sup>

### Help to ecologise vocational education and training facilities

Specific references to the ecological restructuring and reorientation of the school can be found in a handout for head teachers of Bavarian schools.<sup>32</sup> Buddensiek presented a working aid that provides assistance for examining the environmental and social compatibility of a school based on six investigation areas with a total of 30 investigation fields.<sup>33</sup> The two-volume guide for environmentally compatible schools, published in 1996 by the Hamburg school

authority, contains specific recommendations, hints and practical examples for everyone involved in the school (including pupils, teachers, head teachers, janitors/cleaning staff, administration, canteen staff, supervisory authority staff).<sup>34</sup>

How environmental protection and environmental training can be systematically integrated into company and company-external vocational training facilities and in SMEs is shown in the “*Handbuch zur Umweltbildung für die Ausbildungspraxis*” (Manual for Environmental Education for Practical Vocational Training) that was compiled within the scope of a pilot scheme for the economy sponsored by the German Federal Ministry of Education and Research (BMBF) and functionally supported by the German Federal Institute for Vocational Education and Training (BIBB).<sup>35</sup>

Mertineit suggested how organisations could be ecologised on the basis of EMAS.<sup>36</sup> Features of this approach include defining a guiding principle or an environmental policy, systematic evaluations of the situation, formulation of environmental goals and programmes, introduction of an environmental management system, systematic information, qualification and involvement of the employees (target group-specifically) and a continuous process of improvement.

In the meantime, concepts for sustainable management of vocational education and training facilities over and above environmental protection aspects are available.<sup>37</sup>

### Training providers and demonstration facilities

Based on the model of the Centre for Energy, Water & Environmental Technology (ZEWU) established in Hamburg in 1985, and the Centre for Environmental Protection and Energy Technology (UHZ) in Oberhausen established by Düsseldorf Chamber of Crafts in 1990, in the period from 1992 to 1995, seven environmental centres for trade were built at eight locations according to a basic concept of the German Confederation of Skilled Crafts (ZDH), with start-up promotion provided by the German Federal Foundation for the Environment (DBU). Apart from consulting services, the environmental centres also offer a comprehensive range of qualifications. In addition to a general basic offer that can be found in all of the environmental centres, the individual centres focus on different areas.<sup>38</sup> The environmentally-related qualifications of the German chambers of crafts and industry & commerce are listed in the database at <http://www.ihk.umkis.de>.

## 3.2 Energy efficiency/use of renewable energies<sup>39</sup>

### Integrative environmental training

Rational use of energy in Germany is integrated into the training regulations of all occupations requiring formal training as part of the section “environmental protection” of the occupational profile. There it says: “Make use of the possibilities of economic energy and material consumption”. Since usually an occupation-specific specification of this learning goal is lacking in the general training plan, in practice rational energy consumption is often limited to “switching off the lights”. For this reason occupation-specific specification is recommended.

In Germany, there are no occupations requiring formal training (such as the “solarteur” in Austria) based specifically on renewable energies. Explicit references to handling solar thermal and photovoltaic installations are contained in the training regulations for plant mechanics for sanitary, heating and air conditioning systems, electronics technicians for building and energy systems, and roofers. From a differentiated aspect and from a functional viewpoint only the plumbing, air conditioning, refrigeration and heating trades offer good access to solar thermal systems, while electricians would have good access to the field of photovoltaics. Roofers only learn about the subject in a one-week course during their vocational training. Completed training schemes in the three occupations offer good formal requirements for advanced training to become a “solarteur”. On the other hand, the occupation of mechatronics fitter offers the best professional requirements to enter occupations requiring advanced training qualifications, such as service technician for wind power systems.<sup>40</sup> Apart from this, several vocational education schools offer full training schemes in the area of renewable energies. One example of this is “assistant for renewable energies and energy management”.<sup>41</sup>

### Environmental protection in additional qualifications and new occupations

The choice of advanced vocational training in renewable energies is vast and the courses vary considerably in terms of quantity (from just a few to several hundred hours) and quality.

Many advanced vocational training courses are offered by the chambers of crafts and by the professional trade associations. In addition to extensive advanced training courses for certified “solar-

teurs”, there are also shorter, practice-based offers, such as “technician for environmentally friendly energy technologies”, offered by the Chamber of Crafts in Münster, Germany. Very popular among the advanced training courses for skilled trades is the “building energy consultant” course. More than 5,000 skilled tradespeople have already passed the course.<sup>42</sup>

More advanced training courses include seminars for “energy consultant in the plumbing, heating, refrigeration and air-conditioning trades”, a 21-month distance learning course “professional building renovation” offered by the Hamburg Akademie für Fernstudien (Hamburg Distance Learning Academy) and the certification course “technician for sealing and insulation work in fit-outs” organised by the Fachverband Luftdichtigkeit im Bauwesen e.V (Association for Airtightness in Building).

The German umbrella organisation for the plumbing, heating, refrigeration and air-conditioning trades developed standard training courses for “plumbing, heating, refrigeration and air-conditioning technician for solar thermal energy”, “plumbing, heating, refrigeration and air-conditioning technician for photovoltaics” and, combined, “plumbing, heating, refrigeration and air-conditioning technician for solar technology”. The vocational training courses are aimed at foremen and skilled employees who have practical experience in one of the plumbing, heating, refrigeration and air-conditioning trades, and are offered by several vocational education and training venues. Saving energy is also a part of the 500-hour advanced training course for environmental protection consultants in the trades, which was developed by the Centre for Energy, Water & Environmental Technology (ZEWU).

In the wind power sector, an advanced training course is available for “service technician for wind power systems”, which is offered by several vocational education and training facilities in North Germany. Although the training courses have the same names, the content and examination-related structures differ.

### Teaching and learning aids and practical examples

The BIBB Internet portal contains 21 case studies and a range of teaching and learning aids for this subject.<sup>43</sup> Many of them include internal use of solar thermal energy and/or photovoltaics in the school. At the August-Sander school in Berlin trainees built solar boiler boxes.<sup>44</sup> Within the framework of the LENE pilot scheme teaching and learning materials were developed and tested in the

areas of solar thermal energy, photovoltaics, combined heat and power, energy-efficient ventilation and building system technology, and their implementation in the vocational training was supported in advanced training events. The material was published by Christiani Verlag. On the state of Hesse's education and school server, "saving energy in schools", material concerning energy efficiency in general and energy efficiency in classrooms is provided for the occupations of plant mechanic for sanitary, heating and air conditioning systems, electronics technician for industrial engineering, electronics technicians for building and energy systems and electronics technician for energy and building systems.<sup>45</sup>

### Qualification of the teaching and training staff

Courses for teacher and instructor qualification are offered by artefact gGmbH in Glücksburg, the Training Centre for the Youth (Jugendwerkstatt) Felsberg and the trade environmental centres.

### Help to ecologise vocational education and training facilities

To improve energy efficiency in vocational education and training facilities, it is possible to draw on concepts and experiences from campaigns to reduce energy consumption. Generally, these are measures requiring no investment in combination with financial incentive systems that were relatively popular from the middle of the 1990s, with names like "fifty-fifty", "Berliner Energiekonzept (Berlin energy concept)" and "Klimabündnis niedersächsischer Schulen (Climate alliance of schools in Lower Saxony)".<sup>46</sup>

### Training providers and demonstration facilities

An overview of selected vocational education and training providers and demonstration facilities in the areas of renewable energies/energy efficiency can be found in Table 3-1.<sup>47</sup>

<b>Course:</b>	<b>Using innovative energy technologies and services</b>
<b>Provider:</b>	Solarbildungszentrum Euregio Freiburg (Solar Training Institute for the Crafts), Bismarckallee 6, 79098 Freiburg, Germany, website: <a href="http://www.haustechnik.de/umweltzentrum-freiburg">http://www.haustechnik.de/umweltzentrum-freiburg</a>
<b>Course:</b>	<b>Training course for building energy consultants</b>
<b>Provider:</b>	Handwerkskammer Koblenz (Chamber of Crafts), August-Horch-Str. 6, 56070 Koblenz, Germany, website: <a href="http://www.hwk-koblenz.de">www.hwk-koblenz.de</a> This training course is also provided by several other providers.
<b>Course:</b>	<b>Training course for plumbing, heating, refrigeration, air-conditioning technicians in the area of solar thermal energy</b>
<b>Provider:</b>	Umweltzentrum des Handwerks Thüringen (Environment Centre of the Crafts Sector in Thuringia), In der Schremsche 3, 07407 Rudolstadt, Germany   This training course is also provided by several other providers.
<b>Course:</b>	<b>Solar technology in vocational training</b>
<b>Provider:</b>	Jugendwerkstatt Felsberg e.V. (Training Centre for the Youth), Sälzestr. 3a, 34587 Felsberg, Germany website: <a href="http://www.jugendwerkstatt-felsberg.de">http://www.jugendwerkstatt-felsberg.de</a>

Tab. 3-1: Selected vocational education and training providers and demonstration facilities in the areas of renewable energies/energy efficiency

<b>Course:</b>	<b>Solar technical training courses</b>
<b>Provider:</b>	Handwerkskammer Bildungszentrum Münster (Chamber of Crafts Learning Centre), Echelmeyerstr. 1-2, 48163 Münster, Germany, website: <a href="http://www.hwk-muenster.de">http://www.hwk-muenster.de</a>
<b>Course:</b>	<b>Advanced training as DGS technician for photovoltaics/solar thermal energy</b>
<b>Provider:</b>	Deutsche Gesellschaft für Sonnenenergie e.V. (International Solar Energy Society, German Section), DGS-Solarschule des Landesverbands Berlin Brandenburg, Erich-Steinfurth-Str. 6, 10243 Berlin, Germany, website: <a href="http://www.dgs-berlin.de">http://www.dgs-berlin.de</a>
<b>Course:</b>	<b>Advanced training as specialist for renewable energy technologies</b>
<b>Provider:</b>	Handwerkskammer Bildungszentrum Münster (Chamber of Crafts Learning Centre), Echelmeyerstr. 1-2, 48163 Münster, Germany, website: <a href="http://www.hwk-muenster.de">http://www.hwk-muenster.de</a>
<b>Course:</b>	<b>Advanced training as solar technician</b>
<b>Provider:</b>	Zentrum für Umwelt und Energie (Environment and Energy Centre of the Chamber of Crafts Düsseldorf), Mülheimer Strasse 6, 46049 Oberhausen, Germany website: <a href="http://www.hwk-duesseldorf.de/uzh/index.html">http://www.hwk-duesseldorf.de/uzh/index.html</a> This training course is also provided by several other providers.
<b>Course:</b>	<b>Advanced training as solarteuer</b>
<b>Provider:</b>	BZS München (Educational Centre for Solar Technology), Bergsonstrasse 109, 81245 München, Germany, website: <a href="http://www.bzs-solar.musin.de/">http://www.bzs-solar.musin.de/</a> This training course is also provided by several other providers.
<b>Course:</b>	<b>Advanced training as certified laminator acc. to DVS guideline 2220 (rotor blade service)</b>
<b>Provider:</b>	Handwerkskammer Aachen (Chamber of Crafts), Sandkaulbach 17-21, 52062 Aachen, Germany
<b>Course:</b>	<b>Advanced training as service technician for wind power system technology acc. to BZEE and Chamber of Crafts</b>
<b>Provider:</b>	Berufsbildungswerk bfw Bildungs- und Trainingszentrum für Windenergie-technik (Professional Further Education Organisation, Education and Training Centre for Wind Power Technology) Tilsiter Strasse 2-4, 28217 Bremen, Germany, website: <a href="http://www.windzentrum.de">http://www.windzentrum.de</a>
<b>Course:</b>	<b>Advanced training as service technician for rotor blade repair and maintenance in wind power systems</b>
<b>Provider:</b>	TÜV Akademie GmbH (Technical Training Academy), Pichelswerder Str. 9-11, 13597 Berlin, Germany
<b>Course:</b>	<b>Advanced training as service technician for wind power systems</b>
<b>Provider:</b>	BZEE - Bildungszentrum für erneuerbare Energien e.V. (Education Centre for Renewable Energies), Theodor-Schäfer-Strasse 14-26, 25813 Husum, Germany



### 3.3 Drinking water supply and wastewater disposal

#### Integrative environmental training

In the German vocational training regulations there is no explicit learning goal in the section “environmental protection” of the occupational profile as regards careful handling of water. However, the training plans of the relevant occupations contain learning goals for handling water-endangering substances, such as cooling lubricant and solvents, which can be used as a basis.

#### Environmental protection in additional qualifications and new occupations

In Germany, in the fields of water/wastewater there are three environmental protection occupations on the dual vocational training level.<sup>48</sup>

The training for **pipe, sewer and industrial service technicians** is carried out in the application areas of pipe, sewer and industrial service. In pipe and sewer service the technicians check sewage systems in private households for leaks, damage, deposits and contamination, for example. In the public sewer system, they carry out regular inspections and initiate any repairs that are necessary. In industrial service, the technicians empty, clean and maintain pump systems, tanks, tankers, filling systems, fermentation and beverage tanks. They check sewers and pipe connections for leaks. They also offer customer service. Generally, pipe, sewer and industrial service technicians work for companies that offer pipe and sewer services and industrial cleaning and maintenance, or in the municipal sewer monitoring service.

**Water supply engineering technicians** operate systems to recover suitable untreated water. Their work also includes storing the water in water tanks and feeding it to the water grid. They also lay pipes, install or dismantle the corresponding systems and maintain and repair pumps, pipelines and other operating equipment. They take samples, check the water quality and document the results of their work. Water supply engineering technicians mainly work in municipal and industrial water plants and for companies that treat, store and distribute water.

**Sewage engineering technicians** manage and monitor the processes in sewage treatment plants and drainage systems. They also regularly inspect and maintain pumps, retention basins and pipes,

incoming and outgoing pipelines and carry out repairs where necessary. They may also operate systems to generate energy from fermentation gases. Generally, sewage engineering technicians work in municipal or industrial sewage treatment plants or they operate and maintain drainage systems.

In a two-year full-time advanced training course at a vocational college it is possible to pass a state examination as certified **technician for sewage engineering**. Certified sewage engineering technicians can work as division manager in large-scale sewage treatment plants or as plant manager in small and medium sized sewage treatment plants. They define all the measures for wastewater drainage and treatment, coordinate the work, distribute the tasks to the individual skilled employees, and have control and management functions. They take samples, carry out measurements and interpret the results of analyses, and carry out monitoring tasks. Certified sewage engineering technicians, in particular, work in municipal sewage treatment plants or for administration unions. They may also work in industrial plants where the wastewater has to be specially treated. They may carry out monitoring and control functions for public authorities.

#### Qualification of the teaching and training staff

The German Association for Water, Wastewater and Waste (DWA) organises events to qualify teaching and training staff in the areas of water supply and wastewater disposal. The German Training and Demonstration Centre for Decentralised Sewage Treatment (BDZ) offers the appropriate qualification in the field of decentralised wastewater disposal.

#### Help to ecologise vocational education and training facilities

Individual references to environmentally friendly water/wastewater management in vocational education and training facilities can be found in the guide by the Environmentally Conscious Education and Community Centre (umweltbewusste Bildungs- und Begegnungsstätte)<sup>49</sup>, which has many checklists, and in the handout for head teachers.<sup>50</sup> Buddensiek presented a working aid that provides assistance for checking the environmental and social compatibility of schools based on 6 areas with 30 fields.<sup>51</sup> The two-volume guide on environmentally friendly schools published by the Hamburg school authority in 1996 also contains specific recommendations, pointers and practical examples.<sup>52</sup>

## Training providers and demonstration facilities

Table 3-2 provides an overview of training providers in the area of drinking water supply and wastewater disposal.

<b>Name:</b>	<b>BDZ - Bildungs- und Demonstrationszentrum für dezentrale Abwasserbehandlung e. V.</b> (German Training and Demonstration Centre for Decentralised Sewage Treatment)
<b>Contact:</b>	Torgauer Strasse 76, D-04318 Leipzig, Germany, website: <a href="http://www.bdz-abwasser.de">http://www.bdz-abwasser.de</a>
<b>Profile:</b>	The German Training and Demonstration Centre for Decentralised Sewage Treatment is a neutral point of contact for ministries, municipalities, authorities, associations, manufacturers of small sewage treatment plant technology and others as regards sustainable water management, in which central and decentralised wastewater disposal concepts are handled equally. The focuses of the work are training and education, research and development. Manufacturers of small sewage treatment plant technology are provided with flexible sewage technology infrastructure on the site of a former sewage treatment plant in Leipzig so that they can demonstrate their products in practice – in the sense of a permanent exhibition.
<b>Name:</b>	<b>DWA - Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e. V.</b> (German Association for Water, Wastewater and Waste)
<b>Contact:</b>	Theodor-Heuss-Allee 17, 53773 Hennef, Germany, website: <a href="http://www.dwa.de">http://www.dwa.de</a>
<b>Profile:</b>	The DWA is a politically and economically independent association. Its roughly 14,000 members include municipalities, universities, consultant engineers, authorities and companies, as well as their experts and managers. The key tasks of the DWA are training and advanced training of operating staff of water management systems. The state associations also offer the training subjects in conferences, courses, studies and in exchanges of experience for all the association's member groups, taking account of special regional features.
<b>Name:</b>	<b>BEW – Bildungszentrum für die Entsorgungs- und Wasserwirtschaft GmbH</b> (Training Centre for Waste and Water Management)
<b>Contact:</b>	Bildungsstätte Essen, Wimberstrasse 1, 45239 Essen, Internet: <a href="http://www.bew.de">http://www.bew.de</a>
<b>Profile:</b>	BEW is a not for profit limited company of the state of North-Rhine Westphalia and provides offers for various aspects of drinking water supply and wastewater disposal such as treatment technologies, measuring and analysis methods, operation of sewage treatment plants and sewage systems.

Tab. 3-2: Selected training providers and demonstration facilities for drinking water supply and wastewater disposal

## 4 . Key questions

Requirements for professional qualifications in environmental protection being developed and offered are that these topics are relevant to society, in demand by the economy and systematically integrated into the national vocational education and training system:

- linked with the ecological requirements of the respective country,
- based on skills and knowledge that are gained in the general school system,
- differentiated according to basic and advanced training and studies,
- adapted to workplace or industry-specific qualification needs.

Integration activities include the regulatory and curricular levels, qualification of the teachers and trainers, and the creation of didactic materials.

To analyse the country information in terms of needs and points of contact for environmentally-relevant qualifications in DC partner countries, it is suggested that certain questions, split into six different areas, are asked:<sup>53</sup>

**Relevance:** To integrate environmental subjects into qualification offers, the first question to be asked should be whether there is any objective relevance.

Questions:

- Is the subject matter important in the selected partner countries?  
Is it practical and feasible based on climate conditions?

**Development strategies:** The question is asked whether the subject matter is especially prioritised in the development strategy of the selected DC partner country.

Questions:

- Is the subject matter especially prioritised in the national development strategy?
- Is the subject matter expressed in priorities, programmes or projects of the German DC?
- Is the subject matter expressed in priorities, programmes or projects of other national or international donor organisations?
- What potential points of contact for vocational education and training offers could be derived?

**Politics/administration:** On this level, the question is asked whether and to what extent the selected subject matter is considered within

the framework of forming national, regional or municipal capacities, and whether there are legal and/or economic incentives for companies to act in this area. Again, questions about the potential demand for environmentally relevant vocational education and training are posed. A distinction is made between possible qualification potentials for employees of a) government and municipal authorities and facilities that result within the scope of forming capacities and b) in companies and other facilities.

Questions:

- Do government institutions create legal, economic and vocational training-related requirements so that the domestic economy can become active in this area?
- What potential points of contact for vocational education and training offers could be derived?

**Economy/companies:** Demand potential for environmentally relevant vocational education and training exists especially when companies want it. On the one hand, demand from companies – apart from the companies' commitment to the environment – can arise due to government specifications (see above) or because environmental competencies can lead to cost savings and/or open up market opportunities that could not be utilised before due to a lack of competence on the part of the employees.

Questions:

- Is the subject matter an issue for companies and economic institutions?
- Is there market potential in this area in the domestic economy?
- What points of contact for vocational education and training offers can be derived?

**Vocational education and training:** Within the framework of the topic dealt with in this guide vocational education and training has a service function insofar that it offers the appropriate qualifications. Therefore, it must be asked whether environmentally relevant vocational education and training is offered and what existing structure can be used as a point of contact, or which structure should be created.

Questions:

- Is the subject field already part of formal vocational education and training?
- What structures could be used to anchor the subjects at the various didactic levels?

- Is it practical to teach relevant environmental competencies in the form of additional qualifications or would it be better to develop an “environmental occupation”?

Question:

- What demand potentials for vocational education and training can be derived?

**Summarising assessment:** Finally, the demand potentials from the previous analyses are summarised.

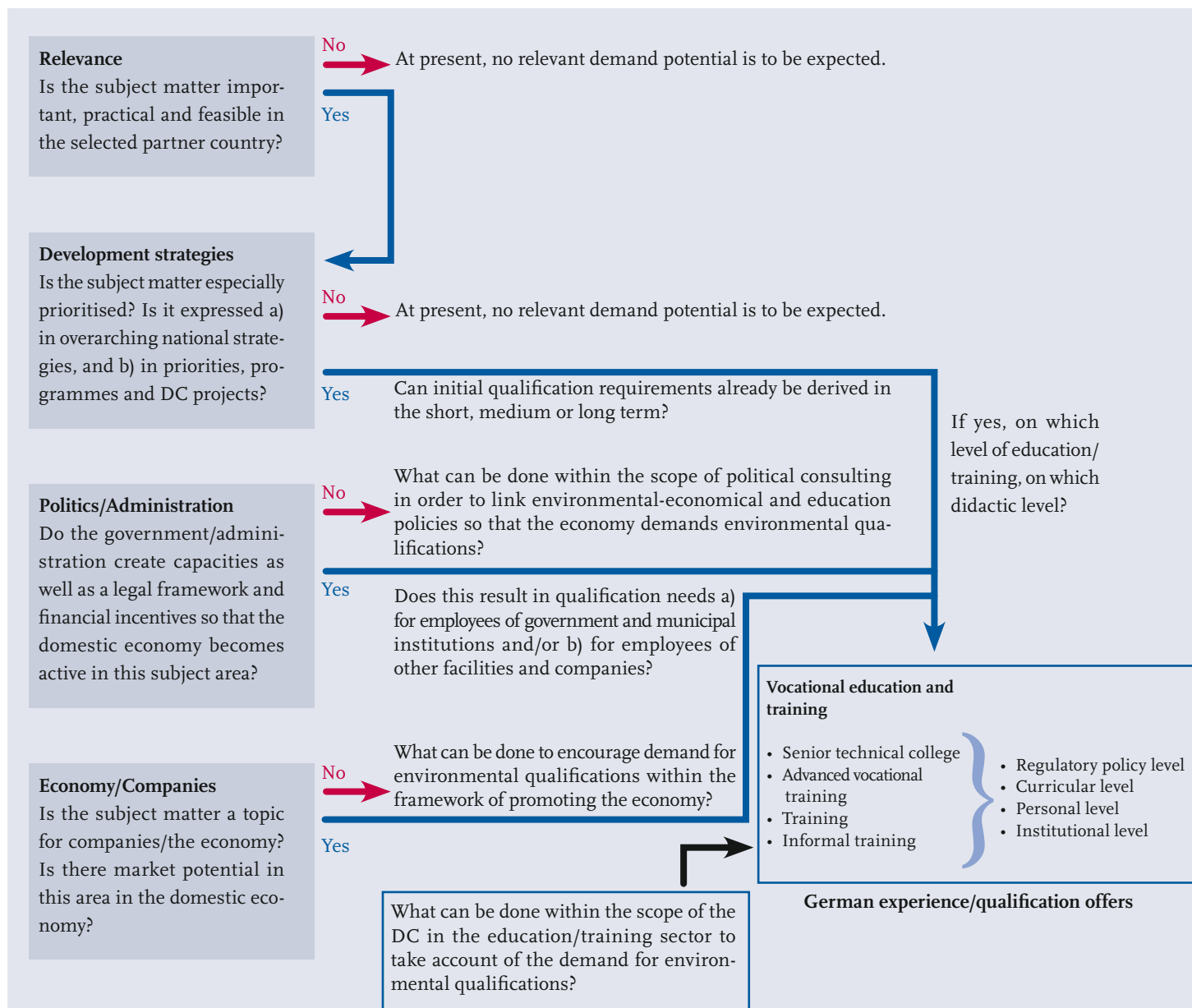


Figure 3: Key questions (source: Mertineit/Hilgers 2004, p. 14)

## 5. Points of contact for initiation and implementation activities in selected partner countries

### 5.1 Egypt

#### 5.1.1 Renewable energies/efficient use of energy

##### Relevance

**Is the subject matter important in the selected partner country?  
Is it practical and feasible based on climate conditions?**

In general, Egypt has a very good solar-energy potential and, regionally, a good wind potential, especially in the coastal regions of the Red Sea.

##### Development strategies

**Is the subject matter especially prioritised in the national development strategy?**

In Egypt, the electricity sector is relatively well developed. In spite of continuing modernisation, there are still many (thermal) power plants with low levels of efficiency and high emissions of pollutants in operation. These are operated with gas or heavy oil. At the start of the 1980s, the Ministry of Electricity and Energy included increased use of renewable energies as an integral part of its national energy plan. In terms of long-term provisions for environmentally compatible energy supply and to prevent supply bottlenecks, in 1982 the Egyptian government decided on a programme to research, develop and implement renewable energies. In 1986,



Employee at a sewage treatment plant working on a PC in a control room; November 2008, Jordan



the New and Renewable Energy Authority was formed as part of the Energy Ministry; its activities are focused mainly on solar, biomass and wind. Its aim is to generate about 14% of the country's energy needs from wind, solar and biomass by the year 2020.<sup>54</sup>

#### **Is the subject matter expressed in priorities, programmes or projects of the German DC?**

In addition to technical education and training, water supply and sanitation, the focuses of the bilateral DC with Egypt are environmental and climate protection including the promotion of renewable energies. Besides building wind parks, Germany supports the German-Egyptian Committee for Renewable Energies, Energy Efficiency and Environmental Protection. Founded at the start of 2008, its mission is to encourage knowledge transfer and to further develop the legal framework in its specialist area.<sup>55</sup>

The German KfW Entwicklungsbank supports projects to use renewable energies and for the ecological improvement of conventional power plants (reducing power plant emissions) in the course of the FC. A wind park with a total output of 600 MW is being built at Zafarana. The wind park will initially be operated by the Egyptian Energy Ministry's New and Renewable Energy Authority. In future, a private company will take over operation of the plant.<sup>56</sup> Wind power system operators estimate the wind potential from Zafarana alone at 3,000 MW.<sup>57</sup>

In the Fayed Training Centre a comprehensive, practice-oriented training system was developed for maintenance crews of thermal power plants in order to supplement the technical training with in-house, practice-based training.

Within the framework of the "Promotion of sustainable management in the Middle East through technology cooperation, employment and environmentally-oriented qualifications" project, InWEnt organised a seminar on the integration of environmental and resource protection in the development of curricula. The seminar aimed to sensitise the participants for more integration of environmental and resource protection topics in vocational education and training, to inform them about the status and prospect of integrating environmental and resource protection topics into vocational education and training, and about concepts and instruments for better integration of environmental and resource protection topics in vocational education, training and advanced training in companies and external training facilities.

#### **Is the subject matter expressed in priorities, programmes or projects of other national or international donor organisations?**

Compared to other topics, *renewable energies and efficient use of energy* is not a priority in the DC of international and national donor agencies. The World Bank is currently supporting 18 projects in Egypt (as of October 2009). These include two projects with a relationship to energy. One of these involves supplying households with electricity and the other enhancing energy supply in a sustainable manner including energy efficiency. In the energy sector, the EU is promoting the construction of natural gas-fired combined power plants and block-unit power plants, the construction of a natural gas pipeline, and the construction of natural gas liquefaction plants. Recently, a large-scale onshore wind farm project on the Red Sea coast was signed.<sup>58</sup>

#### **Politics/Administration**

##### **Do government institutions create legal, economic and vocational training-related requirements so that the domestic economy can become active in this area?**

For political reasons, energy prices are subsidised in Egypt. At present, there is no financial incentive for efficient energy consumption or the use of renewable energies. No other information is available.

#### **Economy/Companies**

##### **Is the subject matter an issue for companies and economic institutions? Is there market potential in this area in the domestic economy?**

It is not known if or to what extent Egyptian companies or foreign companies with Egyptian employees are currently committed to the use of renewable energies or the efficient use of energy apart from the fact that in future the wind park in Zafarana will be operated by a private company. Here, and in the use of solar power systems, it can be assumed that at least the installation, operation and maintenance of suitable systems will be carried out by Egyptian companies. In these areas and in terms of the efficient use of energy, it can thus be assumed that there is potential demand.

Because of the considerable solar energy potential it can be assumed that there is a corresponding market potential in this area for Egyptian SMEs. In particular, the use of solar power systems could be relevant in the hotel and tourism industries. However, this can be realised only if the employees have the necessary qualifications.

Accordingly, there is demand potential in terms of:

- installation and operation of solar power and wind power systems;
- manufacture of solar power and wind power systems and components for these;
- installation and maintenance of solar power systems (solar thermal systems and photovoltaics); maintenance of wind power systems.

#### Vocational education and training

**Is the subject field already part of formal vocational education and training? What structures could be used to anchor the subjects on the various didactic levels?**

In the Fayed Training Centre, a comprehensive, practice-oriented training system was developed for maintenance crews of thermal power plants in order to supplement the technical training with in-house, practice-based training. By integrating the energy generating companies into vocational training and advanced training, it will be possible to align the training contents more with market requirements. To implement and manage the project on a national level, a Power Plant Training Management Unit was formed. For this unit, a coaching concept was developed to train managers. The Fayed Training Centre pilot project now carries out the training on its own responsibility. Dual training is already carried out in three of five Egyptian electricity generation companies. It is planned that the cooperative (dual) training system will be extended to cover the entire energy sector. It may be possible to integrate aspects of renewable energies and efficient use of energy, and qualify the teachers and instructors accordingly.

In the PVTD, with its 16 training centres, occupational safety and health is integrated into the course, but not environmental protection. There are references to environmental protection in the curricula of the Mubarak-Kohl Initiative, which is also supported by Germany. However, here, like in the PVTD, there is no evidence that the use of renewable energies or efficient use of energy is actually a subject of vocational education and training. Nevertheless, there are concrete starting points to integrate renewable energies and efficient use of energy into the training and advanced training systems.

On a curricular level:

- to integrate and specify for the specific occupations the rational use of energy as a learning goal in the training and advanced training curricula and in the training and advanced training of

the teaching and training staff;

- to integrate the demand potentials listed in *Development strategies, Politics/administration* and *Economy/companies* into existing and/or new training and advanced training courses.

On a personnel level:

- qualify the teachers and instructors in the areas of rational energy use and, if relevant, the use of renewable energies functionally, didactically and methodologically.

On an institutional level:

- equip and operate the vocational education and training facilities sponsored by the German DC in an energy efficient manner so that they can be used as real learning material at the facilities.

#### Summarising assessment:

**What demand potentials for vocational education and training can be derived?**

Because of the planned increase in the use of renewable energies it can be assumed that there will be a need for qualification in the medium to long term. Table 5-1 shows the areas where this is to be expected.

To ensure the necessary structural, organisational and individual requirements, the appropriate qualifications should be anchored on all didactic levels.

#### 5.1.2 Drinking water supply and wastewater disposal

##### Relevance

**Is the subject matter important in the selected partner country? Is it practical and feasible based on climate conditions?**

Egypt is one of the driest countries in the world - it seldom rains and the country has little groundwater. Farmers, industry and the population depend on the Nile. The river is the country's central water source. More than 80% of the available volume is used for agricultural irrigation and irrigation efficiency is low. Ten percent of water is used by industry and just 3% is used as drinking water. The annual useful water supply per capita is already below the water poverty threshold. Population growth and increasing living standards will reduce the available water supplies even more. On a country average, 90% of the urban population is supplied with drinking water from the public grid - but only half of the rural population. Only 60% of city dwellers and 5% of the people out-



Level	Demand potential/need
Initial training/advanced training	<ul style="list-style-type: none"><li>– Installation and maintenance of energy-efficient air conditioning</li><li>– Installation and maintenance of solar power systems (solar thermal and photovoltaics)</li><li>– Manufacture of solar power systems/components</li><li>– Installation, operation and maintenance of wind power systems</li><li>– Manufacture of wind power systems/components</li><li>– Energy consulting</li><li>– Energy-efficient building</li><li>– Preventing energy loss/efficient use of energy in the construction and operation of technical plant and buildings</li></ul>
Training facilities	<ul style="list-style-type: none"><li>– Energy-efficient education and training facilities</li><li>– Functional, didactic and methodological qualification of teachers and instructors</li></ul>
System	<ul style="list-style-type: none"><li>– Cross-occupational and specific competences for the sustainable use of energy in all vocational teaching and training curricula</li></ul>

Tab. 5-1: Demand potentials in Egypt for vocational education and training in terms of renewable energies/efficient use of energy

side the cities are connected to the public sewage system. According to estimates, demand for drinking water and industrial water will double in the next 20 years.

Only 3 - 4% of Egypt's land area can be used for agriculture. The fertile Nile sludge that used to be washed on to the soil with the annual floods, and which acted as a natural fertiliser, is now held back by the Nasser Dam. The use of artificial fertiliser as a replacement for the Nile sludge causes soil salinity and will lead to long-term worsening of the already sparse soil that is available. Attempts are being made to counteract this process by using sewage sludge to improve the soil; however, often this does not meet hygienic requirements. It often contains pathogenic germs that represent

health risks for the farm workers. In addition, with the present method the sludge is not dry enough to be spread mechanically.

Only 60% of the urban population and 10% of the rural population are connected to the sewage system. A large part of the sewage flows untreated into the agricultural irrigation canals and then into the Nile or the Mediterranean, or it seeps slowly and untreated into the groundwater. The irrigation canals are used as rubbish tips and are completely contaminated. Water contaminated with sewage gets on to the fields via the irrigation systems. This causes diseases.

## Development strategies

### **Is the subject matter especially prioritised in the national development strategy?**

The subject of sustainable water management is thus important for Egypt and is expressed in government policies. Qualification potentials in the areas of water management, drinking water and wastewater treatment and disposal as well as irrigation management exist at all levels.

### **Is the subject matter expressed in priorities, programmes or projects of the German DC?**

Besides environmental and climate protection including promotion of renewable energies and technical education and training, other priorities of the DC with Egypt are water supply and sanitation. The subjects of the DC in these priorities are advising politicians about sector reform in the areas of agricultural irrigation and drainage, improving agricultural water management, municipal water supplies for the poor population and training and advanced training.<sup>59</sup>

The aim of reforming the water sector is to shift responsibility for water supply to the country's governorates and municipalities and enable the supply companies to cover their costs for managing the water. The programme consists of four components:

- advising the holding company for water and wastewater management (HCWW);
- strengthening the operating capacities in the Quena Water and Wastewater Company (QWWC), a subsidiary of HCWW;
- developing and promoting adapted sanitary concepts in rural areas;
- consulting for sector reform in water supply and wastewater management.

In cooperation with small farmers, strategies will be developed for efficient use of water in agriculture. Together with other donors, the Federal Republic of Germany helps the family-run businesses form water usage communities within which the irrigation cycles are optimised. The available water can then be used much more productively. Water losses and conflicts are minimised.<sup>60</sup> The cooperation is showing the first signs of success. The jointly developed reform strategy is represented publicly, implementation has commenced and farmers are starting to reap the benefits from new irrigation techniques. The user community that was formed for this purpose in Kafr El Sheikh operates the wastewater treatment

system and bears the ongoing costs. Before this, within the scope of a joint project the German Technical Cooperation (GTZ) and the KfW Entwicklungsbank provided hygienically safe, adapted low-cost wastewater disposal solutions (septic tanks) for 30% of the local population. Qualification measures should ensure that the maintenance and operation of the septic tanks that the locals built can largely be carried out by local people, which will also create jobs. Local small farmers are also being taught how to use sewage sludge as a fertiliser and how to apply it properly. This opens up a window to provide vocational education and training facilities that offer the corresponding qualifications within the scope of disseminating these techniques. If they should become established, suitable qualifications could be included in the national vocational education and training system.

InWEnt offers “qualification for sustainable water management in the Middle East” for managerial staff in planning and research institutions, water/wastewater authorities and ministries and in private water management companies. Broad-based technical knowledge is taught and management of the various institutions is improved. Regional cooperations and networks are promoted to transfer knowledge.

### **Is the subject matter expressed in priorities, programmes or projects of other national or international donor organisations?**

Improvements in the water/wastewater areas is also a focal point of the DC of other donor agencies in Egypt. The World Bank is currently supporting 18 projects in Egypt. These include two projects involving integrated irrigation concepts; another project aims to improve the wastewater disposal infrastructure in selected regions.

## Politics/Administration

### **Do government institutions create legal, economic and vocational training-related requirements so that the domestic economy can become active in this area?**

In Egypt numerous ministries, authorities and institutions are involved in the water sector. This requires considerable coordination. Both drinking water supply and wastewater disposal are legally regulated but not very effective. Government investments to protect the environment and resources increased from USD 430 in 1992 to about USD 3 billion in 2003. Most investments were in drinking water supply and wastewater disposal systems.<sup>61</sup>

In Egypt, the water supply and wastewater sectors have been undergoing a dynamic reform process for several years. The current focus is on improving the underlying organisational and institutional conditions. Increasingly, responsibilities are being transferred from the governorates to newly founded water companies that are gradually being aggregated under the umbrella of the state Holding Company for Water and Wastewater (HCWW), which was formed in 2004. The step towards commercialisation should improve the situation in the water and wastewater sectors considerably. The first signs of success have already been recorded: While just a few years ago, 8 million Egyptian pounds were charged for water in Cairo, this has now risen to 52 million pounds. The reason: The HCWW has installed new water meters and ensured that water consumption is not only metered properly but also paid for. Each year, 20,000 water meters will be added.

The Water Ministry has introduced institutional reform for water resource management. To manage and coordinate the reform process an Institutional Reform Unit that reports directly to the minister was established. The new national water resource policy (2002 to 2017) first had to rectify major shortages of personnel and management staff. Even though about 70% of managers were due to reach pension age by the end of 2005, no thought was paid to successors. Within the framework of a project by the Egyptian-German DC, young managers and efficient personnel were qualified for the responsible organisations. The Regional Centre for Training and Water Studies – RCTWS, which is connected to the Ministry for Water Resources and Irrigation, is advised in the development and organisation of training courses. It is also helped in the establishment of a training programme especially for management of the reform measures.

Qualification of employees in the relevant ministries and authorities has already been planned in the corresponding DC projects. However, it can be assumed that in the HCWW there is a considerable need for qualification at the skilled worker level. If the costs for use of drinking water are reflected in the income and loss statements, especially of water-intensive industries, there is sure to be a need for personnel qualified to use water efficiently.

#### Economy/Companies

**Is the subject matter an issue for companies and economic institutions?  
Is there market potential in this area in the domestic economy?**

In the meantime, relatively high amounts of money have been invested to improve sewage treatment. Pioneers are the sugar,

paper, detergent and textile industries, where the wastewater is treated or at least pre-treated.<sup>62</sup>

Interviews with experts that the author carried out on behalf of InWEnt while staying in Cairo in December 2007 showed that:

- Most drinking water systems work ineffectively and are badly maintained. The operating staff are inadequately qualified and badly paid. Much of the drinking water seeps away unnoticed because of leaks in the pipeline system.
- Most wastewater systems are not operated properly or maintained regularly. The staff have no understanding of the technical processes. As a result of this, the systems a) do not adhere to their discharge values and b) have only a very limited life.
- According to the experts, in general, careful use of water or effective wastewater treatment has no priority in companies.
- The technical study courses do not qualify the engineers adequately for environmental protection tasks in the companies. There are no special training courses for the water or wastewater sectors.
- On a skilled worker level we cannot assume that they have any basic knowledge of environmental protection. Several experts also complain about the lack of understanding for the processes at a skilled worker level. Because of this, mistakes are common.
- The HCWW sees considerable qualification requirements at the skilled worker level and there is a lot of interest in cooperation in this area; perhaps also in the course of developing specific technical water and wastewater occupations.

Qualifications are therefore needed

- for personnel in drinking water recovery, treatment and distribution systems. The aim is that they detect leaks, repair the pipelines and respond quickly in case of leaks;
- for personnel in water and sewage treatment plants. Several experts see a need for special technical water and wastewater occupations, especially at HCWW;
- for engineers: There are no practice-related or functionally sound study courses that prepare future engineers for working with environmental-technical or water/wastewater-technical systems;
- for employees in all areas of industry. It is recommended, like in Germany, to link basic qualifications in environmental protection with resource/energy efficiency (including waste avoidance) and occupational safety (including handling hazardous materials).



### Vocational education and training

#### Is the subject field already part of formal vocational education and training? What structures could be used to anchor the subjects on the various didactic levels?

Several ministries are involved along the process chain of water recovery/distribution - water usage/consumption - wastewater treatment/discharge. Every ministry has its own training centres. It was not possible to ascertain the extent to which suitable qualifications are offered. Vocational qualifications in the area of water/wastewater are not taught in the PVTD training institutes or in the MKI vocational education and training facilities. Nevertheless, con-

scious handling of this element (economical consumption, cleanliness) should be part of the basic qualification of every formal vocational training. Here, there are specific starting points to integrate the sustainable use of water in all occupations and across all didactic levels of vocational training and advanced training.

On a curricular level:

- to substantiate and specify for the specific occupations the sustainable use of water as a learning goal in the training and advanced training curricula and in the training and advanced training of the teaching and training staff;

Level	Demand potential/need
<b>Informal</b>	Basic qualification in the use of treated wastewater or mixed water in agricultural irrigation Basic qualification in the use of soakaways and simple sewage treatment techniques Basic qualification in the use of and potential applications for sewage sludge in agriculture
<b>Advanced training</b>	Additional qualification “water supply technology” Additional qualification “plumbing technology” Additional qualification “sewage engineering” Installation and maintenance of simple, local sewage treatment plants
<b>Training facilities</b>	Water-efficient training facilities Functional, didactic, methodological qualification of the teaching and training staff
<b>System</b>	Cross-occupational and specific competencies for the sustainable use of water in all vocational teaching and training curricula Cross-occupational and specific competencies for the careful use of water-endangering substances in all vocational teaching and training curricula If necessary, introduction of an environmental-technical occupation “Sewage engineering technician”

Tab. 5-2: Demand potentials in Egypt for vocational education and training in terms of drinking water supply and wastewater disposal

- to integrate cross-occupational and specific competences to handle water-endangering substances carefully in all vocational teaching and training curricula at all levels (training, advanced training), and
- to integrate the demand potentials listed in *Politics/administration* and *Economy/companies* into existing and/or new training and advanced training courses.

On a personnel level:

- to qualify the teaching and training staff to use water carefully and rationally, in functional, didactic and methodological terms.

On an institutional level:

- to equip and operate the vocational education and training facilities sponsored by the German DC in a water efficient manner so that they can be used as real learning material in the facilities.

#### Summarising assessment:

#### What demand potentials for vocational education and training can be derived?

The subject of sustainable water management is of existential importance for Egypt. There is need for qualification throughout the entire process chain (water recovery - distribution - use - disposal/recycling and agricultural irrigation). Table 5-2 shows the potential demand for vocational education and training in detail.

## 5.2 Jordan and Syria

### 5.2.1 Renewable energies/efficient use of energy

#### Relevance

#### Is the subject matter important in the selected partner countries?

#### Is it practical and feasible based on climate conditions?

In *Jordan*, because of the strong sunlight it would be practical to build and operate thermal solar power plants to cover the growing requirements for energy and drinking water. *Syria* has good natural conditions for the use of wind and solar energy. In view of the foreseeable oil and gas shortages, renewable energies have interesting development potential.

#### Development strategies

#### Is the subject matter especially prioritised in the national development strategy?

In light of increasing prices for oil and gas on the world markets, *Jordan* is considering the use of renewable energies. In summer 2004, the government put studies on solar, wind, geothermal energy and energy efficiency out to tender. In spite of the very strong sunlight, solar energy is not considered economically viable. However, at least the small technical utilisation for hot water could be developed. To date, the technology is used by less than 30% of households, or according to more plausible figures, less than 15%.<sup>63</sup> Prince Hassan Ibn Talal, the brother of the former King Hussein, is a great advocate for generating solar energy in the desert and has organised several international congresses on this subject. In cooperation with the Trans-Mediterranean Renewable Energy Cooperation (TREC), Prince Hassan is planning large-scale transfer of solar energy to Europe. A Danish company has been commissioned to plan a wind park at Jerash on the mountain range overlooking the Dead Sea.

*Syria* is gradually increasing energy prices to market levels. The cash that will be freed up from the falling subsidies will be used to develop the infrastructure, to save energy and specifically to help poorer sections of the population. Within the scope of the economic reform programme the use of renewable energies and energy efficiency will play an important role.

#### Is the subject matter expressed in priorities, programmes or projects of the German DC?

Based on available information, the use of renewable energies and the promotion of energy efficiency is not an important topic of the DC with *Jordan*. The German Federal Ministry for Economic Cooperation and Development (BMZ) is helping *Syria* to develop a master plan for energy.

Within the framework of the “Promotion of sustainable management in the Middle East through technology cooperation, employment and environmentally-oriented qualifications” project, InWEnt organised a seminar entitled “Integration of environmental and resource protection in the development of curricula” in Germany. The seminar aimed to sensitise the participants to more integration of environmental and resource protection topics in vocational education and training, to inform them about the status and prospect of integrating environmental and resource protection topics into vocational education and training, and about concepts and instruments for better integration of environmental and resource protection topics in vocational education, training and advanced training in companies and external training facilities.

**Is the subject matter expressed in priorities, programmes or projects of other national or international donor organisations?**

Renewable energy is not a focal point of the EU or WB development cooperation with either country.<sup>64</sup> However, the EU is currently sponsoring the construction and operation of two natural gas-fired combined power plants in Syria.<sup>65</sup>

**Politics/Administration**

**Do government institutions create legal, economic and vocational training-related requirements so that the domestic economy can become active in this area?**

No information is available.

**Economy/Companies**

**Is the subject matter an issue for companies and economic institutions?**

**Is there market potential in this area in the domestic economy?**

No information is available.

**Vocational education and training**

**Is the subject field already part of formal vocational education and training? What structures could be used to anchor the subjects on the various didactic levels?**

No information is available.

**Summarising assessment:**

**What demand potentials for vocational education and training can be derived?**

Because of the lack of information, no proper statements can be made. On a plausibility level, it can be assumed that currently - if at all - there is only a low demand potential for vocational education and training in the area of renewable energies. But this should change in the future.

**5.2.2 Drinking water supply and wastewater disposal**

**Relevance**

**Is the subject matter important in the selected partner countries?**

**Is it practical and feasible based on climate conditions?**

*Jordan*<sup>66</sup> is one of the driest countries in the world. At the same time, at almost 3%, population growth is very high. Since the 1980s, water consumption has exceeded the available resources, which has caused the groundwater level to drop considerably in some regions. For 2010, it is estimated that 500 million m<sup>3</sup> of water per annum will be “missing”. Because of this, water rationing has become necessary throughout the country, resulting in

latent health risks, for example, because of the population resort to drinking water from private and uncontrolled water sellers or due to contamination in water pipes. About two-thirds of the water produced still flows into agricultural irrigation, but this is still not enough to cover the farmers’ requirements. Drinking water distribution is very inefficient in parts, a lot of energy is used and water losses are about 45% on average. These losses are mainly due to the inadequate technical condition of the distribution system (in some cases unfavourable hydraulic design, unsuitable and low-quality pipe material, incorrect household connections). Supplies are also affected negatively by inadequate wastewater disposal, fertilisation by farmers and discharge of dangerous chemicals from industry. In view of Jordan’s extreme water shortage and the high production and pumping costs, every cubic metre of drinking water that is lost means great losses for the country in development policy, economic, socio-economic and ecological terms. Efficient use of water resources is thus of existential importance for the country.

*Syria*<sup>67</sup> is an arid to semi-arid country; availability of water resources varies considerably from region to region. As a scarce resource, water is the key factor in *Syria*’s development. In some areas with high population density, demand for clean drinking water can no longer be satisfied. The high population growth (2.4%) is one of the causes of water shortage in the country, which has intensified considerably over the last years. *Syria* has also had to cope with an influx of roughly 1.5 million Iraqi refugees: a large part of the Syrian population has access to public drinking water supplies. But the grids are often ramshackle, which leads to high losses; the situation is compounded by bad management in the water supply companies and the authorities. Areas on the outskirts of the cities, and thus poorer groups of people, are generally less likely to be connected to the city’s supply system and, because of this, are often forced to use worse quality water from wells and from private water sellers. The proportion of water-induced illnesses in these population groups is 38% - well above the average (20%). In addition, the price of water supplied by the vendors from tankers is ten times higher than water from the grid, which makes the poorer population strata even poorer. More than 90% of the existing water resources are used for agriculture, which remains one of *Syria*’s most important economic sectors. It generates about a third of the gross domestic product and is directly responsible for the living conditions and income of almost half the population. Overuse of the water resources has already caused a severe drop in the groundwater level. In some parts of the country this represents a severe threat to traditional farming.

Agricultural production and drinking water supply are at risk because of the discharge of untreated wastewater. In many parts of the country, wastewater is still not treated adequately. This applies to municipal wastewater as well as to wastewater from the outdated industrial plants that discharge their water into the waterways without or at best with inadequate environmental protection measures. This has serious effects on the quality of the groundwater and the surface water. The use of wastewater that has either not been treated or treated inadequately to irrigate agricultural products leads to health risks for the consumers and the farmers who come into contact with the wastewater. Hygienically unsafe water causes health problems and the poorer groups of the population are especially affected by this.

#### Development strategies

##### **Is the subject matter especially prioritised in the national development strategy?**

*Jordan* has a national water strategy covering management of the groundwater and wastewater, and including principles for irrigation and water distribution. For the water sector there also exists a planning and investment programme that was passed in 2002 and covers the period until 2011. Government policy is to increasingly use treated wastewater and mixed water in agriculture instead of drinking water. At present, 40 sewage treatment plants are in operation - half of them private and the other half state owned - whose wastewater is to be used for agriculture. No new irrigation areas are to be approved. The first privatisation steps have been taken in the water supply and wastewater disposal sectors.

In *Syria*, the subject of environmental protection was neglected by politicians for a long time. Integration of environmental aspects in the sector strategies is very slow. The Syrian government is faced with the challenge of ensuring an adequate and hygienic supply of drinking water in the long term. In addition to investments, reform in the water sector is urgently needed to reduce the environmental and health impacts and to supply the population with drinking water in the long term.

##### **Is the subject matter expressed in priorities, programmes or projects of the German DC?**

In *Jordan*, the water sector has been the only declared priority area for the German DC since 2001. Ultimately, the aim is - in agreement with other donor agencies - to ensure an integrated, in other words an economically efficient, socially equitable and ecologically sustainable, water resource management system. This involves

the corresponding use of renewable water resources, a reduction of technical and administrative water losses, the development of wastewater disposal facilities, use of treated wastewater for agricultural irrigation instead of drinking water, groundwater protection and institutional reinforcement with the involvement of the private sector. The German DC mainly helps the Jordanian authorities implement demand-oriented water policies in practice. This is supported with investments to reduce water losses in the distribution networks, to protect resources and to reuse treated wastewater in agriculture. Investments in municipal water management are linked to reforms in the sector. Supply companies are working towards improving cost coverage with improved efficiency, better service quality and customer orientation (corporate governance). These goals are to be reached especially with institutional restructuring and decentralisation, commercialisation and the involvement of the private sector, as well as by optimising the water supply and wastewater disposal systems. So as not to overuse the groundwater reserves, water resources are to be protected in terms of quality and quantity through increased use of lower-quality water (brackish water, treated wastewater) to substitute fresh water in agricultural irrigation and by optimising the supply and disposal systems.

The focal point of the cooperation 2001-2009 between the German *Federal* Institute for Geosciences and Natural Resources (BGR) and the Jordanian water authorities was to protect water resources against contamination and overuse. The BGR supported the water ministry, its subordinate authorities and other institutions in the development of functional competencies, and promoted the necessary institutional cooperation. One objective of the cooperation was to anchor protection of groundwater and surface water in the law. The BGR has made suggestions for the respective laws and regulations. Charts for contamination sensitivity of the groundwater in Jordan have also been compiled, which could be considered in groundwater-relevant approval proceedings, such as for landfill sites, sewage treatment plants and industrial sites. Several conservation areas for groundwater have also been identified and suitable recommendations for restrictions in the use of the land have been made.<sup>68</sup>

The German Technical Cooperation (GTZ) has been active in Jordan in the areas of water, water-related environmental and resource protection since 2001. Its activities have been concentrated locally in Greater Amman, the Jordan valley and the north of the country where 90% of the available water is consumed. The focuses are in

the areas of institutional structural reform and participation by the private sector, the sustainable use of treated wastewater, improvements in operational management of water supply and wastewater systems, and integrated information management.<sup>69</sup>

The KfW Entwicklungsbank is also involved in several water/wastewater projects in Jordan. Technical water losses are to be reduced with the FC programme “Use and management of water resources”. The focus is on installing new small water supply pipelines and household connections. Consultants support the project sponsor in the planning and construction activities and also in ensuring uniform quality of the building work in all parts of the programme. It is expected that when the project is completed about 2.5 million cubic metres of water each year can be prevented from being lost due to leaks - a volume that can supply roughly 70,000 more people with enough water. Another programme priority relates to funding for the construction of a mechanical-biological sewage treatment plant, including the necessary pipelines.<sup>70</sup>

In the MENA region, InWEnt offers advanced training courses dealing with water issues in which broad-based technical knowledge is taught and management of the various institutions is improved. Regional cooperations and networks are promoted to encourage knowledge transfer.

Besides sustainable economic development, drinking water supply and wastewater disposal are the focuses of the German DC with *Syria*. To promote sustainable use of water resources, Germany is helping Syria reform the water sector. Water and wastewater systems are being modernised, institutions are being advised in terms of resource management and skilled workers are being trained. Important elements of the reform are cost-covering and socially equitable tariffs as well as autonomous operating companies. They have a model function and can be transferred to other public property and sectors. In this area, Germany is the biggest donor and works closely together with other parties, especially the European Investment Bank (EIB).<sup>71</sup>

In terms of water and the environment, the German Technical Cooperation (GTZ) is working in Syria, focusing on an integrated approach to water resource management (including the use of a suitable price and subsidy scheme), in order to improve the long-term situation as regards drinking water supply and the provision of water resources for farmers. The Syrian partners are supported by the development of investment projects for wastewater treat-

ment and the supply of drinking water, the development of strategic approaches for investment projects and the organisational structure of the sector. The measures are supplemented by a training programme for Syrian skilled workers. Another field of work will involve improving information management to process the necessary hydraulic data and to aggregate the fragmented responsibilities of the Syrian ministries and downstream authorities. It is planned to aggregate the projects in a programme to support the Syrian water sector. A professional network to improve knowledge transfer between the Syrian skilled workers employed in the sector is to be established and supported. A PPP cooperation project to build a biological sewage treatment system is in the planning stage.<sup>72</sup>

In Syria, the KfW Entwicklungsbank is carrying out a project “reduction of water losses” in Aleppo. This involves financing investments in the water grid.<sup>73</sup>

#### **Is the subject matter expressed in priorities, programmes or projects of other national or international donor organisations?**

The World Bank is currently supporting 7 projects in *Jordan* (2009). There are no explicit projects in the water sector. The World Bank is currently not involved in *Syria*.

In *Syria*, the EU is currently sponsoring a project involving the development of new water supply and wastewater disposal infrastructure in 14 municipalities.<sup>74</sup>

#### **Politics/Administration**

#### **Do government institutions create legal, economic and vocational training-related requirements so that the domestic economy can become active in this area?**

*Jordan and Syria:* Due to the low water prices and high government subsidies for water supply, there are no financial incentives to use water economically; this also applies to farmers, the biggest consumers of water in Jordan.

In both countries it can be assumed that there is basic potential demand as regards the creation and implementation of water management concepts for employees of government and municipal authorities and facilities. The same applies to the area of agricultural irrigation and drainage. Here, there are potential qualification requirements in terms of efficient, environmentally compatible irrigation and drainage systems among the employees of the responsible authorities. In *Jordan* in 2004, a great demand for



advanced training for skilled workers and for teachers and instructors was determined by government institutions, such as the Ministry for Water and Irrigation, and the downstream authorities. The Jordanian Ministry for the Environment needed advanced training in the field of training management for environmental and resource protection.<sup>75</sup>

#### Economy/Companies

**Is the subject matter an issue for companies and economic institutions?**

**Is there market potential in this area in the domestic economy?**

*Jordan and Syria:* Regardless of whether drinking water supply and wastewater treatment are handled by government institutions, or whether private companies are or are to become involved, it can be assumed that the personnel employed in these areas must have the necessary qualifications. There would seem to be a need for qualification in the areas of water management, treatment and distribution (including laying pipes and creating household connections). There would also appear to be a lot of demand in agricultural irrigation. Specifically, potential demand can be seen in the areas of

- basic qualifications to use treated wastewater or mixed water for agricultural irrigation;
- additional qualifications “water supply technology” and “efficient irrigation technology”.

In the area of water cleanliness and water treatment/sewage, qualifications are needed, on the one hand for planning, construction and maintenance of industrial and municipal sewage treatment plants; and on the other hand, qualifications are needed in all commercial activities that have an effect on the cleanliness of waterways:

- basic qualification in the construction, maintenance and operation of central and decentralised sewage treatment plants;
- basic qualification in the “sustainable use of water” specified for particular occupations in all vocational education and training curricula;
- basic qualification in the “careful use of water-endangering substances” specified for particular occupations in all vocational education and training curricula;
- additional qualification “sewage engineering”.

#### Vocational education and training

**Is the subject field already part of formal vocational education and**

**training? What structures could be used to anchor the subjects on the various didactic levels?**

In *Jordan*, there are approaches for integrating environmental and resource protection into vocational education and training. At the inaugural national training development conference initiated by King Hussein in 1987, principles for environmental education were determined and the institutions that carried out education and training work, also vocational training, were asked to carry out training measures in the area of environmental protection. As a result, the first environmental protection aspects were included in the teaching curricula of vocational education and training courses. The labour ministry’s Directorate of Occupational Safety and Health and the Environment has a key role, as it developed occupational safety and health regulations. It is planned to train technical personnel, instructors and supervisors to encourage increased efficiency and professionalism in the areas of environmental protection and occupational health.<sup>76</sup> In 2004, training institutions indicated that there was a need for long-term training for trainers, as well as for adaptations in the teaching curricula and teaching methods.<sup>77</sup> It could not be determined whether it would be possible to offer special qualification courses or modules for water/wastewater in vocational education and training.

Also in *Syria* the subject of environmental protection is now being integrated into selected vocational training courses. Sustainable use of water is not yet an explicit subject of vocational education and training.

Basically, conscious handling of this element (economical consumption, cleanliness) should be part of the basic qualification of every formal vocational training course.

In vocational training facilities there are specific starting points to integrate the sustainable use of water in all occupations and across all didactic levels of vocational training and advanced training.

On a curricular level:

- to substantiate and specify for the specific occupations the sustainable use of water as a learning goal in the training and advanced training curricula and in the training and advanced training of the teaching and training staff;
- to integrate cross-occupational and specific competences to handle water-endangering substances carefully in all vocational teaching and training curricula across all levels (training, advanced training, senior technical college), and

- to integrate the demand potentials listed in *Politics/administration* and *Economy/companies* into existing and/or new training and advanced training courses.

On a personnel level:

- to qualify the teaching and training staff to use water carefully and rationally, in functional, didactic and methodological terms.

On an institutional level:

- to equip and operate the vocational education and training facilities sponsored by the German DC in a water efficient manner so that they can be used as real learning material in the facilities.

#### Summarising assessment:

The provision of hygienically safe drinking water, sustainable management of the water resources, as well as technically safe wastewa-

ter disposal and efficient use of treated wastewater in agriculture are key factors for sustainable development in Jordan and Syria. These aspects are considered in the national development strategies of both countries and are also reflected in the programmes and projects of the DC. The aim is to reform both policies and administration as well as to achieve technical improvements and innovations.

There seems to be a lack of specialised skilled workers in this area, which means that there is demand for water-specific qualifications or occupational profiles in the public sector and in trade and industry. Table 5-3 shows the potential demand for vocational education and training in detail.

Level	Demand potential/need
<b>Informal</b>	Basic qualification in the use of treated wastewater or mixed water in agricultural irrigation Basic qualification in the use of soakaways and simple sewage treatment techniques Basic qualification in the use of and potential applications for sewage sludge in agriculture
<b>Advanced training</b>	Additional qualification “water supply technology” Additional qualification “plumbing technology” Additional qualification “sewage engineering” Installation and maintenance of simple, local sewage treatment plants
<b>Training facilities</b>	Water-efficient training facilities Functional, didactic, methodological qualification of the teaching and training staff
<b>System</b>	Cross-occupational and specific competencies for the sustainable use of water in all vocational teaching and training curricula Cross-occupational and specific competencies for the careful use of water-endangering substances in all vocational teaching and training curricula If necessary, introduction of an environmental-technical occupation “Sewage engineering technician”

Tab. 5-3: Demand potentials in Jordan and Syria for vocational education and training in terms of drinking water supply and wastewater disposal

## 6. German experiences and qualification offers to meet demand in the selected partner countries

### 6.1 Renewable energies/efficient use of energy

Table 6-1 shows which German experiences and qualification offers can be drawn on to meet the potential demand determined in Sec-

tion 5 for the area of renewable energies/efficient use of energy, or the basis on which German experiences and qualification offers can be used to develop needs-based qualifications for the selected partner countries.

Level	Demand potential/need	German experiences/qualification offers
Initial training/ advanced training	Installation and maintenance of energy-efficient air conditioning systems	Modules on air-conditioning technology in the occupation of central heating and ventilation technician could be used.
	Manufacture of solar power systems/components	In Germany there is no specific occupation for the construction of solar power systems.
	Installation and maintenance of solar power systems (solar thermal and photovoltaics)	Many additional qualifications are available in the trades in the areas of solar thermal energy and photovoltaics. Examples: <ul style="list-style-type: none"> <li>– Training course on “solar thermal energy” for the plumbing, air conditioning, refrigeration and heating trades;</li> <li>– Advanced training as “technician for environmentally friendly energy technologies” from the Institute for Environmental Protection of Münster Chamber of Crafts;</li> <li>– “Solar technology in vocational training” (Jugendwerkstatt Felsberg/Training Centre for the Youth);</li> <li>– Advanced training as DGS technician “Photovoltaics/Solar thermal energy”;</li> <li>– Advanced training as “solar technician” by the Energy and Environment Centre in Oberhausen;</li> <li>– Advanced training as “solarteuer“, e.g. at BZS Munich.</li> </ul>
	Installation, operation and maintenance of wind power systems	The BZEE offers an advanced training course “service technician for wind power systems”; the bfw Bremen offers an advanced training course “service technician for wind power system technology” and the TÜV Rheinland Academy offers an advanced training course “service technician for rotor blade repair and maintenance in wind power systems”.
	Manufacture of wind power systems/components	In Germany there is no specific occupation for the construction of wind power systems. The Chamber of Crafts Aachen offers an advanced training course, certified “laminator”.

Tab. 6-1: Demand in the selected partner countries and German experiences and qualification offers in the areas of renewable energies/efficient use of energy

Level	Demand potential/need	German experiences/qualification offers
	Energy consulting	Meisterteam offers an approx. 250-hour advanced training course “initial consultant for energetic building renovations”; the environmental protection and occupational safety centre of Koblenz Chamber of Crafts offers a 200-hour course “building energy consultant”; saving energy is also a part of the 500-hour advanced training course developed by the ZEWU “environmental protection consultant for the trades”.
	Energy-efficient building	The environment centres for the trades offer advanced training courses “energy consultant in the plumbing, air conditioning, refrigeration and heating trades”. In addition, the 21-month distance training course “professional building renovation” offered by the Hamburg Akademie für Fernstudien (Hamburg Distance Learning Academy) and the certification course “technician for sealing and insulation work in fit-outs” by the Fachverband Luftdichtigkeit im Bauwesen e.V (Association for airtightness in building) are also available.
Training facilities	Energy-efficient education and training facilities	To improve energy efficiency in vocational education and training facilities, it is possible to draw on concepts and experiences from campaigns to reduce energy consumption. Generally, these are measures requiring no investment in combination with financial incentive systems that were relatively popular from the middle of the 1990s, with names like “fifty-fifty“, “Berliner Energiekonzept” (Berlin energy concept) and “Klimabündnis niedersächsischer Schulen” (Climate alliance of schools in Lower Saxony) cf. also Freie und Hansestadt Hamburg 1996.
	Functional, didactic and methodological qualification of the teaching and training staff	Courses for training staff qualification are offered by artefact gGmbH in Glücksburg, Jugendwerkstatt Felsberg (Training Centre for the Youth) and the trade environmental centres.
System	Integration of cross-occupational and specific competences for the rational use of energy in all vocational teaching/training curricula	Rational use of energy in Germany is integrated into the training regulations of all occupations requiring formal vocational training, as part of the section “Environmental protection” of the occupational profile. There it says: “Make use of the possibilities of economic energy and material consumption”. It is recommended that courses are substantiated for specific occupations. Suitable suggestions from teaching and learning aids and case studies can be used; however, they must be adapted to suit the specific situation in the selected partner countries.

## 6.2 Drinking water supply and wastewater disposal

Table 6-2 shows which German experiences and qualification offers can be drawn on to meet the potential demand determined

in the Section 5 for the area of drinking water supply and wastewater disposal, or the basis on which German experiences and qualification offers can be used to develop needs-based qualifications for the selected partner countries.

Level	Demand potential/need	German experiences/qualification offers
Informal	Basic qualification to use treated wastewater or mixed water for agricultural irrigation; basic qualification on the use and applications of sewage sludge in agriculture	These qualifications must be planned with a good knowledge of the local situation. The work should be carried out with providers that are, for example, active in the DC in a PPP context.
	Basic qualification in the use of soakaways and simple sewage treatment techniques	BDZ and DWA would be conceivable cooperation partners.
Training/ advanced training	Additional qualification “water supply technician”	As regards the additional qualification as water supply technician, modules from the training for “water supply engineering technician” and “pipe, sewer and industrial service technician” could be used.
	Additional qualification “irrigation technician”	An additional qualification in irrigation technology must be planned within the context of introducing the corresponding innovative technologies.
	Additional qualification “plumbing technology”	Modules from the occupation of “plant mechanic for sanitary, heating and air conditioning systems” could be used.
	Additional qualification “installation and maintenance of simple decentralised sewage treatment systems”	BDZ offers qualification events.
	Additional qualification “sewage engineering technician”	Modules from the “sewage engineering technician” training and certified “technician - sewage engineering” would be suitable.

Tab. 6-2: Demand in the selected partner countries and German experiences and qualification offers in the areas of drinking water supply and wastewater disposal



Level	Demand potential/need	German experiences/qualification offers
Training facilities	Water-efficient education and training facilities	Details can be found in Bayerisches Staatsministerium für Landesentwicklung und Umweltfragen 1996, Staatsministerium für Schulpädagogik und Bildungsforschung 1991, Bundesienk 1993, Freie und Hansestadt Hamburg 1996.
	Functional, didactic and methodological qualification of the teaching and training staff	The German Association for Water, Wastewater and Waste (DWA) offers events to qualify teaching and training staff in the areas of water supply and wastewater disposal. BDZ offers the appropriate qualification in the field of decentralised wastewater disposal.
System	Integration of cross-occupational and specific competences for the sustainable use of water in all vocational teaching/training curricula	There is no learning goal on the careful use of water in the German training regulations in the section “environmental protection” of the occupational profile; however, the training regulations and training curricula of the “water supply engineering technician” can be used for orientation.
	Integration of cross-occupational and specific competences for the careful use of water-endangering substances in all vocational teaching/training curricula	The general training plans of the relevant occupations contain learning goals for handling water-endangering substances, such as cooling lubricant and solvents that can be used as a basis. References to occupation-specific implementation are available as case studies and teaching and learning aids from the employers’ associations, for example.
	If necessary, introduction of an environmental-technical occupation “sewage engineering technician“	The “sewage engineering technician” training is a suitable basis.

## 7. Abbreviations

BBiG	Berufsbildungsgesetz (German Vocational Training Act)	FH	Fachhochschule (University of Applied Sciences)
BDZ	Bildungs- und Demonstrationszentrum für dezentrale Abwasserentsorgung e.V. (German Training and Demonstration Centre for Decentralised Sewage Treatment)	GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation)
BIBB	Bundesinstitut für Berufsbildung (German Federal Institute for Vocational Education and Training)	HCWW	Holding Company for Water and Wastewater
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe (German Federal Institute for Geosciences and Natural Resources)	HRD	Human Resources Development
BMBF	Bundesministerium für Bildung und Forschung (German Federal Ministry of Education and Research)	HWK	Handwerkskammer (Chamber of Crafts)
BMU	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	InWent	Internationale Weiterbildung und Entwicklung gGmbH, Capacity Building International, Germany
BMZ	Bundesministerium für wirtschaftliche Zusammen- arbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)	IUB	Institut für Umweltschutz in der Berufsbildung e.V. (Institute for Environmental Protection in Technical Vocational Education and Training)
BWP	Berufsbildung in Wissenschaft und Praxis (Vocational Training in Research and Practice)	KfW	Kreditanstalt für Wiederaufbau/KfW Entwicklungs- bank (KfW Development Bank)
BZEE	Bildungszentrum für erneuerbare Energien e.V. (Education Centre for Renewable Energies)	KMK	Ständige Konferenz der Kultusminister der Länder der Bundesrepublik Deutschland (Standing Confe- rence of Ministers of Education and Cultural Affairs in Germany)
BZS	Bildungszentrum für Solartechnik (Education Centre for Solar Technology)	MENA	Middle East and North Africa
CSP	Country Strategy Paper	MKI	Mubarak-Kohl Initiative
CSR	Corporate Social Responsibility	OD	Organisation Development
DBU	Deutsche Bundesstiftung Umwelt (German Federal Foundation for the Environment)	OECD	Organisation for Economic Cooperation and Develop- ment
DC	Development cooperation	PPP	Public Private Partnership
DGS	Deutsche Gesellschaft für Sonnenenergie e.V. (International Solar Energy Society, German Section)	PV	Photovoltaics
DUK	Deutsche UNESCO-Kommission (German Commission for UNESCO)	PVTD	Productivity and Vocational Training Department
DWA	Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V. (German Association for Water, Wastewater and Waste)	SHK	Sanitär-Heizung-Klima(-technik) (plumbing, heat- ing, refrigeration and air conditioning trades)
EMAS	Eco Management and Audit Scheme	SME	Small and Medium-Sized Enterprises
EE	Erneuerbare Energien (Renewable Energies)	TVET	Technical and Vocational Education and Training
EEG	Erneuerbare-Energien-Gesetz (German Renewable Energy Sources Act)	UBA	Umweltbundesamt (German Federal Environment Agency)
EIB	European Investment Bank	USD	US Dollar
EU	European Union	WB	World Bank
FC	Financial Cooperation	ZEWU	Zentrum für Energie-, Wasser- und Umwelttechnik der Handwerkskammer Hamburg (Centre for Energy, Water & Environmental Technology, Hamburg Chamber of Crafts)

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<http://infobub.arbeitsagentur.de/berufe/index.jsp>

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<http://www.bibb.de/nachhaltigkeit>

(Portal of the German Federal Institute for Vocational Education and Training on vocational training for Sustainable Development)

<http://www.bmz.de/en/issues/energie/index.html>

<http://www.bmz.de/de/laender/partnerlaender/>

(BMZ portal with country information and country-specific programmes and projects)

<http://www.eib.org/projects/regions/index.htm>

(Overview of countries, regions and projects in which the European Investment Bank is involved)

<http://www.energie-und-schule.hessen.de/index-pt.htm>

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[http://www.inwent.org/portal/internationale\\_zusammenarbeit/index.php.de](http://www.inwent.org/portal/internationale_zusammenarbeit/index.php.de)

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## 10. Endnotes

- 1 Cf. <http://www.bmz.de/en/issues/energie/energiepolitik/index.html>
- 2 Cf. BMZ 2008, p. 282
- 3 Cf. BMZ 2005, p. 17
- 4 Cf. *ibid.*, p. 18
- 5 Cf. Hilgers/Mertineit 2004; Mertineit/Hilgers 2004
- 6 Cf. Hilgers/Mertineit 2004, pp. 40 - 43
- 7 Whenever we mention environmental policies, environmental law, etc. hereafter, this should be understood in a wider sense and expressly includes the area of energy.
- 8 Kutt 2000, p. 54
- 9 Cf. Dietrich/Hahne/Winzler 2007
- 10 For the company training curricula for selected metal and commercial professions, see Schluchter 1992 and 1994. An analysis of 3,000 training goals in 26 occupations conducted for BIBB showed a reference to environmental protection aspects in 1,200 goals (Cf. Kutt 2000, p. 8).
- 11 Although they naturally anticipate company/economic underlying conditions.
- 12 Kutt 2000, p. 29
- 13 Cf. below Mertineit 1998, Hilgers/Mertineit 2002, Jungk/Mertineit 2000 and Mertineit 2002
- 14 To incorporate EMAS in vocational environmental training, see Mertineit 2002. Apart from the two mentioned, in Germany other environmental management approaches and concepts with varying coverage are used. BMU/UBA 2005 contains a relatively recent overview.
- 15 Cf. Hilgers/Mertineit 2005; Mertineit 2006
- 16 Corporate Social Responsibility (CSR) is a concept from the European Union. This refers to voluntary corporate actions over and above the company's actual business activities that also accept social responsibility and integrate social and ecological needs into their business and in their relationships with the stakeholders (Cf. CSR Europe 2007).
- 17 Cf. Fietkau/Kessel 1991, p. 10
- 18 BMBF 1998, Sect. 3.3.1.
- 19 Apart from job-related learning goals, this also includes personality-oriented learning goals.
- 20 Cf. KMK/DUK 2007
- 21 To date the chambers of industry and commerce have passed advanced training regulations for the following professions (acc. to Section 46,1 BBiG and Section 42,1 HwO): energy consultant for trades, recycling and waste management technician, recycling mechanic, water protection technician, environmental protection technician, environmental and building biology technician, building renovation technician, motor vehicle service technician, technical environmental business administrator, environmental consultant for trades, building energy consultant, environmental protection assistant.
- 22 In addition, there are the so-called "green jobs". These are vocational training courses with a close relationship to nature conservation, such as, at the dual vocational training level, gardener, forest manager or farmer and at the vocational college level, agricultural-technical assistant.
- 23 Cf. Severing/Fietz 2002
- 24 Cf. <http://www.infobub.arbeitsagentur.de/berufe/index.jsp>
- 25 Other jobs with a reference to the environment are listed in this database under the keywords "green jobs, environmental maintenance and protection, monitoring and investigation, planning and supply" and under the keyword "disposal". Green jobs are skilled trades and advanced training courses that are closely linked to nature conservation, like forest manager, re-cultivation technician or gardening technician.
- 26 Cf. IUB 2002
- 27 The following description of the basic seminar is based on BIBB 1990.
- 28 Cf. the detailed description in Bonhaus/Hilgers/Mertineit 1992
- 29 Cf. Environmental protection and vocational training working group 1995
- 30 Kutt 2000, p. 34
- 31 The procedure and the results are documented on the Internet ([www.bibb.de/nachhaltigkeit](http://www.bibb.de/nachhaltigkeit) under International) and have been assessed in an evaluation report (Cf. Hilgers 2003).
- 32 Cf. Staatsministerium für Schulpädagogik und Bildungsforschung 1991. Two areas are highlighted as being relevant, namely environmentally friendly design of the entire school operation based on the principles of considerate handling of all goods, economical consumption and closeness to nature as well as the introduction or intensification of situation and practice-related action-oriented and cross-disciplinary forms of work.
- 33 Cf. Buddensiek 1993. The investigated areas were forms of learning and the learning organisation, everyday behaviour, working environment and school philosophy, supply and disposal, school subject and the learning content, the school and its environment and classrooms and the design of the school.
- 34 Cf. Freie und Hansestadt Hamburg 1996
- 35 Cf. Finkenzyler/Schick/Wallenschus 1998
- 36 Cf. Mertineit 1998 and 2002



- 37 Cf. Mertineit/Hilgers 2005; Mertineit 2006
- 38 An overview of the environmental centres can be found at <http://www.umweltzentrum.de/www/umweltzentrum/uzh/weitereumweltzentren/>
- 39 The following overview focuses on the use of solar and wind power
- 40 Cf. BIBB 2006, p. 15
- 41 This training scheme is offered by Oberstufenzentrum Technische Informatik, Industrie, Elektronik, Energiemanagement (Technical college and specialised secondary school for technical computer science, industry, electronics and energy management), Berlin
- 42 Cf. BIBB 2006, p. 16
- 43 Cf. [www.bibb.de/nachhaltigkeit](http://www.bibb.de/nachhaltigkeit)
- 44 These are described in more detail in BIBB 2006, p. 148ff.
- 45 Cf. <http://www.energie-und-schule.hessen.de/index-pt.htm>
- 46 Cf. Hamburg Environmental Authority 1996
- 47 More lists of vocational training providers and their offers can be found on the Internet at <http://www.jobmotor-erneuerbare.de> (subject portal of Wissenschaftsladen Bonn e.V. on work and training in the area of renewable energies).
- 48 The following data was taken from the German Federal Labour Office's database (Cf. <http://infobub.arbeitsagentur.de/berufe/index.jsp>).
- 49 Cf. Bayerisches Staatsministerium 1996
- 50 Cf. Staatsministerium für Schulpädagogik und Bildungsforschung 1991
- 51 Cf. Buddensiek 1993
- 52 Cf. Freie und Hansestadt Hamburg 1996
- 53 Cf. Mertineit/Hilgers 2004, pp. 13 - 14
- 54 Cf. <http://www.bmz.de/de/laender/partnerlaender/aegypten/projekte/windpark.html>
- 55 Cf. [http://www.bmz.de/de/presse/pm/2008/juni/pm\\_20080623\\_55.html](http://www.bmz.de/de/presse/pm/2008/juni/pm_20080623_55.html)
- 56 Cf. <http://www.bmz.de/de/laender/partnerlaender/aegypten/projekte/windpark.html>
- 57 Hamm 2008, p. 22
- 58 Cf. <http://www.eib.org/projects/loans/regions/mediterranean-countries/eg.htm>
- 59 Within the scope of the FC the KfW also sponsors projects to improve water supply and wastewater disposal.
- 60 Cf. <http://www.bmz.de/de/laender/partnerlaender/aegypten/index.html>
- 61 Cf. Bode 2004, p. 30
- 62 Cf. *ibid.*
- 63 Wirtschaftsdienst magazine 2006, p. 1
- 64 In the energy sector the EU works together with both countries. Because of a lack of information, it cannot be said to what extent this cooperation could be extended to the area of renewable energies.
- 65 Cf. <http://www.eib.org/projects/loans/regions/mediterranean-countries/sy.htm>
- 66 Cf. [http://www.kfw-entwicklungsbank.de/DE\\_Home/Laender\\_Programme\\_und\\_Projekte/Nordafrika\\_und\\_naher\\_Osten/Jordanien/Landesinformation.jsp](http://www.kfw-entwicklungsbank.de/DE_Home/Laender_Programme_und_Projekte/Nordafrika_und_naher_Osten/Jordanien/Landesinformation.jsp)
- 67 Cf. <http://www.bmz.de/de/laender/partnerlaender/syrien/index.html>  
[http://www.kfw-entwicklungsbank.de/DE\\_Home/Laender\\_Programme\\_und\\_Projekte/Nordafrika\\_und\\_naher\\_Osten/Syrien/index.jsp](http://www.kfw-entwicklungsbank.de/DE_Home/Laender_Programme_und_Projekte/Nordafrika_und_naher_Osten/Syrien/index.jsp)
- 68 Cf. [http://www.geozentrum-hannover.de/nn\\_472238/DE/Themen/TZ/Laender/jordanien.html](http://www.geozentrum-hannover.de/nn_472238/DE/Themen/TZ/Laender/jordanien.html)
- 69 Cf. <http://www.gtz.de/de/weltweit/maghreb-naher-osten/jordanien/18151.htm>
- 70 Cf. [http://www.kfw-entwicklungsbank.de/DE\\_Home/Laender\\_Programme\\_und\\_Projekte/Nordafrika\\_und\\_naher\\_Osten/Jordanien/Leuchtturmprojekt\\_1.jsp](http://www.kfw-entwicklungsbank.de/DE_Home/Laender_Programme_und_Projekte/Nordafrika_und_naher_Osten/Jordanien/Leuchtturmprojekt_1.jsp)
- 71 Cf. <http://www.bmz.de/de/laender/partnerlaender/syrien/index.html>
- 72 Cf. <http://www.gtz.de/de/weltweit/maghreb-naher-osten/syrien/1579.htm>
- 73 Cf. [http://www.kfw-entwicklungsbank.de/DE\\_Home/Laender\\_Projekte/Nordafrika\\_und\\_naher\\_Osten/Syrien\\_Leuchtturmprojekt\\_1.jsp](http://www.kfw-entwicklungsbank.de/DE_Home/Laender_Projekte/Nordafrika_und_naher_Osten/Syrien_Leuchtturmprojekt_1.jsp)
- 74 Cf. <http://www.eib.org/projects/loans/regions/mediterranean-countries/sy.htm>
- 75 Cf. Bode 2004, p. 27f
- 76 Cf. Bode 2004, p. 37f
- 77 Cf. *ibid.*, p. 27

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