

Employment effects and needs for vocational training and qualification in the field of energy-saving building refurbishment

Summary and action recommendations



Bundesministerium
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Employment effects and needs for vocational training and qualification in the field of energy-saving building refurbishment

Summary and action recommendations

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1 Introduction and background

The buildings sector accounts for about 40% of final energy consumption in Germany, and by far the largest part of this is due to old buildings. In total, more than 80% of the final energy consumed in households is used for space heating and hot water (Federal Statistical Office 2010). Implementing the economically worthwhile measures for reducing energy consumption in the buildings sector would permit at least a 20 percent reduction in Germany's total emissions by 2020 (McKinsey 2007).

At present, however, the potential in the field of energy-saving building refurbishment is not being exploited to the full, whether in terms of technological possibilities or economic efficiency. For example, on average only about 1/3 of the economically worthwhile savings potential in the buildings sector is being exploited (Kleemann 2006). The German government has therefore identified energy-saving building refurbishment as one of the central fields of activity in its energy and climate programme, which means that relevant assistance programmes can be expected to continue in the future as well. To ensure efficient exploitation of the energy-saving refurbishment potential, it is first necessary to use information and promotion measures to create and maintain the demand. However, it is equally important to ensure availability of the qualified personnel needed for consultation, planning and implementation – which means creating suitable training courses.

1.1 Objectives and research issues

The study “Employment effects and training and upgrading needs in the field of energy-saving building refurbishment”¹ made an analysis of employment structures and trends and the relevant needs for vocational training and qualification in the field of energy-saving building refurbishment. A dual-perspective study design was used for this purpose: On the one hand it examines, from the point of view of companies operating in this field, the current and future needs that exist for qualified personnel and the requirements that such personnel will have to meet. On the other hand it analyses, from the point of view of training providers, the extent to which existing vocational training and further education structures can support the provision of qualifications for job-related activities in the field of energy-saving building refurbishment. By comparing supply and demand, a list was then prepared of action recommendations designed to make a contribution to ensuring the qualitative and quantitative supply of new sector-specific qualified personnel.

The investigations were based on the following **key questions**:

1. What are the framework conditions, current trends and future issues in the field of energy-saving building refurbishment?
2. **How great is the current and future employment potential** in the selected areas of energy-saving building refurbishment?
3. What skills and competencies are expected of those who work in this field?
4. What are the resulting qualification requirements that vocational training and further education have to meet?

¹ The full version of the study will be published shortly. This summary provides an outline of the main findings.

1.2 Subject of investigation

As examples of the entire field of energy-saving building refurbishment, four areas of activity were examined in detail (cf. also areas marked in Figure 1).

- Initial consultation and energy consulting
- Planning and coordination
- Implementing measures in the field of thermal insulation
- Implementing measures in the field of heating

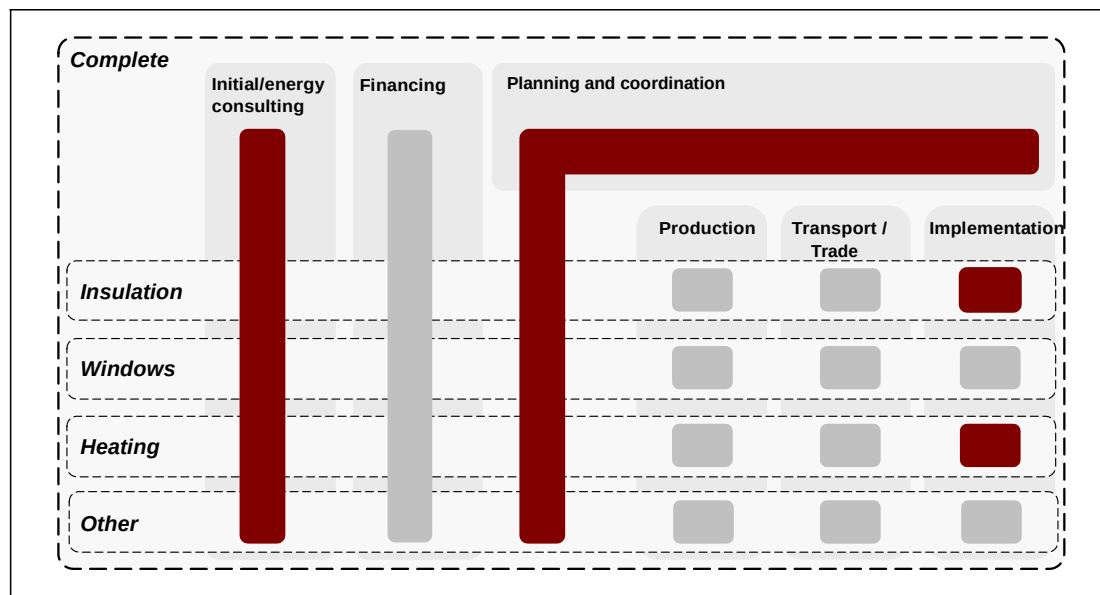


Fig. 1: Selected areas of activity (source: own diagram)

These areas of activity cover large sections of the value-added chain of energy-saving building refurbishment and also include the key processes which determine the choice and quality of individual efficiency measures. These areas and the relevant criteria for their selection are outlined briefly below.

Consultation normally takes place at the beginning of the refurbishment process, where there is a need to determine the refurbishment requirements and decide on appropriate measures. This was the reason for selecting the process of initial and energy-oriented consulting and the assessment of extensive refurbishment projects. The quality of such consultation is a crucial factor in the decision as to whether to invest in energy efficiency and, if so, on what scale.

In the course of product selection, engagement of building trade businesses and, where appropriate, consulting engineers, and also during the construction phase, there is a constant need for decisions in which good planning is important for the quality of the refurbishment. This applies to both complete refurbishment and individual measures. The process of planning **and coordination** is therefore particularly interesting for analysis, since the complexity of the

measures makes great demands on the quality of the consultation and planning. Important factors here are the interaction between the trades and good planning and coordination of the individual measures.

When it comes to the **implementation** of refurbishment measures, **insulation** plays a key role, because this field involves particularly high energy-efficiency and resource-related potential which is often not adequately exploited as a result of incorrect implementation. Moreover, the importance of quality standards has already proved its relevance in this very young business field: There is a need to implement specific solutions for the individual building requirements, with the result that suitably qualified trades are necessary to avoid serious damage such as moisture problems.

Another field investigated in relation to the **implementation** of refurbishment measures was that of **heating** (including hot water), because it was possible here to analyse not only the great impacts of energy efficiency, but also in particular the aspects of resource efficiency and consistency.

1.3 Methods

In view of the exploratory character of the study, it was mainly qualitative methods that were used. In line with the principle of triangulation of different methods, the qualitative interviews were supplemented and extended by quantitative surveys. The following data survey methods were used:

Table 1: Overview of data survey methods

Data survey methods	Evaluation method	
	<i>Quantitative</i>	<i>Qualitative</i>
Document analysis		X
Online survey of businesses in the field of “consultancy and planning”	X	X
Analysis of job vacancies advertised in two online databases	X	
Semi-structured interviews with – Businesses in the insulation and heating sectors, – Trade associations, architects and higher-level stakeholders, – Vocational training and further education institutions		X

During the research, individual results from previous surveys were included in the design of the subsequent phases of the study. For example, the findings of the business survey were taken into account when developing the framework script for the subsequent interviews.

2 Summary of findings

The findings are described on the basis of the key questions asked above.

1. What are the framework conditions, current trends, and future issues in the field of energy-saving building refurbishment?

→ *The role of assistance programmes*

Any increase in the refurbishment rate, and hence the future shape of the labour market for energy-efficient building refurbishment, depends to a large extent on developments in legal framework conditions and existing assistance measures. Here special mention must be made of the KfW's "CO₂ Building Refurbishment Programme" and the Energy Saving Ordinance (Energieeinsparverordnung – EnEV) as the German government's two central climate protection instruments for the buildings sector. In the past, the additional investment triggered by assistance programmes has been many times the actual amount of assistance, stimulating demand for refurbishment measures in the field of energy-saving building refurbishment. The respondents in businesses, trade associations and training establishments have confirmed that companies in this sector profit substantially from the assistance programmes.

But particularly in the rented housing sector, lack of economic incentives for building refurbishment, or failure to recognise such incentives, often reduce the frequency of refurbishment work. Here the investor-user dilemma plays an important role, since it is the tenants who feel the benefit of the heating fuel cost savings that refurbishment makes possible, although it is the landlords who bear the cost of the investment. Conversely, the additional cost of any failure to implement potentially economic investments is borne as running costs by the tenant, but does not place any burden on the landlord. In the end, however, it is the rent including heating that matters to anyone renting a home.

→ *Future issues*

The experts consulted regard *energy production* and *more efficient insulation* in particular as the issues of the future. The topic of *material efficiency* will also acquire greater importance in the insulation sector. These issues are closely connected with the requirements for upgrading courses that follow from the demand perspective. One challenge here is to keep up with the pace of development in these fields. Here it is not only the exacting demands on planning and implementation, but also the overall wealth of topics that present challenges for the various training courses.

On the one hand the experts stressed the importance of sound basic training, but at the same time the demand side is increasingly calling for the integration of new themes in training courses.

→ *Challenge: Material efficiency*

The selection and production of building materials and their efficient use are central themes for energy-saving refurbishment. Greater account should also be taken of the entire life cycle of the materials, including their recycling properties. For example, building materials from renewable raw materials can still be used at the end of their life cycle to produce renewable energy. In practice – in the opinion of the business associations – the material properties of insulating materials are of virtually no importance alongside the thermal conductivity and price of the insulation.

Ultimately it is the trades which plan and execute the work that influence the choice of materials through their advice. Training and upgrading can be used to raise the awareness of all those involved about the importance of material selection and efficient use of materials. The surveys also drew attention to the importance of assistance measures for increasing the percentage of renewable raw materials in the form of building materials. In view of the market distortion effects, the experts consulted did not consider it advisable to use direct sales promotion activities such as market launch programmes.

2. How great is the current and future employment potential in the selected areas of energy-saving building refurbishment?

→ *Attempt to quantify the need for qualified personnel*

The sector has the potential to secure jobs along the entire value-added chain and also to create additional jobs. Even today, modernisation work accounts for 78% of all work in the building sector, corresponding to an order volume of €115.91bn Euro (DIW 2009). If the economically worthwhile refurbishment measures alone are implemented in the future, we can expect to see an increase in demand for such refurbishment measures and hence for qualified personnel. On the other hand it has to be said that long-term predictions in particular are difficult and were viewed with caution by the vocational training and further education establishments. The associations and businesses questioned nevertheless expect demand to grow at least in the short and medium term. The results of the online survey also reveal such tendencies.

Since many refurbishment measures are carried out by businesses in various sectors that also engage in other activities, it is impossible on the basis of the study methods used to assess the numbers of qualified personnel who can be assigned exclusively to the field of energy-saving building refurbishment. To get an idea of the size of the employment effect, it is worth noting here the calculation by the Bremen Energy Institute that an investment volume of €1bn generates an employment effect of 16,500 person-years (BEI 2008). Assuming that roughly half the order volume mentioned above can be attributed to energy-saving building refurbishment, the employment effect in the field of energy-saving building refurbishment can currently be put at more than 900,000 person-years.

In view of demographic change, the implementing trades in particular are faced with challenges when it comes to meeting their needs for qualified personnel. In some federal states there is already a surplus of apprenticeship vacancies. There is also a tendency to demand higher-grade school-leaving certificates, thereby reducing the numbers that will potentially decide in favour of an apprenticeship under the German dual system.

3. What skills and competencies are expected of those who work in this field?

→ *Challenges in relation to ensuring refurbishment quality*

The pace of innovation in this sector is very rapid. In both the heating and insulation sectors, the range of technologies (e.g. heat pumps, combined heat-and-power generation, photovoltaic systems, insulation technology) and products (e.g. new insulating materials and composite systems) is growing all the time. The dual-system training courses in this sector are thus faced with the challenge that, while they need to stay on the ball where new developments are concerned, their courses also need to teach the necessary fundamentals, such as building physics and material science. Both are a prerequisite for assessing the fabric of the building and the possible approaches to refurbishment.

On the whole there is a tendency to take advantage of suitable further training courses to provide the additional qualifications necessary for energy-saving building refurbishment. This represents a challenge from the demand perspective. This is because businesses, as a rule, tend not to be very proactive with regard to further training, but only make use of offerings that they regard as necessary in view of new statutory requirements in the field of refurbishment. Further training courses which the trade associations describe as important (e.g. coordination of trades, marketing) are not (yet) regarded as such by businesses.

→ *Qualitative requirements for qualified personnel from the demand perspective*

More than 80% of craft-trade businesses see the future focus of work in the building sector as being in the refurbishment of existing buildings, and in the case of architects the figure is as high as 90%. Energy-saving refurbishment involves considerably more work than refurbishment without energy-oriented modernisation. In particular, there is a greater need for planning and coordination, not only between planners and implementers, but also between the trades themselves. The study makes it clear that potential for improvement exists in the planning and implementation of energy-saving refurbishment measures, and that the degree to which this savings potential is exploited is closely related to the quality of the preceding initial and energy consultation and of the planning and implementation.

There are great variations in the specific requirements expected of personnel in the fields of activity considered from the energy-saving building refurbishment sector. As indicated by an analysis of job vacancies (relating to energy efficiency in general) advertised in the Online portal 'green-jobs' (Strohschein 2010), the fields of planning, concept development and consultancy call for a broad spectrum of knowledge ranging from contracting through legal framework conditions to specific technical know-how. However, the findings of the business survey and job vacancy analyses carried out as part of the study show that, in addition to the wide variety of specific subject-specific competencies, general communication and advisory competencies and also the ability to work in a team are coming to play an increasingly important role. The closer the field is to the implementation/ execution level, the more important and specialised are the technical competencies required for the relevant refurbishment measures. But here too the explicit calls for 'soft skills', especially in the form of team skills and customer orientation, are becoming increasingly frequent.

In addition to specific specialist competencies, energy-saving building refurbishment calls in particular for an "overall picture". Routine operations are called into question and new technologies enter the market. This makes it necessary to become familiar with new fields. The topic of coordination between the different trades acquires special importance here. The following requirements are important from the point of view of those working in the sector:

- The **"overall picture"**: Overview of energy-saving refurbishment as a whole and the resulting requirements to be met by the individual actors
- **Coordination between trades**
- **Material science, material efficiency**: Material properties, energy consumption during production, choice of correct materials
- **Identification of potential savings**: Knowledge of energy-efficiency measures, savings potential with regard to different materials
- **Specialist commercial knowledge**: Not only purchase costs, but also life-cycle costs

- **Communication and consultancy competence**
- **Management competence**
- **Logistics and construction planning**
- **Legal knowledge:** e.g. implementing the Energy Saving Ordinance
- **Financing:** Financial planning, knowledge of opportunities for assistance: sources of funds, conditions

4. What are the resulting requirements that vocational training and further education measures have to meet?

→ Demand-side perspective

According to the findings of an online survey in the field of planning and consultancy, few businesses are satisfied with the knowledge and skills taught in training and further education courses (most businesses take a neutral attitude). The main complaints in relation to further training and upgrading relate to lack of up-to-dateness and lack of specialist relevance. Take-up of further training course is impeded by obstacles which are largely financial or concerned with time (e.g. cost of participation and travel, distances). Cross-disciplinary upgrading courses for consulting and planning professions and for implementing trades are regarded by 84% of respondents as useful – but only 65% make use of such offerings.

→ Importance of qualifications for energy-saving building refurbishment

The training and upgrading institutions surveyed generally acknowledge the importance of qualifications for energy-saving building refurbishment, and this applies not only to traditional trade-based construction work on existing buildings, but also to new buildings using industrial components and complete systems. At present, however, it is not possible to describe any clearly defined qualification profiles. Neither is it yet possible to assess the relative importance of the new qualifications that need to be taught and the qualifications that in any case have to be acquired in organised apprenticeships under training regulations and curricula. This also applies to qualifications that have already been clearly associated with the requirements for energy-saving building refurbishment.

Experts in the field of practical vocational training describe these qualifications as fundamentals of building physics and technology, material science knowledge, basic business management knowledge about the profitability of energy-efficient refurbishment, and the ability to think and act in a systemic fashion (“the holistic view”).

→ Energy-saving building refurbishment as a new interface vocation?

Although practical training experts regard dealing with energy-efficiency issues as an important aspect of work on existing buildings, they see it as only one aspect among many of refurbishing existing buildings. Thus occupational specialisation only makes sense if (1) it does not lead to the disappearance of the complex spectrum of qualifications for the building trades, and (2) the volume of energy-saving refurbishment work that is necessary for professionalisation is guaranteed in the long term.

However, the experts interviewed took a sceptical attitude to these requirements. They are worried that in an “interface vocation” the typical broad cross-vocational qualification would be lost, and that the volume of orders for energy-saving refurbishment in particular cannot be re-

liably predicted either now or in the future, and that as a result the preconditions for professionalisation of a new occupation do not actually exist. However, if qualification processes for energy-saving refurbishment were simply added on top of existing vocational training courses, this would be an unacceptable extra burden on the present apprentices. Moreover, if the construction industry continues to develop complete systems and “smart houses” and energy-saving refurbishment of existing buildings subsequently proves to be unprofitable, then professionalisation of energy-saving building refurbishment in craft-trade interface occupations will have serious effects on the livelihood of those affected.

→ *Using modules to supplement the range of vocational training and further education courses*

Instead, the acquisition of qualification for energy-saving building refurbishment should take the form of sound specialist upgrading, on a cross-trade and cross-sectoral basis, of the training provided in all building trades associated with energy-saving building refurbishment, for example by means of modules in the context of collectively agreed upgrading courses. Comparable modules can also be devised for initial vocational training and also made available for initial vocational training depending on training requirements. This would be one means of making job profiles more specific with regard to energy-saving building refurbishment.

→ *Opportunities for addressing key issues*

Another means of accentuating training in building trades with the aid of modules is courses on addressing key issues (e.g. designing transitional systems, designing airtight building envelopes, moisture problems in existing buildings, typical errors in refurbishment of existing buildings) as cross-sectoral topics not confined to individual trades. Such courses would take advantage of existing scope to address trade-related fields of activity and action in the field of energy-saving building refurbishment.

Brief summary of action recommendations

On the basis of the underlying study, five central fields of action were compiled in relation to vocational training and qualification needs in the field of energy-saving building refurbishment and suggestions for their implementation were drawn up:

Action field A: Initiate communication and image campaigns to meet present and future demand for qualified personnel

- Action recommendation A1: Image campaign – Construction trades in energy-saving building refurbishment
- Action recommendation A2: Energy-saving building refurbishment requirements for the building trades – communication by associations

Action field B: Use curricular and didactic options for vocational training and further education for energy-saving building refurbishment

- Action recommendation B1: Additional qualifications through modules for initial training and further education
- Action recommendation B2: Take advantage of scope offered by existing vocational training and further education courses

Action field C: Raise awareness of the importance of material selection and material efficiency in construction vocations

- Action recommendation C1: Make it possible to experience material efficiency through cooperative training models
- Action recommendation C2: Strengthen old techniques and traditional materials as course content for energy-saving building refurbishment

Action field D: Develop, test and evaluate cross-trade further education and training

- Action recommendation D1: Develop, test and evaluate a range of upgrading offerings for further training and career advancement

Action field E: Facilitate creation of profiles for energy-saving building refurbishment in degree courses

- Action recommendation E1: In-depth options relating to remediation and conservation of structures

3 Action recommendations

The analytical approach of showing the study results separately for the supply and demand perspectives makes it possible to arrive at differentiated and well-founded action recommendations. Five central fields of action can be defined. For the most part, these start from the supply processes and structures of providing qualifications for energy-saving building refurbishment. A systematic relationship between the five fields can be described: Action field A – “Initiate communication and image campaigns to meet present and future demand for qualified personnel” – proposes a marketing approach that cuts across the individual qualification strategies. This is concerned with showing potential qualified personnel how attractive the labour market for energy-saving building refurbishment can be, and at the same time raising business awareness of the requirements of this market. Action fields B, D and E make specific suggestions as to how the qualification phases of the dual vocational training system, further training and degree courses can be tailored better to the needs of energy-saving building refurbishment. The action spectrum here ranges from better exploitation and extension of didactic and curricular scope, through the implementation of refurbishment-specific further training courses, to the expansion of in-depth options relating to remediation and maintenance of structures in selected degree courses. Action field C, which sets out to raise awareness of material selection and material efficiency issues, addresses a fundamental concern of vocational training keyed to sustainable development.

Each of these action fields is described below, starting with the background situation and/or underlying problem and moving on to operationalised action recommendations.

3.1 Action field A: Initiate communication and image campaigns to meet present and future demand for qualified personnel

3.1.1 Background situation / Description of problem

Opportunities for the labour market through more climate protection: Energy-saving refurbishment of buildings plays a central role in discussions about measures for reducing CO₂ emissions. A large proportion of anthropogenic CO₂ emissions are due to the construction and housing sector; many homes have to be classed as in need of energy-saving refurbishment. Thus savings potential exists especially in the refurbishment of existing buildings.

Apart from its ecological relevance, the field of energy-saving refurbishment and building modernisation offers economic potential in particular: the experts interviewed are agreed that through innovative business models this field ensures secure jobs along the entire value-added chain. According to calculations by the Bremen Energy Institute (BEI 2008), which undertakes an annual review of the energy-saving and employment effects of the KfW's CO₂ refurbishment programme, an investment volume of €1bn generates an em-

ployment effect of 16,500 person-years². On this basis the KfW programme in 2007 alone, which provided reduced-interest loans totalling some €1.9bn, had an employment effect of around 35,000 person-years. This ecologically and economically worthwhile savings potential and the associated jobs have to be seen against the background of a “refurbishment backlog”. According to various studies, only between a third and a half of all “possible” refurbishment opportunities are used for energy-saving refurbishment (Weiß/Dunkelberg 2010). Although the refurbishment volume is currently not being exploited to the full, there is a lack of skilled personnel possessing the necessary qualifications for energy-saving refurbishment. Not only the craft trades operating in this sector, but also the trade associations and the research and development institutions confirm the present lack of qualified personnel and suspect that this situation will get worse in the future (at least in the medium term). For many years now the focus of work in the building sector has been shifting more and more towards refurbishment of existing buildings.

It is important to note here that the information supplied by the respondents is confined to medium-term assessments. On this basis, building refurbishment would appear to be an important market for the future in the medium term. It is possible that in the long term (after 2050) it might no longer be possible from a technical point of view to meet the standards necessary or required in the refurbishment of existing buildings.

There are general complaints that, at the level of basic apprentice training in building trades and at the implementing journeyman level, it is becoming increasingly difficult to attract suitably well educated juveniles into the building industry. This problem is being exacerbated by demographic change. For these reasons alone there will continue to be a shortage of suitable upcoming qualified personnel. This will make itself felt in the implementing trades in particular and is already doing so today in some regions. At the same time one can see a particularly sharp decline in the number of school-leavers with a basic or intermediate school-leaving certificate, who are traditionally the usual candidates for an apprenticeship trade.

For businesses which have concentrated on business fields in the energy-saving building refurbishment sector, the qualitative and quantitative recruitment problem is especially serious. Much more than other areas of the building sector, these fields require not only a sound basic knowledge of building physics and of modern energy and heating technologies, but also a knowledge of traditional craft-trade techniques and a sustainability-oriented basic attitude. At the higher operating level of the master craftsman there is a need for experienced qualified personnel who can make a holistic overall assessment of the extent to which a building needs to be refurbished. Moreover, the advent of energy-saving building refurbishment seems to be making it more important than ever to ensure effective implementation of the frequently voiced call for cooperation between the individual building trades.

It is important to note that the success of the business fields relating to energy-saving building refurbishment depends to a considerable degree on the extent to which it is possible to interest upcoming personnel in training opportunities in these fields of the building industry. Before developing, improving and revising qualification courses, it is essential to stimulate demand for such courses. The findings of the underlying study illustrate the need to initiate image strategies for “recruiting” potentially suitable qualified personnel (Action recommendation A1).

² According to the BEI, one person-year corresponds to the employment of one person for a period of one year on the basis of the weekly working hours that are usual in the relevant industry/sector.

At the same time it is important to ensure that businesses operating in the field of energy-saving building refurbishment are made aware of requirements and issues that are becoming increasingly important in their sphere of activities. These include the cross-trade cooperation mentioned above, and also marketing (especially stressing the value of one's own craft trade services) and customer acquisition. Although trade associations have already identified important issues for upgrading courses, businesses are not showing enough demand for the opportunities that have been devised (Action recommendation A2). Whereas the later action fields focus on specific aspects of training and upgrading, Action field A is devoted to the need to inform the target groups better about such training opportunities.

3.1.2 Action recommendation A1: Image campaign – Construction trades in energy-saving building refurbishment

An image campaign run or supported by educational policy institutions (Federal Ministry of Education and Research, Federal Ministry of Labour and Social Affairs / job centres, careers advice institutions, training institutions, associations, chambers) could communicate the variety of craft trades and tasks in the field of energy-saving building refurbishment, convey an up-to-date picture of this sector, improve future opportunities and thereby increase the attractiveness of the job profiles concerned – especially among young people.

The aim of the campaign would be to make the work and career situation of energy-saving building refurbishment more attractive and to increase the number of new recruits to the implementing trades in this sector. The campaign should primarily be aimed at young people who are still at school or have just finished school, and should inform them about the career and the opportunities it offers for the future.

The associations and Chambers of Craft Trades should be involved in the running of the campaign. The initiative "Fit for new energy" could serve as a reference model³. Under the JOBSTARTER programme promoted by the Federal Ministry of Education and Research, this initiative is designed to increase the number and range of apprenticeships available in the renewable energy sector in the Weser-Ems region. The renewable energy job information fair "Energieberufe live", first held in March 2010 under the lead management of the University of Oldenburg, could also provide ideas about how to present the fields of activity of energy-saving building refurbishment to future specialists⁴.

Another possible starting point could be the image campaign launched in 2010 by the German Confederation of Skilled Crafts (ZDH) under the title "Craft Trades – The economic power next-door". The aim of this campaign is to communicate a modern picture of the craft trades, emphasise their economic and social importance and arouse young people's interest in the craft trades and the relevant apprenticeships. If this were used as a starting point, one could integrate topics relating to energy-saving building refurbishment in the existing campaign. The spectrum of topics and necessary knowledge and skills to be introduced here ranges from knowledge of materials and identification of savings potential, through commercial knowledge, marketing and customer service, to coordinating aspects such as building-site logistics and craft trade coordination.

Integrating these topics could bring added value to both the campaign as a whole, and the field of energy-saving building refurbishment in particular. On the one hand the campaign as a whole

³ The initiatives and measures mentioned here are only a selection of examples (with no claim to completeness).

could embed in its concept the topical issue of the sustainability, environmental relevance and hence future viability of the job profiles in question. On the other hand the field of energy-saving building refurbishment would profit from the visibility of the existing campaign.

Examples of other campaigns (specific to individual states) where it would be possible to integrate the topics of energy-saving building refurbishment are the recruitment campaign "www.handwerks-power.de" which the Baden-Württemberg craft trades federation has been running since 2005, or the recruitment campaign "Macher gesucht!" ("Doers wanted") launched in 2008 by the Bavarian craft trades federation.

Another means of using synergies would be to communicate the attractiveness of the job in consumer-oriented campaigns in the field of energy-saving building refurbishment, for example the nationwide information and advice programme "Refurbish your home – Reap the benefits" run by the German Federal Foundation for the Environment (Deutsche Bundesstiftung Umwelt – DBU).

An independent image campaign designed to improve the attractiveness of jobs in the field of energy-saving building refurbishment would have to be the result of cooperation between the relevant associations and chambers and an advertising agency, paying special attention to target group specific media. In view of the age of the target group this could focus on a website, supported by PR and advertising on TV and radio and in the print media. The website and the magazine "handfest" of the West German Federation of Craft Trade Associations would serve as a starting point here.

3.1.3 Action recommendation A2: Energy-saving building refurbishment requirements for the building trades – communication by associations

Admittedly the field of energy-saving building refurbishment involves considerable challenges, but it also offers good opportunities for businesses to establish themselves in a field where good growth prospects can be expected for the next 10-15 years. However, the majority of businesses do not yet have sufficient awareness of the requirements, which experts say will become increasingly important for the future success of a company. This can be seen from the fact that they rarely take a proactive approach (e.g. through further training courses) to dealing with topics that go beyond the statutory requirements, like those in the Energy Saving Ordinance (EnEV). In this connection, the respondents in the underlying study made special mention of the topics of cross-trade work planning and interface management, and also marketing and customer acquisition.

It is the task of the associations to communicate more targeted information about requirements that will be important in the future and raise the awareness of businesses about new development, in order to generate interest in the relevant courses offered. The target group for this communication is the craft trades operating in the field of building/ refurbishment. This should be done through their individual organisations (associations and craft trade chambers), which act as multipliers. It would also be possible to cooperate with cross-sectoral initiatives working in the field of energy-saving building refurbishment, since they have good access to relevant trade associations (e.g. Federal Working Group on Refurbishment of Existing Buildings (Bundesarbeitskreis Altbausanierung), Federal Association for Moisture & Refurbishment of Existing Buildings (Bundesverband Feuchte & Altbausanierung)).

⁴ See <http://www.energiebildung.uni-oldenburg.de/38841.html>

3.2 Action field B: Use curricular and didactic options for vocational training and further education for energy-saving building refurbishment

3.2.1 Background situation / Description of problem

The labour market for energy-saving refurbishment as a subset of the overarching idea of sustainable building will come to have an increasing influence on the training and upgrading courses available. The experts interviewed from training and upgrading institutions and from academic and research establishments generally acknowledge the importance of qualifications for energy-saving building refurbishment, and this applies not only to traditional trade-based construction work on existing buildings, but also to new buildings using industrial components and complete systems. At present, however, it is not possible to describe any clearly defined qualification profiles. Neither is it yet possible to assess the relative importance of the new qualifications that need to be taught and the qualifications that in any case have to be acquired in organised apprenticeships under training regulations and curricula. This also applies to qualifications where a clear connection has already been established with the requirements of energy-saving building refurbishment.

Asked about the most important qualifications for energy-saving building refurbishment, experts from training and upgrading institutions and from academic and research establishments cite the following:

- Fundamentals of building physics and technology,
- Knowledge of building material science,
- Basic commercial knowledge about the profitability of energy-saving refurbishment projects,
- Ability to think and act in a systemic fashion (“the holistic view”).

The latter qualifications are also described as assessment skills. Similar findings emerged from the survey of experts from trade associations, who regard the following qualifications as particularly relevant to energy-saving building refurbishment:

- Ability to identify savings potential, and relevant knowledge about various energy-efficiency measures,
- Knowledge of materials (thermal conductivity, recycling properties, percentage of renewable raw materials, energy consumption during production, and other material properties),
- Cooperation between trades, interface management in view of increased demands on the synchronisation and coordination of planning and implementing work,
- Construction-site logistics,
- Commercial knowledge (especially in relation to extended cost analysis through life-cycle management),
- Advisory/communication skills, customer service and marketing.

New vocations do not necessarily make sense

Even if experts are already in a position to describe a broad qualification spectrum for energy-saving building refurbishment, this does not necessarily mean that new vocations in this field make sense. Although the respondents regard energy-related issues as important aspects of construction work on existing buildings that need to be addressed, they see them only as a subsector of the refurbishment of existing buildings, and refurbishment in turn as a subsector of the much more complex job-related activities and actions in building trades. Thus vocational specialisation only makes sense if it does not result in the disappearance of the complex spectrum of qualifications for the building trades, and if the volume of energy-efficient refurbishment work that is necessary for professionalisation is guaranteed in the long term.

The experts are however sceptical about both conditions. They fear that in an “interface job” the broad, cross-cutting qualification that is typical of building trades will be lost. The volume of orders for energy-saving building refurbishment in particular cannot be reliably predicted now or in the future. As a result, the preconditions for professionalisation of a new vocation do not exist at present.

Doubts about long-term improvement in job market opportunities solely through specialisation in energy-saving building refurbishment

It is by no means certain that simply obtaining qualifications in energy-saving building refurbishment will bring a general improvement in job market prospects. In the short term this might be the case, in view of the current great demand for such building services and the specialisation by building companies in energy-saving building refurbishment. A long-term improvement in labour market opportunities also requires permanent, ongoing demand for energy-saving refurbishment of existing buildings and a general upgrading of such qualifications in building vocations.

However, if qualification processes for energy-saving refurbishment are integrated in the existing vocational training courses, i.e. included in the relevant framework curricula and ordinances as compulsory course content and learning objectives, this would mean an unacceptable extra burden on the present apprentices. Few of them would be capable of meeting the requirements demanded of them. Moreover, if the construction industry continues to develop complete systems and “smart houses” and if energy-saving refurbishment of existing buildings subsequently proves to be unprofitable, then professionalisation of energy-saving building refurbishment in craft-trade interface occupations will have serious effects on the livelihood of those affected.

3.2.2 Action recommendation B1: Additional qualifications through modules for initial training and further education

Instead of reforming the craft-trade interface jobs in the directions of professionalisation of energy-saving building refurbishment, the acquisition of qualifications for energy-saving building refurbishment – seen as a whole – should take the form of sound specialist upgrading, on a cross-trade and cross-sectoral basis, of the training provided in all building trades associated with energy-saving building refurbishment. This could be done with the aid of modules for gaining additional qualifications in the context of collectively agreed upgrading courses or provider qualifications (with certificates awarded by the provider, e.g. craft-trade establishment). These options could be designed by training providers and training regions to meet specific requirements. Participants or providers include:

- joint training and upgrading centres, which are usually financed by the associations,
- vocational schools or colleges as upgrading providers (e.g. via technical colleges) within the scope of their educational autonomy,
- craft-trade chambers as competent bodies for the approval of further training courses, and
- miscellaneous private training providers.

Comparable modules can also be devised for initial vocational training and also made available for initial vocational training depending on training requirements. This would be one way of making vocational profiles more specific with regard to energy-saving building refurbishment. For this purpose it would seem appropriate to offer the modules for additional qualifications to particularly capable young people who are willing to learn, comparable to “higher certificate models” but without demanding a higher school-leaving certificate as an entry requirement. This would create and offer training courses for energy-saving refurbishment as an option for acquiring additional qualifications extending beyond the spectrum of the course content and course objectives that are in any case provided in vocational training.

Starting points for the additional qualification modules can be identified from the curricular sources pinpointed in the analysis of documents from the underlying study in terms of course objectives, course content and examination content bearing an affinity to energy-saving refurbishment. For example, most framework curricula of the principal and ancillary building trades include specific learning areas relating to activities of (energy-saving) building refurbishment: in the case of bricklayers, for example, it is learning field 17 “Repairing and refurbishing part of a building”; for building structure waterproofers it is learning field 10 “Insulating and sealing flat roofs”, and for drywall installers it is learning field 8 “Refurbishing an external wall”. For the training of facade fitters, the learning field 15 “Refurbishing a facade” would seem to be a logical point of attack, and in the training of painters in the field of “Design and repair”, learning field 11 “Repairing buildings” would seem to be relevant to energy-saving building refurbishment. In almost all training courses examined, it is found that qualifications in energy-saving building refurbishment are not scheduled until the last third of the apprenticeship. This is by no means surprising, because the experts consulted all call for a well-founded basic knowledge as a prerequisite for competent execution of energy-saving building refurbishment. On the whole, course content and course objectives appear to be adequately enshrined in the training-relevant regulations (including ordinances), and they already offer the instructors at vocational schools and in businesses that provide apprenticeships, and also the chambers involved in examinations, a good starting point for providing qualifications in energy-saving building re-

furbishment, partly through existing options and partly through additional modules yet to be developed. Thus on the one hand there is a need to investigate the extent to which course content from upgrading courses, e.g. in the field of energy consultancy qualification, is suitable for use as a reference model for a reduced qualification module that is tailored to apprentices' learning requirements. On the other hand there is also a need to develop totally new kinds of modules, especially with a view to course content relating to innovative and in some cases completely different networks of sustainable energy use and supply, for example the kind described in the "e-energy" programme supported by the Federal Ministry of Economics (BMWi) and the Federal Environment Ministry (BMU) (cf. BMWi 2008; BMWi & BMU 2010). Modules relating to such networks go far beyond the focus of mere energy efficiency in the building industry. They develop network structures combining various fields of everyday needs, such as building and living, mobility, leisure and recreation, as a basis for creating a holistic system for improving energy efficiency. This is an area for cooperation between energy suppliers, manufacturers of various renewable energy technologies (wind, solar, biogas etc.), energy storage specialists (including car makers involved in electric mobility), consultancy service providers, the building industry with its craft trades and construction companies for infrastructure and building construction, financial service providers, research establishments etc.

3.2.3 Action recommendation B2: Take advantage of scope offered by existing vocational training and further education courses

Courses dealing with key issues as cross-sectional inter-trade themes are a completely different concept for accentuation of training in building trades. This would not involve creating additional modules. Instead, cross-vocational learning as a universal principle in existing vocational training and further education courses should be put into practice even more effectively and stringently, as called for and considered possible by the training experts consulted. Unlike Action recommendation B1, this strategy for obtaining qualifications in energy-saving refurbishment can be directly implemented in teaching as a short to medium-term measure at the micro level of vocational training, for example within the scope of the individual responsibility of vocational schools. With regard to the "output" of this implementation, it may be assumed that it could foster a basic understanding of the requirements of energy-saving refurbishment. In particular, it could in vocational teaching and learning place a stronger focus on interaction and networking of the various trades in the building industry and the consequences for vocational activities in the building trades. For example, it is obvious that as a result of the typically marked need for cooperation in energy-saving refurbishment projects, job and work are characterised much more than in conventional vocational fields in the building industry by thinking and acting in cause-and-effect networks. In other words, craft trade practitioners will in future be faced with the challenge of having to think much more carefully about the consequences of their actions and overcoming the domain-specific limits of their jobs. Such courses would take advantage of existing (!) scope to address trade-related fields of activity and action in the field of energy-saving building refurbishment. This scope results from the fact that since 1996 the framework curricula of the standing conference of ministers of education of the German federal states (KMK) for job-related teaching in vocational schools have been developed on the "learning field principle", which differs considerably from the previous curricula (Rebmann et al). Until then the regulations contained detailed lists of course objectives and course content. They were structured systematically by subject matter with a view to the reference disciplines relevant to vocational training. The present regulations, by contrast, are structured in "learning

fields” on an action oriented basis. In the terminology of the KMK, learning fields are “thematic units which are described by objectives, content and timing guides and oriented to vocational tasks and workflows”. In the learning field concept, teaching staff become actors who shape the curricular basis for vocational teaching and learning. In course conferences, they have to interpret the very vague and general requirements of the KMK specifically for the region, establishment and school class, and give specific, differentiated shape to their content. One positive aspect of this is that it creates room to manoeuvre in the design of practical teaching, for example by providing scope for implementing key issues in energy-saving building refurbishment.

Possible examples of such key issues include:

- designing transitional systems,
- designing airtight building envelopes,
- moisture problems in existing buildings,
- typical errors in refurbishment of existing buildings,
- construction industry component solutions and complete solutions, and combining these with traditional craft-trade solutions.

These key topics would then be used to communicate the subject-related qualifications with regard to building physics, constructional technology, building service equipment and building material science.

As far as didactic method and implementation are concerned, preference should be given to student-oriented and preferably project-oriented approaches in training. This would ensure sustainable learning, generate a broad spectrum of knowledge in the students, and at the same time permit effective communication of the knowledge. In this connection the experts mention excursions and fact-finding visits to existing buildings undergoing refurbishment, but also object-oriented learning and work assignments at school. The latter require in particular a willingness on the part of industrial manufacturers to make up-to-date products such as modern heating systems for training system mechanics available for teaching purposes (preferably on a cost-neutral basis). All in all, effective exploitation of the scope that exists in the curricula for vocational training and further education in the field of energy-saving building refurbishment calls for successful cooperation between all participating institutions with regard to where the learning takes place. The craft trade businesses can provide the practical experience for excursions, for example, the schools can offer a space for reflection and safe familiarisation, the industrial companies can make teaching material available, and the chambers can make the most of their communicative function.

3.3 Action field C: Raise awareness of the importance of material selection and material efficiency in construction vocations

3.3.1 Background situation / Description of problem

The selection of building materials and their production and efficient use should be central themes for energy-efficient refurbishment. For example, making economical use of building materials and choosing materials that are less energy-intensive to produce can save energy as early as the planning stage or when starting construction. This is true of the insulation sector in particular, firstly because this is an area that uses large quantities of material, and secondly because an alternative range of insulating materials made from renewable raw materials is available. According to the experts consulted, the topic of insulation will continue to grow in importance.

Furthermore, the topic of sustainable, healthy building and living is closely linked to the question of choice of materials. As a rule, the materials used in sustainable building are familiar or temporarily forgotten natural building materials (wood, hemp, reeds, clay etc.) which have low or non-existent pollution levels and do not affect the home living environment. One important finding of recent years is the fact that especially traditional building materials such as clay permit a mould-free living environment in airtight building envelopes. Ultimately it is the trades that plan and execute the work which influence the choice of materials through their advice. Their advice is based on the systems they commonly use, the processing requirements for which are primarily passed on to businesses through manufacturers' training courses and/or training courses run by the trade. According to the relevant craft trade associations, manufacturers' courses have a firm place in the range of further training courses and are frequently used by businesses. One example here is the field of composite thermal insulation systems, but here the relevant manufacturers' courses rarely discuss renewable raw materials or other alternative materials. In practice – in the opinion of the business associations questioned – the material properties of insulating materials are of virtually no importance alongside the thermal conductivity and price of the insulation.

On the whole there is still a considerable need among the trade public for information about the use of building materials made from renewable raw materials. In its action plan for the use of renewable raw materials as material, the German government states:

“There is a considerable need to inform owners, craft trade personnel and architects about the properties and characteristics of building products made from renewable raw materials, and to test and improve building products, components and structures.”

Federal Ministry of Food, Agriculture and Consumer Protection (BMELV 2009: 27).

According to the German government, the market launch programme started by the Federal Ministry of Agriculture (BMVEL) in 2004 to promote insulating materials from renewable raw materials has resulted in insulating materials that had previously been a niche product for a

highly specialised consumer group becoming known to a broader trade public as an alternative to conventional insulating materials. Vocational training and further education can be used to raise the awareness of all those involved about the importance of material selection and efficient use of materials. With regard to curricular specifications it is clear that the central idea of sustainable development, especially in the framework curricula of the standing conference of ministers of education (KMK), is clearly specified as a reference point for implementing the specifications for course content and course objectives in the individual occupations. The specifications for training in the building trades also contain explicit remarks about the importance of environmental protection and the economical use of resources and materials. Thus it would seem that vocational training and further education can above all make a contribution to the climate-relevant goal of increasing material and resource efficiency in the building industry by ensuring targeted transfer of curricular requirements into teaching-learning situations (see Action recommendation C1).

Whereas approaches to sustainable building in almost all trades call for personnel to make competent use of modern technologies, in energy-saving building refurbishment it is also necessary to recognise a need for old building techniques, such as laying tiles in a bed of mortar, to be included in training and upgrading once again (see Action recommendation C2). For example, the surveys of training providers in particular revealed that typical refurbishment projects always call for everyone concerned in the building work to be aware of the materials used in existing buildings and to be able to assess the old building techniques. After all, it is only with these basic competencies that the fabric of old buildings can be maintained and at the same time refurbished with new materials (e.g. filling materials for subsequent cavity insulation).

3.3.2 Action recommendation C1: Make it possible to experience material efficiency through cooperative training models

Students in vocational training and further education courses in the building industry should be able to experience the effects that inefficient use of materials and resources can have on man and the environment. They should learn to see the selection and use of building materials and resources in holistic terms, i.e. above all to take into account the origin of the material and the cost of transport when choosing materials. Frequently it is a matter of demonstrating alternative action models to the trades on site, in order to break through established routine in the choice of materials. Since existing learning and working environments are frequently unable to offer material-efficient alternatives because of established structures, there is a need for cooperative learning alliances. For example, businesses could exchange their apprentices and possibly even their journeymen and master craftsmen within the value-added chain for a certain period and thereby enable the implementing trades to experience new horizons. Such exchanges are unusual in the building industry to date, and probably not very well known. But other sectors such as the metalworking industry in Lower Saxony show that exchanges of employees can even be arranged under collective agreements, and that apart from the learning potential they could also contribute to job security in cyclical areas of the economy. On a small scale, training in the craft trades has been working on a cooperative basis for years now, as shown by the examples of integrated training and inter-company training.

The relevant chambers or a trade association could act as mediators and drivers for this topic. Thanks to their existing contacts, they can identify needs for learning and action and match

them to potential offers. To raise students' awareness of the issue of material efficiency, it is also necessary to identify training providers who are prepared to focus more strongly on this issue in their training. They are the ones who can set priorities and initiate learning alliances.

3.3.3 Action recommendation C2: Strengthen old techniques and traditional materials as course content for energy-saving building refurbishment

To pass on knowledge about old building techniques to young specialists, the businesses themselves need adequate knowledge management to develop targeted training concepts. In practical terms, this means giving older and experienced skilled personnel from the craft trades, the technical sector and consulting engineers an opportunity to pass on their know-how, e.g. how doors used to be fitted in old buildings, how windows used to be produced on an individual artisanal basis, and how tiles used to be laid in a bed of mortar. Such knowledge can be preserved and passed on, for example, in an experience-based and action-oriented way using situation-dependent learning concepts such as coaching or mentoring. It may be necessary to include and supplement such course content and objectives in the curricular specifications for the apprenticeship trades, in order to establish the relevance of traditional architecture and building culture.

3.4 Action field D: Develop, test and evaluate cross-trade further education and training

3.4.1 Background situation / Description of problem

Compared with other refurbishment measures, energy-saving building refurbishment places greater demands on the interaction of planning and implementing work. Here there is a need for good coordination not only between architects and the executing trade, but also within and between the executing trades themselves. The analyses of documents on existing vocational training and further education courses of relevance to energy-saving building refurbishment revealed suitable training opportunities in the fields of adaptation, advancement and further training. On the whole, it emerged that from both a quantitative and qualitative point of view there are already promising opportunities for providing skilled personnel at various levels with specialised and trade-specific qualifications for energy-saving refurbishment. The surveys of businesses and associations, i.e. on the demand side for qualified personnel, make it clear, however, that there are not enough courses which provide qualifications in inter-trade cooperation. One key requirement of energy-saving building refurbishment is a holistic, cross-trade approach to refurbishment projects, and this is not sufficiently well catered for by the existing opportunities. The example of energy consultancy qualifications provides an interdisciplinary model which could serve as a reference for the implementation level of energy-saving building refurbishment.

The experts consulted consider appropriate further training measures to be meaningful for other topics as well, but have doubts about their implementation in practice. In particular, it might be difficult to integrate the relevant craft trade businesses – the smaller they are, the more limited is their scope for such measures.

3.4.2 Action recommendation D1: Develop, test and evaluate a range of upgrading offerings for further training and career advancement

The analysis of curricular framework conditions and specifications for qualifications in the field of energy-saving building refurbishment shows, differentiated by training and upgrading courses, what course content and objectives are related to energy-saving building refurbishment. On the whole, it emerges that considerable curricular and didactic scope already exists, especially in the apprenticeship trades, and that this could be qualitatively upgraded by supplementary qualifications for energy-saving building refurbishment (cf. Action field B). Moreover, the existing opportunities for adaptation and advancement and in the “further training occupations” offer quite good starting points and preconditions for subject-oriented and trade-specific qualifications. It has also transpired, however, that with the exception of the building energy consultancy upgrading course, there are to date no cross-trade upgrading approaches leading to a standardised or certified qualification.

One suitable measure might therefore be to develop, test and evaluate a further training course in the context of career advancement qualification. One could conceivably establish a further training course below the “classic” master craftsman, i.e. for the middle management level, which did not, as in the past, provide qualifications only for clearly definable functions and spheres of responsibility in craft trade businesses, but instead offered qualifications on a holistic and cross-trade basis for tasks such as energy-saving building refurbishment. In the renewable energy sector there is already a reference model in the form of a further training course leading to a qualification as energy efficiency manager; this indicates how a “generalist” further training course of sustainable management could be implemented. In the field of energy-saving building refurbishment the starting point could be the training course leading to the qualification of technical efficiency manager, which normally counts towards the qualification of master craftsman. As a rule, the entry requirements for further training are the apprenticeship or journeyman examination in a commercial, craft-trade or other recognised industrial/technical apprenticeship trade, plus IT knowledge and at least one year’s relevant job experience. This further training course for the qualification of state-examined technical efficiency manager is suitable for catering for cross-trade requirements in energy-saving building refurbishment because it is originally based on an interface function between the commercial and technical sides of a company⁵. Moreover, in view of the entry requirements mentioned, it is a good instrument for promoting permeability in the vocational training sector.

Such an in-service upgrading course with a focus on energy-saving building refurbishment should comprise approximately 400 to 600 hours and last a total of 1.5 years. In terms of curriculum, it should provide qualifications in interdisciplinary cooperation and should, in addition to technical craft-trade know-how, promote commercial and organisational skills in particular. It

⁵ Cf. synoptic description of Federal Institute for Vocational Training:
http://www.bibb.de/de/fortbildungsprofil_50554.htm

should also seek to develop social and communicative skills such as a capacity for self-organised learning and working in interdisciplinary teams, the ability to reflect on group processes, the development of a common cross-trade terminology and methodological design skills, to make it possible to transfer content from the training course and apply it to the conditions of the individual business. In addition, it should provide strategic and planning skills with a view to opening up new business fields and developing and implementing company-specific visions which take account of the different framework conditions in the broad field of sustainable building.

The testing, development and evaluation of such a pilot upgrading course would appropriately involve the participation of the responsible body – i.e. craft trade chamber –, the educational institution running the course, the trades active in the field of energy-saving building refurbishment and, above all, scientific backup. The latter should not only support the development of curricula and teaching concepts from a theoretical point of view, but also provide didactic support.

3.5 Action field E: Facilitate creation of profiles for energy-saving building refurbishment in degree courses

3.5.1 Background situation / Description of problem

The experts interviewed from trade associations and the Federal Working Group on Refurbishment of Existing Buildings (Bundesarbeitskreis Altbausanierung) stress that energy-saving building refurbishment as a sector of sustainable building is not sufficiently established in the degree courses for Architecture and Construction Engineering, and that there are only a small number of degree courses in the academic world which have focused on energy-saving refurbishment. Nevertheless, the analysis of selected examples of study module descriptions yielded some promising results. The Braunschweig University of Technology, for example, offers a in-depth option “Conservation of Structures”, which has been well frequented for years and simultaneously serves a number of engineering-related degree courses. It cannot be assumed, however, that this example of good practice is representative of the mainstream of academic education in the fields of Architecture and Construction Engineering. There is also a need for courses relating to the use of alternative building materials.

As far as the labour market is concerned, the experts questioned also identified a need for increased qualifications. For example, the trade surveys revealed increased demand for environmental and energy-related skills and knowledge in the fields of energy consultancy and planning of refurbishment measures. For the years ahead the trade also predicts a growing demand for environmental and energy engineers. All in all, it is clear that environmental and energy-related topics are not adequately represented in the courses relating to building planning and implementation, and that there is a need for closer integration in architectural and engineering courses.

The experts interviewed from trade associations and the Federal Working Group on Refurbishment of Existing Buildings specifically mentioned the following requirements for personnel involved in planning and consultancy in the field of energy-saving building refurbishment:

- Material science, material efficiency: Material properties, energy consumption during production, disposal/recycling properties, health aspects, processing;
- Knowledge of the various energy efficiency measures, identification and optimisation of savings potential;
- Awareness of requirements of the various craft trades, acquisition of know-how on these trades, interface management;
- Logistics and construction planning;
- Commercial knowledge of importance for a holistic economic view of investments (e.g. with the aid of life-cycle cost analysis instead of an isolated view of purchase costs alone);
- Funding: Financial planning, knowledge of opportunities for assistance and the relevant conditions.

They also mentioned skills going beyond the specialist competence:

- Communication and consultation skills as one of the central capabilities of consulting/planning architects or construction engineers, because they influence many decisions by owners. In spite of their great importance in practice, communication and consultation skills tend to be learned “on the side” rather than systematically in the course of training or targeted “on-the-job” measures.
- Management competence: Management competence basically tends to be learned “on the job” (though even here rarely as part of targeted measures), rather than taught during training. This applies in particular to the fields of coordination, instruction and delegation of tasks, since these also require leadership skills. However, basic things like team capacity and work sharing should form part of training.

3.5.2 Action recommendation E1: In-depth options relating to remediation and conservation of structures

As in the case of basic-level training in building trades (cf. Action field B), it would seem to make little sense for the academic world of Bachelors and Masters degrees to create courses specifically tailored to energy-saving building refurbishment. Instead, the possibility of offering in-depth options focusing on the refurbishment and conservation of structures – of the kind successfully demanded and offered for many years by the Braunschweig University of Technology – has emerged as a suitable option. Here students from neighbouring degree courses can be trained in a broad spectrum of course content and objectives, ranging from building conservation, through preservation of historic monuments and waterproofing of structures, to viable future-oriented energy design for existing building. By developing such a profile, students can deepen and broaden their basic-course knowledge in the fields of statics, design, building physics etc., all of which are necessary prerequisites for energy-saving building refurbishment. As far as practical implementation is concerned, it is worth considering the possibility of coupling the introduction of such an in-depth option with a suitably oriented new post specifically for the topic, since otherwise there is a risk of offering “new wine in old bottles”.

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