



**BUILD UP
SKILLS**

ENERGY TRAINING
FOR BUILDERS



BUILD UP Skills Denmark National roadmap

Month and year

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Colophon

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The Danish Energy Agency is coordinator for the consortium survey and roadmap recommendations; recommendations and results reported in this project reflect the overall process and are not necessarily the views of the Danish Ministry of Climate, Energy and Building.

Further information

Further information on BUILD UP SKILLS Denmark can be found at www.buildupskills.dk

Further information on BUILD UP SKILLS can be found at www.buildupskills.eu

Further information on the IEE Programme can be found at <http://ec.europa.eu/intelligentenergy>

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Foreword

Build Up Skills Denmark is the Danish contribution to an EU project currently being carried out across the 27 EU countries and Norway, Switzerland, and Macedonia. The project is part of the Intelligent Energy – Europe (IEEE) program, which supports energy optimisation and the use of renewable energy in Member States. Primary focus of the Build Up Skills project is on competence levels of craftsmen in the construction sector. The project is divided into two pillars:

- Pillar I – National mapping and roadmap
- Pillar II – Development of education programmes and modules

The Danish Build Up Skills project is being carried out by a consortium of the Danish Energy Agency (coordinator), Danish Technological Institute (project manager), the Danish Building Research Institute, and KommunikationsKompagniet A/S.

The project is supported by a steering committee composed of representatives from Dansk Byggeri (The Danish Construction Association), Dansk Industri (Confederation of Danish Industry), BAT Kartellet (a professional syndicate for 7 members of the Danish Confederation of Trade Unions), Byggeriets Uddannelser (construction sector education programmes), and Dansk Håndværk & Industri (DS Trade and Industry). In addition, a stakeholder group of relevant stakeholders in the construction and education sectors has provided sparring and consultancy for the consortium.

This publication is the Danish roadmap and thus the conclusion of Pillar 1. The goal of the national roadmap is to present a plan to overcome barriers and competence gaps in the construction sector in order to be able to contribute to the Danish and EU goals for reducing energy consumption or making it more efficient and for increasing the use of renewable energy in the building stock.

The roadmap has been prepared through close collaboration between the consortium and the steering committee, and with ongoing contributions from the stakeholder group. The contents of the roadmap are thus deeply rooted in the Danish construction industry, which is a precondition for subsequent implementation.

More information on the Build Up Skills project and on Pillar II, which is expected to start in 2013, can be found at www.buildupskills.dk.

1. Summary

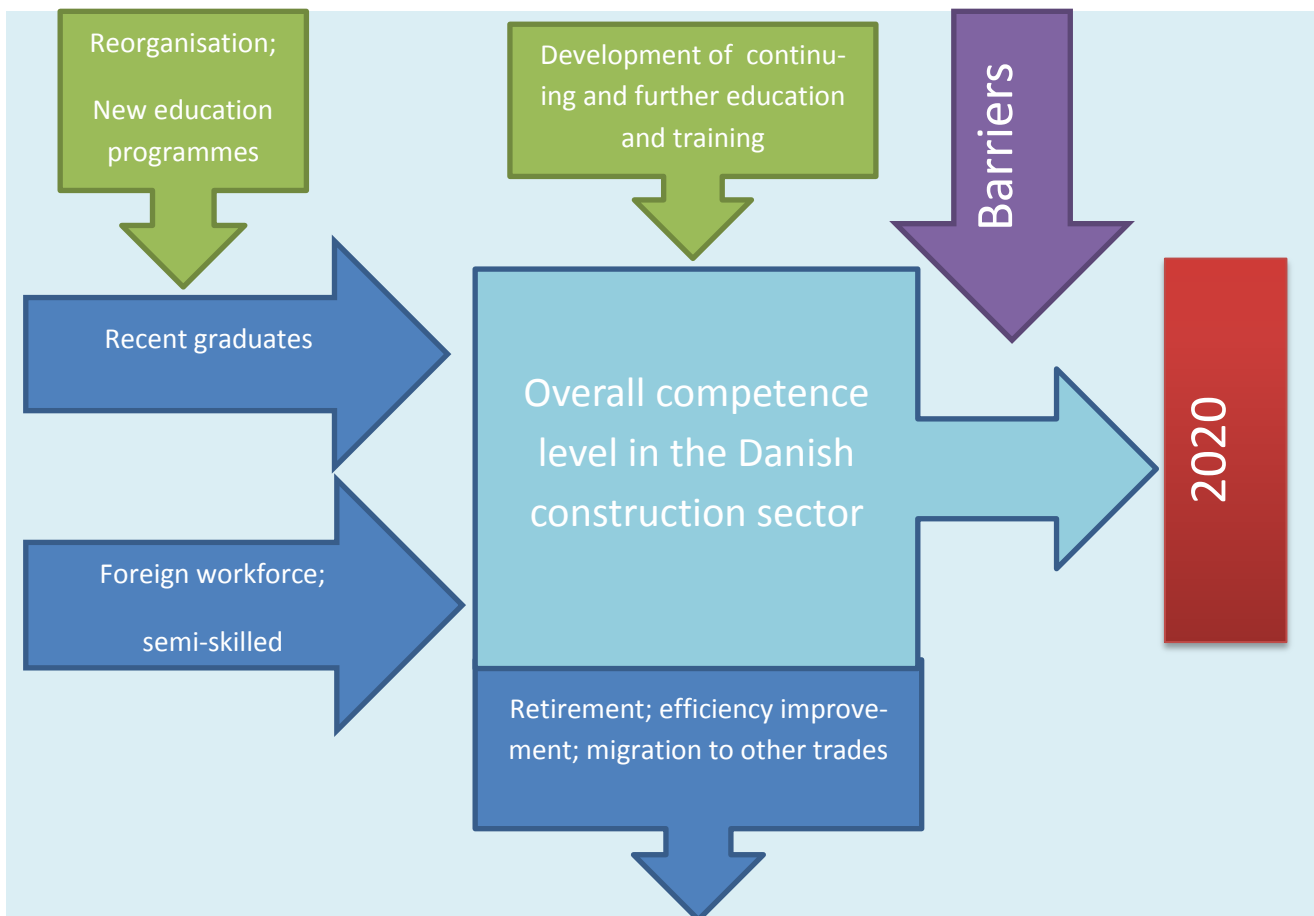
Energy consumption in buildings is a major share of the EU's total energy consumption. Energy optimisation and the use of renewable energy in buildings are crucial if the EU 2020 energy goals are to be met. It is essential that craftsmen in the building and construction industry possess the proper competences related to energy efficiency and the use of renewable energy if the construction sector is to play a central role in meeting these goals. It is on this background that the European Commission has launched the Build Up Skills projects across Europe.

The goal of this national roadmap is to assure that the Danish labour force possesses sufficient competences related to energy efficiency and the use of renewable energy in buildings, so that Denmark can meet its targets related to the overall European 2020 goals.

Mapping and analysis

The Danish roadmap is built on mapping and an analysis presented in a status quo report and an analysis report. The status quo report is presented in an independent publication by Build Up Skills Denmark, while the analysis is attached as appendix 1 of this roadmap. The approach to both of these reports has been a comprehensive investigation of barriers to the acquisition by construction sector craftsmen of competences in energy efficiency and the use of renewable energy. This is illustrated in the following figure:

Figure 1-1: mapping and analysis



The status quo report concluded that there would be a shortfall of up to 13,100 skilled construction craftsmen if the sector is to meet its share of the 2020 goals. The current competence level is thus insufficient and is a barrier to meeting these goals. The roadmap presents concrete initiatives aimed at overcoming this barrier.

There are several approaches to this. The workforce supply can be increased; the current workforce can have its skills in energy efficiency and the use of renewable energy upgraded through continuing and further education and training; and the loss of skilled workforce to other sectors can be minimised. **These are presented in more detail in chapter 2 and in the appendix.**

Nine recommendations

It has been the steering committee's wish to reflect this holistic approach in its recommendations. At the same time, it is important to recognise the fact that Denmark does not currently lack of supply of relevant vocational education and continuing and further education programmes; a greater problem is that of quality, visibility, certification and recognition, and recruitment regarding vocational education and continuing education and training. Concurrently, greater and more explicit focus is needed on multidisciplinary energy competences and collaboration.

On this background the steering committee has agreed upon nine recommendations.

- **1.** We recommend the development and introduction of new joint competence outcomes for energy topics in both school-based and enterprise-based portions of upper secondary vocational education.
- **2.** We recommend that trade committees review their education programmes to assure sufficient content regarding energy.
- **3.** We recommend increased recruitment to vocational education programmes
- **4.** We recommend establishing short cycle academy profession modules in energy topics.
- **5.** We recommend making craftsman enterprises aware of the value of skills upgrading through the adult vocational training system (AMU).
- **6.** We recommend more and better information to the target group about continuing and further education and training in energy topics.
- **7.** We recommend a systematic skills upgrading in energy topics for teachers in the adult vocational training systems, in addition to the further development of quality assurance of specialist teacher competences in energy topics.
- **8.** We recommend promoting collaborative models between architects, engineers, constructing architects, and construction craftsmen regarding energy topics. This should apply both to upper secondary vocational education programmes and to continuing and further education and training.
- **9.** We recommend increased collaboration and communication between the trade committees and the vocational training committees regarding energy topics.

Implementation of each recommendation includes a series of initiatives. **See chapter 3 for more details on the recommendations and initiatives for implementation.**

Plan of action

A plan of action is drawn up for each recommendation and its initiatives. Each plan of action presents the following overview:

- A short description of each initiative
- A list of possible participants
- The expected earliest start date
- The expected duration
- An overview of those stakeholders expected to participate in financing
- Estimated total costs of implementation of each initiative

The maximum duration of any initiative is four years if it is to have any effect on goals to be met by 2020. The total costs are estimated at DKK 61.5 million. **See chapter 4 for details about the plan of action.**

Monitoring

Coordination and monitoring are necessary to assure an effective implementation of the Danish plan of action. The steering committee suggests establishing a comprehensive information platform about implemented initiatives and an impact evaluation through 2020. **See chapter 5 for more information about monitoring.**

Financing

Some of the recommendations could likely be funded through existing structures and public appropriations. Others will need extra appropriations or other funding. **Chapter 6** presents a short introduction to EU financing possibilities.

Statements

Ongoing participation of all key construction sector stakeholders has been a central element in the Build Up Skills Denmark process. It is important that all stakeholders take ownership of the plan of action in order to assure rapid and effective implementation of the recommendations. In **Chapter 7** the steering committee demonstrates that there is full endorsement of the contents of the roadmap.

2. Introduction

The roadmap is based on a comprehensive mapping and analysis carried out in 2012-2013, and is supported by the main stakeholders in the construction sector. The figure below presents an overview of the process leading to the roadmap.

Figure 2-1: The roadmap process



The following presents a summary of the overall results and the methodological basis.

2.1. *Status quo report*

The status quo report provides an overview of the size of Denmark's heated building stock and its energy consumption for heating. The report also presents current upper secondary vocational education programmes and adult continuing and further education and training offers that target energy optimisation of the building stock. This status quo provides the basis for examining the extent of necessary future energy saving measures and the competence needs of the workforce in order to reach the construction sector's share of the 2020 goals. The status quo report thus insures a solid basis for drawing up the national roadmap.

Method

In March 2012 a broad political agreement was made, the Energy Agreement 2012, to assure an ambitious green transition in Denmark focusing on energy optimization and greater use of renewable energy throughout society. The goal of this Energy Agreement is a 7% reduction in gross energy consumption by 2020 compared to energy consumption in 2010. For the purposes of this report, this goal is seen as a corresponding reduction in the energy consumption for heating the building stock. In this report this reduction is referred to as the construction sector's share of the 2020 goals. If the goal of the Energy Agreement 2012 is reached, then Denmark will also fulfil its obligations regarding EU's 2020 goals.

With this as a point of departure, two scenarios have been set for the extent of annual energy saving initiatives within the building stock from 2015 to 2020. The positive scenario (A) assumes factors that will reduce the extent of necessary initiatives; a negative scenario (B) assumes factors that increase the extent of necessary initiatives. A range of typical, overall

energy saving initiatives are used, mainly based on the energy solutions prepared by the Danish Knowledge Centre for Energy Savings in Buildings.

The presentation of relevant education programmes focuses on the education and training of craftsmen for the construction sector workforce. The presentation of each programme includes its competence outcomes that are relevant for reducing energy use and for renewable energy, and the subjects that support these outcomes. These outcomes and the goals have been indicated by the secretaries of the national trade committees. The report includes a few medium-cycle tertiary programmes that are relevant for workforce competences in the construction sector. In addition, the report presents a snapshot of the supply of relevant continuing and further education and training, with focus on adult vocational training (AMU) offers.

Characteristics of the construction sector

The construction sector in Denmark is made up of approximately 33,000 enterprises, the great majority of which are one-man enterprises or have fewer than 10 employees. The sector is very important for Danish economy; in 2010 its net value added was DKK 64 billion, and it employed over 150,000 people (Status Quo Report 2012 - Build Up Skills Denmark). The table below presents the distribution by education of employees in the main employment categories of the construction sector.

Table 2-1 : Construction sector employees, distributed by education and field of employment

	Lower secondary	General upper secondary	Vocational	Short-cycle tertiary	Medium-cycle tertiary	Long-cycle tertiary	No information
	%	%	%	%	%	%	%
Development of building projects	12,4	6,7	35,0	7,3	22,5	9,3	6,8
Construction of buildings	26,8	3,0	51,4	3,3	11,0	2,1	2,5
Construction of roads and railways	41,5	2,6	37,0	3,7	9,8	2,7	2,8
Construction of utilities systems	44,9	2,2	43,4	3,4	3,2	0,6	2,5
Construction of other civil engineering projects	37,2	2,6	49,0	2,1	6,2	0,6	2,4
Demolition	46,2	2,4	36,7	1,5	5,0	0,9	7,4
Site preparation	46,7	1,7	43,3	1,1	2,7	0,5	4,1
Test drilling and boring	28,1	6,3	34,4	6,3	21,9	.	3,1
Electrical installation	19,8	3,5	58,6	14,3	2,7	0,5	0,6
Plumbing, heat and air-conditioning installation	19,4	1,5	65,9	9,8	2,3	0,3	0,8
Other construction installation	28,4	3,3	57,9	3,9	4,5	0,6	1,5
Plastering	20,0	.	65,0	2,5	2,5	2,5	7,5
Carpentry and joinery	21,3	2,4	69,6	2,1	3,2	0,3	1,1
Floor and wall covering	41,1	4,0	48,0	1,4	2,7	0,3	2,5
Painting	22,4	1,9	70,6	1,1	1,4	0,3	2,3
Glazing	23,4	1,9	69,9	1,2	1,8	0,4	1,5
Other building completion and finishing	29,1	5,4	56,8	2,2	2,8	1,2	2,6
Roofing activities	41,5	2,5	47,4	2,5	3,6	0,5	2,1
Bricklaying	23,2	1,8	69,1	1,8	2,6	0,3	1,2
Other specialised construction activities	38,7	3,4	49,4	2,3	3,1	0,7	2,4
total	25,9	2,6	59,6	5,1	4,4	0,8	1,6

Source: The Economic Council of the Labour Movement, based on construction employment in the registry of workforce statistics 2010.

Skilled craftsmen account for about 60% of the construction sector workforce, and semi-skilled account for a bit more than 28%; persons with general upper secondary qualifications

are statistically registered as semi-skilled. Skilled and semi-skilled workers are the core target group of the Build Up Skills initiative. The table does not present the fact that skilled workers can be employed in fields outside that of their education qualification.

One of the challenges facing the construction sector is productivity, which has been declining since 2000 according to figures from Statistics Denmark. The premise of the potential for improved efficiency is central to the assessment of the extent of educational shortcomings and needs in the workforce by 2020.

The building stock and energy consumption

The total annual energy consumption in Denmark is around 640 PJ (2011). Energy consumption in buildings is a bit over 40% of the overall adjusted consumption.

The heated building stock in Denmark is composed of approximately 2.6 million constructions; around 60% of the total floor area is used for housing. The remaining 40% is used for trade, services, and other commercial activities. A large portion of the building stock was built before 1930 and between 1961 and 1972. Only a tiny fraction (around 1%) of the total area is classified as protected or worthy of preservation.

The presentation in the Status Quo report of the building stock's energy consumption focuses on building envelopes and insulation characteristics, and on exterior windows, doors, and roof windows. In addition, data are presented for gas- and oil-fired heating installations and heat exchangers for district heating. These figures are scaled from data found in the BBR (Central Register of Buildings and Dwellings) and the energy labelling data base.

About 46% of the building stock has less than 200 mm of roof and loft insulation, which indicates an important potential for re-insulation. In addition, 58% of the building stock has poor exterior wall insulation. Re-insulation here, however, is often complicated by technical and architectural circumstances.

The presentation of the building stock's exterior windows and doors and roof windows shows that only about 40% use thermal glass. The remaining 60% have a U-factor of more than 2, which indicates that the replacement of older panes can greatly reduce energy consumption.

The Danish building stock contains around 70,000 gas-fired and 160,000 oil-fired furnaces with poor energy efficiency, and around 150,000 heat exchange units for district heating with a relatively large heat loss. These figures are scaled from data found in the BBR (Central Register of Buildings and Dwellings) and the energy labelling data base. The Energy Agreement 2012 supports the replacement of oil and natural gas furnaces in exiting construction with heating based on renewable energy.

Current education programmes for the construction sector

Upper secondary vocational education (EUD) in Denmark is offered and quality controlled by the Ministry of Children and Education (formerly the Ministry of Education) together with the national trade committees, who are responsible for monitoring and dimensioning. The most important EUD programmes for energy optimisation of buildings are: property maintenance technician, electrician, energy technician, glazier, bricklayer, chimney sweep, carpenter/joiner, concreter, technical insulator, woodwork construction, and plumbing, heat and air conditioning energy.

The individual programmes are very varied as to whether energy optimisation is a competence goal or not. The concreter programme for example does not include energy optimisation as a competence goal, but all of the electrician programmes do.

The tertiary education programmes included that are relevant to the Build Up Skills project are installations technology, architectural technology and construction management, and energy technology.

The majority of adult continuing training programmes for the construction sector workforce are offered by the adult vocational training system (AMU). There are some private suppliers, and producers of construction materials also play a role in continuing education and training by offering product-specific courses. All three groups have for some years seen an increasing demand for courses in energy optimisation and green energy.

Scenarios for Danish energy saving initiatives and education shortcomings and needs

In order to evaluate the potential of specific energy saving initiatives, an estimate has been made of the total floor area of poorly insulated lofts, exterior walls, floors, and windows, based on scaling from those constructions that are registered in the energy labelling database. Similar estimates have been made as to the number of old and outdated heat exchange units for district heating and as to the number of gas fired and oil-fired furnaces.

An estimate has been made of the number of skilled construction craftsmen needed to carry out energy saving initiatives, based on the extent of these initiatives and a hypothesis as to the time needed for individual tasks. Energy-saving initiatives in the optimistic scenario (A) need to result in annual energy savings of 1250 TJ, and in the conservative scenario (B) in annual energy savings of 2650 TJ.

Scenario A requires an additional 3700 construction craftsmen compared to the number currently employed in the construction sector. This is based on the premise that energy consumption for heating already starts to be reduced from 2011-2014 and a stricter construction code for new construction results in a reduction of overall energy consumption for heating. This scenario also incorporates do-it-yourself (DIY) projects and a number of other initiatives. A final premise is a 40% improvement in construction process efficiency.

If there is no assumption of lowered energy consumption for heating or other energy optimising initiatives, DIY is not incorporated, and construction processes are not assumed to be more efficient, then an additional 13,100 craftsmen will be needed to reach the 2020 goals.

The Table below shows the number of extra craftsmen needed for energy saving initiatives from 2015 to 2020 for scenarios A and B. The table is organised by trade group, but does not factor in improved construction process efficiency.

Table 2-2: Number of extra construction sector craftsmen needed, excluding improved productivity

Trade group	Initiatives	Scenario A	Scenario B
Bricklaying	Exterior wall insulation, floor structures, basement slabs	1.408	3.058
Carpenter/joiner	Insulate lofts, replace windows	3.973	8.352
Plumbing/heating/air conditioning (VVS)	Heating and ventilation systems	703	1.479
Electrical installations	Lighting installations and replacement of ventilators	112	224
Total		6.195	13.113

Table 2.3 below shows the number of extra craftsmen necessary in the two scenarios if experience and improved products and solutions are assumed to reduce time consumption by 40%.

Table 2-3: Number of extra construction sector craftsmen needed, including improved productivity

Trade group	Initiatives	Scenario A	Scenario B
Bricklaying	Exterior wall insulation, floor structures, basement slabs	845	1.835
Carpenter/joiner	Insulate lofts, replace windows	2.384	5.011
Plumbing/heating/air conditioning (VVS)	Heating and ventilation systems	422	888
Electrical installations	Lighting installations and replacement of ventilators	67	134
Total		3.717	7.868

Projection of the number of extra construction craftsmen needed is built on current education provision for the construction sector. It should be emphasised that the presentation of educational shortcomings and needs is an estimate.

2.2. Identification of barriers

Due to a number of barriers, a simple scaling of the number of construction craftsmen needed to reach the construction sector's share of the 2020 goals is insufficient. These barriers are economic and structural. In addition there are factors related to educational incentives. An increased supply of workforce is not necessarily the best initiative. If focus is on workforce competence levels, then increased productivity through more and better skills upgrading can complement increased workforce supply.

The next phase in drawing up the national roadmap was therefore to identify barriers to sufficient workforce size and competence levels so that the construction sector can attain its share of the 2020 goals.

Method

A range of methods were used to identify the major construction sector barriers for reaching the 2020 goals.

Table 2-4: Overview of methods used in preparing the roadmap

Method	Description	Target group
Workshop	17 representatives from the Build Up Skills stakeholder group participated in a workshop in March 2012 to identify and discuss possible barriers	Professional organisations, branch organisations, vocational schools, education and training committees
Interviews	64 in-depth semi-structured interviews with stakeholders from a range of organisations and education institutions in the construction sector. These were carried out as telephone, fact-to-face, and focus group interviews.	Specialist teachers ¹ , education managers, headmasters and heads of training at vocational colleges, education consultants, craftsmen, engineers, architects, alternative suppliers of education, trade and industry associations, and manufacturers.
Questionnaire surveys	Electronic questionnaire survey sent out to 2018 craftsmen	330 responded. Participants had all completed one or more modules of the Energy Counsellor programme. Most of the respondents were master craftsmen or business owners.
Desk research	Examination of existing reports, analyses, evaluations, and memorandums regarding energy competences and	-

¹ The Danish term "faglærer" is translated as specialist teacher. The term refers to a teacher who is a trained high-level occupational specialist and who has additional pedagogical qualifications.

Method	Description	Target group
	education and continuing education in the construction sector	

This multi-pronged methodology assures that Build Up Skills is based on available knowledge and that employees, education institutions, trade associations, and education committees can contribute to the process.

A number of barriers were thus identified to a sufficient reduction of the building stock energy consumption so as to reach the construction sector's share of the 2020 goals. These barriers were categorised as follows:

- Barriers in vocational education
- Barriers in continuing and further education and training
- Barriers in tertiary education
- Barriers in structural conditions

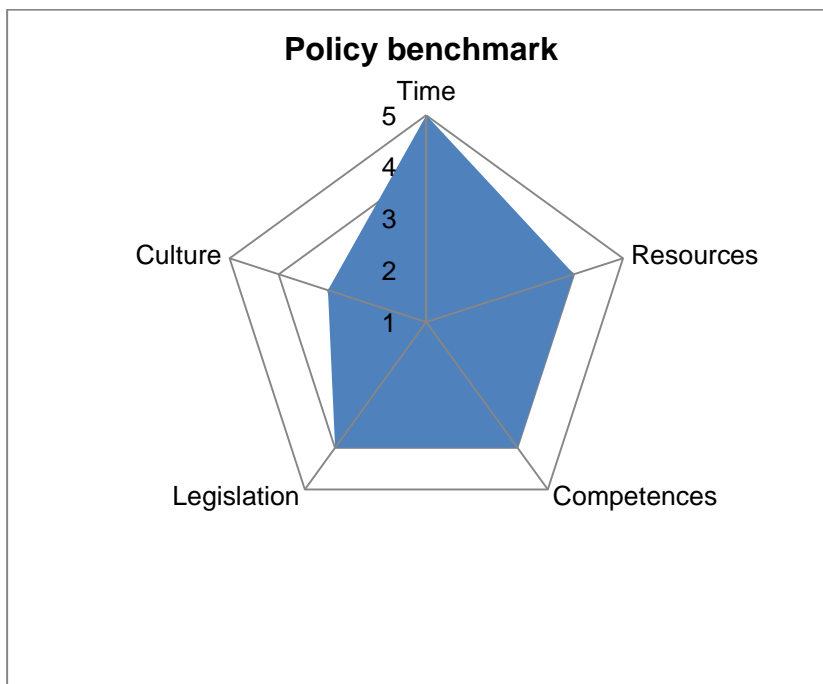
Detailed analysis results are presented in the roadmap appendix 1.

2.3. Roadmap

The final phase of the roadmap process has been to arrive at a shared understanding in the construction sector of which barriers are most significant and at the same time can most plausibly be overcome through concrete initiatives.

The stakeholder group workshop identified 12 central barriers and drew up 12 recommendations for overcoming these barriers. A SWOT analysis was drawn up for each recommendation. The workshop also attempted to identify any actions already taken to overcome these barriers. Finally, a policy benchmark was created for each recommendation, based on parameters of time, resources, competences, legislation, and culture, as illustrated in the following:

Figure 2-2: Policy benchmarking



A scale of 1 to 5 was used for each benchmark parameter:

- **Time:** How long does it take to carry out the recommendation? (1= short, 5 = long)
- **Resources:** How many resources are estimated as necessary to carry out the recommendation? (1 = few; 5 = highly resource demanding).
- **Competences:** To what degree are necessary competences seen as in place for carrying out the recommendation? (1 = to a great degree; 5 = to a slight degree).
- **Legislation:** To what extent is legislation necessary in order to carry out the recommendation? (1 = no legislation; 5 = major changes including legislation, executive orders, instructions, public hearings, etc.).
- **Culture:** To what degree will there be resistance among the stakeholders affected by the recommendations (1 = little resistance; 5 = a great deal of resistance).

The object of policy benchmarking was to create an overview of those recommendations that can be implemented easily, rapidly, and with few resources, and those that are more resource- and time-demanding. Benchmarking can thus be used to set priorities among the recommendations.

After an additional stakeholder group workshop the number of recommendations was reduced from 12 to 9, and concrete development possibilities were drawn up for each recommendation. The final recommendations have been approved by the steering committee for Build Up Skills Denmark and are thus broadly supported by the most important construction sector stakeholders in Denmark.

3. Recommendations

The following nine recommendations for the national roadmap have been approved by the steering committee for Build Up Skills Denmark:

Recommendations 1-3: Upper secondary vocational education

- We recommend the development and introduction of new joint competence outcomes for energy topics in both school-based and enterprise-based portions of upper secondary vocational education.
- We recommend that trade committees review their education programmes to assure sufficient content regarding energy.
- We recommend increased recruitment to vocational education programmes

Recommendations 4-7: Continuing and further education and training

- We recommend establishing short cycle academy profession modules in energy topics.
- We recommend making craftsman enterprises aware of the value of skills upgrading through the adult vocational training system (AMU).
- We recommend more and better information to the target group about continuing and further education and training in energy topics.
- We recommend a systematic skills upgrading in energy topics for teachers in the adult vocational training systems, in addition to the further development of quality assurance of specialist teacher competences in energy topics.

Recommendation 8: Tertiary education:

- We recommend promoting collaborative models between architects, engineers, constructing architects, and construction craftsmen regarding energy topics. This should apply both to upper secondary vocational education programmes and to continuing and further education and training.

Recommendation 9: Structural conditions

- We recommend increased collaboration and communication between the trade committees and the vocational training committees regarding energy topics.

The recommendations are not solely for new education programmes and modules. In a European context, Denmark has in its adult vocational training system (AMU) a unique system for continuing education for construction sector craftsmen. AMU courses are developed jointly by the social partners and benefit from state subsidy and from the Employer's Reimbursement Fund, financed by the Ministry for Children and Education and by enterprises through mandatory contributions from all employers, both public and private. Lack of continuing and further education supply is not necessarily a major barrier to achieving the 2020 goals for reduced energy consumption. The steering committee feels there is a barrier composed of the combination of the quality of, acquaintance with, recognition of, and attraction to upper secondary vocational education and continuing and further education and training. At the same time, sharper focus is needed on interdisciplinary energy competences and collaboration. The term interdisciplinary refers to the synergy between professions in relation to carrying out a task.

The individual recommendations are presented in greater detail in the following.

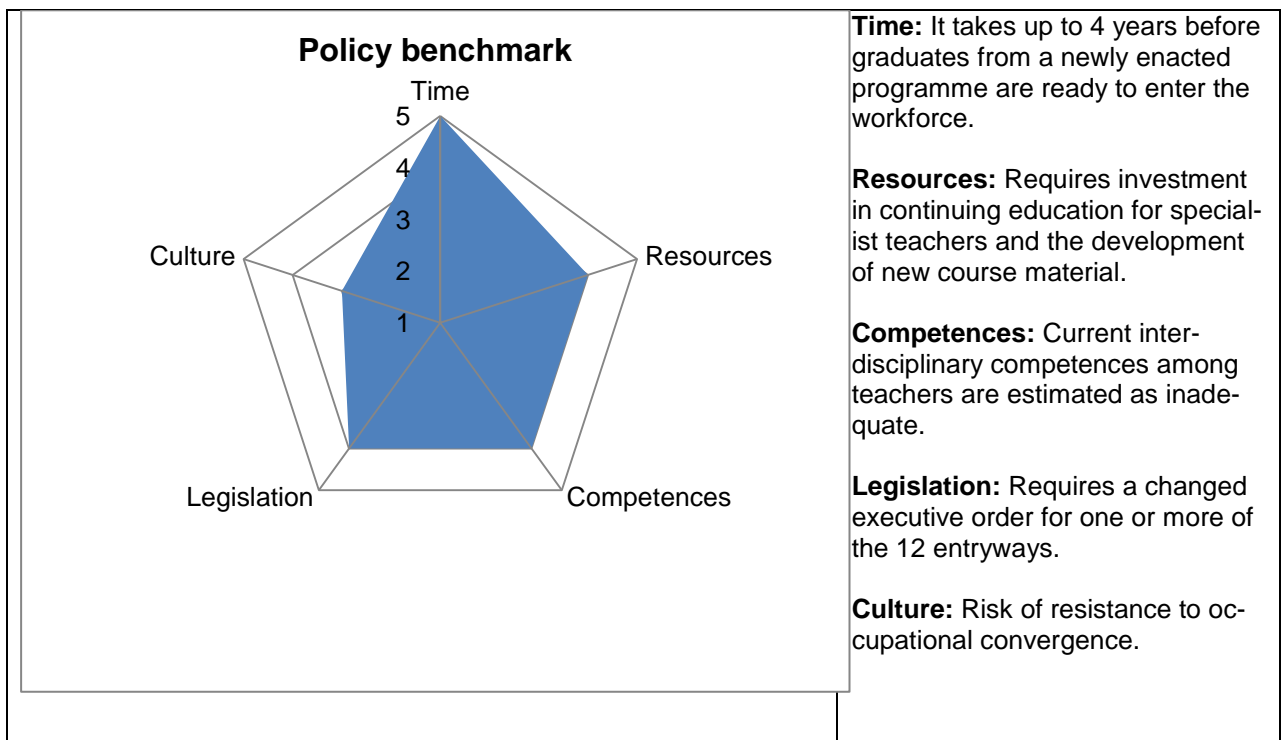
Recommendation 1: Development and introduction of new joint competence outcomes for energy topics in both school-based and enterprise based portions of upper secondary vocational education

Real insight into the physics of buildings is necessary if energy optimisation initiatives are to function optimally together. The education system must provide apprentices with better knowledge of energy problems in subjects outside their fields of specialisation. The steering committee therefore supports this recommendation.

Implementation of this recommendation will oblige schools and enterprises will have to come to terms with interdisciplinarity, leading to greater understanding of the overall construction and opportunities for logistical planning in the construction process. Joint competence outcomes assure better insight into other professions and create better collaboration. This will produce better overall construction results. Competence outcomes are however often broadly formulated. Joint competence outcomes should be accompanied by interpretation initiatives and by continuing education of occupational specialist teachers. The recommendation thus includes the following initiatives.

- 1.1 Develop new joint competence outcomes for energy topics
- 1.2 Develop guidelines for the interpretation of new joint competence outcomes
- 1.3 Inter-disciplinary continuing education for specialist teachers

The recommendation requires the trade committees to review existing competence outcomes in order to develop new joint subjects. Because of therefore changing apprenticeship goals, enterprises are at the same time responsible for incorporating these changes. It should be emphasised that energy must not be an isolated subject, but must be balanced with other elements such as indoor environment, architecture, health, and safety. A policy benchmark for this recommendation is presented below:



It is estimated that the recommendation will notably improve energy competences in the construction sector craftsman workforce. The main drawback is that the time frame for implementation is very long in relation to the 2020 goals.

Recommendation 2: The trade committees review their education programmes to assure sufficient content regarding energy

The Status Quo report and the roadmap appendix clearly show that there is a need for a greater number of specialists who can manage energy renovation and energy efficient construction within existing professions if the 2020 goals for CO₂ emission reduction are to be met. Important fields are:

Woodwork construction (carpenter/joiner)

- Installation of vapour barriers/building air-tightness
- Replacement and sealing of windows and doors
- Thermal bridges in building envelopes
- Re-insulation
- General energy and building understanding

Bricklayer

- Installation of vapour barriers/building air-tightness
- Transition to foundations, windows, and other potential thermal bridges
- Exterior wall re-insulation
- General energy and building understanding

Concreter and paver

- General energy and building understanding
- Transition to foundations and other potential thermal bridges

Electrician

- Vapour barriers/building air-tightness
- Dimensioning, installation, and operations of sustainable energy systems (heat pumps, solar heat, solar cells, etc.)
- Technical system instruction for end users and owners of buildings
- Dimensioning, installation, and operations of CCM, building automation, air conditioning, and ventilation systems
- General energy and building understanding

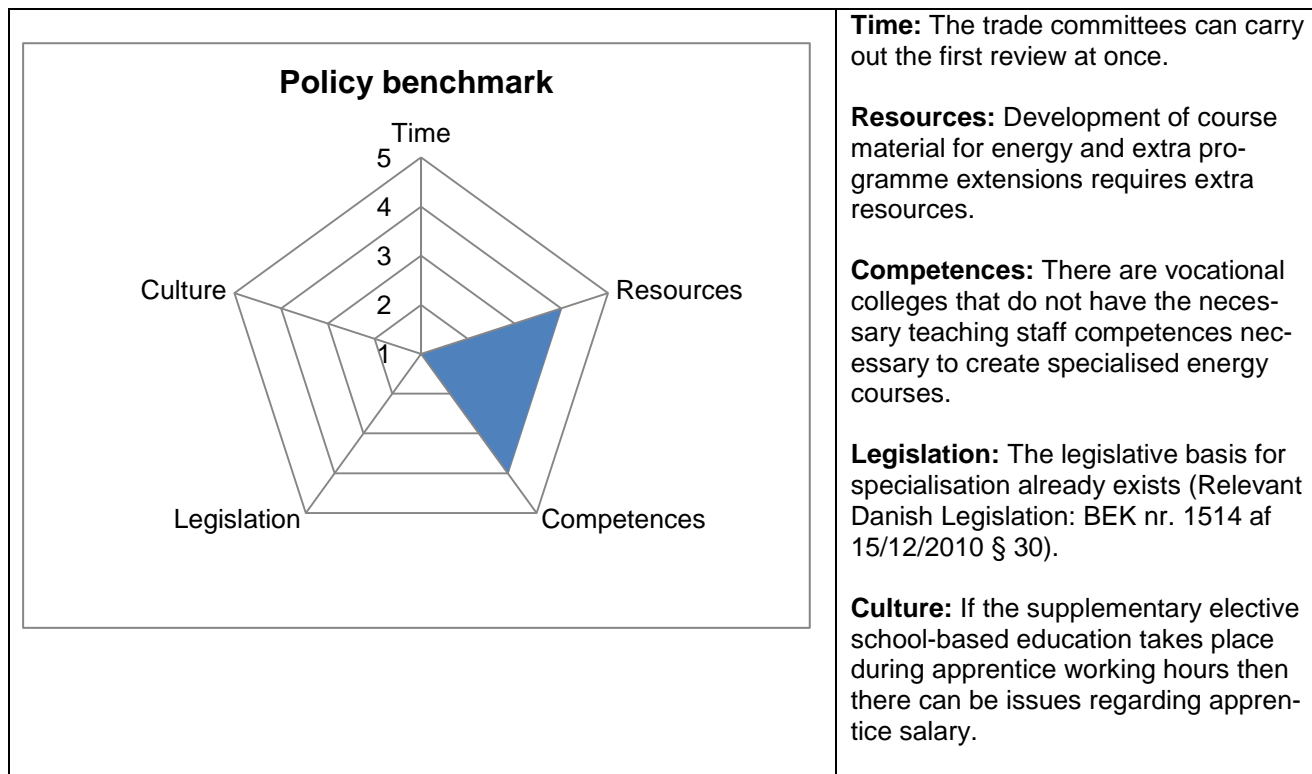
Plumber (plumbing, heating, and air conditioning)

- Technical system instruction for end users and owners of buildings
- Dimensioning, installation, and operations of CCM, building automation, air conditioning, and ventilation systems
- General energy and building understanding
- Understanding of hydraulic balance in heating systems

Specialisation courses can be offered either during the normal vocational education programme or through add-ons. The recommendation includes the following initiatives:

- 2.1 Develop energy subject matter (modules) for standard vocational programmes and for relevant add-on courses.
- 2.2 Develop an extension of relevant vocational programmes, for example with an energy theme lasting six months.
- 2.3 Increase joint information efforts - with trade associations, education institutions, youth counselors, etc. - about new and existing opportunities for energy specialisation.

Strengthened programme-relevant energy add-ons and extensions will raise competence levels and strengthen interdisciplinary understanding. At the same time, craftsmen with special focus on energy could be pioneers for others on the construction site. The steering committee also finds, however, that new courses and qualification extension need to be accompanied by massive information efforts in order to achieve the desired goals. A policy benchmark for this recommendation is presented below:



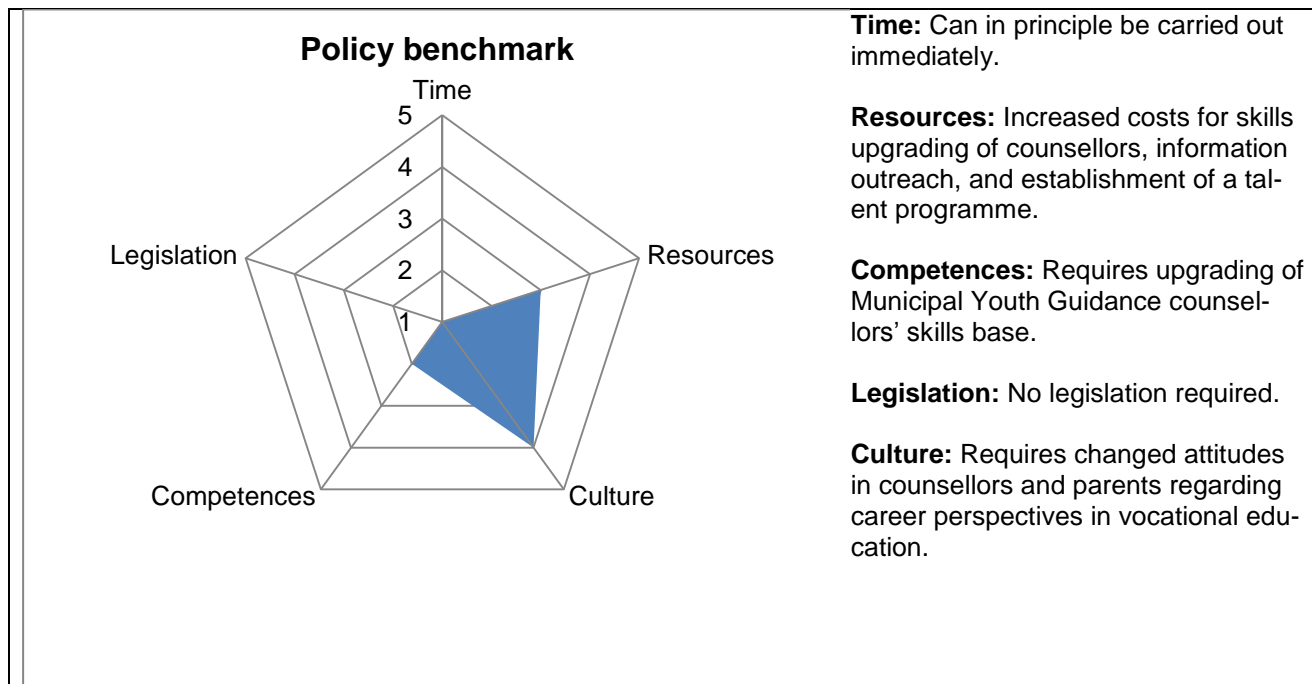
The major challenges to this recommendation are that it can be resource-demanding and at the same time requires skills upgrading of many specialist teachers. The recommendation is closely linked to recommendation 7 described later.

Recommendation 3: Increased recruitment to vocational education programmes

According to the scenarios in the Status Quo report, up to 13,000 more skilled construction workers will be needed in order to meet the 2020 energy goals. At the same time, intake to vocational education programmes has been declining, and drop-out levels remain high. If this pattern is to change, a multi-pronged strategy will be necessary to increase recruitment to vocational education programmes in energy topics. The recommendation includes the following initiatives:

- 3.1 Raise the priority of vocational education programmes at the Municipal Youth Guidance Centres. Counsellors should acquire greater familiarity about vocational programmes and what they can lead to of further education opportunities.
- 3.2 Establish a talent programme for energy effective construction and energy renovation.
- 3.3 Information campaigns about EUX (general upper secondary vocationally oriented) programmes and opportunities for further study in energy and energy sustainability.
- 3.4 Strengthen recruitment from general upper secondary to vocational programmes through visible credit transfer opportunities.

Greater emphasis on counselling will show vocational education programmes as real career possibilities for a larger target group. Talent programmes, information about upper secondary vocationally oriented programmes, and strengthened recruitment from general upper secondary programmes can together attract a larger group of socio-economically advantaged students, which will benefit the construction sector. It is especially important that general upper secondary students be made aware of credit transfer schemes early in their education. This can save time and resources for the individual and for society. A policy benchmark for this recommendation is presented below:



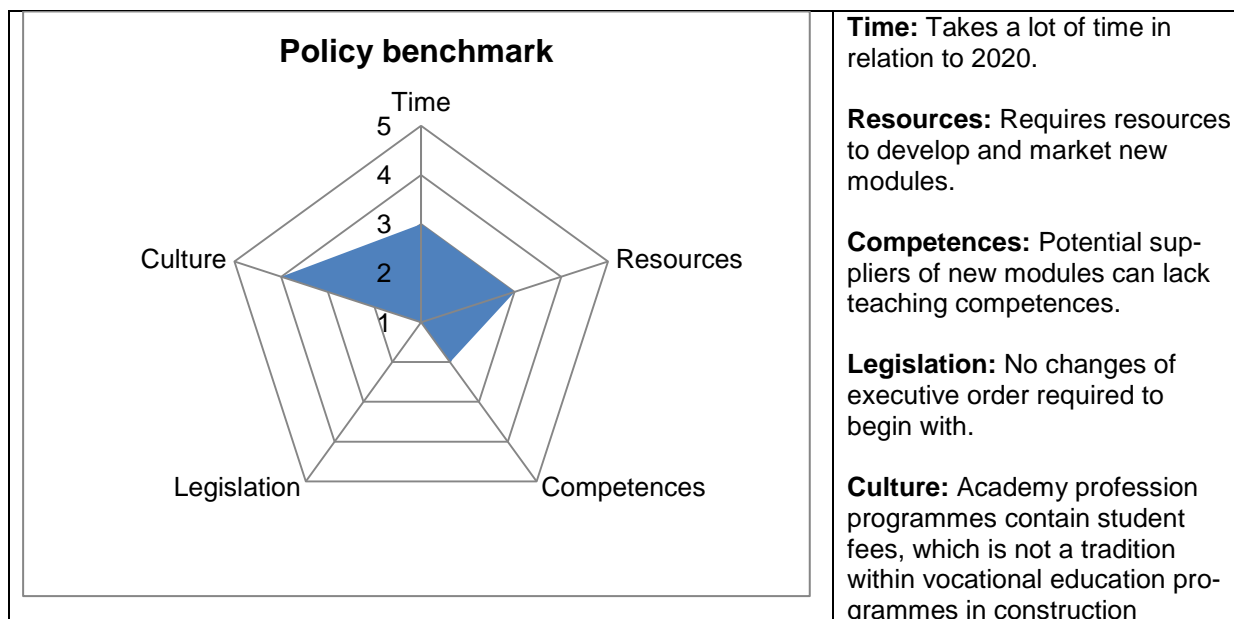
The greatest challenge to implementation of this recommendation is the necessity of changed attitudes in counsellors and at the vocational education institutions. In addition, there is a long time frame in relation to the 2020 goals before this recommendation can take effect; recruitment to and completion of a vocational education programme in construction takes a minimum of 4 years. The steering committee thus recommends that the concrete initiatives be initiated immediately.

Recommendation 4: Develop short-cycle academy profession modules in energy topics

The adult vocational training system (AMU) offers continuing education up to and including that of a skilled worker. The field of energy lacks attractive and publicly recognised continuing and further education and training programmes at levels higher than that of skilled worker. To respond to this shortage, the steering committee therefore recommends the establishment of short-cycle academy profession modules in energy topics. New academy profession modules in energy topics will raise competence levels and strengthen professionalism for the benefit of the construction industry as a whole. The recommendation includes the following initiative:

4.1 Develop new, national professional modules as short as 5 ECTS points. These modules can be incorporated into a complete academy profession qualification.

Academies of professional higher education that offer craftsmen continuing and further education in energy topics can provide employees the opportunity for upgrading professional skills within a competence framework while remaining on the job. The steering committee found it important that the modules be relatively short in order to reduce barriers for participation. At the same time, these modules should represent a clearly marked pathway to a full academy profession qualification. The policy benchmark is presented below:

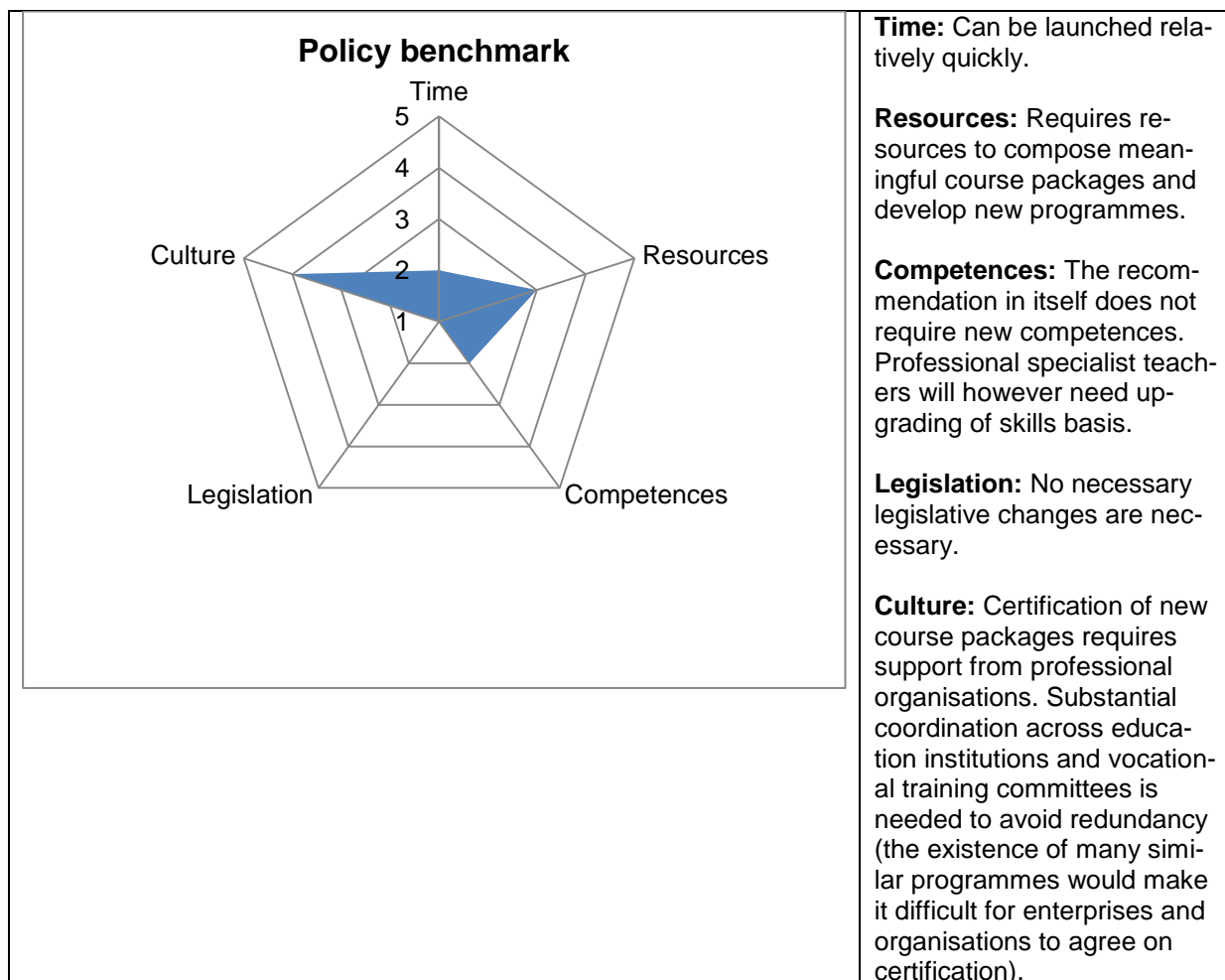


Recommendation 5: Make craftsman enterprises aware of the value of skills upgrading through the adult vocational training system (AMU)

The Status Quo analysis and the roadmap appendix show that there in general is a comprehensive supply of AMU courses in energy topics. Many enterprises are reluctant to send employees to courses because it is difficult to see the value of these courses for the employees and for the enterprise. The steering committee therefor finds that there is a need to make enterprises aware of the value of skills upgrading through the AMU system. This can be achieved through a multi-pronged strategy. The recommendation includes the following initiatives:

- 5.1 Certify course packages consisting of existing AMU outcomes.
- 5.2 Develop of new course packages that can lead to an industry certification
- 5.3 Establish professional networks etc. to disseminate the value of skills upgrading.

Certification of course packages can take place on the basis of AMU outcomes or newly-developed outcomes. Vocational training committees are responsible for this assessment. A policy benchmark is presented below:



The greatest challenge to this recommendation is the need for coordination across vocational training committees to avoid redundancy and the existence of many similar course packages. Certification of a course package requires agreement within the individual trade organisation.

Recommendation 6: Develop more and better information to the target group about continuing and further education and training in energy topics

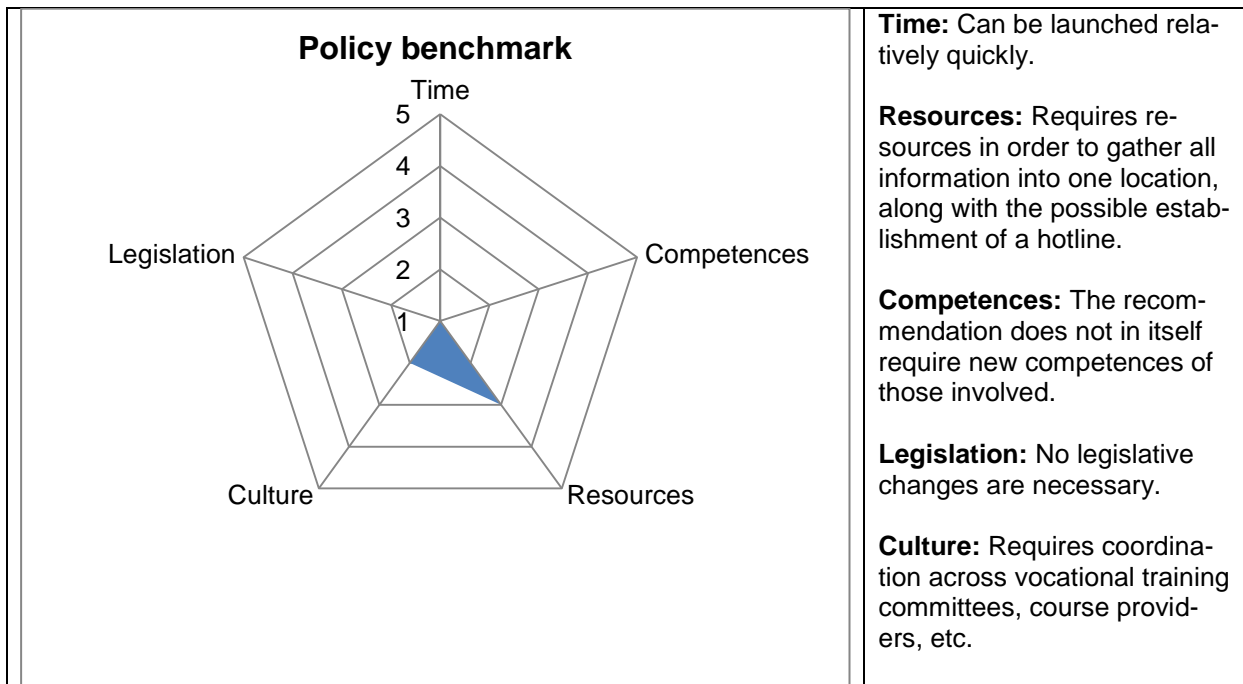
If the workforce is to have its skills basis upgraded in energy topics, then enterprises and their employees need to be aware of the existence of skills upgrading opportunities. The Status Quo analysis and the roadmap appendix show that there is little familiarity with exiting opportunities, and there is little knowledge as to where to obtain information. The steering committee recommends the development of more and better information about continuing and further education and training in energy topics. The recommendation includes the following initiatives:

- 6.1 Gather all information on continuing and further education and training in energy topics in an interdisciplinary portal - including information about course opportunities.
- 6.2 Adult continuing training (VEU) centres must be better prepared to offer counselling on continuing education opportunities in energy topics.
- 6.3 Establish a hotline.

A number of websites already offer information on continuing and further education opportunities to a range of target groups. The Ministry of Children and Education has established *eferuddannelse.dk*. This site includes courses offered by technical colleges, business col-

leges, adult vocational training centres, social and health care colleges, agricultural colleges, and a number of private providers. The recommendation is not to establish a new website, but rather to integrate existing websites in a single new portal for energy topics.

The steering committee agreed to build upon existing information structures in order to improve information about continuing education opportunities in energy topics. The 13 adult vocational training (VEU) centres play a central role, since they represent a unified entryway for individuals and for enterprises in need of counselling on opportunities for adult education and continuing education. The Status Quo report and the roadmap appendix indicate, however, that there is a need for better VEU counselling regarding energy topics. A policy benchmark is presented below:



The threshold for implementing this recommendation is assessed as low for most of the parameters. The greatest challenge is to get all stakeholders to use a single entryway for available continuing and further education offers in energy topics, and to market this entryway so that it becomes known.

Recommendation 7: Carry out a systematic skills upgrading in energy topics for teachers in the adult vocational training system, and further develop a quality assurance system for the assessment and assurance of specialist teacher competences in energy topics.

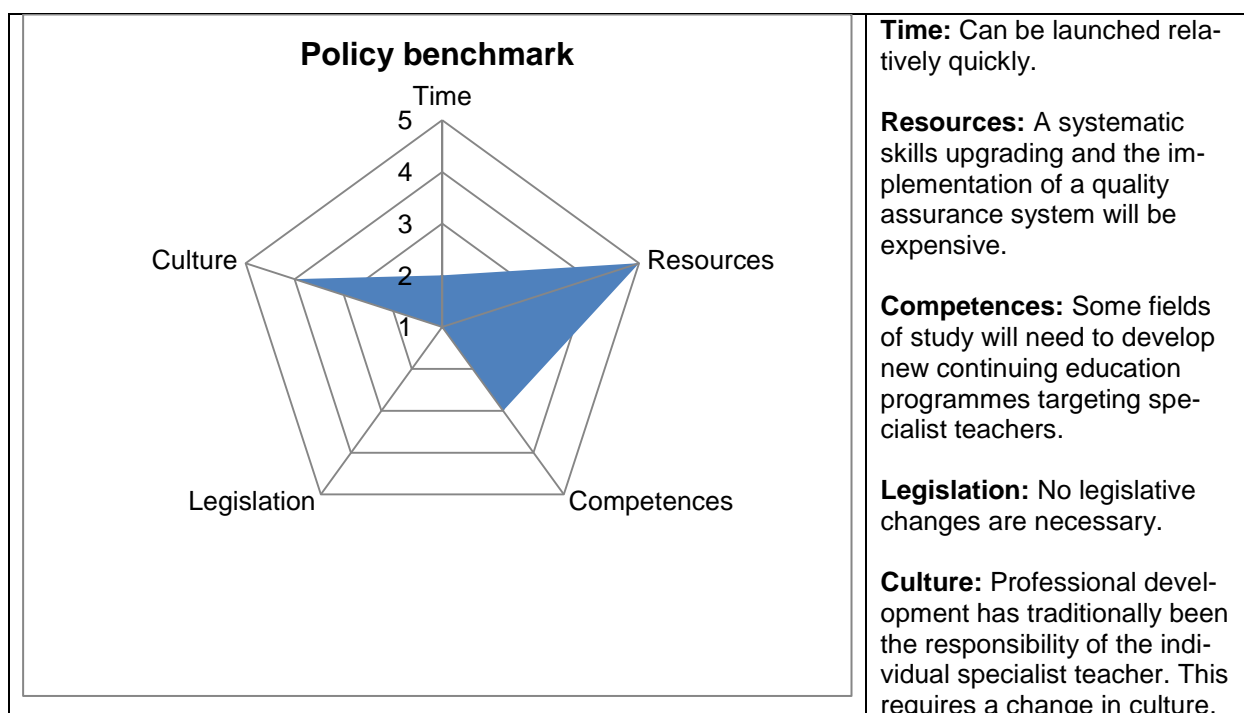
There is a need for increased upgrading of specialist teacher skills in adult vocational training (and throughout upper secondary vocational education) in order to assure the quality of teaching and the level of professionalism regarding energy topics. This is a central recommendation, and a prerequisite for the implementation of several other recommendations, especially recommendation 2 about strengthening content regarding energy topics in upper secondary vocational education programmes. The recommendation includes the following initiatives:

- 7.1 Systematic investigation of the need for skills upgrading in energy topics of specialist adult vocational training teachers.
- 7.2 Develop better teaching resources for energy topics.
- 7.3 Develop a framework for quality assurance of teacher competences in energy topics.
- 7.4 Develop a framework for uniform national continuing education opportunities for teachers.

7.5 Develop a portal for teaching resources for specialist teachers.

Systematic skills upgrading of specialist teachers will raise the level of professionalism in both the adult vocational and upper secondary vocational programmes, since specialist teachers usually work in both areas. The steering committee finds that such a skills upgrading will demand the development of new and better teaching resources and long-term the development of a framework of uniform national opportunities for continuing education for teachers. A portal for teaching resources can be beneficial to knowledge sharing. Implementation of this recommendation can increase the quality of adult vocational programmes and increase collaboration with enterprises on necessary initiatives in continuing education.

The development of a framework for quality assurance of teacher competences in energy topics is an important element; in this way education institutions and private suppliers can document that they have a sufficiently competent teaching staff. A policy benchmark is presented below:



The greatest barrier to this recommendation is that systematic skills upgrading is expensive.

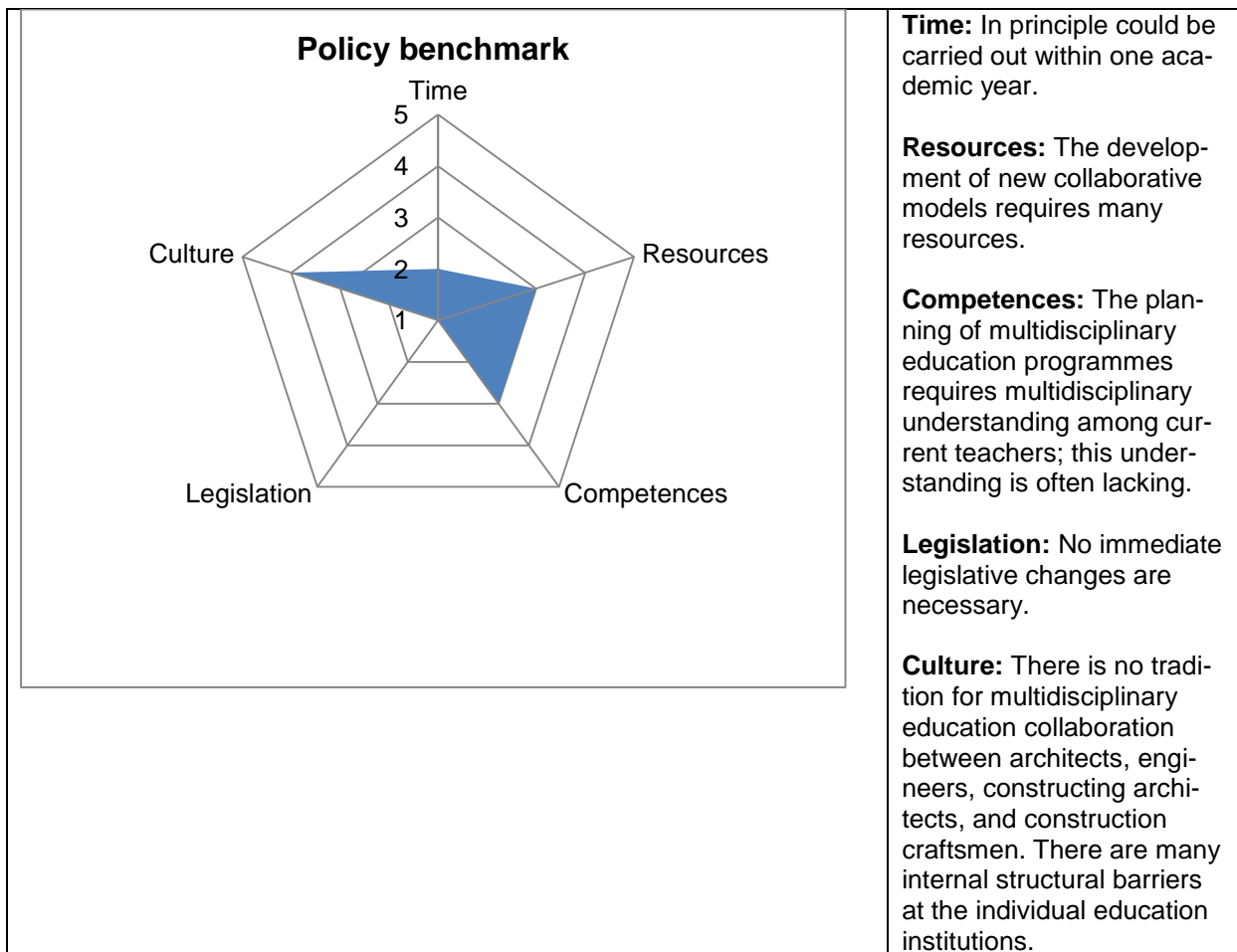
Recommendation 8: Promote collaborative models between architects, engineers, constructing architects, and construction craftsmen regarding energy topics. This should apply both to upper secondary vocational education programmes and to continuing and further education and training

The Danish national roadmap includes tertiary education insofar as it overlaps competences relevant to construction sector craftsmen. Newly qualified architects, engineers, and constructing architects often know little about each other's occupational fields and little about the occupations employed on the construction site. This leads to avoidable errors in projection design and execution, and negatively affects energy optimisation of buildings. The steering committee therefore recommends promoting collaborative models between professions - both in upper secondary vocational education programmes and in continuing and further education and training. The recommendation includes the following initiatives:

- 8.1 Establish pilot projects such as interdisciplinary teacher collaboration, interdisciplinary courses shared between education institutions, and interdisciplinary continuing education courses in energy topics.
- 8.2 Perhaps prepare a motivational catalogue that clearly shows the bottom-line value of interdisciplinary understanding in construction.

Interdisciplinary insight that is instilled early in the education programme increases the chances of its survival beyond the education institution and onto the construction site. This increases construction site efficiency and reduces errors, which positively influences energy optimisation, increases innovation, and improves bottom-line figures.

If motivation to participate in collaborative projects is to increase, the steering committee concludes that there is a need to make the bottom-line value more visible; this is the reason for including the "motivational catalogue" as a concrete initiative. A policy benchmark is presented below:



The greatest barrier to this recommendation is cultural. This is why pilot projects were chosen (see 8.1 above) rather than mandatory collaboration.

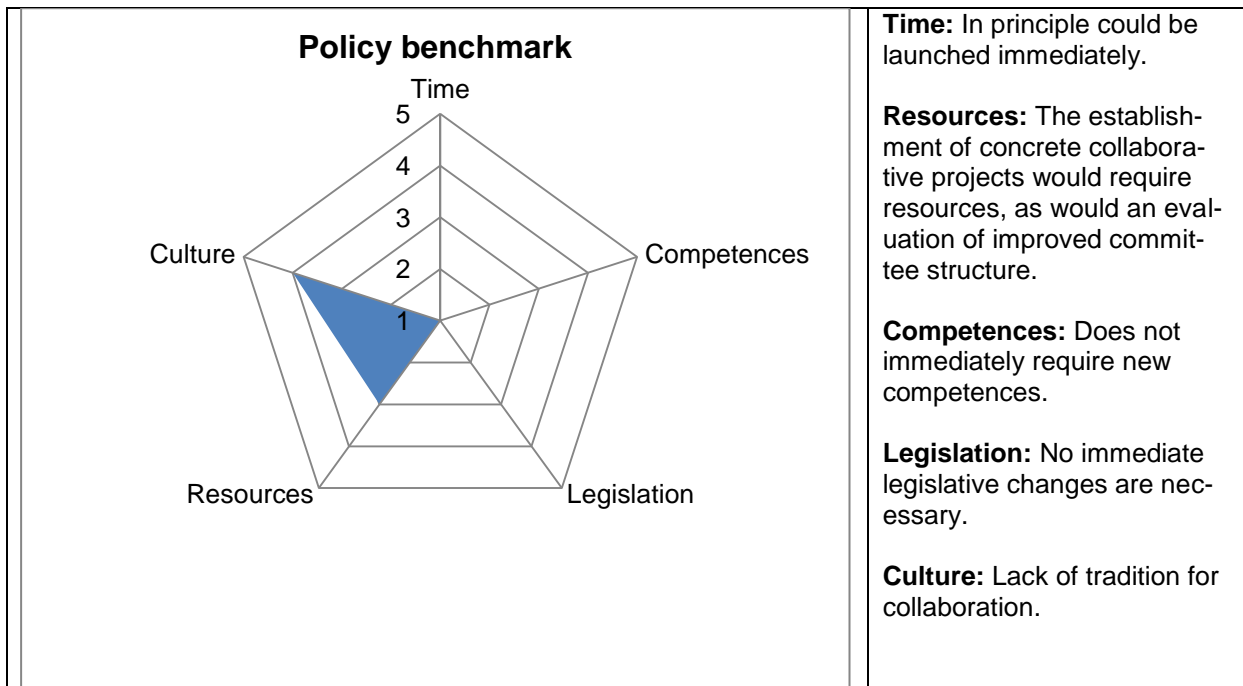
Recommendation 9: Increase collaboration and communication between trade committees and vocational training committees regarding energy topics

Communication and collaboration between committees - trade committees and vocational training committees - are not optimal. This does not promote multidisciplinary or coordination of energy efforts, which in turn is detrimental to a general holistic understanding of ener-

gy in construction. With recommendation 9 the steering committee aims to strengthen collaboration and communication between education committees regarding energy topics. The recommendation includes the following initiatives:

- 9.1 Establish binding collaboration between trade committees and vocational training committees, including a concrete strategy for the provision of joint interdisciplinary energy subjects and courses.
- 9.2 Evaluate how improved committee structure could promote collaboration between trades on energy topics.

Committee collaboration between construction sector trades can strengthen focus on collaboration in construction, and thereby help meet future interdisciplinary competence needs in energy topics. If the binding collaboration results in joint energy competence outcomes in vocational education programmes, then this in turn will strengthen new graduates' general holistic understanding of energy in the construction sector. The same holds true for collaboration in continuing education. Recommendation 9 is thus closely linked to recommendation 1. A policy benchmark is presented below:



4. Plan of action

The plan of action presents concrete implementations of each initiative presented in the previous section. It should be emphasised that the list of possible participants is not necessarily complete. In addition, the expected start date is an assessment of how quickly the initiative could be launched assuming sufficient financing and willing participants. Estimated costs express the total costs of each initiative, and also indicate the steering committee's assessment of the relative importance of each initiative.

Recommendation 1: Upper secondary vocational education (EUD)

Development and introduction of new joint competence outcomes for energy topics in both school-based and enterprise based portions of upper secondary vocational education

Initiatives	Description	Possible participants	Expected start	Expected duration	Own/co-financing	Estimated costs (million DKK)
1.1 Develop new joint competence outcomes for energy topics	Establish a strategic collaboration in order to formulate new joint competence outcomes	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ Other occupational experts 	2013	1-2 years	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education 	1
1.2 Develop guidelines for the interpretation of new joint competence outcomes	Develop new subjects and guidelines for the interpretation of new competence outcomes	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ Other occupational experts 	2014	2-4 years	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education 	2
1.3 Interdisciplinary continuing education for specialist teachers	Carry out a systematic investigation among specialist teachers to establish the need for skills upgrading of interdisciplinary competences related to energy topics. Subsequently, implement tailored continuing education initiatives.	<ul style="list-style-type: none"> ▪ Vocational colleges ▪ Consultancy ▪ Suppliers of tailor-made continuing and further education of specialist teachers 	2013	2-4 years	<ul style="list-style-type: none"> ▪ Vocational colleges ▪ The Ministry of Children and Education 	12

Recommendation 2: Upper secondary vocational education (EUD)

The trade committees review their education programmes to assure sufficient content regarding energy

Initiatives	Description	Possible participants	Expected Start	Expected time frame	Own/co-financing	Estimated costs (million DKK)
2.1 Develop energy subject matter (modules) for standard vocational programmes and for relevant add-on courses.	Establish a strategic collaboration in order to carry out a systematic review of current education programmes and subsequent development of needed energy subjects in upper secondary vocational programmes	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ Other occupational experts 	2013	1-2 years	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education 	2
2.2 Develop an extension of relevant vocational programmes, for example with an energy theme lasting six months.	Establish a strategic collaboration in order to develop programme extensions dealing with energy topics for the relevant vocational education programmes.	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ Other occupational experts 	2014	2-4 years	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education 	2
2.3 Increase joint information efforts - with trade associations, education institutions, youth counselors, etc. - about new and existing opportunities for energy specialisation.	Establish a strategic collaboration in order to systematically review existing information material, and subsequently develop joint communication strategies and materials.	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ UUUC (Youth Counselling Centres) ▪ Occupational experts ▪ Communication agencies 	2014	1-2 years	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education ▪ Occupational and trade associations 	1.5

Recommendation 3: Upper secondary vocational education (EUD)

Increased recruitment to vocational education programmes

Initiatives	Description	Possible participants	Expected Start	Expected time frame	Own/co-financing	Estimated costs (million DKK)
3.1	Raise the priority of vocational education programmes at the Municipal Youth Guidance Centres. Counsellors should acquire greater familiarity about vocational programmes and what they can lead to of further education opportunities.	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education ▪ UUUC (Youth Counselling Centres) ▪ Other occupational experts 	2013	1-2 years	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education ▪ UUUC (Youth Counselling Centres) 	2
3.2	Establish a talent programme for energy effective construction and energy renovation.	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education ▪ Other occupational experts 	2014	2-4 years	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education 	2

3.3 Information campaigns about EUX (general upper secondary vocationally oriented) programmes and opportunities for further study in energy and energy sustainability.	Carry out a systematic review of existing information channels and materials. Subsequently, develop joint communication strategies and materials.	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education ▪ UUUC (Youth Counselling Centres) ▪ Communication agencies ▪ Other occupational experts 	2013	1-2 years	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education ▪ UUUC (Youth Counselling Centres) 	2
3.4 Strengthen recruitment from general upper secondary to vocational programmes through visible credit transfer opportunities.	Establish a strategic collaboration in order to review existing information channels and materials. Subsequently, develop joint communication strategies and materials.	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education ▪ UUUC (Youth Counselling Centres) ▪ Communication agencies ▪ Other occupational experts 	2014	1-2 years	<ul style="list-style-type: none"> ▪ Trade committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education ▪ UUUC (Youth Counselling Centres) 	2

Recommendation 4: Continuing and further education

Develop short-cycle academy profession modules in energy topics

Initiatives	Description	Possible participants	Expected Start	Expected time frame	Own/co-financing	Estimated costs (million DKK)
4.1 Develop new, national professional modules as short as 5 ECTS points. These modules can be incorporated into a complete academy profession qualification.	Establish a strategic partnership in order to develop new academy profession modules in energy topics.	<ul style="list-style-type: none"> ▪ Academy profession institutions ▪ Ministry of Science, Innovation and Higher Education ▪ Social partners ▪ Other occupational experts 	2014	1-2 years	<ul style="list-style-type: none"> ▪ Academy profession institutions ▪ Ministry of Science, Innovation and Higher Education ▪ Social partners 	2

Recommendation 5: Continuing and further education

Make craftsman enterprises aware of the value of skills upgrading through the adult vocational training system (AMU)

Initiatives	Description	Possible participants	Expected Start	Expected time frame	Own/co-financing	Estimated costs (million DKK)	
5.1	Certify course packages consisting of existing AMU outcomes.	Establish a strategic collaboration among all relevant sector stakeholders in order to certify course packages consisting of existing AMU outcomes.	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Local training committees ▪ Social partners ▪ Vocational colleges ▪ Other occupational experts 	2014	1-2 years	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education 	1
5.2	Develop of new course packages that can lead to an industry certification	Establish a strategic collaboration in order to develop new course packages not yet specified in terms of AMU outcomes, and concurrently assure national recognition of certification.	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Local training committees ▪ Social partners ▪ Vocational colleges ▪ Other occupational experts ▪ Adult continuing training (VEU) centres 	2014	2-4 years	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Social partners ▪ Vocational colleges ▪ The Ministry of Children and Education 	3
5.3	Establish professional networks etc. to disseminate the value of skills upgrading	Establish new networks or strengthen existing networks regarding the value-added of continuing education and training.	<ul style="list-style-type: none"> ▪ Social partners ▪ Manufacturers ▪ Education institutions ▪ Adult continuing training (VEU) centres ▪ Other occupational experts 	2014	1-2 years	<ul style="list-style-type: none"> ▪ Social partners ▪ Manufacturers ▪ Education institutions ▪ Adult continuing training (VEU) centres 	1

Recommendation 6: Continuing and further education

Develop more and better information to the target group about continuing and further education in energy topics

Initiatives	Description	Possible participants	Expected Start	Expected time frame	Own/co-financing	Estimated costs (million DKK)
6.1	Gather all information on continuing and further education and training in energy topics in an interdisciplinary portal - including information about course opportunities	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Social partners ▪ Adult continuing training (VEU) centres ▪ Education institutions ▪ Other occupational experts ▪ The Ministry of Children and Education 	2014	0-1 years	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Social partners ▪ Adult continuing training (VEU) centres ▪ Education institutions ▪ The Ministry of Children and Education 	1
6.2	Adult continuing training (VEU) centres must be better prepared to offer counselling on continuing education opportunities in energy topics. Subsequently, implement tailored continuing education initiatives.	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Social partners ▪ Adult continuing training (VEU) centres ▪ Education institutions ▪ Consultancy ▪ Other occupational experts 	2014	1-2 years	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Social partners ▪ Adult continuing training (VEU) centres ▪ Education institutions 	3

6.3	Establish a hotline	Establish a strategic collaboration in order to implement a joint hotline.	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Social partners ▪ Adult continuing training (VEU) centres ▪ Education institutions ▪ Other occupational experts ▪ The Ministry of Children and Education 	2014	0-2 years	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Social partners ▪ Adult continuing training (VEU) centres ▪ Education institutions ▪ The Ministry of Children and Education 	1
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Recommendation 7: Continuing and further education

Carry out a systematic skills upgrading in energy topics for teachers in the adult vocational training system, and further develop a quality assurance system for the assessment and assurance of specialist teacher competences in energy topics

Initiatives	Description	Possible participants	Expected Start	Expected time frame	Own/co-financing	Estimated costs (million DKK)
7.1 Systematic investigation of the need for skills upgrading in energy topics of specialist adult vocational training teachers	Carry out a systematic investigation of specialist teachers to assess any need for continuing education in energy topics. Subsequently, implement tailored continuing education initiatives.	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Education institutions ▪ Other occupational experts ▪ Social partners ▪ Trade associations ▪ The Ministry of Children and Education 	2014	1-2 years	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Education institutions ▪ Social partners ▪ Trade associations ▪ The Ministry of Children and Education 	12
7.2 Develop better teaching resources for energy topics	Review existing material and develop new teaching resources.	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Education institutions ▪ Social partners ▪ Trade associations ▪ The Ministry of Children and Education ▪ Other occupational experts 	2014	1-2 years	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Education institutions ▪ Social partners ▪ Trade associations ▪ The Ministry of Children and Education 	2
7.3 Develop a framework for quality assurance of teacher competences in energy topics	Establish a strategic collaboration in order to develop a framework for a quality assurance system.	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Education institutions ▪ Social partners ▪ Trade associations ▪ The Ministry of Children and Education ▪ Other occupational experts 	2015	1-2 years	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Education institutions ▪ Social partners ▪ Trade associations ▪ The Ministry of Children and Education 	2

7.4 Develop a framework for uniform national continuing education opportunities for teachers	Establish a strategic collaboration in order to develop a framework for a uniform national continuing education concept.	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Education institutions, including academy profession ▪ Social partners ▪ Trade associations ▪ The Ministry of Children and Education ▪ Other occupational experts 	2014	0-1 year	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Education institutions, including academy profession ▪ Social partners ▪ Trade associations ▪ The Ministry of Children and Education 	1
7.5 Develop a portal for teaching resources for specialist teachers	Develop and establish a joint portal for teaching resources regarding energy topics.	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Education institutions, including academy profession ▪ Social partners ▪ Trade associations ▪ The Ministry of Children and Education ▪ Other occupational experts 	2014	0-1 years	<ul style="list-style-type: none"> ▪ Vocational training committees ▪ Education institutions, including academy profession ▪ Social partners ▪ Trade associations ▪ The Ministry of Children and Education 	2

Recommendation 8: Tertiary education

Promote collaborative models between architects, engineers, constructing architects, and construction craftsmen regarding energy topics. This should apply both to upper secondary vocational education programmes and to continuing and further education and training

Initiatives	Description	Possible participants	Expected Start	Expected time frame	Own/co-financing	Estimated costs (million DKK)
8.1	Establish pilot projects such as interdisciplinary teacher collaboration, interdisciplinary courses shared between education institutions, and interdisciplinary continuing education courses in energy topics.	<ul style="list-style-type: none"> ▪ Vocational colleges ▪ Schools of architecture ▪ University colleges ▪ Business academies ▪ Schools of engineering ▪ Social partners ▪ Other occupational experts 	2013	1-2 year	<ul style="list-style-type: none"> ▪ Vocational colleges ▪ Schools of architecture ▪ University colleges ▪ Business academies ▪ Schools of engineering ▪ Social partners 	2
8.2	Prepare a motivational catalogue that clearly shows the bottom-line value of interdisciplinary understanding in construction	<ul style="list-style-type: none"> ▪ Trade associations ▪ Social partners ▪ Education institutions ▪ Other occupational experts 	2014	1-2 years	<ul style="list-style-type: none"> ▪ Trade associations ▪ Social partners 	

Recommendation 9: Structural conditions

Increase collaboration and communication between trade committees and vocational training committees regarding energy topics

Initiatives	Description	Possible participants	Expected Start	Expected time frame	Own/co-financing	Estimated costs (million DKK)
9.1	Establish binding collaboration between trade committees and vocational training committees, including a concrete strategy for the provision of joint interdisciplinary energy subjects and courses	<ul style="list-style-type: none"> ▪ Trade committees ▪ Vocational training committees ▪ Social partners ▪ The Ministry of Children and Education ▪ Other experts 	2015	1-2 years	<ul style="list-style-type: none"> ▪ Trade committees ▪ Vocational training committees ▪ Social partners ▪ The Ministry of Children and Education 	1
9.2	Evaluate how improved committee structure could promote collaboration between trades on energy topics	<ul style="list-style-type: none"> ▪ Trade committees ▪ Vocational training committees ▪ Social partners ▪ The Ministry of Children and Education ▪ Other experts 	2014	0-1 year	<ul style="list-style-type: none"> ▪ Trade committees ▪ Vocational training committees ▪ Social partners ▪ The Ministry of Children and Education 	

5. Monitoring

The goal of the national roadmap is to present a plan for overcoming barriers and competence gaps in energy topics relevant to the construction sector. The plan includes 9 recommendations, each accompanied by concrete initiatives that all aim at the 2020 goals and beyond.

Implementation of the Danish roadmap requires the participation of a number of stakeholders including ministries, trade organisations, education institutions, research centres, and course suppliers. Overall coordination and monitoring is necessary in order to assure effective implementation. The following coordination and monitoring instruments are suggested:

Coordination

A comprehensive information platform that officially presents implemented initiatives is necessary in order to avoid overlapping initiatives. The Danish Energy Agency has constructed the portal www.buildupskills.dk as part of Build Up Skills Pillar I. It is recommended that this portal continue and be regularly updated with information about initiatives running under Pillar II.

Monitoring

Some of the initiatives that comprise the 9 recommendations can be started at once, while others require preparation. To assure progress, it is recommended that applications for Build Up Skills Pillar II include budgets for ongoing monitoring activities. One possible model is a first impact evaluation towards the end of 2014 and a second in 2016.

Impact evaluation examines initiatives that are carried out and goals that are achieved. By carrying this out twice it will be possible to evaluate which initiatives function as intended - or don't - both short- and longer term. The relatively early first evaluation can permit adjustment of initiatives to assure that the construction sector meets its share of the 2020 goals.

Monitoring						
Initiatives	Description	Possible participants	Expected start	Expected duration	Own/co-financing	Estimated costs (million DKK)
Coordination	Ongoing website presentation of implemented Danish Pillar II initiatives	<ul style="list-style-type: none"> ▪ Danish Energy Agency ▪ All applicants for Pillar II funding 	2013	5-7 years	<ul style="list-style-type: none"> ▪ Danish Energy Agency 	0.1
Monitoring	Carry out two impact evaluations	<ul style="list-style-type: none"> ▪ Consultancy ▪ All applicants for Pillar II funding 	2014	2 years	<ul style="list-style-type: none"> ▪ All applicants for Pillar II funding 	0.5

6. Financing

Some of the recommendations could likely be funded through existing structures and public appropriation, as indicated in the financing column of the plan of action tables. Others will require either additional appropriations or other sources of funding.

EU funding and grant programmes could be used as additional sources of financing. Below is an overview of possibilities identified at a workshop on financing which was held for stakeholders in the consortia for the national roadmaps in the EU27 and Norway, Switzerland, and Macedonia.

The overview is not exhaustive, nor is there any guarantee that the funding sources are applicable to the specific recommendations in the Danish Build Up Skills roadmap. The list should be seen as a source of inspiration for stakeholders who are considering implementing projects with the goal of upgrading qualifications levels in vocational education and continuing and further education and training targeting craftsmen in the construction sector.

- **Intelligent Energy Europe, Build Up Skills, Pillar II**

Applications are open for funding of recommended projects in Pillar II of Build Up Skills. Application deadlines are 30 April 2013 and 20 November 2013. According to Intelligent Energy Europe there is €5.5 million available in the first round and €27 million in the second round. These funds are available for Build Up Skills and the three other focus areas: energy efficiency and renewable energy systems in buildings, local energy leadership, and mobilising local energy investment. The funds are not reserved for individual focus areas, but represent an overall total.

Stakeholders in all of the relevant countries can apply for funds to implement projects recommended in the national roadmaps; not all recommendations, however, meet the specifications for funding. Applicants must study the proposal guidelines and other documents and assess which initiatives qualify.

More information at: http://ec.europa.eu/energy/intelligent/getting-funds/call-for-proposals/how-to-apply/index_en.htm

- **Erasmus for all**

More information at: <http://ec.europa.eu/education/erasmus-for-all>

- **EU's structural funds: The European Social Fund (ESF) and the European Regional Development Fund (ERDF)**

More information (UK websites) at: <http://www.dwp.gov.uk/esf/> and <https://www.gov.uk/browse/business/funding-debt/european-regional-development-funding>

- **European Globalisation Adjustment Fund (EGF)**

More information at: <http://ec.europa.eu/egf>

- **Horizon 2020 - EU's new programme for research and innovation**

More information at: <http://ec.europa.eu/research/horizon2020>

7. Statements

Ongoing participation of all key construction sector stakeholders has been a central element in the Build Up Skills Denmark process. It is important that all stakeholders take ownership of the plan of action in order to assure rapid and effective implementation of the recommendations. In this section, the steering committee demonstrates that there is full endorsement of the contents of the roadmap

The outcome for us by participating in the stakeholder group of the Danish Build Up Skills initiative has been an increased focus on the challenges facing the respective educations and training programs - to enhance more energy efficient buildings. The process has been satisfying and has given us more certain and substantial knowledge of how to upgrade the workforce of the construction industry. We believe that it will lead to a more systematic and thorough education and training in this comprehensive field.

Rasmus Zier Bro from Secretariat for educations in the building industry.

The Danish Construction Association has appreciated the work on the roadmap and looks forward to the implementation of the initiatives. The increased focus on energy consumption and energy renovation means that there is a great need for training of the craftsmen and, as a natural consequence, a need to focus on energy in the entire educational system - from vocational education to university education. How to upgrade one's skills must be made clear and accessible if we are to reach the Danish goals for reducing the energy consumption in buildings. Hopefully, the roadmap can help to boost this.

Sidse Frich Thygesen, The Danish Construction Association

The Danish Build Up Skills process has been organised with focus on involving all stakeholders in the construction sector. The result is a solid foundation for alignment of the educational system, built on consensus.

Now the stakeholders must take up the torch and implement the recommendations. When this proves successful, we are convinced that our education programmes will fully ensure Denmark's ability to comply with the EU 2020 energy objectives."

Sidse Buch, BAT-Kartellet (a professional syndicate for 7 members of the Danish Confederation of Trade Unions)

Collaboration on Build Up Skills Denmark has been extremely fruitful; stakeholders from sectors that deal with energy efficient building have been able to meet each other and engage in dialogue about challenges and solutions. This professional debate has led to collaborative relations that will most likely continue and which never would have occurred without Build Up Skills.

Christine Bernt Henriksen, The Confederation of Danish Industry (DI)

The Energy Department at Technical College of Jutland, Hadsten (TCJ) has participated in the development of the "Build Up Skills Denmark" project with focus on acquiring and improving energy topic skills through education in the use of renewable energy in buildings. As a participant in the stakeholder group we have been part of an exciting process in "Pillar I", mapping the shortfalls and collaborating on the challenges of future needs and current national educational programmes. All participants have contributed with their specific knowledge about workforce competences in the construction industry regarding energy efficiency and renewable energy in buildings. The results have been a significant and convincing guideline for the challenges in "Pillar II".

TCJ has participated in the stakeholder group and would like to continue participating in "Pillar II"; "Build Up Skills Denmark" is closely connected to our present activities in the fields of renewable energy and energy efficiency, which comprise part of our educational profiles related to HVAC, heat pumps, photovoltaic systems, building automation technology and electrical engineering, regulations and legislation, etc.

Technical College of Jutland, Hadsten

The organisation SustainableEnergy has with great interest participated in developing the roadmap. The project has contributed to increased focus on common and interdisciplinary needs in the construction sector for continuing and further education and training. Focus on energy optimisation in buildings presents challenges to project management and construction skills. There is therefore a need for new approaches to upper secondary vocational education and to continuing and further education and training, as well as new approaches to research and development, where university programmes need to play a more active role together with the construction sector.

We hope that the roadmap can contribute to increased focus on the interdisciplinary and holistic challenges facing the construction sector. We look forward to the implementation of the roadmap initiatives in our education system.

Marianne Bender, SustainableEnergy

Build Up Skills Denmark has drawn up a useful roadmap showing how we can reach our 2020 goals for reduced energy consumption in buildings. DS Trade and Industry has continuously supported the project and fully supports the ensuing roadmap recommendations. The Build Up Skills project has led to a common understanding and to knowledge sharing among the main stakeholders in the construction sector. This will be central to further collaboration on adapting education programmes to match energy topics.

Birger Tannebæk Christiansen, VVS-consultant (plumbing/heating/air conditioning), DS Trade and Industry

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Appendix 1

Analysis of energy competences and barriers to energy competence development in the construction sector and its upper secondary vocational education and continuing education systems.