

LuxBuild2020

**Luxembourg's national project in the
European Build Up Skills Initiative**

Analysis of the national Status Quo



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Further information

More details on LuxBuild2020 can be found at luxbuild2020.myenergy.lu

More details on BUILD UP Skills can be found at www.buildupskills.eu

More details on the IEE programme can be found at <http://ec.europa.eu/intelligentenergy>

Table of Contents

0. Summary	4
1. Introduction	7
2. Objectives and methods	8
2.1. Objectives	8
2.2. Methods	8
2.2.1. Information on energy policy (mémorial, Pläne).....	8
2.2.2. Data on the construction sector	9
2.2.3. Data on training.....	9
2.2.4. Analysis of existing skills → on-site survey.....	9
3. Characteristics of the construction sector	11
3.1. The economic situation	11
3.2. The structural situation	15
3.2.1. The construction and housing sector : creator of companies	16
3.3. Required business licenses and professional qualifications	18
3.3.1. The skilled trade activity groups within the construction sector	18
3.3.2. Required qualifications.....	20
3.4. The players of the Grand Duchy of Luxembourg's construction sector	24
3.4.1. The Chamber of Trades.....	24
3.4.2. The Federation of Craftsmen – an organisation of the skilled trade for the craftsmen ¹	25
3.4.3. The « Groupement des Entrepreneurs du Bâtiment et des Travaux Publics »	26
3.4.4. The « Ordre des Architectes et des Ingénieurs-Conseils ¹ ».....	27
4. National policies and strategies to contribute to the EU 2020 energy targets in buildings	28
4.1. Activities in relation of the EPBD recast Directive	28
4.2. Activities in relation of the energy end-use efficiency and energy services Directive	36
4.3. Activities in relation of the renewable energy Directive	39
4.4. Further activities of national energy policy	40
4.4.1. Increase of energy efficiency and renewable energy in the public sector	41
4.4.2. Information provision for the improvement of energy efficiency and renewable energy sources.....	41
4.4.3. Training in the domain of energy efficiency and renewable energy.....	43
4.4.4. Financial aid programs.....	45
4.5. National and regional implementation of European Qualifications Framework (EQF) and other EU education and training policies in the building sector.	46
4.5.1. The European Qualifications Framework (EQF)	46
4.5.2. The European Qualifications Framework (EQF) in Luxembourg.....	46
5. Construction and energy sector statistics	53
5.1. Housing stock in Luxembourg	53
5.1.1. Building age and their energy consumption	54
5.1.2. The composition of the households.....	56
5.1.3. Owners according to their nationality.....	57
5.1.4. The recently completed housings.....	60
5.1.5. Public facilities and non-residential buildings.....	62
5.2. Real estate needs	64
5.2.1. The demand in housing sees a considerable growth.....	64
5.3. The employees of the construction and building sector	66
5.4. Employment in the construction sector	71

5.4.1.	Ageing of the employees.....	71
5.5.	The qualification of the workers	72
5.6.	Market potential for construction businesses	73
5.6.1.	Achievable potential in the biomass sector	74
5.6.2.	Achievable potential in the solar thermal area.....	75
5.6.3.	Achievable potential in the photovoltaic area.....	76
5.6.4.	Achievable potential in the area of heat pumps	77
5.6.5.	New accommodations: energetic and ecologic constructions	77
5.6.6.	Energy-efficient retrofitting of existing housings	78
6.	Vocational training for artisans in Luxembourg	81
6.1.	Initial vocational training	81
6.1.1.	The educational structure in Luxembourg	81
6.1.2.	Initial vocational training for the artisanry	91
6.1.3.	The authorities in charge with the initial vocational training for artisans.....	98
6.1.4.	The accreditation authorities for artisans	100
6.1.5.	Existing instruments allowing the monitoring of the market evolution in terms of technology, their necessary skills and training.....	101
6.2.	The integration of energy-efficiency and susatainable energy in the existing initial voactional training.....	102
6.2.1.	Concerning the vocational trainings leading to a DAP (Diploma for Vaocational Aptitude) and a CCP (Certificate for Vocational Competence)	102
6.2.2.	The curricula of the master's degrees.....	103
6.3.	The continuing vocational training.....	104
6.3.1.	The providers of continuing vocational training for blue collars.....	104
6.3.2.	Existing continuing vocational training framework conditions in Luxembourg	109
6.3.3.	The construction sector and the continuing education	111
6.3.4.	Existing initiatives for non-qualified workers.....	115
6.4.	Energy-efficiency and sustainable energies in the existing continuing vocational training (curriculum and statisitcs)	116
6.4.1.	Continuing vocational trainings offered by the Chamber of Crafts	116
6.4.2.	The continuing vocational trainings offered by the Training Institute for the Building Sector	122
6.5.	The initiatives and programs of the continuing vocational training supported by European programs.....	126
6.6.	Conclusion	127
7.	Skills and required qualifications.....	128
7.1.	Labour needs	128
7.2.	Number of workers to be trained.....	129
7.3.	Trainings needed	130
7.4.	Monitoring.....	132
8.	Barriers	132
9.	Conclusion	134
10.	Authors and contributors.....	137
11.	References.....	138
•	Validation des acquis de l'expérience http://www.men.public.lu/sys_edu/form_vie/vae/	138
12.	Glossaire	140

0. Summary

The “Build Up Skills” initiative, funded by the European Commission, aims to improve the skills of building professionals in the energy-efficient construction and energy optimisation sector.

The aim of the “Intelligent Energy Europe” programme is to help ensure that Europe has access to a secure, sustainable energy supply at competitive prices, whilst maintaining measures designed to encourage energy efficiency and the rational use of energy resources, promote new and renewable sources of energy and encourage energy diversification. In addition, it provides support for tangible initiatives with a view to achieving the 20-20-20 energy targets the European Union has set for itself by 2020, namely:

- a 20% reduction in greenhouse gas emissions
- a 20% reduction in energy consumption
- a 20% increase in energy from renewable sources

As part of this programme, the “Build Up Skills” initiative aims to improve the skills of building professionals in the energy-efficient construction and energy optimisation sector. The initiative is therefore primarily geared to continuing education and training for (blue-collar) workers in the area of energy efficiency and the use of renewable energy in buildings, following on from their initial education or training or initial experience of the workplace, including developing skills amongst workers who are unemployed.

“LuxBuild 2020”: Luxembourg's national project

All new buildings in Luxembourg from 2017 onwards will have to meet AAA energy classification requirements. The government's new “PRIME House” financial aid scheme, which came into effect in January 2013, is designed to encourage more energy-related renovation work and the use of renewable energy sources. It is clear that the targets that have been set can only be met if there is an adequate number of skilled workers in the construction sector in Luxembourg. Skills are a fundamental element in implementing the national climate and energy policy. LuxBuild2020 is therefore aimed at providing training for skilled tradesmen and manual workers in the building sector.

The consortium backing the national project LuxBuild2020 is made up of myenergy, the Chambre des Métiers du Luxembourg and the Institut de Formation Sectoriel du Bâtiment (IFSB). The consortium has produced a National Status Quo Analysis combining structural and economic data on the construction sector, information on the country's building stock and information on existing training organisations and the training courses available on energy-related construction and renovation work.

A national forum for qualifying skilled tradesmen has been set up by representatives of the construction sector in Luxembourg. This will provide a way of producing and

developing various strategies for preparing the construction sector and, in particular, skilled tradesmen working on building sites, to meet the “20/20/20” targets and new requirements. The results will be compiled in a road map, which will be completed in 2013 and which will serve as the basis for developing training courses in the area of skilled trades between now and 2020.

The building sector in Luxembourg offers significant potential for energy savings and skilled trades have an important role to play in the move towards energy-efficient buildings. Energy products and services are subject to constant technological change and are becoming ever-more sophisticated. Changes of this kind mean that all those involved are obliged to update their abilities, knowledge and skills on an ongoing basis.

Some of this knowledge is already taught at both a theoretical and practical level during the basic training provided through apprenticeship schemes. Students who take courses leading to a *brevet de maîtrise* qualification further broaden and deepen their technical knowledge, to cover all questions relating to the energy efficiency of buildings. The training requirements laid down in Directive 2009/28/EC on renewable energies, for example, were swiftly incorporated into *brevet de maîtrise* programmes for heating installers and electricians, which has led to the qualification being updated.

As a key player in the training of skilled tradesmen, the Chambre des Métiers is not only responsible for initial training but has also made substantial efforts to ensure that continuing training for skilled tradesmen in the construction sector is constantly refreshed and updated.

As early as 2001, the “Energie fir Zukunft” label was created at the instigation of the Chambre des Métiers and over the last 11 years has been awarded to 250 building firms, whose employees have taken part in specific training courses on energy efficiency technologies and renewable energies.

The new “Energie fir Zukunft” cycle was launched in November 2012. The new training programme, on passive houses, will help to guarantee that work carried out is of high quality, whilst particular attention will be paid to cooperation between different trades.

The Centre National de Formation Professionnelle Continue (CNFPC) also plays a significant role in continuing training for workers and has also embarked on organising a wide range of courses dealing with the area of sustainable construction.

The Institut de Formation Sectoriel du Bâtiment (IFSB) has a particular role to play in continuing training for bricklayers and stonemasons and offers both theoretical and practical courses on building energy efficiency (insulating masonry, insulating facades, etc.) for workers in these areas.

Training programmes of this kind are all the more important insofar as the construction sector suffers not only from a shortage of skilled workers but also a poor image. The building trade is continually dogged by negative perceptions, which persist not only amongst young people but also their parents and even teachers.

Nonetheless, the sector is set to create around 6,500 jobs in the areas of renewable energies, energy-efficient construction and energy optimisation by 2020.

On the one hand, just 150 people a year pass their exams at the end of their apprenticeship and 60 *brevets de maîtrise* are awarded. On the other hand, it is becoming increasingly difficult to recruit qualified tradesmen from neighbouring countries because of a limited pool of workers from the Greater Region, given that 48% of construction workers (24,000 people) come from this region.

In general terms, it could be said that Luxembourg has to some extent lost control over the qualification of workers in the construction sector as a result of the high proportion of foreign workers in the country. Fewer and fewer workers have gone through the national education system. The very high level (90%) of foreigners in the construction sector is unique in Europe.

This very specific situation led the consortium to carry out an on-site survey to identify the level of skills amongst workers. The survey took into account the various trades involved in the construction of energy-efficient buildings and renewable energies and showed that there is still a great deal of work to do with regard to continuing training for workers.

In conclusion, it is fair to say that sustainable construction requires a change in attitude at all levels, not only amongst individuals but also property developers, contracting authorities, designers, architects and, of course, small building firms, based on a comprehensive vision and approach that should lead to tangible results.

Whilst the subject is certainly uppermost in people's minds, it is now time to think about the next step: enabling everyone to build sustainably.

1. Introduction

The report begins with a description of the objectives and methods used in the 'status quo' analysis in chapter 2. The authors describe why an on-site survey was carried out in the various categories of firms in the construction sector with an impact on the energy efficiency of buildings.

Chapter 3 analyses the economic and structural situation of the construction sector and describes the main players involved in the industry.

Chapter 4 explains Luxembourg's energy policy in detail and its national strategy in response to the targets set for 2020. A detailed history of regulations in the Grand Duchy shows that as early as 1993, the country produced the first regulation regarding the rational use of energy and has consistently adapted its regulations since in response to new standards and directives. The latest of these means that any new building from 2017 onwards will be required to meet AAA energy requirements. Measures to support and motivate contracting authorities have also been introduced, via a system of positive financial incentives.

The state of the current building stock and housing needs are examined in chapter 5, along with various statistics relating to construction workers (qualifications, number, nationalities, etc.). The authors have also assessed the market potential for small firms in the construction sector in the areas of renewable energies and energy efficiency.

Chapter 6 focuses entirely on initial and continuing vocational training of tradesmen in Luxembourg, describes the major players in vocational training and explains the various initiatives and training programmes in the construction sector in relation to building energy performance.

The state of labour requirements and above all the shortage of workers are described in chapter 7. A large part of this chapter explains the results of the on-site survey, providing accurate identification of the level of skills of employees and thus constitutes a basis for the introduction of measures to improve skills, particularly with regard to training.

To conclude, chapter 8 sets out the barriers to achieving the 2020 objectives and obstacles to continuing training.

2. Objectives and methods

2.1. Objectives

- **Analysis of the status quo**

The analysis of the current situation sets out the objectives to be achieved at a national level and identifies the resources available to reach them.

On the one hand, there is the political aspect, which has imposed requirements that new buildings have had to comply with since 1995. These restrictions will continue until 2017 and even beyond. On the other hands, there are targets for introducing at least 10% of renewable energies whilst reducing CO2 emissions by 20% by 2020.

One of the main challenges has been set for 2017, namely the construction of passive houses (with a maximum energy consumption of 22 kWh/m²/year). Passive houses consume less than a quarter of the usable energy required to heat a new house built in 2013.

The construction sector is one of the main players that can help to achieve the 2020 targets.

- **Creation of a national forum for qualifying skilled tradesmen**

The forum will be created in conjunction with various partners in the construction sector. These include the various federations representing different skilled trades along with the relevant ministries and other institutions that provide support for training and business development.

The role of the forum will primarily revolve around exchanging know-how between various players.

- **Production of a road map**

It is extremely important to identify gaps in know-how on building sites at an early stage. Following this analysis, the organisations concerned, namely the IFSB (Institut de Formation Sectoriel du Bâtiment) will produce a road map. This will include a comprehensive training programme, which will enable the various players working on building sites to prepare themselves for the new requirements in the building trade.

2.2. Methods

2.2.1. Information on energy policy (mémorial, Pläne)

First of all in Luxembourg, there is a regulatory framework concerning requirements in relation to new buildings and energy-optimisation work (not obligatory, but subsidised in the case of standards compliance) and in relation to technical installations, above all regarding the integration of renewable energies.

Alongside this, there are agreements and master plans based on analyses and statistics in order to evaluate the current situation and possible scenarios.

The **climate package** defines, amongst other things, a wide range of proposed measures for the public and private sectors. It concerns not only residential buildings but also municipal and public buildings.

The **NEEAP** is the second national action plan on energy efficiency and defines a number of objectives in order to reduce energy consumption across all sectors.

In the residential sector we have the **housing package**, which defines various strategies for promoting low-energy buildings.

LUXRES also defines methodologies for reducing CO2 emissions and the rational use of renewable energies.

The **LUREAP** is based on various European directives and transposes these measures at a national and sectoral level.

The **PNDD** is the national plan for sustainable development overall.

The **national action plan for climate protection** defines strategies in this area and proposes new options for environment-friendly transport, etc.

2.2.2. Data on the construction sector

- Chambre des Métiers
- STATEC (Institut National de la Statistique et des Etudes Economiques du Grand-Duché de Luxembourg)

2.2.3. Data on training

- STATEC
- INFPC
- IFSB
- Observatoire de la formation

2.2.4. Analysis of existing skills → on-site survey

We decided to base our analysis on an on-site survey, interviewing a representative sample of team leaders in order to be able to reflect the reality on the ground.

We took this decision because of the somewhat exceptional situation of the construction sector in Luxembourg. Only a small proportion of the people working on building sites have come through the national education system. Most of them have come through the school system in neighbouring countries. In addition, a not insignificant proportion comes from more or less all over Europe, particularly areas that

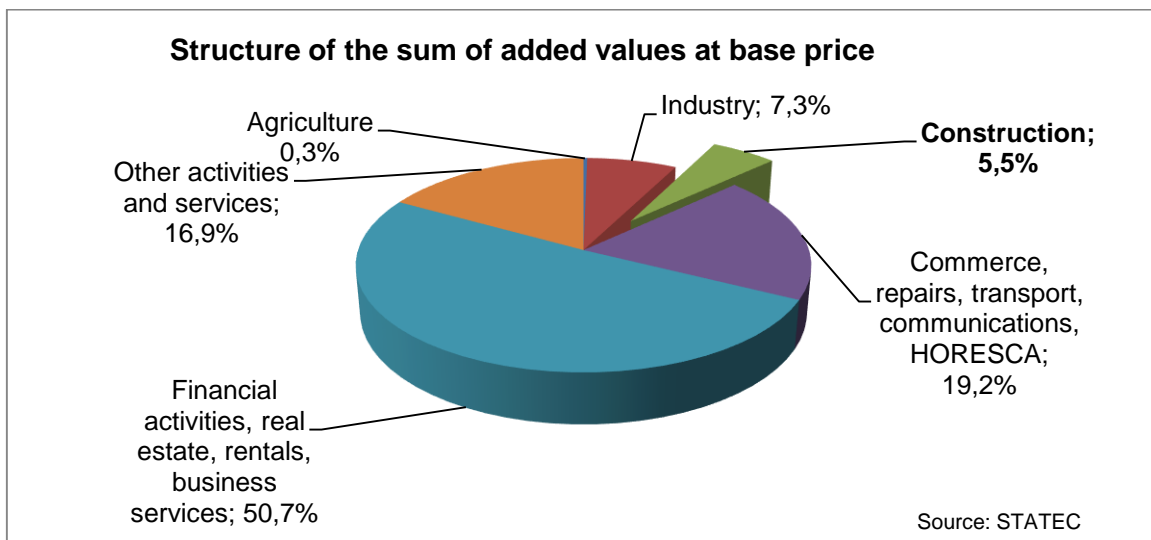
are currently in crisis, such as Portugal, or countries in the east. Unfortunately, it is difficult to trace the educational background of many of these people, who were often not even working in the construction sector prior to their arrival in the country.

We also observed that a great deal of know-how is shared.

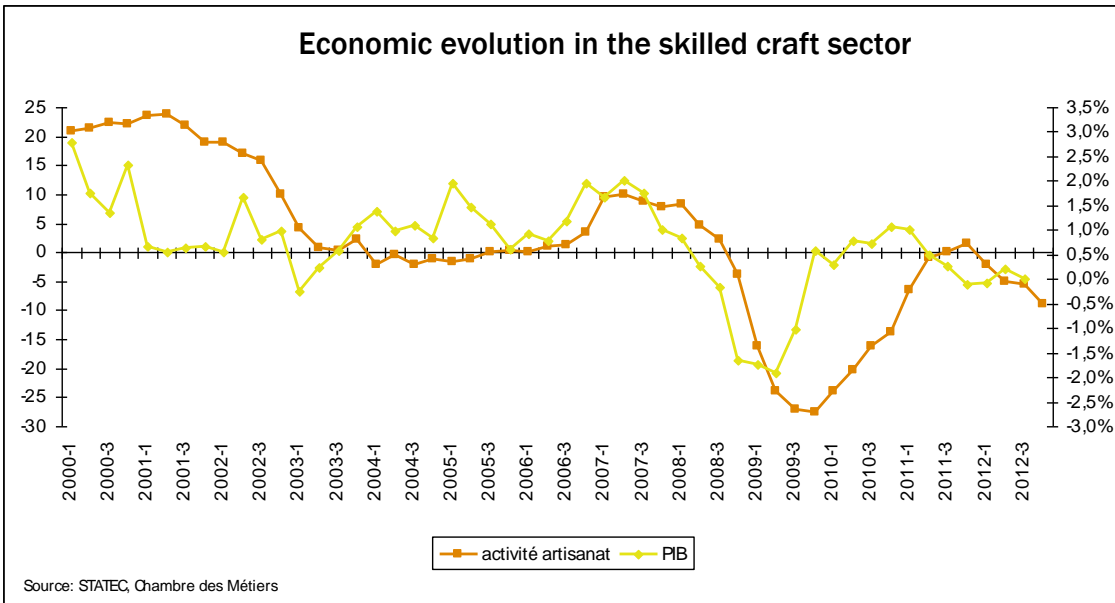
3. Characteristics of the construction sector

3.1. The economic situation

With more than 3,000 companies and 50,500 employees, the Grand Duchy of Luxembourg's construction sector is an indispensable part of the country's economic landscape. Thus, it has always been a sector with high added value and high employment intensity. From a structural point of view, the sector makes up for more than 15% of Luxembourg's total employments and close to 6% of its added value. Concerning the Luxembourgish skilled craft sector with its roughly 6,000 companies and 72,000 employees, construction represents 50% of the companies and more than 70% of total employments.



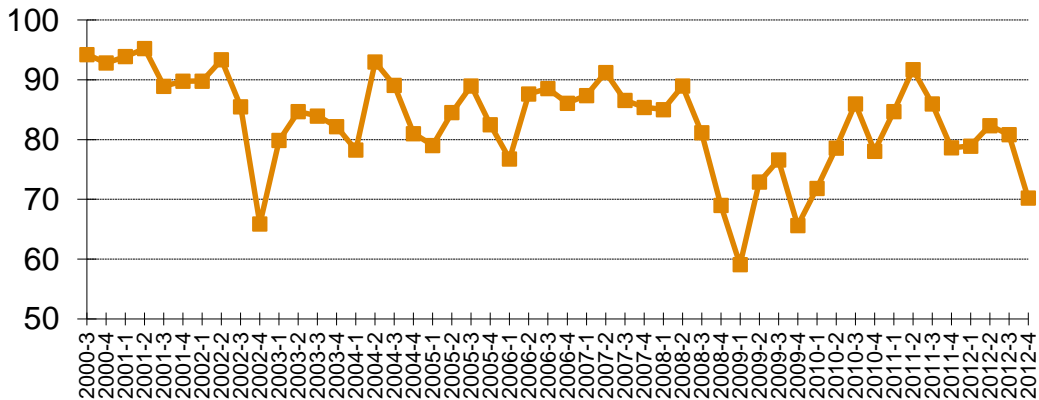
Before 2008, the skilled craft sector in general went through a period of high activity. However, the economic crisis has led to a significant deterioration of that situation, the low point being attained in the 4th quarter of 2009. Since the end of that year, activities have registered a slight recovery, even though not to the levels of 2008. However, this increase was not to last since activities were again in decline since the beginning of 2012.



Nevertheless, one needs to stress that the results of the craft sector are above all else influenced by those of the construction sector, which, by far, constitutes the most important sector within the craft businesses.

The construction sector follows the evolution of the national economy with a lag, as measured through the GDP.

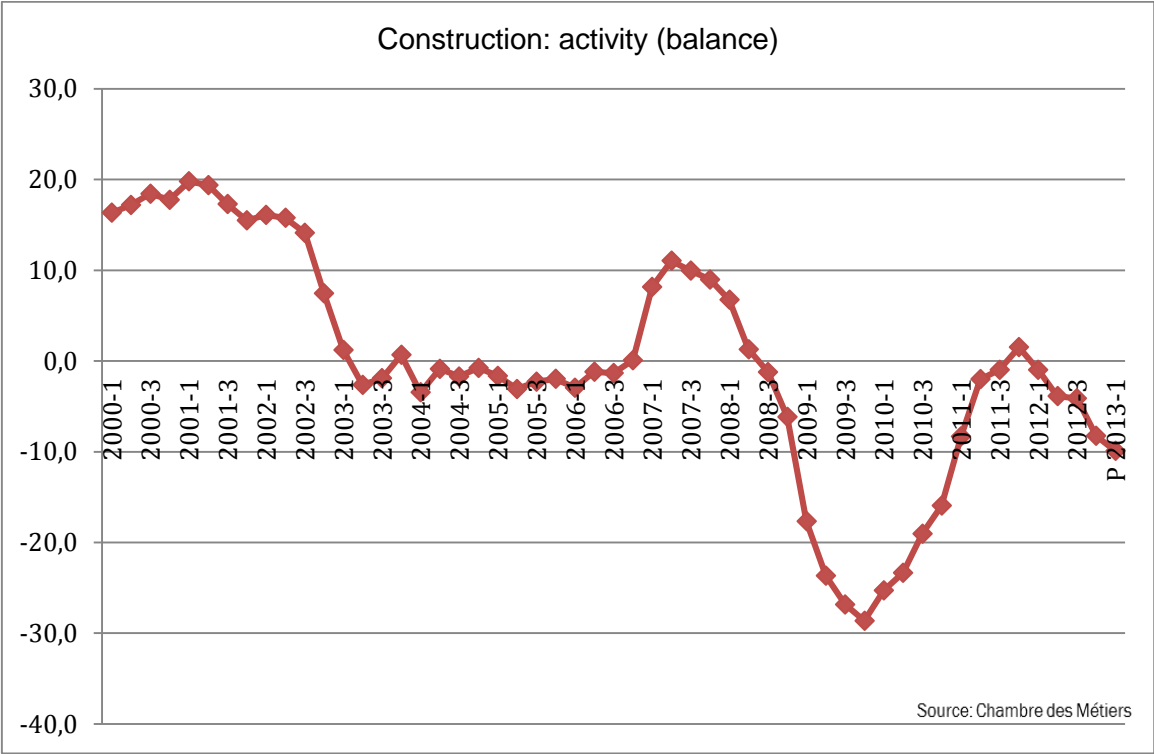
Construction: Business Environment



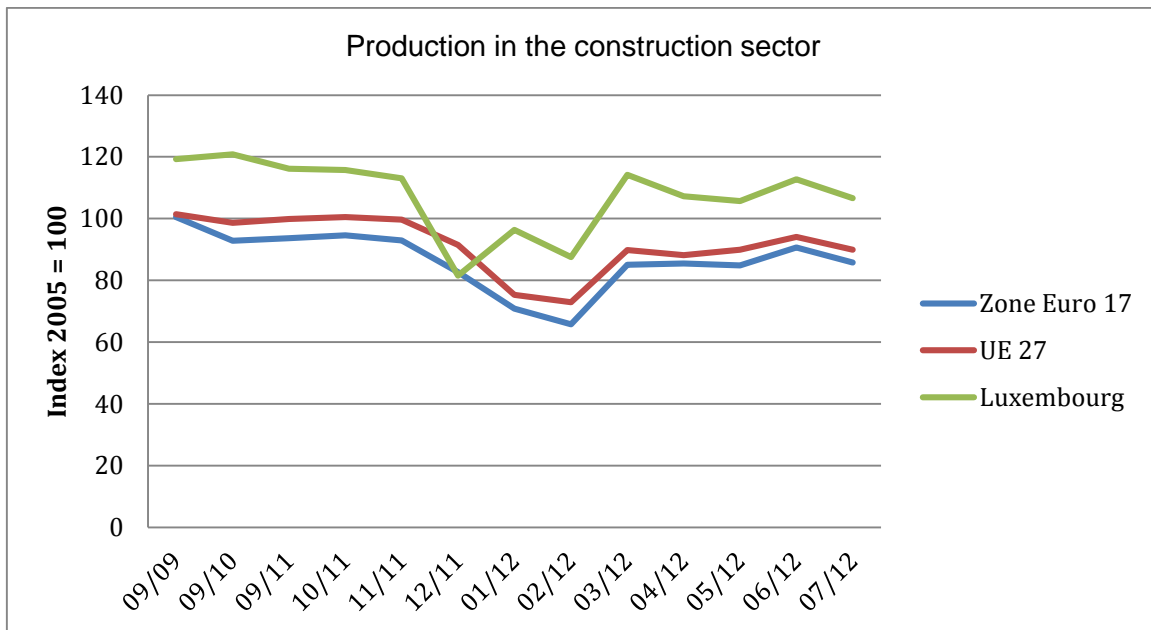
Source: Chambre des Métiers

In the 2nd quarter of 2011, the construction sector went through a period of exceptional activity. Since then, all indicators experienced a sharp decrease. In the first quarter of 2012, the business environment indicator was set at 78 points. The activity is still limited by the less than vigorous demand and the financial constraints of businesses. The activity index registers a significant decline (-17.5 points), just like the number of employees (-3.1 points), orders (-16.3 points) and selling prices (-24.7 points). The

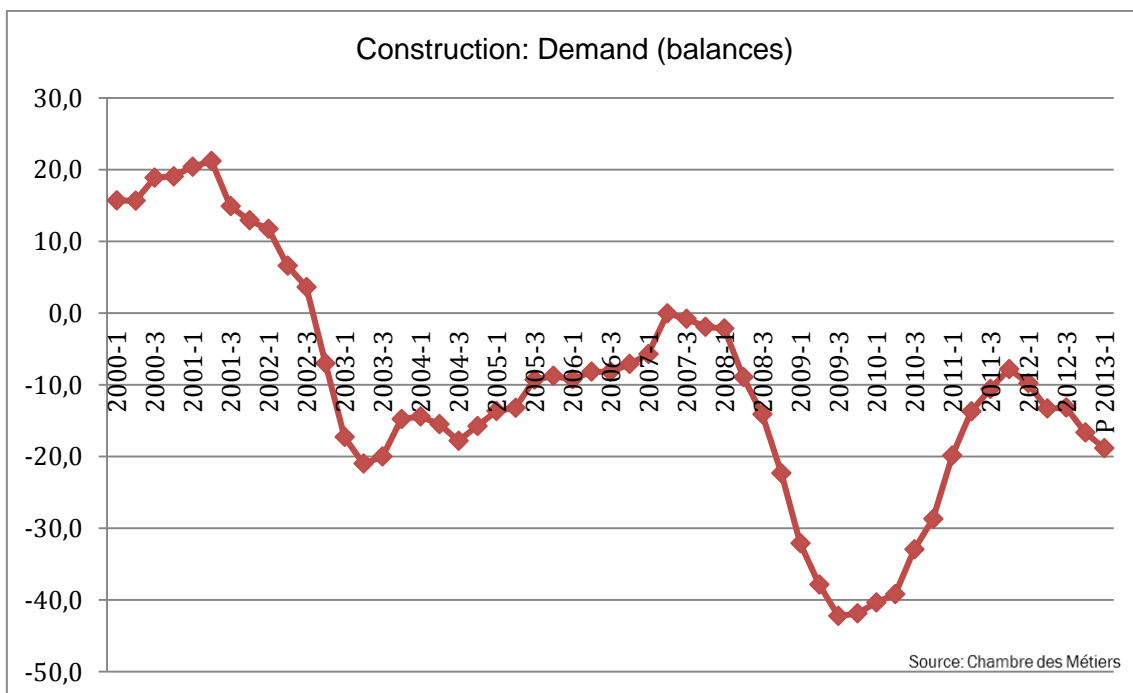
margins of companies have constantly declined throughout 2011 and show an additional reduction of -38.3 points in the 1st quarter 2012. In short, the current recession does not spare this sector.

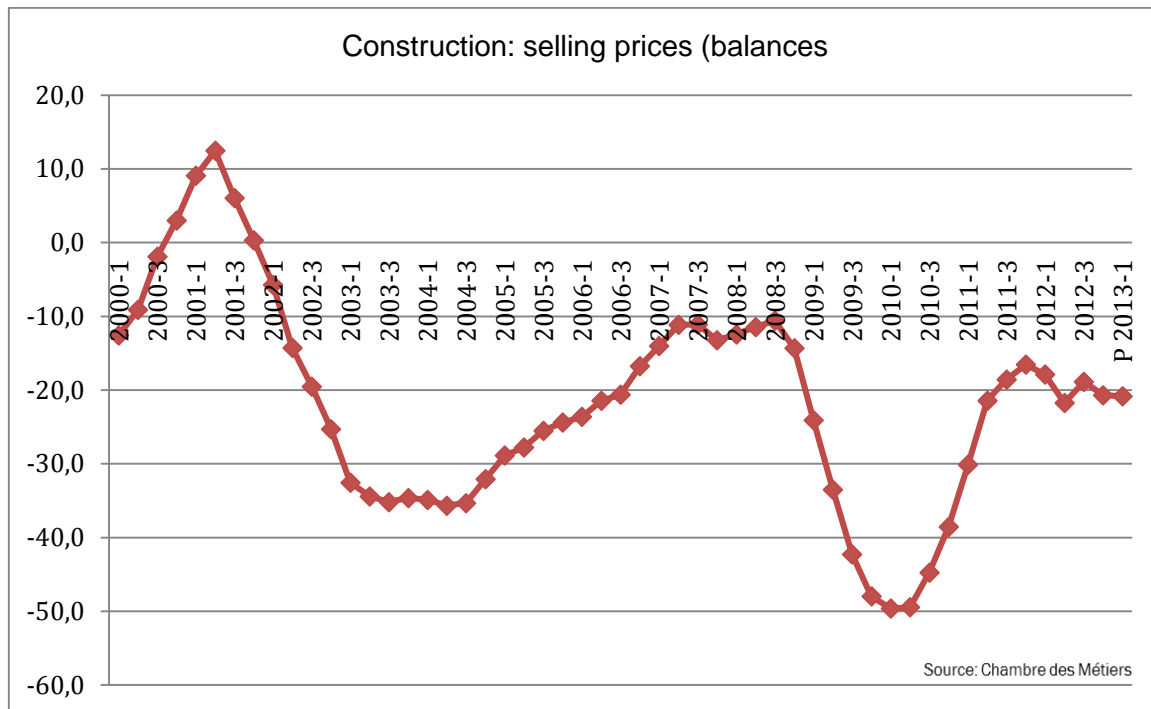


Concerning construction, the STATEC stresses that the confidence indicator of construction contractors showed a sharp decline in the 2nd quarter 2012. The turnaround that was already observed in the 1st quarter is thus easily confirmed, even if, on the whole, views still remain at rather high level, especially if compared on the European scale.



Over the first four months of 2012, production shows a decrease of 10% compared to 2011. This decline can partially be explained by exceptionally low production levels in February 2012 (-21% over one year), when activity was restricted by temperatures way below the seasonal averages. For the month of April 2012 (the last available data for production), it is noticeable however that, yet again, a 10% decrease over one year has been recorded. Since the weather conditions are less likely to have influenced that month's activity, this result suggests the decline is of an economic nature.





3.2. The structural situation

Luxembourg's construction sector consists of a multitude of small businesses hovering around a few large companies. The local firms are mainly family businesses, sometimes already in the hands of a third generation. They are thus deeply rooted in the construction sector. These Luxembourgish companies, at a European level considered to be SMBs, act more on a local level at the cost of a strategy of internationalization.

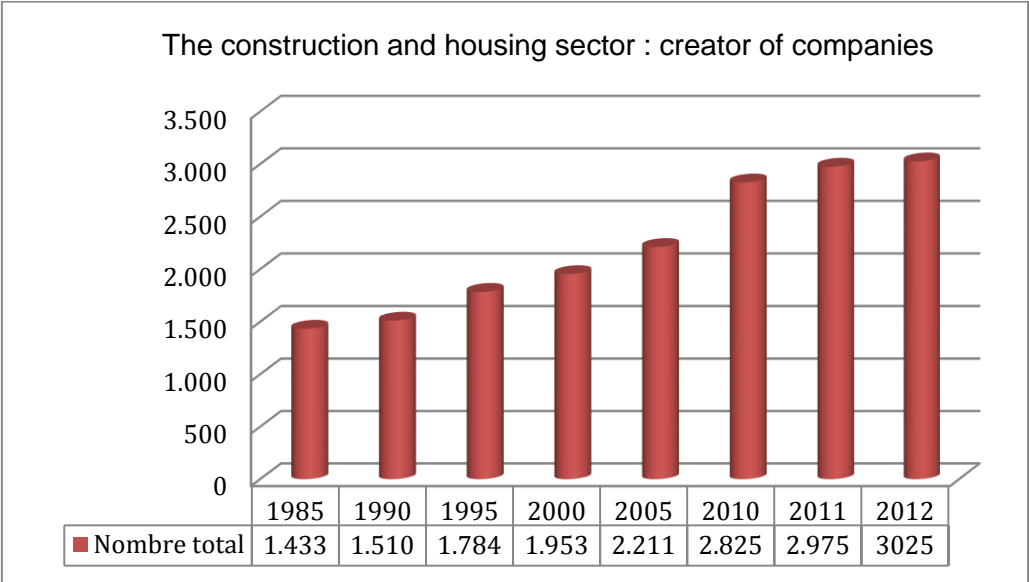
The construction sector includes a set of activities that can be grouped into three main categories:

- the construction of buildings (construction of residential and non-residential buildings as well as real-estate promotion), representing roughly 30% of the sector's total employment
- Specialised construction works (drilling, sounding, plumbing, heating, sanitary engineering, electricity, carpentry, plaster works, tiling, floor covering, painting, glazing, roofing, etc.), representing roughly 60% of the sector's total employment
- Civil engineering (construction of roads, motorways, railroads, bridges, tunnels, electric grids, telecommunications networks, etc.), representing roughly 10% of the sector's total employment

Thus, the Grand Duchy of Luxembourg’s construction sector contains a multitude of activities that can be put into three types of activities: general and specialised construction activities, fitting activities that make the building usable (isolation, electricity, heating, etc.) and finishing activities. This kind of approach is also to be put in relation to the trades: in this case, the building shell trades or public and finishing works are often mentioned.

3.2.1. The construction and housing sector : creator of companies

Over the past 30 years, the number of companies from the construction sector has evolved significantly. Especially since the 1990’s, thanks to the Grand Duchy of Luxembourg’s very favourable economic situation, the number of companies has more than doubled.



Source : Chambre des Métiers

Companies active in the construction sector in 2011, according to their activities	
Activity	Number of companies
Construction of buildings	482
Construction of residential and non-residential buildings	482
Specialised construction works	2.421
Levelling works	11
Site preparation works	40
Electrical installations	326
Plumbing works and installation of heating and air conditioning	246
Other installation works	168

Plastering works	60
Carpentry works	327
Tiling	90
Laying of marble and other natural stone coatings	19
Laying of coatings made from other materials	46
Painting works	218
Glazing works	16
Other finishing works	25
Roofing works	183
Other specialised construction works	646
Civil engineering	72
Construction of roads and motorways	43
Construction of railway tracks (surface and underground)	3
Construction of bridges and tunnels	5
Construction of fluid grids	16
Construction of electric and telecommunications networks	5

Source : STATEC

In 2011, a construction company averaged some 16 employees. Today, roughly 45% of all companies from the construction sector employ between 1 and 9 people, which shows that almost half of the companies are micro-sized. A significant number of companies have no employees. Those are companies, which either outsource 100% of their jobs or which only employ with temporary workers.

Companies active in the construction sector in 2012, according to their number of employees	
Total number of companies	3,025
1-4 employees	774
5-9 employees	562
10-19 employees	455
20-49 employees	362
50-99 employees	117
100-199 employees	57
200-499 employees	25
>500 employees	6
no employees	667

3.3. Required business licenses and professional qualifications

Article 1 of the Incorporation Law of 2nd September 2011 stipulates:

“No one may, for a profit-making goal, practise, as a principal or subsidiary occupation, an independent activity in the areas of commerce, skilled trade, industry or accredited professions referred in the Act without holding a business license.”

Hence, every company, regardless of its legal status (operated under the owner’s name or under any form of company), which practices a commercial, craft, industrial or accredited profession activity referred in the Act and is established in Luxembourg must hold a business licence (“autorisation d’établissement”).

The company requesting a business licence must designate a natural person, called the qualified manager, who:

- meets the certification and professional integrity requirements
- genuinely and permanently ensures the daily management of the company
- has a real link to the company, either by being the owner, a partner, a shareholder or an employee and who has not evaded the social contribution and fiscal taxes, neither under his own name, nor through a company he is managing or has managed.

Hence, it is clear that the qualified manager has the obligation to personally and regularly ensure the management of the company. It is thus not possible to simply “hire out” one’s professional qualification without being present at the company. For that matter, the permanent presence of a third person, even one authorised to make binding agreements on behalf of the company, cannot compensate the absence of the manager who holds the business license.

In companies, this function is in general that of the managing director (“administrateur” in public limited companies) or the manager (“gérant” in limited companies).

It should be noted that in case of operation under the owner’s name, the qualified manager is bound to be the company’s owner. The qualified and reputable person must have a genuine link with the company, be it as owner, shareholder or employee.

3.3.1. The skilled trade activity groups within the construction sector

The Law of 2nd September 2011 organises the skilled trade activities according to two lists: List A and List B. The exercising of an A-list activity requires the possession of a master craftsman diploma (“brevet de maîtrise”), whereas the exercising of a B-list activity requires a DAP/CATP diploma. It stipulates that the master craftsman or the DAP/CATP diploma cover the concerned skilled trade activities or their essential parts.

LIST A

- construction and civil engineering contractor
- thermal, acoustic and airtightness contractor
- heating, sanitary and air-conditioning fitter
- electrician
- carpenter/cabinetmaker
- metal constructions contractor
- fitter of elevators, freight elevators, escalators and handling equipment
- carpenter-roofer-tinsmith
- tiler-marble specialist-stone mason
- painter-plasterer-façade specialist

LIST B

- contractor for levelling, excavation, channelling and asphaltting works; stone sealers, scrap merchant for reinforced concrete
- drilling and anchoring contractor
- landscaping contractor
- stove fitter
- screed maker
- illuminated sign fitters
- recycler of electric and electronic equipment
- installer, fitter and renovator of prefabricated parquet floor elements
- undertaker
- manufacturer and fitter of shutters and blinds
- manufacturer of road signs and licence plates

For explanations regarding the master craftsman diploma (“brevet de maîtrise”), the “Certificat d’Aptitude Technique et Professionnelle” (CATP) and the “Diplôme d’Aptitude Professionnelle” (DAP), refer to chapter 6.

- manufacturer of industrial ovens
- fitter of high-altitude safety measures
- chimney sweeper-roof cleaner
- scaffolding fitter
- installer and fitter of windows, doors and prefabricated furniture
- installer of shading devices
- building and monument cleaner
- glazier and mirror specialist
- manufacturer and fitter of chimneys and tiled stoves
- interior decorator

3.3.2. Required qualifications

The following table defines which certificates or DAP/CATP diplomas give access to which skilled trade activities, based on the essential aspect criterion.

The professional qualifications required for exercising an A-list activity can be recapped as follows:

- master craftsman diploma covering the concerned craft activity or its essential parts
- Bachelor's Degree in the area of expertise
- Bachelor's degree partially covering the area of expertise + min. 1 year or professional experience in the sector
- Bachelor's degree unrelated to the area of expertise + min. 2 year or professional experience in the sector
- DAP/CATP diploma in the area of expertise + 6 years in a managing position in the sector
- Business licence in a technically related activity + 3 years of practical experience in the concerned area of expertise

List A		
master craftsman diploma	tiler	tiler – marble specialist - stonemason
master craftsman diploma	carpenter	carpenter - roofer - tinsmith
master craftsman diploma	roofer	carpenter - roofer - tinsmith
master craftsman diploma	electrician	electrician fitter of alarm and security systems
master craftsman diploma	contractor for thermal, sound and airtightness insulations	Contractor for thermal, sound and airtightness insulations
master craftsman diploma	construction contractor	tiler – marble specialist - stonemason construction and civil engineering contractor
master craftsman diploma	metal constructions contractor	metal constructions contractor fitter of elevators, freight elevators, escalators and handling equipment
master craftsman diploma	tinsmith-zinc worker	carpenter - roofer - tinsmith
master craftsman diploma	printer	printer – silk screen printer
master craftsman diploma	heating and sanitary fitter	heating, sanitary and air-conditioning fitter
master craftsman diploma	air-conditioning fitter	heating, sanitary and air-conditioning fitter
master craftsman diploma	marble specialist	tiler – marble specialist - stonemason
master craftsman diploma	dental technician	dental prothesist
master craftsman diploma	carpenter – cabinet maker	Carpenter – cabinet maker

master craftsman diploma	painter - decorator	painter – plasterer – façade specialist
master craftsman diploma	plasterer – façade specialist	painter – plasterer – façade specialist
master craftsman diploma	stonemason and -sculptor	tiler – marble specialist - stonemason

The professional qualifications required for exercising a B-list activity can be recapped as follows:

- DAP/CATP covering the concerned craft activity or its essential parts
- Professional experience of at least 3 years

List B		
CATP/DAP	tiler	screed maker manufacturer and fitter of chimneys and tiled stoves building and monument cleaner
CATP/DAP	carpenter	manufacturer and fitter of shutters and blinds fitter of high-altitude safety measures scaffolding fitter installer and fitter of windows, doors and prefabricated furniture installer of shading devices chimney sweeper-roof cleaner
CATP/DAP	roofer	manufacturer and fitter of shutters and blinds fitter of high-altitude safety measures scaffolding fitter installer and fitter of windows, doors and prefabricated furniture installer of shading devices
CATP/DAP	electrician	illuminated sign fitters light and lighting operator sound operator installer of shading devices recycler of electric and electronic equipment repairer of household appliances, gaming and automated machines
CATP/DAP	manufacturer and fitter of shutters and blinds	manufacturer and fitter of shutters and blinds fitter of high-altitude safety measures scaffolding fitter installer and fitter of windows, doors and prefabricated furniture installer of shading devices installer, fitter and renovator of prefabricated parquet floor elements
CATP/DAP	tinsmith-zinc worker	manufacturer and fitter of shutters and blinds fitter of high-altitude safety measures scaffolding fitter installer of shading devices tinsmith – roof cleaner

CATP/DAP	chimney sweeper	<p>manufacturer and fitter of chimneys and tiled stoves</p> <p>chimney sweeper</p> <p>fitter of high-altitude safety measures</p> <p>scaffolding fitter</p> <p>chimney sweeper-roof cleaner</p>
CATP/DAP	heating, sanitary and air-conditioning fitter List B	<p>boilermaker – manufacturer of reservoirs and sheet metal items</p> <p>chimney sweeper</p>
CATP/DAP	air-conditioning fitter	boilermaker – manufacturer of reservoirs and sheet metal items
CATP/DAP	sanitary fitter	boilermaker – manufacturer of reservoirs and sheet metal items
CATP/DAP	mason	<p>screed maker</p> <p>manufacturer and fitter of chimneys and tiled stoves</p> <p>drilling and anchoring contractor</p> <p>contractor for levelling, excavation, channelling and asphaltting works;</p> <p>stone sealers, scrap merchant for reinforced concrete</p> <p>landscaping contractor</p> <p>chimney sweeper</p> <p>fitter of high-altitude safety measures</p> <p>scaffolding fitter</p> <p>building and monument cleaner</p>
CATP/DAP	marble specialist	<p>screed maker</p> <p>manufacturer and fitter of chimneys and tiled stoves</p> <p>fitter of high-altitude safety measures</p> <p>scaffolding fitter</p> <p>building and monument cleaner</p>
CATP/DAP	parquet floor fitter	<p>undertaker</p> <p>manufacturer and fitter of shutters and blinds</p> <p>installer, fitter and renovator of prefabricated parquet floor elements</p> <p>theatre, cinema and television decorator</p>
CATP/DAP	painter-decorator	<p>interior decorator</p> <p>contractor for the treatment of metallic surfaces</p> <p>fitter of high-altitude safety measures</p> <p>model maker</p> <p>scaffolding fitter</p> <p>building and monument cleaner</p> <p>theatre, cinema and television decorator</p> <p>glazier and mirror specialist</p>
CATP/DAP	plasterer-façade specialist	<p>manufacturer and fitter of chimneys and tiled stoves</p> <p>fitter of high-altitude safety measures</p> <p>scaffolding fitter</p> <p>building and monument cleaner</p>

CATP/DAP	stonemason and -sculptor	<p>screed maker manufacturer and fitter of chimneys and tiled stoves fitter of high-altitude safety measures scaffolding fitter building and monument cleaner</p>
CATP/DAP	upholsterer- decorator	<p>interior decorator model maker building and monument cleaner theatre, cinema and television decorator stylist</p>
CATP/DAP	glazier – mirror specialist	<p>fitter of high-altitude safety measures scaffolding fitter installer and fitter of windows, doors and prefabricated furniture glazier – mirror specialist</p>

3.4. The players of the Grand Duchy of Luxembourg's construction sector

3.4.1. The Chamber of Trades



The Chamber of Trades is a professional association and a legal person governed by public law and regroups all skilled trade businesses, i.e. those from the food, fashion, health, hygiene, mechanics, construction (building shell, finishing, technical equipment), communication, multimedia and art sectors, as well as other activities, totalling 6,000 companies with 80,000 employees.

The Chamber of Trades' mission is the defence, representation and promotion of its members' interests (from the skilled trade sector as well as Luxembourgish SMBs).

The activities of the Chamber of Trades are chiefly to:

- promote a legal and regulatory framework, favourable to the development of the skilled trade and its members,
- promote entrepreneurship and offer assistance and consulting regarding company establishment and transmission,
- assist and consult its members on economic, technological, legal and innovative aspects, as well as in their efforts in internationalization,
- establish statistics regarding the skilled trade and create studies and analyses on the skilled trade and the SMBs,
- promote initial and further professional training, as well as the related assistance and consultancy,
- participate in the professional training and development of youths and adults concerning the statutory requirements for the basic professional training and the master craftsman diploma ("brevet de maîtrise"),
- accomplish specific missions it has been delegated based on laws or conventions,
- inform and raise awareness for the compliance with the legislation concerning the skilled trade and SMBs.

The Chamber of Trades is a legal entity, benefitting from financial and administrative autonomy. To cope with its expenses, it is entitled to collect membership fees as well as compensation and payment for its rendered services.

3.4.2. The Federation of Craftsmen – an organisation of the skilled trade for the craftsmen¹



The “Fédération des Artisans” (Federation of Craftsmen) is the umbrella organisation of Luxembourg’s craft and unites 51 professional federations. It is the successor of the “Allgemeiner Handwerkerverband” that was founded in 1905. Through its affiliation to a professional federation, each company is automatically a member of the craftsmanship’s central body.

Together with its members, the “Fédération des Artisans” defines the general policy of the skilled trade, which it promotes both amongst its members and in public. The “Fédération des Artisans” is strong and respected professional organisation, just like those from the political and economic sectors. With his membership, every entrepreneur is actively involved in the defence of the interests of Luxembourg’s skilled trade.

The “Fédération des Artisans” actively contributes to the creation of a political, economic and social environment favourable to the development of Luxembourg’s skilled trade.

Keeping close contact with the political leaders, the public authorities, syndicates and other economic players, the “Fédération des Artisans” is directly involved in the development of economic and social decisions.

To this end, the “Fédération des Artisans” represents your interests as a privileged partner in numerous private and public organisations, such as:

- The tripartite
- The “Union des Entreprises Luxembourgeoises (A.s.b.l.)” (UEL)
- The “Conseil Economique et Social”
- The administrative bodies of Social Security
- The “Service de Santé au Travail Multisectoriel”
- The “Comité de Conjoncture”
- As a member of the European Association of Craft, Small and Medium-Sized Enterprises (UEAPME), the Federation represents the interests of Luxembourg’s skilled trade on a European scale.

The “Fédération des Artisans” informs and consults, takes charge of the member organisations’ secretary work, represents the skilled trade in the national and international organisms and institutions, assists the affiliated federations in the negotiations of collective agreements and defends, together with the “Confédération Luxembourgeoise de Commerce” and the “Horesca”, the interests of SMBs.

The construction trades represented by the “Fédération des Artisans” are:

- Association des Patrons Electriciens
- Association des Patrons Menuisiers
- Confédération de la Toiture
- Fédération des Entrepreneurs de Revêtements Modernes
- Fédération des Entreprises de Carrelages
- Fédération des Entreprises de Construction d'Echafaudages
- Fédération des Entreprises de Construction et de Génie Civil
- Fédération des Entreprises de Nettoyage de Bâtiments
- Fédération des Entreprises des Pompes Funèbres et de Crémation
- Fédération des Entreprises du Parachèvement à sec
- Fédération des Installateurs en Equipements Sanitaires et Climatiques
- Fédération des Maîtres Charpentiers et Charrons
- Fédération des Maîtres Couvreurs
- Fédération des Maîtres Ferblantiers et Calorifugeurs
- Fédération des Maîtres Marbriers, Sculpteurs et Tailleurs de Pierres
- Fédération des Maîtres Tapissiers-Décorateurs
- Fédération des Patrons Peintres et Vitriers
- Fédération des Patrons Plafonneurs et Façadiers
- Fédération des Patrons Ramoneurs et Ramoneurs-Fumistes
- La Fédération des Entreprises des Métiers du Métal
- Féierschutz asbl. (Protection Incendie)
- Fédération Luxembourgeoise des Entreprises en Télécommunications, Téléinformatique et Systèmes d'Alarme

3.4.3. The « Groupement des Entrepreneurs du Bâtiment et des Travaux Publics »



The “Groupement des entrepreneurs du bâtiment et des travaux publics” (association of building and public works contractors) was founded in 1946 by a group of Luxembourgish entrepreneurs driven by the desire to create an association representing the construction sector. The association is organised as part of the “Fédération des industriels luxembourgeois” (FEDIL) and is affiliated with the European Construction Industry Federation. Today, the association brings together some 40 big and medium-sized companies, representing some 65% of the construction sector’s labour force.

The association defends and preserves its members' professional interests and makes the economic and social analysis of all matters related to the construction industry. It assists, consults and informs its members on the evolution of the Luxembourgish and European legal framework. The association is in permanent contact with the political and economic decision makers, as well as with the syndicates.

3.4.4. The « Ordre des Architectes et des Ingénieurs-Conseils¹ »



The “Ordre des Architectes et des Ingénieurs-Conseils” (order of architects and consulting engineers) was established on 15th March 1990 in Luxembourg, under the Law of 13th December 1989 regarding the organisation of the occupation of architects and consulting engineers.

In order to present territorial planning, urbanism, architecture and engineering, to accentuate its general and artistic interest, to encourage quality, creativity and innovation and to favour interregional and international exchanges, the Order guarantees a multitude of communication and awareness campaigns.

¹ www.oai.lu

4. National policies and strategies to contribute to the EU 2020 energy targets in buildings

The national energy policy, with the focus on the construction sector, is legally based on the «loi du 5 août 1993 concernant l'utilisation rationnelle de l'énergie». This law offers the Government a legal basis to set up the requirements of the energy sector. Under this law, several regulations to meet requirements, especially for the implementation of the EPBD directive, have been adopted.

Furthermore, the energy policy of Luxembourg follows the exigencies of the national action plans going out of the both directives 2006/32/EC on energy end-use efficiency and energy services and 2009/28/EC on Renewable Energy.

Regulations for new buildings exist for the residential as well as for the non-residential building sector. In the residential sector, regulations for financial aid exist since several years to promote energy efficiency and renewable energy. Financial aid is also possible for such projects for the municipal sector and the non-residential sector.

The national energy agency, myenergy, is responsible for sensitization, information and basic advice in the domains of energy efficiency and renewable energy. Myenergy, which is supported by the government, increased considerably their activities in these domains during the last years.

4.1. Activities in relation of the EPBD recast Directive

In 1995, Luxembourg implemented the first mandatory requirements for residential and non-residential buildings by a regulation setting up requirements for new buildings and the renovation of existing building stock. The regulation fixes a maximum average U-value for the whole building. In 2008 the requirements for residential buildings were modified by the «règlement grand-ducal modifié du 30 novembre 2007 concernant la performance énergétique des bâtiments d'habitation». Implementation for non-residential buildings is based on the «règlement grand-ducal modifié du 1er août 2010 concernant la performance énergétique des bâtiments fonctionnels» which came into force on the 1st of January 2011.



Picture: Energy efficient symbol residential buildings and non-residential buildings

At this time the energy performance requirements of new buildings and existing buildings are fully implemented. The regulations implement:

- a methodology to calculate the energy performance of buildings;
- minimum requirements for new buildings, extensions and renovated elements of existing buildings;
- an energy performance certificate.

For new and existing residential buildings the calculation of the energy performance is based on energy needs and the calculation methodology for these buildings includes heating, hot water, ventilation and auxiliary needs. The results of the calculation are expressed in terms of absolute levels of primary energy need, final energy need and CO₂ emissions.

In case of non-residential buildings the energy performance calculation is based on energy needs for new buildings and energy consumption for existing buildings. The calculation methodology for both (new and existing buildings) includes, in addition to the calculation of needs for residential buildings (heating, hot water, ventilation and auxiliary needs) the calculation of energy needs (consumption) for refrigeration, lighting and for humidification and dehumidification. The results of the calculation are expressed relatively to a reference building of the same type. The 100% mark represents the requirement for new non-residential buildings, this means that no building permit is granted for new buildings situated above this mark. For existing non-residential buildings, the scale of classification reaches from 0% to 400%, the 100% mark represents a typical existing building of the same type.

The national regulation sets from 1996 on, minimum requirements for in principle all types of buildings (a few exceptions exist). The table below illustrates the minimum required U-values applicable from 1996 to 2008 and those currently in force:



1996	To outdoor air	To soil or unheated spaces	
Building component			
Outdoor walls	0.40		0.40
Windows and doors	2.00		0.30
Ridget/flat roof and attic	0.30		2.00
Foundation, Cellar	0.40		2.50

2008	To outdoor air	To weakly heated spaces	To soil or unheated spaces
Building component			
Wall and floor	0.32	0.5	0.40
Roof and ceiling	0.25	0.35	0.30
Domes	2.7	2.7	2.7
Window or balcony door including frame	1.50	2.00	2.00
Door including frame	2.00	2.50	2.50

Picture: U-values for residential buildings 1996-2008

These U-values are applicable to new residential buildings, new non-residential buildings, public buildings and to modifications and extensions of all these buildings.

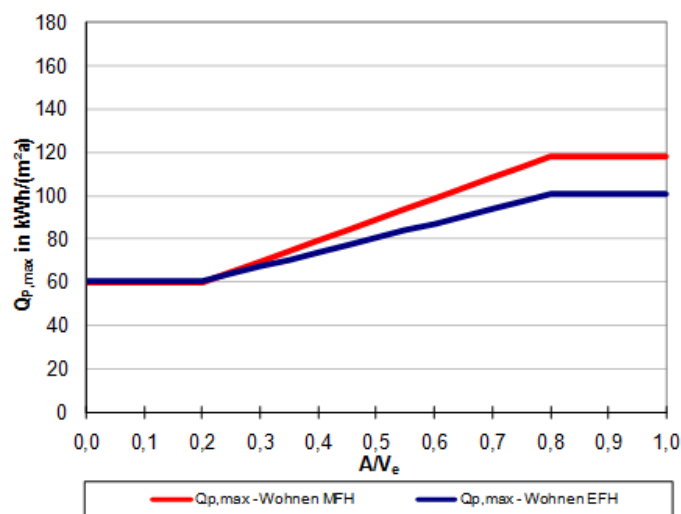
From 2008 on, the new regulation sets up new minimum and global requirements for residential buildings. For non-residential buildings this was done from 2011 on. The table below shows the different stages and sorts of requirements for residential and non-residential buildings from the 1st January 2008 on up to now.

The principles of legislation - REQUIREMENTS			
	Before 1.1.2008	After 1.1.2008	After 1.1.2011
	RGD 22.11.1995	RGD 30.11.2007	RGD mod. 30.11.2007
	U-Values	* Minimal values ◦ U-Values ◦ Tightness ◦ Pipes ◦ Ventilation * Heating energy index * Primary energy index	
	RGD 22.11.1995	RGD 30.11.2007	RGD 2010
	U-Values	U-Values	* Minimal values ◦ U-Values ◦ Sun protection ◦ Tightness ◦ Thermal bridges ◦ Pipes and storage ◦ Ventilation ◦ Regulating & measurement devices * Heating energy index * Primary energy index

Picture: Energy performance in buildings-requirements 2008-now

Global requirements for example for new residential buildings are expressed in terms of absolute primary and final energy needs. The absolute level is depending on the compacity of the building. For instance, the primary energy requirement currently in force for new residential buildings is shown below:

<u>Building category</u>		$Q_{P,max}$ [kWh/m ² a] $0,2 < A/V_e < 0,8$	$Q_{P,max}$ [kWh/m ² a] $A/V_e \leq 0,2$	$Q_{P,max}$ [kWh/m ² a] $A/V_e \geq 0,8$
1	Single family building	40+98(A/V _e)	59,6	118,4
2	Multi family building	47+67(A/V _e)	60,4	100,6



Picture: Primary energy requirements for residential buildings

A new regulation of 2012 reinforces the primary energy requirement in stages up to 2017 for new residential buildings and the final energy requirement for new residential buildings and its extensions of existing residential buildings exceeding 80 square meters.

In Luxembourg the transposition of the European Directive as well as the energy performance requirements and the energy performance certificate have been implemented by a grand-ducal regulation having its legal basis in a Law.

The following regulations implement the EPBD:

1. Règlement grand-ducal modifié du 30 novembre 2007 concernant la performance énergétique des bâtiments Mémorial A N° 221 de 2007;

(www.legilux.public.lu/leg/a/archives/2007/0221/2007A3762A.html)

2. Règlement grand-ducal modifié du 31 août 2010 concernant la performance énergétique des bâtiments fonctionnels Mémorial A N° 173 de 2010 ;

www.legilux.public.lu/leg/a/archives/2010/0173/2010A2850A.html)

Luxembourg is currently drawing out the NZEB action plan. Definition of NZEBs is given in this report and a roadmap containing different actions to implement NZEBs is proposed.

The National System for energy performance certification of residential buildings came into force on the 1st of January 2008 for new buildings and on the 1st of September 2008 for existing buildings.

Since the 1st of September 2008, all existing residential buildings need to be certified when they are sold or rented. The owner must present a valid EPC to the buyer, when the selling or renting contract is established. This involves a qualified expert visiting the property and assessing the building in terms of the type of construction (walls, windows, insulation, thermal bridges, ventilation and air-tightness, aso.) and the type and quality of HVAC and hot water systems. The qualified expert will then calculate the thermal and primary energy efficiency of the building and issues the EPC. There is no minimum requirement for an existing building, i.e., they can be labeled A through I.

The energy performance certification of non-residential buildings came into force on the 1st of January 2011 for new buildings and on the 1st of June 2011 for existing buildings.

After the calculation of the energy rating and, in the case of existing buildings, the definition of required improvement measures, the expert compiles the EPC for delivery to the building's owners.

The energy label classifies all residential buildings on an efficiency scale ranging from A (high energy efficiency) to I (poor efficiency) and is based on an asset rating. Each building is assigned an energy performance rating according to the tables below:

Building category		Class A	Class B	Class C	Class D	Class E	Class F	Class G	Class H	Class I
1	Multifamily building	≤ 45	≤ 75	≤ 85	≤ 100	≤ 155	≤ 225	≤ 280	≤ 355	> 355
2	Single family Building	≤ 45	≤ 95	≤ 125	≤ 145	≤ 210	≤ 295	≤ 395	≤ 530	> 530

Picture: Classes for total primary energy performance (kWh/m².year) in residential buildings

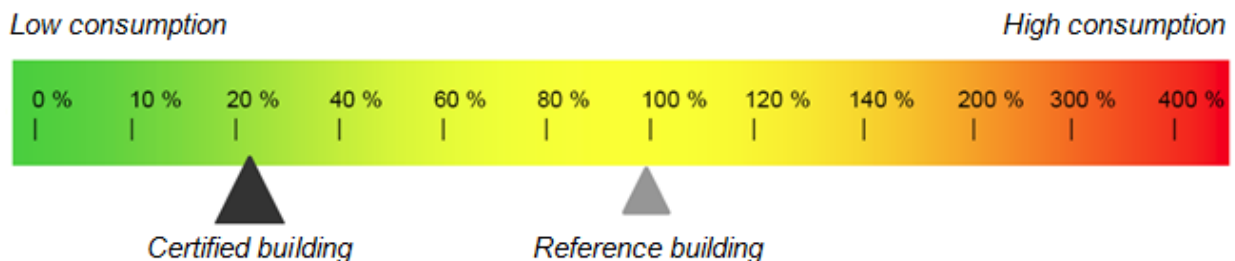
Building category		Class A	Class B	Class C	Class D	Class E	Class F	Class G	Class H	Class I
1	Multi family building	≤ 14	≤ 27	≤ 43	≤ 54	≤ 85	≤ 115	≤ 150	≤ 185	> 185
2	Single family building	≤ 22	≤ 43	≤ 69	≤ 86	≤ 130	≤ 170	≤ 230	≤ 295	> 295

Picture: Classes for heating energy performance (kWh/m².year) in residential buildings

Energy performance class	Class A	Class B	Class C	Class D	Class E	Class F	Class G	Class H	Class I
Primary energy demand	≤ 55 %	≤ 70 %	≤ 85 %	≤ 100 %	≤ 150 %	≤ 200 %	≤ 300 %	≤ 400 %	> 400 %
CO ₂ Emission performance figure	≤ 55 %	≤ 70 %	≤ 85 %	≤ 100 %	≤ 150 %	≤ 200 %	≤ 300 %	≤ 400 %	> 400 %
Heating energy demand	≤ 45 %	≤ 60 %	≤ 80 %	≤ 100 %	≤ 150 %	≤ 200 %	≤ 300 %	≤ 400 %	> 400 %
Heating primary energy demand	≤ 45 %	≤ 60 %	≤ 80 %	≤ 100 %	≤ 150 %	≤ 200 %	≤ 300 %	≤ 400 %	> 400 %
Cooling primary energy demand	≤ 45 %	≤ 60 %	≤ 80 %	≤ 100 %	≤ 150 %	≤ 200 %	≤ 300 %	≤ 400 %	> 400 %
Ventilation primary energy demand	≤ 65 %	≤ 75 %	≤ 85 %	≤ 100 %	≤ 150 %	≤ 200 %	≤ 300 %	≤ 400 %	> 400 %
Lighting primary energy demand	≤ 55 %	≤ 70 %	≤ 85 %	≤ 100 %	≤ 150 %	≤ 200 %	≤ 300 %	≤ 400 %	> 400 %
Weighted final energy demand	≤ 55 %	≤ 70 %	≤ 85 %	≤ 100 %	≤ 150 %	≤ 200 %	≤ 300 %	≤ 400 %	> 400 %

Picture: Definition of the limits of the energy performance classes related to the reference building for non-residential buildings

The energy label classifies existing non-residential buildings on a scale from 0-400% with regard to a reference building. The different classes in building certification for non-residential buildings are shown below:



Picture: Energy scale for existing nonresidential buildings

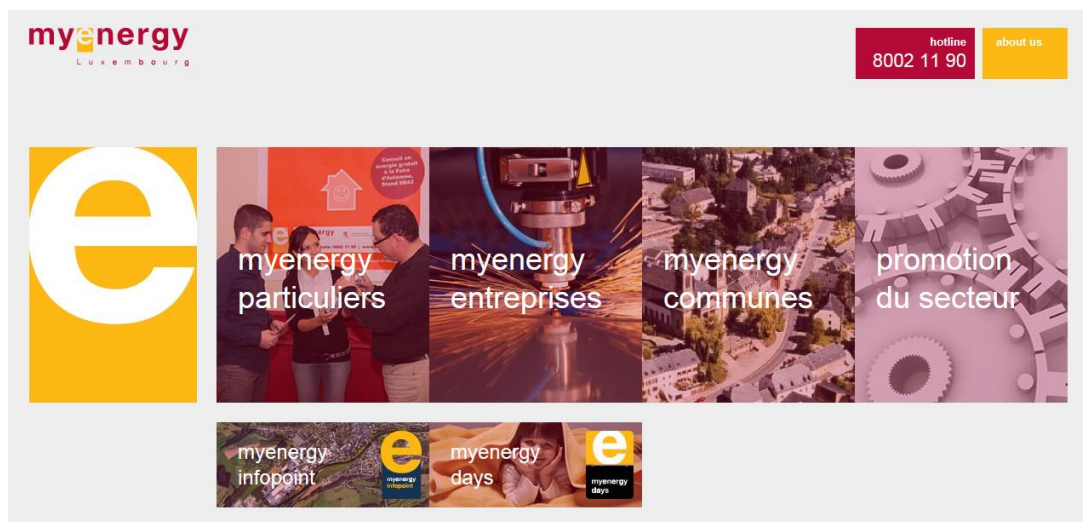
The energy performance certificate (EPC) is the most visible aspect of the regulation concerning the energy performance in buildings. This document assigns an energy performance label to residential and non-residential buildings or building units and lists, for existing buildings, cost-effective measures for improving their energy performance.

The real benefit of the energy performance certification lies in the recommendations given to the building owner. These are summarized on the certificate. These recommendations should be the first step towards renovation of existing buildings.

Advertising campaigns are continuously developed about the energy certification of buildings and are promoted on television, in the cinema, in the press and on the internet. The message of these campaigns is to show that the EPC is promoting market transparency and that it is the first step towards undertaking energy saving measures.

Furthermore, the government created a virtual online desk (www.guichet.lu) where people may get all information on all kinds of procedures. This online desk includes a section with all necessary information on energy performance certification of buildings, energy performance, authorized experts and governmental subsidies.

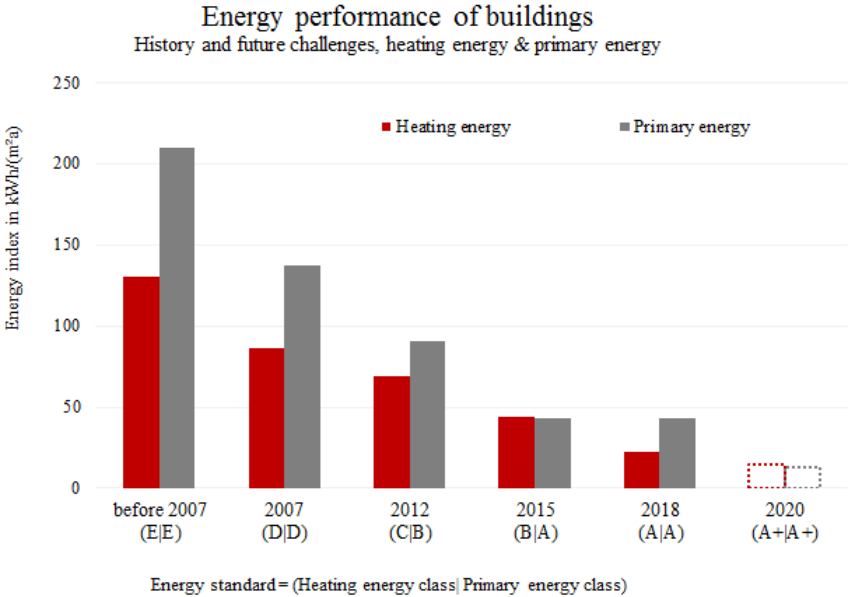
Detailed information on energy efficiency in buildings and on the EPC is available at myenergy website (www.myenergy.lu). During the last years, myenergy, the national structure for the promotion of energy efficiency and renewable energy, was present in many events, fairs, seminars and workshops, disseminating information about the certification process and promoting awareness among citizens, regarding the added value of building energy performance certification that is based on clear and reliable information.



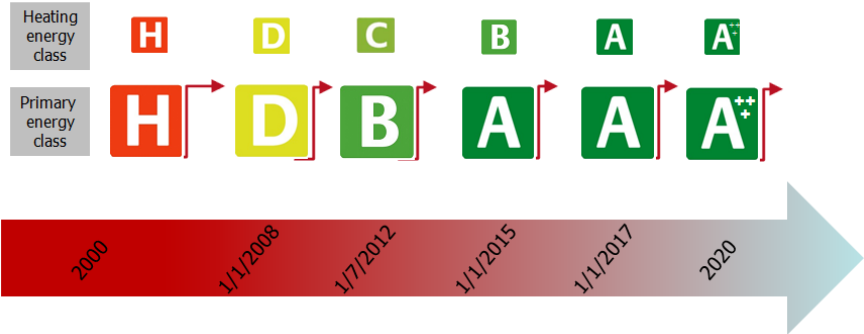
Picture: www.myenergy.lu

myenergy has, in order to reach people directly, set up a network of so called «myenergy info points» over the country. In this infopoints the citizens get professional and neutral free information about energy performance and its certification.

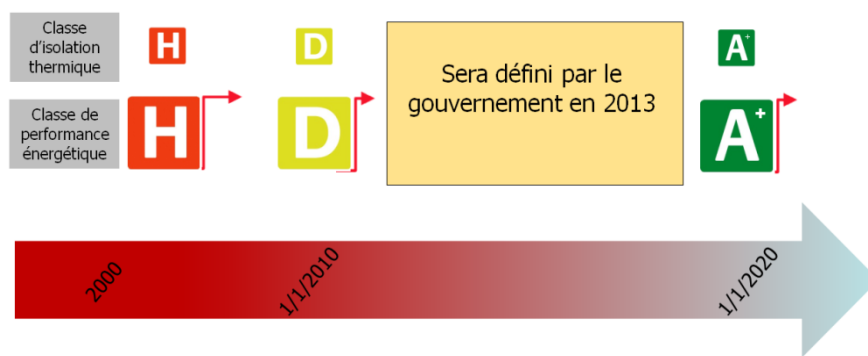
In conclusion, it can be said that the EPBD requirements for new buildings bring important energy savings in the near future, although new buildings only represent a small share of the entire building stock. Nevertheless, Luxembourg remains one of the countries with increasing population, so that the added buildings are relatively high and that an energy efficient construction of it is guaranteed.



Picture: Evolution of the energy performance of residential buildings



Picture: History of building regulations an future challenges (residential sector)



Picture: History of building regulations and future challenges (non-residential sector)

4.2. Activities in relation of the energy end-use efficiency and energy services Directive

The Directive 2006/32/CE sets the frame for the national energy efficiency action plans (NEEAP) which have to be established by the member states. Luxembourg finalized its second NEEAP during the year 2012. The aspects in relation of the construction and building sector are relevant. Most of the implementations done in the frame of the EPBD recast Directive reflect their effects in the NEEAP results.

The overall national indicative energy savings target for the ninth year (2016) of application of this Directive is 9 %, which means an absolute value of 1.769 GWh. The target achievements for Luxembourg are 7,59 % for the year 2010 and could be 14,06 % for the year 2016, which means an absolute value of 2.764 GWh.

The achievement of the measures is done by early action – measures (implemented between 1995 –2007), new measures (in implementing process) and new planned / possible measures (further measures which aim to provide energy savings to fulfill the NEEAP). In relation of the value of the target achievement of 2016, more than 50 % of the measures are related to the households, business and services sectors in which measures in relation with buildings and construction play an important role. Among the top 5 measures with the highest potential in the NEEAP, three are dealing with building regulations for households, businesses and services, adding up 4,71 % of the 14,06 %.

Concretely, the measures of the NEEAP dealing with the construction sector are:

Current and planned measures	2010		2016	
	GWh/a	Contribution to saving targets	GWh/a	Contribution to saving targets
Household Sector				
A1 - WD1996 Old building upgrade programme and new	385	1,96 %	385	1,96 %

Current and planned measures	2010		2016	
	GWh/a	Contribution to saving targets	GWh/a	Contribution to saving targets
buildings				
A2 - WD 1996 - Promotion of energy efficiency in new homes/efficient heating systems	90	0,46 %	90	0,46 %
B1 - WD2008 Promotion of old building upgrade programme	15	0,08 %	53	0,27 %
B1 - WD2008 New buildings	31	0,16 %	295	1,50 %
Promotion of old building upgrade programme	10	0,05 %	19	0,10 %
B3 - Promotion of energyefficient new buildings	6	0,03 %	15	0,08 %
B11 - Promotion of heating upgrade programme	6	0,03 %	12	0,06 %
B10 – Promotion of efficiency labelling	0	0,00 %	13	0,07 %
C1 – Increase in the old building upgrade programme	0	0,00 %	31	0,16 %
C1 – Increase in energy-efficient new building programme	0	0,00 %	6	0,03 %
C4 – WD2012 Old building upgrade programme	0	0,00 %	12	0,06 %
C4 – WD2012 New buildings	0	0,00 %	50	0,25 %
C10 - Promotion of heating upgrade programme	0	0,00 %	11	0,06 %
Tertiary sector				
A3 – WD1996 Old building upgrade and new buildings	171	0,87 %	171	0,87 %
WD2008 Promotion of old building upgrade programme and	58	0,29 %	89	0,45 %

Current and planned measures	2010		2016	
	GWh/a	Contribution to saving targets	GWh/a	Contribution to saving targets
new buildings				
B14 – WD2011 Promotion of old building upgrade programme and new buildings	0	0,00 %	193	0,98 %
Cross-cutting measures				
As they may not clearly be referenced to the construction sector, cross-cutting measures are not mentioned here. They contain mainly renewable energy measures, the respective values in relation of the construction sector are more clearly referenced in the NREAP (see below)				
Sum of measures	772	3,93 %	1.445	7,36 %

The contribution to the saving targets percentage refers to the energy saving targets in relation of the directive. Values up to 2020 are currently not available.

Concerning the general assumptions of all fuel-related measures in private households, the following indications may be given:

- Annual growth in number of households 1,3 %
- Annual upgrading rate for old buildings (refurbishment rate) 0,5 %
- Annual new building rate 2,0 %

In the tertiary sector, an annual upgrading and refurbishment rate of 2 % has been assumed.

The Government of Luxembourg has initiated - or is planning to initiate -the following actions within the framework of the energy efficiency efforts for the exemplary role of the public sector pursuant to Article 5(1) of the ESD, in relation to public buildings (requirement f in Annex VI of the ESD):

- New buildings: The highest achievable level of energy efficiency is the goal for new buildings. Based on the Luxembourg Government Program of 2009, from 2010 all new state or state-subsidized administrative buildings (and other types of buildings where applicable) must comply at least with the lowest domestic energy standard. Both the state and the municipalities strive to exceed this efficiency level. Government plus-energy buildings shall be built for demonstration purposes.

- Existing buildings: Luxembourg has published an upgrading program for public buildings. Around EUR 30m have been made available for the gradual upgrading of old building stock involving energy measures. The Ministry for Sustainable Development and Infrastructure plans the increase of public funds (Budget and Personnel) aimed at accelerating the energy upgrading of public buildings.

4.3. Activities in relation of the renewable energy Directive

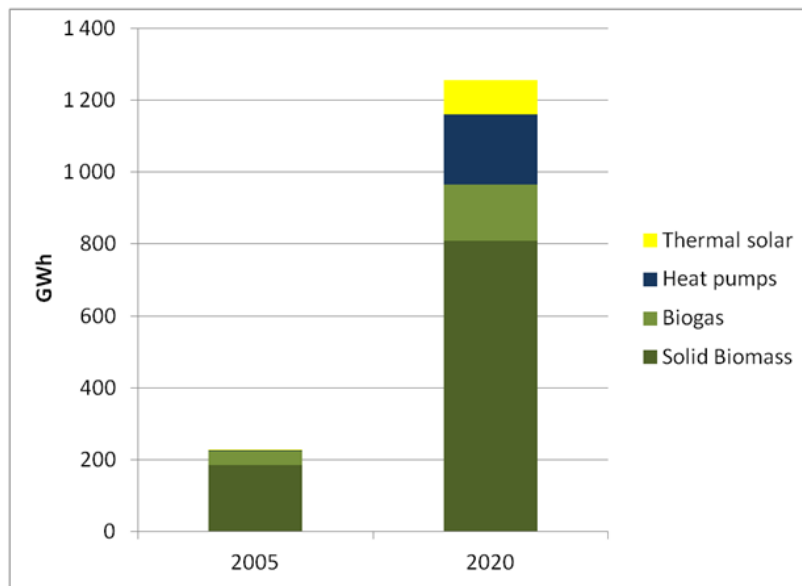
The Directive 2009/28/CE sets the frame for the national renewable energy action plans (NREAP) which have to be established by the member states. Luxembourg finalized its first NREAP during the year 2010. The aspects in relation of the construction and building sector are relevant.

The Luxembourg policy for the development of renewable energies is based on three main areas:

- The utilization of national potentials is a top priority. Here, an intensive development of the electricity and heat generation is desired. In the area of electricity, biomass and wind will, in the future, represent the two top performers. In the heating field, in addition to the development of a grid-connected heat supply based on biomass, decentralized heating production is also of great relevance. In households, the technologies of solar thermal energy and heat pumps will increasingly be used in addition to biomass. Luxembourg primarily intends to continue the promotion of renewable energies in the electricity sector through feed-in tariffs and investment incentives as well as in the heating sector through investment incentives.
- The second component of the national strategy involves energy from renewable sources in the transport sector. Here the 10 % target established by the directive needs to be achieved. In this context Luxembourg is — due to limited land potential — focusing on sustainable biofuel imports by requiring that a percentage of biofuels be added to regular fuel, but also focusing on an ambitious national development of electro mobility in public transport and in private transport in order to meet the requirements.
- The third main pillar is represented by the cooperation mechanisms. Based on limited national potentials and according to the current situation, Luxembourg must rely on this possibility in order to be able to reach its 11% overall target.

The overall share of energy from renewable sources in gross final consumption of energy in 2020 is 11 %. The NREAP proposes several measures of regulative, normative, informative, infrastructural, financial or cooperative type, to achieve the targets of the directive. From the different sectorial targets affected by these measures, the heating and cooling sector seems the most relevant in relation of housing and buildings (the other ones are electricity and transport). In comparison to the values of

2005, the targets for the renewable heating and cooling sector for 2020 can be illustrated as follows:



Picture: NREAP-Target in renewable heating and cooling

For this domain, implementation costs in order of 178 million € have been announced for the period of 2011 to 2020.

The following table resumes the estimation of total contribution (final energy consumption) expected from the, for the relevant renewable energy technology of the building sector in Luxembourg to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in heating and cooling (values in ktoe).

Technology	2005	2010	2015	2020
Solar	0,2	0,7	2,4	8,1
Solid biomass	16,0	18,8	38,7	69,5
Biogas	3,2	4,6	11,6	13,4
Renewable energy from heat pumps	0,2	1,4	4,2	16,9

4.4. Further activities of national energy policy

4.4.1. Increase of energy efficiency and renewable energy in the public sector

A sample contract for public sector energy service contracts in Luxembourg (energy savings contracting) has been drafted under the auspices of the Ministry of Economy and Foreign Trade.

In 2012, the Ministry of Sustainable Development launched a pact about climate protection between State and municipalities, and proposed the introduction of the European Energy Award (eea) adapted to Luxembourg - a quality management systems for municipalities with respect to energy and climate protection policy. Each participating municipality undertakes to implement the quality management system in return for financial and technical support from the State. The mutual commitment becomes a convention between the State and municipalities, which should last until 2020. A large part of the measures of the climate pact contribute to improving energy efficiency at municipal level.



Picture: Climate pact

4.4.2. Information provision for the improvement of energy efficiency and renewable energy sources

The following actions have been undertaken or are being planned in order to provide information. Increasing awareness and providing information and advice about energy efficiency and renewables was stepped up in recent years as a result and will be further strengthened in future:

- myenergy (www.myenergy.lu) is the national institute responsible for creating awareness and providing information and advice about energy efficiency and renewables. The services it offers have been substantially increased since it was founded in 2008. It is aimed at citizens, municipalities and companies. The means used for creating awareness and providing information endeavor to inform as many consumers as possible: the participation in national exhibitions and regular presence in the media are the most important measures in order to achieve this goal. Basic advice is available both over the phone, thanks to a free phone number, as well as face-to-face, at information centers. A further increase of the activities of myenergy and the extension to not yet completely covered target groups is being planned.



Picture: www.particuliers.myenergy.lu

- A comprehensive network of regional and municipal advice centers (myenergy information points) is being developed in partnership with municipalities. At the end of 2012, information points had been created in nearly 75 % of the municipalities. Moreover, myenergy offers different support measures such as road shows, presentations, information days and information tours within the framework of the partnership with municipalities.



Picture: www.myenergyinfopoint.lu

- The myenergy days trade is a great success around a single topic: energy-efficient retrofitting: Building envelope, technical systems and services. Furthermore, the exhibition offered a comprehensive program of lectures, product presentations and demonstrations.



Picture: myenergy days

- The Luxembourg administration portal (www.guichet.lu) includes information about state incentive programs for energy efficiency and renewables.



Picture: www.guichet.lu

4.4.3. Training in the domain of energy efficiency and renewable energy

The extension of the training offering in the energy efficiency and renewables area is a priority measure. However, significant training and professional development efforts were undertaken in the past ten years, of which some examples are listed below:

- Chamber of Handicrafts Luxembourg (Chambre des Metiers): The professional development program of the Chamber of Handicrafts ‘Energie fir d’Zukunft’ covers, amongst others, the topics of retrofitting, passive house, (envelope and building services), ventilation systems, solar systems, heat pumps, internal insulation, hydraulic compensation and promotion programs. It is intended primarily for the executives of relevant craft businesses and has been provided every year since 2001. In 2012, the offer was enlarged by a new program for passive house craftsmen (“Energie fir d’Zukunft +”).



Picture: Energie fir d’Zukunft +

- IFSB (Institut de Formation Sectoriel du Bâtiment): Sustainable building is one of the cornerstones of the building sector professional development institute. The programme is aimed at planner and craftspeople – including applied training about topics such as sustainable building and retrofitting, thermal insulation, windows, timber constructions, energy balancing, thermography, air tightness tests, solar installations, heat pumps and wood heating systems.



Picture: www.ifsb.lu

OAI (Ordre des Architectes et Ingénieurs-Conseils) and CRP Henri Tudor (Centre de Recherche Public Henri Tudor): Since 2003, the CRP Henri Tudor organises the training program 'Building and energy' in collaboration with the architects and consulting engineers' professional organisation (OAI). The advanced professional development programme deals with sustainable, energy-efficient building issues and is aimed primarily at architects and engineers. The content of the professional development programme is defined in cooperation with energieagence S.A., the Ministry for Sustainable Development and Infrastructure, the Oeko-Zenter Lëtzebuerg and the University of Luxembourg. Moreover, the CRP Henri Tudor offers further courses on the topic of energy efficiency.



Picture: *Ordre des Architectes et Ingénieurs-conseils*

Since the publication of the ordinances about the total energy efficiency of buildings in 2007, specialist training courses about the total energy efficiency of domestic and non-

domestic buildings are offered on behalf of the Ministry of the Economy and Foreign Trade.

University of Luxembourg: The applied engineering course of study 'Energy and environment

4.4.4. Financial aid programs

In Luxembourg, both households and companies and municipalities are stimulated to invest in the energy efficiency of buildings through financial aid programs.

- Households are supported with investment subsidies for the energy retrofitting and the building of passive or low-energy housing by means of the „Règlement grand-ducal du 12 décembre 2012 instituant un régime d'aides pour la promotion de l'utilisation rationnelle de l'énergie et la mise en valeur des énergies renouvelables', called "PrimeHouse". It constitutes a fundamental upgrading of the previous program, especially for refurbishment measures. Further information is available at www.myenergy.lu and www.guichet.lu ;



The logo for PrimeHouse features the word "PRIME" in a bold, dark grey sans-serif font, with the letter "e" in a light green color. Below "PRIME" is the word "House" in a smaller, dark grey sans-serif font. A horizontal dotted line is positioned below the word "House".

Picture: PrimeHouse

Companies that invest in the energy efficiency of buildings are supported with investment aid thanks to the „Loi du 18 février 2010 relative à un régime d'aides à la protection de l'environnement et à l'utilisation rationnelle des ressources naturelles', or with investment aid and subsidized interest rates thanks to the „Loi modifiée du 30 juin 2004 portant création d'un cadre général des régimes d'aides en faveur du secteur des classes moyennes'. Further information is available at www.myenergy.lu and www.guichet.lu ;

Municipalities are supported with investment aid thanks to the 'Loi du 31 mai 1999 portant institution d'un fonds pour la protection de l'environnement' for the energy retrofitting, the planning of an entire energy concept for the municipality or the municipality's buildings as well as the construction of new buildings that exploit solar gains. Further information is available at www.myenergy.lu .

4.5. National and regional implementation of European Qualifications Framework (EQF) and other EU education and training policies in the building sector.

4.5.1. The European Qualifications Framework (EQF)

Definitions (Source: http://ec.europa.eu/education/lifelong-learning-policy/eqf_fr.htm)

The European Qualifications Framework (EQF) acts as a translation device to make national qualifications more readable across Europe, thus promoting workers' and learners' mobility between countries and facilitating their lifelong education and training.

The EQF aims to relate different countries' qualification systems to a common European reference framework. Individuals and employers will be able to use the EQF to better understand and compare the qualifications levels of different countries and different education and training systems.

Agreed upon by the European institutions in 2008, the EQF is being implemented across Europe.

It encourages countries to relate their national qualifications systems to the EQF, so that all new qualifications issued from 2012 carry a reference to an appropriate EQF level. An EQF national coordination point has been designated for this purpose in each country.

The EQF concerns eight reference levels describing the knowledge, skills and competence of a learner - called "learning outcomes." Levels of national qualifications will be placed at one of the central reference levels, ranging from basic (Level 1) to advanced (Level 8). This will enable a much easier comparison between national qualifications and should also mean that individuals do not have to repeat their learning if they move to another country.

The EQF applies to all types of education, training and qualifications, from school and higher education, to vocational training. This approach differs from the traditional system which emphasises "learning inputs" such as the length of the learning experience or the type of institution. It also encourages lifelong education and training by promoting the validation of non-formal and informal learning.

4.5.2. The European Qualifications Framework (EQF) in Luxembourg

During the 2005 consultation concerning the proposal for the European Qualifications Framework, Luxembourg, while expressing some reserves, adopted a positive attitude vis-à-vis this framework. The position sent to the European Commission pointed out that the concept of unique reference framework complements the efforts being made by countries over several years to search for an explanation of their systems. Furthermore, the Luxembourg position substantiated Luxembourg's interest in this approach with the following three reasons:

the option to base the reference framework on skills and learning outcomes complemented reflections to adapt the education and training system in this direction;

the framework would facilitate the recognition of many qualifications awarded by the other Member States, qualifications that public authorities have to deal with in the recognition procedures, regarding the specific situation of the labour market and immigration;

in a lifelong learning approach, a framework would consider, in the interest of the learner, certifications and qualifications acquired in non-formal contexts.

Following the adoption of the Recommendation of the European Parliament and of the Council of 23 April 2008 establishing the European Qualifications Framework for lifelong learning, the Ministry of National Education and Vocational Training, in consultation with the Ministry of Higher Education and Research, developed a proposal for the Luxembourg Qualifications Framework, a proposal that was submitted for review and discussion to the various partners.

The Luxembourg Qualifications Framework (LQF) is currently being finalised. It is based on European recommendations laid down in the European Qualifications Framework (EQF) and establishes eight levels defined by the following descriptors: "knowledge, skills and competence." These descriptors identify what the learner knows, understands and is able to do after completing his training. The LQF is intended to make qualifications more transparent and permeable both within the national education and training system as well as from one country to another. This is therefore a relevant instrument for assessing the value of different qualifications and their equivalents. The LQF will help learners to acquire additional qualifications.

(Excerpt from the [White Paper: National Strategy for Lifelong Learning](#))

Qualifications instead of certifications

One of the characteristic of the Luxembourg Qualifications Framework concerns the terminology. If the French term "certification" was chosen in the European official texts to translate the term "qualification" (in English), we in Luxembourg, following preliminary discussions regarding the development of a Luxembourg framework, have decided to use the term qualification because the word "qualification" includes the notion of certification and establishes the link to the world of work.

Responsibilities

Certifications referenced at levels 1-4 are the responsibility of the Ministry of National Education and Vocational Training.

Certifications referenced at levels 6-8 are the responsibility of the Ministry of Higher Education and Research.

Certifications referenced at level 5 are the responsibility of the Ministry of National Education and Vocational Training and the Chamber of Trade regarding the master's degree, and the Ministry of Higher Education and Research regarding the brevet de technicien supérieur (advanced vocational diploma) and the brevet de technicien supérieur spécialisé (specialised advanced vocational diploma).

Level descriptors

The Luxembourg Qualifications Framework is currently a systematic description of the qualifications of the Luxembourg education and training system. Their acquisition is evidenced and standardized when a degree, diploma or other certificate issued by a competent authority is obtained.

The Luxembourg Qualifications Framework includes a general description of qualification profiles, training outcomes and, for levels 5-8 within higher education, in addition to the above elements, formal aspects, especially the ECTS volume. The framework is based on the European Qualifications Framework for lifelong education and training, and with regard to levels 5-8, it is more linked to the Qualification Framework of the European Higher Education Area "QF-EHEA." The qualifications framework does not provide information on admissions to different levels of education. The Luxembourg Qualifications Framework uses descriptors to define what the learner knows, understands and is able to do after completing training. Three categories of descriptors describe in a generic and non-disciplinary manner, classify and specify the learning outcomes of a qualification.

The framework distinguishes the following three categories of descriptors: knowledge, skills and competence.

'Knowledge' means the outcome of the assimilation of information through learning and training. Knowledge is the body of facts, principles, theories and practices that is related to a field of study or work, and assimilation is defined as the process through which knowledge or know-how is acquired by the learner.

"Skills" means the ability to apply knowledge to complete tasks and solve problems. In the context of the European framework, skills can be cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).

"Competence" should be understood as the ability to use personal and social abilities in work or study situations and in professional or personal development. Personal skills are characterized by an autonomous and responsible ability to think critically about one's own actions and those of others; they also enable self development through studies or practice. Social skills are characterized by an autonomous and responsible ability to work with others and be able to take the interests of others into account. For levels 5-8, these descriptors are specified through communication skills and the ability to make a judgement..

Niveau	Résultats d'apprentissage			Définition dans le cadre du système d'éducation et de formation formelle
	Descripteurs en relation avec les savoirs	Descripteurs en relation avec les aptitudes	Descripteurs en relation avec les attitudes (prise de responsabilité et autonomie)	
1	Avoir acquis les connaissances de base, ainsi que celles qui sont nécessaires à la vie active et à l'exercice des responsabilités de citoyen dans une société démocratique.	Effectuer des tâches simples, sous supervision, dans un contexte structuré.	Accomplir des tâches définies sous contrôle direct et savoir faire preuve d'engagement personnel dans des contextes structurés. Apprendre sous guidance.	Certificat de réussite du cycle inférieur de l'enseignement secondaire technique
2	Posséder les connaissances spécifiques élémentaires dans un domaine de travail ou d'études.	Effectuer des tâches simples, sous supervision, dans un contexte stable et simple en se conformant à des règles et routines simples et en utilisant certains savoir-faire professionnels.	Prendre des responsabilités limitées pour l'amélioration de la performance au travail dans des contextes stables et simples et au sein d'une équipe ou d'un groupe homogène. Apprendre sous guidance tout en faisant preuve d'une certaine autonomie.	Certificat de capacité professionnelle (CCP)
3	Posséder des connaissances courantes dans un domaine de travail ou d'études défini.	Effectuer des tâches déterminées, en autonomie, dans un domaine défini en se conformant à des règles et routines et en utilisant certains savoir-faire professionnels.	Prendre des responsabilités pour exécuter des tâches et manifester une certaine indépendance dans son travail dans le cadre de contextes généralement stables, certains facteurs pouvant changer. Apprendre avec une certaine autonomie.	Diplôme d'aptitude professionnelle (DAP) Certificat de réussite du cycle moyen de l'enseignement secondaire technique Certificat de réussite de cinq années d'enseignement secondaire
4	Utiliser les connaissances générales courantes et appliquer des connaissances spécifiques approfondies dans un domaine de travail ou d'études défini.	Effectuer des tâches complexes susceptibles de se présenter dans un domaine de travail ou d'études défini en faisant preuve de savoir-faire professionnels, tout en identifiant les approches stratégiques adéquates.	Prendre des responsabilités pour accomplir une activité structurée, dans un contexte de travail ou d'études généralement prévisible, mais avec de nombreux facteurs de changement dont certains se trouvent en interrelation. Faire des propositions visant à améliorer les résultats de cette activité. Superviser le travail de routine d'autres personnes. Apprendre des notions nouvelles et participer à l'évaluation et l'amélioration des activités liées au travail et aux études.	Diplôme de technicien Diplôme de fin d'études secondaires techniques Diplôme de fin d'études secondaires

Table 1 : Luxembourg Qualifications Framework

5	<p>Posséder des connaissances procédurales et déclaratives diversifiées, souvent spécifiques à un domaine de travail ou d'études défini.</p> <p>Analyser, interpréter et évaluer des informations, des concepts et des idées.</p> <p>Comprendre différentes perspectives, approches et le raisonnement qui les sous-tend.</p>	<p>Maîtriser des savoir-faire permettant le transfert des connaissances procédurales et déclaratives pour apporter des solutions à de nouveaux problèmes.</p> <p>Développer des réponses techniques appropriées et créatives dans la recherche de solutions à des problèmes concrets ou abstraits bien définis.</p>	<p>Prendre des responsabilités pour:</p> <p>gérer des projets d'études ou de travail ; ces projets demandent la résolution de problèmes incluant de nombreux facteurs, dont certains interagissent et sont sources de changements imprévisibles;</p> <p>développer des projets en proposant des solutions pertinentes;</p> <p>exercer une autonomie de jugement en définissant des paramètres larges;</p> <p>évaluer et développer ses propres compétences par des apprentissages liés aux études ou au travail;</p> <p>gérer et former des collaborateurs;</p> <p>veiller à développer la performance des collaborateurs et de l'équipe.</p>	<p>Brevet de Maîtrise</p> <p>Brevet de technicien supérieur</p> <p>Brevet de technicien supérieur spécialisé</p> <p>Volume 120-135 ECTS</p>
6	<p>Posséder des connaissances procédurales, déclaratives et méthodologiques approfondies, soit dans un domaine de travail défini, soit dans un ou plusieurs domaines d'études.</p> <p>Analyser, interpréter et évaluer de façon critique ces savoirs et comprendre le contexte du champ d'étude ou de travail.</p>	<p>Maîtriser des savoir-faire avancés et faire preuve de sens d'innovation pour résoudre des problèmes complexes et imprévisibles dans un domaine de travail ou d'études spécialisé.</p> <p>Gérer des projets d'études ou de travail complexes.</p> <p>Communiquer des informations, des idées, des problèmes et solutions relevant du domaine de travail ou d'étude en tenant compte du public cible.</p>	<p>Former des jugements en collectant et en interprétant des données pertinentes en vue de formuler des avis qui intègrent une réflexion sur des problématiques sociétales, scientifiques ou éthiques.</p> <p>Développer des stratégies d'apprentissage en vue d'une poursuite d'études et de l'acquisition de compétences permettant de maîtriser des processus et situations complexes.</p> <p>Prendre des responsabilités en matière de développement de la performance des collaborateurs et de l'équipe.</p> <p>Exercer une autonomie et des jugements généraux.</p>	<p>Bachelor</p> <p>Volume 180 – 240 ECTS</p>

Table 1 : Luxembourg Qualifications Framework

7	<p>Posséder et maîtriser la systématique des connaissances procédurales, déclaratives et méthodologiques spécialisées et actuelles dans un domaine de travail ou d'études.</p> <p>Analyser, interpréter et évaluer de façon critique des informations, concepts et théories en vue de les appliquer et modifier.</p>	<p>Maîtriser des savoir-faire spécialisés permettant le développement de nouvelles idées et procédures, ceci en tenant compte d'alternatives possibles.</p> <p>Gérer des situations complexes et imprévisibles demandant de nouvelles solutions et être capable de communiquer les résultats de façon claire aux spécialistes et professionnels ainsi que de les discuter avec ces derniers.</p>	<p>Former des jugements : intégrer des connaissances, maîtriser la complexité et formuler des avis à partir d'informations limitées qui intègrent une réflexion sur des problématiques sociétales, scientifiques ou éthiques.</p> <p>Réfléchir de façon autonome par rapport à des stratégies en vue d'un développement professionnel ou scientifique.</p> <p>Initier et conduire de façon autonome des collaborations professionnelles ou scientifiques impliquant la responsabilité pour le travail et les rôles d'autrui.</p> <p>Exercer un jugement et une autonomie larges dans le cadre d'un champ de travail ou d'étude significatif.</p>	<p>Master</p> <p>Volume 60 -120 ECTS</p>
8	<p>Posséder des connaissances spécialisées et actualisées se situant à la frontière la plus avancée d'un ou plusieurs domaines scientifiques, ou d'un champ professionnel respectivement stratégique et innovateur.</p> <p>Analyser, interpréter et évaluer de façon critique ces connaissances pour développer de nouvelles connaissances et étendre un domaine de savoir ou de travail.</p>	<p>Maîtriser des savoir-faire larges pour identifier et résoudre des problèmes impliquant une multitude de facteurs complexes et interactifs dans le domaine de la recherche, du développement ou de l'innovation dans un champ professionnel ou scientifique.</p> <p>Gérer des situations survenues dans de nouveaux contextes ayant pour conséquence des changements organisationnels et professionnels significatifs.</p> <p>Évaluer de nouvelles idées et de nouveaux processus.</p>	<p>Former des jugements : concevoir, réaliser et évaluer des processus innovateurs susceptibles d'élargir le champ du savoir ou du travail tout en tenant compte des problématiques sociétales, scientifiques ou éthiques.</p> <p>Initier de façon autonome des projets de recherche ou de développement et produire par ce biais de nouvelles connaissances, aptitudes et attitudes.</p> <p>Initier de façon autonome des discussions spécifiques afin de développer les connaissances, aptitudes et attitudes d'autrui dans le champ scientifique ou professionnel.</p> <p>Exercer une autonomie et un jugement larges comme praticien responsable pour le développement du savoir ou du champ de travail ou pour des changements organisationnels ou professionnels substantiels.</p>	<p>Doctorat</p> <p>Diplôme de formation spécifique en médecine générale</p>

Table 1 : Luxembourg Qualifications Framework

Any of the following degrees referenced at level 4 must first be obtained before admission to level 5 and level 6: High School Diploma or recognized equivalent foreign certificate), Technical High School Diploma (or recognized equivalent foreign certificate) or Technician's diploma with certain additional conditions. At levels 6, 7 and 8, the master's level comes after successfully completing studies at the "Bachelor" level and the doctorate comes after the obtaining of the master's degree. Notwithstanding, students with some working experience and professional skills are also considered.

The learning outcomes of levels 5 (regarding the brevet de technicien supérieur (advanced vocational diploma), 6 (Bachelor's training) and 7 (master's training) are accompanied with ECTS credits. The credits of the "European Credit Transfer and Accumulation System (ECTS)" are units of measurement based on the volume / workload to be borne by the student. 60 credits correspond to one year of full-time studies. 1 credit is equal to 25 to 29 hours of work to be done by the student to attain the set learning outcomes. Credits are awarded to the student when he meets the validation requirements of the education and the learning outcomes.

Source: Report on the referencing of the Luxembourg Qualifications Framework to the European Qualifications Framework for lifelong learning and the Qualifications Framework for the European Higher Education Area.

5. Construction and energy sector statistics

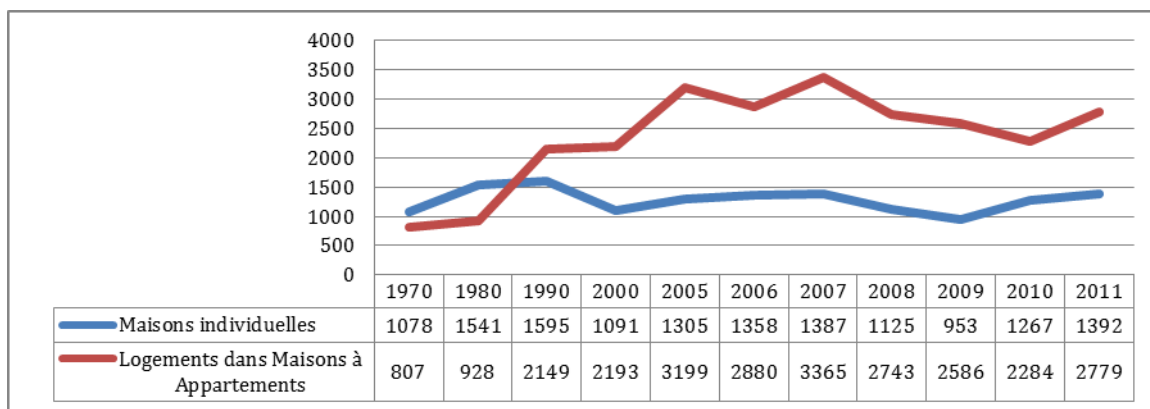
5.1. Housing stock in Luxembourg

On 1st February 2011, the Grand-Duchy counted 130.091 residential buildings, no less than 108.682 among which were one-family dwellings. This represents an impressive ratio of 83,5%. More so: 49.321 single-family homes are detached houses. With 37,9%, this type of accommodation is by far the most common, second in line are the semi-detached homes (25%) and lastly you have the adjoined houses (20,6%). Yet, the single-family homes only account for 62,6% of the population, which corresponds to 320.824 people in absolute figures, a mere two thirds of the total population.

	Buildings		Residents		Average of
	Numbers	in %	Numbers	in %	residents / building
Farm, agricultural building	2 509	1.9	7 290	1.4	2.9
Detached house (4 sides frontage)	49 321	37.9	141 434	27.6	2.9
Semi-detached house (3 sides frontage)	32 586	25.0	97 019	18.9	3.0
Row houses (2 sides frontage)	26 775	20.6	82 371	16.1	3.1
Other individual houses	1 968	1.5	5 652	1.1	2.9
Collective building entirely used for residential purpose	10 927	8.4	118 927	23.2	10.9
Collective building with mixed usage	5 340	4.1	48 605	9.5	9.1
Building mostly used for non-residential purpose	247	0.2	790	0.2	3.2
Hotel, boarding house	79	0.1	725	0.1	9.2
Boarding school for pupils and students	7	< 0.0	98	< 0.0	14.0
Home for children and young people	59	< 0.0	544	0.1	9.2
Home for adults	61	< 0.0	1 060	0.2	17.4
Shelter for homeless people	7	< 0.0	322	0.1	46.0
Home for elderly people and special-care	68	0.1	5 297	1.0	77.9
Institution for the sick	13	< 0.0	232	< 0.0	17.8
Religious institution	30	< 0.0	267	0.1	8.9
Other residence	94	0,1	1 720	0,2	13,8
Total	130 091	100	512 353	100	3.9

Source: STATEC

In the last couple of years, less and less single-family houses have been built however, resulting thus in a constant decrease of their part of the residence completion rate. These days, apartments encounter a serious growth in relation to individual housing. Representing only 12,5% of the housing stock, they nevertheless constitute 54% of the newly completed residences. Collective buildings have gained consistently and gone from 15,3% in 1991-2000 to 21,2% in the years 2001-2010. This last phenomenon can be explained by a rarity of building lot but also by a strong tendency of the land owners to try and make profit by building apartments. Near one third of the population, 167.532 people, live in such collective buildings.



Source: STATEC¹

Whereas the overall average number of people living in a private residence is 3,9, in single-family homes it is 3 persons and about 10 per collective building.

5.1.1. Building age and their energy consumption

Although the ratio of 11,5% new buildings between 2001 and 2010 is seemingly high, more than 13,6% of all the buildings have been built before World War I. A third of all the row houses go back to the period of 1919-1945 in comparison to a mere 5,9% of the detached one-family houses.

Generally speaking, next to three quarters of the private buildings used for residential purposes are more than 20 years old and even close to 90% are older than 10 years, which underlines the enormous potential with regards to energy-efficient renovations of these buildings.

Years of construction	Total	Detached single-family house	Semi-detached house	Adjoined house	Collective building
before 1919	13.6%	9.0%	13.8%	18.3%	7.0%
1919-1945	15.1%	5.9%	16.7%	30.3%	11.5%
1946-1960	13.5%	8.4%	16.3%	19.3%	14.4%
1961-1970	9.7%	10.0%	10.5%	8.5%	11.6%
1971-1980	12.9%	18.0%	11.8%	7.4%	11.3%
1981-1990	11.1%	18.0%	8.5%	4.5%	7.8%
1991-2000	12.5%	19.0%	9.6%	4.8%	15.3%
2001-2010	11.5%	11.7%	12.8%	6.7%	21.2%

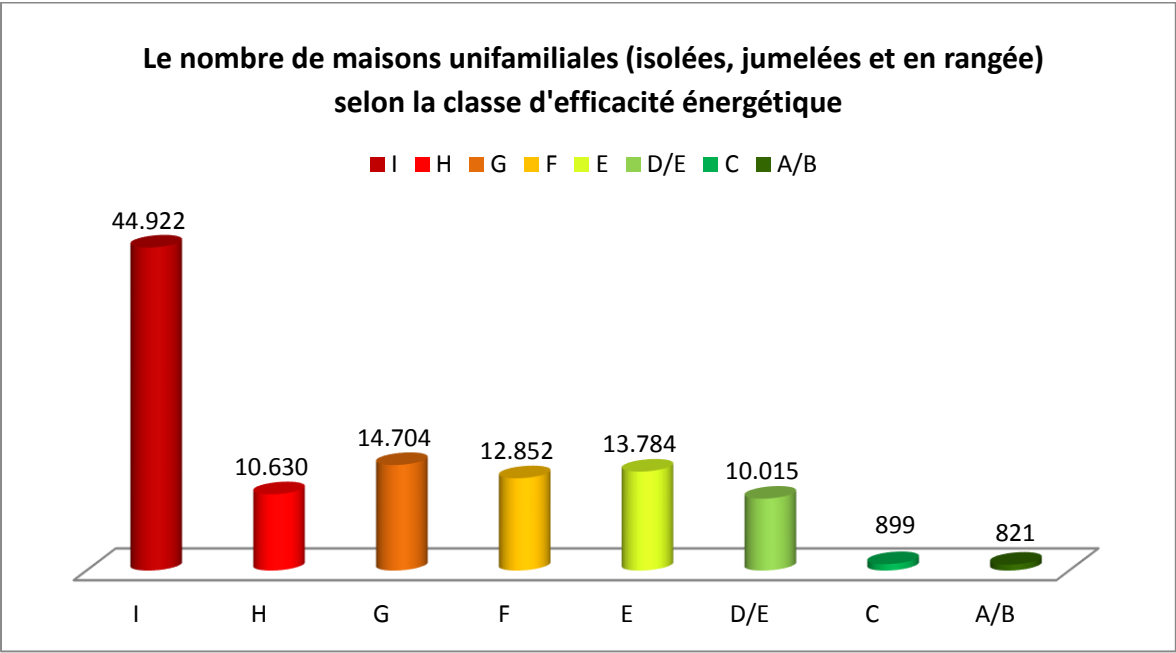
Source : STATEC

Regarding the efficiency class of the different buildings, it is noticeable that the 15.000 constructions realized after 2001 generally have the D classification or even E. This is due to the two facts that on the one hand a Grand-Ducal Regulation from 2008 stipulated a minimum classification D for every new construction and on the

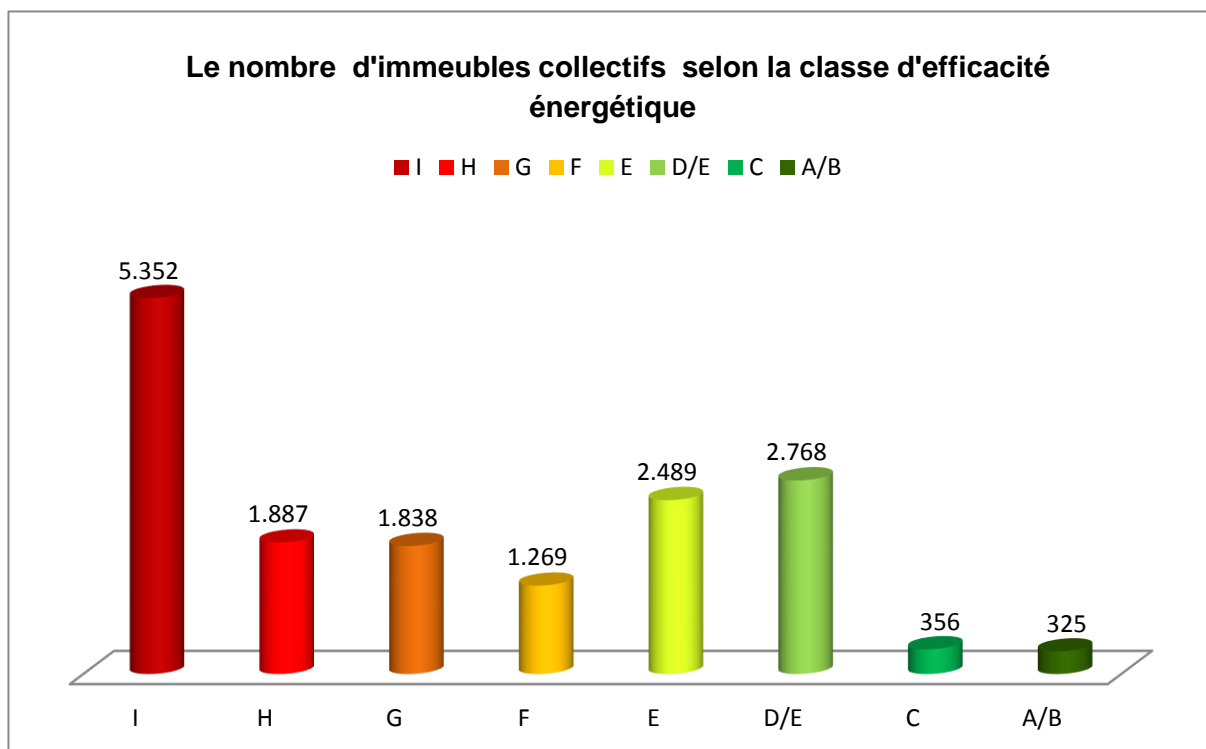
¹ Single-family housing
Residences in apartments

other hand very few new constructions with a B or A classification have actually been realized during that period (see chapter 5.1.4.).

The majority of the buildings have been constructed before 1960 and their classification can be regarded as I, the one with the lowest energy efficiency. One can also state that each ten years, the constructions have known a growth of one energy efficiency class. That said, the 1960 buildings can be classified as H, the ones from the 1970s as G, those from the Eighties F and finally the buildings originating in the 1990s as class E.



² The number of single-family houses (detached, semi-detached and adjoined) according to their energy-efficiency classification



3

5.1.2. The composition of the households

On the 1st February 2011, 503.280 people lived in 208.565 households, which makes an average of 2,41 persons per household. A third of these households is made of one person, a quarter of two. The respective numbers of households with three persons (15%) or four (15,9%) is approximately equal. As to the people living in private households, one can notice that up to 25% of the inhabitants live in a household with 4 people whereas only 13,8% live alone.

People living in private households	503 280	
Number of private households	208 565	
Average per household	2.41 persons	
	% of the households	% of the population
Single households	33.3 %	13.8%
Household with two people	27.4 %	22.7%
Household with three people	15.9 %	19.8%
Household with four people	15.0 %	24.8%
Household with five people	5.9 %	12.3%
Household with six or more people	2.5 %	6.7%
Source : STATEC		

In general there is a lot of movement on the housing market: Thus 9,4% of the residents have been living in their homes for less than a year, 34,1% for less than five years. Moreover, it is interesting to note that half of the country inhabitants (49%)

³ The number of collective buildings according to their energy-efficiency classification

have been living in their housing only since 2002, so about ten years. These figures point to a high degree of mobility within the population, originating in a considerable increase in the population and immigration rate.

5.1.3. Owners according to their nationality

69% of the private households, which make out 73% of the overall population, officially state ownership on their housing. A mere 28,3% are tenants, usually in a non-furnished accommodation (22,6% of the households). Only 4,5% of these accommodations are furnished; also on a very small scale we find the percentage of sub-lessees with 0,8%.

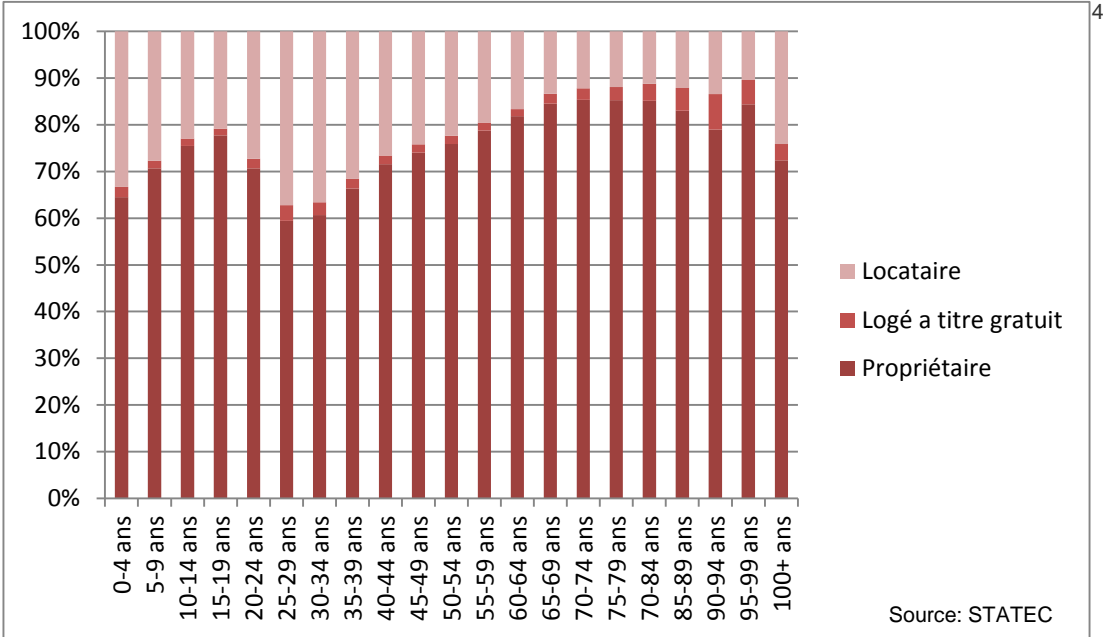
	Households	Persons
Owned housing	69.0%	73.0%
Accommodation free of charge	2.7%	2.1%
Tenant	28.3%	24.7%
Tenant of a non-furnished accommodation	22.6%	20.9%
Tenant of a furnished accommodation	4.5%	2.9%
Sub-lessee	0.8%	0.6%
Source :STATEC		

With a ratio of 84,5%, most of the owners are Luxembourgish of origin, followed by the Montenegrins, the Italians and the Belgians.

Nationality	Owner	Tenant
Luxembourg	84.5%	13.0%
Montenegro	82.4%	16.5%
Country average	73.0%	24.9%
Italy	71.5%	26.3%
Belgium	68.2%	29.7%
UK	66.4%	33.0%
Spain	65.5%	33.2%
Netherlands	65.5%	32.8%
Germany	57.9%	39.9%
Portugal	54.3%	44.8%
France	53.2%	45.3%
others	46.4%	50.8%
Source :STATEC		

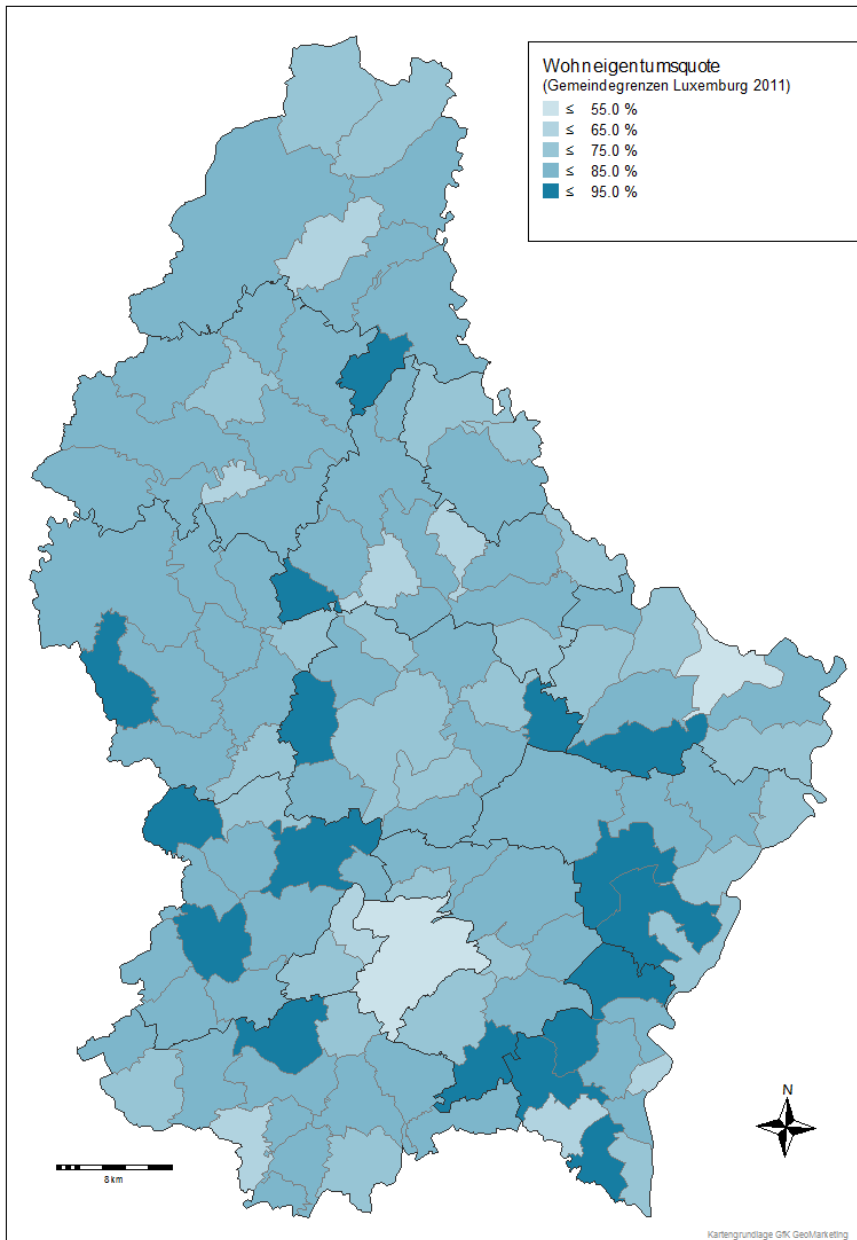
The ratio of owners only increases after the age of 30, which very often coincides with the founding of a family. The curve keeps ascending until the category of the 80-84 years old. Infants and adolescents for the large part live in owned housing. Their ratio starts decreasing from twenty years on which can be explained by the fact that a

lot of young people then leave their parents' either for studies sake or simply because they want to live alone.



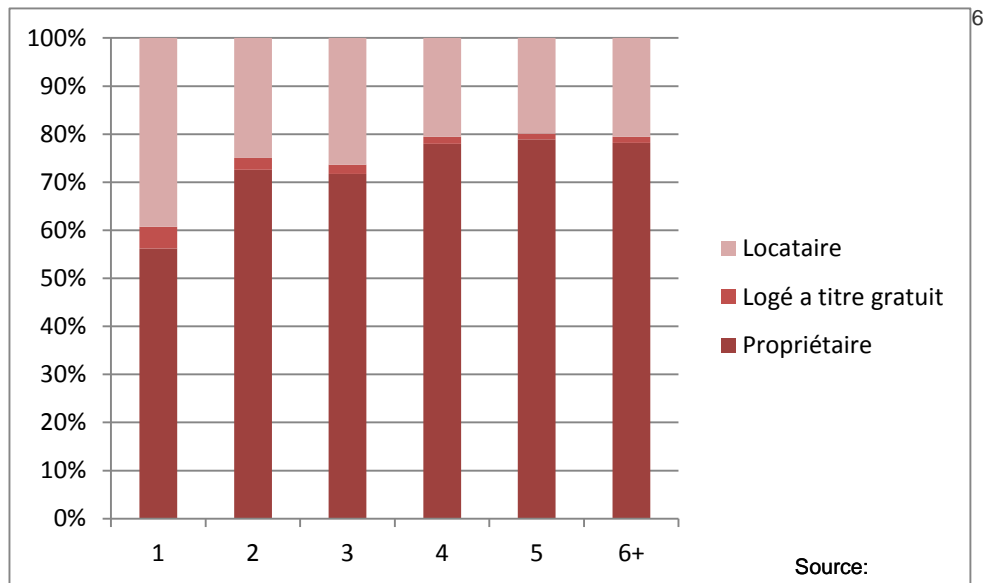
Another interesting fact is that accommodation is mostly bought outside of the capital city: Thus in Luxembourg city only 47,9% of the households are property owners, which is in fact the lowest ratio in the country. The municipality of Burmerange on the other hand has the highest rate (91,6%) of owners. For the most part, those municipalities a bit further away from the capital city have above average ratios, which is probably due to the exorbitant accommodation prices in the capital and its surrounding boroughs.

⁴ Tenant
Residing free of charge
Owner



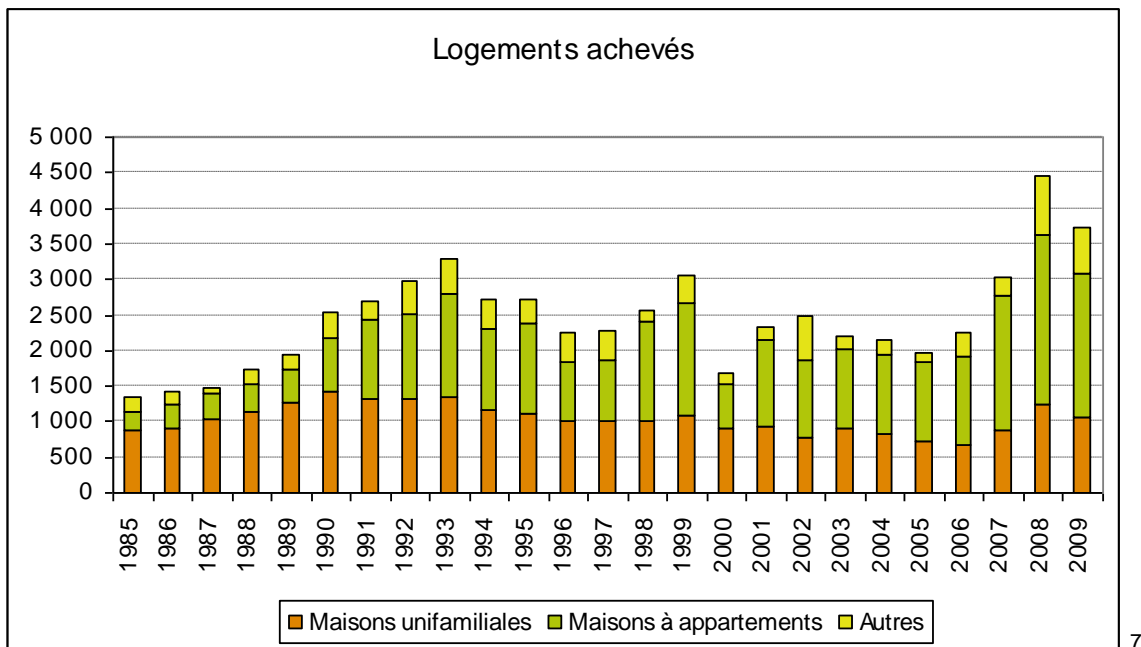
The ownership rate within the households with 4 people and more is very high (80%), whereas the single households' ownership ratio is the lowest, yet their tenancy percentage is the highest with close to 40%.

⁵ Homeownership rates (Municipality borders in Luxembourg 2011)



5.1.4. The recently completed housings

Between 1999 and 2010, 31.252 accommodations have been completed on the territory of the Grand-Duchy of Luxembourg, an average of 2.604 units per year. In 1999 still 36% of all the housings completed were single-family dwellings. Ten years later this percentage has considerably diminished to a mere 29%.



⁶ Tenant
Residing free of charge
Owner
⁷ Completed housings

The 1,073 single-family houses realized in 2009 had an average habitable surface of 190 m² whereas the 2.018 apartments that were completed in 2009 had an average habitable surface of 90 m² (these 2.018 apartments are spread over 313 buildings).

Year	Total number of accommodations	Accommodations in single-family homes	Average habitable surface per house in m ²	Accommodations in apartment houses	Average habitable surface per apartment in m ²
1999	3.067	1.099	171,0	1.580	68,4
2000	1.671	896	174,7	642	82,6
2001	2.342	922	175,2	1.236	85,2
2002	2.475	784	180,7	1.085	86,2
2003	2.199	898	179,8	1.118	85,0
2004	2.155	841	180,2	1.099	87,5
2005	1.979	724	187,0	1.114	85,0
2006	2.266	665	182,0	1.246	87,0
2007	3.023	881	181,0	1.887	85,0
2008	4.444	1.236	186,6	2.400	87,7
2009	3.740	1.073	189,5	2.018	90,0

Source : STATEC- annual statistics of finished residential buildings 1970-2009

As the figures of the chart below demonstrate, only between 2007 and 2009 did the number of newly built accommodation surpass the limit of 3.000 entities with an extraordinary pique in 2008, thus shortly before the economic crisis. In accordance with recent figures, 2.824 accommodations were completed in 2010, which amounts to the average of the years 1999-2009.

According to the figures delivered by the Ministry of Sustainable Development and Infrastructure, between 2001 and the 30th September 2012, 641 houses with low energy consumption and 87 passive houses have been subsidized in Luxembourg.

Considering that during the same period, as one can see in the chart below, 10.542 single-family houses have been realized (estimating a total of 3.500 houses completed in the period of 2009 to the 30th September 2012), no more than 7% of the newly constructed individual houses had a “low energy” or “passive” standard.

	RGD 2001	RDG 2005	RGD 2009*	RGD2013	2015
maisons unifamiliales "basse énergie"	123	299	219		
maisons unifamiliales "passives"	30	23	34		
total maisons unifamiliales "prime house"	153	322	263		
total des maisons achevées	3445	3507			
taux des maisons unifamiliales achevées à haute performance énergétique	4,4%	9,2%			100%

8

*provisional report until the 30.09.2012

Thus knowing that starting from the 1st January 2015 the required energy-efficiency class will be A and the required thermal isolation class will be B (see chart below), the construction sector will have to raise these 7% to 100% in 3 years' time. (See chapter 4)

The situation regarding flats is even more delicate, considering that not even 2% of the new constructions since 2001 have a "low energy" or "passive" standard (see chart below). Bearing in mind that 2/3 of the new housings in Luxembourg are flats, it goes without saying that this will be a major challenge as to the construction of highly energy-efficient accommodations.

	RGD 2001	RDG 2005	RGD 2009*	RGD2013	2015
appartements "basse énergie"	0	105	87		
appartements "passifs"	0	6	55		
total des appartements "prime house"	0	111	142		
total des appartements achevés	4539	6647			
taux des appartements à haute performance énergétique achevés	0%	1,7%			100%

9

*provisional report until the 30.09.2012

5.1.5. Public facilities and non-residential buildings

The real estate property of the State is made up of 1.500 buildings and stands for a construction volume of about 12 million m³. Its composition is very heterogeneous in nature as well as functionality, going from office spaces such as ministries, administrations, State services to real estate properties like the "Caserne de l'Armée Herrenberg", the penitentiary in Schrassig or even the Domaine Thermale in Mondorf-les-Bains. An important part of the real estate property is made up of the 35 "lycées" (high schools) throughout the country. Largely represented are also European institutions as well as a couple of more prestigious buildings such as the

⁸ „Low energy“ single-family houses

„Passive“ single-family houses

Total single-family houses "prime house"

Total completed houses

Ratio of the completed single-family houses with a high standard of energy efficiency

⁹ Idem ⁸

“Chambre des Députés”, the “Grand-Duc Jean Museum” and the “Philharmony”, to name but a few. In 2007 the average dilapidation of the real estate property lay along the lines of 30%, the majority of the buildings having been conceived before the first oil shock.

There is no up-to-date information on the status of the energy-efficiency classes of these public buildings.

	1980	1990	2000	2005	2006	2007	2008	2009	2010
Commercially used buildings									
Number of buildings	18	25	26	18	28	13	22	19	9
Construction volume (in m³)	238.664	201.041	371.313	514.432	758.430	145.309	224.183	562.269	272.938
Surface (in m²)	52.751	57.910	91.034	135.816	149.101	35.967	55.975	93.671	40.804
Buildings used for industry or artisanry									
Number of buildings	11	16	8	5	10	15	21	11	9
Construction volume (in m³)	259.301	209.280	137.008	32.423	166.106	178.590	201.475	125.068	493.726
Surface (in m²)	53.025	31.695	18.713	6.027	25.768	29.254	33.605	26.756	50.929
Agricultural buildings									
Number of buildings	6	14	6	7	12	9	9	8	3
Construction volume (in m³)	14.710	30.561	36.707	26.770	53.706	49.515	52.292	38.756	13.310
Surface (in m²)	4.810	7.649	8.861	4.794	10.659	10.278	9.100	8.258	2.354
Administrative buildings									
Number of buildings	5	3	4	8	6	8	6	2	4
Construction volume (in m³)	329.847	33.200	794.585	167.908	103.393	396.799	76.333	177.966	266.345
Surface (in m²)	87.501	5.698	92.886	44.773	21.807	81.413	16.448	34.645	58.936
Other buildings									
Number of buildings	12	7	11	13	12	5	8	5	3
Construction volume (in m³)	28.890	74.860	71.645	350.837	118.808	83.894	40.391	22.909	61.648
Surface (in m²)	5.058	20.070	11.089	46247	19.012	17.186	7.666	5.533	6.560

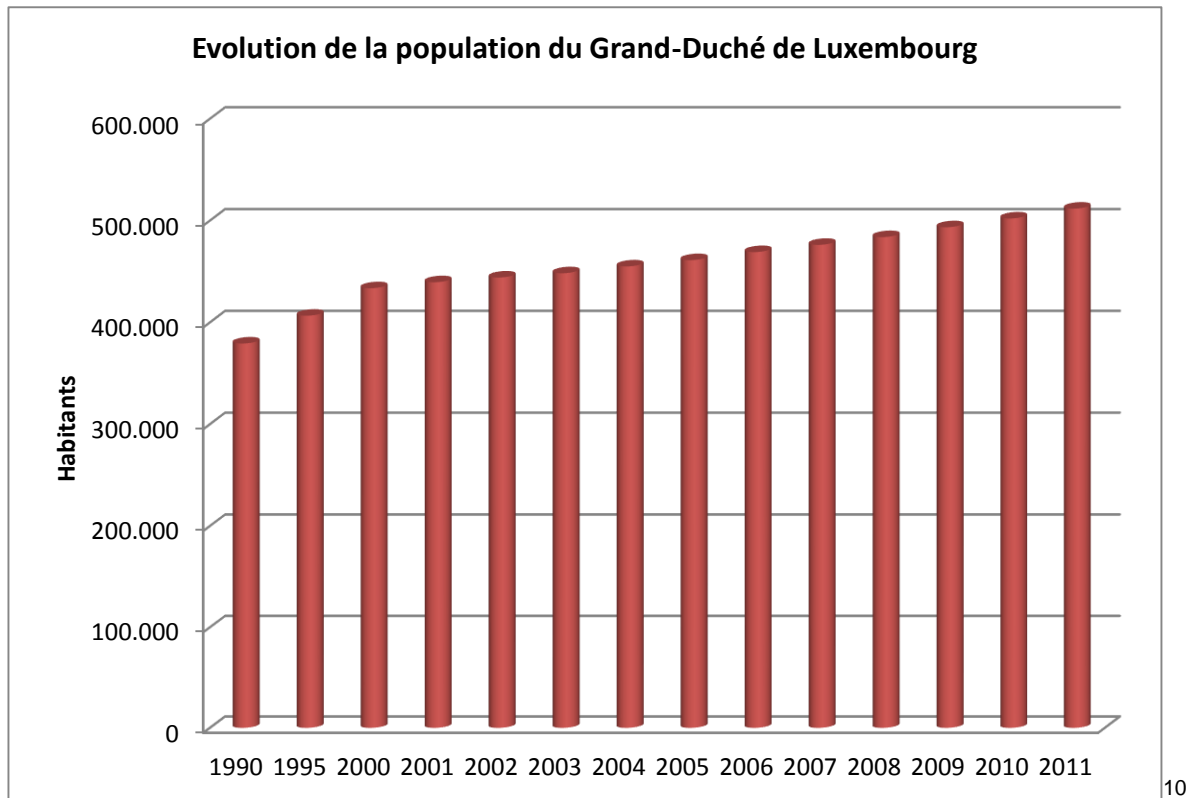
Source : STATEC

All buildings used for commercial purposes, for industry or artisanry, agriculture, administration and other purposes are considered non-residential buildings. Fluctuations in the 0,65% non-residential sector have to be interpreted with caution as the actual number of realized buildings is quite low and the type of buildings very diversified. There is a decrease to be noticed in the figures regarding finished projects in 2010 as compared to 2009. As a consequence of this slow-down, the accessible surfaces are decreasing by 10% as well.

As with the public buildings, there is no information to be had on the status of the energy-efficiency situation of these sites.

5.2. Real estate needs

For a good twenty years now, the Grand-Duchy of Luxembourg has been in the middle of a significant demographic boom threatening the delicate balance between offer and demand on the real estate market, even more so looking at the average number of persons per household. Between 1990 and 2009 only, the population has known a growth of 30%. And even with the beginning of the crisis in 2009, Luxembourg's populace has still augmented by 18.300 residents (+3,71%), resulting in a total of 511.800 residents on the 1st January 2011.



Source: STATEC

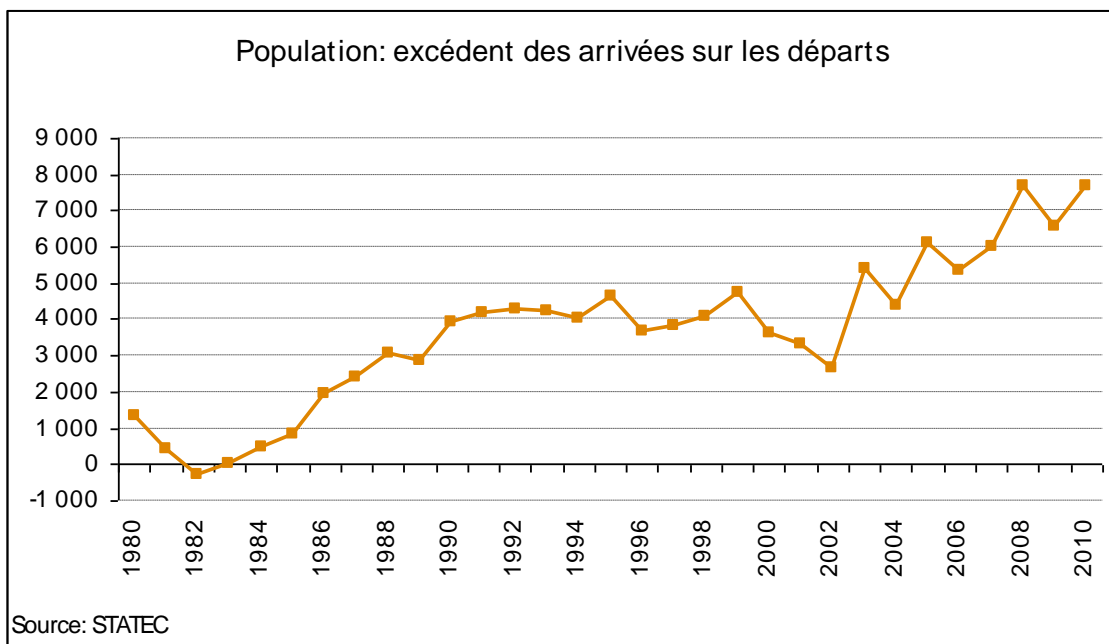
According to certain hypotheses, Luxembourg could reach 647.000 residents in 2030 and more than 700.00 until 2050 (whereas in 2006 there were no more than 460.000). Facing such a substantial growth in population, in fact the largest on a European scale, the Government has elaborated a number of contingency measures particularly for the housing area.

5.2.1. The demand in housing sees a considerable growth

The high demand in housing results from a considerable growth in the population, mainly caused by immigration. The surpluses of the arrivals on the departures have

¹⁰ Evolution of the Grand-Duchy of Luxembourg's population residents

gone up from 13.069 in the Eighties to more than 50.000 in the beginning of the 21st Century.



11

Period	Surplus of the arrivals over the departures
1980-1989	13 069
1990-1999	41 506
2000-2009	51 153

Moreover, the average size of the households has decreased and gone from 3,6 in 1947 to 2,4 in 2010 and will, according to estimations by STATEC, be at 2,2 in 2030, which logically will also have an strong increase in the housing demand as a consequence.

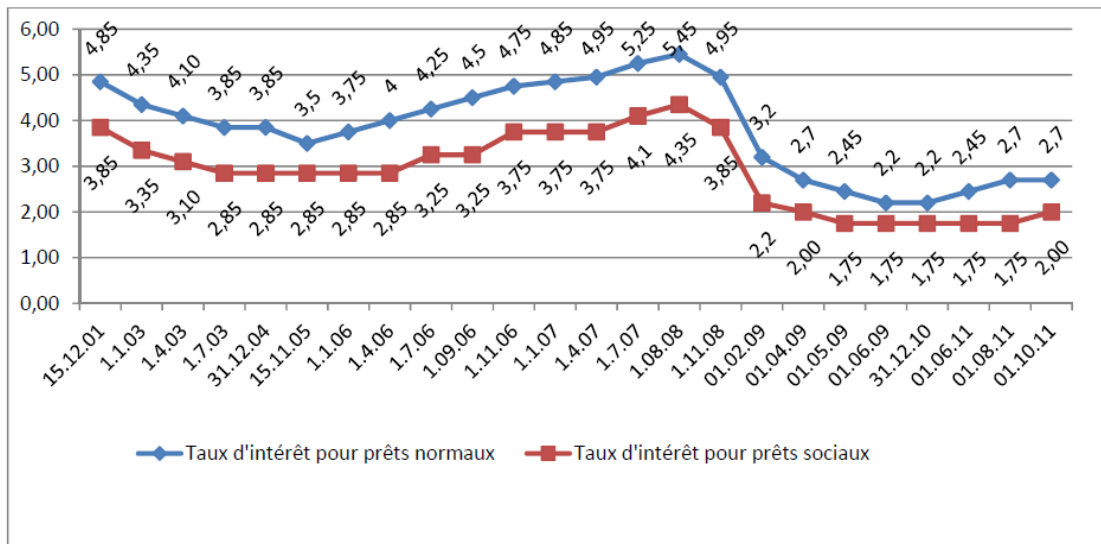
There are multiple reasons for this:

- Young people start their relationships later
- The relationships are more fragile
- After a rupture, new relationships are less frequent
- The general ageing of the population

The housing demand situation can also be explained by the financial environment with low interest rates very much in favor of real estate investments.

What's more, wages as well as subsidies and grants in Luxembourg are way above average on a European scale.

¹¹ Population: surplus of the arrivals over the departures



Source et graphique : Ministère du Logement

12

Taking into account the evolution in the past of the number of built housings and considering the fact that the economic growth of the years to come will certainly be situated way below the historic average, the artisan organizations hold the opinion that a realization of 4.000 new housings per year should easily cover the needs.

In fact, during the last 25 years this figure has been exceeded only once. The decennial average of newly built accommodations amounts to 2.600 units.

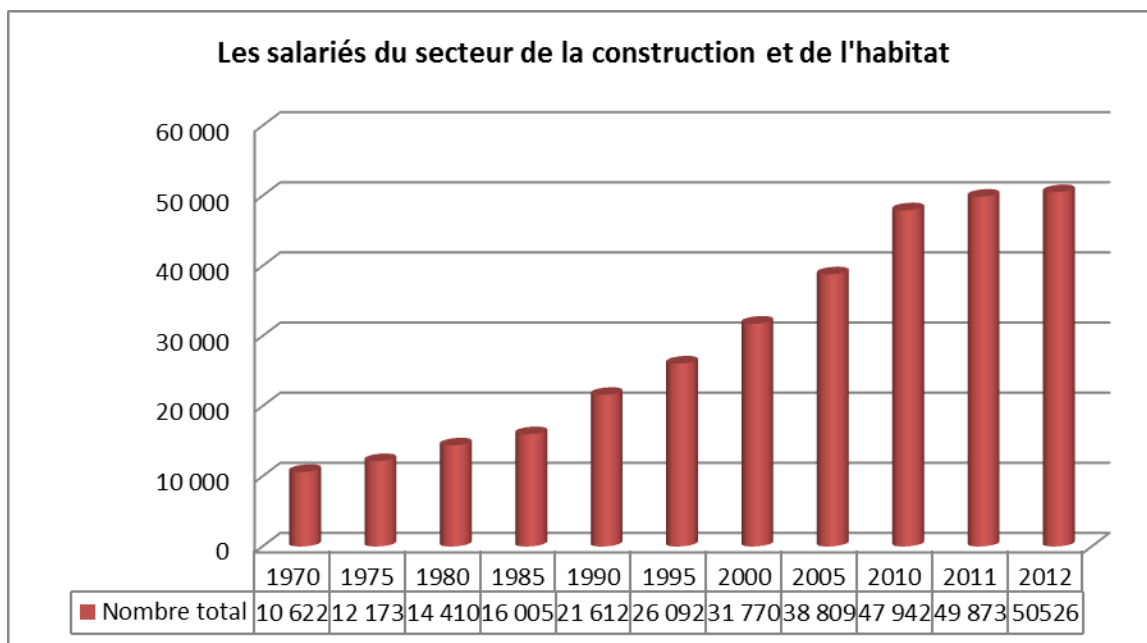
All the above mentioned facts will lead to an increase of the number of households up to 82.000 until 2030, which results in more or less 4.000 housings a year.

5.3. The employees of the construction and building sector

Between 1970 and 2012 there has been an extraordinary evolution in the number of available employments. Wage employment has gone up a total of 39.904, nearly five times more than in 1970. This sector in itself makes out 68% of the workforce of the Luxembourgish handicraft.

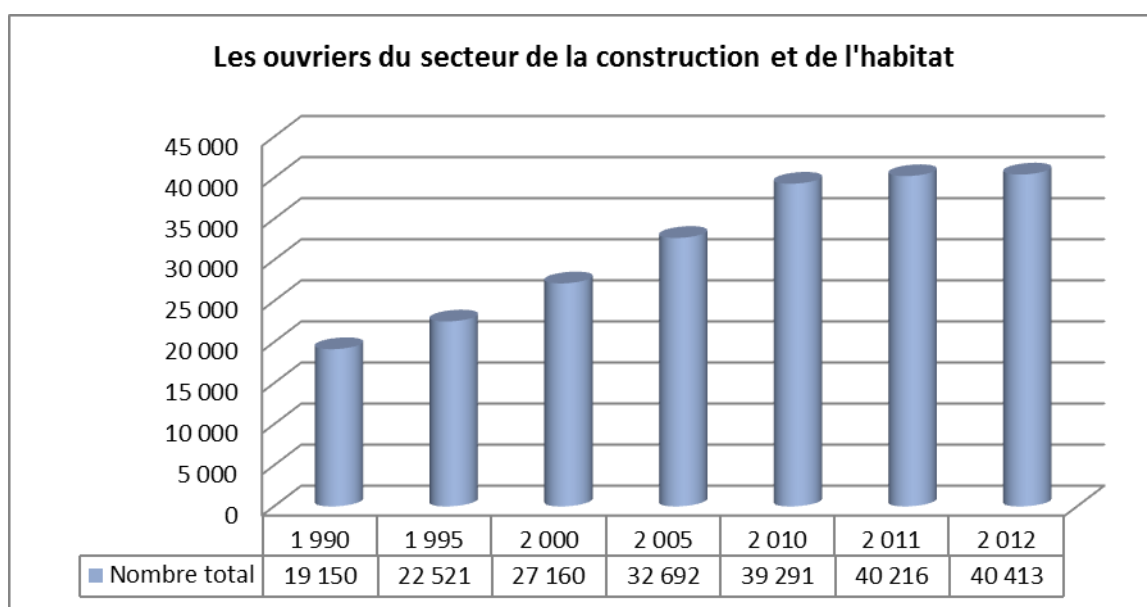
¹² Interest rate for normal loans
Interest rate for social loans

Source and graphic: Ministry of Housing



13

Source: Chamber of Crafts



14

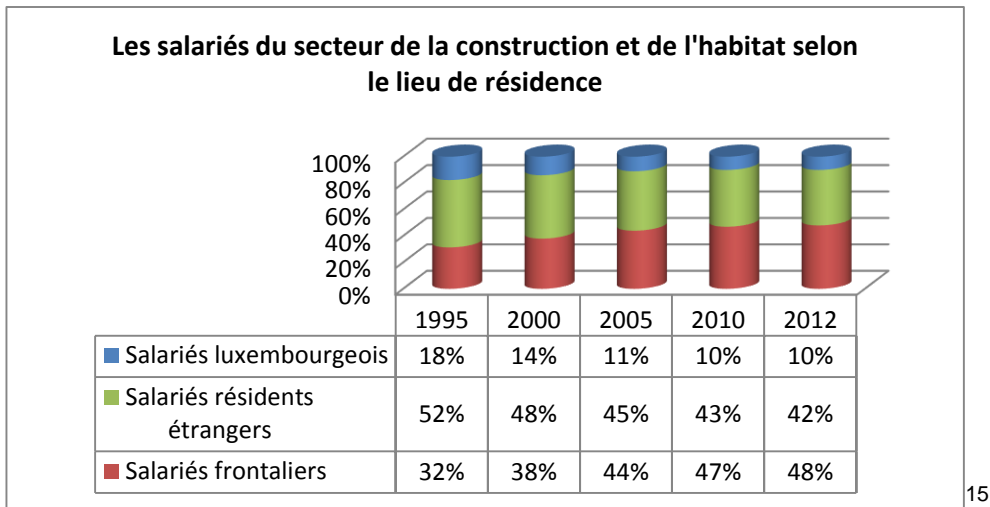
Source: Chamber of Crafts

In 2012, 40.413 of the 50.526 employees of the construction sector were craftsmen working on construction sites (blue collars). For the largest part male (>90%), the employed workforce was composed of only 10% Luxembourgish residents and 48% cross-border commuters. Statistics also show that the sector constitutes an important integration vector into society in as much as in 2012 42% of the employees were

¹³ The employees of the construction and building sector
Total number

¹⁴ The workers of the construction and building sector
Total number

resident immigration workers. On a European scale, this is a uniquely high rate of foreigners in the construction field.

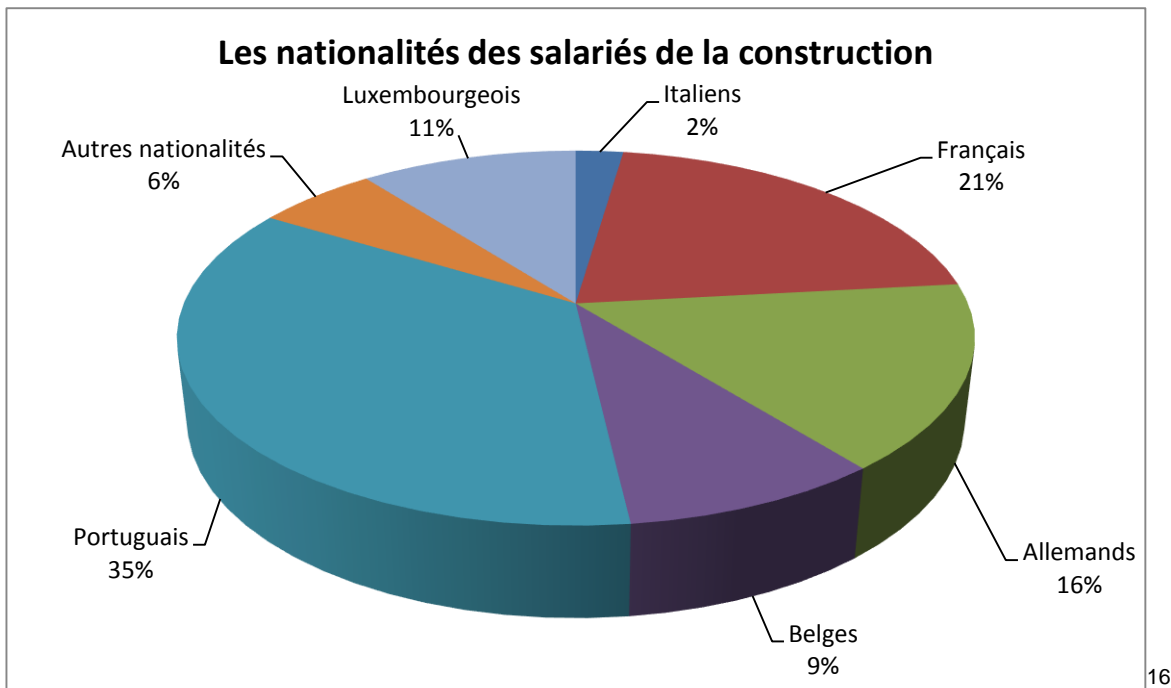


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Source: Chamber of Crafts

Among the foreigners, the Portuguese are by far the most prominent ones with a ratio of 35%, the 21% French workers are essentially cross-border commuters from the Grande Région (Greater Region). For a couple of years now, there has been a certain tendency of more and more Germans, mostly qualified employees, to integrate the construction sector.

The noticeable rise in numbers of cross-border workers in the employment leads to the fact that the artisanry has increasing problems in finding the much needed qualified handicraft personnel on the Luxembourgish labor market.



16

¹⁵ The employees of the construction and building sector according to their place of residence

¹⁶ The nationalities of the construction employees

Source: STATEC

The charts below account for the number of employees in 2012 in the different construction trades. As already mentioned, there is a high percentage of both foreign employees and cross-border commuters in all of these trades.

Trades	Civil engineering construction contractor	Thermic, acoustic and sealing contractor	Heating-sanitary-cooling systems installer	Electrician	Carpenter/Cabinet maker	Metal construction contractor
Total number of workers	12 861	425	3 480	3 943	1 398	1 462
Male workers	12 774	423	3 430	3 872	1 355	1 422
Female workers	87	2	50	71	43	40
Luxembourgish workers	320	13	398	670	155	157
Foreign workers	12 541	412	3 082	3 273	1 243	1 305
Italians	185	21	91	80	16	22
French	978	178	1 159	1 216	179	351
Germans	1 355	60	684	735	493	277
Belgians	861	10	266	319	308	260
Portuguese	8 451	113	736	769	187	313
Spanish	39	3	12	10	4	6
Other nationalities	672	27	134	144	56	76
Cross-border commuters	4 038	307	2 196	2 227	966	933
Belgians	1 083	17	300	321	285	281
Germans	1 523	68	704	715	510	268
French	1 432	222	1 192	1 191	171	384

Trades	Installer for lifts, goods lifts, escalators and handling equipment	Carpenter – roofer - tinsmith	Tiler – stonemason -chiseller	Painter – plasterer - renderer	Stove fitter	Screed manufacturer
Total number of workers	278	1 848	1 347	2 575	34	88
Male workers	276	1 815	1 312	2 506	33	87

Luxembourgish; Italian; French; Germans; Belgians; Portuguese; Other nationalities

Female workers	2	33	35	69	1	1
Luxembourgish workers	11	273	52	205	3	-
Foreign workers	267	1 575	1 295	2 370	31	88
Italians	3	22	55	63	-	1
French	128	173	136	445	6	2
Germans	41	526	330	671	7	23
Belgians	69	165	74	81	4	1
Portuguese	12	516	614	939	13	44
Spanish	-	-	4	11	-	1
Other nationalities	14	173	82	160	1	16
Cross-border commuters	246	858	609	1 300	20	30
Belgians	74	174	85	101	5	1
Germans	50	519	353	698	7	24
French	122	165	171	501	8	5

Trades	Installer, fitter and restorator of premanufactured elements and parquets	Shutters and blinds maker and installer	Window, door and premanufactured furniture installer	Solar protection and shading system installer	Glazier and mirror expert	Chimney and earthenware stove maker and installer
Total number of workers	553	112	186	10	178	139
Male workers	531	105	184	10	174	135
Female workers	22	7	2	-	4	4
Luxembourgish workers	50	19	4	1	16	5
Foreign workers	503	93	182	9	162	134
Italians	9	-	5	1	6	1
French	79	11	47	-	34	23
Germans	264	6	40	2	75	19
Belgians	64	60	12	2	10	61
Portuguese	34	13	62	4	33	29
Spanish	-	-	1	-	-	-
Other nationalities	53	3	15	-	4	1

Cross-border commuters	417	79	114	4	118	100
Belgians	57	59	17	2	10	63
Germans	273	6	41	2	77	19
French	87	14	56	-	31	18

Source: Chambre of Crafts

5.4. Employment in the construction sector

In December 2012, 16.963 people were registered as job seekers in Luxembourg, a total unemployment rate of 6,4%. 3.617 people were looking for a job in the professional artisan sector (precision, clock-making, mechanics, electricity, wood and building), thus more than 20% of the total amount of resident job seekers.

One needs to consider though that the majority of these people have a low level of education (compulsory schooling), stressing again the fact that the firms are still looking for skilled labor force. Only 2% of the job seekers had a superior degree of education on a post-secondary level.

Regarding the job offers in the construction sector, it is noticeable that in December 2012, 123 of a total of 1.875 or 6,5% of the vacancies officially declared at the Administration for Employment remained open.

As to the apprenticeship, right now the greater part of the apprenticeship places are offered in the construction sector. This is one way of asserting that they get work force that can then be trained on-the-job.

The problem is that each year 150 to 200 apprenticeship positions are not occupied. In 2011 for instance, the proprietors of the roofing crafts (carpenter, roofer, tinsmith, etc.) had opened quite a number of opportunities for apprenticeships, twelve of which remained unanswered.

The same goes for the electricians, the tillers, painters, decorators, plasterers or locksmiths, every year vacancies are not filled.

Non-skilled labor becomes more and more a concern, a fact closely linked to the constantly evolving high technicality of the trades.

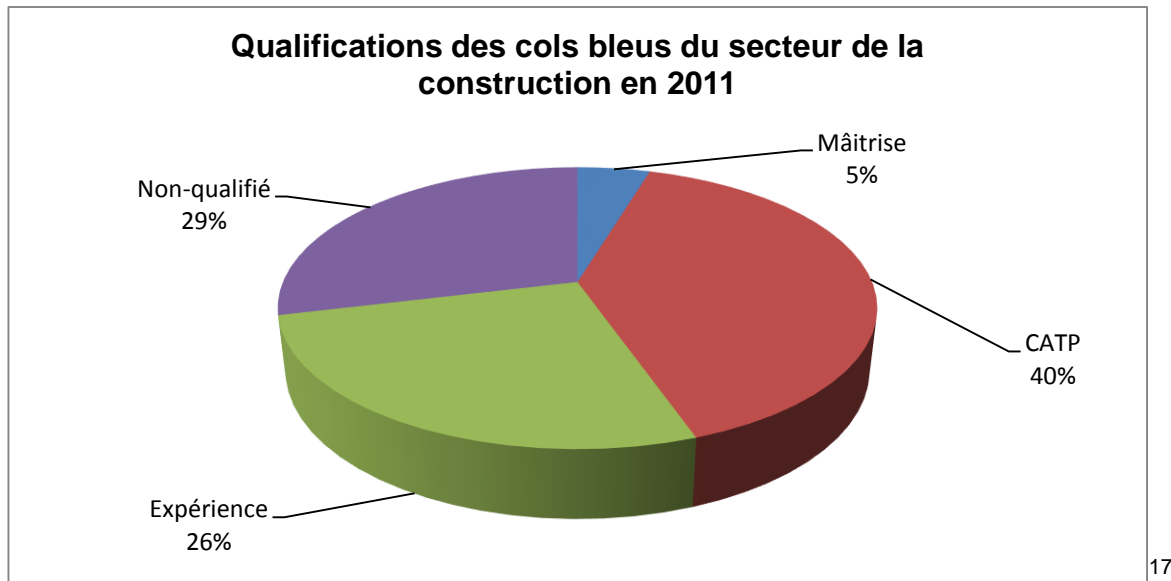
5.4.1. Ageing of the employees

According to a survey by CEPS Instead, 19% of the employees in the private sector on the employment market in 2011 were 50 or more years old. The fraction of professionally active elderly people has been multiplied by 1,5 in less than 10 years. In comparison to the foreign residents and the cross-border commuters, Luxembourgish resident employees happen to be among the major part of the working seniors. In 2011, 25% of the Luxembourgish resident workers were 50 or more years old against 18% of the foreign resident workers and 16% of the cross-border commuters.

As to the construction sector, there was a fairly important portion of 20% of seniors (that in general were qualified and well trained) in 2011 as opposed to 14% in 2003. Thus in less than 10 years, there has been an increase of 48% of elderly people in this sector.

The consequence thereof is that the current lack of qualified personnel in the construction trades will certainly worsen in the ten years to come.

5.5. The qualification of the workers



Source: Chamber of Crafts

In a certain way, Luxembourg has lost its sovereignty over the qualification of its employees, be it in the artisan crafts or the construction sector. Less and less employees (10%) follow the Luxembourg educational system. Not all of the foreign resident employees, that amount to 42% of the employments in the building trade, have actually gone through the national education system. Close to half of the wage-earners come from the Greater Region.

All the more difficult it has become to determine the qualifications of the employees knowing that many different European nationalities have as many different educational systems, yet they are all mingled on the building sites.

29% of the blue collar workers in 2011 had no qualification whatsoever whereas 26% indicate a certain degree of acquired experience in their trade. This also means that more than half of the workers did not have the initial training required for their job.

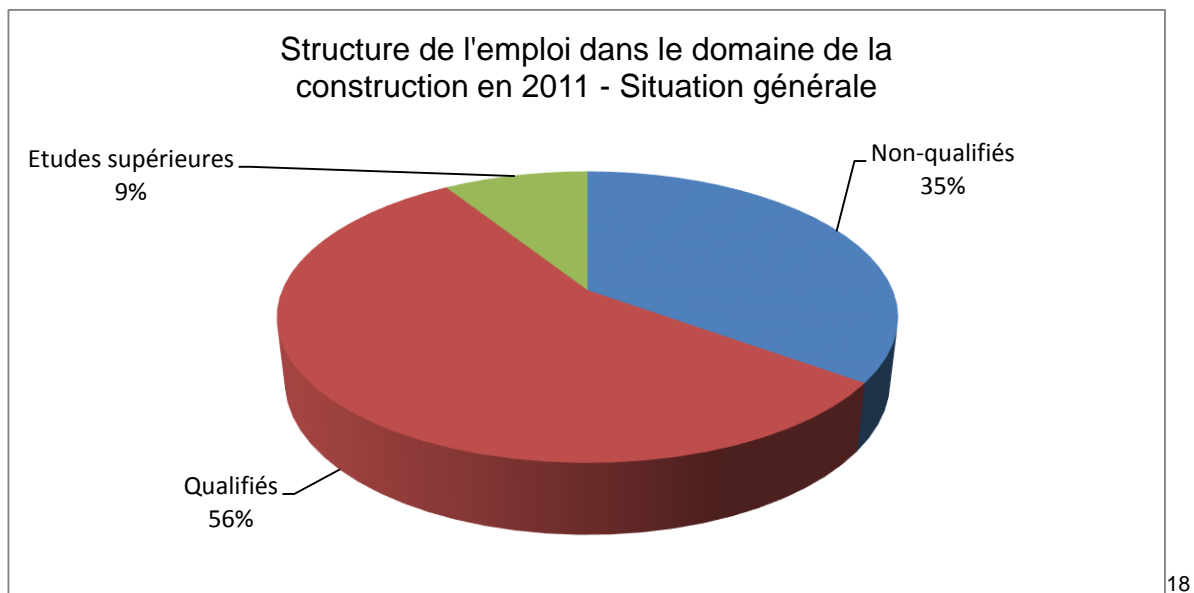
Yet, 40% did have a vocational training certificate, the CATP (Certificat d'Aptitude Technique et Professionnelle). Only 5% of the employees were in possession of a master's degree.

In 2011, the Chamber of Crafts conducted a study in the artisanry that showed a growing part of employees in the construction sector with a high qualification. These are in particular the managerial staff, due to fundamental changes in the business management. There are several reasons for this:

¹⁷ Qualification of the blue collars in the construction sector in 2011
Master's degree; CATP; Experienced; Non-skilled

- Technological progress (constructions with a high energy-efficiency, renewable energies, ...)
- Evolution in managerial functions
- Enhanced need for administrative functions in order to be able to cope with the imposed administrative burden for the firms

If you analyze the overall employment structure in the construction business sector, you will find that 35% of the employees are to be qualified as non-skilled, 56% of the employees possess the necessary training and 9% even have a degree or at least studied on a post-secondary level. In this context, it is important to stress that between 2010 and 2011 the number of employees with a predominantly intellectual function has increased substantially faster than that of the wage-earners with a predominantly manual function.



5.6. Market potential for construction businesses

The rational use of available energy, the emphasis on sustainable energy sources, the construction of energy-efficient buildings along with the energetic refurbishment, all these are opportunities for the different artisan trades with potentially positive influences on both employment and business creation possibilities.

The consortium has thus evaluated the market potential for the crafts in the areas of housings with low energy consumption and passive constructions, energetic restorations of existing homes, public buildings and sustainable energy.

¹⁸ Employment structure in the construction sector in 2011 – Overall situation
Non-skilled; Qualified; Graduate studies

The LUXRES study (LUXembourg Renewable Energy Sources)¹⁹ concerned with the sustainable energy sources in Luxembourg was jointly presented on the 26th March 2007 by the Minister for Economy and External Trade and the Minister for the Environment.

The main goal of this survey was to evaluate the potential of the different sources of renewable energy in Luxembourg and to propose strategies on how to put their mobilization on the agenda for the years 2010 and 2020 onwards.

The rate of renewable energies produced in our country has since 2005 gone from 0,9% to 1,7% in 2009 and should reach 4% in 2020. The national plan for sustainable energies of July 2010 divides this objective of 4% of renewable energies on the national territory into the different technologies like solar energy, biomass, biogas, wind farm, etc.

This aim will necessitate a considerable effort and commitment from all the actors of Government, municipalities, business and citizens alike.

In order to achieve the 4% renewable energies in our overall energy consumption, the Grand-Duchy, in 10 years, will have to evolve:

- from 2.400 photovoltaic installations to 20.000
- from 3.000 solar thermal installations to 30.000
- from 44 wind farms to 90
- from 34 hydro-electrical installations to 45
- from 1 solid biomass-based CHP (Combined Heat and Power) plant to 10
- from 25 medium-sized biogas facilities to 125
- from 200 heat pumps to 10.000

Estimated costs run along the lines of 830 million euros over 10 years.

Subsequently, the consortium has deducted the market potential for the artisan SMEs based on the energetic potential of the LUXRES survey regarding biomass, solar thermal energy, photovoltaic installations, heat pumps and wind farms.

5.6.1. Achievable potential in the biomass sector

In order to attain a massive production of electricity and heat via renewable energy sources, the Government's chosen politics puts the main focus on biomass.

The user comfort of central heating installations with wood pellets and chips has augmented immensely and is nowadays comparable to any gas- or oil-based heating

¹⁹ Bestimmung der Potenziale und Ausarbeitung von Strategien zur verstärkten Nutzung von erneuerbaren Energien in Luxemburg, Fraunhofer Institut für System- und Innovationsforschung – Energy Economics Group, TU Wien – BSR Sustainability

system. Such low energy power installations will be used mainly in buildings with a high energy performance.

In houses and flats, the energetic exploitation of biomass is used for heating and water temperature through low power systems very often combined with other technologies such as solar thermal energy.

As to the energy-intensive installations, heat and electricity producing biomass systems will play a dominant role in the alimentation of heat networks.

Among other things, thanks to its regional availability, resource recovery has the potential of reinforcing the regional economy, favoring the creation of new jobs and as a sustainable energy source, helping to reduce Luxembourg's strong dependence on the international fossil energy market.

In the years 2005 to 2009, 90 wood chips boilers (Hackschnitzelkessel), 147 wood distillation boilers (Holzvergaserkessel) and 352 wood pellets boilers have been installed and state-subsidized in Luxembourg.

800 new municipal installations of wood chip boilers as well as 40 more on a private level are planned in Luxembourg for the coming years 2013 to 2020.

Based on the data from the LUXRES study and based on the estimations of the Chamber of Crafts, there is a potential of about 28,5 million euros for the period of 2013 to 2020 regarding wood chips, wood distillation, wood pellets and log wood installations for the artisanry.

5.6.2. Achievable potential in the solar thermal area

The total amount of installed collectors until 2009 cover a surface of 19.300 m², with an estimated surface of 5,5m² collectors used for domestic hot water only and 9,1m² collectors used for domestic hot water plus heating.

A conservative hypothesis of the LUXRES study presumes a 16% progression per year which would account for a surface along the lines of 98.700 m² in 2020.

A more ambitious hypothesis builds on an annual increase rate of 25% a year which will reach a total surface of new installations in the order of 225.000 m² in 2020.

It is worth noting that solar thermal installations have a considerable impact on the reduction of the greenhouse gas emissions since they help reducing the energetic needs for the production of warm water for households up to 60%.

The conservative approach quantifies the potential for the artisanry to a sum of 60,9 million euros for the period of 2013 to 2020. The more ambitious hypothesis would actually come up with an estimation of 173,3 million euros for the same period.

5.6.3. Achievable potential in the photovoltaic area

From 2002 to 2010 a total installed capacity of 29,4 MW has been achieved in Luxembourg. A framework of measures to support private households had introduced a subsidiary quota of 3 MW for the period of 2005 to 2007. This political change had a devastating effect on the market which collapsed in 2005.

According to LUXRES, the future development of photovoltaic systems highly depends on the implemented support measures and thus the achievable potential until 2020 is hardly quantifiable. Nevertheless a photovoltaic system remains, under the current conditions, a cost-efficient investment and a better communication thereof would be more than appropriate.

The overall installed capacity until 2005 was of 24 MW. As reported by the Luxembourgish Institute of Regulation the installed capacity in 2011 was 40,3 MW, corresponding to a 2.899 installations.

Whereas the LUXRES survey distinguishes between a conservative and an ambitious evolution of the presence of photovoltaic systems, it is clear now that we are currently far from the conservative hypothesis.

Installed capacity	2005	2010	2011	2020
Conservative hypothesis*	23,6 MW	33 MW	37 MW	73 MW
Ambitious hypothesis*	23,6 MW	54,3 MW	62 MW	222 MW
Actually installed capacity	23,6 MW	29,4 MW	40,3 MW	

*According to estimations made in the LUXRES survey

As you can see, there has only been an increase of about 2 MW/year between 2005 and 2011. Assuming a similar progression for the next ten years, the total capacity installed in 2020 in Luxembourg will be 60 MW.

The real potential for the artisanry in the years between 2013 and 2020 would thus be around 60 million euros, if we take into account the installation price of more or less 3.000 €/KW.

Taking the ambitious hypothesis of an estimated installed capacity in 2020 of 222 MW by LUXRES as a starting point, or even that of Eurosolar Lëtzebuerg asbl estimating 300 MW of installed capacity, the potential for the artisanry would amount to 491 million respectively 702 million € for the years 2013 to 2020.

We are not even close to these aimed objectives so we absolutely have to actively support the installment of photovoltaic systems in order to be able to reach the 4% of renewable energies in 2020.

5.6.4. Achievable potential in the area of heat pumps

The 2009 annual report of the Ministry of Sustainable Development and Infrastructure states that on the whole 92 heat pumps have been subsidized between 2005 and 2009 in Luxembourg.

Stimulating information and financial aids provided, the LUXRES study anticipates 5.000 heat pumps for new buildings and 3.500 heat pumps for existing structures during the period of 2011 to 2020.

Installment and connection costs for a heat pump in a single-family house can be estimated at an average of 15.000 €. The different crafts related to the installment of such a system (heat pump with possibly the installation of photovoltaic equipment), building shell, soil removal, underground drilling etc. are likely to have orders placed in the range of 50% of the estimated investments.

The potential estimated by the Chamber of Crafts for the period of 2013-2020 adds up to 79 million euros (3.900 installations x 15.000 € + 2.750 installations x 7.500 €).

5.6.5. New accommodations: energetic and ecologic constructions

As mentioned before, these last ten years, 2.600 accommodations have been built on average. The single-family homes realized in 2009 had an average area fit for habitation of 190 m² whereas apartments built during that same time presented an average living space of 90 m². Since then, new housings for which the construction authorization was demanded as of the 1st July 2012, generally have to correspond to the current energy classes B as to energy efficiency and C as to the thermal insulation. Starting with 1st January these new buildings will have to comply with the energy efficiency classes A for energy performance and B for thermal insulation.

According to the statistic results of the finished constructions, based on the indications made by the awarding authorities, the average construction cost per accommodation (estate price not included) was approximately 2.200 €/m² in 2011 as to single-family housings and next to 1.800 €/m² for collective buildings.

Estimating a housing construction cost increase of 3% per year (the construction costs having gone up 28% from 2000 to 2010), an augmentation of 5% for class BC respectively class AB buildings and a rise of 10% for passive constructions from 01.01.2017 on, it will be possible to assess the potential for the artisanry until 2020. For this survey's sake, an estimated 1.000 new individual house constructions and 2.000 new apartment buildings per year have been used as a basis.

Annual potential of houses and apartments of classifications BC and AB until the 01.01.2017

	Number	Average surface in m ²	Average price in €/m ²	Total in Mio €
Houses	1.000	190	2.400	456,0
Apartments	2.000	90	1.970	354,6
Total				810,6

Annual potential of houses and apartments of classification a from 01.01.2017 on

	Number	Average surface in m ²	Average price in €/m ²	Total in Mio €
Houses	1.000	190	3.000	570,0
Apartments	2.000	90	2.500	500,0
Total				1.070,0

Hence, the additional potential on the market of accommodations with a high energy-efficiency can be estimated to a good 150 million euros per year.

5.6.6. Energy-efficient retrofitting of existing housings

Habituated buildings are subject to restoration at certain intervals during their long lifetime, be it for comfort's sake, for the sake of preserving their value or in order to reduce their energy consumption.

Generally speaking, there has been an upwards tendency in the restoration market in the Grand-Duchy for a few years now. Energy prices, but also the energy-efficiency certificate for buildings, have had an accelerating influence on the timing with which buildings undergo an energy-efficiency work over.

The crafts profiting the most from the restoration of existing accommodations are the ones concerned with heating-plumbing, roofing, carpentry, insulation and rendering but also painters and other crafts of completion and finishing. The complexity of the implementation of energetic restoration should nevertheless never be underestimated and one should always be attentive to the specificities of the building in question and the technology of the needed materials.

5.6.6.1. *Potential for the energy-efficient retrofitting of existing buildings older than 10 years*

The survey entitled "*Mutations démographiques et socio-économiques au Luxembourg à la fin du XXème siècle - Une analyse spatiale au niveau des communes*", published in January 2006 by STATEC and based upon the census of

the population of 2001, indicates that in 2001 there were 119.000 buildings occupied by 172.000 households in Luxembourg.

Based on the assumption that buildings older than ten years represent potential targets for an energy-efficient retrofitting, these 119.000 buildings currently are the theoretical potential for the artisanship.

In 2001, the single-family house was the predominant form of housing present in Luxembourg. They made out 87% of all the buildings in the country.

As mentioned before, the objective to concentrate on should be a 3% annual rate as to the energy-efficient restoration of private buildings, which are the majority of the existing building stock in Luxembourg, amounting to 3.570 accommodation restorations a year.

Thus the annual potential for energy-efficient retrofitting could be seen as follows

	Units	m ² /unit	m ²	€/m ²	€
Building faces	3.570	250	892.500	120	107.100.000
Insulation roof or attic	3.570	180	642.600	125	80.325.000
Window replacement	3.570	56	199.920	350	69.972.000
Slab insulation	3.570	159	567.630	35	19.867.050
Total:					277.264.050

In consequence, energy-efficient retrofitting could generate work orders for artisan firms adding up to 277 million euros a year.

5.6.6.2. *Energy-efficient retrofitting of buildings from the Luxembourgish State patrimony*

The State of Luxembourg possesses some 1.500 buildings, an overall surface of 3.500.000 m² and a volume of 14.000.000 m³, more than 12% of all the buildings. As owner of the buildings, the State also has to ensure the management of these facilities, which is done via the Public Building Administration.

We have to underline the fact that very few numbers regarding the energy-efficient restoration of the public buildings are at hand, which makes it next to impossible to judge any potential for the artisanship. However, we think that there is a huge potential here.

Recapitulation:

The potential for the construction sector until 2020 can be numbered to some 230 million euros as to the sustainable energies biomass, solar thermal, photovoltaic and heat pumps.

The potential for new energy-efficient constructions and the energy-efficient retrofiting on the other hand amounts to 427 million euros per year.

At present some 900 firms with 20.000 employments are active in the sector of sustainable energies, energy-efficient construction and retrofiting.

Based on the potential described here above, 6.500 new employments could be created in this sector until 2020.

6. Vocational training for artisans in Luxembourg

6.1. Initial vocational training

6.1.1. The educational structure in Luxembourg

According to the Act of 6th February 2009 on compulsory school attendance, “every child living in Luxembourg of 4 years of age before the first September shall attend school. This obligation extends over twelve consecutive years starting with the first September of the year in question.”

Cycle 1 of the basic primary school is made up of the early infantile education and preschool classes. The early infantile education was progressively introduced from 1998 on and is a mandatory part of each municipalities' educational offer since 2009. Facultative in nature, its target group is the children having reached the age of 3 and the context of its creation is a better socialization of the children in general as well as an easier acculturation of immigrated children. Following the Grand-Ducal Regulation of 2nd September 1992, the attendance of preschool classes is mandatory for the children having reached their fourth birthday before the first September.

Cycles 2 to 4 of the basic primary school education correspond to the former primary school education. Each cycle is normally composed of two years. The basic primary school education is subject to the Act of 6th February 2009 relating to the organization of the basic primary school education.

The post-primary education system distinguishes between two levels of education:

- The secondary education, governed by the Organization Act of 10th Mai 1968, modified by the 22nd June 1989 Law and the Act of 12th July 2002. Secondary education has a standard duration of 7 years and leads to secondary education graduation certificate, mainly preparing for further studies at university level.
- The secondary technical education, governed by the modified secondary technical education and vocational training Reform Act of 4th September 1990. Secondary technical education comprehends different training regimes with a duration of 6 to 8 years depending on the various orientations.

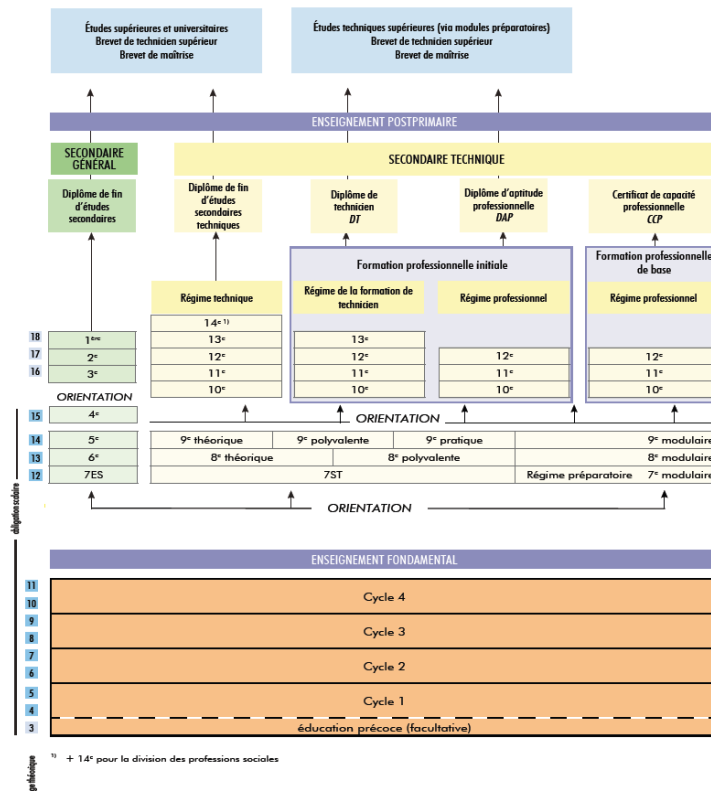


Chart 1: Structure of the Luxembourg education system from 2010/2011 on
 (Source: Les chiffres clés de l'éducation nationale – Statistiques et Indicateurs 2010-2011)
http://www.men.public.lu/sys_edu/postprimaire/est/index.html)

The secondary technical education (STE) is a preparation for working life. It also grants access to higher education. According to the choice or regime and the degree of specialization, secondary technical education has a varied duration from 6 to 8 years. Secondary technical education is divided into 3 different cycles: the lower cycle, the middle cycle and the upper cycle, plus the preparatory regime.

The secondary technical education lower cycle

The lower cycle regroups the first 3 classes of the STE: the 7th, 8th and 9th grade. This cycle guides the pupils towards a consolidation of their fundamentals and a progressive approach towards the training and later the profession best adapted to their skills and taste.

In 7th grade ST classes, the syllabus comprises languages (French, German), mathematics, human sciences, natural sciences, technological education and expression skills as well as religious and moral education or moral and social education classes. Those pupils that find it hard to follow the stipulated curriculum are offered the possibility of entering an adapted 7th grade (7th ADAPT). Only essential subjects are being taught in this special class and the number of different teachers is limited in order to achieve a better care for the individual pupil.

In accordance with the results achieved in a 7th grade ST class, the children are being oriented either towards a theoretic or towards a versatile 8th grade class. Both

educational paths have different general orientations, different levels of importance regarding the taught subjects as well as different methodological approaches.

After the 9th grade, the pupils have fulfilled the minimum required school years. Successfully passing a 9th grade is the key to either a technical or a vocational training thereafter.

The decision as to whether a young person can be admitted into a 10th grade of the middle cycle or not, is taken by the class council and according to the results of the 9th grade, theoretical, versatile or practical class. The level and the type of studies or training that are then open to the pupil are dependent on his/her results and level of excellence obtained.

The middle and the upper cycle

The middle and the upper cycle of the secondary technical education open the door to the learning of a trade. Both cycles end with a certificate or a diploma. There are 3 educational regimes:

- the vocational regime (10th grade – 12th grade classes). You will either end up with a Certificate for Vocational Competence (CCP) or with a Diploma for Vocational Aptitude (DAP) for the trainings and classes that apply the vocational training reform. The trainings and classes that have not been reformed yet, lead to a Certificate for Manual Abilities (CCM), a Certificate for Technical and Vocational Initiation (CITP) or a Certificate for Technical and Vocational Aptitude (CATP).
- the technician training regime (10th grade – 13th grade classes), leading to a technician diploma
- the technical regime (10th grade – 13th grade and even 14th grade classes for certain healthcare and social care trades), ending with the technical education certificate.

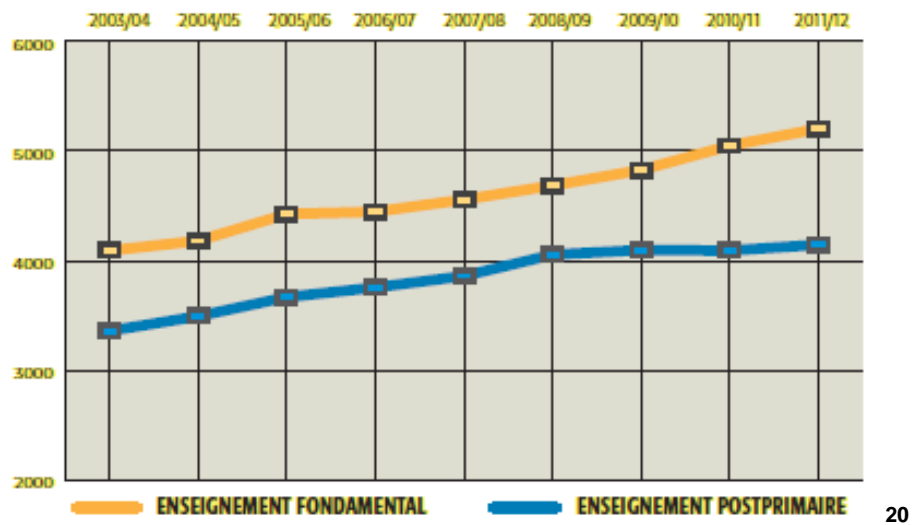
The preparatory regime

The preparatory regime is an integral part of the technical secondary education. It is meant for those pupils that experience difficulties assimilating certain contents and following the average learning rhythm. Taking preparatory classes should enable those pupils to either enter a 8th grade lower cycle versatile class, 9th grade lower cycle practical class or to accede a vocational training (e.g.: diploma for vocational aptitude or certificate for vocational competence).

In Luxembourg, public schools are free and the government takes care of all the tuition expenses. Most schools in Luxembourg are public schools. There are some private schools however which have to adapt their syllabus to the public sector though.

The graphic below shows the evolution of the number of teachers in the public sector, there is a regular evolution for the basic primary education to be noted and a small progression in the secondary education. This depicts in general the substantial financial resources allocated to education and training in Luxembourg.

Evolution du corps enseignant dans l'enseignement public



Source: L'enseignement luxembourgeois en chiffres: année scolaire 2011-2012 – Ministère de l'Education Nationale et de la Formation Professionnelle)

²⁰ Evolution of the teaching profession in the public education
Basic primary education –post-primary education

L'ENSEIGNEMENT LUXEMBOURGEOIS EN CHIFFRES

ÉVOLUTION DU NOMBRE D'ÉLÈVES DANS L'ENSEIGNEMENT PUBLIC ET LES ÉCOLES PRIVÉES QUI SUIVENT LES PROGRAMMES OFFICIELS

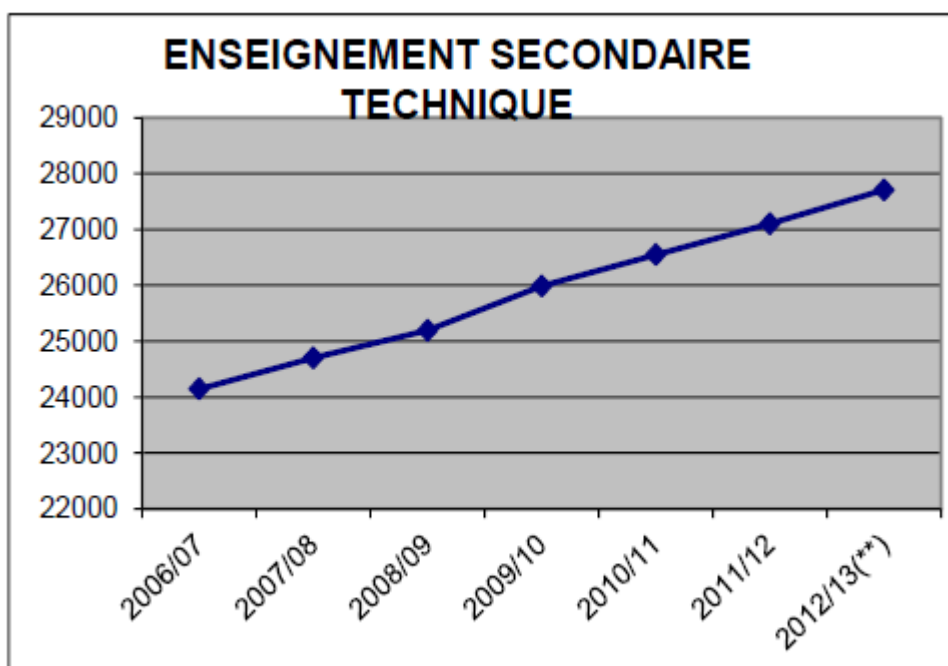
		2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Enseignement fondamental	Cycle 1									
	Éducation précoce	3088	3410	3492	3671	3865	4036	4105	3961	4258
	Éducation préscolaire	10412	10441	10411	10001	9824	9966	10026	10195	10434
	dont filles	49,3%	48,2%	48,4%	48,8%	47,8%	47,7%	47,8%	48,4%	49,1%
	dont étrangers	43,2%	43,5%	43,8%	44,9%	46,2%	49,1%	50,0%	48,3%	47,5%
	Cycle 2 - 4									
	Enseignement primaire	32456	32840	33138	33136	33020	32496	32312	32096	32269
	dont filles	48,8%	49,1%	49,0%	48,8%	49,1%	49,1%	48,8%	48,8%	48,4%
	dont étrangers	39,2%	40,2%	40,9%	41,6%	42,7%	44,4%	46,1%	47,6%	49,4%
	Total enseignement fondamental	45956	46691	47041	46808	46709	46498	46443	46252	46961
Total éducation différenciée	718	706	681	707	671	663	628	690	779	
Total enseignement secondaire	10316	10571	11114	11693	12122	12469	12757	12825	12975	
dont filles	56,1%	56,4%	55,7%	55,3%	54,7%	54,7%	54,2%	54,3%	54,1%	
dont étrangers	16,5%	16,9%	17,1%	17,8%	18,6%	19,2%	18,6%	18,7%	19,1%	
Classes inférieures secondaire technique	10835	11125	11206	11434	11762	12081	12421	12746	12915	
dont filles	46,6%	46,7%	46,6%	46,7%	46,6%	46,6%	47,2%	47,1%	47,5%	
dont étrangers	41,1%	42,3%	44,4%	46,4%	48,6%	49,6%	49,5%	49,4%	50,2%	
Régime technique	4305	4265	4309	4626	4739	4840	5220	5405	5677	
dont filles	60,2%	60,7%	60,5%	59,8%	59,6%	59,0%	58,6%	57,8%	57,5%	
dont étrangers	27,4%	29,5%	30,2%	30,8%	31,8%	30,8%	28,9%	29,0%	30,1%	
Régime de la formation de technicien	2792	2953	3072	3092	3162	3182	3198	3315	3378	
dont filles	42,3%	41,8%	41,5%	42,0%	42,6%	43,5%	44,2%	45,0%	44,7%	
dont étrangers	34,4%	34,8%	34,5%	36,4%	37,5%	38,5%	37,9%	38,3%	39,2%	
Régime professionnel	4272	4117	4172	4125	4142	4220	4345	4413	4360	
dont filles	40,6%	41,0%	40,0%	38,7%	38,0%	37,0%	36,7%	37,3%	38,1%	
dont étrangers	42,5%	42,0%	41,3%	40,8%	40,9%	41,6%	42,2%	43,3%	42,9%	
Total enseign. secondaire technique	22204	22460	22759	23277	23805	24323	25184	25879	26330	
dont filles	47,5%	47,6%	47,3%	47,2%	47,2%	47,0%	47,4%	47,4%	47,7%	
dont étrangers	37,9%	38,9%	39,8%	41,0%	42,5%	43,0%	42,5%	42,7%	43,2%	
Total enseignement postprimaire	32520	33031	33873	34970	35927	36792	37941	38704	39305	
TOTAL ÉLÈVES	79194	80428	81595	82485	83307	83953	85012	85646	87045	

21

Source: L'enseignement luxembourgeois en chiffres: année scolaire 2011-2012 – Ministère de l'Éducation Nationale et de la Formation Professionnelle)

The below depicted graphic shows the significant evolution of the number of pupils to choose the secondary technical education (all regimes combined)

²¹ The Luxembourg Education in Figures



The chart below illustrates the strength in numbers of the secondary (lycées) and secondary technical schools (lycée techniques) at the start of the academic year 2012-2013. As you can see, some schools only offer the possibility of a classical secondary education, others only a technical secondary education and finally some propose both educational systems.

The chart also shows that there are twice as many pupils in the secondary technical education system as in the classical secondary education regime.

Etablissement scolaire	SECONDAIRE	SECONDAIRE TECHNIQUE	TOTAL
AL Athénée de Luxembourg	1473		1473
ALR Atert-Lycée Reiden	349	736	1085
CL Centre de logopédie		7	7
CNFPC (Esch)		140	140
CNFPC-E (Ettelbruck)		151	151
CSEE Centre socio-éducatif		24	24
E2C Ecole de la 2e chance		84	84
LAML Lycée Aline Mayrisch Luxembourg	1184	278	1462
LBV Lycée Bel-Val	12	624	636
LCD Lycée Classique Diekirch	1424	637	2061
LCE Lycée Classique Echternach	842	402	1244
LEM Lycée Ermesinde	313	285	598
LGE Lycée de Garçons Esch	1221		1221
LGL Lycée de Garçons Luxembourg	1182		1182
LHCE Lycée Hubert Clement Esch	930		930
LJBM Lycée Josy Barthel	144	1057	1201
LMR Lycée Michel Rodange Luxembourg	1413	15	1428
LN Lycée du Nord Wiltz	424	974	1398
LNB Lycée Nic Biever Dudelange	302	1401	1703
LRS Lycée Robert Schuman Luxembourg	983		983
LTA Lycée technique Agricole Ettelbruck		585	585
LTAM Lycée technique des Arts et Métiers Luxembourg		1401	1401
LTB Lycée technique de Bonnevoie		1861	1861
LTC Lycée technique du Centre	71	2070	2141
LTE Lycée technique d'Esch		1461	1461
LTECG Lycée technique Ecole de Commerce et de Gestion		454	454
LTETT Lycée technique d'Ettelbruck		1328	1328
LTHAH Lycée technique Hôtellerie Alexis Heck Diekirch		344	344
LTJB Lycée technique Joseph Bech Grevenmacher	65	818	883
LTL Lycée technique Lallange	39	1057	1096
LTMA Lycée technique Mathias Adam Petange	123	2121	2244
LTML Lycée technique Michel Luclus Luxembourg	24	1116	1140
LTPES Lycée technique pour Prof. Educatives et Sociales		890	890
LTPS Lycée technique pour Professions de Santé		844	844
NOSL Nordstad-Lycée	76	587	663
SLL Sportslycée	249	63	312
UELL Uelzecht-Lycée	6	528	534
TOTAL PUBLIC	12849	24343	37192
Ecole Privée Fieldgen	371	1162	1533
Ecole Privée Marie-Consolatrice		530	530
Ecole Privée Ste Anne		956	956
Ecoles Privées Notre Dame Ste Sophie		192	192
Lycée Technique Privé Emille Metz		522	522
TOTAL PRIVE ⁽¹⁾	371	3362	3733
TOTAL	13220	27705	40925

(1) Ecoles privées appliquant les programmes officiels du MENFP

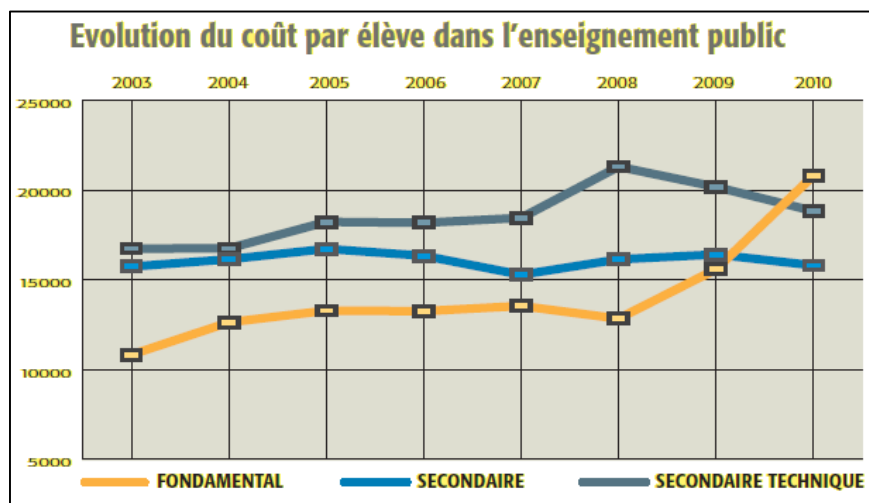
Number of designated classical and technical secondary schools at the start of the academic year 2012-2013

The chart below stresses the cost per pupil in the public sector that is quite high regardless of the type of education (basic primary, secondary and secondary technical). In 2010, the average annual gross cost per pupil was of 18.858 €.

Coût par élève dans l'enseignement public			
Année budgétaire 2010			
Dépenses par élève	Enseignement fondamental	Enseignement secondaire	Enseignement secondaire technique
■ Coût du personnel enseignant	14.046 €	9.830 €	11.491 €
■ Coût du personnel non-enseignant	599 €	2.200 €	2.220 €
■ Autres dépenses courantes	3.179 €	2.176 €	2.480 €
■ Dépenses en capital	2.997 €	1.623 €	2.666 €
Coût annuel moyen brut par élève	20.821 €	15.829 €	18.858 €

22

The graphic and chart below show a cost increase per pupil in the basic primary education starting in 2008 which can be explained by the limitation of the number of pupils allocated to a class (15 students maximum). Moreover, there has been a heightened augmentation in numbers of foreign pupils in comparison to the Luxembourgish ones. In preschool as well as in primary school education next to one in two pupils are foreigners in the academic year 2011/2012, thus creating certain difficulties on a linguistic level (several nationalities are represented in one class).



23

²² Cost per pupil in public education

Budget year 2010

Expenditure per pupil

Teaching staff cost

Non-teaching staff cost

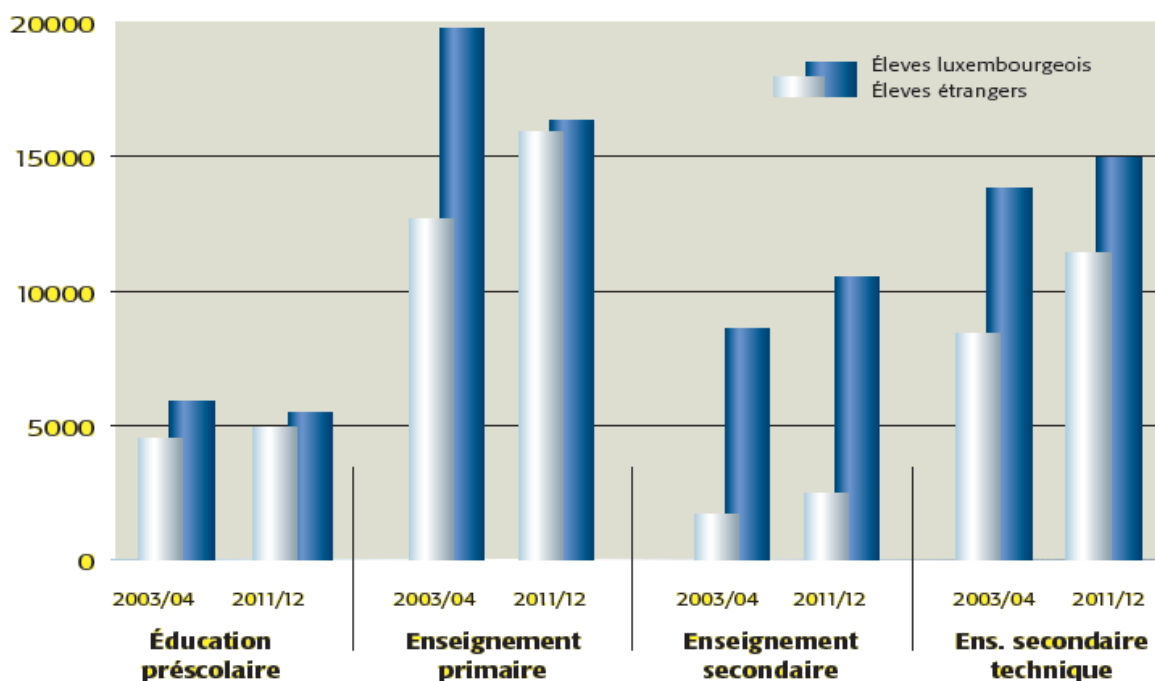
Other expenses

Capital expenditure

Average annual gross cost per pupil

²³ Cost evolution per pupil in the public sector

Répartition des élèves luxembourgeois et étrangers



24

Source: L'enseignement luxembourgeois en chiffres: année scolaire 2011-2012 – Ministère de l'Education Nationale et de la Formation Professionnelle)

The number of pupils over several years leaving school without any qualification has given birth to a significant socially marginalized segment of young people. The consequences of school dropout are indeed numerous and alarming as they affect both the young people as individuals and society in general. Prevention of school failure has an enormous importance in our economic and social environment in which people with low qualifications or none at all are more and more at risk.

That is why the Ministry for Education and Vocational Training has made the fight against school exclusion one of its priorities.

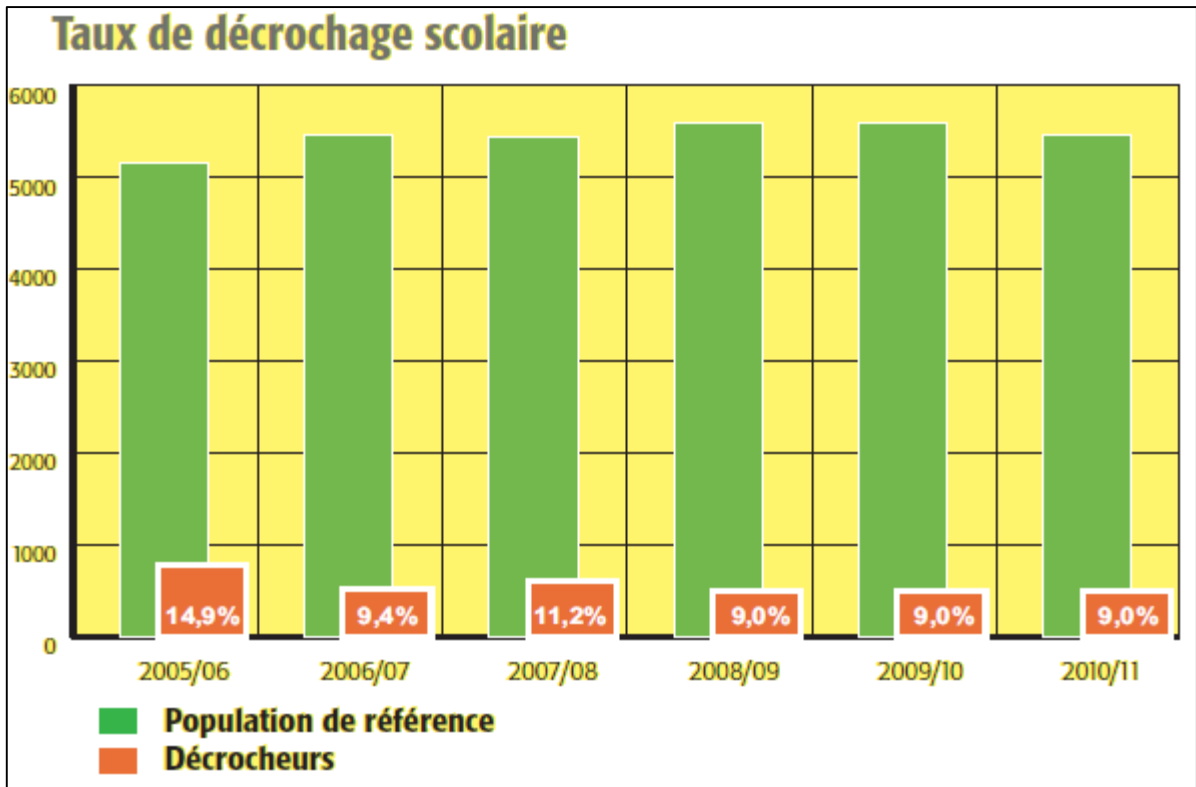
Since 2003, individual monitoring for the pupils that leave the Luxembourg education system without qualification is ensured. A list of names of these young people is established on a monthly basis and transferred to the regional centers of the Local Action for Young People (ALJ). The young concerned are contacted individually by the ALJ and questioned as to the reasons of their school dropout and their resulting personal situation. Where appropriate, ALJ offers help with the search for training or an education possibility.

In addition, several actions and reforms have been decided and implemented in order to decrease the rate of those without certification and to generally increase the qualification level:

²⁴ Distribution of Luxembourgish and foreign pupils

- intensification of the efforts undertaken by the ALJ and the National Centre for Continuing Vocational Training (NCCVT → CNFPC) in order to reintegrate young people in a training process;
- organization of special classes for school dropouts;
- education via a skills-centered approach: core skills are determined at different levels of education so as to ensure that each pupil has the possibility to achieve a qualification level in accordance with his/her capacities;
- reform of the promotion criteria: This measure has lessened a number of negative impacts of our education and has already had beneficial effects in the secondary technical education;
- intensified follow-up of the pupils presenting learning problems through those remedial measures enlisted in the new promotion regulation;
- more flexible conditions for the access of preparatory regime pupils to lower cycle classes of the STE and subsequently to vocational trainings;
- intensified follow-up of the pupils presenting behavioral problems via different projects such as intermediary classes for instance in which an interdisciplinary staff accompanies pupils that have been temporarily taken out of their class group with the goal of reintegrating them;
- inscription of the school mediation in the Act of 13th July 2006 relating to the reorganization of the Centre for Psychology and School Guidance (CPOS)
- secondment of teaching staff from the Lycée Josy Barthel to the youth psychiatric service of the Kirchberg Hospital and teaching staff from the Nordstadlycée to the youth project in Ettelbrück;
- opening of the School of Second Chance in March 2011

The combined efforts of the Luxembourg education system has enabled the reducing of the early school leaving rate since 2003. It was at 17,2% at that time. According to the last two surveys made on the years 2008-2009 and 2009-2010, the ratio has gone to one of 9%. (cf. graphic below)



25

6.1.2. Initial vocational training for the artisanry

Vocational training pupils make out more than a third of the educational population of the middle and upper secondary technical education cycles.

More than 60% of the vocational trainees are male. In the academic year 2009/10, 92,6% of the youth in vocational training were enrolled in a public school.

Vocational training was reformed by Act in November 2008. Since the start of the academic year 2012-2013, all the 10th grade classes as well as a number of 11th and 12th grade classes of the vocational training regime offered in Luxembourg are organized according to the reformed system.

The reform addresses the need of a profound revision of the vocational training system in Luxembourg. The main objectives are to heighten the quality of the vocational training, to decrease the school failure rate and to allow an easier access to vocational training on a lifelong learning basis.

Such a modernization with aim on the skills became necessary because of the rapid evolution of technologies and the constantly changing environment.

The reform system is based on three pillars:

²⁵ School dropout rate
Reference population
Early school leavers

- the skills-oriented approach: vocational training goes from an education mainly focused on the content of taught school subjects towards a formation stressing the development of the skills (knowledge, know-how, soft skills) necessary as to obtain a professional qualification;
- the modular system: each vocational training is divided up into single training credits (partial qualifications). This kind of organization allows the creation of links and access points between the different types of trainings. It also offers the possibility of re-sit exams in case of failure in one module without the necessity of repeating a whole year;
- a reinforced partnership of the vocational training in schools and in professional environments so as to better adapt the education to the needs in real life work situations.

To aid the teachers of CCP (Vocational Competence Certificate), DAP (Vocational Aptitude Diploma) and DT (Technical Diploma) classes with the implementation of the reform, the ministry has installed a continuing training offer that hinges on five modules:

Module 1: Skills-oriented teaching in vocational training

Module 2: Evaluate skills in vocational training

Module 3: Develop soft skills

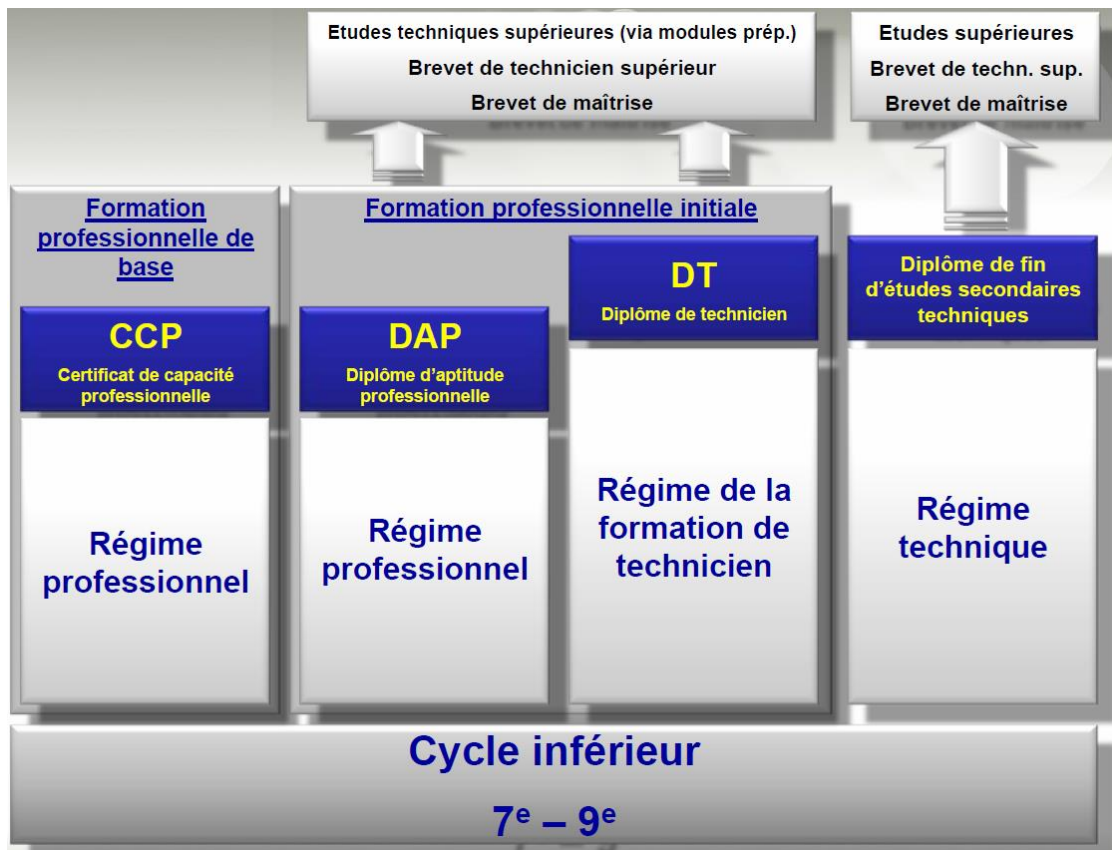
Module 4: Evaluate soft skills

Module 5: Develop personal (self-sustaining) skills

Vocational training is now made up of 3 educational paths:

- **the CCP, Certificate for Professional Competence**, replacing the former CITP and CCM;
- **the DAP; Diploma for Professional Aptitude**, replacing the former CATP
- **the DT, Technical Diploma**

The orientation towards one of these 3 possible paths is decided at the end of the 9th grade (third year of the secondary technical education) on advice from the class council, based upon the school results and personal interests of the pupil in question.



26

Simplified structure of the Luxembourg education system

The vocational regime (CCP and DAP) is the direct way towards a professional qualification. You can either absolve it:

- in the accompanying regime: practical training takes place in a firm, theoretical training (once or twice a week) in a lycée technique (vocational high school);
- in the mixed regime: the apprentice is in a vocational training class at school for 1 or 2 years and finalizes his/her training in the accompanying regime;
- in the full time regime: the complete training takes place in a lycée technique.

6.1.2.1. The Certificate for Professional Competence (CCP)

This certificate grants the acquisition of the basic vocational competence necessary for a first step on the labor market. It replaces the former CCM and CITP and is directed towards those pupils with academic difficulties that are not able to graduate with a professional aptitude (DAP) or a technician diploma (DT).

²⁶ Lower cycle 7th – 9th grade:

Vocational regime
Vocational regime

Technician training regime

Technical regime

- ➔ CCP; basic vocational training
- ➔ DAP; initial vocational training => technical higher education (via preparatory modules); higher technician diploma (BTS); master's
- ➔ DT; initial vocational training => technical higher education (via preparatory modules); higher technician diploma (BTS); master's
- ➔ Secondary technical graduation certificate => higher education; higher technician diploma (BTS); master's

Although the CCP is a strictly practical training, some theoretical knowledge will be acquired, more or less profound depending on the chosen path.

Since the CCP works with credits and uses a system of validation of the acquired experience (VAE), it is possible to pursue the training after certification in order to obtain other higher degrees. The training is supposed to basically last three years. As it is structured with modules and a continuous evaluation system, it functions under apprenticeship contracts and so the major part takes place on-the-job in a company and the rest of the time at school (one or two days per week).

The pupils that are not yet ready to pass the CCP at the end of their compulsory school attendance are offered career guidance and basic vocational initiation courses (COIP). The CCP constitutes a basic vocational training.

Adults which encounter or rediscover the wish to learn a trade or who want to redirect their professional future have the possibility of acquiring a CCP via adult education classes.

The existing CCPs in the construction and habitation trades that have a direct impact on the energy-efficiency of buildings are the following:

- roofer
- electrician
- heating and plumbing system installer
- mason
- plasterer/renderer

6.1.2.2. *The Professional Aptitude Diploma (DAP)*

It replaces the CATP. It gives access to the labor market as a qualified worker. The training works with apprenticeship contracts as well as with internship contracts (minimum 12 weeks internship during the whole training). It has a basic length of three years.

With the DAP, the apprentice is take up a technician training or do a master's.

By absolving the preparatory modules, he/she can take up higher technical studies (university or BTS).

Professionally active adults can achieve a DAP in their field of activity via evening classes.

Adults that wish to learn a trade or who want to redirect their professional future have the possibility of acquiring a DAP via adult education classes.

The existing DPAs – Professional Aptitude Diplomas (previously CATP) in the construction and habitation trades that have a direct impact on the energy-efficiency of buildings are the following:

- carpenter
- roofer
- electrician
- tinsmith-zinc sheeter
- heating – plumbing installer

- mason
- joiner
- plasterer-renderer

CATP	2007	2008	2009	2010	2011	2012
MACON	8	11	5	9	5	2
CALORIFUGEUR	0	0	0	0	0	0
INSTALLATEUR DE CHAUFFAGE, DE VENTILATION ET DE CLIMATISATION	12	14	25	17	21	14
INSTALLATEUR SANITAIRE	2	3	3	7	8	3
INSTALLATEUR FRIGORISTE	0	0	0	0	0	1
ELECTRICIEN	18	28	20	33	23	34
COUVREUR	5	1	7	3	7	5
FERBLANTIER-ZINGUEUR	1	1	1	3	2	1
CHARPENTIER	2	2	2	5	5	6
PLAFONNEUR-FACADIER	0	0	5	2	0	1
Total	48	60	68	79	71	67

Source Chambre des Métiers

The chart above tells us that the number of CATPs has been rather stable since 2009 but that we are speaking of a fairly small number of graduates (67 certificates delivered in 2012).

Based on the number of CATPs (former regime) delivered (cf. chart below), 21 % of the delivered certificates can be placed into the construction sector. Thus this sector has a fairly high importance for the artisanry in Luxembourg.

Formation Initiale

Réussite à l'examen de fin d'apprentissage, session extraordinaire et ordinaire 2012

	CATP	CCM	CITP	Total
Maçon	2	3		5
Installateur de chauffage, de vent. et clim.	14		17	31
Installateur sanitaire	3		4	7
Installateur frigoriste	1			1
Electricien	34		20	54
Menuisier	11			11
Parqueteur	2			2
Serrurier	14			14
Couvreur	5	0		5
Ferblantier-zingueur	1			1
Charpentier	6			6
Carreleur	1	1		2
Planfonneur-façadier	1			1
Peintre-décorateur	15	9		24

Source : Chambre des Métiers

Sous-total - Métiers de la construction	110	13	41	164
Total tous métiers	448	44	51	543
Part des métiers de la construction	24,6%	29,5%	80,4%	30,2%

27

The chart above depicts the number of CATP, CCM and CITP delivered in 2012, in general we have to stress the fact that each year very few students obtain a vocational diploma or certificate, thus the rather high presence of cross-border commuters in the construction sector.

6.1.2.3. The technician training regime

The 2008 vocational training reform defines the vocational training for technicians, leading to the technical diploma. On the one hand by concentrating the training more on the preparation for working life so as to better respond to the needs of the labor market and on the other hand on a better preparation for higher technical studies. In order to achieve the second means, complementary preparatory modules have been installed for the pupils wanting to pursue higher technical studies.

²⁷ Initial training

Apprenticeship graduation exam results, ordinary and extraordinary sessions 2012

TAUX DE RÉUSSITE PAR SECTION

		Diplômes FORMATION DE TECHNICIEN 2010-2011				
		Admis		Refusés		Total candidats
Division	Section	Absolu	%	Absolu	%	
Division électrotechnique	Communication	17	85,0%	3	15,0%	20
	Energie	15	65,2%	8	34,8%	23
Génie civil	Bâtiment	34	63,0%	20	37,0%	54
	Constructions civiles	5	71,4%	2	28,6%	7
	Travaux publics	10	52,6%	9	47,4%	19
Total		547	78,3%	152	21,7%	699

Technicians with this kind of training as a background are in general more involved in the conception and management of projects. They have a high training level.

6.1.2.4. Lifelong Learning

Lifelong learning is accessible to any adult of the education system, regardless of their age, education level or professional situation. The education and training system gives everybody the opportunity to have training with the chance of earning a first degree, acquiring knowledge and perfecting skills, changing vocational orientation, adapting to new technologies and enhancing their personal culture.

Generally speaking, any of the above described certification can be gained by any adult person, qualified or not. The diplomas and certificates for adults are the same and confer the same rights as their equivalent obtained inside the education system and the initial vocational training. The main elements of the vocational training being here evening classes and adult apprenticeship.

6.1.2.5. The validation of acquired experience (VAE)

The validation of the acquired experience is a new procedure permitting to valorize professional or extra-professional experience by certifying it. Every individual with at least three years (or 5.000 hours) of practical experience in a certain field they want to get a validation for, may submit a request at the Ministry for National Education and Vocational Training. Given all the requirements are met, he/she will be able to obtain a certificate, a secondary technical education diploma or a master's of artisanry, in whole or in part.

The VAE covers:

- secondary technical education certificates and diplomas:
 - o Certificate for Technical and Vocational Initiation (CITP)
 - o Certificate for Manual Abilities (CCM)
 - o Certificate for Technical and Vocational Aptitude (CATP)
 - o Technician Diploma (DT)
 - o Secondary Technical Graduation Certificate
- the artisan master's degrees

6.1.3. The authorities in charge with the initial vocational training for artisans

6.1.3.1. *The Ministry for National Education and Vocational Training*

The prime mission of the Ministry for National Education and Vocational Training is the planning and administration of all educational offers in Luxembourg, aside from the higher education, which falls into the purview of the Ministry for Culture, Higher Education and Scientific Research.

The project missions and attributions subject to the Ministry for Education and Vocational Training are as follows:

- Legislative and policy matters related to the education and lifelong vocational training
- Basic primary school education
- Early infantile and primary education, research based on the inclusive teaching principles
- Secondary and secondary technical education, educator training, training for healthcare providers
- Vocational training: apprenticeship/technician training/master's
- Lifelong learning
- Continuing vocational training: collective and individual access – National Center for Continuing Vocational Training – National Institute for the Development of the Continuing Vocational Training
- Vocational Training and Retaining, anti-unemployment training measures – Local Action for Young People (ALJ)
- Socio-professional initiation training
- Planning – control of the management of the institutions – recruitment of the educational staff (schools and high schools), organization of the educational traineeship, assignment of personnel for the institutions and control of the personnel management
- Relations between the Government and the private education sector
- Regional and international cooperation – European affairs: National Agency for the European Education and Lifelong Learning (ANEFORÉ): Socrates (Lingua, Comenius, Grundvig), Leonardo da Vinci, Euridyce.
- Validation of work experience
- Recognition of non-academic degrees

6.1.3.2. *The Ministry for Higher Education and Scientific Research functions*

The Ministry for Higher Education and Scientific Research functions

- Higher and university education: University of Luxembourg, International University Institute, training for higher technician diploma (BTS), initial and continuing university training

The training for the Higher Technician Diploma is accessible after completion of the secondary technical education level. It ensures the continuity towards a higher education.

- Recognition and homologation of university degrees
- Consultative commissions: Commission for homologations, Commission for titles, Commission for the assimilation of diplomas, National Ethical Advisory Commission for the Sciences of Life and Health; Research Unit for Conflict Resolution

6.1.3.3. Vocational high schools (secondary technical schools) active in the initial training for the construction sector (some examples)

The Atert-Lycée in Redange organizes the training for energetic equipment technicians and building technology.

The following subjects are part of the curriculum:

- Commissioning, maintenance, reparation and optimization of electric installments, heating, plumbing, cooling, ventilation and air-conditioning systems
- Compliance, maintenance and servicing works in complex buildings
- Energy counseling, auditing and monitoring
- Rational use of the existing techniques in all kinds of buildings
- Increase in performance of existing installments
- Promotion of sustainable energy
- Compliance with the latest regulations on the energy-efficiency of buildings

The Lycée technique des Arts et Métiers organizes the BTS (Higher Technician Diploma) trainings for Engineering

The higher technician in engineering performs its activities in the fields of studying, installing, using, maintaining and exploiting technical equipment. Simultaneously he/she should develop skills regarding the environmental impact of this equipment. This training is accessible for anyone having accomplished post-primary education levels and is in the continuing line of the initial vocational training. The higher technician will mainly be active in the conception and management of projects, he/she is not a blue collar.

The BTS engineer is also responsible for a team of auxiliary forces and is very often operating outside of the company. He/she has to master the technical, the normative and the regulatory aspects but also needs to develop interpersonal skills necessary for a successful dialogue with the clients, as much on technical, an economic as on a commercial level. Furthermore, he/she stands for the quality and the conditions of

practice of the crafts proposed to the professionals he/she is in charge of. He/she needs to promote health and security at work.

In order to be able to cope with all the activities mentioned, the BTS engineer needs to be able to fall back on a multitude of skills and multi-technique knowledge leading to a better understanding of the most common processes in electrical engineering, industrial IT and computing services, mechanics, thermal fluid use and climate control both in the industrial sector as for public infrastructures, the tertiary sector, transport or housing.

The high school also offers technician training for the electro-technical area (energy section) which includes an optional module on solar thermal energy.

The Lycée technique du Centre also organizes a technician diploma in civil engineering, energy equipment and building technology

The Lycée Josy Barthel organizes training for technicians in civil engineering.

Next to the quality general education the training includes the following subjects:

- Technical drawing (manual and DAO – computer aided design CAD)
- Material and building technology
- Urbanism
- Topography
- Safety and construction site management
- Architectural elements
- Construction elements

Moreover it offers the works supervisor BTS, the training focusing on the following aspects:

- Construction and public works study (BTP)
- Safety and civil engineering construction site management
- Construction economy and legislation
- Languages and communication (French and German)
- Mathematics and applied sciences
- Internships in companies, brief

This BTS ties notions of energy-efficiency in building and renewable energies.

6.1.4. The accreditation authorities for artisans

The master's degree (also called artisan master's) is a diploma that allows its holders to establish themselves as independents in the artisan sector and to train apprentices.

There are master's degrees for every core craft in artisanry. The artisan sector is composed of approximately 150 trades from the consumer goods industry or the provision of services, art professions, industry subcontracting or outsourcing, etc.

The preparatory courses for the master's qualification have a norm length of 3 years and are organized by the Chamber of Crafts (CDM). The master's degree grants the title of master artisan in a certain craft or trade. There is no master's qualification for the professions belonging to the Chamber of Commerce (CDM).

The training has a modular structure and takes place in the evening and on weekends. It is an integral part of the lifelong learning system and adapted to the needs of adults or young people of 18 years and more.

In order to enroll for a master's the candidate needs to be in possession of one of the following diplomas:

- Certificate for Technical and Vocational Aptitude (CATP) or Diploma for Vocational Aptitude (DAP)
- Technician Diploma subject to the specific area
- Secondary graduation or secondary technical graduation certificate
- A duly recognized and equivalent diploma

6.1.5. Existing instruments allowing the monitoring of the market evolution in terms of technology, their necessary skills and training

The National Institution for the Development of the Continuing Vocational Training (INFPC) is a public institution under the authority of the Ministry for National Education and Vocational Training. Its objective is one of promoting vocational training. Its activities are the following:

- Promote vocational training. To this end, different types of tools and information services are being developed.
- Guide co-financing requests
- The INFPC sees companies through the governmental co-financing procedures as provided by the legislation context aiming towards the support and development of the continuing vocational training
- Entertain the portal www.lifelong-learning.lu, which lists the different possible trainings for Luxembourgish companies. This portal is nothing short of a genuine map of the continuing vocational training universe in Luxembourg and functions like a database with hands-on recommendations and practical pointers
- Observe tendencies in vocational training
- Assume its duties as an intellectual watchtower and monitor developments in the vocational training area via the Vocational Training Observatory

A new online version with a modernized design, a rethinking on the navigation level and more potent search engine of the www.lifelong-learning.lu portal was made available by the INFPC in 2011.

Immediately on the homepage you can now easily access information on the continuing vocational training by means of five new thematic navigation categories: understand, aid, graduates, move, trends. The search engine, much more intuitive, guides the user in his training choice and the content linked to the training. In 2011, in all sectors, the portal totaled an average of 6.050 visitors a month.

6.2. The integration of energy-efficiency and sustainable energy in the existing initial vocational training

6.2.1. Concerning the vocational trainings leading to a DAP (Diploma for Vocational Aptitude) and a CCP (Certificate for Vocational Competence)

For the following CCPs, there are no specific modules related to energy-efficiency in the enclosure nor are there any other specific energy-efficiency modules

- Electrician
- Roofer
- Heating-plumbing installer
- Mason
- Plasterer – renderer

The part of the DAP trainings of the construction sector enclosure made up of:

- 18% cabinet makers
- 3% roofers/tinsmiths, zinc sheeters
- 0% masons – plasterers/renderers
- 0% carpenters
- 0% electricians
- 0% energy electricians with a solar thermal option
- 0% heating-plumbing installers

The part of the training dealing with energy-efficiency linked to technical installments:

- 0% cabinet makers
- 0% roofers/tinsmiths, zinc sheeters
- 0% masons – plasterers/renderers
- 0% carpenters
- less than 1% electricians
- 5% energy electricians with options in sustainable and solar thermal energy
- 0% heating-plumbing installers

It appears that those subjects linked to the energy performance of buildings are not integrated enough in the trainings leading to DAP and CCP. It is essential to train the pupils at a very early stage regarding these subjects in order to enable the future craftsmen the establishment of a good practice in their trade.

6.2.2. The curricula of the master's degrees

The different master's qualification programs for the crafts of the construction sector comprise specifics linked to the energy-efficiency of buildings and sustainable energy while integrating specific skills as described below:

- **Plasterer/renderer trade:**

Vocational skills related to energy: Fabrication and fitting of thermal insulated frontages, installing of insulating slabs and discs, knowledge regarding construction physics (vapor diffusion, thermal constraints,...)

- **Electrical trade:**

Vocational skills related to energy: Fitting of photovoltaic solar systems and heat pumps according to the clients' demands regarding performance and reliability while putting into practice quality craftsmanship and respecting the totality of the applicable norms and regulations, in particular in terms of the energy and ecology labels

- **Heating-plumbing installer:**

Vocational skills related to energy: installment of biomass-based systems, heat pumps, shallow geothermal energy and solar thermal energy systems according to the clients' demands regarding performance and reliability while putting into practice quality craftsmanship and respecting the totality of the applicable norms and regulations, in particular in terms of the energy and ecology labels. Aeration, air-heating and -conditioning

- **Construction contractor:**

Vocational skills related to energy: Insulation works related to masonry. Basic knowledge in physics linked to thermal protection

- **Tinsmith:**

Vocational skills related to energy: Insulation works on roofs with the use of the habitual materials for roofing

- **Roofer:**

Vocational skills related to energy: Insulation works on roofs with the use of the habitual materials for roofing

- **Cabinet maker:**

Vocational skills related to energy: Fitting of insulation material linked to the cabinet maker's craft. Fitting and installing thermal insulation and hygrometric material
The part of the trainings for master's degrees in the construction enclosure dealing with energy-efficiency is divided as follows:

- Plasterer/renderer trade: 10% to 15% of the specific vocational training
- Electrical trade: 0%

- Heating-plumbing installer: less than 1% of the specific vocational training
- Construction contractor: less than 1% of the specific vocational training
- Carpenter: 5 to 10% of the specific vocational training
- Roofer: about 10% of the specific vocational training
- Cabinet maker: about 15% of the specific vocational training
- Tinsmith: 10 to 15% of the specific vocational training
- Contractor for thermal, acoustic and sealing insulation: 20 to 25% of the specific vocational training
- The part of the trainings for master's degrees in the construction enclosure dealing with technical installments is divided as follows
- Electrician: 25 to 30% of the specific vocational training
- Plus a mandatory certified training of 2 days for heat pumps and a mandatory certified training of 2 days for photovoltaic systems
- Heating-plumbing installer: 5 to 10% of the specific vocational training

Plus a mandatory certified training of 2 days in heat pumps, a mandatory certified training of 2 days for biomass systems and a mandatory certified training of 2 days in solar thermal energy

- Construction contractor: 0%
- Roofer, cabinet maker: less than 1% of the specific vocational training

We can see that the energetic component has in parts been integrated into the curricula of the vocational trainings for master's degrees. Some subjects, like air-sealing, do not seem to appear on the syllabus, especially in the trainings for electricians and heating-plumbing installers, though these might have an important impact on the quality of the construction enclosure, in particular the channeling of sheaths and pipes.

6.3. The continuing vocational training

6.3.1. The providers of continuing vocational training for blue collars

The major players in the continuing vocational training sector for employees in the Grand-Duchy of Luxembourg are the following:

- The Chamber of Crafts
- The Training Institute for the Building Sector
- National Centre for the Continuing Vocational Training (CNFPC)
- Manufacturers

6.3.1.1. *The Chamber of Crafts*

As a professional chamber, the Chamber of Crafts regroups all artisan companies, namely those from the food sector, the fashion sector, healthcare, hygiene, the mechanical sector, the construction sector – building shell – finishing works, the construction sector – technical equipment, the communication sector, multimedia, arts and other activities, all in all 6.000 companies employing 80.000 people.

The Chamber of Crafts has been offering trainings for artisans of the construction sector on building energy-efficiency subjects for over 10 years now.

The “training” department’s mission is to ensure the management of the apprenticeship contracts and the organization of the final apprenticeship exams. Thus the Chamber of Crafts plays a primordial role in this reference training system with which the “artisan career” starts. In the context of artisan apprenticeship, the Chamber of Crafts, the Chamber of Labor and the Ministry for National Education and Vocational Training have installed a specific structure, namely the apprenticeship counseling service whose role it is to give advice to the different parties of the apprenticeship and to watch over a smooth course of action of the on-the-job apprenticeship in a company.

What’s more, it organizes the classes and exams leading to a master’s degree, which is the company management training par excellence.

Conferences, seminars, internships and classes in the context of the continuing vocational training are also organized by the Chamber of Crafts, so as to effectively contribute to the development of vocational skills and thus improve the competitiveness and secure the sustainability of the artisan enterprises. In the year 2013, the Chamber of Crafts will hold over 150 different continuing technical vocational trainings in the construction area.

In 2011, the Chamber of Crafts was responsible for the management of a total of 1.899 apprenticeships and 832 candidates for a master’s degree. No less than 3.573 people have taken classes in a continuing vocational training

6.3.1.2. *The CNFPC (National Center for Continuing Vocational Training)*

There are currently two CNFPCs in Luxembourg, one in Esch-sur-Alzette and one in Ettelbruck. These two centers have been created in the beginning of the Eighties with the aim of investing in the organization of a continuing vocational training system for young people as well as adults. Global projects have enabled a number of people to professionally and personally evolve.

The CNFPC also offers every year a panoply of evening classes adapted to the public needs and demands.

The CNFPC organizes the:

- Career guidance and basic vocational initiation courses (COIP)
- Continuing vocational training and professional reconversion classes
- Adult apprenticeship classes (CATP-CITP-CCM)
- Trainings based and adapted on the business needs, of general or specific nature, for the professional sector or associations as a response to the demands of the Ministry of Labor

- Evening classes

The National Center for Continuing Vocational Training among other things proposes vocational initiation classes for the young of less than 18 years that are seeking a job, in order to reorient them towards an active life with the help of internships.

It organizes trainings for:

- The preparation of the practical examination leading to the CATP in masonry
- The preparation of the practical examination leading to the master's degree in masonry
- The preparation of the practical exam leading to the master's degree in construction finishing

The first two trainings include no elements relative to the energy-efficiency of buildings as opposed to the last one in which the fitting and installment of insulation is taught.

In the context of the more practical part of the initial and continuing vocational trainings, the Chamber of Crafts often uses the premises and facilities of the two CNFPCs.

6.3.1.3. *The Training Institute for the Building Sector (IFSB)*

As in all the industrial and artisan sectors, the construction companies of large or small size had to face huge changes in techniques and technologies as well as on a social level. These changes, along with the regular evolution, have had the effect that the companies saw themselves forced to resort to higher qualification within their personnel.

In this context, the Luxembourgish construction and civil engineering companies were confronted with a series of uncertainties, namely linked to the lack of qualified personnel, the heterogeneity of the qualifications and the inadequate continuing vocational training offer.

Very much conscious of the economic and social issues tied to a development of skills and qualifications of the personnel of this sector that were at stake, the social partners and the sector leaders have undertaken, from 1996 to 2006, a series of negotiations regarding the inclusion of a global system of qualifying trainings in form of a continuing vocational training system in the collective agreement.

The basis of this qualifying training system, that is mentioned for the first time in article 28.1 of the collective agreement of 1st July 1996, is defined more precisely in the collective agreement signed, on 14th July 2000, by the different parties implied: Federation of the Construction and Civil Engineering Companies, Grouping of Entrepreneurs of the Construction Sector and Public Works, OGB-L and LCGB.

Based upon the professional classification system defined in the amendment II of the collective agreement of 1st July 1996, the organization of the qualifying training model targets at the development of the qualification of the active personnel through adjustment, retraining and promotion trainings. Considering this and binding into a lifelong learning perspective, the activities of the IFSB largely contribute to the

upgrading and adjusting of the qualifications of the construction and civil engineering sector employees.

As a genuine instruction promoter, the IFSB's main role is to address the companies of the construction sector and to organize trainings and offer skills development programs for the employees.

Its primary purpose is to act as an operator for the designated disposals regulated in the different collective agreements, meaning the conception, development, editing and organization of training measures as referred to. In addition to this fundamental mission, the secondary role of the newly created Institute aims at the answering of all the needs in terms of training coming from within the sector, be they technical trainings, managerial or others.

Within the scope of the collective agreement, the IFSB ensures the continuing vocational training for the following craftsmen:

- Unskilled laborer
- Mason
- Lorry driver
- Welder
- Drivers of worksite equipment
- Crane operator
- Team leader

The contributions allow the company to send its employed workers to a training without having to pay the training fee, it only needs to pay the wage and the social insurance contribution of the person in training. The Building Sectorial Fund takes charge of the fees related to the training.

The IFSB has multiple missions though its primary purpose is to function as an educational operator for the designated disposals regulated in the different collective agreements, meaning the conception, development, editing and organization of vocational, technical and safety training measures targeting at strengthening and structuring the skills of the sectorial personnel. In addition to this fundamental mission, the role of the Institute is to answer all the needs in terms of training coming from within the sector, be they technical trainings, managerial or others. Resolutely directed towards the future, it has developed and integrated several skill anticipation, technological challenge identification and managerial processes into its core functioning, creating thus the ability to bring to life all the necessary projects and procure the means to better guide this sector in full mutation with a high organizational flexibility.

The training areas of the IFSB destined for the operational staff are the following:

- **Construction techniques:** the techniques and technical codes of practice of the construction trades

- **Safety:** theoretical and practical trainings aiming at reducing the number of accidents at work and health consequences of the operational staff of the sector (personal protective equipment, work at height, trenches, scaffoldings...)
- **Sustainable construction and energy-efficiency:** theoretical and practical trainings in accordance with the environmental protection on construction sites, the energy-efficiency of the buildings (insulated masonry, insulated frontages, air-tightness of buildings, thermal bridges...), on-site quality controls (thermography, blower door test)

The IFSB activities are thus structured in concordance with the areas of expertise and present themselves as follows:

- Put into practice the sectorial vocational training system as provided in the collective agreement
- Identify the sectorial training needs
- Develop and organize technical training programs
- Propose a multidisciplinary training offer divided into different categories
- Promote the technical, juridical and managerial information propagation
- Coordinate and support the efforts of the construction actors regarding R&D (research and development) and innovation
- Develop a series of strong partnerships with various national and international players
- Develop and follow the concept of sustainable construction and energy-efficiency of buildings

Educational quality has been stressed by prioritizing an apprenticeship close to the construction site. The training center of the IFSB is a central element of the training process in as such as the greatest part of the exercises and technical studies are issued from construction site plans and situations.

Currently, the IFSB is constructing a didactic training building for low energy and passive construction actors. This 3-storey-building will allow the practical training of workers on the following subjects:

- How to use insulated masonry
- How to fit insulated frontage
- How to install external joinery
- Wood constructions
- Technical transitions from heated to non-heated zones
- How to realize air-tightness
- Roofing insulation...

The pedagogical merit of this training concept lies in the possibility of testing the quality of the work after the practical exercise via blower door test or thermography and thus see the mistakes made as well as the perfect realizations.

Educational infrastructures have been built with the aim of being able to train solar thermal installers and solar panel fitters.



6.3.1.4. *The manufacturers*

The product manufacturers (building materials or technical installations) also conduct trainings for the operational staff.

These trainings are generally rather short in length (half a day to a day) and their objective is to present the correct handling of their products. These special trainings are centered on very specific products. Treated subjects are essentially linked to the production of energy (solar thermal, photovoltaic, heat pump, gas boiler).

There is no relevant way of quantifying these trainings as to their number of participants and training duration since they are organized directly between the manufacturers and the companies.

6.3.2. Existing continuing vocational training framework conditions in Luxembourg

6.3.2.1. *Co-financing: training aid*

The companies legally installed in Luxembourg, by continuing vocational training legislation, are eligible for training aid for their training program.

The companies from the private sector legally installed in Luxembourg are eligible for such an aid amounting to taxable 20% of the annual investment. The governmental financial participation is of taxable 35% for the wage costs of the participants corresponding to the following criteria at the beginning of their training program:

- either no recognized diploma and a seniority < 10 years
- or a recognized diploma or seniority > 10 years and being > 45 years old

The aid can be postulated for via a co-financing request. The type of co-financing request depends on the training investment.

6.3.2.2. Vocational training of construction workers inside the collective agreement

The construction sector, as much as any other sector with an economic activity, has suffered for quite some time multiple changes and necessary evolutions. And although it is largely affected by technological and managerial evolutions, it remains very much focused on human capital which represents the backbone of the construction companies' skills and competitive capacity. These changes, to which one has to add legal and technological evolutions, subsequently force the companies to adapt the skills of their staff.

In this context, the Luxembourgish construction and civil engineering companies were confronted with a series of uncertainties, namely linked to the lack of qualified personnel, an immense heterogeneity of the qualifications and the inadequate continuing vocational training offer.

The Training Institute for the Building Sector (IFSB) has thus been created on the sectorial wish for the development of a general structure of qualifying trainings and techniques, initial and continuing, and to make of it a primary objective of the sector. To this end, the social partners and the trade federations of the sector have led a series of negotiations, from 1996 to 2000, aiming at including it in the collective agreement and thus giving it an optimal legal scope. The basis of this qualifying training system, that is mentioned for the first time in article 28.1 of the collective agreement of 1st July 1996, has been defined more precisely in the collective agreement signed, on 14th July 2000, by the different parties implied: the Federation of the Construction and Civil Engineering Companies, the Group of Entrepreneurs of the Construction Sector and Public Works, and the trade unions OGB-L and LCGB.

In 2001, the decision to develop this sectorial training structure entails the creation of a tool adapted to the needs and ambitions of the project.

Perfectly articulate on the area of integrated skills, the IFSB covers subjects that are at the heart of the activity of the building societies: All these subjects were structured and have a clear and consistent transversal action line, namely Sustainable Development and the application of this rather progressive concept on a sector that today is identified as a major player in sustainability.

The implementation of such a sectorial training project presupposes of course the existence of a group of measures, financial and administrative, aiming at maintaining the action over time. To this end, since 2002, the companies of the construction and civil engineering sector have agreed on participating in the financing of the training measures through annual contributions in the vicinity of 0,65% of the payroll of the employed workers, paid to a fundraising organism called "Fund for Vocational Training of the Building Sector" whose function it is to receive possible subsidies from the State, the Community or others related to the organization of sectorial trainings, and to ensure the redistribution to the Training Institute for the Building Sector in order to finance the installment of planned trainings.

6.3.3. The construction sector and the continuing education

6.3.3.1. Studies by the Vocational Training Observatory (Source : FORMABREF déc. 2012, Observatoire de la formation)

The following INFPC data result from vocational training in companies co-financing requests and are based on companies that hand in a co-financing file, whatever their size. These figures help to form a clear image of the training practices in enterprises.

Training providing companies : Companies that have offered a continuing vocational training to their employees.

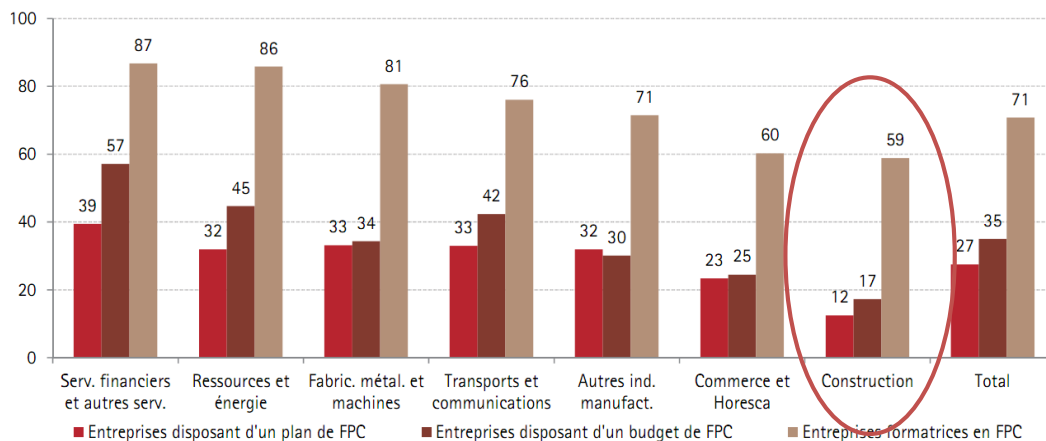
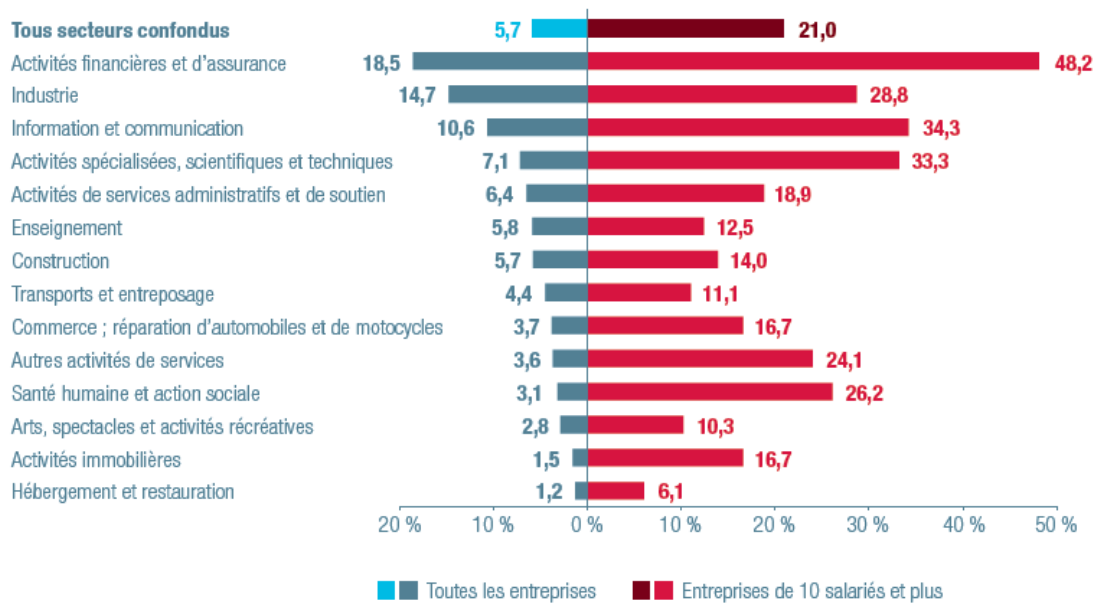


Chart 5:Percentage of the companies having an FPC plan (Continuing Vocational Training Plan), disposing of an FPC budget, offering FPCs, per sector, 2010

The percentage of companies that declare themselves as providing trainings represents 59% of all the companies of the construction sector, this sector the last in ranking.

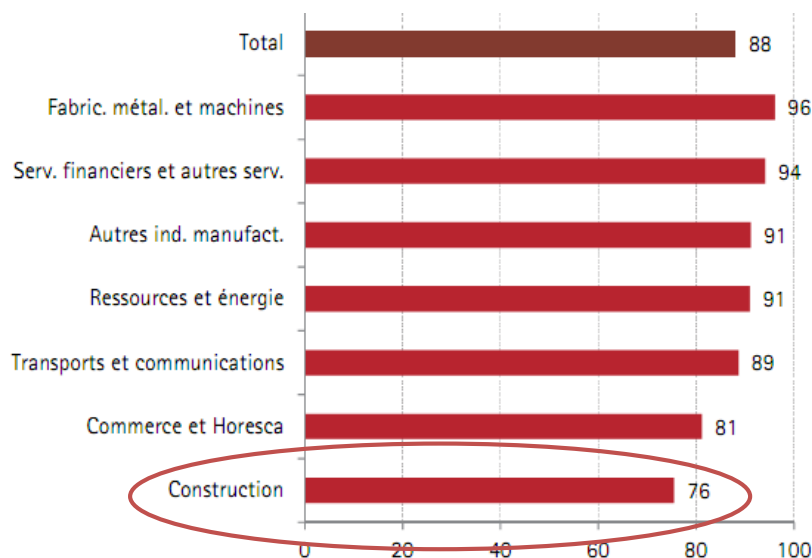


Graphic: Percentage of Luxembourgish companies entering a co-financing request, 2010

The percentage of companies from the construction sector that request public co-financing for their trainings is 5,7% of all the enterprises in the building sector (all sizes confounded) and 14% if we take into account only the companies employing 10 or more people in this sector.

In 2010, 135 companies of the construction sector filed in a co-financing request, 7% of very small size, 39% middle-sized and 10% large size.

The part of the wage-earners employed by a training providing company over all employees



Theoretical percentage of employees with access to the FPC – 2010

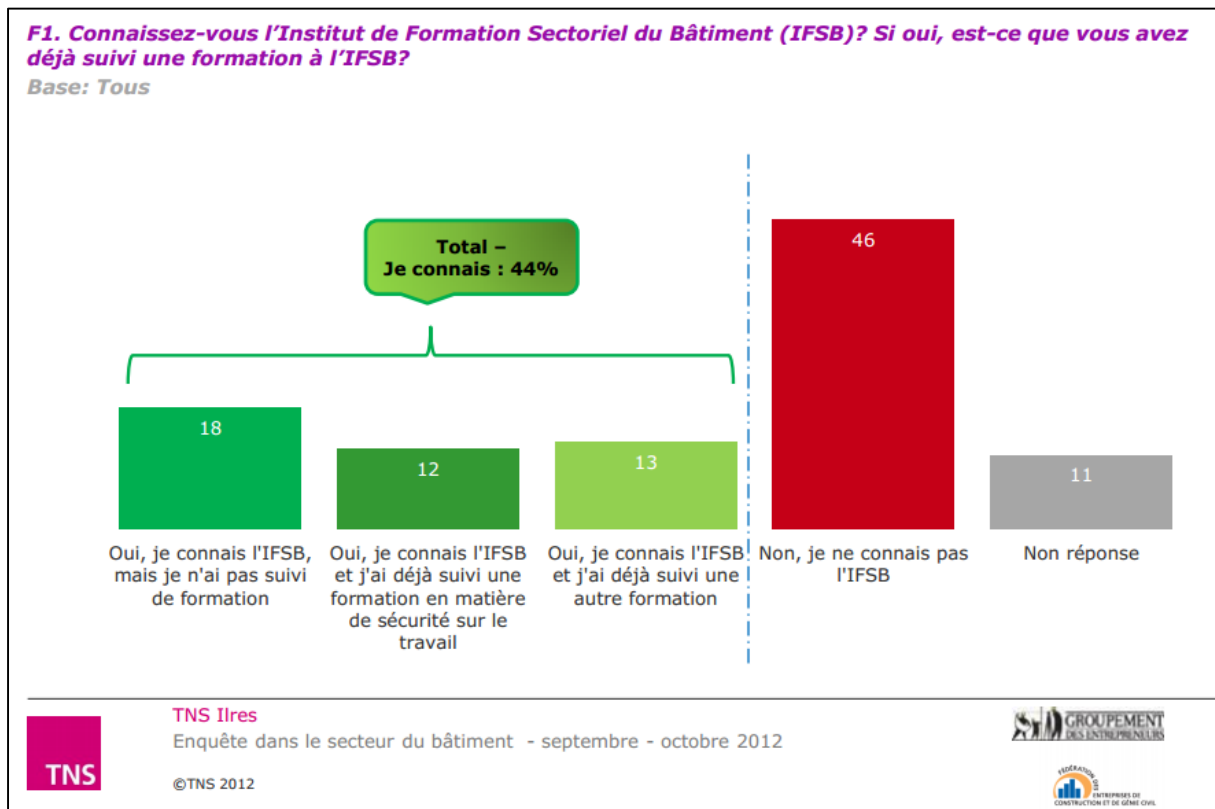
The companies of the sector providing training possibilities regroup 76% of the employees of the sector. In other words, 76% of the employees of the construction sector theoretically had access to vocational training in 2010.

Interpreting the data from the co-financing requests, 31% of the employees of the construction sectors work in a company that has filed a co-financing request (i.e. 31% of the employees are potentially concerned by the FPC legislation). In 2011, the percentage was 28,7%.

We notice that the training co-financing system is a beneficial factor for the companies but not all the companies seem to be necessarily aware of this beneficial quality, do not use it or do not offer continuing vocational training at all for their employees.

6.3.3.2. ILRES studies (Survey of the construction sector 2012)

A satisfaction study in the Luxembourg construction sector has been made from 17th September to 2nd October 2012 by TNS Ilres for the “Group of Entrepreneurs” and the “Federation for Building and Civil Engineering Companies”. The results relating to vocational training are the following:

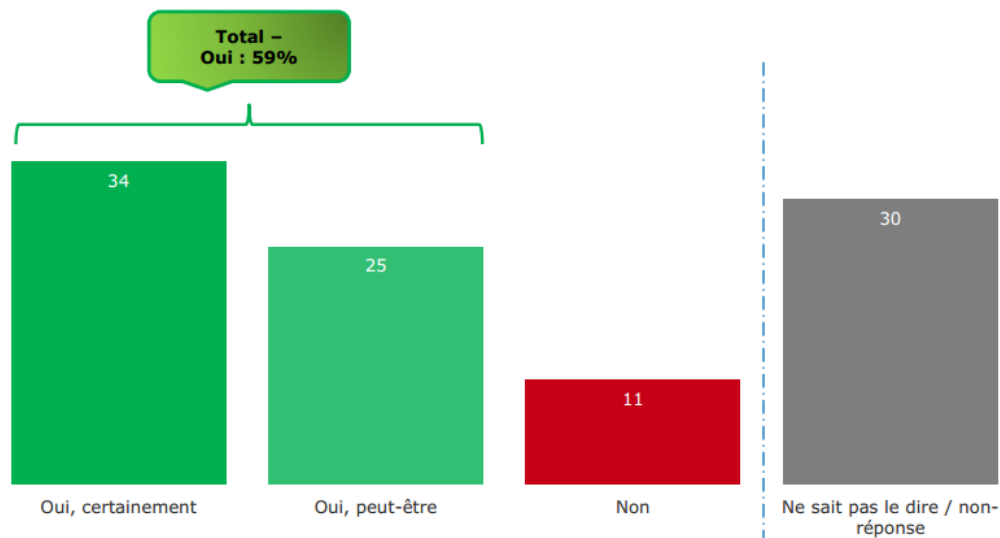


Graphic: IFSB knowledge of the workers (Source TNS ILRES)

Souhait de suivre une (autre) formation à l'IFSB ou ailleurs

F3. Souhaiteriez-vous suivre une (autre) formation à l'IFSB ou ailleurs?

Base: Tous



TNS Ilres
Enquête dans le secteur du bâtiment - septembre - octobre 2012

©TNS 2012



35

Graphic: Workers' training wish/need (Source TNS ILRES)

This study shows that despite the IFSB's existence for 11 years now and despite the communication that is regularly made, at least 46% of the employees do not know the Training Institute for the Construction Sector. This is an important fact, since the employee can actively request vocational training in order to improve his/her skills, which also means that 46% of the employees do not have vocational training access. We also note that at least 59% of the operating staff would acquiesce to follow vocational training and want to improve their knowledge and skills.

6.3.4. Existing initiatives for non-qualified workers

6.3.4.1. *The FIT4 Civil Engineering project*

The Fit4 Civil Engineering project is co-financed by the European Social Fund (from 2011-2013)

Aiming for a better employment of the filed job-seekers from the construction sector, the Fit4 Civil Engineering program's goal is to organize a system of accreditation of acquired skills and the establishment of specific trainings defined together with the sector.

The Fit4 Civil Engineering program is seen through by the Ministry for Labor and Employment in close cooperation with the sector itself represented by the CDEC and the IFSB. This partnership homes on giving a certain dynamic and optimizing the employability and the professional reintegration of job-seekers into the construction sector.

The project is made up of 3 phases:

- Evaluation of the job-seekers during three days via the elaboration of a vocational skills assessment by the Training Institute for the Construction Sector according to a well-established methodology. It helps to inform the vocational advisor on the qualifications of the job-seeker and the resulting chances of a reintegration into the sector.
- Training, if necessary, so as to reach a higher qualification
- Practical training internship in a company allowing the job-seeker to improve their chances of being employed in the leading sector of the labor market

This approach allows for a better understanding and evaluation of the real qualifications of the job-seeker thus making it easier and faster to find an adequate employment adapted to their skills and know-how.

221 job-seekers have so far, and for three years now, been evaluated by the IFSB in the context of the FIT4 Civil Engineering project.

6.4. Energy-efficiency and sustainable energies in the existing continuing vocational training (curriculum and statistics)

6.4.1. Continuing vocational trainings offered by the Chamber of Crafts

In 2001, the Chamber of Crafts developed a certifying vocational training cycle called “Energie für d’Zukunft” with the aim of training the construction sector artisans. Since 2012, the cycle has evolved towards a label “Energie für d’Zukunft+” which is a vocational training cycle wanting to instruct the active building staff regarding the new energy standards.

The centerpiece of this cycle is the “Certified Passive Housing Artisan”. This label can be obtained by any employee of a company filed at the Chamber of Crafts having participated in the “Certified Passive Housing Artisan” training and passed the final international test. It is a training focusing on practical exercises that transport technical knowledge in theory and practice to the artisan company managers and their employees that will help them in the construction and restoration of high energy performance buildings. Perfect coordination and a good collaboration of the different trades are the key features for the construction of passive housing.

The training has a common core whose content will be deepened via specific trade-related trainings: the module “construction enclosure” and the module “building technique”.

The training adapted for the trades working on the construction enclosure (building shell, frontage, exterior joinery, roofing, electricity, plastering, etc.) is made up of a common part (part A) and a specific part (part B “construction enclosure”).

The complete training for the specialists of the building technique on the other hand consists of a common part (part A) and a specific part C (“building technique”).

Passing the exam means being rewarded the new label “Energie für d’Zukunft+”. The participants themselves will be attributed the label “Certified Passive Housing Mason” from the “Passivhaus Institut”.

Both labels have a time limited validation of 5 years. A prolongation can be obtained through relevant documentation of ongoing practical activities in the construction of passive housing or the energetic restoration of existing buildings with passive components.

PARTIE A : TRONC COMMUN (1 JOURNÉE)

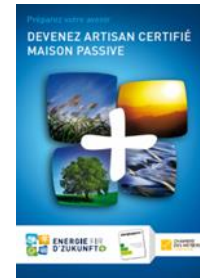
- Standards de construction
- Etanchéité à l'air
- Rentabilité
- Conviction du maître d'ouvrage
- Différentes étapes de la construction
- Interfaces entre les différents corps de métiers

PARTIE B : ENVELOPPE DU BÂTIMENT (2 JOURNÉES)

- Isolation thermique
- Ponts thermiques
- Fenêtres
- Assainissement énergétique
- Principes de base de la technique du bâtiment
- Exercices pratiques

PARTIE C : TECHNIQUE DU BÂTIMENT (2 JOURNÉES)

- Ventilation
- Ventilation des bâtiments existants
- Chauffage
- Principes de base de l'enveloppe du bâtiment
- Exercices pratiques



28

The following chart lists the number of companies having gained the label “Energie fir d’Zukunft(+)”.

Years	
2001-2004	97
2008/2009	63
2009/2010	54
2010/2011	38
2011/2012	23
TOTAL	275

²⁸ Part A: Common core (1 day)

- Construction standards
- Air-tightness
- Cost-effectiveness
- Conviction of the builder-owner
- The different stages of construction
- Interface between the different trades

Part C: Building technique (2 days)

- Ventilation
- Ventilation of existing buildings
- Heating
- Basic principles of the building technique
- Practical exercises

Part B: Construction enclosure (2 days)

- Thermal insulation
- Thermal bridges
- Windows
- Energetic restoration
- Basic principles of the construction enclosure
- Practical exercises

The training cycle « Energie fir d'Zukunft » had been suspended from 2005 to 2007. In 2012, 18 companies have been awarded the label “Energie fir d'Zukunft+”.

This training cycle will be completed by a single day training per module for the operational staff instructing them on the technical specificities of passive housing and is meant for the following trades:

- Building shell
- Wood construction fitter
- Exterior joinery
- Special techniques: ventilation, heating, plumbing
- Electricians
- Plasterers/renderers

The following energy-efficiency-oriented vocational trainings are also organized by the Chamber of Crafts:

- Roofing insulation (1 day)
- Fitting solar thermal installments according to the European Directive CE 2009/28 (2 days)

From 2014 on, the successful attendance of this vocational training will be mandatory in order to obtain a master's degree as heating/plumbing installer.

- Fitting photovoltaic installments according to the European Directive CE 2009/28 (2 days)

From 2014 on, the successful attendance of this vocational training will be mandatory in order to obtain a master's degree as electrician.

- Installment of heat pumps according to the European Directive CE 2009/28 (2 days)

From 2014 on, the successful attendance of this vocational training will be mandatory in order to obtain a master's degree as heating-plumbing installer or electrician.

- Installment of biomass-based boilers according to the European Directive CE 2009/28 (3 days)

From 2014 on, the successful attendance of this vocational training will be mandatory in order to obtain a master's degree as heating-plumbing installer

- Conception of gas systems
- Gas combustion technique
- ...

Année	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Performance énergétique des bâtiments d'habitation						69	287				
Maisons à basse énergie et maison passives, Visite de maisons à basse énergie et maisons passives	18	12					40				
Tronc commun, Généralités	75	40					40	101	77	42	22
Energie solaire thermique active / Solaranlagen	24	19					38	52	16	16	
Photovoltaikanlagen	36	32					27	42	19		
Die Wärmepumpe	28	11					35	55	17		
Cogénération	23	10									
La ventilation contrôlée et la construction étanche							32	65	41	36	
Die Biomasse	13						37		20		
Isolation thermique des immeubles	27	12									
Maisons à basse énergie - Construction	27	11					30	37	41		27
Maisons à basse énergie - Technique du bâtiment	32	12					32	37	34		18
Utilisation rationnelle de l'énergie			12								
Altbausanierung							36	30	43	27	
Programme de calcul du certificat de performance énergétique								39	22		
Chaudière à condensation et équilibrage hydraulique	25	12						33	27	18	
Energie fir d'Zukunft: Passivhaus - Gebäudehülle										31	15
Energie fir d'Zukunft: Passivhaus - Gebäudetechnik										21	11
Energie fir d'Zukunft: Innenisolation										43	22
Energie fir d'Zukunft: Gesunde Gebäude durch baubiologisches Bauen										25	
Energie fir d'Zukunft: Gasmotor-BHKW für Einfamilienhäuser										14	

Energie fir d'Zukunft: Zeolith-Wärmepumpe										11	
Energie fir d'Zukunft: L'équilibrage hydraulique d'une installation de chauffage											
Energie fir d'Zukunft: La ventilation contrôlée et la construction étanche											
Bâtiments sains et constructions biologiques											28
Prüfung Gebäudehülle											16
Prüfung Haustechnik											10
TOTAL	328	171	12			69	634	491	357	284	169

Chart above: The number of participants per year of the “Energie” trainings by the Chamber of Crafts

6.4.2. The continuing vocational trainings offered by the Training Institute for the Building Sector

The different classification levels for the employed workers (as depicted in the collective agreement of the construction sector employees) are structured as follows:

> **Bd:** Inexperienced non-qualified worker. This is the basic level, training is organized in a general polyvalent manner. Primarily directed towards non-qualified individuals performing basic tasks, the training cycle Bd leads to the acquisition of basic knowledge and skills in the BTP (main construction) trades. In this model, the Bd level is a prerequisite for the passage to a higher level (B1)

The worker having passed the competence test in the context of the IFSB S.A. training may enter the BD training with the IFSB S.A. in order to gain the BD qualification. Once the exam is passed, the worker can advance to a BD qualification and the employer has to pay him/her accordingly.

(160 training hours)

> **B1:** Worker. Task description :

- Prevalent works in the chosen specialty according to general instructions ;
- Technical knowledge of his/her work and compliance with professional regulations;
- Awareness of the safety regulations of the job;
- Regular use of the technical equipment related to the work and basic knowledge of their functioning;
- Awareness of the safety rules regarding the use of the technical equipment.

The B1 training starts off with an introduction to the specifics linked to the work in the main construction trades. This level distinguishes between the construction part and part related to the Public Works and counts as a prerequisite for the access to the B2 level. Its goal is to develop specific skills in the main construction trades to such extent that the participants should be capable of carrying out their tasks autonomously in any professional situation.

(160 hours of training)

After 6 years at most in the BD qualification, the Bd worker having successfully passed the skills test may choose to have a training at the IFSB S.A. in order to rise to a B1 level. Having successfully taken the training and passed the test, the worker will count as a B1 worker and thus the employer needs to pay him the corresponding wage.

> **B2:** Worker with a CATP at the end of an apprenticeship; Worker with CCM having spent five years on B1 level. Task description:

- Accomplishing the tasks related to the job according to general instructions;
- Knowledge of the material to be used;
- Good professional knowledge;

- Awareness of the safety regulations;
- Regular use of the technical equipment needed to perform the tasks linked to the trade, including knowledge on the functioning and controlling of the equipment;
- Profound knowledge of the safety rules relative to the use of the equipment

The B2 training level has the ambition to develop in-depth competences in different specific main construction trades (form worker, steel fixer, paver, etc.). In accordance with this training structure, this level of achievement is a prerequisite for the next level B3 (160 hours of training)

After 6 years at most on a B1 level, the B1 worker having successfully passed a skills test may take a vocational training at the IFSB S.A. in order to arrive at a B2 qualification. The successful completion of the training including the test will lead the worker to a B2 qualification which the employer will have to pay a correspondently.

- **B3:** Worker with a CATP having spent 8 years on a B2 level. This level corresponds to a general versatile education level but implies rather high responsibilities. Description of the tasks:
 - Execution of delicate and complex tasks of the trade according to detailed plans or general instructions;
 - Blueprint-reading skills permitting him/her to lead a small team up to 4 workers;
 - Good knowledge of the components to be used;
 - Very good technical and professional knowledge;
 - Awareness of the safety regulations;
 - Regular use of technical equipment for delicate tasks possibly implying blueprint-reading;
 - Knowledge of the functioning of the equipment as well as the regular control of it;
 - Ability to detect an equipment failure and to carry out small repairs not entering the competence field of a mechanic;
 - Knowledge of the relevant safety regulations as to the handling of the equipment.

After 8 years at most as a B2, the worker having successfully passed a competence test and having the acquiescence of the company management can take a vocational training at the IFSB S.A. in order to rise to a B3 qualification (120 training hours).

If successful, the worker will advance, according to the needs of the company, to a B3 inside the company. Provided the company has no such needs at that moment, the worker will have the possibility to valorize his certificate on the labor market or to wait for a free B3 vacancy inside the company.

> **G1:** Worker in charge of the organization, surveillance and control of a team of workers. Description of the tasks:

- Mastering of the trades his/her team his composed of;
- Editing of reports and accident declarations;

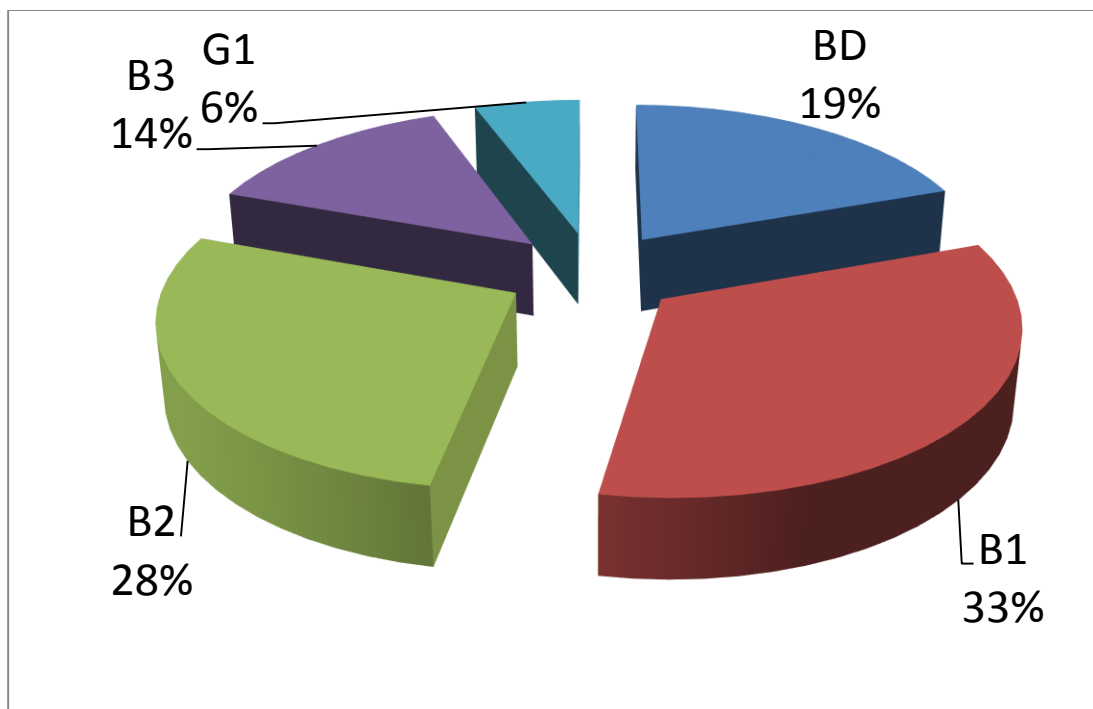
- Perfect blueprint-reading skills and application of the plans;
- Responsible for the proper execution of the works;
- Knowledge of the safety regulations and supervision the adherence to them;

(240 hours of training)

In 2009, the energy-efficiency of buildings was integrated into the vocational training curricula for workers.

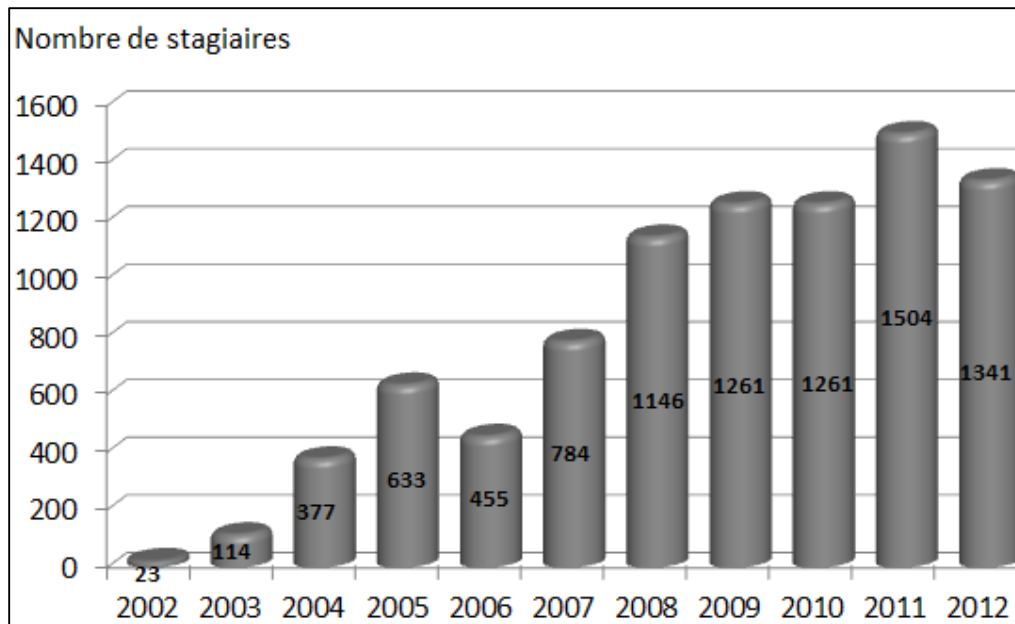
On average, 5% of the training hours are devoted to subjects related to the energy-efficiency of buildings (thermal bridges, air-tightness, insulation, insulated masonry...)

The graphic below shows the distribution related to the qualification level of all the workers having taken a vocational training for masonry at the IFSB from 2002 to 2012. We can observe that 80% belong to the categories Bd, B1 and B2, the remaining being the B3 and G1 that lead a team of workers on the construction sites.

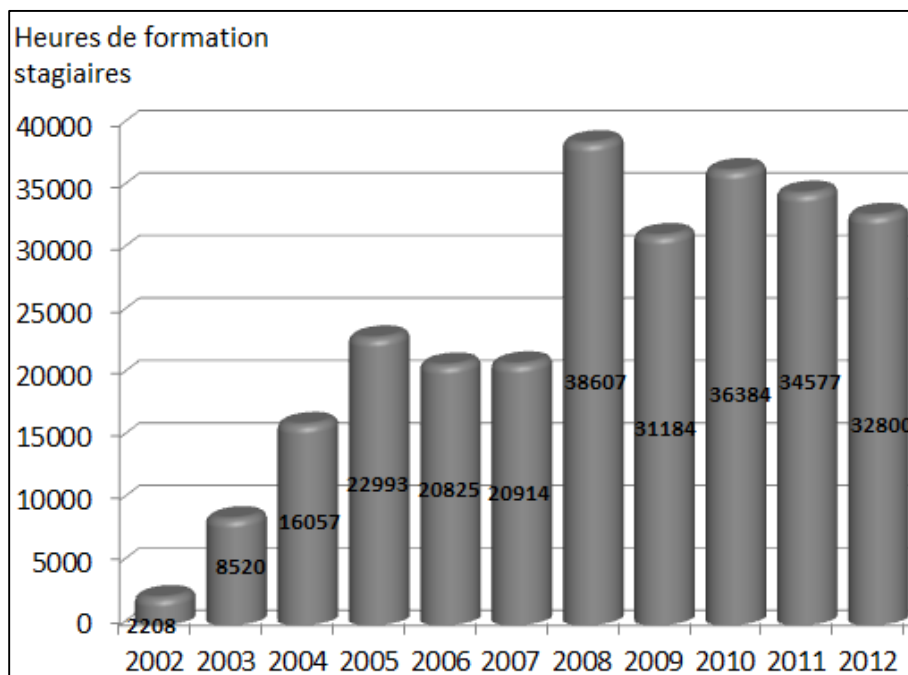


Distribution of the masonry interns according to their qualification level

The chart below depicts the number of interns having undergone a training at the IFSB



The IFSB training for workers of the construction sector (in terms of the number of trained people)



Total number of IFSB training hours by workers of the construction sector

We see that in 10 years' time, the implemented training strategy for the construction sector has born fruits in terms of a constant progression of the number of training hours for the workers of the construction sector. Next to 10% of the operational staff regularly undergo IFSB trainings.

Since 2010 a specific offer on vocational trainings on green jobs has been developed for the workers of the building sector. The following trainings have been proposed:

- For all trades: good practices for passive and low energy construction sites (1 day): basic rules that guarantee the quality of the construction enclosure (air-tightness)
- Roofing insulation (2 days): How to insulate a roof, this training includes the carrying into practice of roofing insulation on educational models
- Wall insulation (2 days): How to insulate walls, this training includes the carrying into practice of wall insulation on educational models
- Solar thermal installer (4 days): solar thermal installment techniques
- Solar panel fitter (1 day)
- Wood frame structure assembler (10 days)
- Implementation of insulated masonry (5 days)
- Exterior joinery fitter (3 days)

At that time, few companies had an actual interest in sending their operating staff to this kind of training highly linked to the energetic performance of buildings. The IFSB being involved in the building sector but not in the construction finishing sector, the companies of the latter sector did not spontaneously send their workers to a training to the Institute. That is why the IFSB and the Chamber of Crafts then started to work together and thus developed vocational trainings for roofing insulation and specific trainings on solar thermal energy, photovoltaic, heat pumps. The Chamber of Crafts was in charge of the coordination as well as the communication of these trainings.

At the moment, we notice that the application of the new regulation on the energetic performance of buildings has led to a constant rise in the number of requests for trainings related to the construction enclosure as well as on energetic systems.

6.5. The initiatives and programs of the continuing vocational training supported by European programs

- **IFSB.** The FORMIDAD project (co-financed by the European Social Fund 2011-2013) aims at elaborating and adapting a set of courses that assimilate notions such as Sustainable Construction and Energy Performance of Buildings. Taking into account the requirements in workmanship quality inalienable for an immaculate completion of highly energy-efficient buildings as well as the adaptation of the technical and safety-related skills of the employee confronted with new material, components and modi operandi.

The creation of new modules labeled “Green Job” developed in particular for interns on state-of-the-art passive construction and low energy techniques (solar panel fitter, insulator,

insulted masonry, ...) These “Green Job” trainings are accessible to job-seekers and young school drop-outs.

- **INFPC** Animation and development of the internet portal lifelong-learning.lu (2013-2015)
- **ADEM** Fit4 Civil Engineering (2011-2013).

6.6. Conclusion

In general, we can observe that the vocational training systems (initial and continuing) are well structured and their offer is of importance.

Also, certain elements linked to the energetic performance of buildings are integrated into the offer.

As mentioned before, we see that the vocational training offer for operational staff of the construction sector is quite well structured and extensive. Moreover, the national environment is in favor of subsidizing the training costs.

Some references:

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7. Skills and required qualifications

7.1. Labour needs

In Chapter 5, it was reported that 6,500 jobs could be created in the field of renewable energy, high energy efficiency construction and energy-efficient renovations by 2020.

It was further explained that the construction sector recorded a good 20% of seniors aged 50 and above in 2011. Starting from a total of 50,526 employees and estimating that the rate of seniors in 2012 was the same as the previous year, we can then estimate that about 8,000 construction workers will retire by 2020.

The theoretical total labour needs in the field of sustainable construction is therefore 14,500 people by 2020 which is +/- 1800 people per year.

Between 2007 and 2012, approximately 1,500 jobs per year were created on average in this sector, a figure that confirms the labour needs calculated by 1,800 people.

Success in apprenticeship final examination in the construction trades					
Trade	2008	2009	2010	2011	2012
Builder	13	9	11	12	5
Heating, ventilation and air conditioning installer	37	39	29	34	31
Plumber	5	8	10	12	7
Electrician	43	40	44	34	54
Joiner	7	8	10	11	11
Locksmith	10	6	5	10	14
Roofer	3	11	6	12	5
Tinsmith- zinc roofer	1	1	3	2	1
Carpenter	2	2	5	5	6
Plasterer-façade specialist	0	5	3	1	1
Painter - Decorator	18	28	19	17	24
Glazier, mirror maker	0	0	0	2	0
TOTAL	139	157	145	152	159

By analysing the current success rate in final apprenticeship examination, we note that only a meagre 150 people on average per year enter the labour market after their initial training. Also the number of master technician certificates awarded is hardly encouraging. About 60 people receive their diplomas on average per year.

Master technician certificates

Trade	2008	2009	2010	2011	2012
Construction Contractor	3	2	9	6	9
Heating-sanitary installer	8	7	4	8	15
Electrician	27	20	27	18	25
Joiner-cabinetmaker	4	3	5	9	4
Metal constructions entrepreneur	2	6	4	0	0
Roofer	1	1	4	7	1
Tinsmith- zinc roofer	2	2	2	1	1
Carpenter	1	6	0	3	1
Plasterer-façade specialist	2	4	2	3	1
Painter - Decorator	3	4	1	2	9
Glazier, mirror maker	0	2	1	0	2
TOTAL	53	57	59	57	68

In December 2012, 3,617 residents of the professional sector of craftsmen, labourers (precision, watchmaking, mechanics, electricity, wood and building) were looking for work with 2267 of them, representing 71%, having a low level of education.

Given the labour needs on the one hand and the shortage of qualified manpower on the other hand, these people have great potential and the employability of the target audience should be increased through a diagnosis followed by special developed trainings.

An important element in the whole discussion of shortage of qualified manpower is the continued employment of salaried workers. People should be prevented at all costs from leaving the construction sector to find work in other industries. A satisfaction survey conducted in the construction sector in 2012 by TNS Ilres for the Groupement des Entrepreneurs (Contractors Group) and the Fédération des Entreprises de Construction et de Génie Civil (Federation of Construction and Civil Engineering Employers) showed that 82% of employees are satisfied with their current employment situation. Even 87% indicate they want to recommend to friends and acquaintances to come and work in their present company and 59% say they have confidence in the future of the company.

From these results we can say that the risk of leaving the building sector to other areas of activity, is however quite low.

7.2. Number of workers to be trained

As explained it is very difficult to know the skill level of workers in the construction sector due to the very high number of foreigners. On construction sites only very few persons come from the Luxembourg education system. A majority come from the school system of neighbouring countries and many of them come from the southern and eastern countries. It is almost

impossible to trace the schooling career of all these people, who often before arriving in the country were not even in the field of construction

The consortium has decided to conduct a site survey and interview a representative sample of team leaders to reflect the reality on the ground.

179 team leaders in the fields of construction, insulation, and exterior joinery as well as electricians, heating and sanitary installers, roofers-plasterers, tinsmiths and façade specialists were interviewed.

One of the survey results show that 60% of team leaders say that they have been trained in the last two years. Amongst these people, half have been trained in the field of energy efficiency or renewable energy. Plasterers-façade specialists and heating engineers are the best trained workers in these fields. Team leaders of the construction trade (builders) are those who have had the least trainings (see chart below).

Most of the team leaders interviewed however see the need for trainings in their professional careers. Between 40% and 50% of them say that trainings especially in the areas of renewable energy, passive houses, smart homes and energy-efficient renovations would help them advance their careers.

An alarming figure of 20% of builders say no training would help them advance their careers.

Another surprising figure is that 22% of team leaders would like to take courses in Luxembourg, this figure is even higher for persons who work across the borders (30%).

Based on the figures mentioned in section 5.3, and the survey results on the training of workers over the past two years, training needs could therefore be calculated in the various construction trades. The results are shown in the table below.

Trade	Number of workers to be trained by 2020
Construction (Builder)	4500 – 5000
Carpenter - Roofer - Tinsmith	1200 – 1500
Heating and sanitary	1800 – 2000
Electrician	3000 – 3300
Plasterer-façade specialist	1500 – 1700
Exterior joinery	800 – 1000

7.3. Trainings needed

The increasing amount of skills to be perfected is a real challenge for tomorrow's craftsmen who are active in the field of renewable energy and energy performance.

Beyond his initial knowledge, he must:

- Continually add new techniques, new products and new solutions to his offer
- Know and comply with ever-changing regulations
- Innovate in all areas
- Work in collaboration with other companies

Craftsmen should be open to the breaking down of divides between the different trades and must incorporate the technical challenges of other trades into their approach. Construction companies should be able to market all complementary and cross-cutting "work solutions". Some companies will in turn be respectively competing partners.

In order to understand all what concerns energy efficiency and renewable energy, it is necessary to define the exact content of these trainings.

The survey results clearly show that there is a great need for training in general knowledge of sustainable construction. In this context it will be very important to explain to all trades that good coordination and good cooperation are of paramount importance.

The team leaders seem particularly not to understand the terms: "Low Energy", "passive homes" and "Energy-efficient renovations". In addition, there is a great knowledge vacuum on the importance and usefulness of the air tightness of the building envelope.

The following trades are responsible for air tightness and thermal insulation:

- Builders
 - Plasterers- façade specialists
 - Exterior joinery
 - Carpenters, roofers-tinsmiths
-
- These trades should develop skills needed to achieve the quality of implementation required for air tightness and performance of the envelope by being trained in new techniques and new equipment for modern homes. Furthermore, they must have basic notions in thermography and BlowerDoor Test and know the thermal performance of walls.
 - The survey also showed that heating and sanitary installers are familiar enough with the solar panel technology and biomass heaters but are not knowledgeable about heat pumps and ventilation systems.

The following trades should have general notions on thermal envelope and air tightness to avoid damaging them during their work:

- Heating - sanitary installer
- Electricians
- Finishers

For heating-sanitary installers, trainings on heat pumps technologies, ventilation systems and the regulation of these modern systems should be envisaged. The electrician should be trained in home automation and smart metering

7.4. Monitoring

The Training Observatory initiated by the National Institute for the Development of Continuing Vocational Training (INFPC), was created in 2009 to provide information on the evolution of training needs to counselling services and schools. Its mission is to collect data on the career monitoring of young graduates and on continuing trainings of persons ready to prepare skills profiles expected in the labour market.

The setting up of a training observatory in Luxembourg is also a response to the wish of the government and social partners to create a measuring tool to assess the effectiveness of initial and continuing training policies for the economic world. Its specific missions consist, among others, of identifying, analysing and disseminating data and training recommendations.

8. Barriers

a) A major problem is the image of skilled trades in general in Luxembourg, which does not reflect reality. The construction sector is tainted by the same poor image and is really struggling to attract new entrants. These trades often find it difficult to shake off their negative image and are dismissed as “socially of limited value”, “unpleasant”, “poorly paid”, “too hard”, etc.

Unfortunately these negative perceptions persist, not only amongst young people but also their parents and even teachers.

It is clear that such stereotypes do not in any way reflect the real situation in the construction trades, which these days offer real career opportunities in a high-tech “green” profession.

b) Another major problem is that Luxembourg has to some extent lost control over the qualification of workers in the skilled trades and naturally in the construction sector as well. Fewer and fewer workers (10%) have gone through the national education system. Not all foreign resident workers, representing 42% of employment in the construction sector, have been through the education system in Luxembourg. Almost half of the workers concerned come from the Greater Region. It is therefore becoming increasingly difficult to be able to determine what qualifications workers have, given that the country’s building sites employ people from numerous nationalities who were educated in a variety of European systems.

c) In spite of the fact that skilled trades in general and the construction sector in particular is a significant source of job and business creation and plays an important role in recruiting and training workers with no or few qualifications, its economic influence far outweighs its political influence. The result is that this very dynamic sector is increasingly hindered by:

- Increasingly complex and onerous administrative burdens
- A higher increase in salary costs than in neighbouring countries

- A shortage of land at affordable prices in business and industrial areas

d) The sustainable construction of the future is not simply a passing trend but a necessary imperative and also a lever for economic growth, an investment in the building stock and a means of improving housing and living conditions. This new way of building requires a change in attitude at all levels, not only amongst individuals with construction and renovation plans in mind but also public-sector contracting authorities, designers, architects and, of course, small building firms, based on a comprehensive vision and approach that should lead to tangible results.

The fundamental question is knowing what can be done to change attitudes, so that it is no longer a small group of committed individuals or only the well-off who can opt for sustainable construction and renovation. Whilst the subject is certainly uppermost in people's minds, it is now time to think about the next step: enabling everyone to build and renovate sustainably.

e) There is currently no single forum for bringing together energy consultants, architects, experts, competent authorities and skilled firms, although it is accepted that both building passive houses and energy-optimisation work requires cooperative working across a range of trades. Given this situation, the forum could set up working groups to deal with specific subjects, the aim being to define methods and tools for collaborative working, for example partnership agreements and documents for coordinating works and monitoring movements in the construction process.

f) The construction market suffers from a shortage of skilled workers. As explained previously, the number of young people qualified in construction trades falls far short of the number of people leaving the sector, on top of the specific context of the labour market in Luxembourg. The market is open to workers in neighbouring countries, who are attracted by the very advantageous salaries in Luxembourg compared with those available in other countries, and should still allow firms based in Luxembourg to access a diverse range of skilled workers and select those who best meet their needs. It is becoming increasingly difficult, however, for firms in Luxembourg to recruit from neighbouring countries because of a limited pool of labour from the Greater Region, despite an enlargement of recruitment areas.

g) As indicated in chapter 3, the average size of a construction firm in 2011 was around 16 people, whilst approximately 45% of firms in the construction sector currently have between one and nine employees. These firms often lack the necessary financial and human resources and cannot spare their employees whilst they attend training courses, particularly those lasting several days.

h) As mentioned in chapter 6, workers in construction firms may themselves seek training. A survey carried out in October 2012 shows that 46% of workers in the construction sector are not familiar with the Institut de Formation Sectoriel du Bâtiment and are therefore unable to take advantage of the courses on offer. Another somewhat surprising figure is that 11% of workers have no desire to take a course at the IFSB or elsewhere. This is surely an important element to address in the road map.

- i) The result of technical changes in energy-efficient construction is that more and more buildings are being constructed from timber, a renewable raw material that is sustainably produced. This sector is therefore currently experiencing unprecedented growth. Luxembourg, however, has no tradition of timber construction, which is a significant obstacle in achieving energy-efficiency objectives.

9. Conclusion

In compliance with the European directive 2006/32/CE of 5th April 2006 regarding energy efficiency and energy services, the Grand Duchy of Luxembourg has developed two courses of action that transcribe these objectives on a national level. The first of these projects, presented in March 2007, is called LUXRES (designation of the potential and development of strategies for an increased use of renewable energies in Luxembourg), followed in May 2011 by the “Paquet Climat” and, in September 2011, by the second national course of action titled “NEEAP” (national energy efficiency plan). Thus, from 2017 onwards, all new constructions in Luxembourg must fulfil AAA energy class requirements. “PRIME House”, the new system of State-funded financial aids implemented in January 2013, aims at further encouraging energy-efficient renovation and the implementation of renewable energies.

As of 1st February 2011, Luxembourg counted 130,091 residential buildings, of which no less than 108,682 single family homes. This corresponds to an impressive ratio of 83.5%. However, these past years, less and less single-family homes have been built. Consequently, their share among completed housing has decreased at a regular level. Compared to single-family homes, apartments are nowadays experiencing a growth rate. Whereas they only represent 12.5% of all existing residential buildings, they represent 54% of all recently completed housing. The largest part (42%) of housings were built before 1960 and one can state with certainty that they belong to the energy class I, which represents the lowest possible energy efficiency class. Since 2001, only 7% of all new single-family homes constructed, were low-energy or passive houses.

The high housing demand is particularly attributable to the significant population increase, mainly achieved through immigration. For some 20 years, the Grand Duchy of Luxembourg experiences a significant demographic boom, provoking an a more and more substantial imbalance between housing offer and demand, which is emphasised even more through the decrease of the average household size. In the period between 1990 and 2009 alone, the population has grown by almost 30%. And even since the beginning of the economic crisis in 2009, Luxembourg’s population has increased by another 18.300 inhabitants (+3.71%), totalling 511,800 citizens as of 1st January 2011. The consequence of these facts is the increase by 82,000 households until 2030, which corresponds to +/- 4,000 accommodations per year.

Between 1970 and 2012, the evolution of jobs in the construction sector has also been extraordinary, i.e. employment increased by 39,904 jobs, which are almost 5 times as many as in 1970. The construction sector by itself represents roughly 68% of the total skilled trade

workforce in Luxembourg. In 2012, 40,413 of the construction sector's 50,526 employees were blue collar labourers working on building sites. Mostly male (>90%), the workforce employed in 2012 consisted only of 10% Luxembourgish residents and 48% cross-border workers. The statistics also reveal that the sector also significantly stimulates integration into society since, in 2012, 42% of all employees are resident immigrant workers. This high ratio of foreigners in the construction sector is unparalleled in the European level. Among these foreigners, most are Portuguese (35%), whereas 21% are French, mostly from the Greater Region. One can also note that over the past years, more and more Germans, mostly skilled workers, integrate the national construction sector.

The increase of cross-border workers shows that the skilled trade has trouble finding the needed qualified workforce on Luxembourg's job market. This market, open to workers from neighbouring countries who are enticed by Luxembourg's comparatively high salaries, has always given companies established in Luxembourg access to a qualified and diverse labour force and a choice of workers best fitting their needs. However, it is becoming more and more difficult for Luxembourgish companies to recruit from the neighbouring countries because of a limited number of skilled workers in the Greater Region, despite an expansion of the recruitment zone. Thus, the construction sector suffers from a shortage of skilled workers.

Today, some 900 companies with 20,000 jobs are active in the areas of renewable energy, high energy-efficient construction and energy-efficient renovation. Based on the potentials described in chapter 5, 6,500 new could be created in this sector until 2020.

In order to achieve all the goals described above, a sufficient number of skilled tradesmen and construction workers need to be trained in the areas of energy efficiency and renewable energies. Part of these skills is already taught at the basic apprenticeship training, both in theory and in practice. During the master craftsman ("brevet de maîtrise") training, the candidates broaden and deepen their technical know-how on the energy efficiency of buildings. Hence, the training demands set by the directive 2009/28/CE regarding renewable energies have quickly been integrated into the "brevet de maîtrise" programmes for heating fitters and electricians, whose worth has thus been increased.

A problem for the construction sector is that Luxembourg has lost its stranglehold on the qualification of employees. Less and less employees (10%) go through the Luxembourg education system. Resident foreign employees, representing 42% of the construction sector's workforce, have not gone through the national education system.

The results of a study regarding the level of competence on construction sites demonstrate that there is a great need of training relating to the general knowledge of high energy-efficient constructions and renewable energies. Moreover, there is a great lack of knowledge regarding the importance and the usefulness of the building envelope's airtightness.

Masons, plasterers-façade specialists, joiners and carpenters need to be trained in the areas of airtightness and envelope performance. Furthermore, they need to acquire notions of thermography and the Blower Door Test and know the thermal performances of walls.

The study has also shown that heating and sanitation fitters master solar panel technology and biomass heaters rather well, but have a lack of knowledge related to heat pumps and ventilation systems.

Moreover, heating and sanitation fitters, electricians and finishers need to have general knowledge of thermal envelopes and air tightness to avoid damaging them during their work.

Concerning training methods for construction workers, one needs to take into account the particularities of this market in Luxembourg, i.e.:

- Multilingualism
- The large number of non-qualified workers
- The large number of workers coming from different education systems

Hence, these training sessions will need to take place on the construction sites with visual aids (pictures, videos, etc.) and in the languages that are most used in the sector. These elements will need to be developed when establishing the “road map”.

Sustainable construction of the future is not a fad, but an imperative necessity and also a lever for economic growth, an investment in the preservation of the housing stock and an improvement of the habitat and the living conditions. This new construction method requires a change of attitude amongst individuals with construction and renovation projects as well as contracting authorities, designers, architects and, of course, small building firms, based on a comprehensive vision and approach that should lead to tangible results. The fundamental question is how to change people’s attitudes so that it is not only a small group of believers or privileged people that opt for sustainable construction and renovation. Today, the subject is on everyone’s mind, but we need to think already about the next step: allowing everyone to build or renovate in a sustainable manner.

Obviously, companies also play a large part in this change of attitude. Companies often point to high work rates and limited time availability as the main obstacles for staff training. However, the companies should recognise the advantages of being able to offer clients solutions adapted to the challenges of sustainable construction and renewable energies. Only then will company managers be willing to enrol their employees in the necessary training programmes.

As part of this project, Luxembourg will need to develop strategies to implement this change in attitude.

10. Authors and contributors

The main authors of this publication are myenergy in its function of project manager, as well as the “Chambre des Métiers” and the IFSB (Institut de Formation Sectoriel du Bâtiment) as partners of the LuxBuild2020 consortium.

myenergy worked on the section regarding the analysis of the Grand Ducal regulations in effect and their history concerning the demands and obligations of residential and non-residential buildings. This section also contains the national courses of action and energy strategies.

Chapters 2 (Objectives and methods) and 4 (National policies and strategies to contribute to the EU 2020 energy targets in buildings) were written by myenergy. All of this information has allowed for the comprehension of the regulations in effect and the guidelines of the courses of action. The “Chambre des Métiers” has worked on chapters 3 (Characteristics of the construction sector), 5 (Construction and energy sector statistics), 7 (Analysis of workforce needs up until 2020) and 8 (Barriers). These chapters are based on the analysis of various statistics, provided in part by STATEC and gathered from in-house information at the “Chambre des Métiers”. This data concerns the construction sector, housing stock, population growth, use of renewable energies and employment in the construction and technical installation sectors.

This information has permitted to take a census of the number of residential buildings and the period of construction. Consequently, one was able to trace the renovation potential. The constant population growth has allowed for the estimation of housing needs and the potential of new constructions.

The “Chambre des Métiers” has also researched the figures representing employment in the construction sector. Thus, one was able to observe certain important points for the LuxBuild2020 project. One of the most striking observations is the aging of the employees in the construction sector. This allowed for the deduction of the figures representing the workforce needs up until 2020. Another important point is the census on worker qualification, as well as their origins. Hence, it is possible to identify the lack of know-how and to allow for the organisation of future training programmes especially developed as part of LuxBuild2020.

The IFSB has written chapter 6 (Vocational training for artisans in Luxembourg). The institute’s main task was to gather all information regarding the Luxembourg education system and the various opportunities young people have for accessing skilled trades. On the other hand, this chapter illustrates all of the basic and further professional training programmes and also contains information relating to the “certificat de capacité professionnelle”, the “diplôme d’aptitude professionnelle” and further professional training.

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12. Glossaire

A/V : Air de la surface de l'enveloppe thermique et V : Volume de cette même enveloppe. Donne la compacité d'un bâtiment

ADEM : Agence pour le développement de l'emploi

ALJ : Centres régionaux d'Action Locale pour Jeunes

An : Surface de référence énergétique

ASBL : Association Sans But Lucratif

Bd-B1-B2-B3-G1 : Niveau de qualification des ouvriers du bâtiment (gros-œuvre et travaux publics)

BTP : Bâtiment et Travaux Publics

BTS : Brevet de Technicien Supérieur

CATP : Certificat d'Aptitude Technique et Professionnelle

CCM : Certificat de Capacité Manuelle

CCP : Certificat de Capacité Professionnelle

CDEC : Conseil pour le Développement Economique de la Construction

CDM : Chambre des Métiers

CEPS Instead : centre de recherche au Grand-Duché de Luxembourg dans le domaine de la recherche en sciences sociales

CITP : Certificat d'initiation Technique et Professionnelle

CNFPC : Centre National de Formation Professionnelle Continue

COIP : Cours d'Orientation et d'Initiation Professionnelles

CPOS : Centre de Psychologie et d'Orientation Scolaire

CREOS : propriétaire et gestionnaire de réseaux d'électricité et de conduites de gaz naturel au Luxembourg

CRP : Centre de Recherche Public

DAO : Dessin Assisté par Ordinateur

DAP : Diplôme d'Aptitude Professionnelle

DT : Diplôme de Technicien

EST : Enseignement Secondaire Technique

ETS : Emission Trading System

FEDIL : Fédération des Industriels Luxembourgeois

FORMIDAD : Formations Intégrées pour un Développement et un Avenir Durables (Projet Fonds Social Européen)

FPC : Formation Professionnelle Continue

FPI : Formation Professionnelle Initiale

G1 : Niveau de qualification ouvriers du bâtiment - gros-œuvre et travaux publics : Niveau Chef d'équipe

Grande-Région : groupement européen de coopération territoriale regroupant le Grand-Duché de Luxembourg, les Länder de Rhénanie-Palatinat et de Sarre, la Région wallonne (Belgique), la Communauté française et la Communauté germanophone de Belgique ainsi que la région Lorraine en France.

Green ICT : Green Information Construction Technology

HORESCA : La Fédération Nationale des Hôteliers, Restaurateurs et Cafetiers du Grand-Duché de Luxembourg

IFSB : Institut de Formation Sectoriel du Bâtiment

INFPC : Institut National pour le développement de la Formation Professionnelle Continue

LCGB : Lëtzebuenger Chrëschtliche Gewerkschaftsbond - Confédération Luxembourgeoise des Syndicats chrétiens

LUREAP : Plan d'action luxembourgeois pour les énergies renouvelables

LuxEeb : méthodologies de calcul pour le Règlement grand-ducal du 30.11.2007 liée à la performance énergétique des bâtiments

LUXRES : LUXembourg Rebewable Energy Sources : Etude en matière de sources d'énergies renouvelables

MENFP : Ministère de l'Education Nationale et de la Formation Professionnelle

NEEAP : est le deuxième plan national d'action concernant l'efficacité énergétique, qui définit différents objectifs afin de réduire les consommations d'énergie tous secteurs confondus.

NREAP : National Renewable Energy Action Plan

OAI : Ordre des Architectes et des Ingénieurs-Conseils

OGB-L : Confédération syndicale indépendante du Luxembourg, Onofhängege Gewerkschaftsbond Lëtzebuerg

PIB : Produit Intérieur Brut

PME : Petites et Moyennes Entreprises

PNDD : Plan National concernant le Développement Durable

PRIMEHouse : Régime d'aides financières étatiques

qH : Coefficient limite de chauffe

RDI : Recherche et Développement de l'Innovation

RGD : Règlement Grand-Ducal

ST : Secondaire Technique

STATEC : Institut national de la statistique et des études économiques du Grand-Duché du Luxembourg

TNS-ILRES : Institut de sondage basé à Luxembourg

UEAPME : l'Union Européenne de l'Artisanat et des Petites et Moyennes Entreprises

UEL : Union des Entreprises Luxembourgeoises

U_{max} (W/m²K) : Transmission thermique maximale de chaque élément de construction

VAE : Validation des Acquis de l'Expérience

Valeur k : Niveau d'isolation thermique

Valeur U : Le coefficient de transmission thermique