



# Report on assessment of impact on industry

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## Report prepared by EURECAT

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## Intelligent Energy Europe

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## 1. Introduction

This document outlines the assessment of the impact on industry regarding actual nZEB implementation of renovation projects. This has been done by literature review and in depth interviews with industry actors like engineers, energy consultants, architects, employers in construction companies, employers in manufacturing company of building envelope products, HVAC and RES equipment, etc.

A methodology has been created to carry out the interviews. Annex I contains the questionnaires for professionals actors.

## 2. Overview

The building sector is one of the key sectors to achieve the 20/20/20 target of the EU, as it is accounting for an excessive 40% of the energy consumption in the EU. To reach this target, Europe aims by 2050 at bringing a reduction in greenhouse emissions of the 88% to 91% compared to 1990.

With the Directive 2010/31/EU, recast of the Energy Performance of Buildings Directive (EPBD), a framework has been configured to reach the target and it should be decisive for the development of the building sector through two main mechanisms; the *nearly zero-energy building* (nZEB) principle and the *cost-optimality* principle.

Transforming the European buildings into nZEB comprises major changes in industry, legal framework and market. This process is not easy and diverse barriers must be overcome in order to achieve EU climate and energy goals.

## 3. The impact on industry actors associated with the actual implementation of nZEB renovations in Med countries. Barriers and challenges - Literature review

The main barriers and challenges reviewed by literature are described below and some of them affect the implementation of nZEB in general and in specific for renovation projects.

SustainCo [SustainCo, 2012] project pointed “The lack of coordination between architects, engineers and construction companies and the shortage of skilled professionals often leads to poor final performances and an uncertain knowledge of the final results until the end of the construction. It has been seen that all the design approaches and solutions to achieve proper thermal comfort, energy efficiency, IAQ (Indoor Air Quality), lighting, etc. have very strong connection between them and they must be faced under an integrated design approach by an entire design team at the very beginning of the project. This way, with the key members present from the very beginning, can help each team to appreciate the specialized concerns of the others and enable to develop the most adequate and efficient solutions for nZEB.

Already during the early stages of the design phase, the presence of different software products and the lack of interoperability and possibility of data-exchange between them hamper the design of nZEB.” The long-term tendency in the construction sector for using methodologies like BIM can solve the exchange or the networking to support decision-making about projects.

Also the current lack of nZEB products in some national database of building products makes it difficult to regularize the nZEB projects so price information is crucial for an affordable project from the point of view of the construction company and the customer.

What is the applicability of the current building technology? According to Ecofys (Ecofys, 2012) “for refurbishing existing buildings into nearly zero-energy buildings, current technologies related to energy savings, energy efficiency and renewable energies are sufficient to reach, in combination, a suitable target for nearly zero-energy buildings. However more adaption to the specifics<sup>1</sup> of the existing building is needed compared to new building situations. A real technology gap that would need to be bridged until 2021 is still not perceived”.

But the large-scale uptake of nZEB construction and renovation will become a big challenge for all market actors and stakeholders involved, and the results of the monitoring and measuring the market maturity across the EU countries conducted by the project ZEBRA2020 (ZEBRA2020, 2014) will help to assess the necessary market conditions for increasing the number of nZEB.

Nevertheless, literature review done by ZenN (ZenN, 2013) of some recent projects\programs reports based within Europe in terms of low energy and high performance buildings, emphasize the need to develop innovative technologies to reach a suitable target for nZEB. Searching for the challenges in the retrofitting process in existing residential buildings, ZenN project find that (ZenN, 2013) “innovative technical solutions are not well accepted by the building owners or construction companies. . So in order to introduce new solutions in the market the public administration should play an important role of demonstration of the performance and reliability of the solutions. Only research projects funded by public administration (typically European projects) implement new and innovative solutions, so the role of these projects is critical to prove new solutions.” The main challenge encountered in terms of technical barriers according to ZenN (ZenN, 2013) is some kind of “disconnection between developing innovative technologies for the building industry and the lack of take-up.”

Otherwise, Ecofys (Ecofys, 2012) point to “investment cost reductions, improved performance of components and systems or improved energy storage solutions can of course positively influence the viability and introduction of nearly zero-energy buildings. Limitations may arise for renewable systems due to disparities in time or place, especially if one technology would be significantly favoured by the market or by policies.”

About technology costs, the investments for nZEB renovation projects are currently high but technologies are subject to changes in the upcoming years as reaction to more mature markets and larger volumes. In a long term, cost optimal levels are expected to be improved in the upcoming years,

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<sup>1</sup> Existing building structure and technical system can sometimes limit the choice of technical solutions that can be used, e.g. mechanical ventilation systems installation in low energy renovation processes in school buildings, which guarantees indoor air quality, but can face easily lack of space in classrooms ceilings and common rooms for equipment installation.

assuming an increasing in the energy price and decrease in the average primary energy factor for electricity.

### **The role of renewable energy technology**

Mediterranean region has high radiation rates and the high average temperatures. Thus, solar systems such as solar thermal and photovoltaic are already a quite good alternative to fossil energy systems and are expected to become even more efficient and cost-competitive in the future.

According to Ecofys (Ecofys, 2012) “the development of the PV market is promising as well. The energy payback time for thin film systems is already less than a year in Southern Europe (EPIA 2011: 1) and the produced residential electricity is expected to be cost competitive in Italy already by 2015 (EPIA, 2011c).” Nevertheless, in Spain the recently approved Royal Decree 900/2015 of 9 October, that regulates the administrative, technical and economic conditions of the modes of supply of electric energy with self-consumption and production with self- consumption, will reduce drastically the use of PV panels in Spain because it will not be economically of interest.

Although reversible heat pumps are economically attractive in the Mediterranean region, and has become the biggest potential that generate heat for space heating purposes in winter times, cold through air-conditioning systems in summer and DHW throughout the year. Nevertheless, they don't seem suitable for school buildings because the low DHW demand (even close to zero) and cooling demand.

According to WIP (2009), “pellet market development in Southern Europe is generally hampered by limited availability of raw materials and a lower heat demand in households due to warm climates. The use of high-tech pellet central-heating appliances does not seem to be feasible in these countries. However, the market in Italy has shown the potential of pellet stove heating under these conditions [...]” Although external preconditions seem to be positive in order to increase the biomass market in Southern Europe, policy support lacks bigger intentions. Nevertheless, Italy belongs to the main producers of wood pellets in Europe.

## 4. Survey results of implementation nZEB renovation projects

### 4.1. The survey

- A questionnaire has been designed to give valuable feedback from industry actors of the 4 countries participants in the project involved in implementing nearly zero-energy buildings (nZEB), especially nZEB renovation projects.
- Interviewed actors were listed in a **Database** prepared for this purpose. Actors were classified into 5 categories (building designers, manufacturers, construction companies, users, others). Construction companies include installers for building envelope products and other equipment (HVAC, renewable energy, etc).
- Actors were chosen upon their **key role in implementing nZEB**. Actors that had already been involved in nZEB renovation projects has been given priority.
- Number of interviews: **a minimum of 5 answered interviews were the target per country**
- Interviews were carried out by online questionnaire.
- Interviews have been translated in each region language when considered necessary for the well-going of the survey.
- Interviews results has been reported in the present deliverable D3.4 “Report on assessment of impact on industry”.
- Survey respondents have been engineers, energy consultants, architects, employers in construction companies, employers in manufacturing company of building envelope products, HVAC and RES equipment, etc.

The questionnaire is about:

- Energy efficiency policies regarding encouragement of nZEB renovations
- Barriers and additional efforts of the implementation of nZEB compared with standard building
- Availability and cost of products and technological solutions for nZEB projects
- Issues in terms of comfort

### 4.2. The results

#### Energy efficiency policies encouraging nZEB renovations

- National EE policy packages are considered to be very few ambitious; defined but not enough developed in the countries respondent
- Lack of specific targets in EE policies for nZEB renovations
- Few promotion on EE policies as an important gap for their applicability

- Unsuitable renewable energy legislation, specially considered main gap in Spanish EE policies according the 50% Spanish respondents

The EU has taken some positive steps to improve regulation, policies and standards, but ambiguity regarding definitions of what constitutes a nZEB or stablishing poor RES policies in some countries, clearly affects implementation at national levels, and it is a general opinion among the survey respondents.

### **Main barriers and additional efforts of the implementation of nZEB vs standard buildings**

There are many different barriers that may difficult the implementation of nZEB, especially nZEB renovations of existing buildings. Some of them listed in order of importance according to respondents:

- Economic/financial resources
- Lack of energy efficiency funding programmes
- Lack of voluntary national nZEB standards for renovation of existing buildings
- Lack of accompanying measures, such as technical information, communication actions and campaigns, conferences and trainings
- User motivation/demand
- Lack of exemplary role of public buildings
- Lack of robust evidence from existing nZEB that promotes Best Practice
- National/regional legislative framework for renovation of existing buildings
- Availability of products
- Standardized costs

38% of survey respondents see economic and financial resources as the main barrier for the implementation of nZEB. Specifically, main barriers for financing nZEB projects are identified for survey respondents in:

- Lack of credits
- Too long paybacks
- Lack of interest in investing

Financing instruments for both in public projects as in private ones are clearly seen the main driver for boosting the nZEB market in renovation projects in the 4 countries. Setting the priorities for building renovations (schools in the present case) will be based on different needs (safety, maintenance, spatial requirements, energy savings, etc.) and will heavily depend on the budget availability and the existing funding channels. Nowadays, the economic crisis in most of Mediterranean countries has led to very reduced self financing capacity, being the budgets allocated to cover only urgent needs and significantly reducing the capacities of municipalities and regional administrations. Funding opportunities like ERDF (European Regional Development Funds) aimed in correcting imbalances between its regions and new business models are also considered to be challenge to paying the way to nZEB energy schools in Mediterranean region.

The renovation of buildings to nZEB standards/concept may require additional resources. Indeed, 29% of survey responses identify finding the skilled actors as the most required additional sources when compared to a traditional project; more than even engaging the project.

### Availability and cost of products and technological solutions

The products and technological solutions for nZEB renovations are available in the construction market of the countries, although the offer is limited and the prices are still too high, specially considered in Greece (83%).

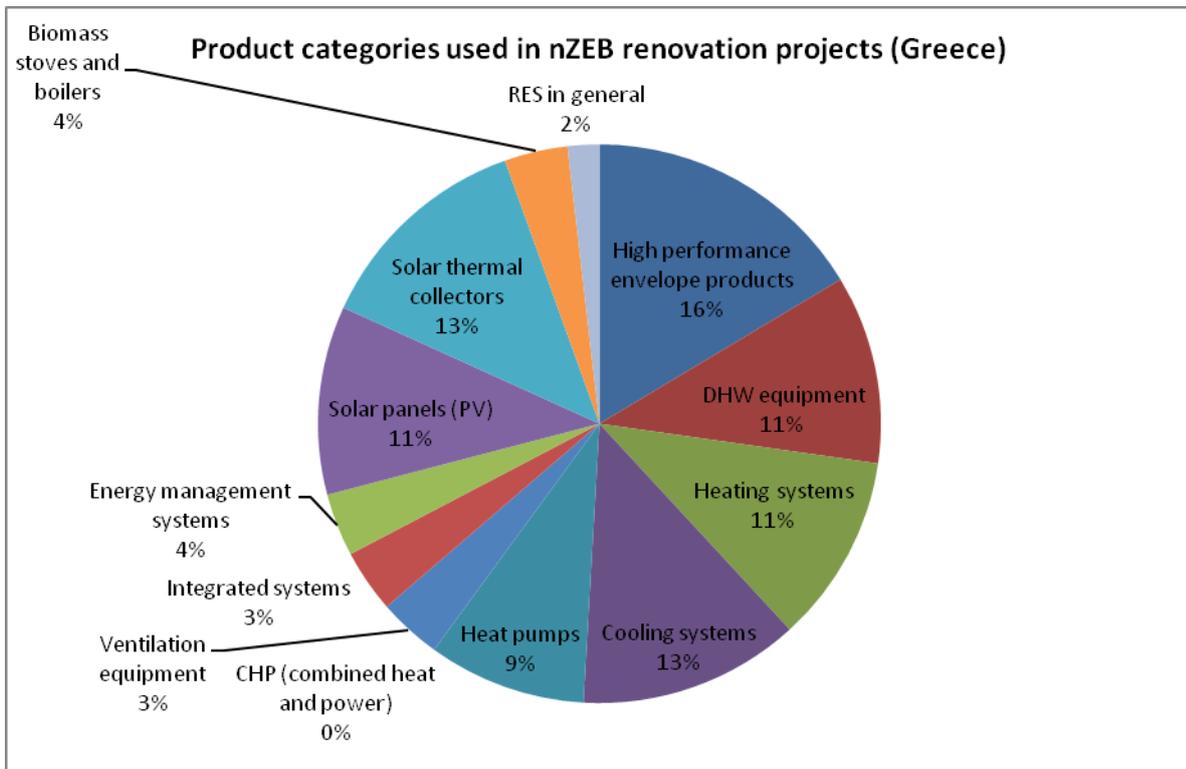
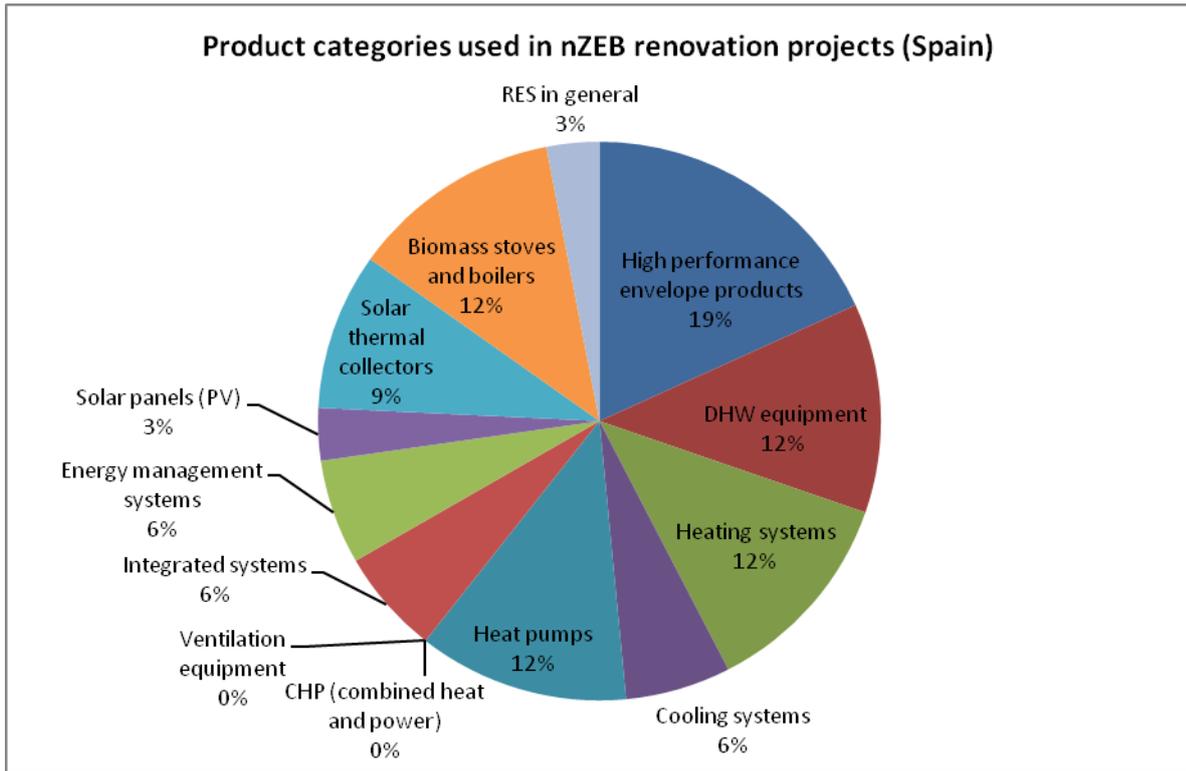
Concerning RES installation in nZEB renovation project, the budget (Greece 34%, Italy 23%, France 41%) is a challenge to be face together with building integration (Greece 34%, Italy 38%, France 25%). In Spain, legislative approval in RES installation has become the bottleneck for PV installations (legislative approval 55%, building integration 27% and other challenges 18%).

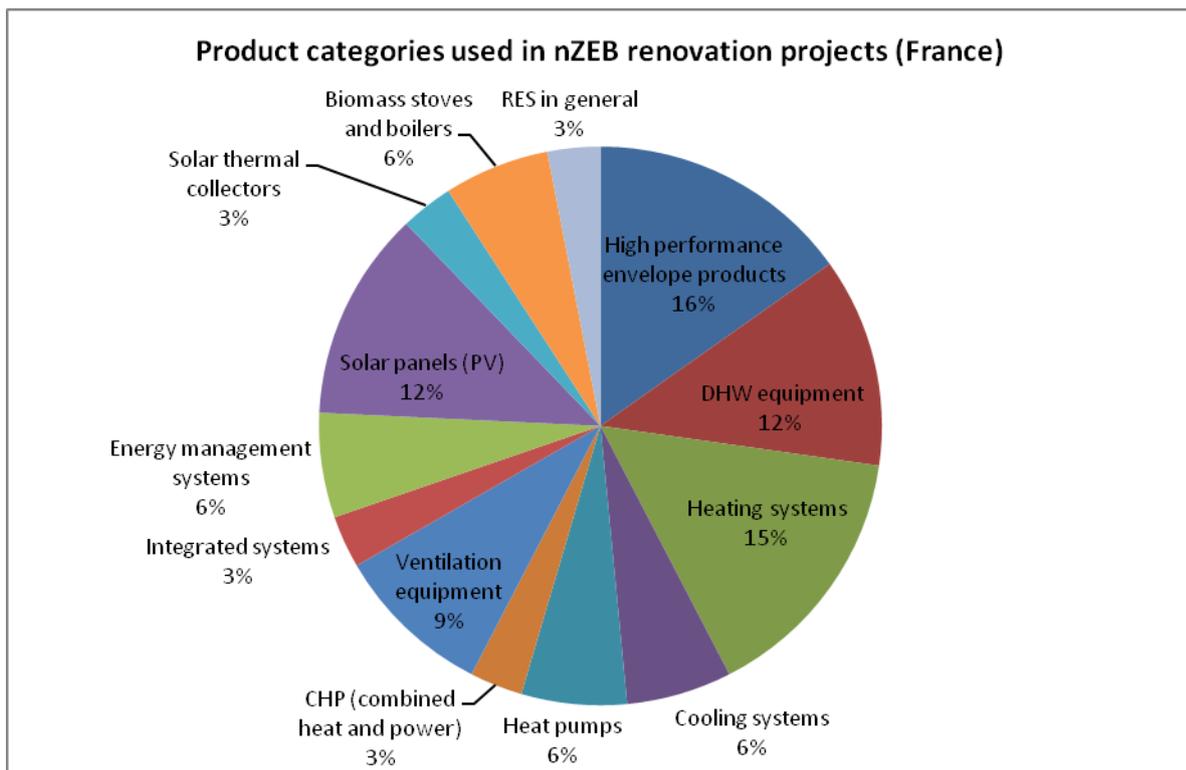
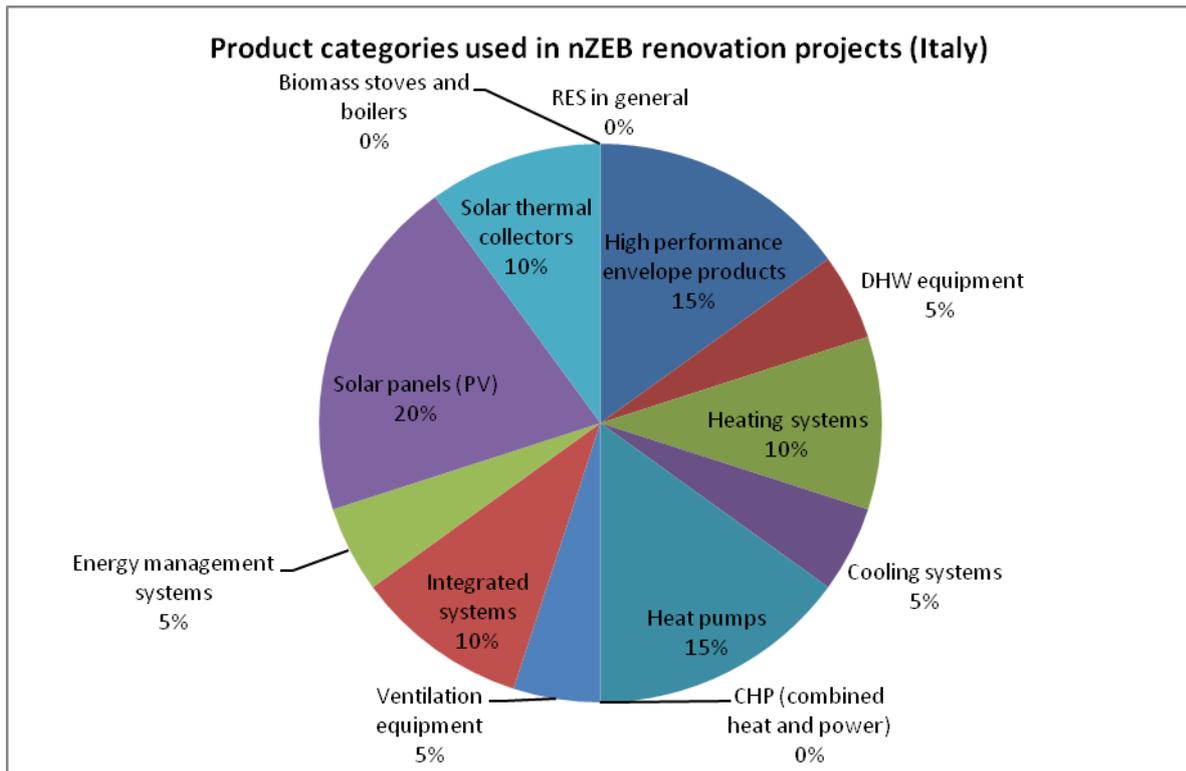
From the survey information, the use of products nZEB in renovation projects is distributed like the following (see the values for country in the following graphs):

Product categories used in nZEB renovation projects	Spain	Greece	Italy	France
High performance envelope products (insulation, windows, etc.)	<b>18%</b>	<b>16%</b>	<b>15%</b>	<b>15%</b>
DHW equipment	12%	11%	5%	12%
Heating systems	<b>12%</b>	<b>11%</b>	<b>10%</b>	<b>15%</b>
Cooling systems	6%	<b>13%</b>	5%	6%
Heat pumps	12%	9%	15%	6%
CHP (combined heat and power)	0%	0%	0%	3%
Ventilation equipment	0%	4%	5%	9%
Integrated systems (heating + ventilation; heating + DHW, etc)	6%	4%	10%	3%
Energy management systems	6%	4%	5%	6%
Solar panels (PV)	<b>3%</b>	11%	20%	12%
Solar thermal collectors	9%	13%	10%	<b>3%</b>
Biomass stoves and boilers	<b>12%</b>	4%	0%	6%
RES in general	3%	2%	0%	3%

This highlights trend in:

- High performance envelope products are the most used in nZEB renovation projects in all the countries requested
- In terms of systems, heating systems are the most installed active systems in Spain, Italy and France; in Greece also cooling systems, and the heat pump the most used technological solution.
- Poor use of PV in Spain comparing to the other countries
- Poor use of solar thermal collectors in France
- Biomass is highlighted in Spain





#### Issues in terms of comfort

The indoor air quality (IAQ) is the physical and psychological aspect of life indoors most considered in nZEB projects according to respondents, in front of other aspects of indoor environmental quality (IEQ) like visual comfort or acoustic comfort.

## 5. Conclusions

*Before getting into a global analysis, we consider it necessary to mention that a difficulty faced during the interpretation of the surveys was the reduced number of participants, so limited in some countries that it was complicated to deduce trades from the results obtained. This problem was further exacerbated by the fact that some of the answers obtained could not be taken into account because they did not correspond to the question asked.*

Transforming the European buildings into nZEB comprises major changes in industry, legal framework and market. This process is not easy and diverse barriers must be overcome in order to achieve EU climate and energy goals.

Clearly, legislation and financial incentives have a strong influence in developing approaches for nZEB within countries, especially in Mediterranean regions, hardly hit by the crisis.

The products and technological solutions for nZEB renovations are available in the construction market of the countries, although the offer is limited and the prices are still too high, specially considered in Greece.

Investment cost reductions, improved performance of components and systems or improved energy storage solutions can of course positively influence the viability and introduction of nearly zero-energy buildings. Limitations may arise for renewable systems due to disparities in time or place, especially if one technology would be significantly favoured by the market or by policies.

The lack of interest in investing, long paybacks and few promotion in best practise nZEB renovation projects as “proven technology” affects the implementation of nZEB and don’t help to boost to industry in a large-scale uptake of nZEB construction and renovation.

## 6. Annex 1. questionnaire for industry actors

### General notice:

This questionnaire has been designed to give valuable feedback from industry actors involved in implementing nearly zero-energy buildings (nZEB) in Europe, especially nZEB renovation projects.

This questionnaire has been developed within the ZEMedS project framework. The results will be included, anonymously, in a public report online in project website (<http://www.zemedes.eu/>). The questions have multiple answers. The questions are provided with the **“other” option where you can include other answers that apply or your comments** about the subject treated in the question.

This questionnaire will be used for the ZEMedS project only. Data collected by the questionnaire will only be used for the purpose of the ZEMedS project and will not be used elsewhere.

We greatly appreciate your time and effort. Thank you very much for your cooperation.

### Abbreviations:

nZEB – nearly Zero Energy Building

EE – Energy Efficiency

RES – Renewable Energy Sources

EPBD – Energy Performance of Buildings Directive

### Questionnaire:

1. What country do you work in?

- a) France
- b) Italy
- c) Greece
- d) Spain
- e) Other

2. What is your profession?

- a) Architect
- b) Engineer
- c) Energy consultant
- d) Employed in a construction company
- e) Employed in a company that manufactures building envelope products, HVAC equipment or renewable energy equipment
- f) RES installer and/or HVAC installer
- g) General installer
- h) Other

3. What is your expertise in the implementation of nZEB renovations?

- a) None at all
- b) I have participated in nZEB renovations
- c) Other

4. How do you consider the energy efficiency policies in your country regarding encouragement of nZEB renovations of existing buildings?

- a) No specific targets for nZEB have been defined yet
- b) Very few ambitious; policy packages have been defined but not enough development
- c) Good policy packages have been defined, detailed issues that concern almost all the chain for nZEB buildings (standards, economic incentives, certification methodologies, trainings, dissemination...)
- d) I am sorry, I don't know
- e) Other

5. What gap in policy is the most important for the applicability of EE policies in your country in your opinion?

- a) Poor overall ambition of the EE policies
- b) Unsuitable renewable energy legislation
- c) Few promotion on EE policies
- d) I am sorry, I don't know
- e) Other

6. There are many different barriers that may difficult the implementation of nZEB, especially nZEB renovations of existing buildings. In order of preference, please indicate in the box “other” which barriers apply for your country in nZEB renovation buildings (numbering the most important barrier first, for example: d, c, i; you can add other barriers too). You can also indicate other barriers or comments.

- a) Lack of voluntary national nZEB standards for renovation of existing buildings
- b) Lack of accompanying measures, such as technical information, communication actions and campaigns, conferences and trainings
- c) User motivation/demand
- d) Economic/financial resources
- e) Lack of exemplary role of public buildings
- f) Availability of products
- g) Standardized costs
- h) Lack of robust evidence from existing nZEB that promotes Best Practice
- i) Lack of energy efficiency funding programmes
- j) National/regional legislative framework for renovation of existing buildings
- k) I am sorry, I don't know
- l) Other

7. What are the drivers that will boost the nZEB market in renovation projects in your country?  
(multi choice)

- a) More ambitious renovation obligations
- b) New business models
- c) Improved financing solutions
- d) Information/advice
- e) Not possible
- f) I am sorry, I don't know
- g) Other

8. Have you ever worked in an nZEB renovation of a school in Mediterranean climate?

- a) Yes
- b) No
- c) Other

9. In case your answer is “yes” in the previous question, what has been the main reason of the renovation?

- a) Poor energy performance of the building
- b) Poor indoor air quality
- c) Security reasons
- d) I am sorry, I don't know
- e) Other

10. In the nZEB renovation projects you are/were involved, has there been a particular difficulty that was hard to overcome?

- a) Technical issues in the design phase
- b) Technical issues in the construction phase
- c) Availability of products
- d) Finding skilled actors
- e) I am sorry, I don't know
- f) Others

The capital cost of an nZEB is usually higher than that of current construction minimum standards. According to EPBD, by 2020 markets should be applying life-cycle cost perspective instead of the usual construction cost perspective.

11. From your experience, how much does it cost to renovate an nZEB comparing it to current standard building? (Please consider construction cost, including energy equipment and renewable energy; with no life-cycle approach.)

- a) Current renovation building standards are in line with nZEB renovation so there is no extra cost.
- b) 0 -5% more
- c) 6- 10% more
- d) I am sorry, I don't know
- e) Other

12. What is the biggest barrier for financing building renovation in your country?

- a) Too long paybacks
- b) Lack of credits
- c) Lack of interest in investing

- d) I am sorry, I don't know
- e) Others

13. Where have you made most efforts in order to reduce construction costs? You can include comments in "other" box.

(multi choice)

- a) Building materials
- b) Equipment (excluding RES)
- c) RES
- d) Labour
- e) Cost has been optimized across the whole project
- f) No particular attention has been given to reduce the cost
- g) I am sorry, I don't know
- h) Other

14. The renovation of buildings to nZEB standards/concept may require additional resources. What tasks have required additional resources when compared to a traditional project?

(multi choice)

- a) Engaging the project
- b) Gaining building approval from the authorities
- c) Finding the skilled actors
- d) Design process
- e) Engaging the works
- f) Finding the products
- g) Construction phase
- h) Equipment installation
- i) I am sorry, I don't know
- j) Other

15. From your experience when implementing an nZEB renovation, what are the gaps regarding all the chain from the customer first demand up to the final use-phase of the end-user?

(multi choice)

- a) There are no gaps and the whole chain is working
- b) Lack of cooperation among actors
- c) Lack of certification entities
- d) Lack of monitoring to survey actual performances
- e) Maintenance
- f) I am sorry, I don't know
- g) Other

16. Are products and technological solutions easily available for nZEB in your region?

- a) Yes, there is a wide variety of technical services on offer
- b) Yes, but offer is limited and prices are high
- c) No, but there is a good offer in other regions in my country
- d) No, there is a limited offer and for some buildings many imported products from other EU countries are installed
- e) I am sorry, I don't know
- f) Other

17. Please indicate which are the most used product categories nZEB renovation projects in your region?

(multi choice)

- a) High performance envelope products (insulation, windows, etc)
- b) DHW (domestic hot water) equipment
- c) Heating systems
- d) Cooling systems
- e) Heat pumps
- f) CHP (combined heat and power)
- g) Ventilation equipment
- h) Integrated systems (heating + ventilation; heating + DHW, etc)
- i) Energy management systems
- j) Solar panels (PV)
- k) Solar thermal collectors
- l) Biomass stoves and boilers
- m) RES (Renewable energy systems) in general
- n) I am sorry, I don't know
- o) Other

18. In the nZEB renovation projects you are/were involved, what issues in terms of comfort have been taken into account?

(multi choice)

- a) Good indoor air quality
- b) Appropriate visual comfort
- c) Appropriate acousitc comfort
- d) I am sorry, I don't know
- e) Other

19. In the nZEB renovation projects you are/were involved, has any parameter of indoor air quality been measured for a long period of time?

(multi choice)

- a) Indoor temperature
- b) Flow ventilation
- c) CO2 concentration
- d) I am sorry, I don't know
- e) Other

20. When installing renewable energy in nZEB renovation projects, what challenges are faced?

(multi choice)

- a) Building integration
- b) Legislative approval
- c) Professional skills of installers
- d) Budget
- e) Product offer
- f) I am sorry, I don't know
- g) Other

21. If you have any additional comment, it is welcome here below.

**Please fill in the personal data**

Name: \_\_\_\_\_

Surname: \_\_\_\_\_

Function: \_\_\_\_\_

Organisation: \_\_\_\_\_

Location and country: \_\_\_\_\_

Date (D/M/Y): \_\_\_\_\_

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