

New challenges for BIM in upskilling the European workforce

BIM IN EUROPE SEMINAR

Architects' Council of Europe
Brussels, 1 December 2017



Peter Op 't Veld, PROF / TRAC coordinator
Ana Tisov
Huygen Engineers & Consultants, Maastricht, The Netherlands



PROF / TRAC



BIMplement



INGENIEURS & ADVISEURS

Current situation in EU

- Slight shortage of building workers by 2020 in most European countries
- The need for training of the current workforce is much stronger than the estimated need for additional workers
- More than 3 million workers (blue collar and white collar) would require up-skilling on energy efficiency or renewable energy sources by 2020
- Importance of transferable and cross-trade knowledge and skills

- Challenge: Need to improve also the skills of the EU workforce to achieve overall quality in NZEB's, to reduce the gap between designed and actual performances of buildings
- Scope: upgrading or setting up large-scale qualification & training schemes, foster cross-trade and cross-level collaboration > *understanding and transparency between different trades and levels*

No quality and quality control in construction and renovation without the required skills and trainings!



PROF / TRAC

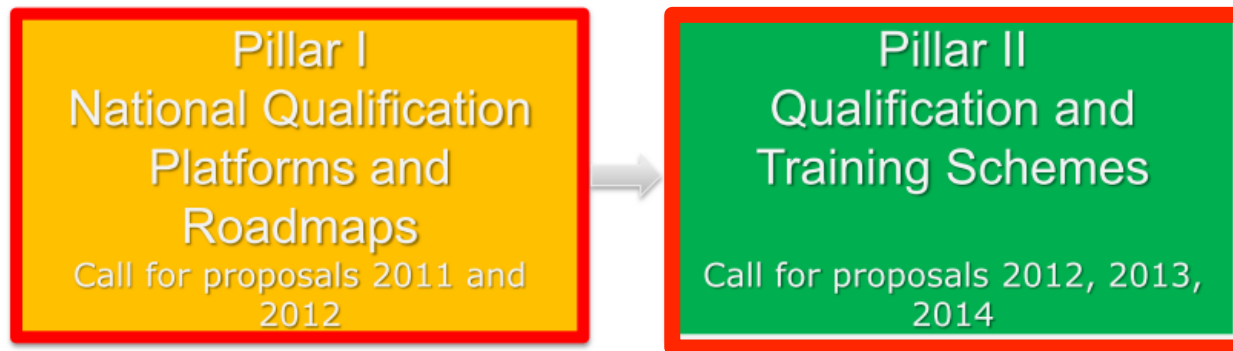


BIMplement

Instruments

IEE BUILD UP Skills Pillar I and Pillar II
H2020 Construction Skills EE04-2014/2015
H2020 Construction Skills EE14-2016/2017

BUILD UP Skills - Structure



PROF/TRAC: H2020 Construction Skills EE04- 2014

BIMplement: H2020 Construction Skills EE14 -2016



PROF / TRAC



BIMplement

Towards Quality Control: From methodology development to hands-on implementation, enabled by BIM

- **PROF/TRAC: PRO**Fessional multi-disciplinary **TR**aining and **C**ontinuing development in skills for NZEB principles
 - Cross-trade
 - Level: white collar workers
 - Methodologies for skills mapping and qualification schemes
 - EU Train the Trainers programs > to start national trainings
- **BIM**plement: Towards a learning building sector for enhanced quality control by setting up a large-scale and flexible qualification methodology integrating technical, cross-trade and BIM related skills and competences, implemented with hands-on BIM enhanced workplace learning tools
 - Cross-trade: multi disciplinary
 - Cross-level: white and blue collar workers
 - Enhanced Quality Control enabled by BIM as universal information carrier
 - hands-on BIM workplaces and learning tools



PROF / TRAC



BIMplement

The PROF/TRAC overall goal

- Develop and maintain an **Open Education Platform for Continuing Professional Development** for professionals in the building sector.
- This platform **addresses technical experts, engineers, architects and building managers** > middle and senior professionals
- The developed **European qualification scheme** as part of a life-long learning process for continuing development and up-skilling of professionals.



www.proftrac.eu

 @PROF_TRAC



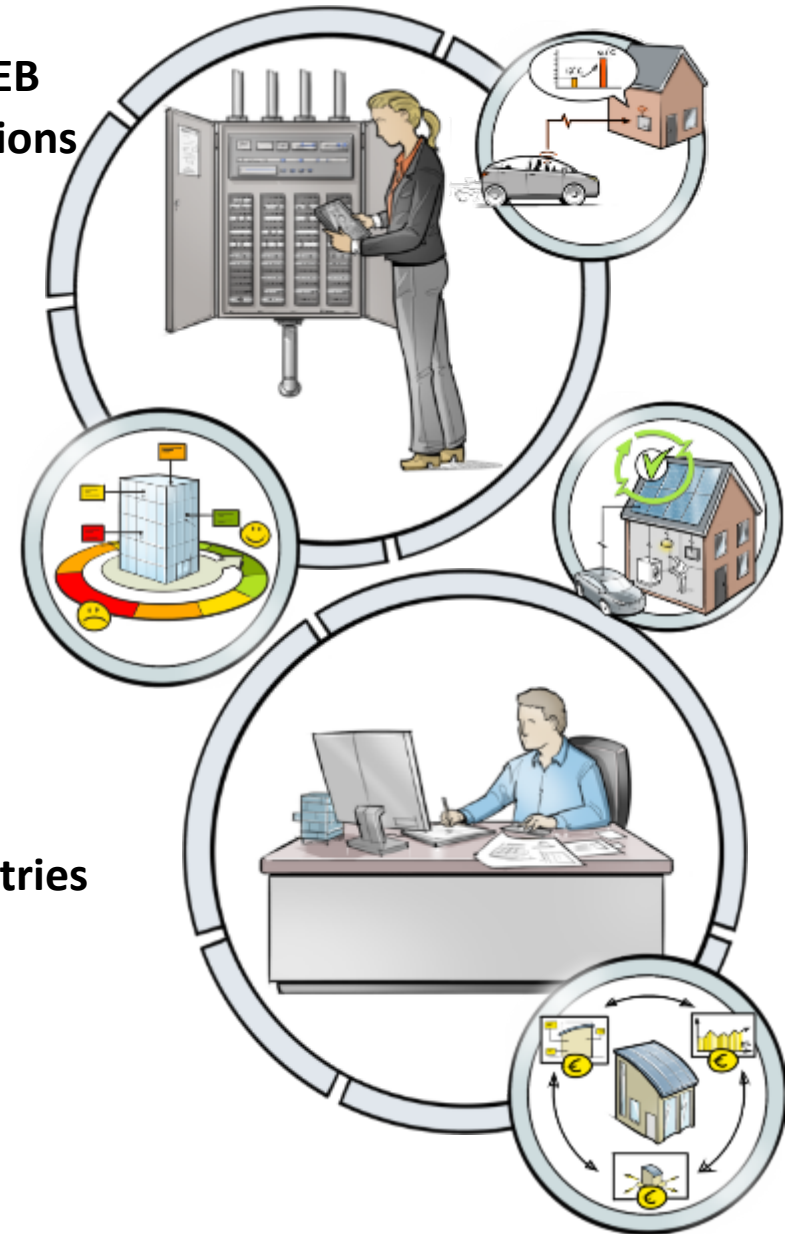
PROF / TRAC



BIMplement

Overview of outcomes PROF/TRAC

- ▶ Mapping of the skills and current skill gaps in nZEB
- ▶ Roadmaps to train nZEB professionalsP Skills actions for 7 countries and on EU scale
- ▶ Methodology for skills mapping
- ▶ The BUILD UP Skills advisor app
- ▶ European qualification scheme
- ▶ PROF/TRAC Database
- ▶ PROF/TRAC Educational guide - Basis for the development of (national) training programs
- ▶ PROF/TRAC Train the Trainer sessions
 - ▶ Three TtT sessions faces-to-face
 - ▶ Two TtT sessions as webinars
- ▶ Seven national training programs as pilots
- ▶ Several national training programs in other countries as result of the TtT sessions(now in progress)



PROF / TRAC



BIMplement

Example of results of skills mapping

Professional

CODE	TECHNOLOGY, INTERDISCIPLINARY SKILLS AND PROFESSIONS	Mechanical Engineer					Building aut. Engineer										
		current	nZEB	Gap	1	2	3	4	5	current	nZEB	Gap	1	2	3	4	5
M	ENERGY MANAGEMENT																
EM1	Smart grid systems	2	2	0													
EM2	Domotic systems	2	2	0													
EM3	Building management systems	2	3	1													
P	ENERGY PRODUCTION (on-site and nearby)																
EP1	Geothermal energy	3	3	0													
EP2	Biomass	2	2	0													
EP3	Biogas	2	2	0													
EP4	District heating and cooling	3	4	1													
EP5	Heatpumps	3	5	2													
EP6	Solar power systems for electricity generation	3	2	0													
EP7	Solar thermal systems for cooling generation	2	4	2													
EP8	Solar thermal systems for domestic hot water	3	4	1													
EP9	Mini wind power	2	1	0													
EP10	Combined Heat and Power (CHP)	3	3	0													

Skills

Skills gap from level 2 to 3

CODE	TECHNOLOGY, INTERDISCIPLINARY SKILLS AND PROFESSIONS	Architect					Building Engineer					Construction Engineer					
		current	nZEB	Gap	1	2	3	4	5	current	nZEB	Gap	1	2	3	4	5
M	ENERGY MANAGEMENT																
EM1	Smart grid systems	2	2	0													
EM2	Domotic systems	2	2	0													
EM3	Building management systems	2	3	1													
P	ENERGY PRODUCTION (on-site and nearby)																
EP1	Geothermal energy	3	3	0													
EP2	Biomass	2	2	0													
EP3	Biogas	2	2	0													
EP4	District heating and cooling	3	4	1													
EP5	Heatpumps	3	5	2													
EP6	Solar power systems for electricity generation	3	2	0													
EP7	Solar thermal systems for cooling generation	2	4	2													
EP8	Solar thermal systems for domestic hot water	3	4	1													
EP9	Mini wind power	2	1	0													
EP10	Combined Heat and Power (CHP)	3	3	0													
R	ENERGY REDUCTION																
RE1	Insulation	3	4	1													
RE2	Air tightness building	3	4	1													
RE3	Heats exchanger	2	4	2													
RE4	Shade systems	2	4	2													
RE5	Hot water systems	1	2	1													
RE6	Windows and/or glazing systems	3	3	0													
RE7	Heating and cooling emission systems	2	3	1													
RE8	Electric heating systems	1	1	0													
RE9	Artificial lighting systems	2	2	0													
RE10	Ventilation systems	2	2	0													
S	INTERDISCIPLINARY SKILLS																
SI1	Communication	4	5	1													
SI2	Information management	4	4	0													
SI3	Collaboration	3	4	1													
SI4	Quality assurance	3	4	1													
SI5	Sustainable architectural design	4	5	1													
SI6	Integrated design	3	4	1													
SI7	Sustainable building materials	3	4	1													
SI8	Sustainable construction methods	2	2	0													
SI9	Environmental/indoor quality	3	3	0													
SI10	Economics	3	3	0													
SI11	Procurement	2	3	1													

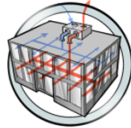
Skills levels can be estimated from level 0 to 5, and will automatically be coloured.

Explanation of the levels 0 - 5:

0	Not applicable / no knowledge and skills required
1	Has little knowledge and skills with respect to the relevant field / technology
2	Understands basic knowledge and has practical skills within the field, is able to solve problems by
3	Has comprehensive, factual and theoretical knowledge, is capable of solving problems within the field
4	Has advanced knowledge involving a critical understanding of theories and principles and skills, required
5	Has specialised knowledge and problem-solving skills, partly at the forefront of knowledge in the field, in

Development of a European qualification scheme

- a **qualification scheme** is elaborated
- for the **targeted professions** using the **integrated, multidisciplinary approach** of the IEE IDES-EDU and other relevant projects

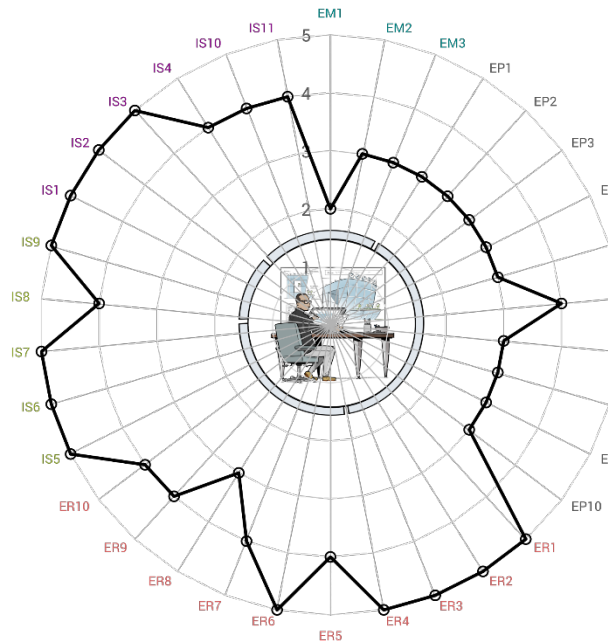
Technology Nr.								
EP5	Planning and design of heat pump installations		energy production for heating, cooling and potable hot water, making use of an energy source with low temperature and bringing it to a higher temperature.					
Project phase	General description and subtasks	Workfield						
		Architecture	Mechanical Engineering	Electrical Engineering	Structural engineering	Construction management	Financing and procurement	Building management
General	General knowledge of heat pumps, design and application	1	4	2	1	1	1	1
	Understands the basic working and application of heat pumps, is able to explain and discuss.	x	x	x	x	x	x	x
	Is aware of types of available heat sources for use with heat pumps, understands the influence of source temperature on energy efficiency.		x	x				
Pre design	Performance of a feasibility study	2	5	3	1	1	1	-
	Can make an inventory of available heat sources and identify possibilities or restraints		x					
	Can estimate the heat loss of the building, to perform feasibility study of heat pumps		x					
	Inventory of possible heat pumps and available sources (e.g. outdoor air, exhaust air, soil, rivers)		x					

PROF/TRAC European Qualification Scheme – nZEB knowledge and skill level

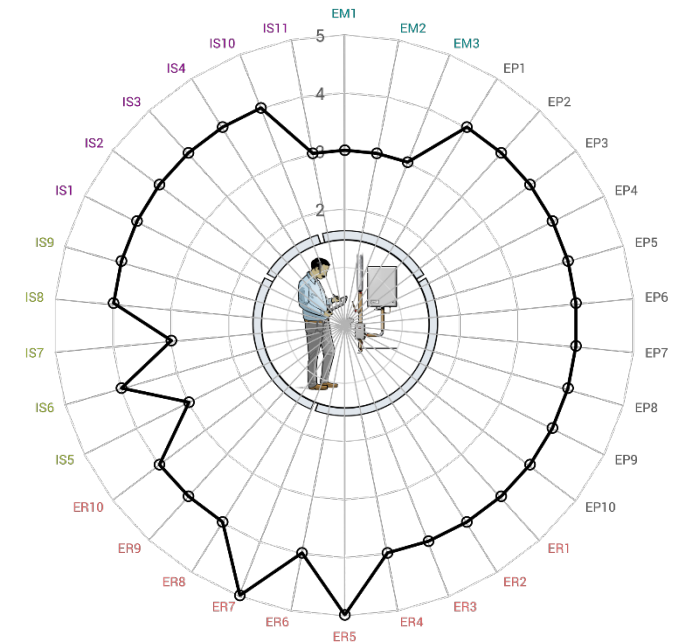
- How to use the qualification level?

EM1	Smart grid systems	ENERGY MANAGEMENT
EM2	Domotic systems	
EM3	Building management systems	
EP1	Geothermal energy	ENERGY PRODUCTION
EP2	Biomass	
EP3	Biogas	
EP4	District Heating and Cooling	
EP5	Heat pumps	
EP6	Solar power systems for Electricity generation	
EP7	Solar thermal systems for Cooling generation	
EP8	Solar thermal systems for Domestic Hot Water and/or Heating	
EP9	Mini wind power	
EP10	Combined Heat and Power (CHP)	
ER1	Insulation	ENERGY REDUCTION
ER2	Air tightness building	
ER3	Micro climates	
ER4	Envelope systems	
ER5	Hot Water systems	
ER6	Window and/or glazing systems	
ER7	Heating and Cooling emission systems	
ER8	Electric Heating systems	
ER9	Artificial lighting systems	
ER10	Ventilation systems	
IS5	Sustainable architectural design	SUSTAINABLE INTEGRATED DESIGN
IS6	Integrated design	
IS7	Sustainable building materials	
IS8	Sustainable installation materials	
IS9	Environmental (indoor) quality	
IS1	Communication	INTERDISCIPLINARY SKILLS
IS2	Information management	
IS3	Collaboration	
IS4	Quality assurance	
IS10	Economics	
IS11	Procurement	

ARCHITECTURE



MECHANICAL ENGINEERING



PROF / TRAC



BIMplement

Outcomes: PROF/TRAC Database – Online

<http://proftrac.eu/training-materials.html>



TRAINING MATERIAL REPOSITORY



On this page you can find all relevant training materials on NZEB. Use the filter form on the left to narrow the results.

Topic
 Select topic ▼

Type of project
 Select one... ▼

Building use
 Select one... ▼

Type of material
 Select one... ▼

Language
 Select one... ▼

Filter result >>

Relevant report	Topic	Project	
The Comfort Houses: Measurements And Analysis Of The Indoor Environment And Energy Consumption In 8 Passive Houses 2008-2011	Energy reduction	ZEB	More details
Energineutralt Byggeri – Definition og fremtidig rolle i samfundet	Energy management	ZEB	More details
Energineutralt Byggeri - Designprincipper og byggede eksempler for enfamiliehuse	Energy management	ZEB	More details
Energineutralt Byggeri – Tekniske løsninger	Energy management	ZEB	More details
Zero Energy Buildings - DESIGN PRINCIPLES AND BUILT EXAMPLES	Energy management	ZEB	More details
Survey Findings Report	Awareness of energy efficiency	TRB	More details
Final conclusions report	Awareness of energy efficiency	TRB	More details



PROF / TRAC



BIMplement

From PROF/TRAC to BIMplement

The overall aim of BIMplement:

- Why** → To achieve an improved quality for nZEB construction and renovation
- How** → by setting up large scale training, Continuous Professional Development and **BIM-enhanced** qualification schemes, addressing the entire value chain
- What** → in a *cross-trades* and *cross-level* multidisciplinary approach, strengthened with **hands-on and BIM-enhanced workplace learning tools**



PROF / TRAC



BIMplement

BIMplement qualitative objectives

1. To *improve the overall quality* of the entire construction and renovation process, from pre-design till operation and maintenance phase

- Developing a methodology to map qualities and skills to improve quality using BIM as information carrier
- Implementing the approach for two selected topics on NZEB
- Bridging the performance gap by using a BIM enhanced workplace learning
- Connecting with lessons learned in recent IEE and H2020 projects

2. To create a *new generation of professionals and craftsmen*, qualified to deliver high quality nZEB-projects

Using BIM-enabled workplace learning to create a large number of professionals and craftsmen, on *different profession levels*, needed in the *entire process* and equipped with the right skills for the process phases in which they are involved. BIM will support this as *information carrier*

3. To foster *interactions between different trades and professions*

- Qualification methodology that integrates technological, cross-trade and BIM related skills and competences
- Implemented in a Model nZEB Cross-trade Quality and BIM-Skills Matrix
- Developing a BIMplement guide

4. To *sustain the qualification and training schemes* a replication and exploitation strategy will be developed and validated

- Making use of the BIM-learning Centres or Field labs
- Developing of a self-instruction BIMplement guide (further exploited and promoted by using the PROF/TRAC open training platform)
- Connecting with suppliers and supplier interest groups through EU networks

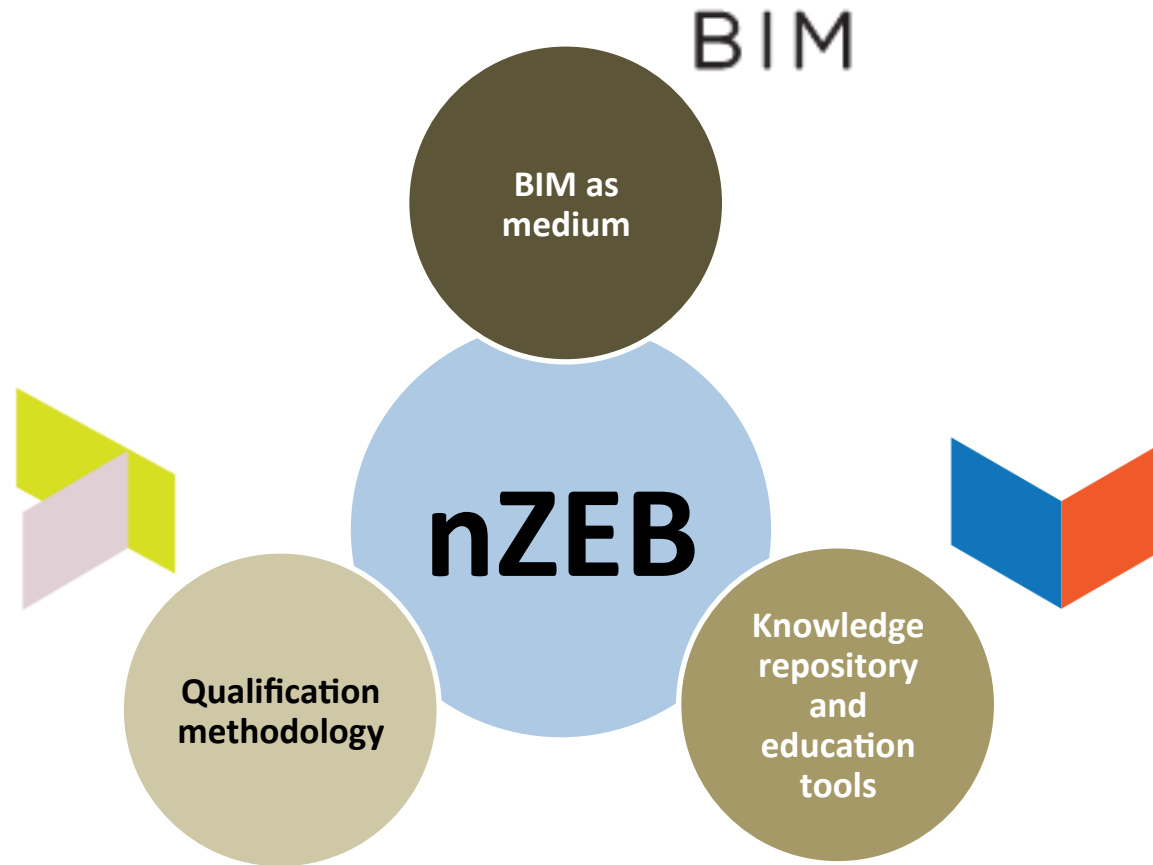


PROF / TRAC



BIMplement

BIMplement approach

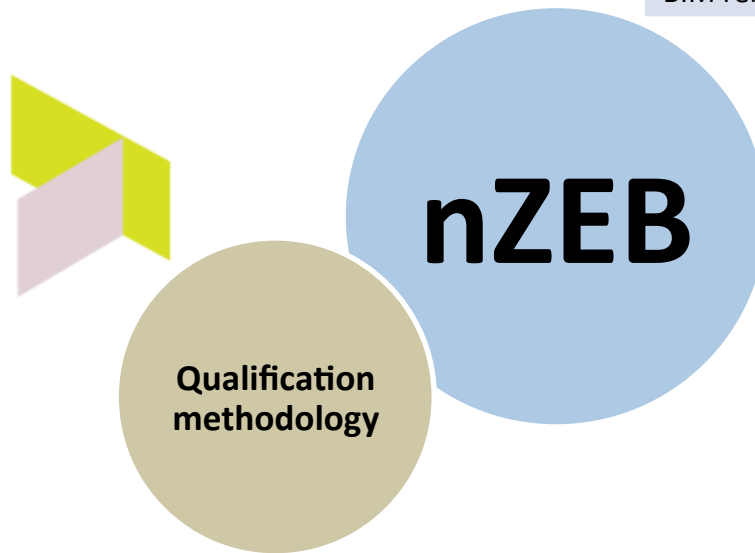


PROF / TRAC



BIMplement

BIMplement approach



BIMplement Qualification Framework (QF)	
Type of knowledge needed	
Relation with other disciplines	
Task description	
Appropriate knowledge repository	
BIM related tools	

	Workfield				
	Architecture	Mechanical Engineering	Electrical Engineering	Structural Engineering	Construction Management
Understands the basic working and application of heat pumps, is able to elaborate and discuss	1	4	2	1	1
Is aware of types of available heat sources for use with heat pumps, understands the influence of source temperature on energy efficiency					
Pre design Performance of a feasibility study	2	5	3	1	1
Can make an inventory of available heat sources and identify possibilities for realisation					
Can estimate the heat loss of the building, to perform feasibility study of heat pumps					
Inventory of possible heat pumps and available sources (e.g. outdoor air, exhaust air, soil, rivers)					

- Systematic standardized approach needed that is enough robust and flexible for national adaptation
- Take advantage of existing classification schemes (based on ISO 81346)
- Added BIMplement taxonomies in order to have a common language

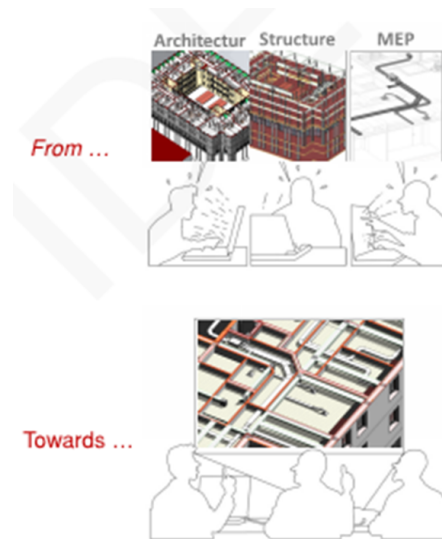


PROF / TRAC



BIMplement

BIMplement approach



nZEB

Knowledge
repository and
education
tools

- Different quality in different member states
-> needed assessment of the current state;
- Filling in the developed QF with the suitable education material, training and tools applicable for particular member state;
- Improve/educate weak links in nZEB chain.



PROF / TRAC

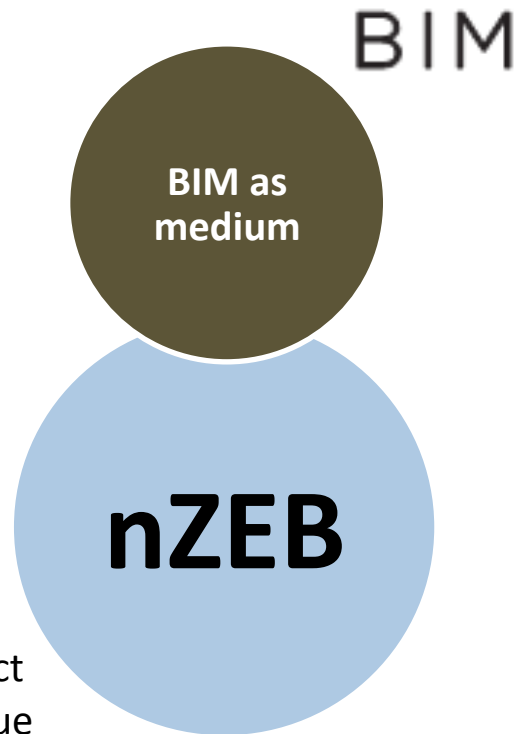


BIMplement

BIMplement approach



- BIM as communication exchange medium and information carrier;
- BIM as integrated building process management;
- Data shared among different project phases and different disciplines (blue and white collar workers).



PROF / TRAC

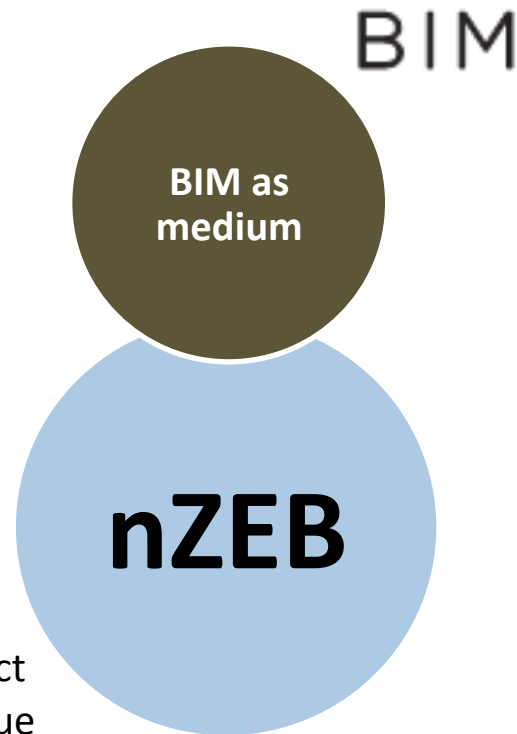


BIMplement

BIMplement approach



- BIM as communication exchange medium and information carrier;
- BIM as integrated building process management;
- Data shared among different project phases and different disciplines (blue and white collar workers).



BIM is not the goal, improved quality for nZEB construction & renovation and a more efficient process are the goals!

The best approach to reach these goals seems to be BIM.

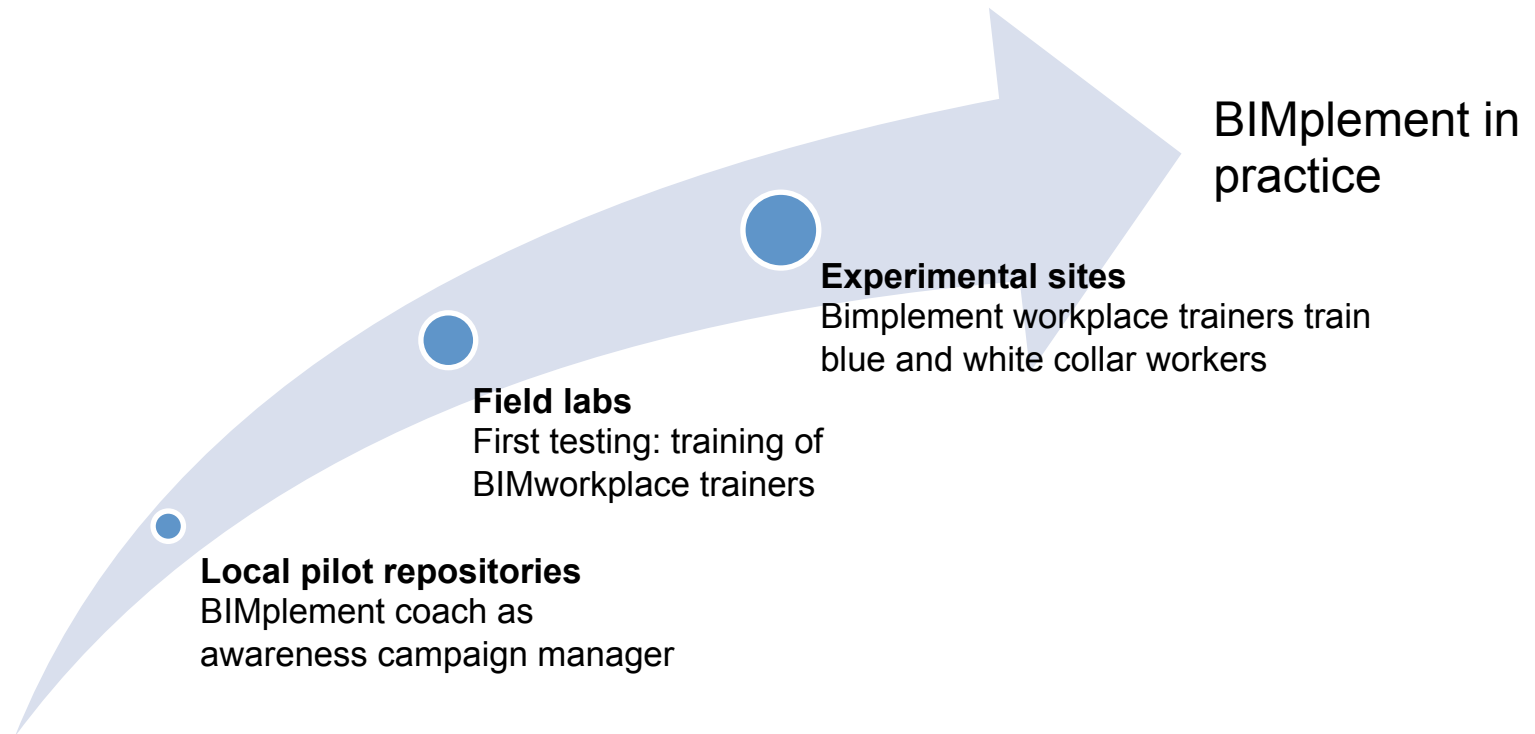


PROF / TRAC



BIMplement

BIMplement implementation



BIMplement methodology

- 5 countries used for demonstration: France, Spain, The Netherlands, Poland, Lithuania



PROF / TRAC



BIMplement

....so, in a nutshell:

- Using BIM as a universal ‘information carrier’ for quality control
- Identifying quality control levels > identifying necessary skills for involved trades and professional levels > identifying necessary trainings and upskilling > BIM enhanced
- Cross-trade and Cross-level
- Enriching BIM-models with process or learning metadata
- Using hands-on and BIM-enhanced workplace learning tools
- Implemented on (at least) 50 building sites in practice
- Mainly SME’s oriented but also for large companies



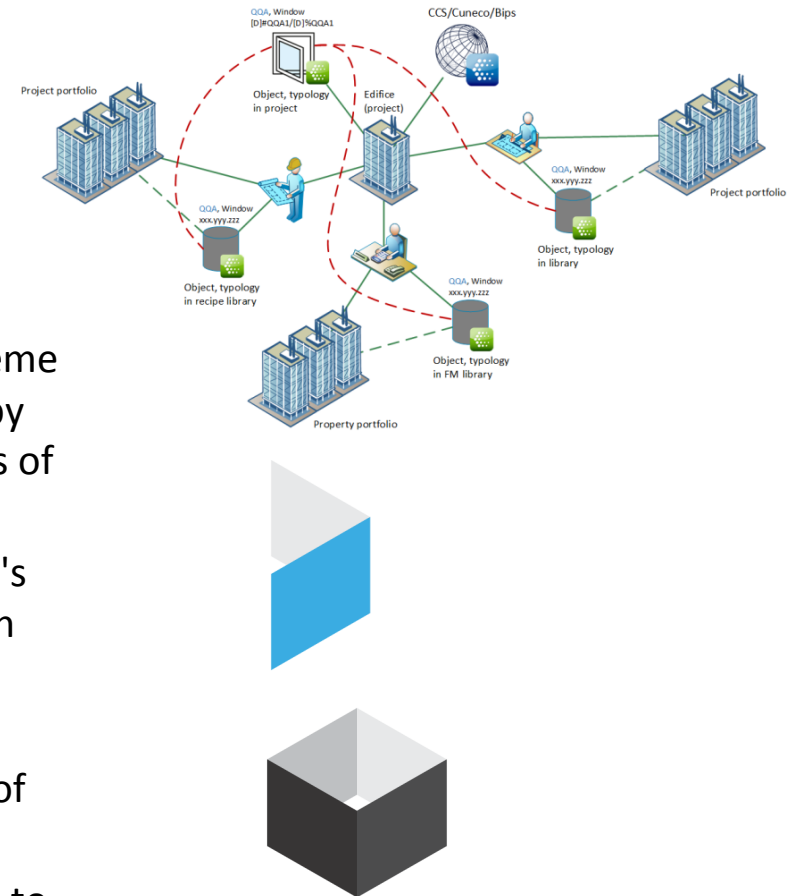
PROF / TRAC



BIMplement

BIMplement: cross-cutting approach

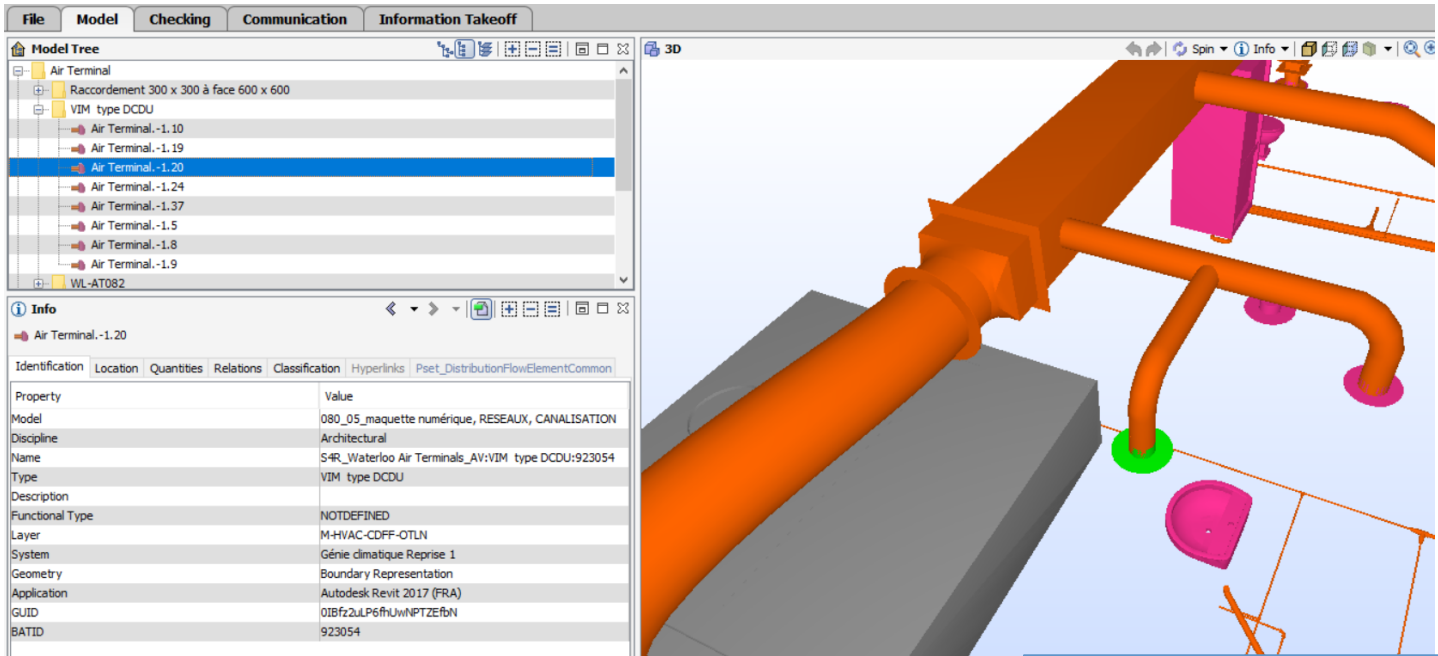
- **Cross-Trade:** with a multidisciplinary approach throughout the entire value chain of the buildings sector.
- **Cross-EQF-level:** addressing both blue collar workers, middle and senior level professionals.
- **Cross-Time:** by setting up a flexible qualification methodology so that new innovations and uses of technologies can be addressed.
- **Cross-Country:** by setting up a mutual recognition scheme of qualifications among different Member States, but by leaving room for Member States specific roles and uses of technology
- **Cross-Value:** by improved appreciation of the end user's needs including the quality of indoor environment in an improved operation and maintenance by closing the learning loop using BIM as information carrier.
- **Cross-size:** from SME to Enterprise, based on regional or local experience centres or BIM-Hubs.
- **Cross-Project:** by using BIM as a learning environment, to facilitate and enable the learning flow.



PROF / TRAC

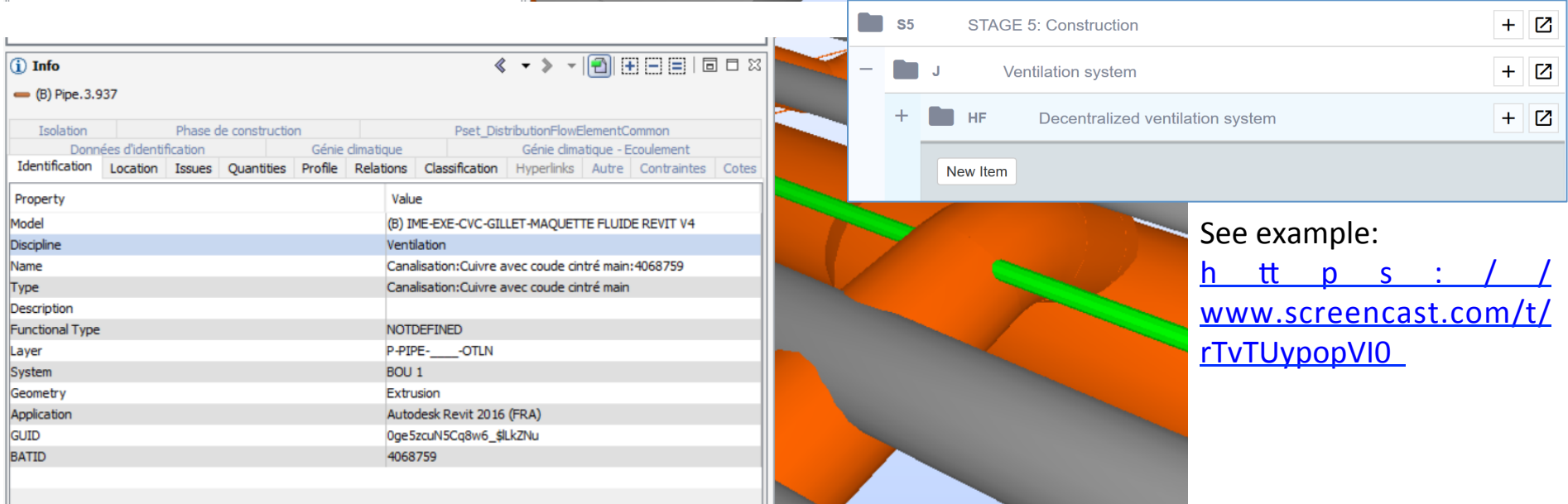


BIMplement



Within the current (MEP) BIM model different information types are shown.

In BIMplement project new property types will be added related to needed qualifications, skills to execute the task (including task description).



See example:
<https://www.screencast.com/t/rTvTUyppovVIO>



PROF / TRAC



BIMplement

Conclusions

- Although the task and challenge is massive (upskilling of more than 3 million workers in the construction sector....) the BUS and Construction Skills actions are not 'a stitch in time'
- Architectural professions are crucial when it comes achieving quality in NZEB's.....but at the same time really need upskilling in knowledge on NZEB technologies and concepts (*ref. Vocational skills for energy efficient buildings - Public stakeholder workshop, 24-10-2017, Bucharest*)
- BIM could enable and facilitate this learning process, also in mutual understanding of different trades and levels
- BIM can be enriched by definition of quality levels, needed skills and linked trainings
- Quality control, upskilling, training etc. should also take end-user related issues into account, especially for NZE / deep renovations



PROF / TRAC



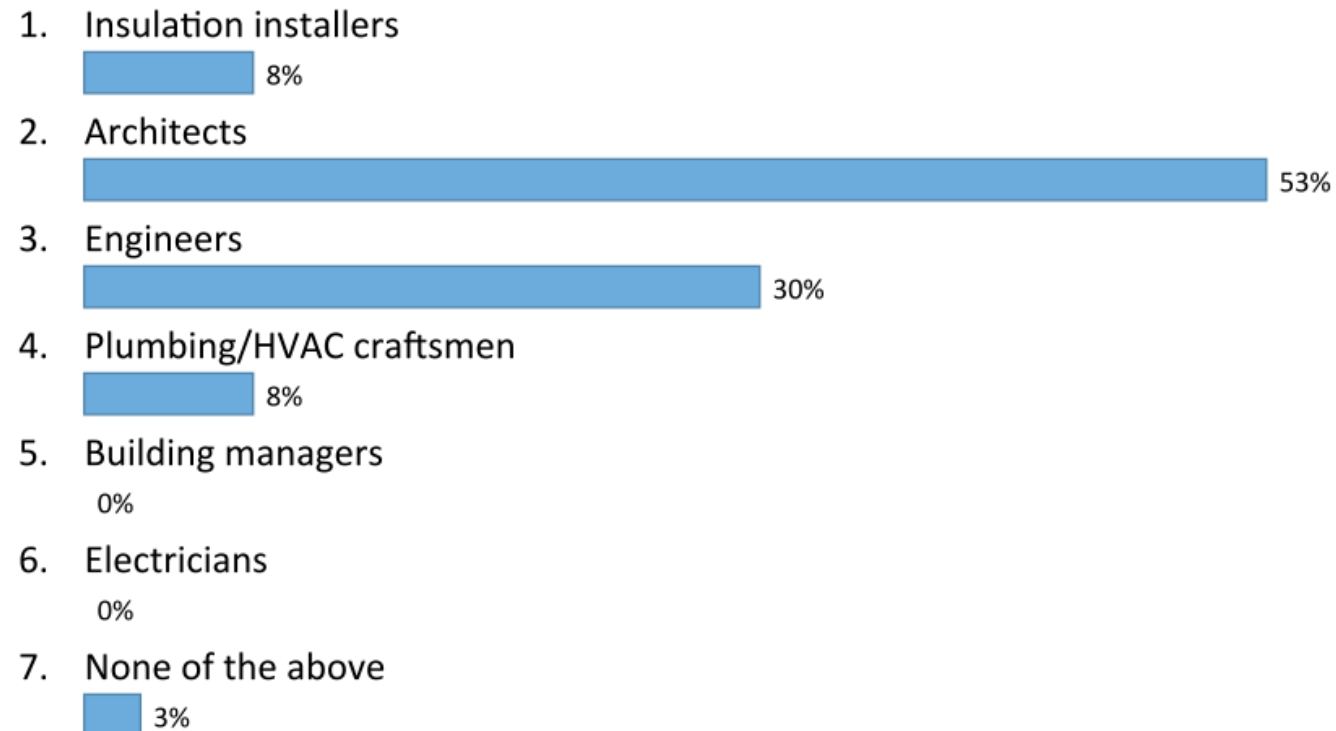
BIMplement



Discussion – votings during the conference Vocational skills for energy efficient buildings 24-10-2017, Bucharest

Do you agree/disagree?

Which trades/professions have the most influence on building energy performance?



PROF / TRAC

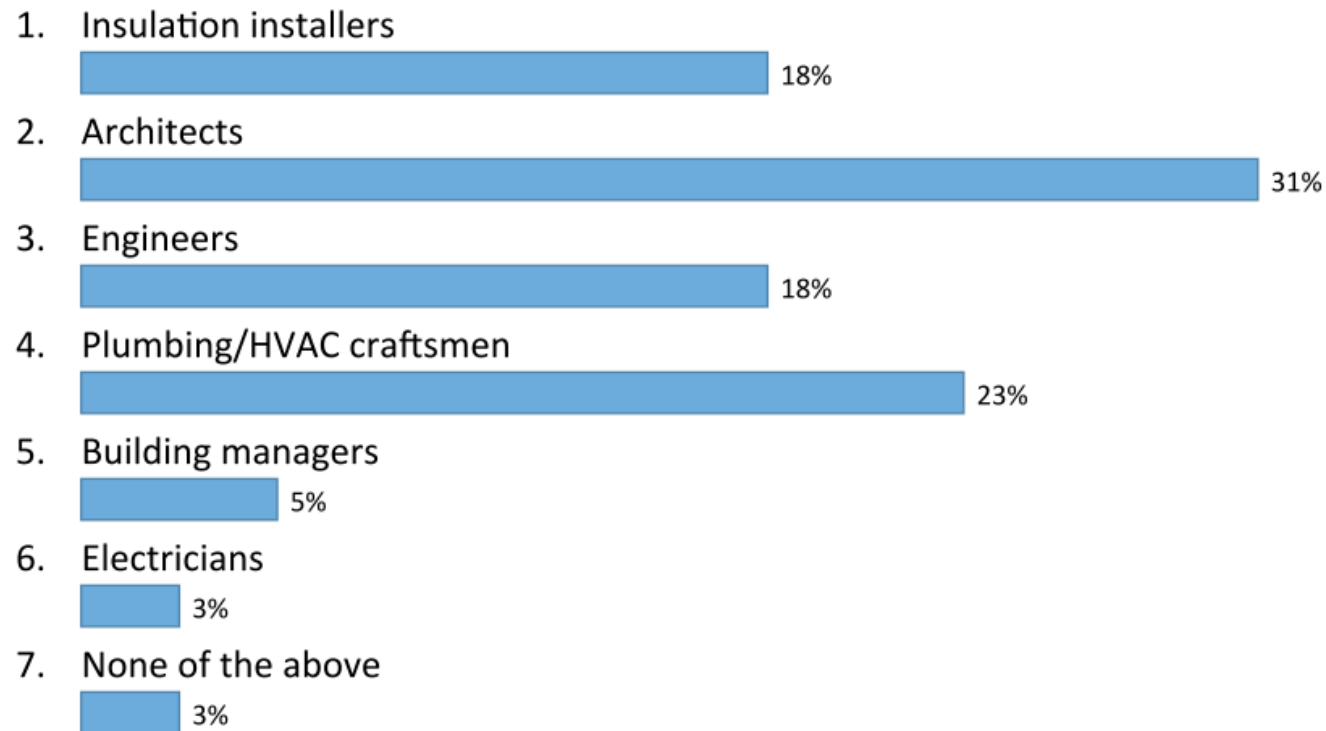


BIMplement

Discussion – votings during the conference Vocational skills for energy efficient buildings 24-10-2017, Bucharest

Do you agree/disagree?

Which trades/professions need the most training for energy efficient buildings?



PROF / TRAC

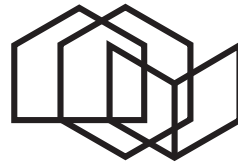


BIMplement

Thank you for your attention!



colofon



PROF / TRAC

www.proftrac.eu

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S H2020 FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION UNDER GRANT AGREEMENT NO 649473.

THE INFORMATION IN THIS PUBLICATION DOES NOT NECESSARILY REPRESENT THE VIEW OF THE EUROPEAN COMMISSION.

© PROF/TRAC
ALL RIGHTS RESERVED. ANY DUPLICATION OR USE OF OBJECTS SUCH AS DIAGRAMS IN OTHER ELECTRONIC OR PRINTED PUBLICATIONS IS NOT PERMITTED WITHOUT THE AUTHOR'S AGREEMENT.



BIMplement

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S H2020 FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION UNDER GRANT AGREEMENT NO 745510.

THE INFORMATION IN THIS PUBLICATION DOES NOT NECESSARILY REPRESENT THE VIEW OF THE EUROPEAN COMMISSION.

© BIMplement
ALL RIGHTS RESERVED. ANY DUPLICATION OR USE OF OBJECTS SUCH AS DIAGRAMS IN OTHER ELECTRONIC OR PRINTED PUBLICATIONS IS NOT PERMITTED WITHOUT THE AUTHOR'S AGREEMENT.