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OPEN LETTER

Sustainable energy skills in the construction sector 3.0: expertise, lessons learned, and developed methodologies on energy efficiency skills competencies, and qualifications

[version 1; peer review: 1 approved, 1 approved with reservations]

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Abstract

The European construction sector is one of the areas with the highest potential when it comes to reducing annual energy consumption. Facing many challenges to achieve ambitious energy efficiency objectives, this sector aims to proceed by applying successful training initiatives and supporting policy instruments.
For this reason, the creation of BUILD UP Skills, an EU Initiative to improve the qualification and skills of Europe's building workers, acted as a springboard to stimulate the demand for energy efficiency skills. Furthermore, focusing on the continuing education of craftsmen and other on-site building workers, this initiative is home to most of the projects presented during the Sustainable Energy Skills in the Construction sector workshops 1.0 and 2.0 and 3.0, presented at SP2020, SP2021 and SP 2022, respectively. Consisting of nine Horizon 2020 projects—PRO-Heritage, TRAIN4SUSTAIN, INSTRUCT, BUSLeague, the nZEB Roadshow, SEEtheSkills, ARISE, BUS-GoCircular and nZEB Ready—the objective of the third edition of the workshop was to share expertise, lessons learned, and developed methodologies on energy efficiency skills competencies, and qualifications across the building design, operation, and maintenance value chain.

Open Peer Review

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Any reports and responses or comments on the article can be found at the end of the article.

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energy; skills; construction; competencies; qualifications; lessons learned; methodologies; building professionals

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Introduction

The European construction sector is facing multiple ongoing challenges, such as the climate crisis, high energy prices and the ongoing geopolitical crisis. In order to respond to these crises, the European Commission has developed multiple initiatives and responses, such as the European Green Deal, to confront each of these issues with fitting measures.

In October 2020 the European Commission launched the Renovation Wave Initiative with the ambitious objective of building on the national long-term building renovation strategy and doubling the building renovation rate by the end of this decade, corresponding to 35 million building units renovated by the end of 2030.

Also, in order to be aligned with the more ambitious greenhouse emissions reduction target by 2030 of 55% compared to 1990 levels, the European Commission has proposed a revision of the current regulatory framework, which is currently being discussed at the inter-institutional level between the council and parliament. It is expected to have the new regulatory framework in place, mainly the energy performance of buildings directive, the energy efficiency directive, as well as the renewable energy directive, in the coming months.

Moreover, another response to the aforementioned crisis has been the increase in the number of initiatives, such as the RePowerEU initiative. Launched in May 2022, RePowerEU is a plan to quickly reduce dependence on Russian fossil fuels and accelerate the ecological transition. To reduce natural gas consumption, the RePowerEU plan proposes to add 10 million hydronic heat pumps in the next five years. All the above measures require a higher number of workers who are qualified in terms of sustainable energy skills in order to deliver these targets and tackle the corresponding challenges.

Another initiative that is aimed to support the achievement of these objectives is the BUILD UP skills initiative. Launched in 2011, it was funded through two programs, the Intelligent Energy Europe Programme (IEE) and the Horizon 2020 research and innovation programme and will be continued under the LIFE Clean Energy Transition sub-programme.

Within the 2019–2020 cycle, the European Commission funded nine projects, aiming to boost demand for energy-related skills in the construction sector. The following projects which some of their results are addressed in this article, are working on measures to stimulate demand in terms of procurements, campaigns, and partnerships.

Projects funded in 2019–20: PRO-Heritage, TRAIN4SUSTAIN, INSTRUCT, BUSLeague, The nZEB Roadshow

PRO-Heritage

The partners of PRO-Heritage strived to offer skilled craftsmen an initial and permanent training that offers traditional competencies and skills for the built cultural heritage, based on best practice examples of the partner organisations. In addition, PRO-Heritage created a structure and environment for regular journeys of journeymen in Europe to further promote the exchange of competencies and skills in Europe. The most important needs addressed in PRO-Heritage were: the protection of traditional competencies and skills for the built cultural heritage relevant to energy efficiency and renewable energy; the need to involve sufficiently trained professionals and craftsmen in the “gentle” maintenance and care; and the need to certify these professionals and craftsmen so that their competencies and skills can be recognised.

Lesson learned. In its lifetime, PRO-Heritage has confirmed the lack of available training and competencies for historic buildings, lack of communication about that skills and limited number of long-term plans by the decision makers. Furthermore, the barrier of not sufficient trainings in local languages has been mentioned.

TRAIN4SUSTAIN

The construction sector is one of the main drivers of the European economy. As sustainable buildings are on the rise, sustainable energy professionals are increasingly requested across Europe. Therefore, the TRAIN4SUSTAIN (T4S) project stimulates the demand for skilled construction sector professionals (architects, contractors, small and medium enterprises [SMEs] and blue collar workers) through raising acceptance of regional and national qualifications and skills on the EU construction market.

The T4S project has developed the European Skills Registry (ESR) web platform for target groups such as building professionals, public administrations, and scheme operators. It is based on the T4S Competence Quality Standard (CQS), which also includes a web-based match-making Hub for professionals and end-users, a skills comparison tool, and e-Inventory for training schemes.

The developed T4S CQS is a CEN pre-standard (CEN Workshop Agreement – CWA No. 17393:2022) published in October 2022, which is a regulatory document that works as pre-standardisation process, leading to the creation of a technical deliverable which can be the basis for a European or international standard at a later stage. The CWA 17393 identify and describe Learning Outcomes (LOs) for professions in a unified manner and communicate the competencies across domains (environment, society, economy, processes),

which leads to a European Skills Passport. The main reference for the methodology development has been the European Qualification Scheme developed by the H2020 Prof/Trac project and it has been expanded in the T4S project to include new topics and new work fields.

In this way, over 300 existing qualification schemes (QS) were evaluated and mapped to fill the T4S CQS. The CQS is not only international but also pan-European, as 67 QSs from all over Europe have been integrated (Austria, Belgium, Croatia, Finland, France, Germany, Hungary, Ireland, Italy, and Spain) as well as non-EU countries (Republic of Serbia and Switzerland). These integrated QSs describe in a total of 1,335 LOs as well as every single Area of Expertise (in total 140 AoE) and profession (in total 22).

Furthermore, the T4S project provides guidance for public authorities in demanding and evaluating sustainable energy skills in Green Public Procurement and contracting processes. This method has been successfully conducted in a pilot by the City of Barcelona. The influence of the skills passport was examined in detail to underline the value of the passport for future GPP tenders in the European member states.

Lesson learned. In conclusion, on the base of the LOs acquired through the completion of learning processes, a professional receives the TRAIN4SUSTAIN Skills Passport, a transnational document reporting the level of competence in relation to the thematic fields and AoE of the Competence Quality Standard.

INSTRUCT

The entire world is facing an energy crisis connected with the post-pandemic economy and the war in Ukraine. The current situation has boosted the demand for renewable sources of energy and supports the need for decreasing energy consumption. This applies to many areas of our lives i.e.: electricity generation, transportation, heating and cooling, agriculture and food production, manufacturing and industrial processes, water and wastewater treatment, recreational activities and construction.

With a focus on construction and housing, we see a huge demand for qualified energy efficiency professionals. This includes managers (project managers, site managers), building inspectors, quality control managers (including quality assurance) but also installers and builders. In the INSTRUCT project, we focus on eight areas that oscillate around construction and architecture. Activities within these areas aim to strengthen the demand for qualified specialists. These areas address topics in the field of recommendations for policymakers or guidance and examples of good practices in cooperation between actors of the construction value chain.

In the context of the presented value chain, we have identified several significant challenges:

- For the material/equipment producers, one of the challenges is better training for retailers and installers to have the real planned performance of the produced goods.
- For the retailer, among all challenges, a better understanding of the components they sell and their combination as a complete system.
- For the installer, challenging tasks are better knowledge of their work (through an adequate understanding of the installation guidelines) and their impact on other works (i.e. airtightness).
- Finally, for all the actors, better communication on a performance indicator (labelling, environmental production declaration, cradle-to-cradle, circularity…) is required.

Despite these challenges, we have also identified opportunities for energy efficiency collaboration:

- Opportunity to meet each other and exchange experiences within the offered trainings.
- Develop new and improve existing formal and informal links with the statutory sector.
- Opportunity to discuss projects and monitoring challenges with an experienced evaluator/tutor (of the training).
- Work-related qualifications leading training to strengthen self-esteem and transversal competencies.
- Building better relationships with employers to create work placements and jobs for young people.
- Opportunity for the lead organisation to access additional support and build capacity that would not have been available otherwise.

In addition to working on the above-mentioned area examples, the INSTRUCT project established a blockchain-based web platform in order to support the training and education of energy efficiency. The platform consists of several tools:

- A blockchain training network integrated into the energy-education.com platform to support passports/registers for workers at the regional/national level and support for their take up at the EU level.
- A mobile interface using QR codes integrated into the energy-education.com platform for facilitating the comparison of workers' skills and qualifications between countries.
- A dedicated legislation service exposed the energy-education.com to present and inform about new legislative frameworks or public procurement practices.
- A dedicated training service complemented with energy sustainability services to support and incentivise initiatives for home and building owners.
- A professional network service and a community of 200+ registered users from the field of energy efficiency aimed to facilitate new partnerships with producers and retailers.

Lesson learned. Although most of the construction sector stakeholders are aware of the benefits of energy-efficient skills, we are still facing a lack of these skills in the market. Moreover, we need to reach more users and investors to encourage them to invest in this area. Raising public and investors' awareness of the benefits of suitable skills and their application requires long-term planning.

BUSLeague

One of the key issues facing the construction industry since 2010 has been the requirement to upskill workers in order to produce high-quality nearly zero-energy buildings (nZEB) and deep energy renovations (zero-emission buildings [ZEB]). By taking a whole-building approach, addressing many systems at once, much greater energy efficiency (EE) can be achieved. BUSLeague is a 30-month-long project started in September 2020 and formed by a coalition of former BUS and Construction Skills projects in Austria, Bulgaria, Spain, Ireland, France, and the Netherlands. It was funded by the European Union's Horizon 2020 framework program, which aims to make a real and sustainable difference to the quality of life in the EU, as well as the EU's position in the world, towards implementation of the Sustainable Development Goals (SDG).

For effective improvement of the built environment (both new and existing buildings) to nZEB and ZEB standards, all actors in the value chain need to have a proper, transparent, and up-to-date set of knowledge, skills and competences. Therefore, BUSLeague created an Energy Skills qualification that is suitable for Recognizing Energy Skills. This recognition is aimed at increasing the demand for properly skilled nZEB teams and facilitating upskilling providers such as training institutes to deliver practical and effective upskilling that counts.

A stakeholder consultation process was carried out in the 6 partner countries in order to validate the qualification for recognition of energy skills. In total, 100 stakeholders were consulted during 30 sessions held in the Netherlands, France, Bulgaria, Spain, Ireland, and Austria. The resulting qualification including detailed unit of learning outcomes is available online in the unit of learning outcomes database of the BUILD UP Skills advisor-app and as Excel file from the BUSLeague website.

To optimise the recognition and expansion of further education in the field of EE, BUSLeague partner countries focus on providing targeted micro-learning and e-learning. In this way, craftspeople can access training through various media and at their own pace. In addition, the educational offer in training centres and the BUS app, including recognition of skills, will be expanded. Moreover, to tackle the challenge of mutual recognition of qualifications, the taught competencies shall be described according to the developed consistent methodology.

BUSLeague has also explored how financing mechanisms (e.g., by introducing additional skills requirements to access public grants) and green public procurement (GPP) could be used to incentivise energy efficiency improvements, and has piloted energy efficiency training clauses in six countries. Commitments will be sought from public and private bodies to use the clauses. The idea is to start with small or local commitments and apply them to the whole portfolio of companies, followed or complemented by local and regional political commitments. This, in turn, should eventually support legislative changes.

Lesson learned. When working on innovations and innovative topics, one has to consolidate the front runners in order to get the best answers on the type skills that are needed. Secondly, if you work on innovations and innovative topics the biggest uptake is after the project duration so in the exploitation and replication strategies you have to be keen that the mass market still has to develop and such means that the project outcomes are effective and valuable for a number of years after the project. Moreover, we should not focus on smaller corners of the value chain because, in order to deliver a build environment that is zero-emission, we need to involve the full value chain as the energy efficiency is not independent from climate adaptation. The future BUILD UP initiatives should be aware that, in order to deliver properly skilled persons, we need to address the connections between the different topics of climate adaptation, circularity, digitisation, energy, etc. in a clear manner.

The nZEB Roadshow

Stepping on the developments of the Train-to-nZEB and Fit-to-nZEB projects, the nZEB Roadshow project put the building knowledge hubs (BKHs) on wheels through the design and construction of prefabricated modular mobile buildings that will serve as information and demonstration centres for raising awareness of the benefits and specificities of nZEB, and organised national-scale marketing and communication campaigns in five European countries. The key activities focus around "nZEB days" organised in three to five selected cities in Bulgaria, Croatia, Greece, Italy, and Romania. The nZEB weeks will consist of a multitude of events: construction products and real estate fairs, practical demonstrations and real-time nZEB construction workshops, training courses for designers and construction workers (with the inclusion of BIM-enabled VR and AR solutions), information sessions and free consultations for professionals and citizens active in the real estate market, on-site training at public building renovation sites, and career orientation centres and construction job fairs with a focus on local construction sector SMEs.

The nZEB Roadshow creates the necessary prerequisites for effective communication between stakeholders. With very careful attention to exterior and interior design, the hubs will offer real-life experience of quality nZEB and will be equipped with all necessary technologies to provide full information on the processes with relevance to the building's performance in terms of comfort, internal air-quality parameters, and energy consumption. In addition, the nZEB Roadshow complements the current efforts to promote nZEB—related to two very important but unfortunately still largely missing components: professional marketing and sales services, and strong media partnerships.

By building a positive image of nZEB as a modern solution and as a comfortable and healthier alternative to standard construction and addressing the wider benefits of energy-efficient buildings, including air quality, healthy environment and comfort of habitation, the project intends to shift the usual communication discourse from energy and financial savings towards values and motivational factors better suited to the demands of the potential buyers and end users. Finally, by coordinating the execution of the marketing and stakeholder engagement strategies and rigorously application of the defined monitoring and evaluation scheme, the nZEB Roadshow will document and develop case studies of the national cases, while preparing and delivering a monitoring report with recommendations for replication of the campaigns model.

Lesson learned. The described approach is effective, and the first lesson learned is to simplify complex concepts in order to increase the understanding and the awareness of the users to implement it. In this area, concepts such as gamification have the capacity to increase the impact. Another lesson is to implement pull tactics by concentrating on increasing the quality of solutions and training that we provide, in order to change the current situation. Finally, clustering with other projects and initiatives that are focused on the same topic will increase the impact.

Projects funded in 2021: SEEtheSkills, ARISE, Bus-GoCircular, nZEB Ready

SEEtheSkills

The project SEEtheSkills is acting through a novel 3V approach aiming to tackle direct stimulation of demand of energy skills in construction, referring to: visibility of skills by creation of an on-line repository for skills i.e. an integrated SEEtheSkills register, enabling cross validation of energy skills by recognising units of learning outcomes in order to issue certificates for energy efficiency competences, which will finally raise the value of the skills and provoke their increased market demand.

This approach is accordingly justified by the results of the conducted online survey in five countries participating in the project: Spain, Slovakia, North Macedonia, Slovenia, and the Netherlands. The survey ran in April 2022, and involved two different groups of respondents: the individual professionals and the companies. Regarding the visibility of the skills, important feedback that proves the need to better manage available skill sets is the finding that less than 25% of respondents have some form of published (announced, visible) information about their EE skills. Only 30% of respondents have formal documents that certify their skills, providing that the development and wider implementation of procedures for validation of skills are more than necessary. Thus, the project is in the phase of enabling the digital process of validation of prior learning by developing and proposing the usage of the e-RPL tool, that will provide the process of recognition of prior learning as a digitally available web based tool.

Regarding the existing gaps in energy efficiency competences and qualifications that were identified so far through project activities, interestingly, the both surveys, for individuals and for companies, revealed high demand for training on "Coordination, Collaboration, and Cross-Craft" and for the "Installation of RES (PVs and heat pumps)", but also the training for "Use of BIM and Digitalisation on the Construction site" is not significantly lagging in terms of interest shown by respondents. These findings will be used further on in the project, for selection of most prioritised training schemes to be developed and piloted, in order to improve energy efficiency competences and qualifications.

ARISE

ARISE is developing a Europe-wide distinguishable recognition scheme of digital energy efficient BIM construction skills linked with a maturity-based digital ranking system for accounting CPD learning transactions. The open competency-based qualification scheme based on maturity levels that empower micro-learning will be the basis for making learning transactions count. The project team will be gathering and linking BIM modules, tools, and materials with the aim to establish a BIM resource and skills recognition pathway that all stakeholders can utilise, deliver and stimulate. This will provide BIM Energy Performance Alliance (BIM-EPA) partners and other stakeholders with an e-learning materials repository to contribute to, whilst also developing a CPD recognition pathway for the whole supply chain to access and utilise.

Micro credentials: ARISE will create a system for issuing, verifying, and sharing micro-credentials for learning credits, creating a digital learning platform allowing learners to store credentials and enabling them to share them with educational institutions and employers. Digitalisation of the skills process empowers the switch from paper- based to digital credentials delivering significant advantages across the skills exchange process to learners, employees, educational institutions, and training delivery agents. The ARISE system of universally recognized, learner focused stackable micro-credentials for micro module units of learning will enhance student mobility, employability and enable truly flexible learning paths.

Skills Monetisation: ARISE will revolutionise the learning process by monetizing the skills and learning exchange with a system based on skills recognition rather than accreditation. The reward of acquiring a competence at a certain level will be CERTcoin–the innovative currency of skills and learning of the construction sector embracing today's digital transformation benefits. This reward based on skills and time credits will be stored in an individual learning account and can be used as digital points accumulation for example in a skills barometer or for exchanging it into valid certificates. It will be accessible easier, less time consuming and still competitive way to up-skill blue and white collars.

BUS-GoCircular

BUS-GoCircular is shaping a circular sustainable future for the construction industry in Europe by bridging the skills gaps that currently exist within all facets of this sector. Our aim is to address and overcome the challenges faced when

implementing real change through equipping a green energy skilled workforce to deliver in an as circular as possible way. Working collaboratively and connecting with partners is our goal and by upskilling both the demand and supply sides of the value chain, we believe real change is afoot. BUS-GoCircular has mapped the skills gaps related to MGRFIE (Multi-Functional Green Roofs Facades and Interior Elements). The skills mapping process applied is suitable to map skill gaps for any technical and process element within the construction value chain.

The BUS-GoCircular skills mapping is based on the key elements as highlighted in the Key Elements framework by Circle Economy. Three core elements are "Prioritise Regenerative Resources", "Stretch the Lifespan" and "Use Waste as a Resource". These elements are the core activities that directly handle products or material flows, meaning these elements are vital to the success of circular economy practices. Along with the core elements there are five enabling elements. These are, "Rethink the Business model", "Design for the Future", "Collaborate to Create Joint Value", "Incorporate Digital Technology" and "Strengthen and Advance Knowledge". The enabling elements support the core elements and thus ensure that any obstacles are removed.

In BUS-GoCircular we have identified 38 professions and 52 skills relating to circular economy and MGRFIE. These include many existing professions and several new and emerging professions. Some of these new professions include Green Public Procurers (GPP), Demolition or Deconstruction Auditor, Green Roofer, and Repair and Maintenance Operatives. Some of the skills we identified were based on the Key Elements framework, such as Design/Build for Reuse and Apply material passports. Based on the outcomes the BUS-GoCircular consortium prepares training of trainers and implementation within national implementation plans in participating countries.

BUS-GoCircular has created a clear path to identify the skills gaps throughout Europe which can easily be repeated in addressing other aspects of the built environment. We are utilising the information gained through our skills mapping through Train the Trainer and mentoring programs which will be carried out across Europe and across the construction sector. The information we have collated will also be added to the BUILD UP Skills advisor-app which will allow industry professionals to gauge their skills levels and direct them toward the required training they will need to reach optimal skills level within their profession.

nZEBReady

The goal of nearly zero-energy can be achieved nowadays with existing technologies and practices, but the concept is still unfamiliar and elusive in most of the European countries, considering the whole process chain, despite all previous initiatives in this direction. There are still barriers in the value chain, making the nZEB concept difficult to arrive at the final users. The nZEB market analysis at European level reveals a significant gap between the countries with a high level of implementation and those which are not so well performing, and which remain increasingly behind.

To overcome this, the nZEBReady project aims to leverage the market drive by addressing 3 key questions: "Why nZEB?"; "Who can provide nZEB?"; and "How to reach nZEB". Thus, the nZEB Ready project will prepare ready to use frameworks to answer the needs related to lack of awareness, lack of skilled professionals and lack of support instruments, implementing the nZEB ready labelled procedures in five pilot countries in order to obtain a broader range of results, representative at European level. The frameworks obtained will be validated by specific stakeholders which are already part of the advisory board of the consortium and will be the starting point for the nZEB readiness roadmap for further replication in a wider use at the European level.

The nZEB Ready project will provide a complex set of learning/training frameworks for nZEB concept, design, evaluation, execution, and exploitation by gathering the already existing courses from previous European initiatives with new courses addressing domains not covered yet, to fully complete an nZEB approach. Modules dedicated to white collars (e. g. architects, auditors, or engineers) and modules dedicated to blue collars related to nZEB buildings are considered. The approach will be specific for each state depending on the needs identified for each of them but the whole courses/training framework will facilitate the mutual recognition of energy skills and qualifications in the building sector. The common learning results obtained from the training programs will facilitate the development of nZEB ready energy skills passports/registers for building professionals at regional/national level and support for their uptake at European level.

It is not enough to have the obligation for implementation in the Official Journal/Monitor – there is more to effectively recognize nZEB in real market, in particular if we acknowledge the nZEB standard as a transition towards net zero emission buildings. nZEB awareness is increasing, yet more effort is needed in order to have the construction chain ready for nZEB implementation. There is a need for upskilling in the framework of existing qualification, but also for new qualifications (e.g., blower door testers, thermal bridge evaluation, infrared inspections and more), and also need for practical tools and procedures to facilitate the application of the nZEB standard in practice. The nZEB Ready project outcomes are developed to respond to these needs to prepare the market for an effective nZEB implementation.

Conclusion

In order to address the skill gap in construction and enable the workers to manage the energy content of their work, skills training within the EU must move from the current static unidirectional maintenance mode to a more dynamic, learner-led engagement that is bidirectional.

Engaging with a large number of workers in the industry that are vocationally excluded, we need to reach further and engage with and stimulate a broader range of stakeholders. Addressing the energy skills that the industry needs is interconnected with addressing blue-collar and white-collar workers.

In the above projects we have addressed digitalisation as broken down into three stages:

1. Awareness – raising the awareness of the potential in delivery and content to both the company and the learner
2. Transformation – mapping out and enabling the pathway to transformation
3. Implementation – developing the digital interface and tools necessary to implement the digitalisation journey

In today's digital world encompassing big data, digital pathways, and micro delivery it is mission-critical to raise both the educators' and trainees' awareness regarding the complexity of using digital technologies and social media for learning. Developing critical digital competencies is in fact key to everyone, especially to educators, trainees, and the supporting systems. The integrated approaches within the projects such as ARISE are critical so we can empower students to engage not only effectively but also ethically with the current socio-technical ecosystem.

For this shift to become mainstream traditional 'internal' systems need to be invested in approaching digital competencies from a critical perspective, starting from the training of trainers, delivery agents and their support staffs, and with the frameworks regulating both pedagogies and associated curricula. This involves reconceptualising the notion of digital literacies and looking beyond just the mere functionality of the skills and encompasses instead a richer set of critical literacies, which are tailored specifically to educators' personal and professional needs.

Data availability

No data are associated with this article.

Open Peer Review

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✓ **Deyslen Mariano-Hernández**
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The open letter from the authors provides a summary of recent projects focused on sustainable energy skills in the construction sector. It offers a comprehensive compilation of information on each project. After reading the article, I have a couple of recommendations for improvement:

- It would be beneficial to include comparative graphs or tables that compare the advantages and disadvantages of each project.
- While there is an interactive link to the project pages, including a reference section and placing the links there would be helpful.

Is the rationale for the Open Letter provided in sufficient detail? (Please consider whether existing challenges in the field are outlined clearly and whether the purpose of the letter is explained)
Partly

Does the article adequately reference differing views and opinions?
Partly

Are all factual statements correct, and are statements and arguments made adequately supported by citations?
Yes

Is the Open Letter written in accessible language? (Please consider whether all subject-specific terms, concepts and abbreviations are explained)
Yes

Where applicable, are recommendations and next steps explained clearly for others to follow? (Please consider whether others in the research community would be able to implement guidelines or recommendations and/or constructively engage in the debate)

Not applicable

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: energy efficiency, building management systems, building energy management systems

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 28 May 2024

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The article provides a comprehensive overview of various European initiatives aimed at addressing the multiple challenges faced by the construction sector, including the climate crisis, high energy prices, and geopolitical tensions. The European Commission has responded to these challenges with initiatives such as the European Green Deal and the Renovation Wave Initiative, which aims to double the building renovation rate by 2030, targeting 35 million renovated units. Additionally, the RePowerEU initiative aims to reduce dependency on Russian fossil fuels and promote ecological transition.

- Citing literature thorough the manuscript is missing
- List of Literature sources at the end of the manuscript is missing.
- While the article provides a thorough overview of each project, it could benefit from a more critical analysis of the challenges and potential drawbacks. For example, discussing potential obstacles in scaling these initiatives or the long-term sustainability of funding could provide a more balanced perspective.
- Include a more critical discussion on the challenges and potential barriers to the successful implementation and scaling of these initiatives.
- Provide insights into potential future directions and how these initiatives might evolve to address emerging challenges in the construction sector.
- Discuss how these various initiatives might synergize or integrate more closely to amplify their collective impact on the European construction sector.
- Highlight the importance of stakeholder engagement and how these projects are involving various stakeholders (e.g., policymakers, industry professionals, the public) to ensure broad-based support and adoption.
- Incorporate case studies or success stories that highlight the tangible impacts of these

initiatives on specific projects or communities.

Is the rationale for the Open Letter provided in sufficient detail? (Please consider whether existing challenges in the field are outlined clearly and whether the purpose of the letter is explained)
Yes

Does the article adequately reference differing views and opinions?
Yes

Are all factual statements correct, and are statements and arguments made adequately supported by citations?
No

Is the Open Letter written in accessible language? (Please consider whether all subject-specific terms, concepts and abbreviations are explained)
Yes

Where applicable, are recommendations and next steps explained clearly for others to follow? (Please consider whether others in the research community would be able to implement guidelines or recommendations and/or constructively engage in the debate)
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: University professor dealing with training of professionals (blue and white collar) in the field of energy efficiency

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.