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Constructing a new relation between labour and the environment: what is needed for a post-covid, green and inclusive construction sector

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Abstract

The paper is set in the context of European Union (EU) policy to reduce built environment carbon emissions, including through the European Performance of Buildings Directive (EPBD), which - despite EU social and equality objectives - remains gender-blind, technologically-driven and in accordance with ecological modernisation. Difficulties in effectively implementing the EPBD relate to vocational education and training (VET) and the labour process requirements for nearly zero energy building (NZEB). The reasons for the failure of VET and labour market policies and practices to improve equality in the sector and what is needed to overcome its exclusiveness are further highlighted. Combined, the requirements for greater equality and for a sustainable construction process provide the pillars on which to construct a transformed post-covid industry. In examining local and organisational examples of where LEC and has been achieved, the ingredients are identified for developing an eco- and inclusive construction sector, in particular the coalition of actors - above all the public authorities, VET institutions, unions, women in construction and environmental organisations - essential to this. The paper concludes by advocating a retrofit programme exemplifying how the industry can be transformed post-covid to become inclusive, socially useful and carbon neutral.

Introduction

The domination and exploitation of labour is inseparable from that of nature, and there is perhaps no sector where this is more apparent than the heavily male dominated construction, an industry with often poor working and employment conditions and responsible for a high proportion of carbon emissions including through extensive use of cement. Yet it is also a sector set to gain more employment than any other from the transition to a green economy through policies and programmes for nearly zero energy building (NZEB), renewable energy installation and retrofit across Europe (ILO 2018). The aim of this paper is to show how the constraints involved in meeting these targets are similar to those confronting the achievement of equality in the sector and how the successful transformation of construction into an eco-industry entails also breaking down the barriers that have served to exclude different groups, especially women and those from BAME (Black and Asian and minority ethnic) groups. The current corona virus crisis has highlighted many of the weaknesses of the industry, in particular the priorities of healthy and safe employment and working conditions and, together with the climate emergency, prompted an urgent, long overdue drive for change.

A major problem with European Union (EU) green transition policy for the built environment is that it is tackled as a ‘technological fix’, as part of energy policy, and underpinned by the logic of consensus of the ecological modernisation approach (Mol et al., 2009). This approach is focussed on ecologically modernising an industry, without concern for the quality of labour and employment involved, for equality, for worker agency, or indeed for the social and economic relations giving rise to climate change in the first place (Hampton, 2015; Lundström, 2018). The EU vision exemplifies this approach in aiming to modernise construction with the aid of renewable technologies and energy efficiency measures without altering the social relations and structures that shape the sector. Though EU equality policy does refer to women’s employment in renewable energy and recruitment to STEM (science, technology, engineering and mathematics) education, green transition policies for the built environment are gender blind and fail to address the inclusivity problem of the sector, including the low levels of participation of women and of those from BAME groups in construction employment.

Though, with some exceptions (Missa 2013; Clarke and Gribbling 2008), there has been little research on the inclusion of those from BAME groups, the reasons for the poor representation of women in construction have been well-researched and rehearsed. They are generally attributed to structural, organisational and cultural obstacles: the fragmented nature of employment; long working hours; the lack of knowledge and poor image of the sector; inappropriate selection criteria; male dominated training courses; lack of formalised recruitment practices and procedures; traditional stereotypes and sexist attitudes; male dominated culture, networking and environment; and lack of work-life balance possibilities (Fielden et al. 2000; Sang and Powell 2013; Clarke et al. 2004, 2015). What is surprising is only the shockingly slow or non-existent pace of change in terms of women working in construction occupations, though there has been more progress in the professions. In 2016, only 3% of those employed as building and related trade workers in the EU were women (Eurostat 2016), a figure that has remained relatively stable, apart from during the world wars, for well over a century. The increasing fragmentation of the construction process through subcontracting and self-employment have certainly aggravated the exclusionary nature of the industry across Europe, but its stubborn persistence, despite all the efforts to increase the number of women, suggests deeply embedded structural obstacles and a gendered division of labour that will never change without a social and ecological transformation, one in tune with radical feminist calls to take into account social reproduction in re-organising society for a sustainable future.

The paper begins with a discussion of EU policy to reduce carbon emissions associated with the built environment, revealing its premises and consequent gender blindness, despite EU equality objectives. Difficulties in effectively implementing the European Performance of Buildings Directive (EPBD) are then addressed, both in relation to vocational education and training (VET) and labour process requirements for NZEB. Drawing also on the experiences of women themselves, the reasons for the failure of policies and practices to improve the participation of women and overcome barriers to their inclusion are pinpointed, both those in the VET system and the labour market, and what is needed for these obstacles to be overcome. Combined, the requirements for inclusivity and for a sustainable construction process provide the pillars on which a transformed industry needs to be constructed. In examining local and organisational examples of where women and BAME groups have been successfully included in construction, some of the ingredients are identified for developing an eco- and inclusive construction sector, in particular the coalition of actors - above all the public authorities, VET institutions, unions, women in construction and environmental

organisations - essential to this. The chapter concludes by advocating a retrofit programme that exemplifies how the industry can be transformed to become inclusive, socially useful and carbon neutral.

EU energy efficiency policies and gender – outline review of key policies

The built environment is targeted for a major transformation as part of EU climate change action plans, being responsible for 36% of CO₂ emissions and 40% of energy consumption. The energy strategy up to 2020 was set out in EU2020 development plans and designed in accordance with Paris Agreement targets. The aim is to achieve an energy efficient Europe (including in the built environment and transport), meeting the long-term objectives of a carbon neutral economy by 2050 by: ensuring energy security through cooperation between EU countries; creating a fully integrated pan-European energy market; improving energy efficiency and increasing renewable energy; decarbonising the economy; supporting research and innovation into clean energy technologies; empowering consumers; and strengthening EU's external energy relations (EC, 2015). Between 2007-2020 implementation was facilitated by National Energy Efficiency Action Plans (NEEAPs), addressing energy efficiency measures, including energy performance certification, inspection schemes and financial incentives, and developing renovation strategies and complementary measures to achieve the now superseded EU 2020 targets (EC, 2010). For 2021-2030, adaptation measures for the built environment are part of the EU's energy strategy, most recently set out in *Clean Energy for All Europeans* (EC, 2019a). Member States are required to develop integrated, ten-year National Energy and Climate Plans (NECPs) to outline how the 2030 targets will be met and a long-term strategy towards 2050 (EC, 2019a). In the medium term, the policy includes a package of initiatives with the aim of improving energy efficiency by 32.5%, increasing the share of renewable energy by 32% and reducing CO₂ emissions by 40% compared to 1990 levels by 2030. It is planned to be progressed in tandem with the European Green Deal (EC, 2019b), the EU's strategic programme for implementing the UN's 2030 Agenda put in motion in December 2019.

Improving the energy efficiency of buildings is fundamental to achieving these various objectives. The policy emphasises job creation as an anticipated outcome, particularly through energy efficiency improvement measures in buildings and growth in the renewable energy sector, which alone is expected to employ 2 million by the end of 2020, mostly in the construction industry. It is driven by the EPBD (EC 2010, 2018), which requires that all new buildings are NZEB by the end of 2020. The EPBD provides the overarching legislative framework, setting out the technical definition of NZEB and guidance for its interpretation and implementation including minimum energy performance requirements, technical building systems, energy performance certificates and inspection regimes (EC, 2010, 2018). Member States are responsible for its transposition into national law, which means achieving higher energy performance standards, though exact technical specifications vary (EC, 2016a). To develop NZEB competencies in the workforce, the EU launched the Build Up Skills (BUS) initiative to increase the number of building workers qualified in energy efficiency measures and the installation of renewable energy systems (EC, 2014). In relation to the energy sector and energy efficiency in buildings, the more recent Green Deal (EC 2019b) sets out decarbonisation strategies and the role of technology in this, emphasises the increasing share of renewable energy and the potential of renovating Europe's building stock with further considerations to the role of legislation, public investment and private financing, and education and training.

These then are the intentions, but what do the various policies and plans show about the underlying rationale of the EU's green transition approach? In general, the policy lacks a social perspective; climate change, energy transition, and energy efficiency are formulated as neutral, scientific systems and processes that have no social context or implications. A review of EU energy and energy efficiency policy documents indicates that, contrary to EU's own commitment to equality, the green transition strategy for the built environment remains gender blind. In none of these documents - the energy policy, the directive, or the NECPs - is there a reference to women or gender, let alone to BAME groups. Instead, the language and priorities are indicative of a transition approach driven by technical energy efficiency targets and lacking a social perspective. With regard to the training plans, to increase the number of building workers equipped with NZEB competencies, the BUS initiative made no specific provisions to facilitate the training of women construction workers (EC, 2014, 2016b, 2018a). The Green Deal, similarly lacks any reference to gender (EC, 2019b). Indeed a review of policy documents on energy and energy efficiency in buildings shows that the energy efficiency strategy of the last two decades has made no provision to address women's participation in the transition to green construction, neither catering to their education and training needs nor taking measures to ensure that they can take advantage of emerging employment opportunities.

At the same time, officially, gender mainstreaming has been pursued since 1996, following the formation of the Beijing Platform of Action (EIGE, 2012), and gender equality remains an explicit objective:

- Article 23 of the Charter of Fundamental Rights (EU, 2000) commits to gender equality.
- The European Parliament adopted a resolution calling for gender equality in the green economy and to include women at all levels of decision making (European Parliament, 2012).
- European Pillar of Social Rights (EU, 2017) covers 20 rights and principles, with the following more directly relevant to women: gender equality in employment (access, progression, pay), equal opportunities (non-discrimination to cover education and all other social services) and work-life balance.
- The European Parliament Committee on Women's rights and Gender Equality is currently working to update the EU Strategy for Gender Equality, renewing commitment to gender mainstreaming (EU, 2020).

As Allwood (2014) points out, policy making in the EU is sectoral, and there are also differences between ambitions and recommendations put forward by the European Parliament Committees and the European Commission (EC) strategies in place. The result is that, whilst addressing inequality requires a fundamental rethinking of all policies, ideas developed by designated departments or committees do not automatically become part of sector-specific policies. The gender mainstreaming objective means that gender should be integral to all policies and strategies but in practice it becomes an add-on, something to be considered afterwards (Weiner and MacRae, 2014).

This is nowhere more apparent than in the documents produced by the European Institute for Gender Equality (EIGE), in particular on *Gender and Energy* (EIGE 2016a) and *Gender in environment and climate change* (EIGE 2016b). These recognise the serious underrepresentation of women in higher technical and scientific education and employed in the energy sector, including in renewable energy and climate change decision institutions. Of those employed in the energy sector, for instance, 22% are women, and these are generally in lower paid and not managerial jobs, though the requirement is increasingly for those with

scientific knowledge and specialist expertise (EIGE 2016a). The EIGE (2016b) calls for: a ‘more balanced representation of women’ at all levels in the field of climate change mitigation; support for women in science and technology; the elimination of gender stereotypes and promotion of gender equality in education, training and working life; and the integration of the principle of gender mainstreaming into relevant legislation, policy measures and instruments related to climate change mitigation. However, as with the EU approach to climate change itself, there is no concern for the quality of labour and employment involved, for worker agency, or the social and economic relations, which in this case give rise to the low participation of women in the first place. In other words, there is no consideration at all of the structural problems in the sectors themselves that perpetuate inequalities and need to be transformed. Policy is instead directed to inserting women and increasing participation in sectors structurally aligned to reproduce gender segregation.

What is NZEB and what are its implications for education and employment?

The approach of the EU to addressing climate change and achieving equality is all the more disquieting given the clear need for a transformation of the construction sector if NZEB is to be achieved. The transition to NZEB has significant consequences for the employment, education and training of the construction workforce. NZEB is fundamentally different from traditional construction as it introduces the concept of energy performance into a production system driven by building on time and within budget. Buildings must meet specific energy performance targets through such measures as airtight building envelopes, thermal-bridge free construction and on-site renewable energy sources. NZEB also needs a co-ordinated construction process where building parts are put together to constitute a system and function to restrict energy use to pre-determined limits. Achieving this degree of precision depends on an adequately trained workforce. Evidence shows that incorrect and poor-quality installation results in a performance gap, the difference between the energy standards intended and those actually achieved, jeopardising the EPBD stipulated emission savings (Sunnika-Blank and Galvin, 2016; Johnson, 2016). Failure to build to standards required indicates structural problems in terms of work organisation, employment and the quality of VET (EC, 2014; Gleeson, 2016; Clarke et al, 2017a, 2019).

To develop NZEB competencies in the workforce, the EU launched the BUS initiative (2020-2017) to increase the number of building workers qualified in energy efficiency measures and the installation of renewable energy systems. This established the scale of the requirements for qualified personnel and helped fund continuing VET (CVET) initiatives and other measures to support the upgrading of existing training provision and resources (EC 2014, 2016b, 2018b). Though countries address similar objectives, the scale of what is needed varies substantially and evaluation of VET for NZEB developments also reveals distinctive approaches (Clarke et al, 2019). Broadly-based VET systems, constructed and maintained through consultation and co-ordination and based on imparting relevant knowledge, represent the most effective route to energy efficiency in buildings and are best placed to respond to the challenges of climate change (Ramioul et al. 2016; Clarke et al 2020). Most EU countries have, however, a long way to go before meeting the criteria necessary for VET systems up to the task of providing for successful NZEB. The problem is not simply one of adapting to the demands of construction at a time of climate change, but of transforming the structure and organisation of the construction industry and the agency required of workers and reforming VET systems to take account of increased requirements for worker autonomy, integrated

teamwork, project management awareness and applied knowledge, as well as specific skill gaps.

The overview report of the *Build-up Skills* National Reports focussed on these social obstacles and especially on upskilling the existing workforce through continuing training, noting weaknesses in national VET systems and a ‘shortage of cross-trade knowledge and skills including insufficient coordination between occupations and their ‘borderline’ skills and unsatisfactory interdisciplinary training opportunities within upper secondary and continuing education and training systems’ (EC 2014: 65). LEC is qualitatively different from the traditional construction process in requiring a singular approach to the building envelope by all site occupations, going beyond their immediate scope of responsibilities and calling for an understanding of the building fabric as a unified system with the emphasis on insulation continuity, treatment of thermal bridges and targeted air tightness. This is apparent from the German BUS report, which locates the main problem in reducing emissions in: ‘interfaces between trades and lack of any understanding for a house/building as one integrated system’ (Build Up Skills 2012, 7). BUS (EC, 2014) highlighted the sheer scale of the task facing the construction sector. The number of construction workers in need of training runs into millions across the EU, with many having low general education levels and lacking formal training or qualifications. Upgrading occupational competences and learning resources, developing new courses and qualifications, and training the trainers entail a major programme of work. These challenges are compounded by under-resourced VET systems in many countries, with several also undergoing major reforms to align national qualification frameworks (NQFs) with the European Qualifications Framework (EQF).

Whilst a more qualified workforce is required to achieve NZEB, there are other imperatives driving this requirement for more and improved VET, including an ageing workforce, the ‘skills drain’, increasing digitalisation and automation, changes in work organisation and the division of work, and the development of a circular economy (EFBWW and FIEC 2020). In criticising the EU skills agenda for its ‘homogeneous vision’ and neglect of ‘responsible partnership’, the European construction social partners - the European Federation of Building and Woodworkers (EFBWW) and the European Construction Industry Federation (FIEC) - stress that the skills and VET agenda is also interconnected with collective bargaining discussions on wages and working conditions. Indeed, the structure of the industry and its labour market characteristics - dominated by micro firms and casual and self-employment, facing a severe recruitment crisis, reliant on migrant labour, with many employers neither valuing nor seeing the need for qualifications – present a momentous challenge to VET and to retraining the construction workforce (Clarke et al. 2019).

Some of these problems are recognised by the EC, as recently highlighted in a report of the European Construction Sector Observatory (ECSO 2020), *Improving the human capital basis*, which estimates that 3-4 million workers will need to develop energy efficiency-related skills in the building sector. It is envisaged that this will be supported by the European Green Deal, through its aim to activate education and training systems, and facilitated by the development of a European competence framework. This ECSO (2020: 8) report identified some of the structural obstacles to skills development, including the fragmentation of the market and of construction value chains, cyclical factors, the uncertainties of development, and, the fact that ‘many companies adopt a temporary employment model ... limiting incentives for long-term investment in the workforce’. Moreover, it notes that 75% of companies struggle to follow occupational safety and health (OSH) requirements and 40% do not work safely, so that OSH-related training must increase by 60% (ECSO 2020). This is

detrimental to the ‘attractiveness’ of the industry, whose poor image is associated with low job security, tough working conditions and health and safety concerns.

If the nature of employment, insecurity, poor OSH and the overall fragmentation of the industry represent some of the reasons for the lack of attractiveness of the sector and underlying structural obstacles to skills development in the sector, in particular to developing VET appropriate to NZEB, it is surprising that they are not then the direct target of policy. More alarming perhaps is that increasing women’s participation is seen as one solution to improving the attractiveness of the sector, even though it is recognised that ‘young people, and especially women, rarely view the construction sector as a potential and attractive employer’ (ECSO 2020: 9). Indeed, most of the initiatives introduced to improve the image of construction in European member states target young people, and increasingly women, who appear to provide the solution in the proposal that: ‘amidst the well-recognised shortage of skills in the sector ... more policies might be needed to incentivise women to join construction-related professions’ (ECSO 2020: 31). Just as policies to achieve a zero-carbon built environment fail to address the employment and working conditions in the sector, therefore, so too do those seeking to increase the participation of women and improve the ‘image’ of the industry, even though these are recognised as underlying obstacles to achieving gender equity and NZEB.

Why is the construction sector so exclusive?

The very use of the term ‘human capital’ in the title of the ECSO (2020) report helps to explain why the social structures forming and constraining the quality and quantity of labour and the complexities of ‘skill formation’ at different levels are neglected. Human capital theory (Becker 1993) has long been challenged for regarding the ‘skills’ or ‘human capital’ of the workforce as the property of individual workers and associated only with the work processes of particular firms (Maurice et al. 1986). This narrow conception of ‘skills’ inevitably ignores the socialisation of labour, including women, into production through structures of employment, wage relations, and training (Campinos Dubernet and Grando 1991). Just as the ecological modernisation approach of the EC to a green transition is without concern for the quality of labour and employment involved or worker agency, so too is the human capital approach taken by ECSO, under the EC’s Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME) programme, which aims to inform European policymakers and stakeholders on market conditions and policy developments in the construction sector in the EU Member States.

ECSO’s remit does nevertheless cover the problem of the low participation of women in the sector across Europe, which averaged 10% in 2018 and ranged from 16.4% in Luxembourg, 13.8% in Germany, 13.2% in Austria and 12.4% in UK down to only 6.4% in Romania, 6.6% in Greece and 5.5% in Ireland (ECSO 2020). Overall, according to Eurostat, in 2018 women constituted 12% of those employed in civil engineering, 10.5% in building construction and 9.4% in specialised construction activities in the EU (ECSO 2020). Participation was higher for the professions, as apparent from Table 1, particularly in the East European countries, with the proportion of women graduating from engineering, manufacturing and construction representing 43% of graduates in Poland and 37% in Romania. In the central European and Scandinavian countries and the UK, between 22% and 27% of these graduates were women, with only Italy faring rather better at 32% and Switzerland worse at only 16%. In the renewables sector, too, women are estimated to represent 35% of those employed, though

disaggregated data are limited (Clancy and Feenstra 2019). In Germany, Italy and Spain less than 30% of jobs in the renewable sector are held by women, though most of these are low paid, non-technical, administrative and public relations rather than technical, managerial or policy-making (IRENA 2019). The occupational trades in the sector, many of which are construction occupations, are all heavily male-dominated, including metal workers, insulation specialists, plumbers, pipefitters, electricians, and heating and cooling experts (Clancy and Feenstra 2019).

Table 1: Graduates in engineering, manufacturing and construction 2018

Country	Number of women graduating	Number of men graduating	Total	% of women graduating	% women employed in narrow construction sector
Denmark	2,607	7,188	9,795	27	7.2
France	2,512	84,421	110,933	24	9.6
Germany	26,379	94,449	120,828	22	12.8
Italy	19,415	42,014	61,429	32	5.9
Norway	1,846	5,458	7,304	25	
Poland	29,049	39,321	68,371	43	6.3
Romania	7,997	13,622	21,619	37	6.2
Switzerland	2,276	11,801	14,077	16	
UK	18,136	55,953	74,090	25	10.7

Sources: Eurostat 2018; ECSO (2020) *Improving the human capital basis*, European Construction Sector Observatory: 28

The reasons given for this lack of diversity in construction vary, ranging from lack of awareness of the possibilities, informal and unregulated apprenticeship recruitment inaccessible to women, lack of support, gender stereotyping, early orientation away from the sector, masculine work culture and working conditions, barriers to employment and inflexible working practices (Clancy and Feenstra 2019; Baruah 2018; Worrall et al. 2010). In terms of ability, however, equal competence has been shown (e.g. Arditi et al. 2013). The most pervasive reason is the working conditions, above all the long working hours, both on sites and in the professions (Watts 2009; Styhre 2011; Caren and Astor 2013). Indeed, in a ‘virtual’ meeting with women working in construction from USA and different European countries held during the corona virus pandemic, working conditions, above all related to health and safety conditions, were the dominant source of complaint, including shift hours, lack of washing, toilet and changing facilities and of personal protective equipment suitable for women, social distancing, site cleansing, and risk assessments.

The solutions to greater female participation also vary, with much emphasis placed on corporate social responsibility and human resource management (HRM), including mentoring and networking (Clancy and Feenstra 2019; ECSO 2020). In addition to these, Worrall et al (2020: 280), in a perfect illustration of the onus placed on women themselves to accommodate to male domination, advocate support systems and continuing professional development (CPD):

... providing women with the necessary ‘soft skills’ in communication, people management and confidence building that equips them to negotiate difficult working environments and male-dominated organisational cultures.

The remit of the unfortunately-named EC-funded initiative, *High heels: building opportunities for women in the construction sector* (ECSO 2020: 81), covering Bulgaria, Greece, Romania and Cyprus, follows this advice, seeking to train women to ‘strengthen their soft skills in order to improve the performance of the construction sector’. Such strategies, in their acceptance of gender discrimination, devalue women and fail to challenge - and even

succeed in maintaining - the gendered nature of construction and engineering (Powell et al. 2009; Watts 2009). Other HRM-inspired solutions involve awareness raising, including through training trainers in 'gender sensitivity' (ECSO 2020: 81). As Michielsens et al (2020) argue, such employer-led, top-down, 'business case' approaches to achieving diversity in STEM occupations lack effectiveness through the absence of involvement from other stakeholders, especially employees and target groups, allowing only a fraction of diversity related issues to be 'visible' in the organisation, while others remain 'suppressed'.

Stronger and more systematic solutions have been more successful, if only temporarily. These include targeted measures and monitoring and enforcement to improve access to and retention in green jobs, though too often employers meet procurement diversity requirements only to let women go as soon as the contract is secured (Baruah 2018). Incremental measures are also proposed that seek to directly alleviate and improve working conditions for those women working in construction, including working in pairs and improved lighting. Overall, however, despite all the efforts over many decades, little has changed. As Baruah (2018: 3) complains, most policies are 'reactive responses that do not engage adequately with broader societal structures and institutions that produce and maintain inequality'. Indeed, over two decades ago, Dainty et al. (1999) questioned efforts to increase the number of women in construction given that work practices were geared to men's needs, including long working hours, geographical instability and the subordination of personal lives. They showed how men progressed in the industry vertically through networking and informal mechanisms, whilst women were focussed on coping with a male environment, and concluded that the only way for women to further their careers was to leave. In raising doubts as to whether women should be attracted to an industry 'ill-equipped for employing them', therefore, Dainty et al. (1999: 356-357) challenged existing measures, and insisted that:

It is only through a genuine commitment to the development of a more equitable industry from the highest level, that women are likely to be able to develop their careers in parity with men.

Overcoming the barriers: Examples of good practice

In terms of NZEB, possible, though unproven, advantages of greater female participation in construction suggested have been sustainable practices, accelerating innovation, enhancing women's opportunities, and accelerating 'both social and technical change in the energy system transition' (Pearl-Martinez and Stephens 2016: 7). Examples of the extensive involvement of women in the green transition in construction are, however, rare and more common in the professions than for construction occupations. There are though examples where women have been employed on a sustained basis in construction organisations, which on examination serve to identify some of the ingredients necessary for their successful participation. Where these ingredients are also conducive to effective NZEB and above all where such organisations are also actively engaged in NZEB, a model for an inclusive, energy efficient construction process is given.

One of the first ingredients for women's successful involvement in LEC is their ability to acquire the necessary qualifications. LEC introduces new factors including: the greater educational input required for thermal literacy; broader qualification profiles to overcome interfaces between different occupations; and integrated team working and improved communication given the complex work processes involved (Clarke et al 2017a). Such requirements potentially open up the possibility to include more women, especially

considering their generally higher educational achievements and greater presence on environmentally-oriented courses and in technical, professional, administrative and clerical functions (Clarke et al. 2017b). In the UK, for instance, there are far higher levels of women in technical positions in construction (24%), such as quality assurance technicians (39%) and quality control and planning engineers (19.1%), than in the skilled trades (3%) (Clarke et al 2019). Across Europe too, Eurostat figures on female engineering workers employed as a share of the total engineering workforce show relatively high proportions, including in: Bulgaria (30%); Slovenia, Poland and Italy (20%); Belgium and Hungary (19%), Spain (17%); and Germany, Ireland and Finland (15%) (Clarke et al, 2015). Given the requirement for high level qualifications with LEC, good communication and coordination skills, and the ability to project manage, the way is potentially opened up for greater involvement of women.

There are also examples of large infrastructure projects where women have been significantly involved, especially in the more professional areas, including: the Vancouver Island Highway Project in Canada; US projects such as Century Freeway Project Los Angeles, Portland Main Bridge Project, and the New York Times Building; and UK projects such as Heathrow Terminal 5, the 2012 Olympics, Crossrail, Thames Tideway Tunnel, and Hinkley Point Nuclear Power Station (Griffin Cohen and Braid 2000; Clarke et al, 2015; Baruah 2018). The longevity, size, complexity and nature of major infrastructure projects mean that they are often highly regulated and subject to scrutiny, opening up the possibility for a more inclusive employment policy, for setting ambitious targets and for new ways of working. For instance, the all-embracing Common Framework Agreement between EDF (Électricité de France) and unions at Hinkley Point places great emphasis on establishing integrated teams and new working practices and is structured to optimise opportunities to bring new people into the workforce (EDF Energy 2013). On the Olympics, contract compliance, continued monitoring and the guarantee of direct employment were critical to meeting equality targets (Wright 2014). All in all, from examining these different mega projects, particular factors critical to the achievement of greater inclusivity are indicated: the roles of public procurement; the significance of regulated agreements secured with key stakeholders, including local authorities and unions; the involvement of the workforce and women's groups; systematic, targeted and controlled recruitment, proactively applying equal opportunities policies; guarantees of direct employment; close monitoring; well-conceived training programmes, facilitating broader occupational profiles, formal links with colleges and universities, work placements and work experience; and good working conditions, including structured working hours, childcare provision, flexible working arrangements, and mentoring (Clarke et al. 2015).

Apart from such mega projects, there are historical instances when women have had a significant presence in the construction industry, providing further clues as to what this requires. During the two World Wars in the UK, for instance, women were encouraged to take up jobs opened up by male conscription resulting in over 25,000 women working in construction with a participation rate, in 1943, of 3.8% (Clarke et al. 2004). This implies that, in times of labour shortage, when there are no other available sources of men, industry will actively recruit women to fill vacant positions. In the 1970s and 1980s in the UK too, a combination of political change through the introduction of the Sex Discrimination Act (1975), making it illegal to discriminate on the grounds of sex in employment or education, and grassroots campaigning created a set of circumstances that supported considerable numbers of women to train and work in construction. Women consequently accessed training in construction occupations at government training centres, after which, classed as

‘improvers’, a further 18 months’ work was required before recognition as fully skilled. In addition, women-only training workshops, providing introductory courses and funded by London local authorities, were set up by women who had successfully entered the industry by this route.

Many trainees consolidated their training by joining local authority building departments known as Direct Labour Organisations (DLOs), which prided themselves on good employment and working conditions. For example, in the mid-1980s, Hackney DLO in London was running one of the largest training schemes for building workers in Britain, in which over 50% of the adult trainees were women, many going on to permanent jobs in construction (Clarke et al. 2015). Local authorities committed to changing their male dominated construction workforce created a framework of support for women through the provision of: a designated women’s officer; regular meetings; placing more than one woman on any site; flexible hours of work; and a clear and transparent set of equal opportunities guidelines backed up by internal procedures to address grievances. The success of these measures can be measured by the presence of 266 women in construction manual occupations in seven Inner London DLOs in 1989. This legacy of the 1980s survives, despite political challenges, and DLOs have continued to address the low numbers of young women seeking construction training. For example, of the 283 apprentices at Leicester DLO between 1985 and 2002, 84 (30%) were women and, by 2012, 123 of its 431 strong workforce were women and 18 of the 75 apprentices, employed in all occupations - as carpenters, electricians, plasterers, painters and decorators, bricklayers, heating and ventilating engineers, gasfitters and metal workers (Clarke et. al. 2015). This historical account from the UK therefore provides us with further ingredients necessary for the sustained employment of women: the involvement and commitment of public authorities, stable and direct employment, and a framework of support.

The different ingredients implied for the successful inclusion of women in construction can, therefore, be summarised as:

- public sector involvement, especially the municipal authorities;
- good organisational employment and working conditions, targeted recruitment and retention, family friendly policies
- stakeholder involvement, including women’s organisations, professional bodies and unions
- comprehensive training linked to employment.

One organisation discovered in Scotland that not only fulfils these different criteria but also has a clear commitment to NZEB is City Building Glasgow, which constructs low energy social housing and represents an alternative employment model to the private sector. City Building Glasgow is a not-for-profit organisation, jointly owned by Glasgow City Council and the Wheatley Group Housing Association, and formed in 2006 from the original DLO of Glasgow City Council. Most of the 2,200 permanent construction employees of City Building Glasgow are unionised and the Joint Trade Union Council is actively engaged in the organisation and underpins its strong social ethos (Clarke et al. 2018). The organisation is unique in directly employing under decent standards a large construction workforce and, where there is subcontracting, monitoring this through a framework agreement that sets employment and quality standards. This is combined with an in-house training centre providing a comprehensive and acclaimed four-year apprenticeship programme for a diverse intake, including many women and school leavers from disadvantaged backgrounds, with most apprentices staying on as employees.

City Building Glasgow is rooted in the local community, committed to quality and inclusivity in employment and training and explicitly driven by the needs of the local population and its workers. As well as an inclusive environment, the organisation provides a favourable one for meeting energy efficiency standards, contrasting sharply with the fragmented and insecure employment practices that often characterise the private construction sector in the UK. Its LEC schemes include social housing, care homes, schools, hostels built to varying energy efficiency standards, and retrofitting social housing estates, including through the installation of district heating using air source heat pumps, as part of efforts to tackle fuel-poverty. City Building Glasgow's highly-equipped manufacturing division has capacity to design, test and produce a range of building materials and internal fittings and is one of the largest supported businesses in Europe; 60% of its 270 employees has a disability, with access to ongoing support, training and development opportunities. Environmental measures are thus intertwined with employment and training practices that prioritise workers in a model shaped by the enhancement of labour capacity and opportunities for direct engagement in the green transition and underpinned by the traditions of municipal socialism.

Concluding remarks

The lack of equality in construction is a critical issue, one that relates to barriers in terms of the nature of VET and employment, human resource policies and practices for the industry, and the lack of employee engagement. Many of these are also barriers to achieving effective NZEB, including the need for a comprehensive and high standard VET system and a stable, safe and healthy system of employment. The suggestion is that meeting the challenge of a green transition in construction opens up the possibility to include women and those from BAME groups. Raising standards in construction VET and in employment and working conditions will also help address the current Europe-wide recruitment crisis in construction. Technologically up-to-date, well-resourced and high-level VET leading to qualifications valued in the sector could make a career in construction an attractive option for young people, male or female, black or white. And interesting, eco-friendly, socially-useful, not-for-profit and challenging construction work, including large-scale retrofit programmes, can turn that option into a reality over which women and BAME can have a decisive impact and say. What is needed to strike a blow at carbon emissions in construction is a major retrofit initiative in which women and men, trained and employed on an equal basis, play a decisive role and which serves as a demonstration of how the industry can be transformed to become inclusive and socially useful and for the building stock to become carbon neutral.

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