EnergyREV

Bristol's building and retrofit subsystem: Case study on skills and training needs for transitioning to smart local energy systems

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Contents

1 Summary

This briefing analyses the role of the Building and Retrofit sector as a subsystem in the city of Bristol's transition to a smart local energy (SLE) system of systems. It identifies three key challenges as the result of a case study of the city:

1. Motivating the current workforce to both take up available training and adopt modern building and retrofit practices
2. Attracting young people into the sector
3. Navigating the transition path equitably in order to avoid obsolescence of sector workers.

It examines how to meet these challenges, as well as highlighting the skills and training needed to address them and how that training should be delivered.

We have previously noted (Chitchyan and Bird, 2021) that the SLE domain should be viewed as a system of systems (SoS), as it is comprised of operationally and managerially (semi-) independent subsystems that work towards a common goal of optimised local energy generation and use and carbon neutrality. In Bristol we have identified seven subsystems, including Building and Retrofit (B&R) (Chitchyan and Bird, 2021) .

B&R constitutes a part of the future SLE SoS, as buildings contribute to both energy generation, through roof mounted PV, etc. and consumption, through energy use for heating and lighting, etc. Thus, as part of energy system transition to SLE SoS, the B&R sector should undergo a change too.

These findings are based on a case study of the city of Bristol, where such a transition is underway. This is a qualitative study, based on data obtained through documentary analysis, interviews and focus groups. Findings from this study are grounded on the evidence from the city of Bristol, but can serve as a "food for thought" and trigger reflection on similar challenges within other localities as well.

2 Factors affecting Bristol's building and retrofit subsystem

The factors affecting the B&R sector in Bristol are illustrated in Figure 1[1] below. Two key factors of influence were flagged:

1. The ethos of the UK building and retrofit industry, of which Bristol is a part of;
2. The climate emergency challenge driven by the national agenda and reinforced by the local city council.

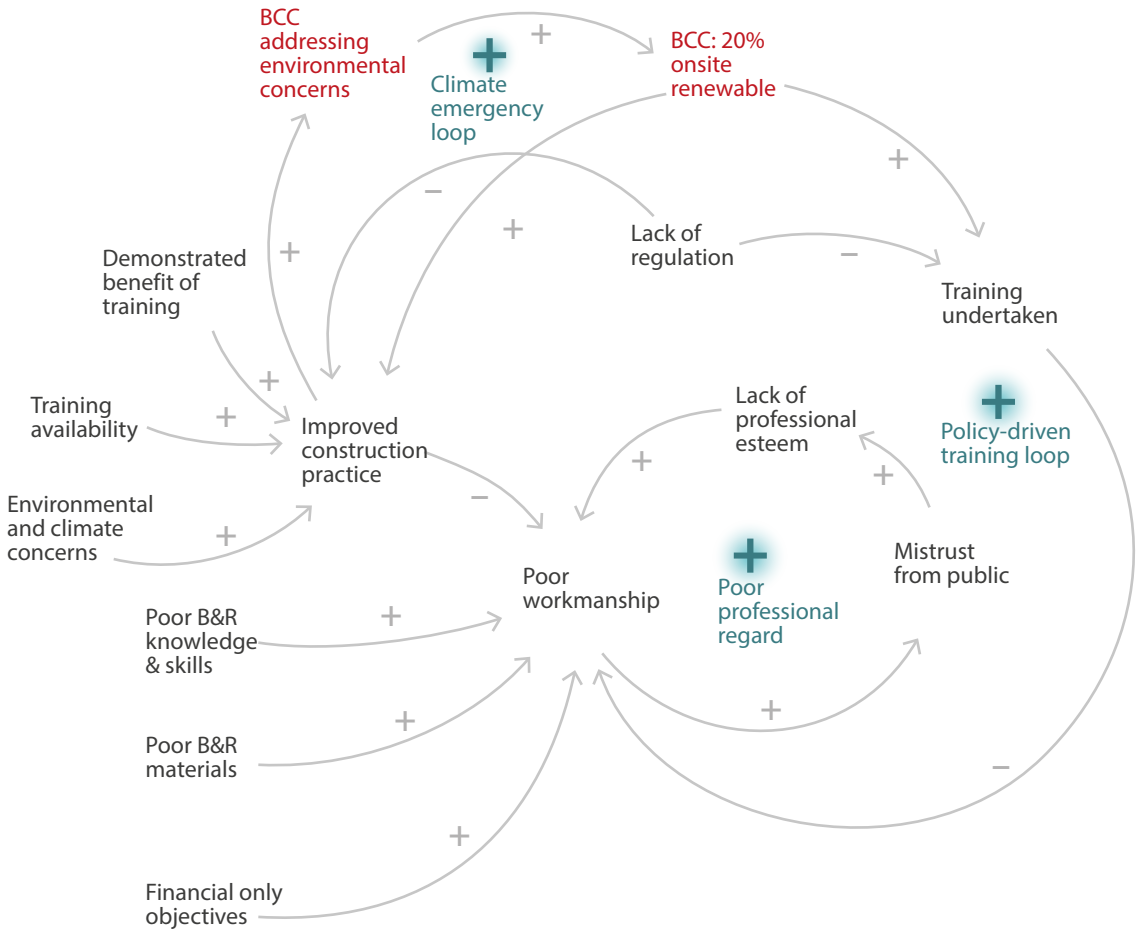

Figure 1: Causal model of Bristol's Building and Retrofit Subsystem (factors local and specific to Bristol are presented in red).

1 This model can be simulated through our retrofit blog.

Study participants describe the UK's B&R sector as very conservative and lagging behind modern building knowledge in materials and methods. As one of the Bristol's interview participants[2] stated:

> "We seem very bad in this country about learning lessons about it from other countries. We're often trailing behind in terms of materials specification technologies. …we seem incredibly resistant to perhaps stopping and looking and learning, and we plough on with our almost unique way of building …" (P11).

This is exacerbated by money driven priorities, especially within large building companies. This culture of building to minimum specifications and as cheaply and quickly as possible leads to poor quality of workmanship where the "*…let's build quick and deal with the problems later*"(P11) attitude results in storing up problems in newly built properties. Thus, "*because things don't get built properly*" (P14) "*…in 20 years times we'll be retrofitting houses that were built …today.*" (P11).

This culture of poor workmanship leads to mistrust by the public towards the builders and retrofit providers:

> "…a lot of the construction industry is not particularly well perceived by the general public. There's major trust issues around who you want to do work on your house …" (P7).

This reinforcing of poor practices also results in a poor view of the profession. It is " *…not seen as being glamorous or interesting or well paid enough …*" (P14).

The climate emergency challenge, however, is a positive factor in driving change in the B&R industry. Bristol City Council (BCC) has introduced a rule which requires that at least 20% of energy is generated locally from renewable sources for each newbuild property. BCC has also banned gas boiler installations in Bristol from 2030. Similarly, as part of the City Leap project, BCC will set up a joint venture for scaling up energy project delivery with qualified delivery providers. All these factors, along with the funding available from the central government for energy efficiency measures, are fostering training, uptake of new technologies, and modernisation of work practices in the local B&R industry.

The Green Register and Futureproof projects have initiated training delivery activities in Bristol, though much still remains to be done.

2 Hereafter we use Px to identify quotes used from interview participant (P) with the specific identifier number, as all respondents are anonymised. Thus, for instance P11 refers to participant 11.

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3 Insights and recommendations on Bristol's building and retrofit sub-system

The key challenges faced by Bristol's B&R sector in supporting the transition to smart local energy systems are in:

- Motivating the current workforce to take up the available training and adopt modern B&R practices;
- Attracting young people into the sector;
- Navigating the transition path equitably in order to avoid the obsolescence of sector workers.

Each of these is discussed below.

3.1 Motivating the current workforce to take up the available training and adopt modern building and retrofit practices

Knowledge of modern B&R techniques and training providers are readily available in Bristol. There are two universities, several further education (FE) colleges, online training delivery organisations, such as the Association for Environment Conscious Building (AECB), as well as local professional development initiatives, such as Futureproof with Green Register and CHEESE. Yet the challenges remain to motivate the current workforce to take up this training, and then to apply the training to their practice.

We suggest that both of these challenges need to be addressed simultaneously. This can be done by, on the one hand, removing the barriers to training, and, on the other, creating demand for up skilled, modern B&R services.

3.1.1 Overcoming Barriers to Training Uptake

Barriers to training uptake are economic, cultural, and personal, and so the means for overcoming them must be of a similar nature, including such strategies as:

- **Pay for training**: Many B&R workers are "*one man bands*" (P14) and cannot afford to take time off work. Even, where the worker is employed by a small or medium sized enterprise (SME), covering the salary to the worker is insufficient, and the overheads (e.g., costs of the company's bookkeeper, warehouse, manager, etc.) to the SME need to also be accounted for.
- **Provide additional support to overcome inertia**: "*People are so used to doing something for so long that it's quite a struggle to introduce something new even though it's really simple/straightforward*" (P14). Thus, when introducing new methods, B&R professionals would require additional support, such as a trainer, or a peer network to help out.

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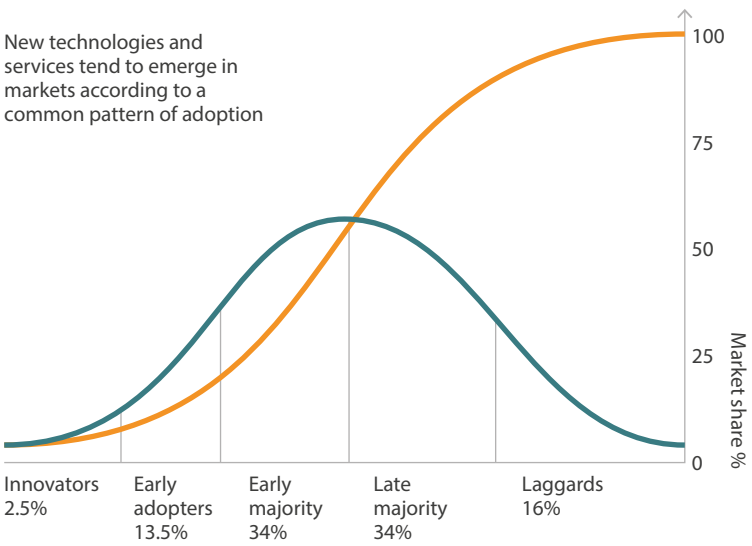
- **Provide funding for trainers**: This is needed for training organisations to continue to function. "*FE colleges …are absolutely strapped for cash and …sometimes they don't have enough money to run the courses*" (P7). It is also required for the development and delivery of modern, hands on, practical and relevant training content. When funding is limited, the training providers could be forced to work with what they have. "*Kingfisher and Knauss give FE colleges free products. Well, if you go and learn how to put Kingspan in …you go into a shop and you see Kingspan, oh, I used that in school so that'll be fine. But what you don't know about is the twenty other different insulant types that might be fine or even better for the purposes you use them.*" (P7)
- **Professionalise vocational education**: Because the present regulations do not require any qualifications for B&R trade, there is little incentive for those already in the profession to undertake extra training. This could be mitigated if there is " *…some certification element attached to it that makes those people that have made the effort stand out in some way*" (P7). This certification can then be used to signal to customers the skill levels of various B&R workers.

3.1.2 On Supply and Demand for Building and Retrofit Training in Bristol

While removing obstacles to training uptake makes training accessible, it does not really motivate already busy builders to upskill. This is the challenge that Centre for Sustainable Energy (CSE), a Bristol based environmental charity, is targeting through something it calls "*locally focused market orchestration*" (Roberts, 2017).

The locally focused market orchestration approach observes that the technology adoption curve (see Figure 2) is led by innovators who take risks. These risk takers have already been adopting new methods and practice, both as builders and as homeowners. The innovators are followed by the "early adopters", who would not take the risk of trying the unknown, but would look for examples and references and recommendations for builders from the innovators and before taking action (Roberts, 2017). Once the early adopters take up the new technology, the early and late majority will follow under the right finance conditions. However:

- The early adopter **homeowners** (the demand for skills) will not invest in extensive energy efficiency measures beyond easy draught proofing and roof insulation, unless they are confident that they can find a good builder and have seen what the end result would be.
- The early adopter **builders** (supply of skills) will not invest in skills development if they don't think that there is local demand which will give better margins than their current skills.



The locally focused market orchestration approach addresses this by stimulating demand on the one hand, and supply on the other.

Figure 2: Technology Adoption Curve (Roberts 2017).

CSE, in collaboration with other partners, have already started this process in Bristol:

- The Green Open Homes project (active in Bristol since 2010 as 'Bristol Green Doors', and now a national network) provides an opportunity for people who have completed retrofit activities to open their homes to interested peer homeowners, who may wish to do a similar upgrade. This gives the early adopters a chance to see the end products and hear about builder recommendations.
- The Green Register organisation (based in Bristol and founded in 2000) provides a register of qualified B&R professionals for each locality. This allows early adopters to find a local builder to employ.
- Bristol Energy Network provides training in understanding energy efficiency opportunities to Bristol's communities, creating more demand. It also works with the Futureproof project to identify and engage B&R providers with training programmes, boosting the supply side.
- Demand is further stimulated through the nationwide Green Homes Grant funding (BEIS, 2020).
- The Futureproof project (active in Bristol since 2019) provides funded training on modern technologies and techniques to building professionals, as well as an opportunity for B&R professionals to build peer networks for mutual learning and support.
- The CHEESE project provides comprehensive energy audits for citizens, as well as trains community members in undertaking energy audits with cutting edge proprietary technology solutions using thermal imaging to identify heat loss in buildings.

All of the above supports both training and B&R uptake, but local authorities in the area (in particular BCC) can take a proactive role in amplifying their positive impact. The following steps would further strengthen this approach:

- **Formal regulation to make specific qualifications a required prerequisite for access to B&R work**: This would be similar to the prerequisites for qualifications to work as an electrician. This can be both local policy and national regulation. For instance, BCC could contract only those registered with the Green Register or qualified to the minimum of Futureproof's Level 1 for work within cityowned properties, strengthening the reputation of these qualifications. Such a regulation seems to be currently on the way; the Retrofit Academy's PAS 2035 accreditation is expected to be a mandatory requirement "*…for all projects in the longterm*". However, BCC does not need to wait for the 'longterm' to act locally.
- **Support for local supply chain provision**: This is particularly relevant for SMEs and sole traders who wish to build to passive house standard and with modern materials and processes:
    * The vast majority of the energy efficient components and natural materials such as triple glazed windows and clay building blocks are imported from Europe: " *…the supply chain is all from Europe, we just don't make this stuff*" (P14). This, already fragile, supply chain can be easily broken down with changes in trade rules and tariffs due to Brexit. We suggest that BCC sets up a regular B&R suppliers network or conference that meets to facilitate supply chain and relationships building between the EU and Bristol companies. It would also be desirable to invest in distribution service set up and support (e.g., help draw together several small and medium B&R companies to purchase from a specific distributor, secure a joint warehousing space for green building materials, etc.). The costs of such a service can be covered, for instance, through contributions from SMEs.
    * Setting up competitions to develop the supply chain could also help facilitate the transition of the sector. Such competitions have previously been funded, e.g., through the EU.
    "*…we did a design competition back in October and so we got some of our prospective landlords to submit buildings which they're thinking about retrofitting. And the design competition, we had some funding so we offered that to consortia of supply chain companies to deliver [specialised retrofit] design for those case study buildings.*" (P12)

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* Draw together the landlords of archetypal properties from across Bristol and orchestrate a common solution for each type. There are many landlords that own properties of a similar design. A solution "… *that is designed is also suitable for other landlords down the line so that they benefit from the cost reduction rather than having dozens of separate pilots …*" (P12). Here the 'solution' refers to both the retrofit designs and also to the supply chain drawn upon to implement those designs. BCC could set up a pilot competition, tender with the winner, and after the successful pilot, award the contract for the archetype.

3.2 Attracting young people

As previously noted, the B&R sector currently has a poor image and is mistrusted by the general public. Yet, the scale and pace of the required transition necessitates attracting new B&R professionals. A number of ways to tackle this challenge are briefly summarised below. Many of these can be carried out by professional bodies, as well as local authorities:

- Training providers and employers can improve the image of the profession within the current workforce by demonstrating the value of the work and its impact on the environment as well as public wellbeing. This could be through modules on Building Biology and Physics, Valuing work within a climate context and Work Ethic.
- Local and national authorities can increase the confidence of the public in the profession through certification of qualifications and quality assurance clauses for post-delivery of the work.
- Training providers and employers can engage with young people at schools to demonstrate the value of the profession and create an early interest. This might be through acting as guest speakers at lessons on subjects such as Building Biology as part of the Biology curriculum, or Building Physics for Physics, or Architecture in Product Design, etc.

3.3 Navigating the transition path equitably

The scale and pace of the change needed to meet Bristol's agenda of becoming a carbon neutral city by 2030 means the city needs to train up a number of tradespeople to take on immediately relevant jobs, such as at-scale gas boiler decommissioning and property retrofit. Yet, these jobs will not have a long term future because once the city is carbon neutral, the gas system decommissioning professionals will become obsolete. This poses a challenge of, on the one hand, training up the tradesmen in large numbers for such jobs, and on the other, planning for their post-2030 transition into other specialisms or jobs.

In order to avoid mass redundancies and joblessness in Bristol's B&R workforce in the post-carbon-neutrality future, we advocate:

- **Avoiding a single skill professionalisation/training provision**: For instance, gas decommissioning tradesmen can also be trained to undertake heat pump installations. Thus, should the demand for work on decommissioning reduce, the installation skills would continue to remain relevant.
- **Maintaining continuous professional development**: and ensure that training in a new, mid-to-long-term relevant skill is made available to B&R workers as the demand in one of their previously relevant skills declines.

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4 Training needs for building and retrofit subsystem

4.1 Areas of training needs

The key areas in B&R where respondents believe training is particularly necessary are:

- **Building physics**: understanding the movement of heat and moisture in buildings, so that retrofitted buildings are more comfortable, energy efficient, and healthy.
- **Building biology**: understanding health hazards in the built environment, from chemicals in building materials, to allergens, mould, and so on. This will help B&R professionals to choose the right materials and deliver healthy dwellings.
- **Delivery of retrofit**: understanding insulation that avoids condensation and mould; thermal bridging; non-dot-and-dab plastering; sealing the edges of insulation and seams around joists, etc. This should include whole house overviews in relation to a number of retrofit measures and their likely benefits and sequencing.
- **Heat pump and heat technology installation**: including solar water heaters, ground and air-source heat pumps, district heating, etc.
- **Maintenance**: This is a particularly relevant skill as all fossil fuel based infrastructure (e.g., gas and diesel) must be decommissioned at scale.
  " *…to turn up in somebody's house that's got some dodgy wiring and weird plumbing …and how you remove …a lead pipe or some nasty lime scaled thing off the wall without destroying it.*" (P7)
- **Building with new methods**: understanding brickfree building, passive and low energy house building.
- **Work ethic**: developing a conscientious approach to work and respect for their own occupation (which has a paramount impact on energy efficiency, health, and environment) as well as respect for those who will use the resultant buildings.

4.2 Modes of training

When discussing how training should be delivered, the respondents noted that a variety of training modes will be relevant:

- **Higher education**: for theoretical and science-based professions, such as architectural engineers, or data analysts
- **FE colleges**: "*NVQs and HNDs in building services are generally focused on newbuild*" (P7). These skills need updating and trainees also need to learn about retrofitting older buildings.

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- **Internal training at companies**: where the innovation delivered is new and specific, such as thermal imaging with air pressure use for energy surveying at CHEESE: "*…nobody else is doing what we're doing so we're training people. We run at least one training course a year*" (P13). This might also include training delivered by the manufacturer of a particular product to ensure correct installation.
- **Learning-by-doing** where the content "*…is not complicated but it does require patience. And it does require you to want to learn and not to rush it.*" (P11). This might include laying insulation or learning to be a "*draught buster*" (P13).
- **Online courses**: such as those from the AECB on retrofit are available, but are limited in content, and would benefit from new material (e.g., on Building Physics and Biology). Green Register has also set up online training, in addition to its in-house provision. This mode is less suited to practical skills development, though AECB uses photographic evidence of completed practical tasks as part of its assessment.
- **Peer learning**: Learning from colleagues, either from within the same company, or from peers outside one's own organisation is another well-established method. The Toolbox Talks programme was recently started by Green Register through the Futureproof project: if a "*…builder would like an hour's training on site from another builder about a particular area…*" (P7) a Futureproof qualified (FAB: Futureproof Associate Builder) peer will be invited to deliver training.
- **In-community training**: delivered by local community organisations for the benefit of the community, "*…skilling up of local people who might be unemployed*" (P13). It is aimed at developing a sense of ownership and engagement within the local community as well as upskilling "*…it's not a company coming in and just doing it and leaving again. You can have that ownership…*" (P18).

Appendix 1: List of skills in short supply for building and retrofit in Bristol

Engineering and design skills

- Architects with current retrofit knowledge (with the new role for architectural technician or retrofit co-ordinator, who would fill the space between builder and the architect)
- Heating and Ventilation Engineering
- Software engineering skills focused on smart buildings and controls

Trades skills

- Building physics
- Building biology
- Installations of alternative heat sources
- Gas boilers decommissioning
- Brickfree building
- Retrofit
    * draught proofing / internal / external wall insulation
    * ventilation
    * whole house approach
    * Quality Assurance
- Passive/low energy house building

Managerial skills

- Building a core trusted team of tradespeople
- Delivering Quality Assurance
- Sourcing modern materials for the right price

Energy skills

- Energy Surveyor

Finance skills

- New business models

Policy skills

- Delivery of clear and consistent regulations
- Stable supportive policy
- Quality and Qualification regulations

Legal skills

- Legal interpretation of policy
- Legislate for energy efficiency of all building and retrofit work
- Legal requirement for an Energy Report for each house

Soft skills

- Willingness to learn from others e.g. beyond the UK
- Valuing own work and profession
- Educating general public on:
    * retrofit
    * attitudes to building and retrofit profession and its link to
    * climate change, health and energy poverty

References

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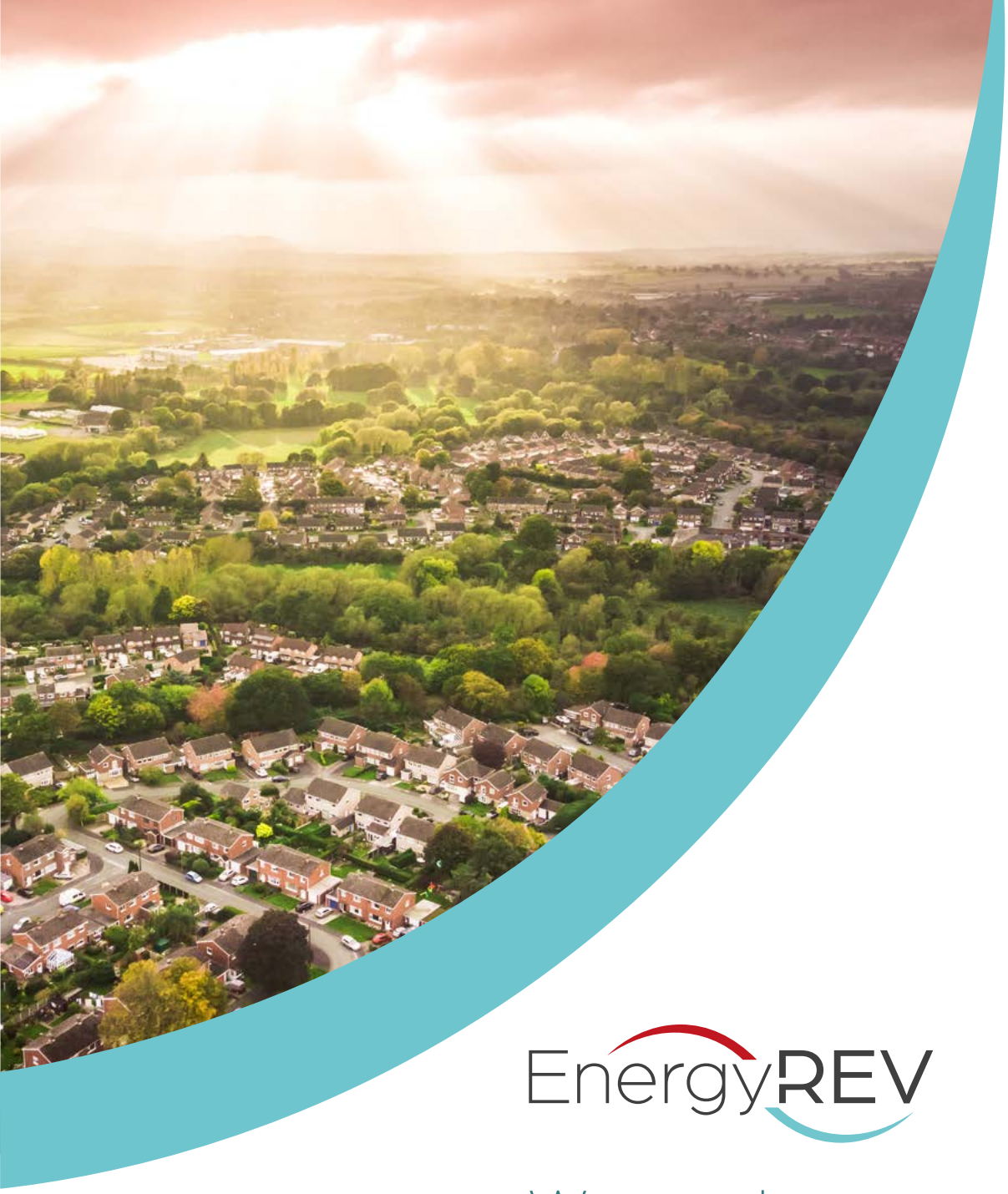
Chitchyan, R. and Bird, C. 2021. Bristol as a smart local energy system of systems: Skills case study. Technical report, University of Bristol, 2021.

Roberts, S. 2017. Do the next million first.

Initiatives and organisations referenced in the report

- Association for Environment Conscious Building (AECB)
- Bristol City Leap
- Bristol Energy Network (BEN)
- Cold Homes Energy Efficiency Survey Experts (CHEESE)
- Futureproof project
- Green Open Homes
- Green Register
- Retrofit Academy



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About EnergyREV

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