EnergyREV

# Smart local energy systems: Training needs and provision

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# Summary

As the energy system becomes increasingly decarbonised, localised and digitalised, the skills required to develop, install and operate its components are changing. Based on interviews with over 70 professionals currently engaged with three case studies (Chitchyan and Bird, 2021; Bird and Chitchyan, 2022b) of smart local energy systems and educators, this report (extracted from Bird and Chitchyan, 2022b) suggests what training provision is needed to deliver the skills needed for future smart local energy systems (SLES).

Four main types of current training provision avenues are identified:

1. **Formal training** at school, college and university with well-regarded and clear qualifications as outcomes – e.g., GCSE, diploma, apprenticeship, degree;
2. **Short courses** – (sometimes) leading to recognised qualifications and adding to pre-existing skills;
3. **On the job and peer learning** - informal and job-specific;
4. **Wider knowledge acquisition** - learners seek to grow their understanding through reading, attending conferences, public engagement etc.

Given that SLES are a dynamic and rapidly technologically evolving area, those working within the SLES sector **must continuously acquire new skills**. This is done by combining different training approaches over the course of a professional's career. Original skillsets are enhanced by learning on the job or evolve as workers move across roles and different companies or domains of the SLES.

For SLES to work effectively, all its sub-systems need to have some smart and inter-connected components. These sub-systems include energy generation and supply; construction and retrofit of buildings where heat and electricity are stored, consumed and, increasingly also produced; transport and mobility where electric vehicles consume electricity or feed it back from battery to grid; local/national government which regulates energy; and people and communities who participate in energy demand management activities. This means that much of the SLES workforce needs to acquire data management and other ICT skills on top of their role-specific skills (e.g., city planner in a local authority who uses data analytics to inform her daily work). These **multi-skilled workers** are in demand as they bring a broader knowledge base to bear on their roles and operate outside of the skills silo.

As technologies continue to change and develop, training and qualifications must also change to keep pace. **Colleges and universities** need to be **responsive to changes** and flexible in delivering the necessary qualifications **within appropriate timescales** in order to develop specific technological or cross-sectoral skillsets.

However, given that qualification development and delivery require substantial investment, colleges and universities need assurance that the various SLES qualifications will be in sufficient demand. Government has a responsibility to set clear and consistent policy, giving employers and educators stable signals and reassurance on the long-term relevance of SLES skills so they are able to invest in the qualifications and training of the future SLES workforce.

Our recommendations suggest key actions for government, qualifying bodies and educators.

# Introduction

## Context

The energy system is changing across the world, with decentralised low carbon solutions including smaller scale renewable and other technologies becoming more widely deployed at a local level. Energy trends include the promotion of technology-enabled systems such as smart meters and smart appliances, the electrification of transport, the development of heat networks and increasing cross sector interactions. This approach to the energy system can be summarised as becoming:

- Decarbonised and decentralised through smaller-scale renewables;
- Democratised as more people and organisations at all scales have a stake in the system;
- Digitalised through the capacities of ICT.

This changing energy system requires new and different skills and a workforce receptive to upskilling to enhance what they already know (e.g., builders learning to practice passive house building) or retraining to new areas (e.g., electricians learning to install Electric Vehicle (EV) charge points).

Across many areas of industry, SLES skills gaps are seen to be hindering economic recovery and the net zero transition. The Aldersgate group for sustainable business (which includes KPMG, Siemens, Triodos Bank and National Grid amongst others) have said that low carbon skills provision must become a national policy priority in order to equip the workforce with the skills desperately needed for a net zero economy (Aldersgate, 2020). The CBI, in their submission to the Green Jobs Taskforce "Skills and training for the green economy" (Trower, 2021) identified three key areas: home efficiency, automotive and electric vehicles, and clean energy. Their report identified the key issues of provision of careers and skills advice, lifelong learning, flexible training and quality standards. National Grid, in their "Building the Net Zero Energy Workforce" (National Grid, 2020) set out training-related goals for the future energy workforce, including the need to inspire young people into STEM (Science, Technology, Engineering, Mathematics) subjects, to develop skills through different levels of qualifications and to ensure a fair transition and boost diversity. These issues are reflected through the work reported here.

## About the research

This research is based on three case studies in Bristol (Chitchyan and Bird, 2021), Oxford (Bird and Chitchyan, 2022) and Orkney and over 70 interviews that look at what skills are, or will be, in short supply in the transition to SLES (Chitchyan and Bird, 2021 & 2022; Bird and Chitchyan, 2022a). This report uses these case studies to identify the training needs and training provision mechanisms that arise in the transition to SLES at scale. The interviews and case studies are supplemented with:

a. A review of the Ofqual accredited qualifications, to ascertain whether the skills noted to be in short supply have any accredited delivery mechanisms,

b. Focus groups with senior college representatives to elicit their concerns about delivering training for SLES.


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Through the case studies, we observe that the SLES is made up of a set of sub-systems (Chitchyan and Bird, 2021) which, to various degrees, interlink with each other through (Chitchyan and Bird, 2022):

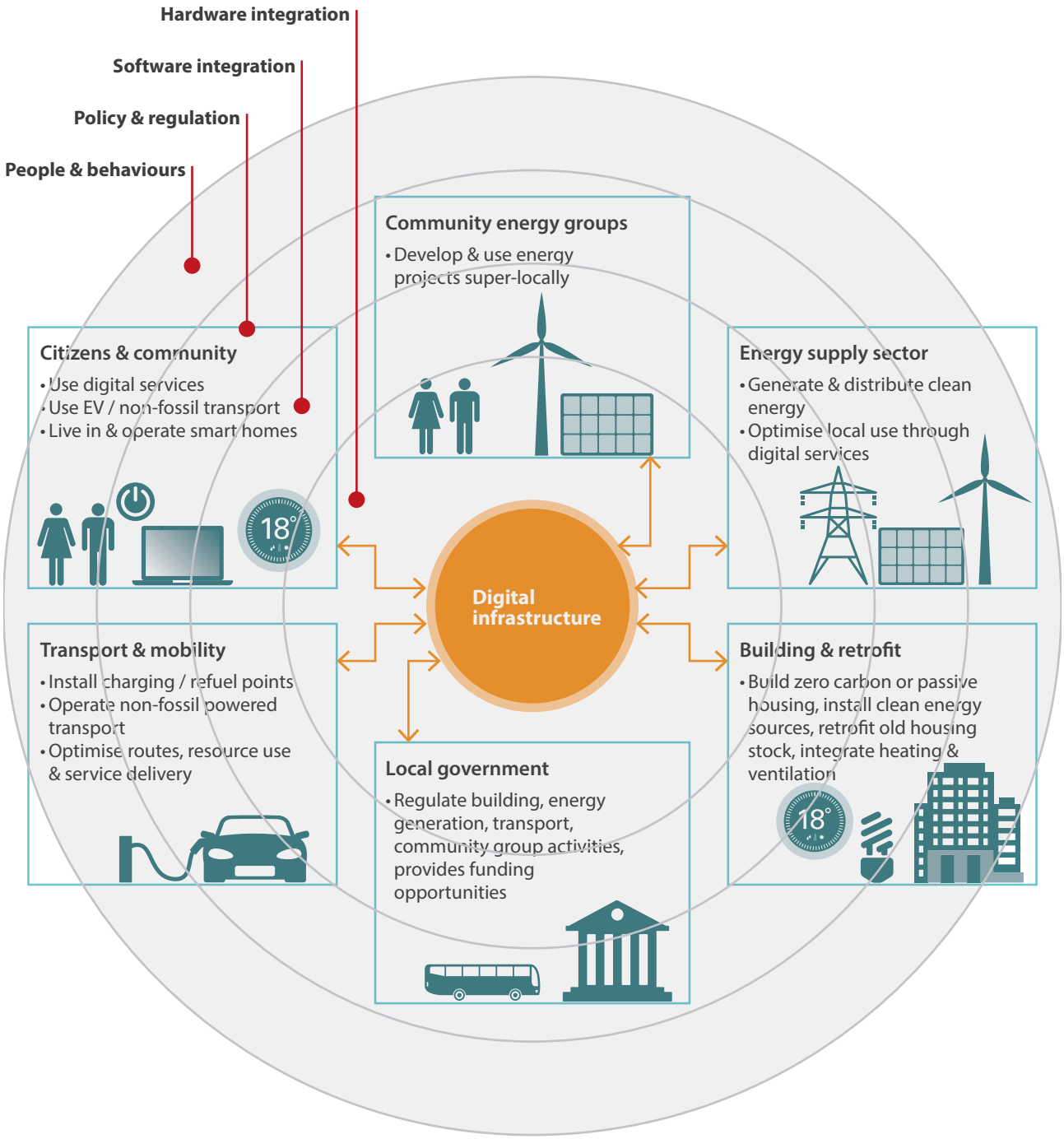
i. Policy and (local) governance;

ii. Physical infrastructure, such as electricity wires, smart meters, gas/hydrogen pipes, etc.;

iii. Virtual infrastructure, such as software platforms and data interchanges, and

iv. The people that design, install, maintain and use all these components.

**Figure 1**: SLES sub-systems and connecting interfaces



# Provision of training

## Skills across systems

The case study-based research led to identification of the following skills areas relevant to SLES:

- **Engineering** including electrical, software, data analytics, civil engineering infrastructure, building management;
- **Trades** for installation and maintenance of a whole range of new technologies, e.g., heat pumps, EV chargers, renewables, retrofit and smart meters;
- **Management** to oversee large projects, bring together various stakeholders, understand technical and regulatory issues and manage risk;
- **Business and financial** skills for new business models, innovation in financing, commercialisation and procurement;
- **Policy and legal** specialists developing new approaches, contract types, compliance (e.g., GDPR, quality standards) and regulation for innovation;
- **Soft skills**, such as communication, negotiation, building collaboration, engaging the public.

Within these areas, some of the identified skills are necessary across different sub-systems, for instance:

- Engineering skills, such as data management, software engineering, requirements engineering, algorithms and software infrastructure integration are essential for a software engineer working within transportation domain, but they are also necessary for interlinking an EV charging hub for electric goods delivery fleets with the power systems. Thus, a software engineer working in a transportation sub-domain needs to understand power system operation.
- To realise smart local energy solutions, businesses need to adopt new business models. Thus, business model design skills and inter-sectoral management and communication skills become necessary in order to manage the complex sets of partners and collaborators that deliver SLES solutions (such as, charging and feeding back electricity from EV fleet batteries to grid as well as ensuring sufficient charge within vehicles batteries for travel or goods delivery).

In parallel, engagement with the wider public is becoming essential for many organisations, as the consumer becomes an active component of energy service decision making - a demand side energy management service expects the householders not to use electricity at peak demand times; a battery-to-grid service expects electric vehicle owners to allow for energy supply to draw electricity stored in their car's battery, etc. In this situation project managers need both partner management and community engagement skills.

These evolving requirements for skills that are presently trained in silos - software engineers separate from power system engineers; managers separate from community workers- require new and more flexible types of training, able to respond rapidly to changing needs and new technologies.

## Types of training

Drawing on the interviews with over 70 practitioners, four main types of current training provision avenues are identified:

1. **Formal training** at school, college and university with well-regarded, certified and clearly defined qualifications as outcomes – e.g., GCSE, diploma, apprenticeship, degree – providing the essential bedrock of recognised qualifications required across sectors.
2. **Short courses** – (sometimes) leading to recognised qualifications and adding to pre-existing skills. This might be to fulfil a particular role, e.g., to work as an energy assessor; to understand organisational processes in local government. Or it could be to work with particular equipment, for example plumbers learning to install heat pumps or electricians to install EV chargers.
3. **On the job and peer learning** - informal and job-specific training avenues, developing particular skills needed to do a job by learning from colleagues, through secondments or shadowing.
4. **Wider knowledge acquisition** - learners seek to grow their understanding through reading, attending conferences, public engagement, etc.

All these avenues will continue to have a role to play in training the workers of the future. However, due to the rapidly changing technological and knowledge requirements within the SLES, it is necessary for up-to-date information to be provided regularly and from the earliest moment possible. For instance, youngsters need to learn about the energy system before they choose their GCSE subjects, so that future career paths within SLES are appreciated and kept open and relevant options can be chosen in preparation for higher education or entry to the workforce.

## Training provision challenges: view from Further Education Colleges

Further education colleges[1] should be ideally placed to support the evolving training needs of the SLES workforce. However, discussions with college leaders highlighted particular barriers to their ability to develop and deliver the necessary training for new skills. There are three key barriers to the development of new training approaches:

1. **Lack of demand for new skills**, in part due to uncertainty over which technologies will continue to grow and be in demand (for example when the UK government changed its policy and discontinued onshore wind turbine subsidies, the wind turbine installers lost jobs, and demand for training in this area reduced). Additionally, students are not aware of some new technologies and employers do not have the current expertise to apply them at scale. This, in turn, suppresses demand as the colleges are not then 'asked for' the training by either employers or potential employees. In other cases, workers have enough work using current skills and see no need for taking time out for additional training.
2. **Qualification accreditation processes** mean that colleges can only offer what is currently accredited. New courses take time and resource to be developed and approved, requiring consultation with industry and

1 For this study, two focus groups were conducted with representatives from the Further Education colleges, thus the below argument is presented from their perspective. However, many issues raised here are also relevant to the higher education sector.

approval by awarding bodies. However:

* In some cases, the industry may not be best placed to forecast future skills needs (e.g., due to the above noted self-perpetuating lack of skills cycle). Thus, government policy often plays an important role in clarifying direction and need over longer timescales.
* So far, renewables-related policy has been very changeable and short-termist, leading to high risk of losses should a college invest into training development within an area with soon-to-be-discontinued policy underpinning.

3. **Lack of flexibility**: across the SLES the newer ways of working draw on skills from more than one traditional qualification. However, lack of flexibility prevents colleges from allowing learners to combine different skills across qualifications. A more agile qualifications approach would allow hybridisation - they could accumulate recognised credits to reach the desired qualification level from across various programmes. For example, with hybridisation, a student would be able to take units on data analysis from a Data Science qualification, add these as part of a mainly Marketing qualification and receive a 'Marketing with Data Science' hybrid qualification outcome.

Discussions with college leaders also show that primary barriers to change are **funding** and **lack of flexibility to be able to respond to the needs of employers fast enough** – and even to be able to pre-empt the demand through government policy drivers. Colleges say that their "*… primary purpose is to get students qualifications*", noting that "*from a curriculum perspective, a lot of our teachers will simply teach what's in the core qualifications*". They suffer from lack of flexibility, demand certainty and resources to be able to develop and enhance the curriculum.

# Recommendations:

## 1 Recommendations to government

i. **Policy and regulation** from central government must send consistent messages to employers, educators and workers about the long term relevance of renewables-based energy jobs and the need for ICT and data science-based skills expansion across different areas. Stable support for clean and smart energy jobs will enable relevant qualifications and training development and facilitate the drive to net zero.

ii. **Regulation requiring properly certified qualifications for SLES jobs** – e.g., for delivering retrofit or EV maintenance and charge point installations in the changing transport sector - alongside quality monitoring and long-term stability in renewables-related policy will prime the market and improve demand for new skills and training. **Workers** must be encouraged to develop these new skills and employers facilitated to release employees to undertake training.

iii. **Colleges and qualifying bodies need core funding** to:

   * **Develop new qualifications** that fully address the needs of net zero;

   * **Be better resourced** to keep up with changing needs of the energy system, enabling them to recruit staff and to deliver new training.

iv. **Apprenticeships** are an important element of skilling the future workforce but require structuring such that employers at all scales are able to be involved. Additional funding is required so that SMEs can also participate in apprentice programmes.

## 2 Recommendations to qualifying bodies

v. Given the fast evolving technological and skills landscape in SLES, accredited **courses and qualifications must reflect both current and upcoming needs** with greater consistency. For this, the qualifying bodies need to maintain continuous dialogue with current SLES employers, policy makers and researchers to forecast and prepare for addressing upcoming future skills gaps.

vi. Qualifications awarding processes must become more flexible, as jobs require a previously unexpected mix of knowledge and skills (e.g., software engineer with knowledge of power systems and electricity grids). The most promising way to achieve this flexibility is through a "**hybridised qualifications framework**", allowing qualification-delivering colleges to combine parts of accredited qualifications into new ones (e.g., combining software engineering and power system units for a Software Engineer for Power Systems qualification).

vii. Accreditation of qualifications must allow for **technology substitution** during teaching delivery, allowing for new technologies to be substituted for outdated ones during the qualification delivery.

viii. Given the increased pressure for continuous learning, a national framework **recognising life-long learning** and training activities **and accrediting** them is desirable.

## 3 Recommendations to educators

ix. **The HE sector** needs to be responsive to the changing requirements of industry and flexible in the way it delivers courses and combines knowledge areas across disciplines. The HE sector must work with industry to ensure that:

   a. Technological advances (for example large scale battery systems) are quickly brought into degree programmes and

   b. New (degree) programmes are quickly developed to target emerging training or upskilling needs (e.g., MSc in AI for Telecommunications).

x. **Schools** have an important role in both steering the future workforce and educating the general population. Thus, schools must:

   a. Be equipped to keep up to date with technology changes and future career choices – particularly in understanding how future energy systems will operate and combine across sectors;

   b. Teach young adults about what the energy system is, how to engage with clean energy solutions and what practices to adopt for a living in a renewables-based energy system.

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## About EnergyREV

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