EnergyREV

# Refining the multi-criteria assessment for smart local energy systems

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# Contents



# Frequently used acronyms

| | |
|---|---|
| DCE | Discrete Choice Experiment |
| IES | Institute for Energy Systems |
| KPI | Key Performance Indicator |
| MCA | Multi-Criteria Assessment |
| MCDA | Multi-Criteria Decision Analysis |
| PAPRIKA | Potentially All Pairwise RanKings of all possible Alternatives |
| PFER | Prospering from Energy Revolution |
| SLES | Smart Local Energy Systems |
| UK | United Kingdom |
| UNSDG | United Nations Sustainable Development Goal |
| WP | Work Package |

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# Executive summary

Smart Local Energy Systems (SLES) are being developed to exploit the capability of digital technology and the Internet of Things to optimise energy use and system management, while incorporating decentralised renewable energy and energy storage to enhance resilience and energy security. The deployment of SLES will support efforts to tackle energy poverty and the climate crisis in the transition toward a fossil-fuel-free and decarbonised energy system. This, in turn, will help to meet the United Nations Sustainable Development Goals.

This report summarises the process of developing a multi-criteria assessment (MCA) tool for SLES that can account for the nature of the pre-existing energy system and infrastructure, the many different spatial scales and system topologies of the new systems, and the evolving impacts associated with the stakeholder and energy system landscape. The outputs from the assessment tool will be used to inform stakeholders such as end-users, regulators and policymakers to support design, decision-making and policy development.

The work presented focuses on the development of an MCA-SLES tool: specifically work to refine the assessment themes, indicators, and metrics that are considered crucial components of any assessment tool. This involved two rounds of stakeholder engagement:

- The first was to identify key themes and assessment criteria to form the basis of the MCA structure. These were data management; people and living; environment; business and economics; governance; and technology performance.
- The second was to prioritise these key themes and assessment criteria. This highlighted that energy system stability, durability and flexibility are critical features for assessment, alongside specific social and environmental aspects such as the impact on emissions reduction and fuel poverty.

The work provides an overview of the MCA-SLES framework; highlighting each step, its tasks, objectives, and current development status.

It reports that the team aims to present a practical assessment tool in Autumn 2022 and outlines the next steps that will focus on developing a functional MCA tool that will be tested and refined through case studies, before release for self-assessment of current SLES pilot projects.

# 1 Introduction

Researchers at the University of Edinburgh have been developing an MCA framework and tool for SLES. An ongoing research task for Work Package (WP) 5.2 of the EnergyREV project, the tool will be used to assess the status of projects relative to key objectives for the energy transition and decarbonisation of energy systems. It will be applied to provide insights into the robustness, success, sustainability and applicability of Prospering from Energy Revolution (PFER) pilot projects.

As Francis et al. (2020a) highlight, there is currently no standardised approach or framework available to evaluate SLES, and approaches or tools for similar applications have problematic limitations and constraints. Some are solely techno-economic, some are unable to carry out a balanced and comprehensive multi-dimensional assessment or are complex and challenging to use.

This report focuses on synthesising development work from the last three years and provides insights into the current status of the MCA tool development, results from completed steps and the future work planned. The core section of this report is focused on developing the work carried out by Francis et al. (2020a, 2020b), refining and validating assessment themes, sub-themes and associated indicators or criteria that are the critical components of the MCA tool. The report also describes the MCA development framework and gives insights into the developing status of the MCA tool.

The MCA-SLES framework development has followed a rigorous and iterative process, which is based on six core development steps:

- Step 1: Identify and define the problem
- Step 2: Identify areas of success
- Step 3: Identify the corresponding indicators and metrics
- Step 4: Build into an assessment tool
- Step 5: Test and refine
- Step 6: Carry out practical case study;
- Step 7: Outcomes.

Steps 1 and 2 involved an extensive literature review to define core research concepts and identify and classify stakeholders. In Step 3 the focus was first on identifying relevant key performance indicators (KPI). That was followed by workshops and interviews with stakeholders to ensure the applicability and relevance and provide affirmation of the selected KPI and assessment themes. The outcome from these tasks resulted in the identification and selection of six core assessment themes, which comprise over 50 sub-themes and relevant assessment metrics (Francis et al. 2020a, 2020b; Francis et al. 2022). Currently, work has either been completed, or is in progress, on six out of the seven steps in the MCA development process.

# 2 Background

SLES are being developed due to the increasing policy and regulatory focus on the transition towards a decarbonised energy system in the UK (Rae, Kerr and Maroto-Valer 2020; Ford et al., 2021). This shift has brought more attention to the digitalisation and decentralisation of energy system development and delivery when it comes to energy system planning (Rae, Kerr and Maroto-Valer 2020; Ford et al., 2021). The successful deployment of SLES can be expected to deliver a multi-dimensional co-benefit which can address numerous issues such as fuel poverty through affordable energy prices leading to a reduction in costs, provide energy security and resilience improvements and decrease greenhouse gas emissions while mitigating impacts on the wider natural ecosystem (Ford et al., 2021).

The task of identifying, selecting and validating the relevant assessment criteria or indicators for the specific area of SLES is a vital task in the development of any assessment tool and it must be robust to ensure the reliability and applicability of the assessment framework (Narula & Reddy, 2015; Hák et al., 2016; Shortall & Davidsdottir 2017; Gunnarsdottir et al., 2020). These criteria or indicators are applied to benchmark, measure progress and provide insight to support decision-making (Narula & Reddy, 2015; Hák et al., 2016; Shortall & Davidsdottir 2017; Gunnarsdottir et al., 2020). Selecting these indicators or criteria is challenging because there is no standardised approach for this. (Narula & Reddy, 2015; Hák et al., 2016; Shortall & Davidsdottir 2017; Gunnarsdottir et al., 2020). The resulting lack of consistency in the identification and selection process leads to limitations in the set of selected criteria. This may result in a large and imbalanced set of criteria that double-counts some indicators. Alternatively, a set of criteria might be too homogenous to capture the differences in condition between different countries in relation to energy system development, or be inadequate for the balanced representation of all themes and thus impact the reliability and consistency of the findings (Narula & Reddy 2015; Hák et al., 2016; Shortall & Davidsdottir 2017; Gunnarsdottir et al., 2020).

The team has chosen to employ a rigorous, structured, iterative and stakeholder engagement-based process to ensure that relevant indicator or criteria have been selected so that the MCA-SLES framework is capable of providing reliable and valuable information to monitor SLES development (Francis et al 2020a, 2020b; Francis et al. 2022).

MCA, also referred to as Multi-Criteria Decision-Making (MCDM) or Multi-Criteria Decision Analysis (MCDA), is a methodology used to analyse and provide support to decision making concerning complex and multi-dimensional problems that often include multiple actors and multiple criteria or objectives (Huang, Keisler and Linkov 2011, Kumar et al., 2017; Francis et al. 2022).  MCA is increasingly applied within sustainable energy development and energy system transition to support decision-making (Wang et al., 2009; Kumar et al., 2017). Energy system development is complex and multi-dimensional, linked to multiple factors across the environmental, economic, and social dimensions (Cherp et al., 2018; Pizarro-Alonso, Ravn and Münster 2019; Rae, Kerr and Maroto-Valer 2020; Ford et al., 2021). An assessment must, therefore, cover multiple criteria or objectives that are evaluated, ranked or scored to identify and recommend the most advisable and qualified choice between the alternative that is being evaluated (Huang, Keisler & Linkov 2011, Kumar et al., 2017; Francis et al. 2022).

The selection of an MCA method is often dictated by key factors such as the suitability and adaptability of the method to the problem at hand, the reliability of the method, the ease of use and understanding and confidence of the results (Zanakis et al., 1998; Huang et al., 2011; Mardani et al., 2017). Similarly, the application of an MCA method provides a systematic approach to structure key activities such as stakeholder engagement, data collection, and analysis and presentation of results, whether it is to other academics, policymakers and public audiences (Huang et al., 2011; Mardani et al. 2017).

MCA methods are divided into two methodological approaches for evaluating the different trade-offs between the criteria: utility-based and outranking (Wang et al., 2009; Kumar et al., 2017; Mendoza & Martins, 2006; Francis et al. 2022.). Figure 1 summarises some common MCA methods. The application of utility-based MCA methods is based on evaluating and ranking the criteria and alternatives to capture trade-offs between the criteria and using a weight sum calculation to identify and recommend the advisable decision (Cinelli, Coles, & Kirwan, 2014; Kumar et al., 2017; Mendoza & Martins, 2006; Ananda & Herath, 2009; Hansen & Devlin, 2019). The MCA-SLES tool being developed here follows the utility-based MCA methodology.

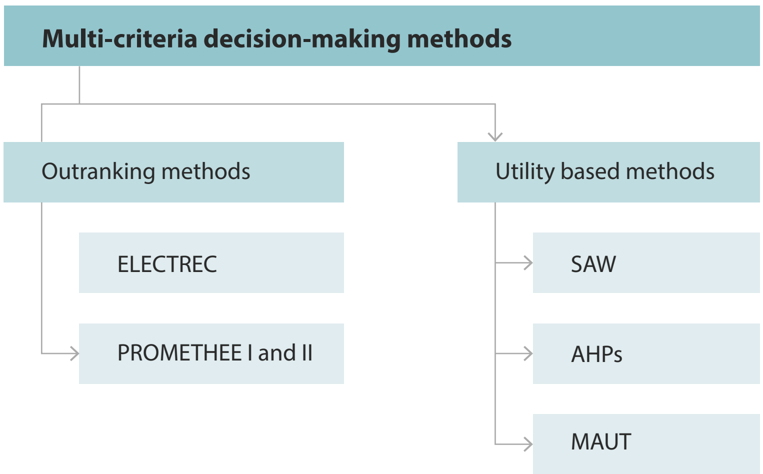


Figure 1: Classification of MCDM Methods, including Elimination and Choice Translating Reality (ELECTRE) Group, Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE), Simple Additive Weighting (SAW), Analytic Hierarchy Process (AHP) and Multi-Attribute Utility Theory (MAUT). (Kumar et al. 2017).

# 3 Developing a multi-criteria assessment tool

Regardless of which MCA method is selected, the development and application of MCA involves several common steps, as outlined in Figure 2 (Belton & Stewart, 2002; Macharis, Milan & Verlinde 2014; Macharis & Bernardini 2015; Francis et al. 2022).

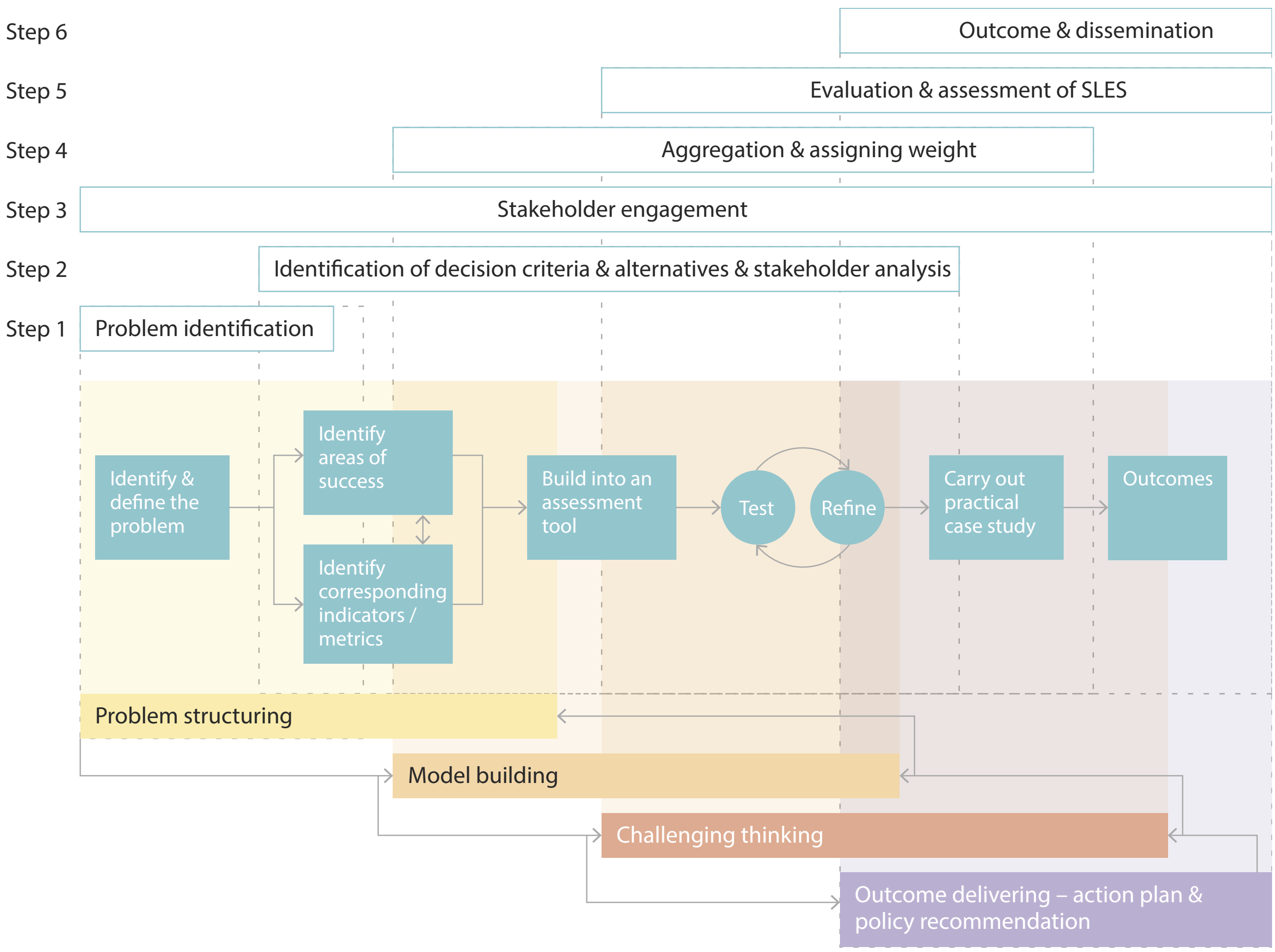


Figure 2: The Assessment Framework Protocol in connection to MCA Development Steps (Belton & Stewart, 2002; Francis et al. 2022).

Figure 2 illustrates in the blue boxes the key tasks for the development process of the WP5.2 MCA-SLES assessment tool that are presented in Francis et al. (2020b). It aligns these tasks with the six steps shown in the white boxes that are related to the development of a MCA tool (Belton & Stewart, 2002; Macharis, Milan & Verlinde 2014; Macharis & Bernardini 2015) and, in the multi-coloured boxes, aligns them with four MCA development phases from Belton & Stewart (2002). Table 1 below provides more detailed information about the MCA tool protocol. It presents the tasks and objectives of each step in the MCA development process and highlights the progress status for each step and output.

**Table 1: Protocol framework for the development of the MCA Tool**

| Process steps | Description | Tasks | Objectives | Progress status |
|---|---|---|---|---|
| Identify and define the problem | This step focuses on three key aspects:<br>a. Identifying the problems or issues.<br>b. Defining the problem down to specific issues and areas of research.<br>c. Identifying the key stakeholder relevant to the problem. | ✓ Define the problem<br>✓ Identify and define key issues<br>✓ Identify and define key concepts<br>✓ Stakeholder analysis<br>✓ Define uncertainties & constraints | a. To clearly define the nature of the problem, alongside key aspects such as key issues, key concepts.<br>b. To have a well defined problem structure which helps formulate the research questions and scope of the research. | Completed<br>(Francis et al. 2020a; Francis et al. 2020b) |
| Identify areas of success | This step focuses on capturing and understanding stakeholder opinion concerning SLES to:<br>a. Identify key aspects of SLES.<br>b. Identify potential associated benefits. | ✓ Stakeholder engagement<br>✓ Identify the key characteristics of SLES<br>✓ Identify criteria<br>✓ Identify alternatives<br>✓ Define uncertainties & constraints | To understand the stakeholders' viewpoint of SLES: identify key themes and characteristics of SLES and what they understand and notice to be a successful SLES when it comes to the potential range of benefits SLES can provide to local community. | Completed<br>(Francis et al. 2020a; Francis et al. 2020b) |

| Process steps | Description | Tasks | Objectives | Progress status |
|---|---|---|---|---|
| Identify the corresponding indicators and metrics | This step focuses on:<br>a) Identifying the corresponding indicators / metrics.<br>b) Calculating the weight of identified indicators. | ✓ Stakeholder engagement<br>✓ Identify and define criteria<br>✓ Identify and define the alternatives<br>✓ Calculate and assign weight<br>✓ Define uncertainties & constraints | c. To identify a large volume of relevant indicators to deployment and development of SLES.<br>d. To understand the importance and relevance of each indicator and key theme through the stakeholder viewpoint. | Completed<br>(Section 4; Section 5; Francis et al. 2020a; Francis et al. 2020b; Francis et al. 2022) |
| Build into an assessment tool | This step focuses on bringing together outcomes from previous steps and developing an MCA by synthesising the information and outcomes from previous work with the MCA method. | ✓ Stakeholder engagement<br>✓ Calculate and assign weight<br>✓ Synthesise information<br>✓ Define uncertainties & constraints | To develop an MCA tool to carry out evaluation and performance analysis that can provide supportive information to policy and decision makers. | In Progress<br>(Section 3, Section 4, Section 5, Section 6) |
| Test and refine | This step focuses on carrying out various test application runs of the assessment tools to identify shortcomings and limitations in order to, help to refine and adjust the tool and improve its quality, robustness and reliability. | ✓ Stakeholder engagement<br>✓ Synthesise information<br>✓ Identify and create new alternatives<br>✓ Define and analyse robustness and reliability | To ensure that the MCA tool is based on rigour and robust process and reliable sensitivity and assessment analysis. | In Progress<br>(Section 4; Section 5; Francis et al. 2022) |

| Process steps | Description | Tasks | Objectives | Progress status |
|---|---|---|---|---|
| Carry out practical case study | This step focuses on applying the assessment tool by carrying out practical assessment case studies on the PFER projects. | ✓ Stakeholder engagement<br>✓ Synthesise information<br>✓ Sensitivity analysis<br>✓ Policy and strategy analysis<br>✓ Challenge current viewpoint<br>✓ Define uncertainties & constraints | To conduct a practical MCA case study on a PFER project. | Next steps |
| Outcomes | This step focuses on engaging in the dissemination of the work carried out, development of the assessment tool and outcomes from applying the assessment tool through EnergyREV events and channels and other events and channels. | ✓ Stakeholder engagement<br>✓ Synthesising information<br>✓ Dissemination of results | To deliver publicly published reports, academic journal papers and attend public and academic events to present the outcomes from applying the MCA tool. | Continuous progress task |

# 4 Refinement of key themes and key performance indicators for SLES

The identification, selection, and validation process of relevant criteria is a key element of an assessment tool. The EnergyREV WP5.2 team has completed an in-depth identification process to identify the key themes and most relevant criteria for inclusion in a MCA framework that will be able to assess the complex and multi-dimensional nature of energy systems such as SLES.

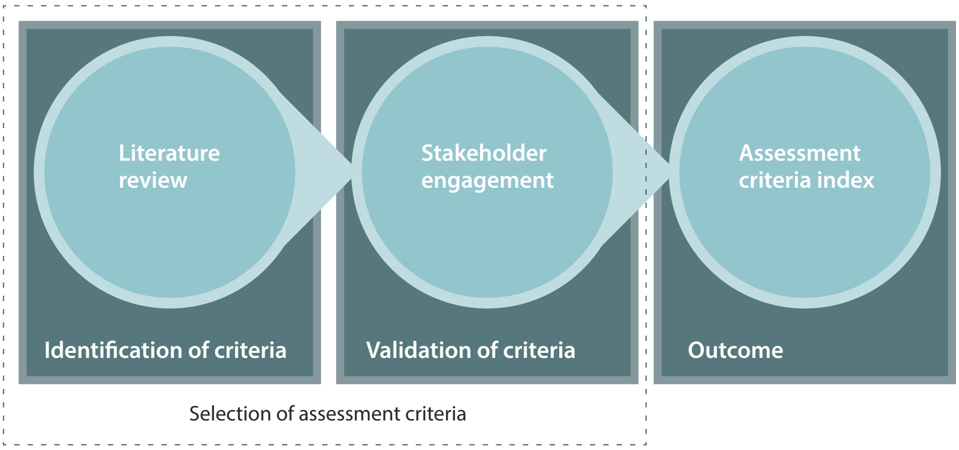


Figure 3: Simplified illustration of the criteria identification and selection process

The EnergyREV WP5.2 team used a three-step selection process to identify and select the assessment criteria for the MCA framework, illustrated in Figure 3.

- The first phase was to carry out an extensive literature review to identify and compile a broad list of criteria (as presented in Francis et al 2020a, 2020b).
- The second phase was to engage with stakeholders through two workshops to validate the already identified assessment themes, sub-themes and criteria (as presented in Francis et al. 2022).
- The third phase focuses on synthesising the results from previous phases to provide a completed list of assessment criteria.

The first workshop asked the participants to take part in three tasks:

- Looking at the future of SLES.
- Identifying key areas of success.
- Generating questions and SLES metrics.

These tasks helped the researchers capture, learn and understand how different stakeholders understand and recognise the characteristics of successful SLES in relation to a broad range of benefits. The results provided an initial list of assessment criteria and key assessment themes.

The second workshop focused on validating themes, sub-themes, and criteria through a discussion structured around each theme, its sub-themes and criteria. The second workshop narrowed down the ten key themes for SLES to six, as some previously identified themes were combined into a new key theme; for example, Data Security and Data Connectivity were combined into a key theme called Data Management (Francis et al. 2022).

These six key themes of SLES were further divided into a total of 50 sub-themes that represent high-level core assessment criteria. The themes and sub-themes as shown in Table 2.

**Table 2: Key themes, and relevant assessment criteria (derived from Francis et al 2020a, 2020b)**

| Key theme (2nd) | Key theme (1st) | Description | Relevant criteria |
|---|---|---|---|
| Data management | Data security | SLES are going to deal with a lot of information and perhaps even some sensitive data: this theme measures how this data, and the integrity of its owners, is being protected. | • Security<br>• Privacy<br>• Trust |
| | Data connectivity | This theme assesses how SLES might impact aspects of data management and infrastructure such as Information and Communications Technology (ICT) accessibility and penetration. | • Digital technology enablers<br>• ICT infrastructure<br>• ICT management<br>• ICT accessibility |
| Technical performance | Technical | This theme evaluates the technical aspects of technology in areas of importance for the energy sector, such as flexibility, resilience, efficiency, innovation and share of renewables. | • Renewable share<br>• Reliability<br>• Resilience<br>• Flexibility<br>• Scalability<br>• Efficiency<br>• Maturity<br>• Lifespan<br>• Grid accessibility<br>• Innovation |
| | Transport | This theme evaluates how transport management is being impacted by the system, as well as what is the level of deployment of electric vehicles (EV) technology. | • Transportation management<br>• EV Infrastructure |

| Key theme (2nd) | Key theme (1st) | Description | Relevant criteria |
|---|---|---|---|
| Business economics | Techno-economic | This theme deals with the economic outputs of the technology. Typical measures for such performances are considered, such as internal rate of return, payback period and benefits to cost ratio. | • Benefits-to-cost ratio<br>• Costs (OPEX and CAPEX)<br>• Rate of return<br>• LCOE (Levelised cost of energy)<br>• Payback period |
| | Economic market | This theme focuses on looking into the financial aspects of the SLES and explores how SLES fit into the market, with criteria such as compensation structure and job creation. | • Regulations<br>• Compensation structure<br>• Affordability of energy<br>• Competitive cost of energy<br>• Investable<br>• Job creation |
| Governances | Governance (Socio-political) | This theme deals with assessing the political and regulatory alignment of the SLES, alongside assessing and understanding its socio-economic impacts. | • Transparency<br>• Socio-economic impact<br>• Integrated management<br>• Political and regulatory alignment |
| People and living | People | This theme focuses on evaluating the impact SLES has on consumers and users, considering aspects such as education/ICT skills, public engagement and acceptance. | • Education & Gender equality<br>• ICT skills<br>• Engaging/Participation<br>• Acceptance<br>• User friendliness/ Control<br>• Inclusion/ Empowerment<br>• Consumer protection |
| | Living | This theme focuses on capturing and evaluating the extended benefits of SLES to communities and their social interactions, considering aspects such as housing insulation, equity, culture or behaviour. | • Thermal comfort<br>• Equity<br>• Culture and behaviour<br>• Livelihood<br>• Convenience |
| Environment | Environment | This theme focuses on evaluating the environmental impacts and benefits obtained through the introduction of SLES. | • Water<br>• Land<br>• Air pollution<br>• Noise pollution<br>• Waste energy potential<br>• Decarbonisation<br>• Resources availability |

# 5 Prioritisation and weighting of KPI assessment criteria

In order to better understand the importance and relevance of identified key themes and associated assessment criteria, the team at IES (during the period January to March 2021) carried out a stakeholder survey. The results from this will be used for preliminary weightings of individual themes and criteria in the overall scoring. This engagement activity involved seven surveys using 1000minds online based software based on the PAPRIKA method - a type of discrete choice experiment (DCE). In the primary survey, the participants were asked to answer a series of pairwise ranking questions to score each key theme and then to score each assessment criteria (KPI) from poor to excellent based on the core question "What type of energy system do you prefer?" (Francis et al. 2022). The answers from the participants formulated the priority weights and ranking of the different KPI themes and associated assessment KPI criteria. Figure 4 below provides a simplified illustration of the process.

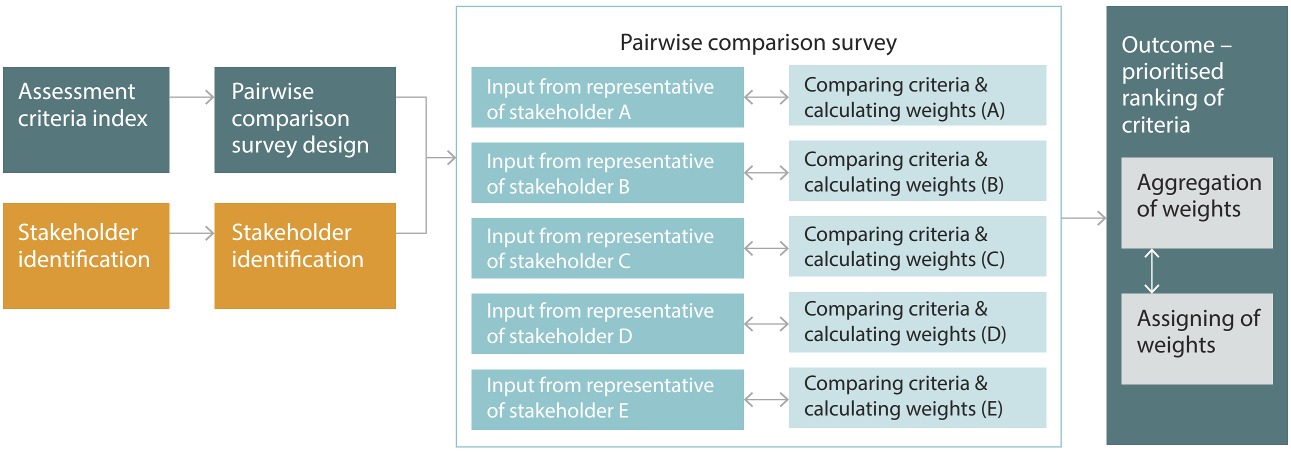


Figure 4: Simple process flowchart of pairwise comparison and weighting assign process

The DCE online surveys involved 234 participants (Francis et al. 2022). They captured opinions from all five stakeholder categories defined as relevant, influenced and impacted by the deployment and development of SLES. For a summary breakdown of the stakeholder participation, see Table 3.

| Table 3: Information on stakeholder participation in the survey (adapted from Francis et al 2022) | | | |
|---|---|---|---|
| **Stakeholder category** | **Type of stakeholder** | **Total Participant per stakeholder category** | |
| | | **Number of participant** | **Percentage** |
| End consumer | Small end user | 38 | 16.2% |
| End consumers | Large end user | | |
| Energy business | Energy industry | 20 | 8.5% |
| Energy business | Product manufacturer and retailer | | |
| Energy business | Network operators and advisors | | |
| Influences | Community energy | 9 | 3.8% |
| Regulation and control | Local authority | 18 | 7.7% |
| Regulation and control | Government | | |
| Regulation and Control | Regulators | | |
| Support | Research organisation or university | 139 | 59.4% |
| Support | Non-Governmental Organisation (NGO) or Non-Profit Organisation (NPO) | | |
| Support | Consultant | | |
| Support | Finance sector | | |
| | Other | 9 | 3.8% |
| | **Total** | **234** | **100%** |

The results from the DCE surveys presented in Table 4 classify and rank the key themes and assessment criteria according to their importance, to identify their weights in the MCA-SLES calculation MCA-SLES. Note that the weight of each specific criterion reflects its assessed importance within that theme. As described in Francis et al. (2022), the survey shows that there is agreement among the participants that the key theme of Environment (and thus its associated assessment criteria) are the most important. Key themes and assessment criteria related to the stability, durability and flexibility performance of energy technologies (i.e. robustness, energy, infrastructure and local renewable generation) were also considered to be important, along with the societal development and prosperity aspects of the People and Living theme (fuel poverty, carbon reduction and cost of energy). In contrast, the two overarching key themes related to economics and governance are considered the least important, although within these themes governance strategy, market design and growth promotion were identified as being the most important criteria.

Understanding this priority ranking for each key theme and associated assessment criteria based on priority-weight values is important in the development and application of the MCA-SLES tool. The priority weights allow different assessment themes and assessment criteria to be classified; they provide a reference point of importance for each key theme and associated assessment criteria; and they enable the calculation of combined scores for each key theme. This provides SLES projects with a way to monitor and understand their implementation status in relation to their annual or long-term objectives, and gain better insights and understanding of the co-benefits and challenges of SLES development and deployment across all assessment themes.

Table 4: Themes, weights & KPI weights and ranking (Derived from Francis et al. 2022)

| KPI Themes | Weight (%) | KPI Criteria | #KPI ID | Weight (%) | Ranking |
|---|---|---|---|---|---|
| Data management | 14.7 | Grid and capacity management | DM.01 | 20.6 | 1 |
| | | Digital technology enabled | DM.02 | 19.5 | 2 |
| | | Investment decisions | DM.03 | 19.1 | 3 |
| | | ICT infrastructure | DM.04 | 18.9 | 4 |
| | | Visibility | DM.05 | 13.2 | 5 |
| | | Privacy | DM.06 | 8.8 | 6 |
| Technical performance | 17.8 | Robustness | TP.01 | 26.6 | 1 |
| | | Energy and infrastructure | TP.02 | 18.6 | 2 |
| | | Local renewable generation | TP.03 | 18.5 | 3 |
| | | Reproducibility | TP.04 | 13.0 | 4 |
| | | System performance | TP.04 | 12.2 | 5 |
| | | Maturity | TP.05 | 11.1 | 6 |
| Business and economics | 13.9 | Market design | BE.01 | 22.3 | 1 |
| | | Promoting growth | BE.02 | 21.4 | 2 |
| | | Techno-economic metrics | BE.03 | 15.5 | 3 |
| | | Competitive energy pricing | BE.04 | 14.8 | 4 |
| | | Attractive to investors | BE.05 | 13.0 | 5 |
| | | Revenue from decarbonisation | BE.06 | 13.0 | 6 |

| KPI Themes | Weight (%) | KPI Criteria | #KPI ID | Weight (%) | Ranking |
|---|---|---|---|---|---|
| Governance | 13.1 | Governance strategy | G.01 | 23.3 | 1 |
| | | Accountability and decision making | G.02 | 19.7 | 2 |
| | | Standards and regulation | G.03 | 16.0 | 3 |
| | | Integrated management and digital planning | G.04 | 15.2 | 4 |
| | | Knowledge exchange and experience | G.05 | 13.4 | 5 |
| | | Transparency and consumer redress | G.06 | 12.4 | 6 |
| People and living | 17.8 | Fuel poverty | PL.01 | 19.4 | 1 |
| | | Carbon reduction | PL.02 | 16.5 | 2 |
| | | Cost of energy | PL.03 | 15.1 | 3 |
| | | Thermal comfort | PL.04 | 14.2 | 4 |
| | | Community engagement | PL.05 | 12.6 | 5 |
| | | Access to services | PL.06 | 11.7 | 6 |
| | | Job opportunities | PL.07 | 10.5 | 7 |
| Environment | 21.6 | Greenhouse gas emissions | EN.01 | 32.1 | 1 |
| | | Other ecosystem impacts | EN.02 | 20.3 | 2 |
| | | Biodiversity | EN.03 | 20.2 | 3 |
| | | Human health | EN.04 | 17.1 | 4 |
| | | Resilience to environment | EN.05 | 8.8 | 5 |
| | | Noise levels | EN.06 | 1.5 | 6 |

# 6 Next steps

The next steps in developing an MCA-SLES tool will focus on the release of a functional tool to SLES stakeholders.

The first task will follow the framework described in Table 1 and focus on producing a preliminary MCA-SLES tool by refining the key assessment themes, corresponding sub-themes and assessment criteria based on what is reasonably practical to measure or assess. This may involve incorporating methods from other tools; for example, incorporating data and calculations from Life Cycle Assessment to facilitate estimation of decarbonisation and other environmental impacts. Similarly, it will incorporate the outputs of other tools produced by the EnergyREV consortium, alongside metrics evaluated by the Energy Systems Catapult and Ipsos Mori as part of the wider PFER programme.

The second task will involve performing test application runs with selected PFER and other SLES projects. This will demonstrate the usability and outputs of the tool while identifying any shortcomings. The tool will then be refined and adjusted to improve its quality, robustness, and reliability.

The final task will be to support project developers and other stakeholders in employing the refined MCA-SLES tool to self-assess the PFER Demonstrator and Design projects. The final version of the MCA-SLES tool will be made publicly available so that it can be used by relevant stakeholders to support planning and design of SLES projects and broader policies to ensure effective, sustainable performance.

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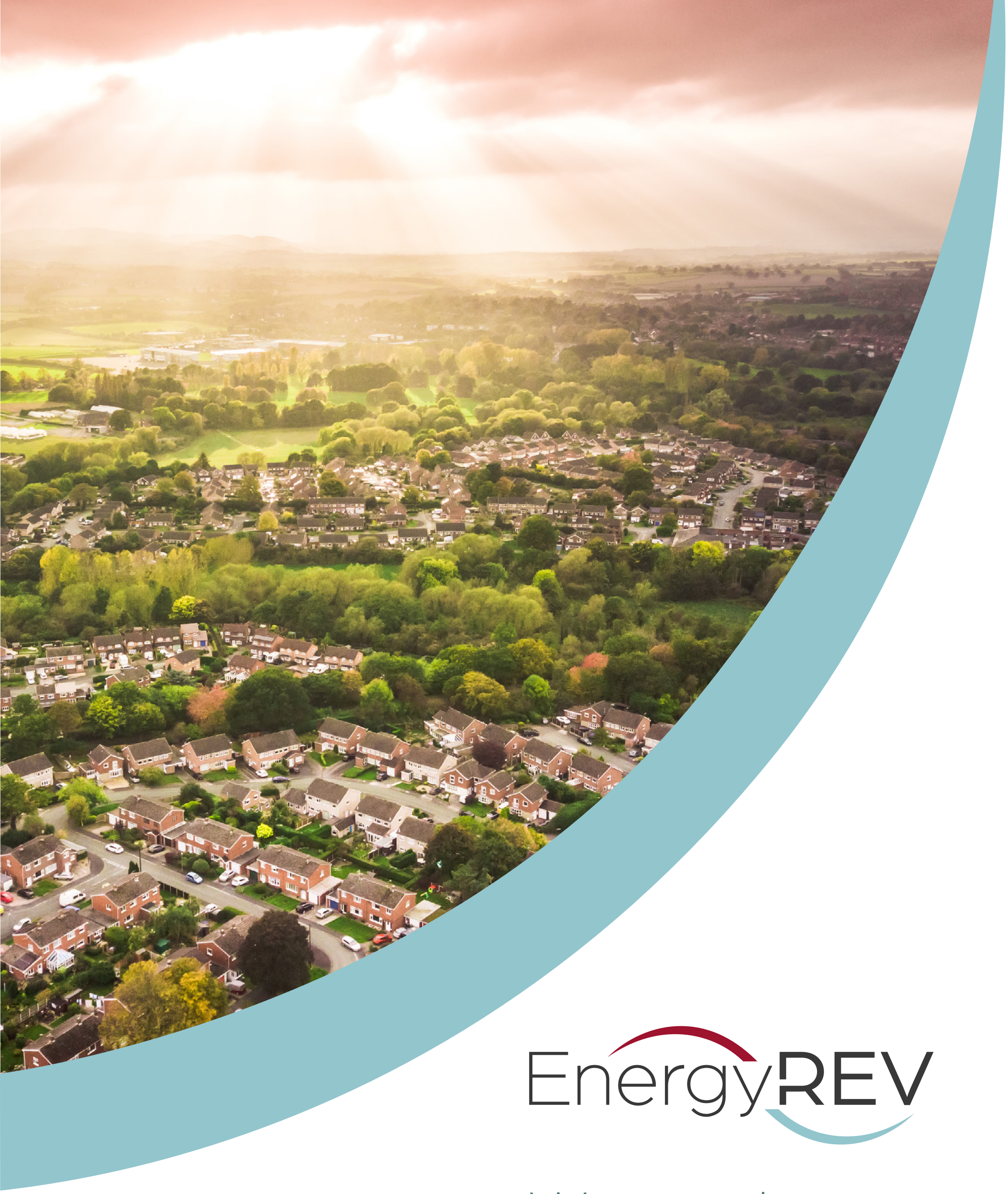

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### About EnergyREV

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