

1 LOGIC DHES BLUEPRINT FRAMEWORK

1.1 PURPOSE OF THE DHES BLUEPRINT

The purpose of this blueprint is to provide a framework for:

- Identifying opportunities for renewables-based decentralised hybrid energy systems (DHES);
- Defining and designing a successful DHES under given circumstances.

This document is intended for use by:

- Communities and other stakeholders interested in developing DHES.

The benefits of implementing a DHES blueprint include:

- Minimises and manages financial and technical risks associated with DHES projects;
- Provides a structured approach to development, i.e. process, systems and tools;
- Helps to identify the potential development risks early in the design and planning process;
- Provides a process, systems and tools for organising and interpreting information;
- Provides consensus on the direction of the project amongst stakeholders; and
- Provides confidence in projects where investment is incremental.

Decentralised Hybrid Energy Systems (DHES)

A Decentralised Hybrid Energy Systems (DHES) is an off-grid or grid-connected decentralised energy system, which combines several renewable energy sources. Balancing demand and supply is accomplished by the application of storage and/or a percentage of conventional energy. This method provides for cleaner, cheaper and more reliable energy to different end-users.

Structure of this document

The DHES blueprint process is described in the following sections:

- Section 1.2: Project Development Process;
- Section 1.3: Project Development Tools;
- Section 1.4: Identification;
- Section 1.5: Options Appraisal;
- Section 1.6: Financial and Technical Appraisal; and
- Section 1.7: Preliminary Project Plan

1.2 PROJECT DEVELOPMENT PROCESS

The DHES Blueprint Framework describes the project development process and key steps required to develop a DHES within a community. The development process is summarised in Figure 1-1 below and described in detail in sections 1.4 to 1.7.



Figure 1-1 Blueprint development process

1.3 PROJECT DEVELOPMENT TOOLS

Project development tools enable a project to consider options and find solutions. Strategically, project development tools can support decision-making processes (internal and external to the developer), and result in consensus upon the way forward within a project. They enable project developers to analyse options and provide the best solution for a project. The ultimate aim of each tool is to provide option(s) that will minimise financial risk to the project, and inform decision makers. Project development tools considered most applicable to DHES development include those outlined in Figure 1-2 and are described in the following sections.



Figure 1-2 Project development tools

Spatial Options Appraisal Tool (TBC – generic tools may be available, AQT has own in-house RADMAPP tool with protected IP)

A spatial options appraisal tool, which is a GIS based framework for data analysis can be used as a powerful decision-support tool for site selection for a range of industries including marine and terrestrial renewables, electrical infrastructure and aquaculture. The raster-based GIS framework can be applied at different scales and resolution (e.g. 1 m or 1 km) to many different scenarios. The tool helps to establish a robust framework by seeking to identify the key decision factors and providing a universal and comparable system for classifying the levels of suitability for each of these criteria.

The tool can be used to assist in the identification of suitable regions for the roll-out of DHES in North-West Europe by incorporating resource data (e.g. wind, solar, tidal or wave), technical parameters and relevant planning and environmental considerations that inform site suitability. These parameters can be analysed to review locations and identify those most suitable for project development.

IfaS tool – [IfaS to provide details here]

DHES toolkit – [OGTC to provide details here]

These tools are complimentary in nature to each other, and will offer much benefit to DHES project development when all used as a suit of tools.

1.4 IDENTIFICATION

The first step of the development process is 'identification'. This process identifies the opportunities that exist for the project, the drivers for the DHES project that form a strong case for investment, the initial exploration of DHES system options and all stakeholders who have influence upon the project from conception. The outcome of this phase is to produce a needs case analysis - which can be utilised as a statement of motivation for the project, to determine the initial options and alternative for the DHES system, and produce a project stakeholder list.

Objective/Goals

The objectives of this stage of the development process are to:

- Define the project drivers for project existence and produce a needs case statement for the project;
- Identify initial options for the project; and
- Determine all project stakeholders with influence upon the project.

Approach

The outline approach to 'identification' includes:

i. Define the drivers for project existence

- List the main drivers for the project;
 - Defining the problem the project will help solve or the opportunities that could be realised;
- Carry out 'needs case analysis', which includes the following steps:
 - Define the relationship of the project to the problem identified;
 - Identify available renewable energy resources (resource mapping);
 - Identify the project as either *Demand-based solution* or *Resource-based solution*¹;
 - Produce a financial justification; and
 - Produce a definitive needs case statement, which can be used to motivate all project stakeholders towards the project's common cause.

ii. Explore content/need for project in the country/region

Review and identify relevant policies and indicators in:

- Local development plans;
- Energy master plans;
- Policy, legal and financial frameworks for sustainable energy, including Renewable energy directives;

¹ *Resource-based solutions are defined as projects which have been chosen based on the best resource available. Demand-based solutions are projects which are driven by a particular demand for energy.*



- o Sustainable Development Goals; and
- o Energy road maps.

iii. Identify initial options

- o Identify project alternatives;
- o Explore mini-grid/off-grid/decentralised grid applicability and alignment; and.
- o Comparison of the cost of setting up an independent DHES/microgrid and a grid connected one.

iv. List project stakeholders

- o Identification of key project stakeholders involved (investors, government, suppliers, customer, finance/funding, competitors, partners (ie local energy cooperatives/community organisations) etc.) and identify which have the most power/control over the benefits;
- o Project development goal (written project mission statement – for one common goal to be understood by the partners and linking all project stakeholders);
- o Ownership aspirations (joint venture share, special purpose vehicle/project company); and
- o High-level responsibility allocation (of project elements) – to identify the role of partners (example responsibility chart to feed into a framework agreement).

v. Initial options

- o Preliminary identification of suitable technology options (detailed evaluation in step 1.2);
- o System requirements – to determine what system would be most appropriate to meet energy, economic and social needs of the community;
- o System configurations – to identify the most appropriate grid set-up and connections that are appropriate to and compatible with the existing infrastructure and the current and future generation needs.

Outputs/Milestones

Needs case statement for the project
Report of initial project options and alternatives
Project stakeholder list

1.5 OPTIONS APPRAISAL

The options appraisal stage allows the project developer to contrast and compare options to identify one that is suitable for the local community needs and will deliver a technically and economically feasible project. Each project option is screened for its viability, which initiates the risk assessment process. The project risk register is populated and can be utilised for the entire project life cycle.

Objective/Goals

The objectives of this stage of the development process are to:

- Carry out project viability screening; and



- Select a DHES project from alternatives.

Approach

The outline approach to 'option appraisal' includes two phases:

Phase 1: Project Screening

- i. **Identify risks**
 - Consider project alternatives and identify the risks for each
 - Identify showstoppers – factors can be identified by brainstorming or site walk-over by infield experts
- ii. **Identify critical success factors**
 - Critical success factors in project management and implementation;
 - SWOT /PEST analysis:
 - strengths, weaknesses, opportunities and threats (SWOT);
 - political, economic, socio-cultural and technological (PEST);
 - SWOT/PEST matrix completed within workshop with partners;
 - outputs from the risk identification process, and the SWOT analysis placed within an initial project risk register.

Phase 2: Project Selection

- i. **Comparison of project alternatives**
 - Comparison of the potential of each project alternative to select one with the highest potential for success.
- ii. **Define selection methodology**
 - Define the process to compare the importance of the project options;
 - Utilise geo-spatial tool to support with the site selection process and aid ranking of project alternatives.
- iii. **Technology option analysis**
 - Run the ifas tool (**Ifas to confirm where in the process this tool would best sit, how it feeds in**);
 - Levelised Cost of Electricity (LCOE), and kWh price, in order to compare different methods of electricity generation.
- iv. **Options appraisal report**
 - Produce an options appraisal report, setting out why the selected project was chosen over alternatives, and set out the justification for selection of technology and DHES solution.

Commented [CAH1]: Insert role of the OGTC toolkit here – once details have been provided by the team



Output/MilestonePhase 1

Project viability screening report (with risks and critical success factors)

Risk register

Phase 2

Final project selection

1.6 FINANCIAL AND TECHNICAL APPRAISAL

Now that the DHES project has been chosen, the financial/technical appraisal looks to assess the value of the project as an asset.

Objective/Goals

The objectives of this stage of the development process are to:

- To determine the value of project; and
- To complete a technical appraisal.

Approach

The outline approach to 'Financial and Technical Appraisal' includes:

- i. Determination of the value of the project**
 - o Carry out a business model assessment (private ownership, private-public partnership etc.); and
 - o Identify key performance indicators (financial viability, social impact, sustainability of energy system and carbon offset, resilience and reliability).
- ii. Perform technical appraisal**
 - o Define risks and opportunities in more detail (including pricing of the risks);
 - o Propose risk mitigation measures;
 - o Evaluation of factors including energy consumption of end users, available renewable resources and existing energy delivery infrastructure;
 - o Determining regulatory and permit/consent requirements (are there siting and zoning requirements);
 - o Verifying land characteristics (siting requirements – land cover, land use, soil testing for mounting structures, archaeological sites, socio-cultural, seismic and flood risk, dwellings, exclusion zones (infrastructure, properties, natural and heritage features etc.) (detailed geo-spatial decision-support tool assessment);
 - o Reviewing existing infrastructure and determine how DHES would be integrated/what the requirements are;
 - o Establishing baseline energy consumption (ifas tool); and
 - o Define existing and future demand scenarios (ifas tool).



Output/Milestone

Project valuation report
Financial and technical appraisal report (with mapping)
Updated risk register



1.7 PRELIMINARY PROJECT PLAN

The preliminary project plan lays down the strategy to support the projects capital investment decision. Documents produced can support the agreement of further capital investment from project partners or approaching potential external financial capital investors.

Objective/Goals

The objectives of this stage of the development process are to:

- Develop a funding strategy and delivery plan
- Carry out risk assessment, management and mitigation measures in order to avoid, reduce or remedy potential impacts or risks
- Produce a business plan
- Preliminary planning for engineering, construction/commissioning, operations and maintenance
- Define the project to inform the capital investment decision for project implementation

Approach

The outline approach to 'Preliminary Project Plan' includes:

- i. Execute financial evaluation**
 - Carry out Economic and financial analysis – ifas tool or other software e.g. HOMER?
 - Develop a funding strategy and delivery plan
 - Cost estimates
 - Prepare a revenue stream
 - Determine Key Performance Indicators
 - Contractual requirements
- ii. Risk assessment, management and mitigation**
 - Carry out a Risk Assessment
 - Detail the process for managing risks going forward and mitigation measures
 - Highlight project consenting requirements and the associated financial risk
- iii. Technology evaluation of the project**
 - Evaluation of technology component options including generation, storage and controls
- iv. Preliminary technical design**
 - Preliminary Front-End Engineering Design (pre-FEED) for the project
 - System outline/outline of design
 - Site investigations
 - Viability of project and address any areas of technical uncertainty
- v. Preliminary planning**
 - Preliminary installation/deployment and commissioning plan
 - Preliminary operations and maintenance planning
 - Preliminary asset management planning



vi. Project definition

- Define the project to inform the capital investment decision for project implementation

Output/Milestone

Project valuation report (financial, permits and licensing)
Pre-FEED report
Preliminary planning documents
Final risk assessment and updated risk register
Project definition

