Guide report 4:

The project development process

Nordic Energy Research
Nordic Council of Ministers

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November 30, 2016

ISBN 978-82-92874-37-0 (PDF)

Layout: Misha Jemsek
Cover photo: COWI A/S

Nordic co-operation
Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland, and Åland.

Nordic co-operation has firm traditions in politics, the economy, and culture. It plays an important role in European and international collaboration, and aims at creating a strong Nordic community in a strong Europe.

Nordic co-operation seeks to safeguard Nordic and regional interests and principles in the global community. Shared Nordic values help the region solidify its position as one of the world's most innovative and competitive.

Contents

List of abbreviations

COP: Coefficient Of Performance. The rate of conversion of energy into heat – most notably used in relation to heat pumps.

CAPEX: CAPital Expenditure

EIA: Environmental Impact Assessment

EPC: Engineering, Procurement and Contracting

FID: Final Investment Decision

FS: Feasibility Study

IFC: International Finance Corporation (part of the World Bank Group)

O&M: Operations and maintenance

OPEX: Operational EXpenditure

PFS: Pre-Feasibility Study

RE: Renewable Energy.

RES: Renewable Energy Source

RES share: Renewable Energy Source share. The share of renewable energy used out of the total energy used.

SIA: Social Impact Assessment

1 Introduction

This guide report is a part of the guideline for project developers and planners of renewable energy projects. The guide is specifically aimed at supporting the implementation of 100% renewable energy heating and electricity production in sparsely populated areas in the Nordic countries.

Over the past 2 years, the International Finance Corporation (IFC) has commissioned and published two separate guidelines for project development of renewable energy projects[1]. These guidelines are great source for additional information. The project development processes on different types of renewable energy projects are typically almost identical. The process we describe in this guide report resembles the methodology and processes described in the IFC guides. The report is structured as checklists that you can go through to make sure you have covered all the most important aspects of the project development process.

2 How to move from idea to concept

A RE project can provide many advantages such as:

- offer cheaper energy supply (electricity, heat) for households or industrial processes
- provide an environmentally friendly solution to the energy needs of an industry or a local community
- reduce GHG emissions by substituting fossil fuels such as oil, gas or coal
- increase security and quality of energy supply
- realizing RE targets

One or more of these reasons may create the idea to develop a RE project.

An opportunity for a potential RE project may be identified, by the owner of an industrial enterprise, by a local enthusiast or by a professional project developer. Next, it will take the

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[1] IFC (2016): Converting Biomass to Energy - A Guide to Developers and Investors. Pending publication.

IFC (2015): Hydroelectric Power - A Guide for Developers and Investors. http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/learning+and+adapting/knowledge+products/publications/hydroelectric_power_a_guide_for_developers_and_investors combined efforts of a larger group of stakeholders to bring the idea to fruition in the form of a successfully operating project.

The project owner faces a number of challenges that must be addressed before proceeding with the actual development of the project. The most important barriers are listed below:

Important project barriers:

1. On grid/ off grid communities
2. Legislation
3. Project ownership
4. Financing
5. Collaboration with grid operator and energy suppliers
6. Land ownership
7. Available renewable energy resources
8. Managing intermittent power generation

Below we list key questions relating to these barriers that you will need to address.

On grid/Off grid

- Is the community connected to a regional or national electricity grid?
- Is there a local distribution grid for electricity?
- Is there a market for sale of electricity to customers?
- How is electricity traded/sold?
- Are there any support mechanisms in place for renewable energy production? (feed-in tariffs, clean energy certificate, etc.)
- What is the time frame for these support mechanisms?

Legislative framework

- Does local, national, regional and international regulation allow this type of project?
- Is there any environmental regulation that must be respected?

Strength of owner

- Does the project owner have sufficient strength to see the project through?
- Which parts of the project development process will require external assistance?
- Is it possible to identify the necessary external assistance and what is the expected cost of the assistance?
- What is the timeline for the project development and is this realistic in terms of authority approvals etc.?

Financing

- Is it possible to finance the project at reasonable terms and conditions?
- Who will be the owner and operator of the project?
- Is the project financially viable?
- Are potential risks identified and adequately mitigated?
- Will external financing from financial institutions be necessary for the implementation of the project?

Grid operator

- Is the local or national grid operator willing to collaborate on integration of system benefits?
- Is it possible to negotiate reduced rates based on the provision of system benefits?
- Will the grid operator be part of the project owners' group?
- Will the grid operator take active part in the system design to ensure optimal conditions for the provision and use of system benefits?

Site identification

- Are there any issues with land ownership that need to be resolved?
- Will private installations take up more or less space than existing installations?
- Will public or collective installations like a district heating plant or wind turbines be visible to the community?
- Will the installations be noisy during operation?
- Will the local community experience noise and other inconveniences during construction?

- How will the local community react to the sight, smell, and sound of these new installations – during construction and operation?

Available renewable energy resources

- What are the possibilities for hydro power and pumped hydro storage? i.e. elevation changes and water resources

- What are the possibilities for wind power? i.e. steady predictable wind patterns – no extremes

- What are the possibilities for solar power? i.e. plenty on sunlight

- Other renewable energy resources like waste and excess heat from industry?

Managing intermittent power generation

- How much wind and solar power will be available?

- What are the options for backup power generation in periods with no or little wind and sun?

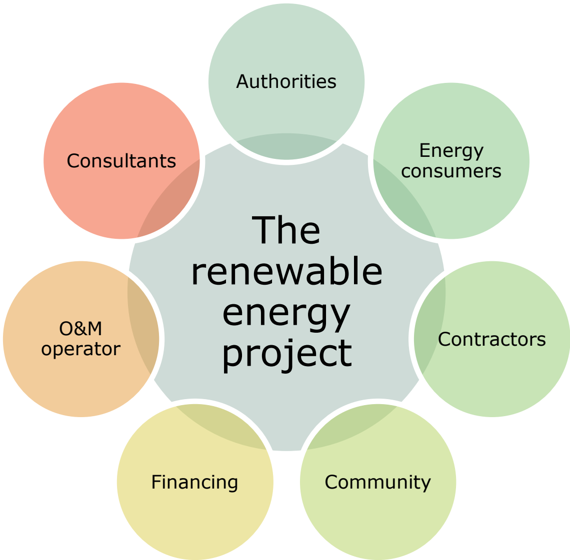
- How much demand can be shifted in time to accommodate variations in supply?

- What are the available options for storage (short and long term) of electricity?

3 Stakeholders

Stakeholder identification and management is an important element in successful project development. In renewable energy projects the stakeholders include authorities, energy customers and local stakeholders including NGO's and various community groups. Securing a positive attitude towards the project from all these stakeholder groups can be essential for a successful project implementation and integration in the local community.

Figure 1 *The stakeholders in a RE project*



Source: IFC (2016)

In Figure 1 we provide an overview of the different stakeholders that may influence or be involved in the development of a renewable energy project. It is important to go through all of these types of stakeholders and assess how they will contribute to the development of your project, what they expect in return, how they can gain from the project and how you will manage adversity and lack of cooperation.

4 Project development

The project stages for a renewable energy project can be broken down into development and implementation of the project.

Project development

- Project idea
- Pre-feasibility study
- Feasibility study
- Contracts and financing

Project implementation

- Design
- Construction
- Commissioning

In Table 1 we present a more detailed breakdown of the project development process from the perspective of project developers and banks respectively and highlights the main activities.

Table 1 Project development stages

Bank perspective	**Developer perspective**
1.1 Project idea	
	• Identification of available resources • Funding of project development • Development of outline of technical concept
1.2 Pre-feasibility study	
	• Assessment of different technical options • Approximate cost/benefits • Permitting needs • Market assessment for sale of produced energy
1.3 Feasibility study	
• First contract with project developer	• Technical and financial evaluation of preferred option • Assessment of environmental and social effects • Assessment of financing options • Initiation of permitting process
1.4 Contracts and financing	
• Lenders due diligence • Financing concept in place	• Permitting • Procurement strategy • PPA negotiated • Preliminary EIA • Financing of project

Source: IFC (2016)

Table 1 reflects a standard process including external financing. If the project is fully owner-financed, many of the steps may be avoided or reduced.

In section 2 above, we went into detail with the process of moving from idea to concept. Below we present detailed lists of the subjects a pre-feasibility study and feasibility study respectively should describe. These are meant as check lists you can go through to ensure that your project is on track and that you have considered all the most important aspects in due time. The Contracting phase is briefly described, but at this stage you should consider getting professional assistance.

4.1 Pre-feasibility study (PFS) stage

A pre-feasibility study is a preliminary systematic assessment of all critical elements of the project – from technologies and costs to environmental and social impacts. It is a sanity check on the feasibility of the project.

For more information on the technical aspects of designing a 100% renewable energy supply as well a potential sources of data on climate, prices etc. See Guide Report 1: Leirvík Case and the Excel screening tool "Feasibility".

The typical pre-feasibility study may cover the following issues:

- Description of the project: Energy types, energy consumption, location, population etc.
- Potential technical concepts: heat pumps, wind turbines, hydro power etc.
- Expected energy production once the project has been implemented including renewable energy share
- Preliminary layout (design)
- Preliminary assessment of energy sales / energy cost
- Preliminary assessment of alternative sites (access to site, size, connection to grid, etc.)
- Preliminary assessment of environmental and social impacts
- Preliminary assessment of construction costs (CAPEX) and operating costs (OPEX), see Guide Report 3
- Preliminary financial analysis
- Preliminary risk assessment
- Preliminary assessment of necessary permits and licensing
- Planning of project implementation incl. tentative time schedule

4.2 Feasibility study (FS) stage

The feasibility study is an elaboration of the pre-feasibility study where all aspects of the project – design, costs, environmental impacts etc. – are scrutinized and detailed to reduce uncertainty to the point where it is possible to use the material to seek financing for the project. Again you should refer to Guide Report 1 and the Excel screening tool for help on design, cost estimation and potential data sources.

We have split the feasibility into three stages:

1 Conceptual design

2 Bankable Feasibility Study

3 Permits

Conceptual design

The conceptual design typically comprises:

- Description of technologies.
- Evaluation of suitable technologies,
- Selection of project location(s) following an evaluation of technical, environmental and economic aspects – and local acceptability.
- Final and detailed assessment of capital costs (CAPEX) and operational expenditures (OPEX).
- Examination of the connections to the electrical grid, will it support the potentially increased load from e.g. electrification of heating?

Bankable feasibility study

Bankable feasibility studies (BFS) are a requirement from most International Financial Institutions (IFIs). The BFS is not consistently defined. The main components will be fairly uniformly defined across IFIs, but you should expect variation in the details. The following items will likely be included in a bankable feasibility study:

- The conceptual design and final assessment of the required investment
- Financial and economic analysis including cost-benefit calculations, calculations of Net Present Value (NPV), Internal Rate of Return (IRR) and similar analyses, see Guide Report 3
- Overview of current regulation and political framework relevant to the project
- Identification of potential additional sources of financing, e.g. public funding

- Sensitivity and risk analyses
- Assessment of the potential impact of risks on the financial viability of the project and suggestions of mitigation measures.
- Environmental and social impact assessment including proposal for mitigation measures, if necessary[2]
- Organization studies of potential O&M service provision
- Procurement plan and identification of potential equipment suppliers and contractors
- Implementation plan including time and financing schedule

Permits

The following elements are normally part of the permitting process:

- Environmental permit based on the Environmental Impact Assessment prepared during the bankable feasibility study stage
- Planning permission
- Building permit
- Power grid connection approval, if relevant
- District heating system, if relevant

4.3 Contracts and financing stage

The contracts and financing stage takes the project from the feasibility study to Final Investment Decision (FID) by the project owner. This involves moving the project forward on a number of fronts, including outline design and selection of contractor(s).

Selection of contractors can be done several ways via public procurement including competition among qualified potential bidders or via a dialogue based procurement process with one or several potential contractors. The outcome of stage 4 is typically an EPC (Engineering, Procurement and Construction) contract ready for signature which allows the project owner to prepare a fairly accurate investment budget.

[2] Guide to environmental impact assesments. http://ec.europa.eu/environment/eia/eia-support.htm

Reports and materials in this series

- Renewable energy supply and storage: Guide for planners and developers in sparsely populated areas.
- Guide report 1: Heat supply in Leirvík - Case Study
- Guide report 2: Technology catalogue
- Guide report 3: Economic and financial analysis
- Guide report 4: The project development process
- Fornybar energy og lagring i spredtbyge områder (an Excel based screening tool: Include data for your own local community and analyse the feasibility of optional solutions for renewable energy systems.)

All reports available for download at www.nordicenergy.org/publications