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Financial Model for a Large Energy Industry Investment Project

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ABSTRACT

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The purpose of the study is to gain an in-depth understanding what kind of information a financial model of a large energy industry project should provide, and study how to utilize the obtained information more effectively in the case investment project. The scope of this thesis is to focus to the phases after the feasibility study, when the investment decision has already been made.

The research type is a qualitative study with empirical research related to the case study. The data is collected through four semi-structured interviews, sixteen discussion meetings and an inquiry.

The study reveals that modelling profitability, financing, cash flow and financial statements provides the most essential information what is needed to follow and to manage the financial big picture of a large energy industry investment project. Additionally, the case investment project requires information about how its Mankala price is estimated to develop. The second part of the study reveals that the case investment project's financial model could be utilized more effectively in a several ways and the model should provide more financial information especially for risk management and financing related activities.

TIIVISTELMÄ

Tekijä: Joel Sihvonen

Aihe: Talousmalli suurelle energia-alan investointiprojektille

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Tämän työn tarkoituksena on saada syvällinen ymmärrys millaista taloudellista informaatiota suuren energia-alan investointiprojektin talousmallin tulisi tarjota, sekä tutkia kuinka tätä talousmallia voitaisiin hyödyntää tehokkaammin case investointiprojektissa. Työ on rajattu tarkastelemaan vain investointipäätöksen jälkeistä ajanjaksoa.

Päämenetelmänään tutkimus hyödyntää kvalitatiivista tutkimusmenetelmää, jonka data kerätään neljästä puolistrukturoidusta haastattelusta, kuudestatoista keskustelutapaamisesta sekä yhdestä kyselystä.

Tutkimuksen perusteella kannattavuuden, rahoituksen, kassavirran ja tilinpäätöksen mallintaminen tarjoaa suurelle energia-alan investointiprojektille kaikista tärkeimmän taloudellisen informaation sekä mahdollistaa taloudellisen kokonaiskuvan muodostamisen. Lisäksi case investointiprojekti tarvitsee informaatiota Mankala-hinnan kehityksestä. Tutkimuksen toinen osuus paljastaa, että case investointiprojekti voisi hyödyntää talousmalliaan tehokkaammin usealla eri tavalla ja mallin tulisi tarjota enemmän talouspohjaista tietoa etenkin riskienhallinnan ja rahoituksen tarpeisiin.

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Helsinki, June 2018

Joel Sihvonen

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ABBREVIATIONS

BS	Balance sheet
CAPEX	Capital expenditure
EPC	Engineering, procurement, and construction
FIT	Feed-in-tariff
IRR	Internal rate of return
LCOE	Levelised cost of energy
NPP	Nuclear power plant
NPV	Net present value
O&M	Operation & maintenance
OPEX	Operating expense
PPP	Public-private partnership
P&L	Profit and loss statement, income statement
SPV	Special purpose vehicle
TVOM	Time value of money
WBS	Work breakdown structure
WNA	World nuclear association

1 INTRODUCTION

This chapter introduces the background, purpose and methodology of the study. In addition, the case investment project, research questions, limitations, scope and structure of the study is presented. This chapter provides necessary basic details allowing to proceed further into to the actual research.

1.1 Background

Large investment projects are characterized by their large-scale capital costs, long duration, and remarkable high levels of technical and process complexity. Due to these features added with massive pressure to deliver the projects are struggling world over. According to Flyvbjerg (2011 p. 321-322), overall 90 % of large investment projects suffer from budget overruns, with delays of over 50 % in project completion. Especially large energy sector investment projects, which are essential for global development, have experienced both significant cost overruns and project delays (Ernst & Young 2016). One solution which can prevent these issues is to provide data-based support for decision making processes. Financial model is a theoretical construction of a project or company that deals with the key determinants and variables and set of relationships between them in a purpose to form and express necessary information (Avon 2015, p. 1). The financial model can be built as a lifecycle model for an investment project and hence is able to provide essential financial data to support decision making processes. This study investigates what kind of information a large energy industry investment project's financial model should be able to provide and how a case investment project could utilize its existing financial model more effectively. The literature review and empirical part of this study are done in the context of financial modelling and its typical components added with theory of investment project's value drivers and characteristics.

The financial structure of investment projects, programmes and portfolios have many different forms but the financial management process is basically similar in all. Basically every large industry investment starts with a feasibility study which is an analysis used to measure the ability and likelihood to complete a project successfully including all relevant factors such as economical, technological and legal factors. From the economical point of view it includes at least estimated capital needs, revenue projections from output sales, debt service capabilities, operating costs and market projections. (Fight 2005, p. 50) The ultimate target of the feasibility study is to determine potential positive and negative outcomes of a project before investment decision. This study focuses into the phase after the feasibility study and investment decision when the investment project's financial standing and progress needs to be managed and forecasted into the future. There are many definitions of financial model but none of those are officially accepted. In this study the financial model is defined as a "theoretical construction of a project, process, or transaction in a spreadsheet that deals with the identification of key drivers and variables and a set of logical and quantitative relationships between them" (Avon 2015, p. 1).

There exists very little literature from the investment project's financial modelling after the investment decision, most probably because the information is confidential and only little relevant data exists in the public domain (Avon 2015, p. 4). Additionally, every investment project has its own special features. This study aims to narrow this gap by investigating what kind of information financial model should provide for a Finnish nuclear power plant project after the investment decision and how the obtained information could be utilized more effectively in the case investment project. Research motivation, case investment project, research objective and scope of the study are introduced in the next chapters.

1.2 Research motivation

Motivation for this thesis derives from the need to investigate whether there are possible development areas in the case investment project's financial model, its operational environment, and the effective utilization of the information provided by financial model.

Discussions with the key stakeholders of the financial model implied that the model contains lot of useful data and it perhaps could be utilized more effectively. Additionally, the model structure is made years ago and the original creators are not working with the project anymore. Therefore, it was advisable to investigate is the model still providing relevant and comprehensive information. Furthermore, another source of motivation was to train the thesis writer to be a back-up financial modeller.

The literature on financial modelling from the investment project perspective is surprisingly scarce. Most of the financial modelling literature focuses only into best practices of financial modelling in the technical perspective or financial statements and finance itself. Undoubtedly, there is lack of literature which combines these two elements and investigates what investment projects can really achieve with financial modelling and how the use of the achieved information could be optimized. In other words, pragmatic company perspective is lacking and this research aims to narrow this gap by using the Finnish nuclear power plant investment project as a case example.

1.3 The case investment project

The case investment project is Hanhikivi 1 nuclear power plant (FH1) in Finland. Its total investment cost is estimated to be between 6.5-7 billion euros, including initial plant costs, financing, and waste management. The project will improve Finland's energy self-sufficiency, help to meet climate targets, and reduce the dependence on imports far into the future. The FH1-Project is owned and managed by project company and future operator Fennovoima Oy, which is a non-listed company, owned by Voimaosakeyhtiö SF (66%), joint venture of Finnish industrial and energy companies, and RAOS Voima Oy (34%), subsidiary of Rusatom Energy International. Fennovoima's mission is to build a new nuclear power plant (Hanhikivi 1) in Finland and produce stable priced electricity for its shareholders. The company has purchased the nuclear power plant as a turnkey delivery from RAOS Project Oy, which is part of Rosatom Group and responsible for the design, construction, installation, and commissioning of the plant. Fennovoima will operate under the Mankala principle, which is a special feature of Finnish energy industry that allows the shareholders to buy the electricity generated by the power plant at cost-price in proportion to their ownership of the company. Therefore, Fennovoima's goal is not to make profit or pay dividends. Fennovoima was granted a positive Decision in Principle in May 2010 for Finland's sixth nuclear power plant and the final investment decision on the construction and financing for a 1,200 MWe pressurized water reactor was made in 2014 after main supplier was selected. Currently the project is under licensing phase and preparing for construction phase. The commercial operation is estimated to start in 2028 and the operating lifetime of the power plant is a minimum of 60 years. The ownership structure of Fennovoima Oy is presented in the Figure 1.

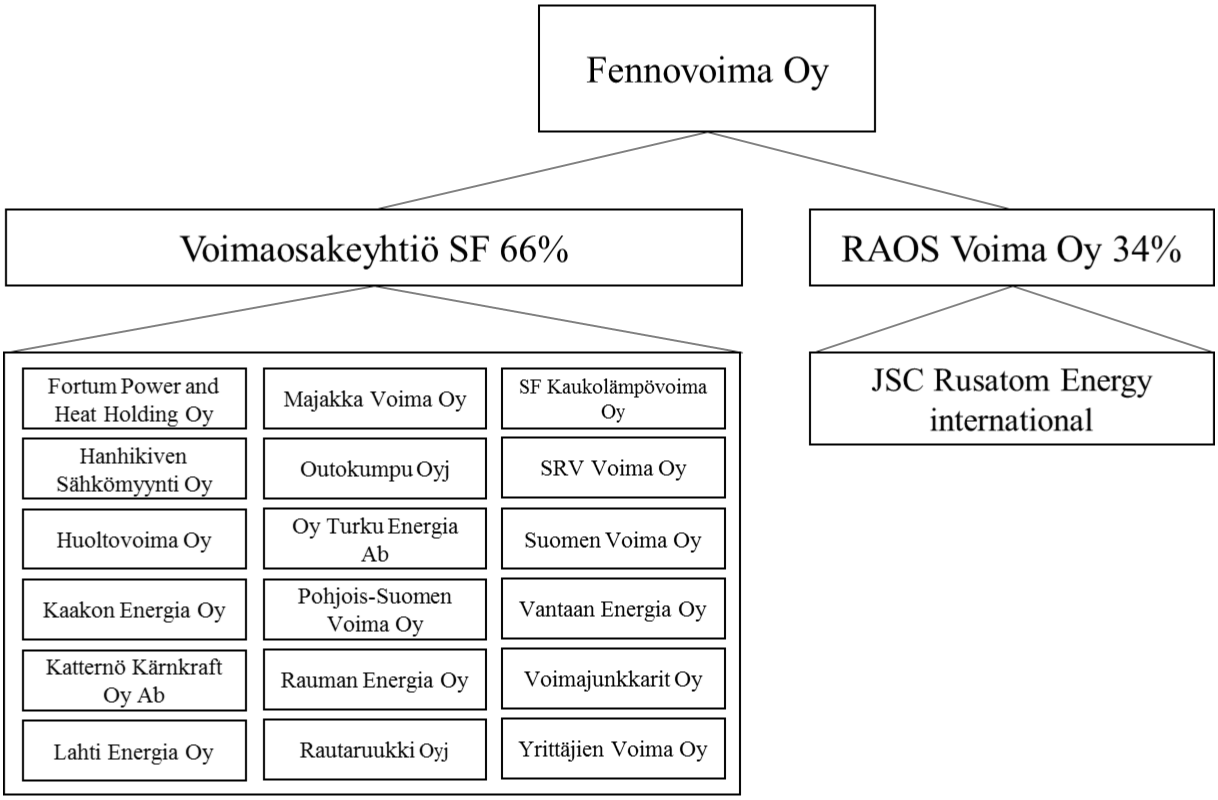

Figure 1. Ownership structure of Fennovoima Oy May 2019 (Voimaosakeyhtiö SF 2019)

1.4 The objective and scope of research

This study investigates what kind of information a large energy industry investment project's financial model should be able to provide and how a case investment project could utilize its existing financial model more effectively. The information need is examined in general level as well as from case investment project's point of view. Another purpose of this study was to examine ways to utilize the case investment project's financial model more effectively to achieve greater benefits. This study answers to following research questions:

1. *What information financial model should provide for a large energy industry investment project?*
2. *How to utilize financial model more effectively in the case investment project?*

Research questions are the basis for the empirical part of this study and answers to them are given later in the results and conclusions.

The scope of research is limited to focus only a large-scale energy sector investment projects. Therefore, other industry sectors as well as small- and medium-scale investment projects are out of scope. Additionally, the scope of research is limited to focus only the investment project's phases after a final investment decision and hence this study does not investigate the factors what needs to be considered before it. The included phases are all the rest ones; licensing, construction, operation and decommissioning. The industry of research is Finnish energy sector and takes into account its specific features. The second research question concentrates into developing Fennovoima's financial modelling utilization and hence it is focusing only to the case investment project.

1.5 The research methodology and process

The study comprises of literature research along with empirical research of the discussed phenomenon. The following paragraphs carry the reader from academic knowledge to the empirical study by justifying the research on its way.

Academic research is often categorized into qualitative or quantitative research. In this study a qualitative research methodology was chosen to gain in-depth understanding of the case investment project's financial modelling needs and utilization possibilities. According to Baxter and Jack (2008) Qualitative case study methodology provides tools for researchers to study complex phenomena within their contexts. The qualitative case study is also a proper way to study people's needs and mindset because it allows the research "to go beyond the quantitative statistical results and understand the behavior conditions through the actor's perspective" (Zainal 2007). Data for this study was collected through four interviews, 16 discussion meetings, one inquiry and literature (Table 1). The results of the first research question are based on literature, case company's material and sixteen discussion meetings with case investment project's analysts who are also the main financial modellers of the project. The results of the second research question are based on one inquiry and on four interviews. The inquiry was indicated for the shareholder who has experience from several investment projects and the aim was is to examine how the case investment project's model could be developed from shareholders point of view. The interviewees were chosen based on their relevant role in the case company. The research case, methodology and process are described more detailed in the chapter five.

Table 1. Research methods

Method	**Source**	**Duration**	**Aim**	**Date**
Theory review	Literature	-	Understand concept, find ideas, support observations	10.01 – 22.05.2019
Discussion	Financial Analyst & Financing Analyst	16 x 1-2h	Learn how Fennovoima's financial model works, what it includes and how it is utilized	15.01. – 26.03.2019
Interview	Financial Analyst, Financing Analyst & Risk Manager	4 x 1h	Find potential development objects concerning financial model utilization	03.04. – 11.04.2019
Inquiry	Shareholder	-	Benchmark existing model, get feedback and potential development objectives	12.04.2019

1.6 Content and structure of the study

The structure of this study follows common guidelines for an academic research paper. The study comprises of literature research along with empirical research of the discussed phenomenon. This study is divided into six chapters which each of them has specific target and contribution. The content and structure of this study is presented in Figure 2.

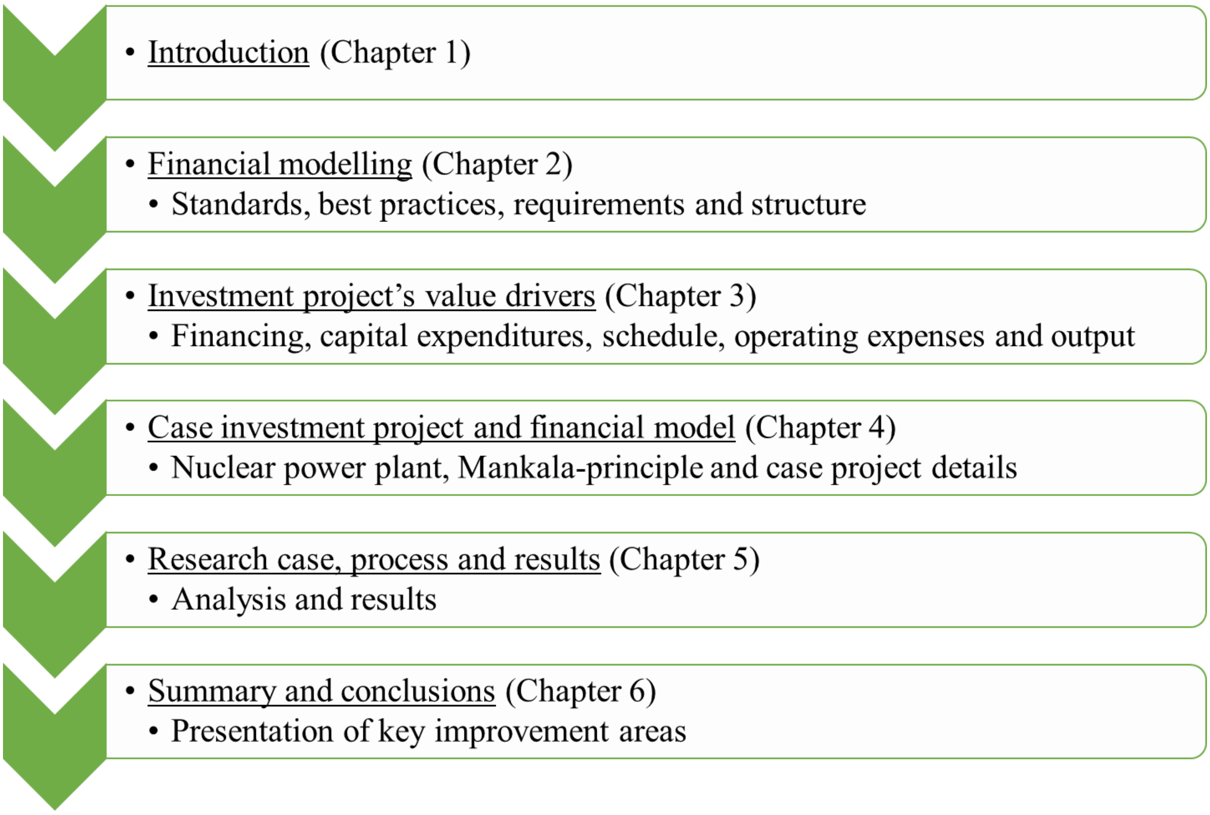

Figure 2. Structure of the study

This study begins with a literature review of financial modelling in chapter two where the financial model and modelling process are defined and common use purposes and benefits introduced. This gives an adequate insight into concept and enables going further into model's technical requirements and common financial modelling steps. Those requirements and steps are essential to understand in order to form pragmatic view and bigger picture.

After financial model part study proceeds more into economical field in chapter three where the common investment projects value drivers are introduced based on field literature. The drivers can be considered as a main measures how successful the investment project will be and they can be separated into five main categories; financing, capital expenditures, schedule, operating expenses, and output. These categories are introduced one by one in chapter 3 from investment project point of view. After the general theory, the characteristics of Finnish energy industry and Fennovoima's FH1 project are introduced in chapter four. The chapter introduces Mankala principle, nuclear power plant economics, nuclear power plant phases, and main value drivers and financial model of case investment project.

After these chapters the necessary background information is introduced and study can go forward into the research part in chapter five, which also includes the results of the study. In the end of this thesis, in chapter five, the results are summarized and conclusions made. Additionally, research limitations and suggestions for further research are presented.

2 FINANCIAL MODELLING

In this chapter, the literature insight on the financial modelling is introduced. The chapter describes what is the purpose and limitations of financial modelling and how it should be executed. Furthermore, this chapter supports strongly the basis of the following empirical and research part.

2.1 Overview

First of all, a model is defined as a numerical or mathematical representation of a real-life situation and a financial model can be understood as a model which relates to business and finance contexts. Officially there is not any generally accepted definition of this concept, and hence for some financial modelling can be a highly pragmatic set of activities in spreadsheet (e.g. Excel), and for others, it can be a mainly conceptual activity, whose focus is on the use of mathematical equations to indicate the relationships between the variables in a system. (Rees 2018, p. 3) There are differing types of financial model, depending on their objectives and goals. In this thesis the approach is intentionally a bit general in order to avoid constraints and on purpose to develop case company's model. Therefore, the financial model in this thesis is considered as a theoretical construction of a project, progress, or transaction in a spreadsheet that deals with the identification of key drivers and variables and a set of logical and quantitative relationships between them as defined by Avon (2015, p.1). Basically in this context it combines the model itself, financial analysis, and forecasting activities in purpose to achieve comprehensive view of what kind of advantages these could provide for a large energy industry investment project.

As an investment progresses from the early stages of basic feasibility assessment to achievement of financial close the financial model changes and develops. There exists many types of models with a wide range of uses but generally all models require at least preparing an income statement, balance sheet, cash flow statement and supporting schedules to enable financial analysis and forecasting. Usually financial analysis involves the selection, evaluation, and interpretation of financial data to assist in evaluating the operating performance and financial condition of an investment (Fabozzi 2009, p. 193). Financial modelling is mainly used for future planning of company's long term goals and if the model is well structured it is able take into account different situations and scenarios that may arise. It can provide data, for instance, to support decision making relating to business plans and forecasts, to support financing decisions, to resource allocation and portfolio optimization, and to value corporations, assets, contracts and financial instruments. (Rees 2018, p. 3) Common financial model benefits, based on literature (Avon 2015; Lynch 2010; Rees 2018; The FAST Standard 2016), are collected to the Figure 3.

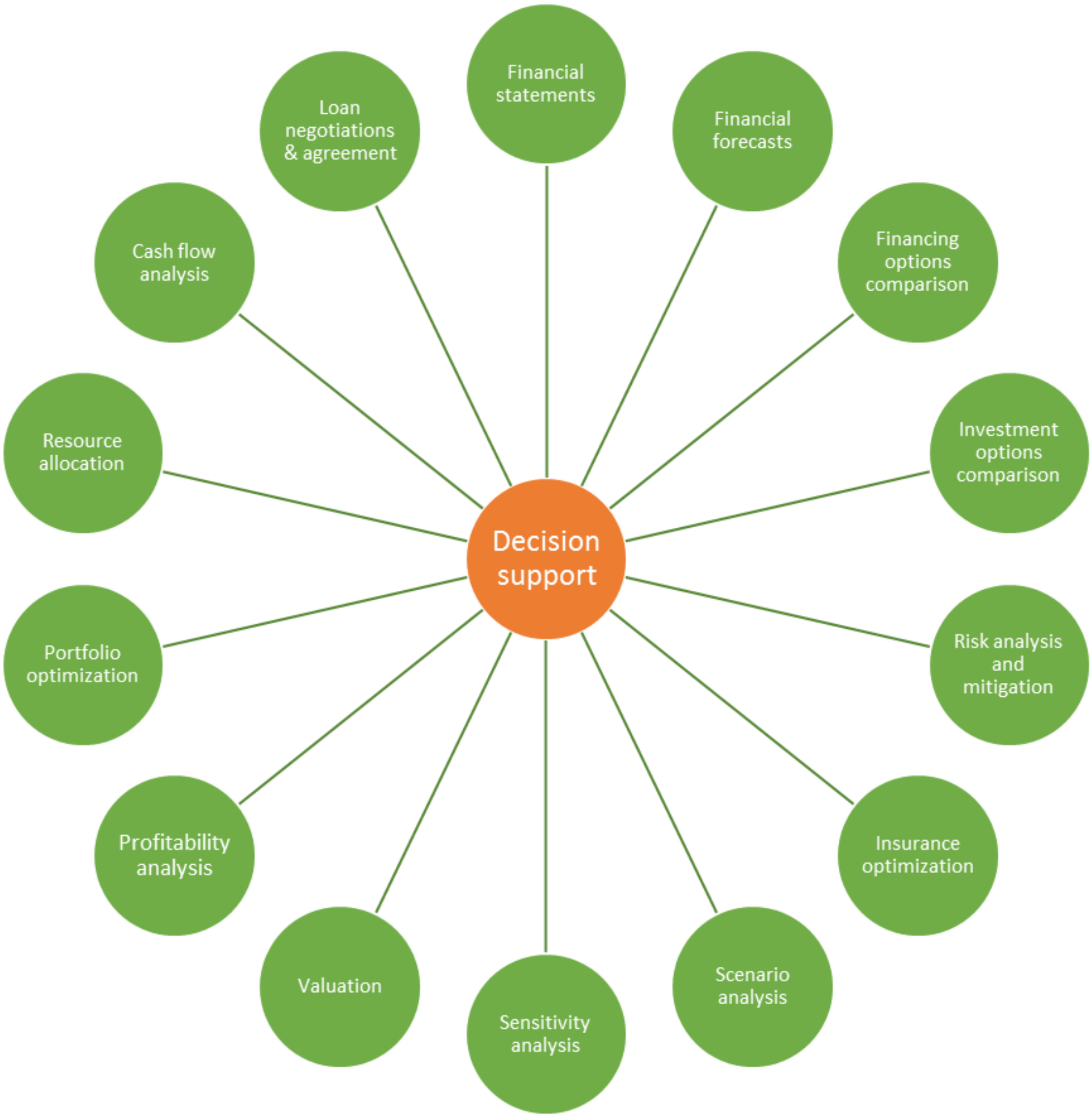

Figure 3. Benefits of Financial Modelling (Avon 2015; Lynch 2010; Rees 2018; The FAST Standard 2016)

As we can see there are many advantages of financial modelling and most of these are essentially supporting decision making process by providing necessary fact-based data to make decisions. Besides decision support, the financial model can be used as a part of investment documentation to record financial history and to support project long-term forecasting reporting, for instance to shareholders. If financial model is well made it can be essential tool in loan negotiations for providing necessary information and outlook. Usually, a loan agreement requires for periodic checks on loan cover factors and an audited version of final model commonly forms part of the loan agreement and provides these required figures. (Lynch 2010, p. 3-4). When developing the model, it is important to bear in mind what stage the investment has reached, and the level of detail available in the data. Too much data increases complexity and debases clarity, and therefore it is essential to decide what needs to be modelled and for what purpose. The use of tools like sensitivity, scenario and risk analysis can, for instance, lead to modifications to the project or decision design, or provide insight to find an optimal decision or project structure, but at the same time model's complexity is increased and more work needed to manage the model (Rees 2018, p. 9).

To achieve necessary benefits, corporations and projects have to identify their business specific characteristics which have to be adapted into assumptions, after which model can be developed to respond their specific needs. It is possible to achieve all these benefits from model with right tools, as described in the following chapters, but it requires a lot of planning and effort to create such a comprehensive model which also works without problems (Rees 2018, p. 17-21).

2.2 Standards, best practices and requirements

This chapter provides an overview of typical standards, best practices and requirements of financial modelling. According to a widely used FAST Standard (2016), basic modelling rule is that the financial models must be as simple as possible, but no simpler. Without simplicity supported by precise structure a financial model will be poorly suited to its main purpose – supporting business decisions. The FAST word is an acronym of the most requisite qualities of financial modelling; Flexible, Appropriate, Structured, and Transparent.

Flexibility allows users to run scenarios and sensitivities, make modifications when new information becomes available, and to adapt new data or data sets without having to perform undue structural modifications – even by different modellers. Appropriate means that the model must reflect key business assumptions directly without being too over-build or cluttered with unnecessary detail. The model must be a good representation of reality, not reality itself. There is always a bit of uncertainty with data or assumptions and therefore the model cannot express the exact reality. (Rees 2018, p. 13-14; The FAST Standard 2016)

A good structure is essential to retain a model's logical integrity over time, because there might be many modellers or a modeller may change. Consistency in model layout and organization saves also time when building, learning, or maintaining the model. In principle, financial models should be self-contained within a single workbook to avoid potential errors that can otherwise easily arise but be hard to detect. (The FAST Standard 2016) The good structure is beneficial also in circumstances where is a requirement to introduce new data sets regularly, as well as in cases where the volume of data is huge and dominates the number of formulas. (Rees 2018 p. 20) More precise structural suggestions and limitations are discussed in the following chapter 2.3.

Transparent model utilizes simple and clear formulas that can be understood by other modellers and non-modellers alike. Therefore, avoiding macros is recommended because they are not transparent and that makes the model more difficult to check, calculations harder to follow, and errors more likely when updating the model. Simple actions to achieve transparency are, for instance, using simple formulas by functionally separating timing, escalation, and monetary calculations and structurally organizing worksheet in logical manner. (Lynch 2010, p. 34) The Table 2 below summaries general financial model design principles in a workbook and a worksheet level.

Table 2. General financial model design principles (The FAST Standard 2016)

Workbook level	Worksheet level
Maintain consistent column structure across all sheets.	Arrange sheet so that calculation order flows left to right.
Maintain a consistent time rules throughout the model.	Do not attempt to optimize calculation layout and user interface/presentation on the same worksheet.
Ensure primary time rulers span time frames of secondary rulers.	Separate flags and factors onto dedicated sheets.
Proliferate links to maximize navigational efficiency.	Separate calculation sheets into functional chapters.
Mark exports with red font and imports with blue font.	Minimize inter-linking between sheets.
Calculate only once.	Each columns should have a single and consistent purpose.
Use normally positive convention on calculation sheets.	Series worksheet should be defined for a single time axis only.
Do not overuse macros.	Make only two columns matter.
Use in-flow/out-flow convention on result sheets	Calculation should generally flow from top to bottom and left to right.
Never release a model with purposeful use of circularity	Mark intra-sheet counter-flows with grey shade.
Do not split a model across multiple workbooks.	Limit counter-flows to opening balance positions.
Avoid direct external file links.	Present information horizontally.
	Do not hide anything.

As we can notice, there is lot of general recommendations and principles for financial modelling. All in all, good financial model is structured in a logical, easy to follow and understandable design. It is well-structured with a good layout and it focuses on important issues. It is important that the first model should be structured to allow easy onward development over the project or investment life. Model should also be accurate and its data sources and assumptions are clearly laid out to avoid any mistakes or misunderstandings. Outputs are preferred to be visually presented and it is good to remember that simplicity is more desirable than complexity. These guidelines ensure that the model achieves necessary flexibility, robustness and clarity, and therefore helps the modeller and any other parties using the model to navigate within the spreadsheets, to identify the items they are looking for and to understand and check the model calculations. (Lynch 2010, p. 6; The FAST Standard 2016)

2.3 Structure

From the structural point of view the financial model is recommended to conceptually divide model into three stages; **data**, **calculations** and **reports** (Figure 4) (Lynch 2010, p. 8). Every financial model starts with a company's or project's historical results which are used as a input data to model. The historical fact-based data is supplemented with necessary assumptions that are the best available estimates of the necessary factors. The data and assumptions are used to execute calculations whose purposes are to process the input values into results. The results are a presentation where the outputs are collected and organized into the format required for summaries and reports. Typically these categories are divided into different worksheets in Excel to achieve clarity and to avoid misunderstandings. Separating calculations from results and reports allows restructuring outputs without compromising the safe calculation of the figures. A financial model can also have some documentation sheets, which provide important information about the models, for instance methodology, background, external inputs, and exported links. (The FAST Standard 2016)

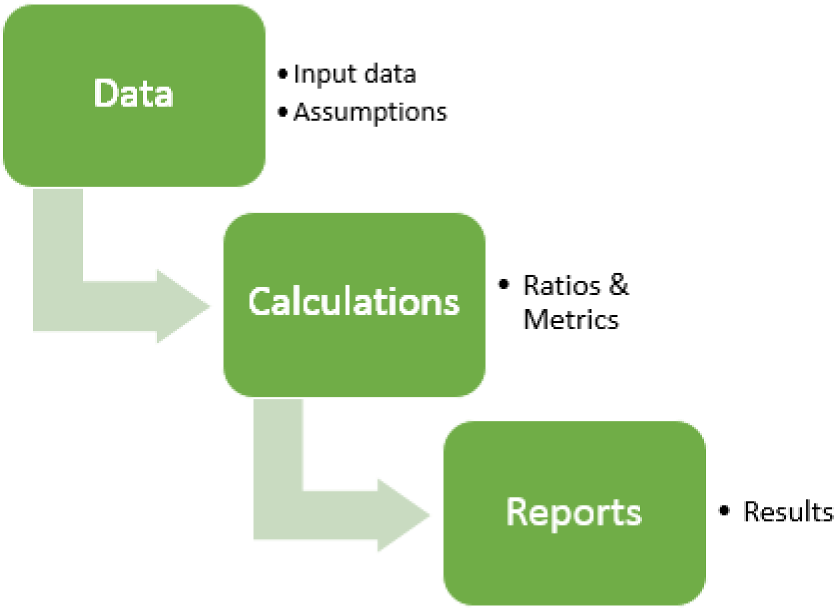

Figure 4. Financial modelling stages (Lynch 2010, p. 8)

The data should contain the input values and assumption to the model. In any case, it should consider overall objectives and decision-making needs to enable to collect the relevant data with desired scope and accuracy (Rees 2018, p. 3-4). When collecting the data and making the assumptions it is good to remember that ongoing investment projects usually have parallel other actions e.g. work planning and budgeting processes that can provide supporting help. Work planning and budgeting processes typically generate precise data from current situation and forecasts for few following years. These specified forecasts can be used to supplement the assumptions made in financial model and, in turn, financial model is able to provide a rough estimates for budgeting purposes. Data section also includes different kind of timing flags and indexation factors to enable following calculations and to keep them enough simple (The FAST Standard 2016). Data items should be grouped into sensible categories to achieve clear and logical layout. Lynch (2010, p. 77-78) suggests following categories in order:

- timing data (such as start of operations and financial close);
- macroeconomic data (includes assumptions about inflation and currency issues);
- capital cost data (expenses incurred on the purchase of land, buildings etc.);
- finance data;
- operating data;
- tax and accounting data.

It is recommended to organize inputs (data and assumptions) both by structure and commercial area, for instance, by separating constant inputs from series inputs, and actual values from forecasts data. These groupings can be further divided into the topics what the inputs really represent. Grouping the modelling stages ensures that the number of errors that otherwise would have been made due to the lack of understanding can be decreased. Another recommended best practice is to include a dedicated instruction and comments column on input sheets. This ensures that anybody handling a model understands what the data means and how to use it. (Avon 2015, p. 12; The FAST Standard 2016)

Calculations can be described as a financial model's engine. They process the data in line with assumptions to gain results and reports in desired format, and therefore they are quite model specific. Calculations are organized primarily for ease of use by the modeller and for clarity if someone wants to check them, for instance in audit process or in loan negotiations. In calculations consistent timeline and currency are highly recommended to minimize errors and complexity. (Lynch 2010, p. 8)

Reports are the sheets where the calculation results are presented in a required format, for instance, financial statements or profitability analysis. A model must communicate the results of numeric analysis and therefore it is worthless if it fails to present information effectively. Separation of report sheets from calculation sheets allows to structure and amend reports without compromising the safe calculation of the figures. The clear presentation of results is a key part of the function of any model. It is useful to have a single page summary which captures key information and presents it in a distinct and clear manner. At the same time, the model still should be able to produce a full set of reports to present the model results in detail. Graphs have instant impact to improve visualization and can help to understand the result, especially for those who have limited understanding of the model. Graphs are ideal option when information can be conveyed more clearly using a visual image than if presented in numeric form. (Lynch 2010, p. 8; 153-155)

Below in the Table 3 is more detailed example framework of financial model's structure. This structure and sheet are generally applicable, but additional sections may be required for specific purposes – for example calculation of Mankala price for Finnish Mankala-companies (Chapter 4.3).

Table 3. Example of financial model's structure (Lynch 2010, p. 15)

Data	
	Input sheet (s)
Calculations	
	Project specific factors e.g. worklines
	Construction/capital costs
	Funding
	Operations
	Tax
	Profit and loss
	Cash cascade
	Cash deposit
	Investor returns
	Cover factors
Reports	
	Net cash flow summary
	One-page key inputs and results summary
	Balance sheet
	Annual summaries, etc.
Other	
	Macro support sheet
	Results library

The structure of above presented example follows the general guideline; Data – Calculations – Reports. Typical calculations are related e.g. to capital costs, funding, operations, taxes, profit and loss statement, cash flow analysis and investor returns. Therefore, calculations are comprehensively providing the financial status that is presented in the distinct and various format reports. For example according to Lynch (2010, p. 15), net cash flow summary, one-page key inputs and results summary, balance sheet and annual summaries are typical results of the financial model.

3 INVESTMENT PROJECT'S VALUE DRIVERS

Investment project's value forms from five main categories; financing, capital expenditures (CAPEX), schedule, operational expenses (OPEX) and output (Lynch 2010, p. 4). These categories are the main factors of project success since they include project's costs, revenues and deliverables and hence enable to determine project's benefits. Additionally, there can exists some significant external and uncategorized value such as taxes and inflation. This chapter describes these value drivers mostly in general level based on literature and in chapter four these drivers are examined from case investment project's perspective.

3.1 Financing

The investment project initiator has traditionally two different options to finance the project; corporate financing or project financing. Additionally, there exists governmental and co-operative financing models in specific purposes but this study and chapter concentrates mostly into project finance. Type of financing model and its ownership structure are in significant role for determining how the risk of a project is managed. The Figure 5 presents typical financing models and describes how generally they are used globally in nuclear energy sector.

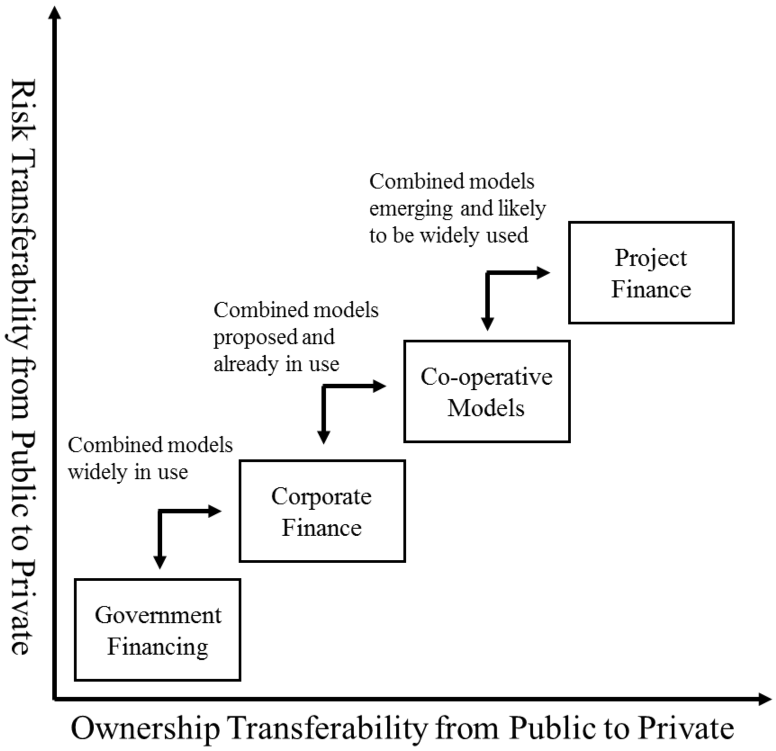

Figure 5. Typical financing model categories (Barkatullah 2011)

In the corporate financing the new project is financed on-balance sheet and in the project financing the new project is incorporated into a newly created economic entity, typically special purpose vehicle (SPV) project company, and financed off-balance sheet. The corporate financing option means that the sponsors use all the assets and cash flows from the existing company to guarantee the additional credit provided by lender. If the project fails, all the remaining assets and cash flows of existing firm and new project can serve as a fountain of repayment for all the creditors. The project finance instead means that the existing firm and the new project are separate entities. Therefore, if it is non-recourse project financing deal and the project fails, project creditors cannot claim the sponsoring firms' assets and cash flow. There is also possibility to settle up limited recourse project finance deal which contains limited obligations and responsibilities for project sponsor. The advantages of project finance are illustrated in the Table 4 below. (Fight 2006 p. 10-11; Gatti 2012, p. 1-2)

Table 4. Advantages of project finance (Fight 2006, p. 4-6)

Non-recourse/limited recourse financing	None or limited obligation to guarantee the repayment of the project debt on the sponsor. Therefore, does not adversely impact the company’s financial structure and credit rating.
Off balance sheet debt treatment	Isolates the risk of the project by taking off balance sheet so that the project failure does not damage the owner’s financial condition.
Leveraged debt	Debt is advantageous for project finance sponsors in that share issues and equity dilution can be avoided.
Avoidance of restrictive covenants in other transactions	A project finance structure permits a project sponsor to avoid restrictive covenants.
Favorable tax treatment	Is often driven by tax-efficient considerations e.g. tax allowances and tax breaks.
Political risk diversification	Establishing special purpose vehicles (SPVs) for projects in specific countries quarantines the risks and shields the sponsor.
Risk sharing	Allows to spread risks over all the project participants, including the lender.
Collateral limited to project assets	Non-recourse project finance loans are based on the premise that collateral comes only from the project assets and in limited recourse collateral to the assets of the project sponsor is sometimes required.
Lenders are more likely to participate in a workout than foreclose	If the project is experiencing difficulties, the best chance of success lies in finding a workout solution rather than foreclosing. Therefore, lenders will more likely cooperate in a workout scenario to minimize losses.

It has become broader that megaprojects as large energy industry projects use project finance due to its many advantages. (Davis 2003, p. 1) For example, coal-fired power plant Laibin B (2 x 350 MW) was the first Chinese infrastructure project financed entirely with foreign capital and the US$616 million project cost was financed with US$154 million equity from the project sponsors and US$462 million in debt facilities in 1997; and Casecnan Water & Energy Company's one of the largest irrigation and hydroelectric power generation projects in the world at that moment was project financed in three tranches (US$75 million in 2002, US$100 million in 2005 and US$181 million in 2010). (Davis 2003, p. 30; 226) In order to receive project financing deal, the project must to prove that it is capable of producing enough cash to cover all operating and debt-servicing expenses over the whole time period of the debt. Consequently, the financing risks are highly project specific and it is essential that all the participants such as commercial bankers, investment bankers, insurance companies, general contractors, subcontractors, suppliers and customers understand these risks, because they all will be participating in an interlocking structure. However, typically these various participants have differing contractual obligations, risks and rewards. Megaproject's being financed often requires the syndication of the finance. For instance, the Eurotunnel project financing involved around 220 banks. (Fight 2006, p. 13) Mostly due to these highly project specific risks and requisite structuring and organizing costs the project finance is 5-10% more costly than the corporate financing option (Gatti 2012, p. 2).

In project financing the project company (SPV) is formed of the consortium shareholders such as contractors or operators who may be investors or have some other interests in the project. The SPV is formed specifically to build and operate the project, and is independent legal entity, which enters into contractual agreements with all parties necessary to the project. The project company has to also enter into negotiations with the host government as it typically has to obtain specific permits and authorizations, for instance construction and operating license to build and operate a power plant. (Fight 2006, p. 10)

If we consider financing from a lenders' point of view, there are three general requirements what they require to be met; repayment of loans, guarantees and adequate security. Repayment of loans should be completed within a safe time period and that level of safe is defined by the lender. Moreover, lenders desire that the cash inflows should be guaranteed and the investment project should be demonstrable and certain, as to amount and timing of cash inflows. Furthermore, lenders require that there should be adequate security at all times to cover the loans advanced. Hence, there should be tangible fixed assets or other arrangement to cover the loans. (Tiffin 1999, p. 141)

The financial modelling is needed to assess economic feasibility of the project and the model's output can be used in structuring of a project finance deal. It is also used to determine the debt levels, debt repayment profile and riskiness of the project and, therefore, as a determinant of interest rate on debt. It is important to remember that the funding structure tends to be very deal-specific and every project has its own characteristics. (Lynch 2010, p. 91)

Different financing models are used in different investment projects and countries. Financing a large investment project such as nuclear power plant (NPP) must take into account its typical factors such as high capital investment, long construction periods, long capital payback periods and nature of the power market (Terlikowski et al. 2019). Attracting billions of euros for the construction of a NPP is a difficult task and typically they are financed by the conventional approach that consists of multi-source financing, where a complete financing package covers the entire cost of the projects. Traditionally, governments have used domestic public sector funds to finance NPP projects but a recent world-wide trend shows that governments are increasingly looking towards the private sector for new financing approaches with different risk and ownership structures (Barkatullah & Ali 2017). The prime source of multi-source financing is the investor/owner/operator and its resources. In addition, the package is completed with bond issues, domestic bank credits and in state-owned cases from governmental budget. Financing of NPPs over the last years has changed significantly from state-owned solutions to more private capital based ones. Investors with interest take advantage of global markets in order to diversify the sources of finance and hence spread the risk and financial cost among multiple investors (Terlikowski et al. 2019). For instance, Hankikivi 1 and Olkiluoto 3 nuclear power plants in Finland are part of Mankala-principle based companies, whose equity has largely been contributed by a consortium of energy-intensive industries and local utilities. (Fennovoima Oy 2018; Pohjolan Voima Oyj 2013) The Mankala model is defined later in Chapter 4.3.

3.2 Capital expenditures

Capital expenditures (CAPEX) indicates critical company's or project's capital budgeting decisions, which have long-term benefit for the business such as buildings, plant, equipment, and equipment replacements. An expense is considered to be a capital expenditure when the asset is a recently purchased capital asset or an investment that has a life of more than one year, or which improves the useful life of an existing capital asset. The importance of CAPEX is well known and established in economic, accounting, and finance literature (e.g. Fama and Miller 1972; Kerstein and Kim 1995; McConnell & Muscarella 1985). At the company level, CAPEX can determine strategic projects, development plans and company's production release. The company's or project's performance is also directly linked to CAPEX and, hence, it is important element considering company's value drivers (McConnell & Muscarella 1985).

Due to long-term scope and benefits the capital expenditures are capitalized into the company's balance sheet (BS) as an investment. This means that they are not added as an expense into the company's profit & loss statement (P&L) and depreciations are a way to account for a gradual loss in value of long-term tangible asset over its estimated useful life. The amortization plays the same role for intangible assets such as intellectual property and patents, and they can be as well capital expenditures. (Makoujy 2010, p. 91-92) The amount of CAPEX is highly dependent on the industry and region it occupies. Construction and energy sector are typically having relatively high level capital expenditures, for example, nuclear power plant's CAPEX vary between 1900-7200 US$/kW in Europe and between 3240-5300 US$/kW in Middle East (Terlikowski et al. 2019). To give a bit perspective to the scale, the premeditated power of Hanhikivi 1 is 1200MW and hence based on these scales the total CAPEX varies between 2280-8640 million US$.

3.3 Schedule

Completing a project on time and within budget is challenging task. The project scheduling plays a central role in predicting both the time and cost aspects and hence it is one of the key drivers of project success. The project management triangle (Figure 6) is a widely known model of the constraints of the project management and it describes correlations between time, cost and scope. Its basic principle is that the quality of work is constrained by a project's budget, timelines and scope, and changes in one constraint necessitate changes in others to compensate or quality will suffer. This triangle can be understood as a base scheduling theory, but it is essential to understand that the triangle is insufficient as a model of project success because it omits crucial dimensions of success such as impact on stakeholders and learning. (Atkinson 1999)

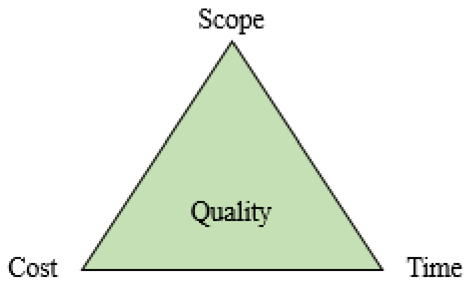

Figure 6. Project management triangle

In project management, a schedule is a listing of a project's milestones, activities, and deliverables, with start and finish dates (Project Management Institute 2013). It is connected, for instance, to resource allocation, budget, and task duration and hence plays very important role in managing projects. However, a project schedule should especially be considered as a predictive model that can be used for resource efficiency calculations, project control, time and cost risk analyses and performance measurement. The techniques of project scheduling are well developed but inconsistently utilized throughout industry. Before a project schedule can be created, project scope, sequence of activities, task dependencies, critical path, and project milestones should be determined. After determining those necessary elements, a work breakdown structure (WBS), which identifies the responsibilities and set of activities needed to achieve the goal, can be created and it acts as a base for project schedule.

The project scheduling should be a dynamic process that involves a continuous streams of changes and constantly supports decision making process through the project lifecycle. Dynamic scheduling comprehends from three components: scheduling, risk analysis, and control and can be formed also into triangle format as presented in Figure 7. Risk analysis in this context means analyzing strengths and weaknesses of the project schedule in order to achieve information about the schedule sensitivity and the impact of unexpected changes that undoubtedly will occur. In turn, project control in this context means measuring the time and cost performance of a project during its progress and use the information obtained during the scheduling and risk analysis steps to monitor and update the project and to take corrective actions in case of any problems. (Vanhoucke 2012, p. 1-2)

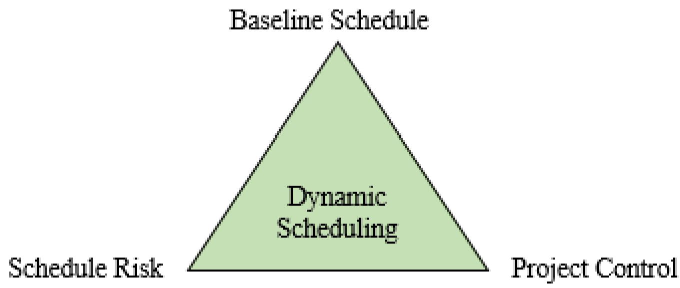

Figure 7. Three components of dynamic project scheduling (Vanhoucke 2012, p. 2)

The time value of money (TVOM) is also an important time and financial related concept which underlines the importance in schedule management to forecast future and prevent any delays. Essentially, the TVOM recognizes that a euro today is worth more than an expectation of receiving a euro in the future. It is due to that inflation reduces the purchasing power in the future and uncertainty reduces the value of the future cash or income payments. The value today must recognize the risk and the opportunity cost to invest in other alternatives. These above mentioned factors are emphasized especially in large and long-time projects where the inflation has time to grow significantly and uncertainty is higher due to difficulties to forecast so far away. (Alexander 2018, p. 441-442)

As stated before, schedule plays a central role in predicting both the time and cost aspects. Therefore, it is essential element in financial modelling to enable, for example, forecasting activities and valuation. Also, a loan drawdown schedule is needed to be able to plan financing activities, and it is strongly connected to the cash flow predictions and project schedule. (Lynch 2010, p. 78) All in all, it is good to understand that the more accurate the schedule is the more accurate financial model’s assumptions are. These advanced assumptions in turn gives more accurate output.

3.4 Operating expenses

Operating expenses (OPEX) are short-term expenses required to meet the ongoing costs of running a business as rent, equipment, inventory costs, marketing, payroll, and insurance. They are those expenditures that a business incurs to engage in activities not directly associated with the production of goods or services. Operating expenses must be ordinary and necessary in the business trade. Unlike CAPEX, OPEX are recorded into P&L and can be fully deducted on the company's taxes in the same year in which the expenses occur. For most businesses operating expenses are necessary and unavoidable, but it is advisable to optimize them because reducing them reduces also costs and hence increases earnings but at the same time can compromise the integrity and quality of operations. Therefore, finding the right balance is essential. Typically there is country specific guidelines and regulations related to how business must capitalize its assets, and what should be recorded to the income statement (P&L) as an OPEX. An income statement typically categorize expenses into six groups: cost of goods sold, administrative costs, depreciation and amortization, other operating expenses, interest expenses, and income taxes. All these expenses can be considered operating expenses as in this thesis is done. (Makoujy 2010, p. 8-9)

3.5 Output

The output is the amount of something produced by a person, machine, or industry. Each investment project has own case specific output and for example in an energy industry the main output is the amount of produced energy. Behind the output lies variable factors, which determine the final result e.g. capacity (MW), availability (%) and operation lifetime (years). Additionally, the scope of output can be broadened to include also the demand of the output and hence and market price is also considered. The economics or any power generation depends primarily on what each unit (MWh) costs to produce and what is the demand for that power (WNA 2019). But in addition it also depends on the market into which the power is sold as well as its government policies such as taxes and regulations.

3.6 Rates of Return

Investors are primarily interested in the profits generated by investments and the risks to which they are exposed (Weber, Staub-Bisang & Alfen 2016 p. 16). Therefore, it is essential that the investment projects are aware what are their estimated future incomes and what is the level of profitability. The two commonly used methods to measure economic efficiency are net present value (NPV) and internal rate of return (IRR).

NPV is widely used in financial statement preparation and analysis, asset valuation, and business purchases. It determines the present worth of future earnings by discounting future cash flows to existing or decided date. (Makoujy 2010, p. 87) IRR is the discount rate at which the NPV of cash flows from/to investors equals zero. Typically, IRR is calculated for all investors (debt + equity) and for shareholders only (equity). The usefulness of the IRR measurement lies in its ability to represent any investment opportunity's return and compare it with other possible investments. Therefore, it is widely used in investment projects. Common 3-year equity IRR for power generators is 12-14% and expected cash yields 4-12% (Weber et al. 2016 p. 37). The risk is estimated to be relatively high compared to other infrastructure investments. Figure 8 below presents common risk-return profiles for infrastructure projects as a large energy investment is. It is important to remember that these are just general estimates and every investment has its own characteristics.

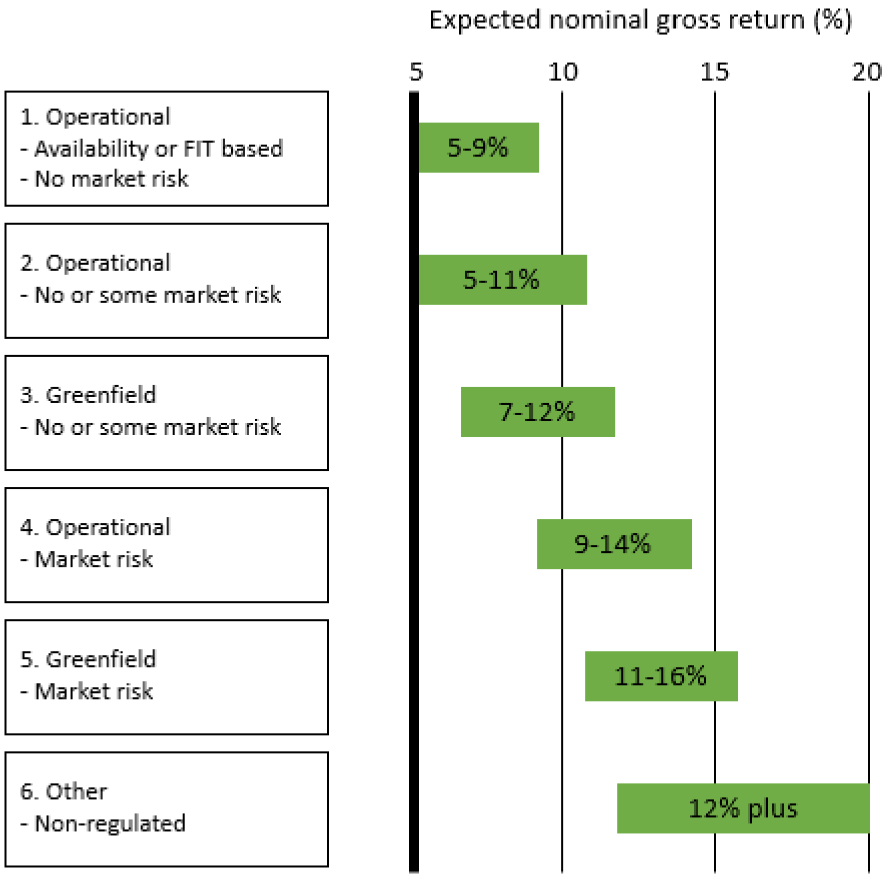

Figure 8. Investment project's risk-return profiles (Weber et al. 2016 p. 38)

The Figure 8 above demonstrates that the risk-return profile of an infrastructure asset is not only determined by the industry but it is also highly dependent on the geography, contractual structure, stage and the on the risk that the partners take on. Hence, such a similar physical asset in an industry can deliver an IRR varying from around 5 % to above 15 %. The case with the least risk (1. Operational) represents, for instance, an operational asset with regulated, long-term availability based public-private partnership (PPP) or feed-in-tariff (FIT) contracts with none or minimal market risk, not too highly leveraged, and with a trustworthy grantor that is recognized public body in a stable country. Whereas another asset (4. Operational) exhibits a riskier profile, even thought is also operational and regulated but it is exposed to market risk. Commonly, market risk is the greatest risk type for an owner followed by political and regulatory risk. (Weber et al. p. 37-38)

3.7 External and uncategorized value drivers

Along with above presented main value drivers, a large energy investment project has some significant external value drivers where it has not direct impact such as inflation and taxes. In financing modelling these external value drivers can be considered as an input assumptions for other value drivers and in this way take into account. External organizations and societies can be used as a partial source for forecasting development of these drivers. For example primary objective of the European Central Bank (2019) monetary policy is to maintain inflation rates of below, but close to, 2 % over the medium term. Therefore, this 2 % inflation rate can be used as a directional rate in financial modelling for medium- and long-term forecasting, if investment project just relies on to European Central Bank's abilities. Additionally, markets are providing several another short-, medium- and long-term predictions for external value drivers from various sources. A large investment projects can also have some general value drivers, which is not suitable to any of above mentioned main value drivers. Hence, there can be group for this kind of uncategorized value drivers. For example, contract specific penalties can be significant for the investment project's value but they do not suit properly into any existing category.

3.8 Risk Monitoring

Financial modelling is an essential way to manage and reduce risks because it can provide forecasting, scenario and sensitivity tools and hence support current and future views. In best case, the risk management is supporting the realization of strategy and business objectives and ensuring operating environment by preventing negative effects by identifying risks as early as possible. Risk monitoring in financial model concentrates typically into financial risk management which deals risks from economical perspective and allows to make scenario or sensitivity analysis. It enables to settle risks on to order of magnitude and evaluate their financial consequences. In most projects will appear events that are even impossible to predict in advance, but managing risks systematically and focusing into correct activities the likelihood this kind of unknowns can be decreased (Stoelsnes 2007) The risks of large energy investment project can be shared into seven categories; construction, operations, market, technology, regulatory, financing, and political. These all have affect to investment's profitability and the impact as well as the amount of these is highly project specific but typically there is always some ways to reduce them. If we look from the financial perspective and whole investment's lifecycle, common financial risks for all investment project phases are liquidity, market and credit risks which can be reduced, for instance, by diversifying sources of finance. Investment project can hedge its risks against cost overruns by entering into fixed-price purchasing contracts. If risks can be reduced it lowers the risk premium and therefore lowers overall financing costs. (Financial Analyst & Financing Analyst 1 2019)

Because globalization, political, market and technological risks are strongly linked to financial risks and large investment projects has to take these into account. Market or political changes can have huge effects to interest rates and loan margins and consequently cause uncertainty in planning finance and costs. Tightening political situation between countries can also cause import and export problems therefore be crucial for project's succeed. Additionally, technology development can affect arise new disruptive innovations which can be more profitable and cost efficient options from investors perspective and hence cause problems for current investment project. Also, laws are tightly connected to large energy investment projects and has to be taken into account in risk monitoring. For example changing regulation or tightening taxation are political risks, which can cause a significant threat to the costs of the project. (WNA 2017)

When considering investment's risk-return profile, there is a general assumption that higher risk projects presents an opportunity for higher returns. Typically this is true but not for all cases. For example, nuclear projects risk-adjusted returns do not conform with this assumption beyond certain risk levels and there is a point where project risk is simply too high regardless of return. In practice this level is reached when it comes difficult or impossible to raise capital from traditional project investors. (Energy Technologies Institute 2018)

Fennovoima's risks are managed and monitored in Risk Register, which is used for documenting the results from risk assessments and risk treatment efforts. The risks are allocated to contractual parties according to the Engineering, Procurement and Construction (EPC) contract. All relevant risks are tracked and documented in the Risk Register and it will be maintained for the project's entire lifecycle. Each risk has owner person who is responsible for the risk information. Currently there is identified approximately 150 higher level risks and hundreds of lower level risks. The risks are divided into external and internal risks. The external risks are grouped to political, economic, social, environment, technological and legal risks (PESTEL). The internal risks are classified by main organizational activities e.g. licensing and permits, legal support, human resources and design. Because project has different risks in different phases, these risks are organized in a time based manner into four different groups: licensing, construction, commissioning and operation. During the development and construction of the nuclear power plant, the most significant financial risks are related to delays in the commissioning of the plant, cost overruns, and the availability and cost of debt financing. (Risk Manager 2019)

4 CASE INVESTMENT PROJECT AND FINANCIAL MODEL

This empirical chapter strives to understand and describe what are the characteristics, needs and requirements of financial modelling in the case investment project. Furthermore, this chapter supports strongly the basis of the following research part.

4.1 Nuclear power plant economics

Low-cost, stable and predictable baseload electricity supply has been a critical enabler of economic and social development and the role of nuclear power has been significant in delivering such supply. The economics of nuclear power are characterized by high fixed costs and low operating costs, where the average electricity costs fall substantially with increased output (WNA 2017). Nuclear power is estimated to provide a significant contribution in the energy transformation process to achieve global greenhouse targets (European Commission 2012). Electricity represents globally around 15% of the total annual energy consumption and nuclear power generates around 11% of total electricity production (Weber et al. 2016 p. 182). The total electricity consumption in Finland in 2018 was 87 terawatt hours (TWh) and the share of nuclear power generated was 25% (Energiateollisuus 2019). In European Union's Roadmap to 2050 nuclear energy is one the key sources of low carbon electricity and maintaining a nuclear generation capacity between 95 and 105 GW of electrical output in EU until 2050 would require as high as EUR 350-450 billion investments. Approximately 90% of the existing reactors in the EU will be shut down by 2030 and new replacements are needed. Nuclear-related investments in the global market are estimated at around EUR 3 trillion by 2050. (European Commission 2017)

According to Greenwich University's emeritus professor Steve Thomas, nuclear power plants (NPP) are the most complicated piece of equipment that people know how to construct (Davey 2016). Nuclear projects have long lead time and long active construction times thus require greater financing before cash-flow is positive. This incurs greater risk for owner and contractor and require a longer level of commitment. Over the years, investment costs have increased in nuclear project plant projects, as safety and security requirements have increased due to tightening safety regulations inflicted by domestic and international controllers. Recent nuclear power plant projects, especially in Europe and North America, have suffered vulnerable to schedule delays and cost increases. On the other hand, nuclear power plant projects in other parts of the world are performing far better on cost and schedule. (Energy Technologies Institute 2018) The availability of adequate and secure financial resources is one the most crucial limitations affecting the implementation of NPP projects (International Atomic Energy Agency 2007). For instance, work on a new NPP in Britain was suspended in 2019 after the developer informed that it had been unable to agree on financing with the United Kingdom government (AP News 2019). Nuclear power plant constructions suffer also from first-of-a-kind issues and issues related to low experience of the team due to low volume spread across multiple actors.

From the owners perspective nuclear power plants provide many benefits, which are related to their nature as an infrastructure investment. The main general benefits are; stable demand, high barriers to market entry, key public service, regulation, long service life, inflation protection, and stable cash flows. Especially these regular and stable cash flows, which are generated in operation phase, are highly valued from owners' perspective because they provide predictable long-term revenues. (Weber et al. 2016 p. 11-12) Figure 9 below is demonstrating common cash in- and out-flows over NPP lifetime. Note that the figure is simplified and usually the cash in phase last from 40 to 60 years.

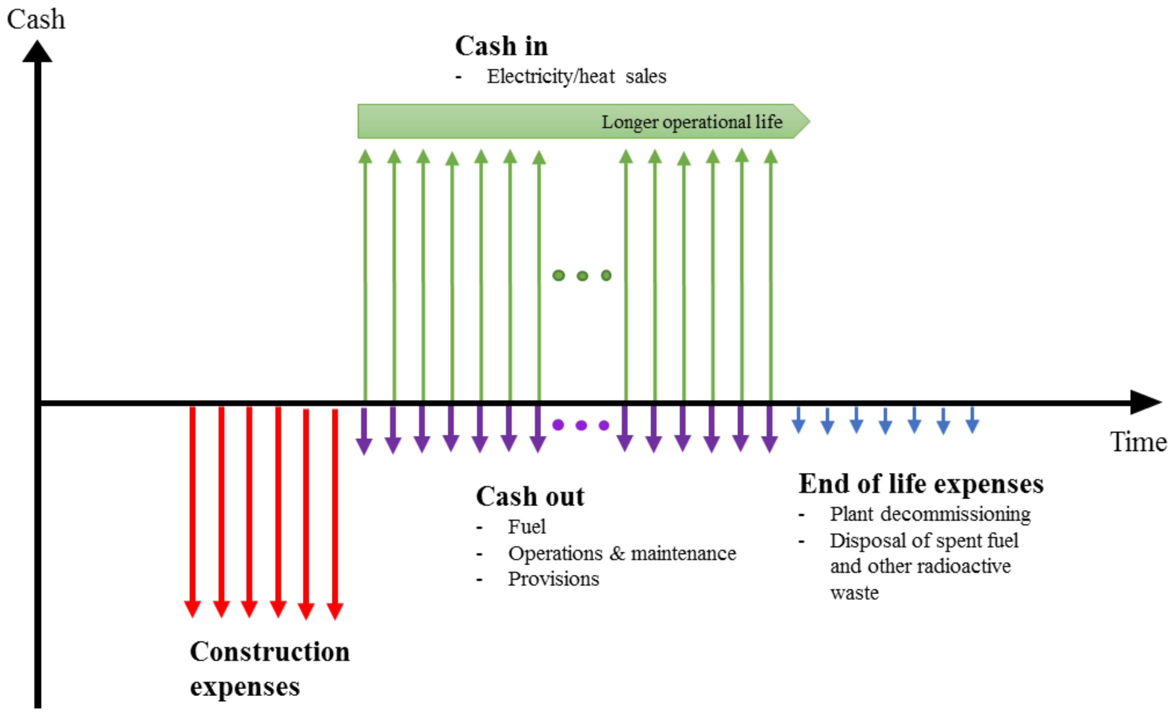

Figure 9. Cash flows over NPP lifetime

Nuclear power plant's cash inflows are coming from electricity and/or heat sales. Therefore, its incoming cash flows are highly related to plant output, capacity factor, operating lifetime and electricity/heat selling prices. NPP's cash outflows are generated from construction expenses, expenses during the operation period, and end of life expenses including plant decommissioning and disposal of spent fuel. The economics of nuclear plants are remarkably influenced by their capital cost, which accounts for at least 60 % and with accrued interest costs around 65-85 % of their levelised cost of energy (LCOE). LCOE is common measure to consider the cost of the energy that comes out of plants lifetime and its unit of measure is euro or dollar per MWh. Interest charges and the construction period are important variables for determining the plant's overall cost of capital. When interest rates are low, projects with low initial capital costs, such as nuclear projects, are advantaged and vice versa if interest rates are high these projects are disadvantaged. (WNA 2019)

When considering the whole life cycle of NPP, the costs can also be divided into three basic categories; capital/investment cost, operation & maintenance (O&M) cost, and nuclear fuel cycle cost. Generally capital/investment costs represent approximately 60 % of the total nuclear generation cost, whereas O&M and nuclear fuel cycle costs represent approximately 20 % each

(IAEA 2007 p. 9). It has to take into account that these are only rough estimates and depend on many factors, for instance on the size and type of the reactor and on the assumed lifetime.

World Nuclear Association (WNA) has identified some general ways to reduce capital costs of nuclear power plant. Firstly, they recommend to replicate several reactors of similar design on one site, which brings major unit cost reductions. Secondly, they have noticed that significant savings can be obtained via standardizing reactors and constructing them in series. Thirdly, it is proved that larger unit capacities can provide economies of scale. These first three means have to basically decide before investment decision and for instance in the case investment project's case, where the investment decision is already made and it is in licensing phase, there is no realistic ways to execute these cost reduction advices. Additionally, WNA has identified some general ways to make capital cost reductions which are applicable also after the investment decision. They have identified that a predictable and consistent licensing process will result in substantial savings. The key is to get the safety and design planning and requirements done properly before the construction starts. Simpler designs naturally support to put this into practice. Another potential way to reduce the costs is learning-by-doing, both through replication at the factory for components and at the construction site for installation. These advices more technical ones and decisions regarding those are most likely out of financial modellers reach, but it is really important that the modeller understands also what is happening behind the numbers and what kind of adjustments are really feasible.

4.2 Nuclear power plant phases

The whole lifecycle of a nuclear power plant can be divided into four main phases. These phases are licensing, construction, operation and decommissioning. Following chapters describe what each of these phases include and what their main characteristics are.

Licensing phase

The nuclear energy sector is a strictly regulated and supervised environment in order to secure safety in every phase of the lifecycle. All NPPs have to follow national and worldwide regulations. In Finland NPPs have to construct and operate according to European standards with the Finnish authority overseeing the procedures. The main Finnish authorities involved in the nuclear industry are the Ministry of Economic Affairs and Employment (MEAE), and the Finnish Radiation and Nuclear Safety Authority (STUK). MEAE has supreme command and control of nuclear energy matters, whereas STUK is responsible for supervising radiation and nuclear safety in Finland through their detailed licensing requirements for nuclear installations. Furthermore, STUK has a reputation as the world's strictest nuclear regulator, which has contributed for its part to the safe construction and operation of the Finnish reactors. (STUK 2017)

The licensing process in Finland includes various milestones i.e. Decision in Principle, Construction License and Operating License that needs to achieve from authorities before project can go forward to the next stage. The licensing phase includes conceptual and preparatory activities that embrace all investigations on technical, economic, safety and regulatory aspects needed for the justifications of a NPP project (IAEA 2007). Licensing phase it is generally understood as a project phase, which includes the licensing activities before achieving the Construction License and stating major constructions. Some non-nuclear safety critical constructions and preparations i.e. supporting buildings are allowed to construct before obtaining the construction license.

Construction phase

Construction and commissioning are the activities when a NPP is built and its systems, structures and components are put into operation. This phase is vital to the safe operation of the facility through its design life. The median average construction time for the four reactors grid connected at 2017 was 58 months (WNA2 2018) but the variance is high and for instance the average construction times for completed NPPs in 2015 was 73 months and in 2014 127 months (Terlikowski et al. 2019). Typical NPP's construction time nowadays is 48-54 months (WNA 2019). Nuclear power plant's capital costs are incurred while it is under construction and include expenditure on the necessary equipment, engineering, instrumentation and labour. Building a NPP needs thousands of workers, enormous amounts of material and components, and several systems to provide electricity, ventilation, cooling, information, control and communication. Costs of these are frequently quoted as 'overnight' costs, which are exclusive of interest accruing during the construction period and include engineering, procurement and construction costs, owners' costs and various contingencies. The significant factors affecting to cost are location of the plant, its size and technology. Using first-of-a-kind technology can result in a project's overnight capital cost increasing by up to 30% (Terlikowski et al. 2019). The Table 5 below present how World Nuclear Association (2019) estimates the breakdown in capital costs in terms of labour, goods and materials.

Table 5. Capital cost breakdown in terms of labour, goods and materials

Equipment		
	Nuclear steam supply system	12 %
	Electrical and generating equipment	12 %
	Mechanical equipment	16 %
	Instrumentation and control system (including software)	8 %
Construction materials		12 %
Labour onsite		25 %
Project management services		10 %
Other services		2 %
First fuel load		3 %
Total		100 %

<u>Operation phase</u>

Operation phase is defined as the period when the plant starts commercial operation to the time when the decision to decommission the plant is made (IAEA 2007). Once the plant is constructed and electricity sales begin, the net cash flow direction turns and plant owner can begin to repay the full investment cost. The price charged for electricity must not cover only these costs, but also operating expenses (OPEX) including fuel costs, operation and maintenance costs O&M, nuclear waste management costs, transmission costs and refurbishment costs (WNA 2019). Generally NPPs' fixed O&M costs are high whereas variable costs are low. In operation phase, the load factor and availability are the most important factors if consider the amount of electricity produced. The load factor expresses how effectively the capacity is used in percentages, whereas availability expresses the utilization rate of the reactor also in percentages. Every NPP tries to achieve as high availability as possible but due to yearly maintenance outages it is really hard to get is over 90 percent. The outages are typically once a year and planned very meticulously. Generally all over the world, O&M costs of NPP's have cheapen over time due to lower uranium and enrichment prices together with new fuel designs allowing higher burn-ups (WNA 2017). Even though NPP's operation phase is stable there is still possibility to make bigger renovations which have relatively strong affect to output and profitability. Uprating the output of nuclear reactors is also possible and recognized as a highly economic source of additional generating capacity. Refurbishments and utilizing new technologies can increase plant output by up to 15-20 % (Energy Technologies Institute 2018).

On average NPPs lifetime is from 40 to 60 years but it is possible to extend the original lifetime date with particular updates. Many existing operators have expressed the intention to operate their NPPs for longer than envisioned by their original design. The requirements to extend operating time are related to a nuclear safety point of view; operator must demonstrate and maintain plant conformity to the applicable regulatory requirements and enhance plant safety as far as reasonably practicable. The average lifetime extend is 10 to 20 years, depending on the model and age of reactor and national regulators. (European Commission 2017)

Decommissioning phase

Decommissioning phase can be described as "post operating activities leading to decommissioning of the plant and management of the waste within the frame of country's long term waste management programme" (IAEA 2007). Globally there is relatively little experience in decommissioning nuclear power reactors. Only 90 nuclear power reactors have been shut down permanently in Europe and only 3 of them have been completely decommissioned so far at January 2016 (European Commission 2017). The costs of NPPs decommissioning including disposal of wastes usually do not exceed 2 % of the total costs of electricity generation, but this is highly country and decommissioning strategy specific (IAEA 2007). In principle, there are three recognized decommissioning strategies: immediate dismantling, deferred dismantling, and entombment. In immediate dismantling option the facility is removed from regulatory control relatively soon after shutdown or termination of regulated activities. Final decontamination or dismantling activities can begin within few months to years and after that the site is then available for re-use. Deferred dismantling option postpones the final removal of controls from 40 to 60 years. The facility is placed into a safe storage configuration until the radioactivity has decayed enough. Entombment option requires placing the facility into a condition that allows the remaining on-site radioactive material to remain on-site without ever removing it totally. Each of these approaches has advantages and disadvantages, and usually national policy determines which approach or combination of these is adopted or even allowed. The overall costs are and requirements are highly related to the strategy selected. (IAEA 2007)

Nuclear waste management

A nuclear waste management is very essential part of nuclear power plants lifecycle and it has to be taken into account in financial modelling. Actually, the nuclear power is the only large-scale energy-production technology that takes full responsibility for all its waste and fully transfers these costs into the product (WNA1 2018). The waste is generated when uranium is used as a fuel during the operation of a nuclear power plant and it turns to radioactive waste that has to be disposed of. The responsibility for nuclear waste management lies with the power companies, who must take care of the waste they have generated and bear the costs for these actions. Radioactive waste is typically classified into three groups, low-level, intermediate-level and high-level waste type, based on level of radioactivity. Low-level waste does not require shielding during handling and transportations, intermediate-level waste requires some shielding due its higher levels of radioactivity, and high-level waste requires cooling and shielding (WNA1 2018).

The Finnish Nuclear Energy Act requires that all the waste must be threated, stored and disposed of within the Finnish borders and consequently final disposal in the bedrock has turned out to be the solution in Finland. In Finland every operator under a waste management obligation must make annual payments to National Nuclear Waste Management Fund which secures that the society has a financial guarantee that nuclear waste management can be arranged under all circumstances. The nuclear waste management costs are distributed to final disposal of spent fuel, power plant decommissioning, regulatory costs and real estate tax and to other power plant waste, for instance clothes. The costs of final disposal of spent fuel are distributed between intermediate storage, transportation and final disposal of spent fuel and includes also necessary research and development costs. According to legislation, the fund target reaches the assessed liability in 40 years from first fuel loading and the collaterals provided to the government shall annually equal to the difference between the total liability and the fund target. The actions taken by the operator will reduce the remaining waste management obligations. Fennovoima contributed EUR 1.8 million to the National Nuclear Waste Management Fund in 2017 (Fennovoima Oy 2018) and the Fund had a balance of about EUR 2.5 billion (Ministry of Economic Affairs and Employment of Finland 2017). Fennovoima's contribution is will grow a lot in future when the FH1 project. The nuclear waste management is a long time process and the costs and collaterals are tied for a long time period. This requires a lot of modelling and assumptions to achieve financially optimal solution which optimizes the financing needs and ensures secure nuclear waste disposal.

4.3 Mankala principle

Most of the developed countries have implemented extensive legislation to open up the possibility of infrastructure investments, including energy investments, for the private sector. In turn, the private sector has recognized the financial benefits of funding, constructing, operating and holding infrastructure assets, whether in the form of long-term permissions or by way of permanent ownership. (Weber et al. 2016, p. 1)

Mankala principle is special feature of Finnish energy industry and it allow to produce electricity for the owners at cost price. This means that the goal of the operating company, which is typically particularly established project company, does not make any profit or pay dividends. The shareholders are charged incurred costs on the price of electricity and therefore if everything goes as planned the profit or loss for the period is zero. The shareholders has to pay variable costs based on the volumes of energy supplied and fixed costs on amount to their ownership, no matter have they made any use of their share of their electricity or not. (Teollisuuden Voima Oyj 2019) The gains for shareholders are formed by the difference of electricity market price and cost price of generated electricity. The shareholders are paying tax for the profit of their operations when they sell their products or the electricity purchased at cost price, hence the Mankala model is not tax evasion or disguised dividend. The unit of measure of Mankala price is same as unit of electricity price (€/MWh) and therefore those are comparable between each other. The Mankala arrangement allows consumers of different various sizes and industries to participate in large energy investments such as nuclear power plants and benefit from the advantages of large-scale production. Therefore, its purpose is to combine resources and share the risks in order to carry out large-scale power plant projects with competitive production costs (Pohjolan Voima Oyj 2013). The shareholders can consume the power by themselves or sell it to the third parties as demonstrated in Figure 10. Mankala principle is widely applied in Finland in power and thermal energy production and the Mankala companies produce over 40% of Finland's electricity. (Teollisuuden Voima Oyj 2019) Additionally, other countries have been interested in adapting this principle to their national conditions due to its many advantages (Barkatullah & Ali 2017).

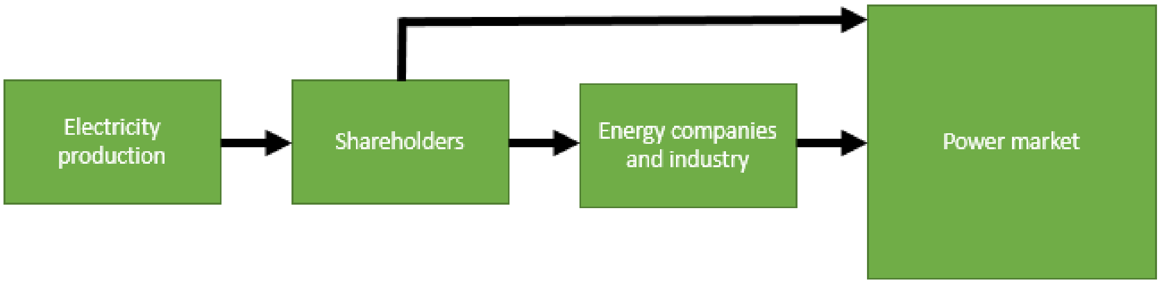

Figure 10. Electricity production in Mankala-companies

4.4 Financial process

The financial model is only one part of Fennovoima's financial process. The whole process is presented below in the Figure 11.

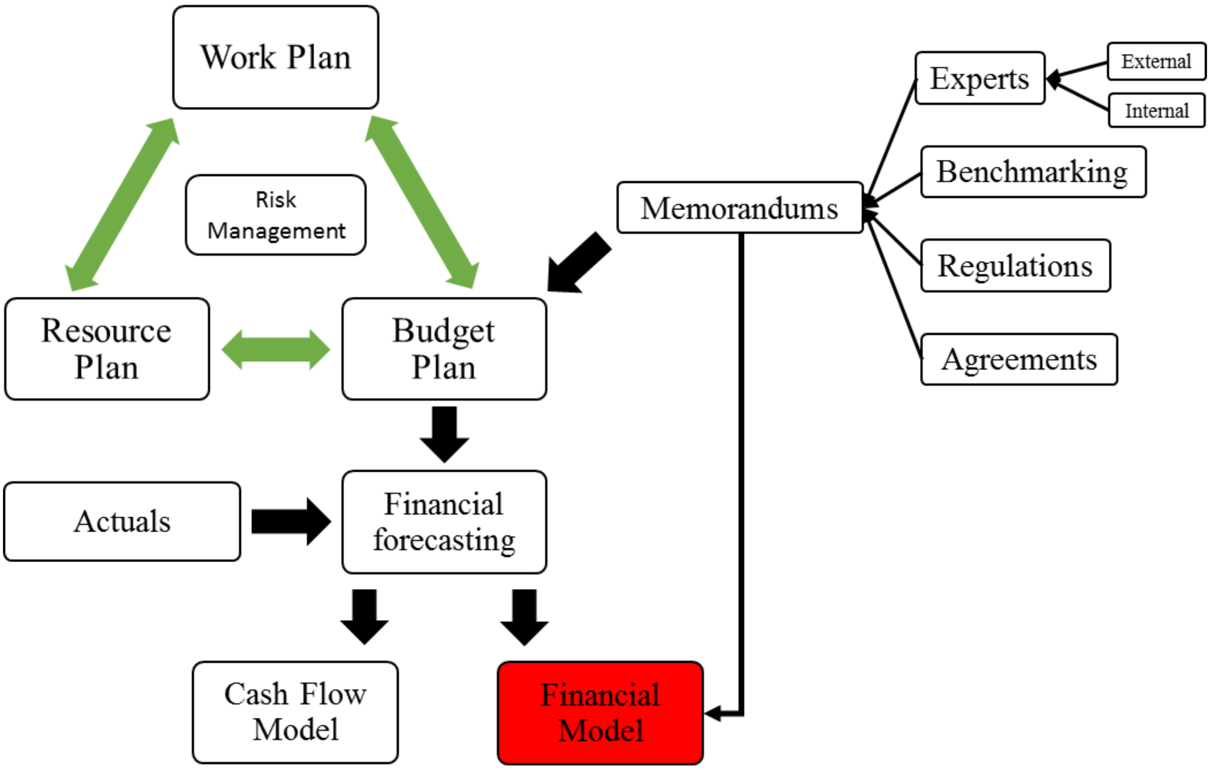

Figure 11. Case company's financial process

The whole financial process starts from work, resource and budget planning, which supports to each other. Budget planning provides data for Financial forecasting system, which is Fennovoima's platform to operatively handle financial status and where the departments are providing their financial forecasts based on their expectations. Therefore, its scope and use purpose is different than the financial model's. Financial forecasting system is more like short-term tool where the current status analysis and forecasts are made. Moreover its time series are shorter than financial model's. There exists also platform that provides realized data (Actuals) for Financial forecasting system. That data allows to generate current status and more accurate short-term forecasts. The Financial forecasting system forwards this realized data to the cash flow model and to the financial model. Cash flow model's purpose is to estimate short-term cash flow and liquidity status, and its scope excludes operation and decommissioning phase. The reason why there exists different forecasting platforms is simply their use purposes. Financial model's aim to provide a big picture of the whole investment project, which lifecycle is over 100 years, whereas Cash flow model is providing more accurate short- and medium-term cash flow and liquidity forecasts in purpose to handle finance process more appropriately. Such a separation enables to keep complexity of tools in a reasonable scale. The memorandums include assumptions, which are provided by the Fennovoima's experts based on their expectation of performance and on the specification of the fixed price EPC contract. They base their expectations to benchmarking data, experience, regulations and agreements. These memorandums provides essential outlook for budgeting processes and especially for financial model, which is highly dependent on assumptions. All in all, purpose of this chapter was to describe that financial model is only one part of whole company's financial process and it has its own specific target. Each part of the process is essential and together they form a well-working entirety.

4.5 Main value drivers

As introduced in Chapter 1.3, the case project of this study is Hanhikivi 1 nuclear power plant (FH1), the biggest investment project in Finland, which total investment cost is estimated to be between 6.5-7 billion euros, owned by Fennovoima Oy. The project is currently at the licensing phase and preparing for construction phase that is estimated to begin in 2021 after the Construction License is granted.

Financial management process is basically very similar to all investment projects. It is the process of estimating and justifying costs and revenues in order to secure funds, control expenditures and evaluate the outcomes (Association for project management 2019). The case project's financial model utilizes these main characteristics as in form of value drivers (key assumptions). The model is based on five value drivers (key assumptions) data; capital expenditures (CAPEX), financing, schedule, operating expense (OPEX), and output. These drivers are the main measures how the project is able to provide value for owners. The financial model uses these drivers distributed smaller parts (data and assumptions) to calculate reports. These FH1-project's main value drivers are presented below in the Figure 12.

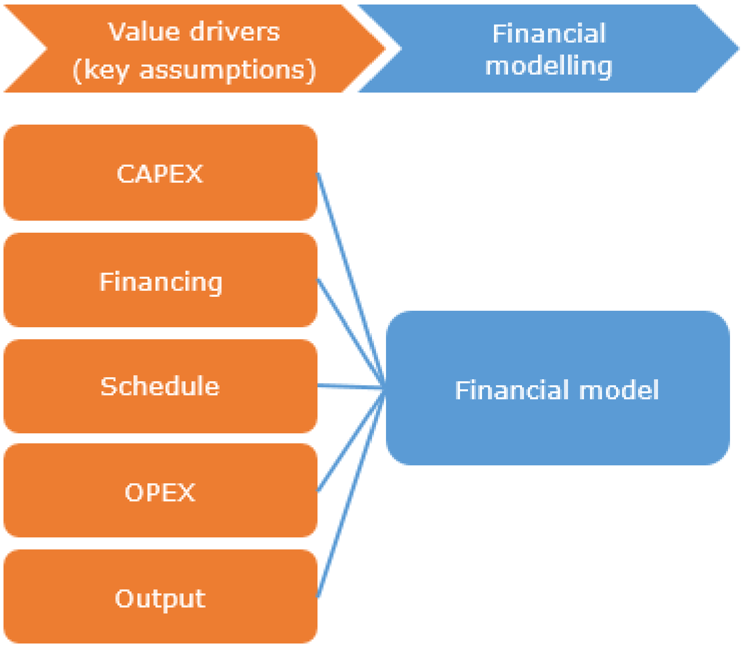

Figure 12. Case project's value drivers

Behind every value driver is more specific key factors which determines how the value driver acts. FH1-project has identified from four to five key factors for each value driver and in addition it has identifies six general factors that have affect to value drivers but cannot solely influence them such as inflation. These FH1-project's key factors are presented in the Figure 13 below.

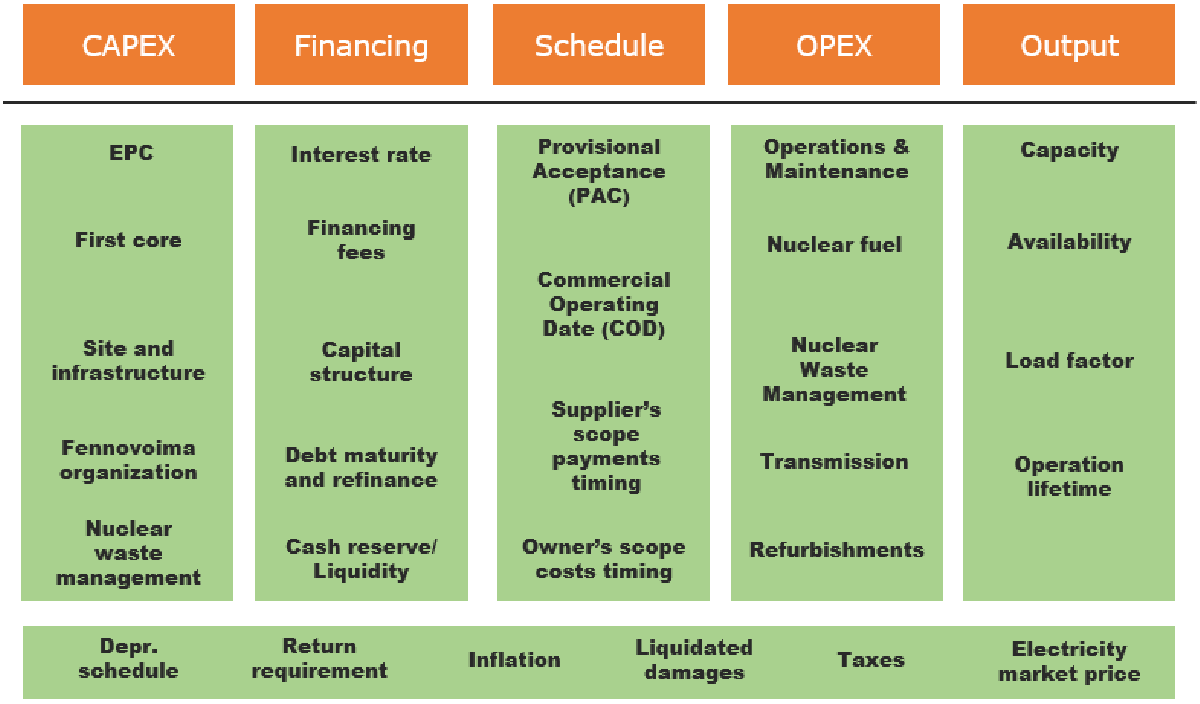

Figure 13. Key factors of value drivers

<u>CAPEX</u>

The overall economics of nuclear power plants are highly dominated by their capital costs and this case investment project is not an exception. The identified main key factors behind case investment project's CAPEX are EPC contract, first core, site and infrastructure, Fennovoima organization and nuclear waste management. The investment's cost profile reflects strongly with the fixed price EPC contract made with the main supplier, and as it is fixed price deal the cost profile from CAPEX point of view is highly predictable. The first core means the first fuel load of NPP, which has to be done before operation phase to start the reactor. Site and infrastructure includes physical construction expenditures which are out of the EPC contract such as electrical grid and office building. These are the costs in which Fennovoima can especially effect during the construction period. Fennovoima organization in CAPEX includes all the costs of works what are needed to build the NPP e.g. salaries. These are necessary parts in building NPP and hence capitalized to the balance sheet. Nuclear waste management is also one of the key factors is CAPEX and its expenditures are generated during the whole lifecycle of the investment. Nuclear waste management expenditures are used for example to build intermediate and final storage for spent fuel.

Financing

The availability and cost of debt typically have a significant effect on the economic viability of nuclear power projects. The study of University of Chicago (Tolley & Jones 2004) shows that interest payments during the construction of NPP for a five-year construction time can be as much as 30% of the overall expenditure and this increases to 40 % if applied to a seven-year construction time. These costs are naturally strongly related to interest rates, market situation and other case specific characteristics.

JSC Rusatom Energy International (REIN), which is the plant supplier through its subsidiaries and a significant minority shareholder of Fennovoima, has committed to procure the necessary debt financing for the project during the construction phase, in line with the shareholders' agreement. (FV report of the board of directors 2017) The identified key factors of financing are interest rate, financing fees, capital structure, debt maturity and refinance and cash reserve/liquidity. The funding and the related guarantees for the investment project to achieve the target interest rate levels for debt financing are relatively dependent on shareholder's capability to achieve it. One of the Fennovoima's duties is to provide necessary input data for due diligence processes and loan negotiations, and the financial model is one of the main sources of this data. Additionally, Fennovoima has to control its capital structure, debt maturities, refinancing needs, liquidity and cash reserves. Total financing costs can be decreased significantly by optimizing above mentioned key factors. For example, cash flow projections can give necessary information to optimize liquidity and cash reserves.

Schedule

Scheduling plays a central role in predicting both the time and cost aspects of the investment project. The identified key factors of scheduling are the date of provisional acceptance, commercial operation date, supplier's scope payments timing and owner's scope costs timing. First two of these are important and well-known date-related milestones and the two other are timing-related factors where optimization is needed.

The date of provisional acceptance is the moment when Fennovoima conditionally accepts that the project is ready but the performance needs to be still verified under operational conditions within an agreed period. Contractually it is important date and its delay would be rise significantly the total costs of the investment project. Commercial operating date is another important milestone and is the moment when all testing and commissioning has been completed and Fennovoima can start to produce electricity for shareholders. Basically electricity production to grid starts already after provisional acceptance date during the testing. Supplier's scope payments timing means the moments when Fennovoima has to pay partial payments to supplier from completed work. The total EPC contract payment is divided to installments which are paid when certain progress milestone is achieved and the requirements are fulfilled. Owner's scope payments timing means the timing of all the payments that are out of EPC contract and what Fennovoima has to pay. Managing the timing of payments is essential part of the investment project's success. The dates, payments and requirements are typically defined in contracts and those are really important assumptions for financial model in order that e.g. cash flow and financing need estimates can be prepared properly.

OPEX

As described before operating expenses are short-term expenses required to meet the ongoing costs of running a business and in this context they are meant to consider expenses during the NPPs operation phase. The identified key factors of OPEX are operations and maintenance, nuclear fuel, nuclear waste management, transmission and refurbishments.

Operations and maintenance includes all the costs which are needed to run the power plant and to make necessary maintenance work e.g. salaries. Another main operating component is nuclear fuel, which needs to be purchased periodically during the NPPs operation. Spent nuclear fuel transforms into nuclear waste and it has to be handled, stored and disposed. The waste management actions will continue decades after the plant decommissioning and hence this nuclear waste management is considered to be long-lasting key factor of OPEX. Transmission includes all the expenses that are needed to pay from electricity transmission. When the electricity generation starts Fennovoima has to pay grid service fees, which are measured as €/MWh. Refurbishments includes all the expenses that needed into renovation to keep the power plant ongoing. For example, it is expected that automation most probably needs to be renovated during the plant’s 60 year lifecycle. These refurbishments are larger and necessary maintenance works that needs financial preparation beforehand, and hence these are treated separately from yearly maintenance works.

Output

The main output of the NPP is amount of energy and its main factors are capacity, availability, load factor and operation lifetime. Together these factors determine how much energy the power plant will produce during its lifetime and that combined can be considered as a mission of the power plant. It is important to note that for instance electricity market price is not an output factor for this plant because Fennovoima’s duty is only to provide electricity for shareholders with cost-price.

External and uncategorized value drivers

The identified main external and uncategorized value drivers for the investment project are depreciation schedule, return requirement, inflation, liquidated damages, taxes and electricity market price. Depreciation schedule means the timing of the depreciations and it is highly related to legislation and company’s depreciation plans. Depreciations are also connected to many value drivers and hence it is not categorized into certain one. Return requirement is a bit more external value driver and it is set by the shareholders. Fennovoima’s aim is to reach the return requirement by keeping the costs as low as reasonably possible, support supplier, manage the licensing process, support financing process and provide status updates. Return requirement can affect to Fennovoima’s value drivers if it for example is raised and it requires cost saving actions. Inflation and taxes are general external factors, which has to be taken in account in financial modelling but the investment project capability to effect on them is minor. Liquidated damages are potential contract penalties that can come into force for instance if supplier cannot keep its contractual promises. These penalties can be significant and hence they are considered as an important factors for the project. Additionally, they are balancing the project risk between Fennovoima and the main supplier. The last one is electricity market price, which is needed to determine the investment's profitability and this factor is important especially from shareholders perspective.

4.6 Current financial model

The project maintains Excel-based financial model that monitors reports based on relevant data and assumptions. The financial model assumptions and structure is built-up based on the expectations of project's financial plan and arrangements set out in the Shareholder' Agreement. Operational assumptions are provided by the project company's experts based on their expectation of performance and on the specification of the fixed price EPC contract. The assumptions are updated regularly once a year and in need if major changes occurs. The current updating process is presented in Figure 14 below.

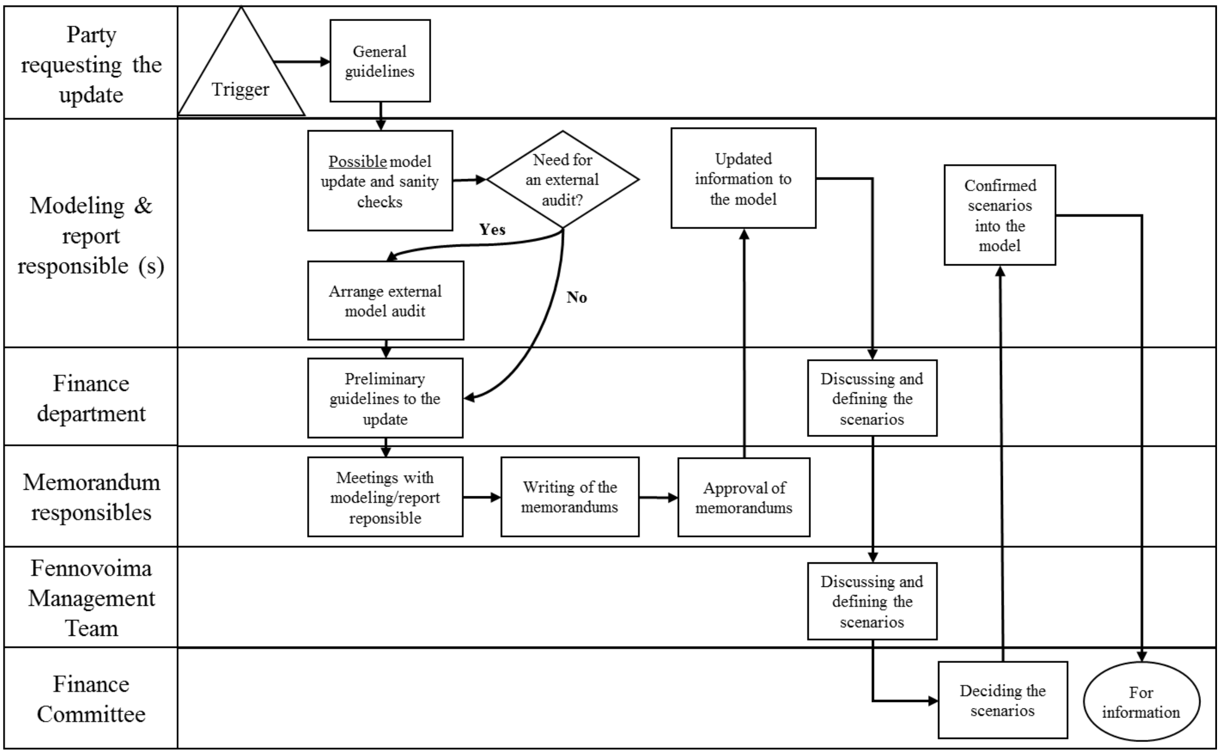

Figure 14. Case company's financial model update process

The investment's cost profile reflects strongly with the fixed price EPC contract made with the main supplier. The financial section of the model reflects the current expectation for the financing plan, including the anticipated drawdown and repayment priority as outlined in the key contracts mentioned above.

The current financial model consist of:

- **Description** sheet providing work flow diagram to assist in navigating through the model.
- Three **Input** sheets:
    - **Assumptions** sheet is the key input sheet containing the construction and operating, funding, macro and market assumptions for the project
    - **Sensitivity** sheet contains functionality to run key scheduling, output and cost sensitivities during the construction and operational phases of the project. It includes single sensitivity possibilities and multiple sensitivity possibilities. Sensitivity interval (%) and Price interval (EUR/MWh) can be defined for each sensitivity. Results show project IRR, Equity IRR and Average 12 years nominal Mankala price for each sensitivity.
    - **Outages** sheet functionality to run outage scenarios and key scheduling.
- Two **Calculation** sheets:
    - **Construction** sheet contains the cash flows, profit & loss (P&L), balance sheet (BS), cash flow cascade, sources and uses of funds, valuation of owner’s cash flows and Mankala Price Guarantee workings through the construction phase of the project on a monthly basis under the active Base Case.
    - **Operations** sheet contains the same calculations as Construction sheet but is examining Operations period including decommissioning. The timing is on a semi-annualized basis under the active Base Case.
- Six **Output** sheets (reports):
    - **Discounted cash flow** sheet combines the construction and operations sheets to present the project cash flows and sources and uses of funds schedule on a semi-annual basis through the project lifecycle.
    - **Valuation** sheet contains the high level shareholder valuation summary.
    - **Financial statements** sheet contains the annual cash flow, P&L and BS for the project.

- **IRR** sheet contains equity and project returns analysis based on pre-tax and post-tax cash flow.
- **Financing need** sheet contains a summary of the sources and uses of funds schedule for the project.
- **Mankala Price** sheet contains Mankala Price calculations and results.

The data and assumptions are entered in the input sheets of the financial model from where it flows to the calculation sheets. After calculations are performed and cash flows prepared, the results flow to the output sheets where they are presented. In this model the output sheets also contain some limited and simple investment return calculations. The Figure 15 below presents project's financial model work flow.

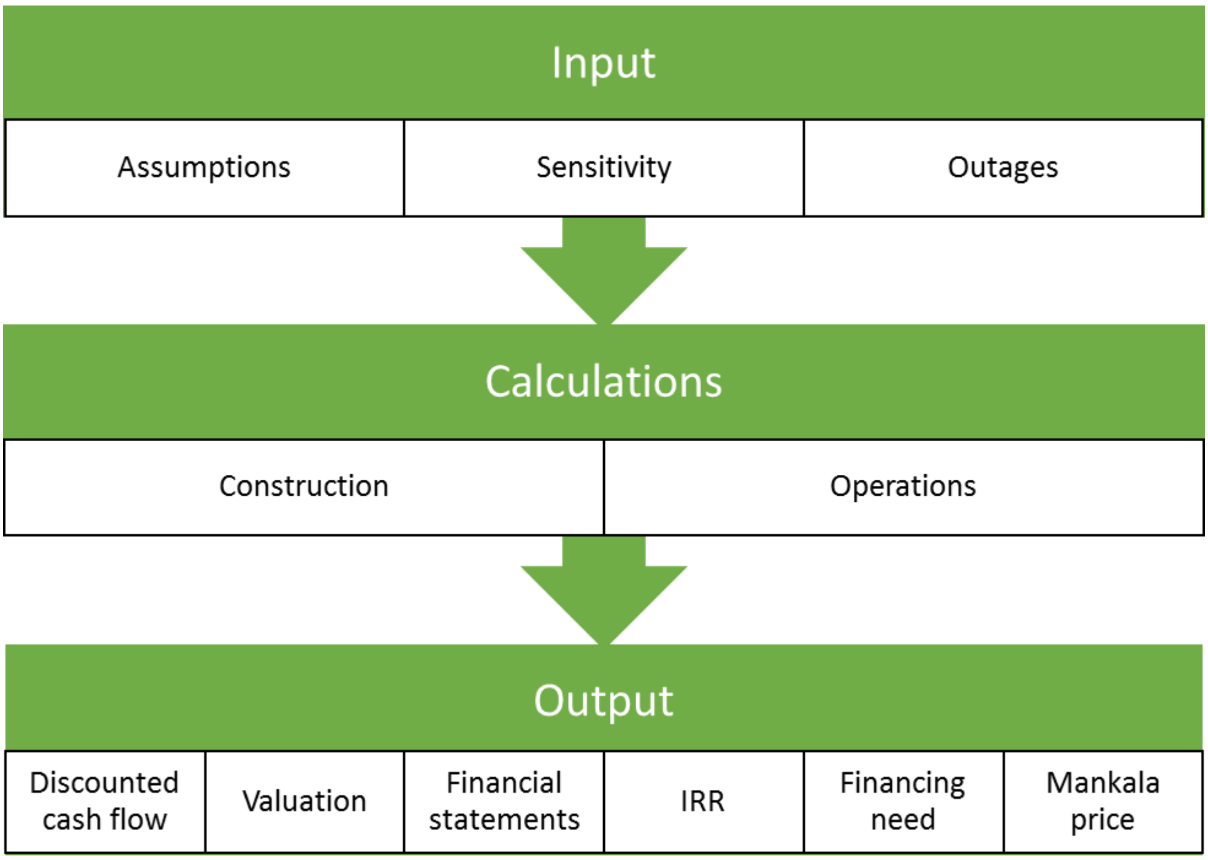

Figure 15. Financial model work flow

The model's calculations are performed in calculation blocks that are fully independent of each other with the following exceptions:

- Information flows from general assumptions sections to all other sections
- Calculated operating and investing P&L, balance sheet and cash flow items flow to the financial statements. A few information is pulled back in order to calculate items such as Value Added Tax (VAT)
- Information on operating and investing cash outflows is pulled back from the financial statements to the cash flow cascade section to determine the financing need and cash available
- Information on required/available cash is used to determine financing cash flows and required operating cash inflows. Additionally, information on draw-downs/repayment of more senior financing is pulled back when calculating required/available cash for sub-ordinated/junior financing
- Calculated financing related P&L, balance sheet, and cash flow items flow to the financial statements

Information required for the valuation of the project flows from the financial statements into the valuation section of the model.

5 RESEARCH CASE, PROCESS AND RESULTS

The following chapter presents the research case, methodology, process and results. A qualitative research approach was chosen to gain in-depth understanding what kind of information financial model should provide and how it could be utilized more effectively in the case investment project. The research process followed the chosen methodologies and the empirical part of the study was designated based on the literature review and chosen theories.

5.1 Research case

Motivation for this thesis derives from the need to investigate whether there are possible development areas in the case investment project's financial model, its operational environment, and the effective utilization of the information provided by financial model. The model is a critical long-term planning tool and it needs to be maintained during the whole investment project's lifecycle. Discussions with the key stakeholders of the financial model implied that the model contains lot of useful data and it perhaps could be utilized more effectively. Additionally, the model structure is made years ago and the original creators are not in the company anymore. Therefore, it was advisable to investigate is the model still providing relevant and comprehensive information. The results of the study will be exploited in the case project company to develop the model and other operations where it is related.

5.2 Research methodology

A qualitative research methodology was chosen to gain in-depth understanding of the Fennovoima's financial modelling needs and utilization possibilities. Qualitative research seeks answers to a question, systematically uses a predefined set of procedures to answer the question, collects evidence, can produce findings that were not determined in advance and produces findings that are applicable beyond the immediate boundaries of the study. Thus, it is used to understand the phenomena at a deeper level. (Denzin & Lincoln 2000, p. 3) Moreover, empirical data gathering methods were used in this study. According to Yin (1994, p. 3) there are three main types of case studies; explanatory, exploratory and descriptive. In this study the exploratory method is used because it is the most suitable way to support the large-scale aim of the study that is to find new development objects in financial modelling activities in the case investment project.

Literature study provided the general knowledge of the research topic, and the deeper insight and justification to the case study's results and conclusions. The literature study consisted mainly of publicly available material, which were chosen and adapted to fit in this research context. Most of the referred scientific journals, books and other sources are available online, and especially scientific papers were found using databases provided by the University. Only reliable, valid and recent information sources were used in this thesis.

Additional to the literature study, several internal discussion meetings with case project's Financial and Financing Analysts, who are also the main financial modellers of the case investment project, provided essential knowledge so that the theory and practice could be combined to find solutions for research problems. Especially, the first research question, where is studied what kind of information financial model should provide for a large energy industry company, is highly based on those discussions and literature study.

In-depth interviews were selected as a main research method for the second research question, which is investigating how the case investment project could utilize its financial model more effectively. Interviewing was chosen to main data collection method due to its many advantages in this kind of single case study. Harrel and Bradley (2009, p. 6) describe that "interviews are discussions, usually one-on-one between an interview and an individual, meant to gather information on specific set of topics". Furthermore, interviews are described to be "the best methods to resolve seemingly conflicting information, because the researcher has the direct opportunity to ask about the apparent conflict" (Harrel & Bradley 2009, p. 10). Interviews are used to be structured, semi-structured or unstructured (Gill, Stewart & Treasure 2008). In this study the interviews were conducted as semi-structured, which allows "the interviewer or interviewee to diverge in order to pursue an idea or response in more detail" (Gill et al. 2008). Put differently, semi-structured design means that a set of questions is predefined but the questions can be modified during the interviews in order to gain a more comprehensive understanding. Using a structured interviews would have been difficult since the roles and perspectives of interviewees were so different. Besides, semi-structured interviews allowed to discuss more broadly on the topic in order to observe potential needs and problems. By applying a semi-structured interview, the interviewees had the opportunity to talk freely about beliefs, behavior and events related to the specific area. This enables deeper insight to the specific phenomena through individual experts.

Last research method was inquiry, which was designated to the shareholder of the case investment project. The original thought was to interview also the shareholder but due to long distance the inquiry was selected to be the most suitable and appropriate method to gain data. The inquiry was sent via email and response was received four days after that. The chosen method allowed respondent to think carefully answers and avoid mistakes. Naturally, the received data amount was not as much as it was achieved via interviews but its quality was commendable and all the questions were answered. Therefore, it promoted well its purpose.

After receiving the data the information was analyzed and composed to the results of this study. The conclusions were formed based on the results.

5.3 Data collection

This research involves three distinct methods for collecting data: discussions, interviews and an inquiry. The first research question is based on literature, case company's material and discussions in 16 one to two hour meetings with financial analysts. Those discussions gave an in-depth understanding of the Fennovoima's existing financial model and its determinants. The second research question is based on four interviews with carefully chosen case company employees and on inquiry results from company's shareholder. The interview section begins with shareholder's interview, which aim is to examine how the case investment project's financial model could be developed from their point of view. After that the section continues with interviewing the case investment project's Risk Manager, Financial Analyst and Financing Analyst and lastly interviewing both analysts together.

In total sixteen discussion meetings were held with two financial analysts who are the main users of the model. Those discussions gave an encompassing comprehension of case investment project's existing financial model and what it contains. Meanwhile the discussions gave the single case perspective, the field literature gave a theoretical perspective, which enabled to examine this context more broadly. The discussions and literature provided requisite information to form solution for the first research question of this study: “What information financial model should provide for a large energy industry investment?”. The question is subdivided into two sections; general information and case company specific information. The research results are presented in chapter 5.4.

The second research question is based on four interviews with precisely chosen case company employees, on inquiry results from company’s shareholder and on the same discussion meeting, which were base of the first research question. The shareholder inquire was accomplished via structured email inquiry where they had defined questions as presented in Table 6 below, but they were also given opportunity to provide additional answers and comments. The first eleven question were directed to their models and modelling activities. The shareholder has considerably of experience from different NPP investments from owner’s as well as from an operator’s perspective. Therefore, this was unique chance to get information how they typically model investments financial status and how they utilize it in general level. The questions from twelve to sixteen were focusing into case company’s financial model, which is familiar to the shareholder. The purpose of these questions was to get straight feedback from existing model and processes related into it in order to get propositions and signals from potential development areas and utilization opportunities.

Table 6. Framework of the shareholder inquiry

Your model (shareholder)	
1.	Do you use Excel or some other software in modelling?
2.	How do you collect the data?
3.	How do you make model assumptions?
4.	What are the key results what are you looking from the model?
5.	What is the main objective of your financial model?
6.	Do you use IRR, NPV, ROE, ROI or some other profitability measures?
7.	Do you calculate Mankala price in FH1 project?
8.	What are the main characteristics how your other projects models differ from yours this project's model?
9.	Do you have any limit how large a project has to be when you see necessary to build financial model? - If you have, how large a project has to be?
10.	Do you use model for risk management? - If you do, how you use it?
11.	How do you utilize your model inside your company?
Our model (Fennovoima)	
12.	As you have worked with various financial models how would you rate our model compared to others from scale one (worst) to ten (best)? - Could you shortly what are the pros and cons of this model compared to the other project company financial models what you have seen?
13.	In experience, is this kind of model common in large projects?
14.	Fennovoima's model is developing more accurate when the project progresses, how about your shareholder model are you making any major changes to it when the project progresses?
15.	Do you have any development ideas or wishes regarding our model?
16.	Do you have any development ideas or wishes regarding our modelling framework and co-operation?

After shareholder inquiry, discussions with the analysts and literature review the main development areas, where financial model could be utilized, were recognized. After observing possibly potential development areas the rest of the research focused into them by interviewing people relevant to these. The seven potential development areas were risk management, long-term financial forecasting, financial reporting, financing, insurance optimization, loan negotiations and resource allocation. Each of these themes were investigated with an interviewee who had strong knowledge on the theme in question. The question frameworks are presented in the Tables 7-11 in below.

Table 7. Framework of Risk Manager interview

Utilizing financial model as part of risk management	
1.	Do you think that we could utilize financial model more effectively with risk management?
2.	Would risks financial costs give more input to your decision making?
3.	How financial model could help in risk management?

Table 8. Framework of Financial Analyst interview

Utilizing financial model in long-term financial forecasting	
1.	How we are utilizing financial model in financial forecasting at the moment?
2.	How we could increase our model's forecasting accuracy?
3.	Do you see any benefit adding variance analysis tool into our model? It would inform how far was forecast from realized.
4.	If yes, do you see it is possible to execute in Fennovoima's model?
5.	How we could utilize long-term financial forecasts more effectively in Fennovoima?

Table 9. Framework of Financing Analyst interview

Utilizing financial model in financing and insurance optimization	
1.	Is Fennovoima utilizing the financial model in comparing different financing options?
2.	Is Fennovoima utilizing the financial model in insurance optimization?
3.	Is financial model providing any necessary input for loan negotiations?
4.	Does lender look the financial model?
5.	If yes, do you know what details they are especially checking?
6.	Do you have ideas how the financial model could be developed to be more convincing and helpful in loan negotiations?

Table 10. Framework of Financial Analyst and Financing Analyst interview

Utilizing financial model in financial reporting	
1.	Is Fennovoima using financial model's data in its financial reporting?
2.	If yes, what kind of data and to whom?
3.	Do you have any ideas how Fennovoima could use financial model's data more effectively in financial reporting?

Table 11. Framework of Financial Analyst and Financing Analyst interview

Utilizing financial model in resource allocation	
1.	Is Fennovoima utilizing the financial model in resource allocation?
2.	If yes, how? If no, why?
3.	Do you have any ideas how financial model's data could be used in resource allocation?

5.4 Results

Research question 1

What information financial model should provide for a large energy industry investment project?

Based on literature there are differing types of financial model, on their objectives and goals. The fundamental aim of every financial model is to provide information to support decision making process as presented in Figure 3. The financial model in a large investment project should provide especially long-term projections to give comprehensive big picture of the whole investment project from its foundation to closing. These projections should maintain during the whole project and revise whenever greater changes occurs. The model should present at least a long-time comprehensive view of performance, extending beyond the financial statements to investment requirements, cash flow, returns, financing needs, and valuation. Additionally, the model can provide other necessary and case specific information to support other activities such as risk management. (Avon 2015; Lynch 2011; Rees 2018)

General information

Based on literature and several discussion meetings with case investment project Financial and Financing Analysts, a financial model in a large energy industry investment project model should contain at least these elements:

- **Financial statements** are written records that convey the business activities and the financial performance. They contain the annual cash flow, P&L and BS for the project. Therefore, it provides information has the project made any profit or loss over a period of time (P&L), what it owns, how much it owes and what is left over at a specific point in time (BS), and how the money has moved (cash flow). It also provides necessary information, which is needed to calculate other key elements e.g. valuation. Financial statements are often audited to ensure accuracy and for tax, financing, or investing purposes.
- **Profitability** expresses a rates of return. Investment projects should be aware of estimated future incomes and the level of profitability. Especially investors are interested in the profits generated by investments. Typical measures for project are Internal Rate of Return (IRR) and Net Present Value (NPV).
- **Financing need** provides information from the sources and uses of funds. It transacts together with cash flows and enables for example to optimize liquidity level, interest costs and financial leverage.
- **Cash flow** analysis is essential part to manage and monitor investment's money movements and financing need. It is also prerequisite for P&L, BS, valuation and in the end for profitability. Cash flow can also be discounted so it works as a valuation method, estimating the value of an investment based on its future cash flows. Additionally, cash provides essential information about sources and uses of funds schedule through the project lifecycle. Even though cash flow is part of financial statement, according to the Analysts, it is still necessary estimate it more closely and calculate discounted cash flow to separate sheet so that information is organized and easy to handle.

<u>Case company specific information</u>

As stated before, investments typically differentiate from each other and unique features. The specialty of this case project and most of the other Finnish energy investments is the Mankala principle, as described in chapter 4.3. It is necessary to model how **Mankala price** evolves during the project progresses. The end result of modelling Mankala price is the electricity price for each of the shareholders. Then it is shareholders decision if they sell it forward or use it by themselves. Basically, the Mankala price information reflects that is the project capable to produce electricity with the price as planned and tells also how a guarantee price promised by one shareholder will affect to the Mankala price of another shareholder. Additionally, the information is comparable between electricity market prices and hence its development it easy to follow.

Summary

These above described elements; profitability, financing, cash flow, financial statements and Mankala price provide the most essential information what is needed to follow and to manage financial big picture of a large energy industry investment project. Moreover, the shareholders and the lenders are interested in these information elements because they strongly reflect about the investment's profits and financing needs. Additionally, risks are in a major role and they should be evaluated continuously alongside with financial situation but in order to avoid complexity there should be another platform to follow risks more closely. In the case investment project the various risks and scenarios are managed in another platform (Risk Register).

The literature review revealed that the case investment project existing financial model is structured properly and contains all these necessary elements. Hence, it is justifiable to keep the current structure and continue model's development on it.

Financial model with above mentioned key elements together with risk management in another platform enables to produce comprehensive big picture of the whole investment project. The Figure 16 presents the main financial information needs and how the financial model links works as a combining engine between them and key value drivers.

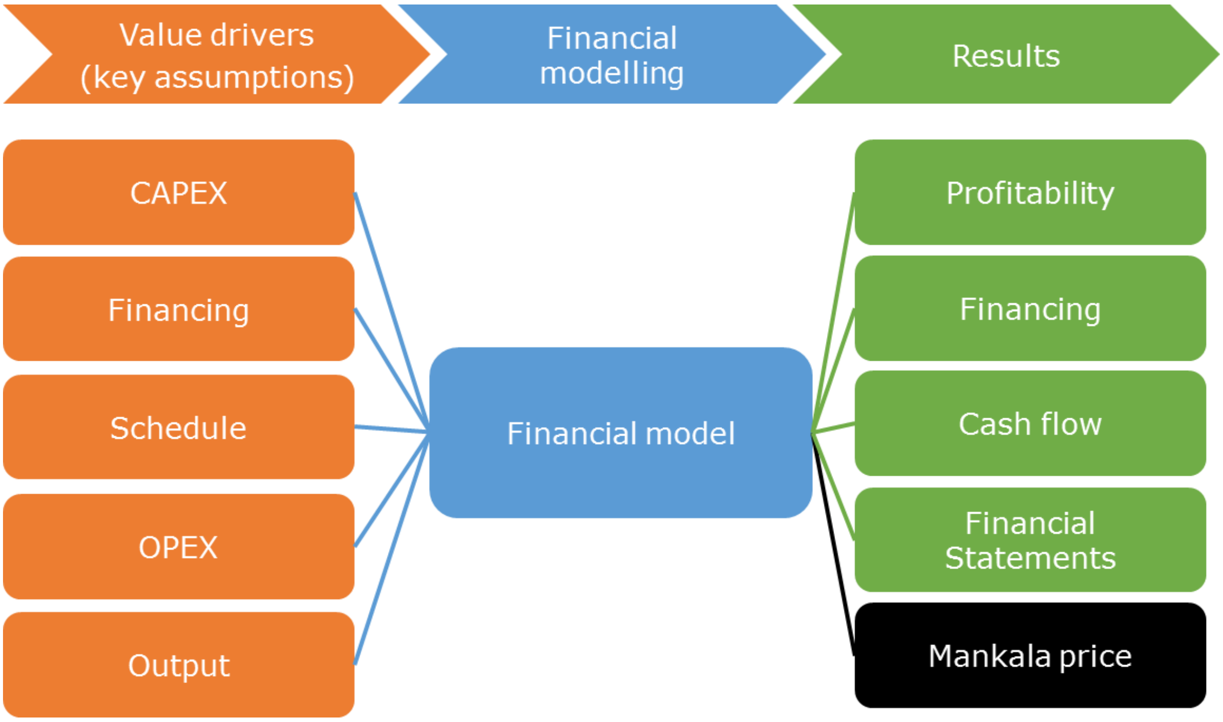

Figure 16. Summary of findings related to financial information needs

<u>Research question 2</u>

How to utilize financial model more effectively in the case investment project?

<u>Shareholder's perspective</u>

The financial model and its long-term projections are important for the investment project but also for the shareholders because they need to know how their investment is proceeding and will it achieve its targets. Therefore, it was necessary to investigate what is the shareholder's thoughts about the current financial model and do they see that it could be improved or utilized even more. The inquiry was sent via email to the one of the two shareholders who has a lot of experience from similar investment projects all over the world and consequently it was assumed that they have seen a lot of various financial models. The shareholder also has experience from supplier's, constructor's and operator's role so they were capable to evaluate the model from different perspectives. The framework of the inquiry is presented in Table 6.

The inquiry verified that the shareholder has own financial model where they are monitoring this particular investment project including their expected Mankala price. They are also actively following the project progress and reflecting all the project changes to the model on a regular basis. Their main modelling platform is Excel but they have also some in-house state corporation programs for supporting. All their financial models are prepared for using the same template and supplemented with additional case specific calculation in accordance with business special aspects. Because the shareholder is part of large multi-billion corporation, they have strict regulations of all the processes from bottom to top. Therefore, their data collection methods are relatively standardized and they feel that the information sharing between departments is working well. Their model's assumptions are based on the collected data, professional judgements and macro data, provided by the corporation. Hence, the process is quite similar as it is in Fennovoima except macro data, which is provided by external parties.

The shareholder's main objective of financial model is to make operative management decisions and hence it is mainly used in operative decision making processes. From this point of view Fennovoima's financial model objective and use purpose differentiates a lot, because it is only narrowly used for operative decision making and it is mainly used for long-term projections not to short-term ones. The main reason for that can be the different roles and perspectives of the companies. The shareholder, who has various investment project's ongoing, might think that their operational job is to manage and follow their investment's progress whereas from Fennovoima's perspective the operational job is to build and operate the NPP.

The shareholder revealed that they use a lot of various profitability measures e.g. IRR, NPV, Return of Equity (ROE), Return of Investment (ROI), payback period and discounted payback period to monitor their investments. Especially they are looking for NPV and IRR, and calculating financing needs of the project. The inquiry also revealed that the shareholder does not utilize its model in risk management activities, because they have separate process for project risk modelling and it is done by another division.

The shareholder gave a lot praises for Fennovoima's existing financial model and they rated it as a 10 from scale 1 (worst) to 10 (best). According to them, the model is very professional and the most detailed that their current modeller has ever seen, but due its amounts of data and complexity it is not very user friendly for a person who is not familiar with it. The project still has many uncertainties and hence the model maybe would not need so much details and assumptions. The shareholder suggested that adding calculation of NPV based on a market price of electricity (not Mankala) to understand the market value of the project would possible help and develop the model. It is a good idea but calculating NPV would require estimates of electricity market price and hence it would not give an appropriate and enough accurate information. Additionally, the market price is out the investment project's control and it would not measure how the project is succeeding.

They also hoped that case company continues co-operation and discussions of the main changes in both models on a regular basis to be on the same page. This is also desired action from Fennovoima's point of view and hence there could be many opportunities to deepen the collaboration. Summary of the shareholder's development ideas is presented in Table 12.

Table 12. Summary of the shareholder's development ideas

Idea	Principle	Would help	Realizable	Reasonable benefit-effort ratio
1.	Deleting and combining useless or rarely used details in a purpose to reduce the model's complexity	Maybe	Yes	Maybe, detail specific.
2.	Adding calculation of NPV based on a market price of electricity to understand the market value of the project	No	Yes	No
3.	Developing co-operation between parties	Yes	Yes	Yes

Utilizing financial model as part of risk management

The literature review and discussions with the Fennovoima's analysts indicated that the financial model could be possibly utilized more effectively in risk management activities. The two-hour interview with Fennovoima's Risk Manager revealed that financial model could give more input and especially financial information to support risk management processes. The framework of the interview is presented in Table 7.

The existing risk management is based on qualitative evaluation, which is inaccurate and requires to make many assumptions. These drawbacks are mostly based lack of relevant data. The case investment project is unique and has its specific characteristics i.e. Mankala-principle and Finnish tight regulation that mostly prevents for using any benchmarking data from other nuclear power plants. Furthermore, the current project schedule is too inaccurate and uncertain to provide necessary input for risk evaluation. One option is to move from qualitative evaluation to quantitative evaluation. The interview revealed that this is not practically possible in this current situation because it would require even more relevant data which is not available due to above mentioned issues. The current process works in the way that every unit reveals their own risks to Risk Manager, who oversees and aggregates evaluations and relevant information from responsible persons and reports changes to top management. Second option is that the financial model could provide numerical cost estimates to support these decisions by evaluating cost of every risk via its scenario analysis tool. The risks are managed and monitored in Risk Register where are currently identified approximately 150 higher level risks and hundreds of lower level risks. The total amount of risks is under one thousand. In practice this second option would be possible to execute, but it would require a lot of work and the risks are changing relatively often due to project progress. The interview revealed that the achieved benefit would not be as high as the required work amount. The third and the most potential option is to use financial model's scenario tool to generate different kind of delay-cost scenarios, which would provide the information how much project delays in certain time would affect to project costs. According to Risk Manager, these scenarios would benefit in evaluating the risks magnitude and put them into perspective. Via financial model it would be possible to calculate direct and indirect costs of delays and simulate the delay effect in different phases of the project. For example, it is obvious that delay in licensing phase, where the amount of tied-up capital is relatively low, is not so harmful and does not cost so much than delay in construction phase, where the amount of tied-up capital is much higher. Especially the risks which are in critical path of the schedule should be evaluated and processed more closely with financial data. Risk Manager estimated that five to ten scenarios, where the delays are different sizes and between different project milestones, would be enough to provide necessary accuracy for the risk management needs. The information could be provided for example calculating how much every delay day would approximately cost in different stages of the project. Summary of findings related to the utilizing financial model in risk management is presented in Table 13.

Table 13. Summary of findings related to financial model's risk management support

Option	Principle	Would help	Realizable	Reasonable benefit-effort ratio
1.	Changing risk evaluation from qualitative to quantitative approach	Yes	No in this situation. No necessary data and resources available	No
2.	Financial model provides cost estimates for every risks	Yes	Yes	No
3.	Financial model provides different kind of delay-cost scenarios to support risk evaluation	Yes	Yes	Yes

Utilizing financial model in long-term financial forecasting

The literature review, shareholder inquiry and discussion meetings with case investment project's analysts indicated that the current financial model is utilized relatively effectively in the financial forecasting activities. The purpose of one-hour interview with case company's Financial Analyst, who is also the main modeller, was to investigate how the long-term forecasts could be utilized more effectively and to find out possible development objectives. The framework of the interview is presented in Table 8.

The main purpose of the Fennovoima's financial model is to give comprehensive big picture of the whole investment project from its foundation to closing. It includes a lot data but it cannot be too detailed and accurate, because otherwise it would be too complex. The company has separate tools to make more precise short- and medium-term forecasts as described in Chapter 4.4. The interview revealed that the structure of current financial model is adequate and allows to produce enough accurate results. Therefore, there is no need to split assumptions into smaller parts or change the model's structure. It also come out that more accurate assumptions would be potential way to achieve more accuracy without changing the structure significantly e.g. changing shorter periods to time series. Basically this assumption development means that experts, who are making assumptions on their own expertise area and maintaining the memorandums, should provide more accurate data for modeller. This could be possibly carried out by providing all the necessary support to memorandum responsible, but there is already available benchmarking and external expert support, regulations and made agreements. Therefore, this part is really hard to be improved. Another potential way to sharpen assumptions is more data-based approach called variance analysis. It would inform how far was forecast from realized by comparing them to each other and if there is regular variation it could be fixed with suitable factor. Additionally, comparing the original base case to realized situation with different outputs would give essential information for all parties. The interview revealed there could be need for this kind of analyzing method, but it would be more beneficial implement into existing Financial forecasting tool because its data is more precise and utilized in operational activities. Furthermore, adding variance analysis tool into already relatively complex financial model would increase complexity even more and cause possible problems. It is also good to note that the investment project is just still in the beginning of its long lifecycle and now made variance analysis from licensing or even construction phase would give executable information for only few years ahead because the project is changing so much. Instead in operation phase the variance analysis would be more beneficial because at that time the activity should be more stable and predictable. Summary of findings related to the utilizing financial model more in long-term financial forecasting and developing these activities is presented in Table 14.

Table 14. Summary of findings related to financial model's long-term financial forecasting support

More accurate assumptions				
Idea	Principle	Would help	Realizable	Reasonable benefit-effort ratio
1.	More support for assumption estimation	Yes	Yes, but the current process is already advanced. Requires case specific inspection	Possibly, case specific
2.	Implementing variance analysis tool	Yes	Yes, but preferably implemented into Financial forecasting system or into separate platform.	Possibly, case specific

Utilizing financial model in financing and insurance optimization

The literature review and discussions with Fennovoima's analysts indicated that the current financial model is utilized relatively slightly in financing and insurance optimization activities. The purpose of one-hour interview with case company's Financing Analyst, who is also a backup modeller, was to investigate how the model could be utilized more effectively in financing and insurance optimization, and to find out possible development objectives. The framework of the interview is presented in Table 9.

From the financing point of view there exists separate Financing Plan, which determines on higher level when and how much financing is needed, but its schedule is dependent on project progress. The plan is accepted by shareholders already in the beginning of the project and it also includes planning of guarantees. Therefore, the main framework financing policies is planned and they become more precise when the project progresses. According to Financing Analyst, the model is supporting finance especially in the due diligence and loan negotiation processes where the project's financial status and plans needs to be reveal in order to achieve loan with feasible terms. The whole financial model is provided for lenders and evaluators so they can check the status and is the project capable to pay back in agreed terms. Interview revealed that lenders are especially interested in cash flow forecasts, because they reflect so well project’s financial status and ability to pay back in agreed terms. Additionally, risks and uncertainties are in center of attention. Typically, the model is tested with various stress tests, which allows to see how project standing will change when various factors are modified. Financing Analyst speculated that it is relatively difficult to predict what kind of exact key figures and ratios lenders want to see, but still model could include more of these to support lenders work. Therefore, adding more financial key figures and ratios could be potential improvement. It would be also very easy to execute because the model has already all the necessary data to calculate most important measures and these exists already many of them. Furthermore, revealed that visualization of the results could be clearer from lenders point of view e.g. presenting the key financing figures and ratios collectively in a separate result sheet and adding more graphs.

According to Financing Analyst, insurance optimization is currently working sufficiently well. The financial model’s scenario tool is used to make insurance analysis e.g. what is the worst scenario and how much it costs. That information supports in evaluating the optimal insurance need. Hence, the model is essential tool in optimizing insurances to optimal level. Basically the insurance information need is same as in risk management and supporting them could be done simultaneously and consequently avoid double work. In best case the model could provide information, which would enable to optimize the insurances so that they are not too large or to small, and hence prevent risks and save costs. Summary of findings related to the utilizing financial model in financing and insurance optimization is presented in Table 15.

Table 15. Summary of findings related to financial model's ability to support more in financing and insurance optimization related activities

Idea	Principle	Would help	Realizable	Reasonable benefit-effort ratio
1.	Adding more financial key figures and ratios to the financial model	Yes	Yes	Yes
2.	Visualizing more the financial model	Yes	Yes	Yes
3.	Creating similar scenario analysis for insurance optimization use purposes than for risk management purposes	Yes	Yes	Yes

Utilizing financial model in financial reporting and resource allocation

The literature review and discussions with case company's financial analysts indicated that the current financial model is not utilized effectively in financial reporting and resource allocation. The purpose of one-hour interview with case company's Financial Analyst and Financing Analyst was to investigate how the model is currently supporting financial reporting resource allocation processes and how it could be utilized more effectively. The interviewees were selected since they have the best knowledge how the model is utilized currently because they are the main modellers. The framework of the interview is presented in the Tables 10 and 11.

The interview revealed that the financial model is not utilized in any regular reporting activities and it is supporting only in ad hoc types of activities. The main reason for that is that the regular reports are utilizing shorter-term information provided by another platforms, and there is no need to report every week or month about the status of long-term estimates because it is highly stable. However, the model's long-term status and estimates are reported once a year to Board of Directors and to owners. According to the interviewees current financial reporting processes are working well and there has not emerged any development objectives how financial model could support more.

The literature review revealed that the financial model could be utilized also in resource allocation, but according to the analysts it is not used on that purpose in case company. Due to the NPP's long lifecycle the case company's financial model covers over one hundred years and would become too complex if it would be utilized also in resource allocation, which requires more specific and accurate information that the current model could provide. Therefore, there exists separate tool and platform for resource allocation and planning that works jointly with work planning and budgeting processes as presented in the Figure 11. According to the analysts the role of the resources and their changes compared to the size of the whole investment is relatively small and consequently it is not necessary to implement into the model. Summary of findings related to the utilizing financial model in financial reporting and resource allocation is presented in Table 16.

Table 16. Summary of findings related to financial model's ability to support more in financial reporting and resource allocation related activities

Idea	Principle	Need	Reason
1.	Utilizing the financial model more in financial reporting	No	Other tools are providing short- and medium-term estimates and status. Long-term status is relatively stable and there is no need to frequently report from it
2.	Utilizing the financial model in resource allocation	No	There exists other tools and process

6 SUMMARY AND CONCLUSIONS

This chapter includes the summary of this thesis and relevant conclusions. First, an overview of research questions is made and answers to them given. Second, the limitations of this research are explained. At last, suggestions for further research are given.

6.1 Overview of research questions

This study investigates what kind of information a large energy industry investment project's financial model should be able to provide and how a case investment project could utilize its existing financial model more effectively. The information need is examined in general level as well as from case investment project's point of view. Another purpose of this study was to examine ways to utilize the case investment project's financial model more effectively to achieve greater benefits. In order to reach the set targets, two research questions were formed.

1. *What information financial model should provide for a large energy industry investment project?*

Based on the results a financial model in a large energy industry investment project should provide long-term estimates and analysis at least on profitability, financing need and cash flow. It is essential to know how profitable the project is, when it needs or returns money, and from where to where the money is transferring. Additionally, the model should contain forecasts of financial statements that contain balance sheet, income statement, and cash flow statement. These financial statements clarify the business activities and the financial performance of the project. All in all, these elements give the essential information to build a financial big picture of the investment project and forecast its evolution. Additionally, risks should be evaluated continuously alongside with financial situation but in order to avoid complexity there should be another platform to follow risks more closely.

Along with above mentioned information needs, the case investment project requires information about how its Mankala price is developing and how the changes during the project progress will impact on it. Information about Mankala price is essential especially for the case investment project’s shareholders, because it is the cost-price what they have to pay from electricity when the power plant starts to operate. Furthermore, it is easy measurement to put into perspective and compare it to current and estimated electricity market price.

The study revealed that the case investment project existing financial model is structured properly and contains these necessary elements. Hence, it is justifiable to keep the current structure and continue model’s development on it.

2. *How to utilize financial model more effectively in the case investment project?*

The second part of the study revealed interesting and potential development targets to utilize the Fennovoima’s existing financial model more effectively. First of all, the model should support more effectively risk management activities by providing different kind of delay-cost scenarios, and cost estimates for the main risks. This is possible to execute and will provide necessary help and data-based support to develop risk management activities. Secondly, the study revealed that the shareholder is willing to continue or even deepen financial modelling co-operation activities. Both parties, Fennovoima and the shareholder, are maintaining own models and hence regular discussions about assumptions, results and project changes would be beneficial for both. Additionally, the study revealed that the current Fennovoima’s financial model is very professional and detailed compared to other investment project model’s what the shareholder has seen. This was very valuable and pleasant information especially for the modellers who are maintaining the model.

The study also unveiled that implementing variance analysis tool, which informs the variance between forecast and actual data, would be useful addition and possibly would allow to sharpen financial forecasts. In addition, the financial model could support more in insurance optimization activities by providing similar scenario analysis as risk management is requiring and hence support both activities without increasing workload tremendously. Adding more financial key figures and ratios to the model would also possibly benefit various financial processes, but currently the exact needs are unclear and hence this improvement has to do when the project proceeds more. At last, the model’s visualization should be improved by adding more graphs and figures from various themes. This would possibly support various internal parties and give necessary visualized data to support their decisions. Additionally, this would possibly reveal new development objects when employees realize how much usable data there exists in one model.

6.2 Limitations and future research opportunities

This study focused on observing only a large energy industry investment project's financial model, which was necessary and reasonable scope limitation. For instance, if the scope would have been all the infrastructure investments it would have been too broad to investigate due to so different characteristics, lifecycle and requirements. Instead studying only various nuclear power plants' financial models and their features and assumptions would be a very fruitful and advantageous research topic to study. The research would require co-operation and knowledge sharing between the plants but would possibly benefit all the participants. Additionally, this kind of study could be executed in any sector.

During the research process turned out that there exists very little literature and research from financial modelling, especially from investment project's point of view. Most probably the reason is that usually the information is confidential and only little relevant data exists in the public domain. For example there does not exist any former research where the results of this study could be compared. Additionally, every investment project has its own special features, which can highly affect to processes and outcome. Hence, this study is mainly made from case investment project's point of view and utilizes its built up experience. Despite the lack of relevant financial modelling research and literature, this study combines the existing ones to compact theory packet and supplements it with theory of general value drivers and finally adapts them into pragmatic case study.

Another research limitation was the confidentiality of case investment project's financial data. As a consequence, the qualitative approach was basically the only possible option for this research. Data-based quantitative approach would have been helpful support method and would have deepen the research part of this study by giving numerical data. But on the other hand, the scope would have possibly broadened too much when considering the limits of this thesis study. In future research it would be very intriguing to see this kind of data-based financial modelling approach adapted into concrete investment project. Additionally, research where would be comparison between different kind financial models and their features would probably be beneficial for companies as well as for financial modeller’s.

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<u>Interviews & discussions:</u>

Financial Analyst (2019). Case investment project. Interviewed: 11.04.2019

Financial Analyst & Financing Analyst 1 (2019). Case investment project. Totally 16 one to two hour discussion meetings. Discussions held between: 15.01.-26.03.2019.

Financial Analyst & Financing Analyst 2 (2019). Case investment project. Interviewed: 11.04.2019

Financing Analyst (2019). Case investment project. Interviewed: 11.04.2019

Risk Manager (2019). Case investment project. Interviewed: 03.04.2019

Inquiry:

Shareholder (2019). One of the two case investment project’s shareholders. Inquiry sent: 08.04.2019. Answer received: 12.04.2019.