The Business Framework in the Implementation of a Biomass Power Plant

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1.0 INTRODUCTION

Renewable Energy has been endorsed as the 5th fuel component in the 8th Malaysia Plan (2001-2005) [1]. An initial target of 500MW by the year 2005 was set. However, planting up has been sluggish. To date, with the exception of a 2MW Landfill Gas Power Plant and a 10MW Biomass Power Plant, most of the projects have failed to take off, indicating the failure of the 5th fuel policy [2]. The primary reason, it seems, was the (marginal) viability of the project due to low electricity tariff purchased by the Utilities and the failure of Techno-preneurs to understand the complexities of planting up a biomass power plant.

The implementation of a grid connected Biomass Power Plant is a rather complex process as it has to have an integrated and multi-discipline approach involving the business, technical as well as the financial components. The business framework that integrates these components into a wholesome entity is a pre-requisite in making the project "bankable". Components of the business framework would then be used as assumptions (input) to the Techno-Financial Model (TFM) to compute its viability. Without a proper business framework and a convincing TFM, Bankers would not have confidence in the technical feasibility and financial viability of the project.

2.0 OBJECTIVES

The primary objective of this paper is to structure the business framework that would ensure the technical feasibility and financial viability of a biomass power generation project. The complexity in implementing such project lies in the multi-disciplinary approach in integrating or linking the "technical" and "financial" components into a framework that will ensure long-term success of the project.

3.0 BUSINESS FRAMEWORK

The first and most important aspect in the implementation of a Biomass Power Plant, which is often overlooked, is the business framework [3]. A wholesome and comprehensive business framework is indeed a crucial pre-requisite for the successful implementation of a biomass power plant from the inception stage right through the implementation and eventual Operation and Maintenance (O&M). The role of the respective partners during the construction stage, and their scheduled departure, pending transfer of technology and / or completion of work to the biomass developer, is essential not only to give comfort to the Bankers, but more importantly, to ensure the efficient operation and maintenance of the plant.

This biomass power plant business framework was adopted from the highly successful Malaysian IPP model comprising the Concession-O&M company and the author's experience with the development of the Genting Sanyen Power (GSP) and the Landfill gas power plant. The GSP 720MW gas fired co-generation combine cycle plant was built on a non-recourse Build-Operate-Own (BOO) project financing basis. This relational structure is depicted in the Figure 1 below. This is a time proven structure adopted to be the basic structure in the framework for implementing biomass power plants in Malaysia. Elements of the 700MW coal fired Shajiao Power Plant, China [4] build on the Build-Operate-Own-Transfer (BOOT) concept are also incorporated. In the structure, the Special Purpose Vehicle (SPV) is the concession company specifically incorporated to implement the biomass power plant. This is structured together with two more companies, namely, the O&M Company (jointly owned by the RE Developer and the EPCC contractor) and the Fuel Supply company. The "open supply" concept allows the Fuel Supply Contractor to source biomass supply from multi sources.

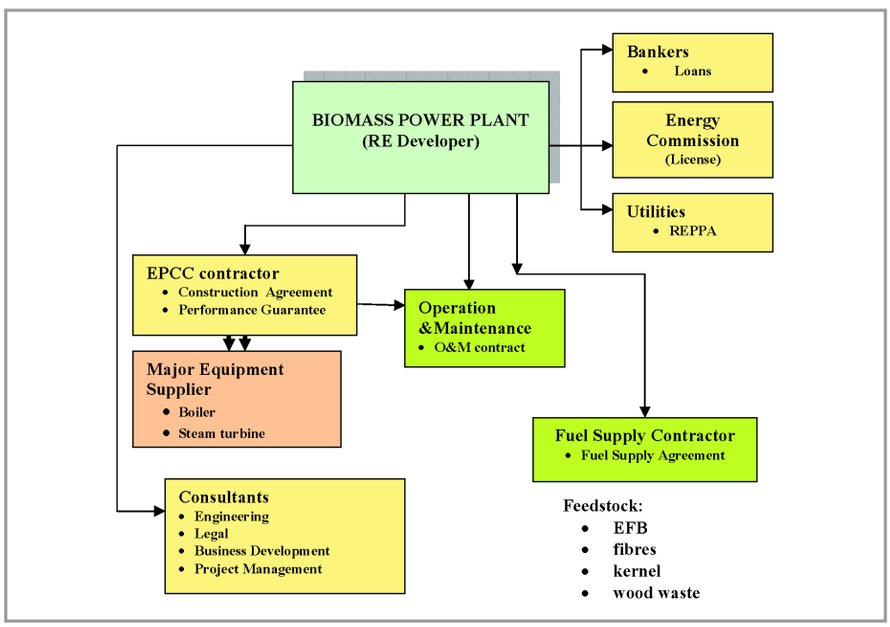

Figure 1: Biomass Power Plant Business Framework

The above structure is in fact a contractual arrangement that support the financing for the Biomass Power Plant project. Since it is critical, it must be firmly in placed before the project can consider itself "bankable". This is simply because Bankers want some comfort, in particular with the following documentations, before disbursement of loans:

1. Renewable Energy Power Purchase Agreement (REPPA).
2. Fuel Supply Agreement (FSA).
3. Engineering, Procurement, Construction and Commissioning (EPCC) contract with the Main Contractor.
   - Construction Contract
   - Performance Guarantee (PG) from the main equipment supplier, namely, the boiler maker and turbine supplier.
4. Operation and Maintenance (O&M) contract in joint venture between the EPCC contractor and the license/ concession holder.
5. Consultancy Agreement from the following:
   - Engineering Consultants
   - Legal Advisors
   - Business Development Consultants
   - Other consultants e.g. Project Management etc, if necessary.

Other minor agreements would include the followings:

6. Land tenancy/lease agreement for the sites.
7. Shareholders Agreements.
8. Licenses from the Energy Commission.
9. Letters of approvals on site utilisation (land office), water discharge permits (Jabatan Parit dan Saliran), infrastructure (JKR).

Once these agreements are all in place, then and only then, will the Bankers enter into a Loan Agreement with the concession holders. Prior to this there was already a Letter of Conditional Offer (LCO). This LCO details the terms and conditions, normally referred to as Condition Precedent (CP), of the offer. Drawdown from the debt fund will be made only on financial closure, that is, only when the equity (fund) has been exhausted on construction drawdown. Upon completion of the construction of the power plant, the EPCC contractor and the RE Developer, will be responsible for the Operation and Maintenance of the plant. The EPCC Company will be backed by the boiler and steam turbine manufacturers and would be legally binded for normally not longer than the tenure of the loan. This arrangement was necessary to give comfort to the Bankers that the plant gets over the teething problems and be properly managed.

4.0 COMPONENTS OF THE BUSINESS FRAMEWORK

Components of the Business Framework comprise the following:

Renewable Energy Power Purchase Agreement

The Renewable Energy Power Purchase Agreement (REPPA) is the contract between the RE Power Developer and the buying Utilities. This REPPA is a standard agreement. The salient features of the REPPA are as follows:

- Clause 3.1 - Tenure of agreement is 21 years from the Commercial Operation Date (COD).
- Clause 5.1 - Non-firm dispatch clause of "take-and-pay".
- Clause 5.2 - Tariff of RM17 sen per kWh (for Semenanjung Malaysia).

The main areas of concern of the REPPA which could adversely affect the project viability are as follows:

- ***Tariff level*** - In this standard REPPA there are no increment clauses to absorb inflation and incremental operation cost and plant degradation. Therefore, the project viability will degrade over the years.
- ***Take-and-Pay clause*** - This clause does not guarantee that Utilities will take the energies as-and-when it is being produced. This clause should be "Must-Take-And-Pay" making it mandatory for the Utilities to take-as-and-when RE are being produced. This would ease RE Developer's feedstock inventory problems.
- ***Interconnection*** - The Utilities should bear this expense.

Fuel Supply Agreement

The Fuel Supply Agreement (FSA) is the contract between the RE Power Developer and the RE fuel supplier. This agreement was signed with a third party instead of the palm oil millers simply because no palm oil mills are willing to sign up the FSA particularly over such a long period of time (21 years). This is the same problem faced in other countries. Thailand [5] for example, reported the same problem quoting uncertainties and difficulties of biomass fuel supply make it difficult to secure a long-term fuel supply contract with biomass producers. This was primarily due to the seasonal nature of the biomass supply compounded by costly transportation cost.

In addition, waste residue producers are not going to get themselves binded into such a long agreement just in case something better comes along such as opportunity for land development that would give a much better yield. Therefore, a third party that is resourceful and willing to undertake the supply of biomass residues was sought and contracted with. To prevent failure to deliver by the Fuel Supplier the agreement provided flexibility by allowing alternative suitable biomass fuel resources from the oil palm industry such as palm kernel and mesocarp fibre. Other biomass fuel such as wood chips and even low quality coal such as lignite or brown coal and fossilised peat soil could also be used. This is the "open system" concept of biomass suppliers.

Since the REPPA does not penalise non despatch there is no necessity to have standby fuel and if co-firing is allowed, reject CPO or POME could be used. The Fuel Supply Agreement has the following salient features:

- Clause 4.2 - Fuel supplier obligation to supply 360 metric ton of EFB per day everyday or its calorific value equivalent.

EPCC Contract

EPCC contract refers to the Full Turnkey Contract involving engineering design, procurement of the equipment, construction and installation and commissioning. It is a lump-sum fixed-price progressive turnkey contract. In the case of the Lukut Biomass Power Plant project, the engineering activities would be carried out at four facilities namely at the boiler maker factory in Japan, at the steam turbine manufacturer factory in India, at the engineering

contractor facilities in Selangor and the site in Negri Sembilan. Therefore, a fixed lump-sum EPCC contract would be a safeguard to RE Developers against foreign exchange fluctuation that could have disastrous effect on the final contract price.

The Engineering, Procurement, Construction and Commissioning (EPCC) contract agreement contain a total of 28 Articles. These clauses are to protect both the Contractor as well as the RE Developers. The most salient feature of the EPCC Contract is the supplementary agreement on the Performance Guarantee. The EPCC Contractor is responsible, jointly and severally, with the major equipment suppliers to guarantee the performance of the power plant as per the design specifications. They would also work closely with the Consultants to implement the project, from the onset of getting the necessary approvals from the relevant authorities, right through to the final commissioning of the plant. The EPCC Contract has the following salient features:

- Fixed Price Contract.
- Project Completion Schedule of 18 months.
- Performance Guarantee.

The performance guarantee is a "save-all" to ensure a good equipment design and proper installation by the EPCC contractor. In addition, the EPCC contractor is further obligated under the Operation and Maintenance (O&M) contract to be involved in the post-construction activities to ensure achievement of the performance design.

Operation & Maintenance Contract

The O&M Contract is executed by the O&M Company which is a company jointly owned by the EPCC Contractor and the RE Developer. This has a significant ramification as the EPCC Contractor has a contractual obligation under the Performance Guarantee on a back-to-back basis with the major equipment suppliers, namely, the boiler makers and the steam turbine manufacturers backed by vast technical support personnel.

Consultancy Agreements

Renewable energy projects even though complicated are not a massive project that requires extensive panels of consultants. In a Biomass Power Plant project the consultants employed are:

- Engineering Consultants (civil, mechanical and electrical engineer)
- Legal Advisors

5.0 COMPONENTS OF THE BUSINESS FRAMEWORK

The biomass power generation project involves two stages as follows: Firstly, is the Fuel Preparation Plant (FPP) that processes the "waste" into combustible "feedstock". This is the "beneficiation" process. The second part is the "generation" process whereby the boiler will burn the feedstock to generate the desired quality and quantity of steam. The steam would then expend its energies in the turbine and thus rotates the alternator, which by an induction process, produces electrical power. This electrical power would eventually be exported to the distribution network. This can be schematically represented by the Figure 2 below.

The Palm Oil Mill is an integral part of the whole process. In some projects, part of the electrical power and steam generated from the power plant is channelled to be used in the milling process itself. This co-generation configuration would increase significantly the plant efficiency and the added revenue from the sale of steam would greatly enhance the viability of the project.

Fuel Preparation Plant

The Fuel Preparation Plant is the feedstock beneficiation plant. It comprises a shredder and dewatering/drying unit. The purpose of this plant is to prepare a consistent combustible feedstock in terms of the water content and calorific value. This would provide a high burning efficiency (less smoke and ash) thus the production of power could be done more effectively and efficiently.

Power Generation Plant

The Power Plant comprises the following major equipment:

- Multi-fuel Boiler
- Steam Turbine
- Electric Generator

The boiler extracts fuel energy and produces high pressure steam from water which has been fed to the boiler at high pressure. The steam is expanded through the turbine, which drives the turbine shaft, which in turn rotates the electric generator. The low pressure steam turns into water in the condenser. The water is then pressurised by the feedwater pumps and fed to the boiler to complete the cycle. The multi-fuel medium-pressure water tube boiler would have a 35tph steam generation capacity operating at 52 bars. The temperature is 440°C. This medium-pressure; medium temperature power boiler would incur low maintenance downtime thus lower O&M cost. To generate 6.2MWe the medium-pressure boiler need some 320-360 ton per day of EFB feedstock equivalent.

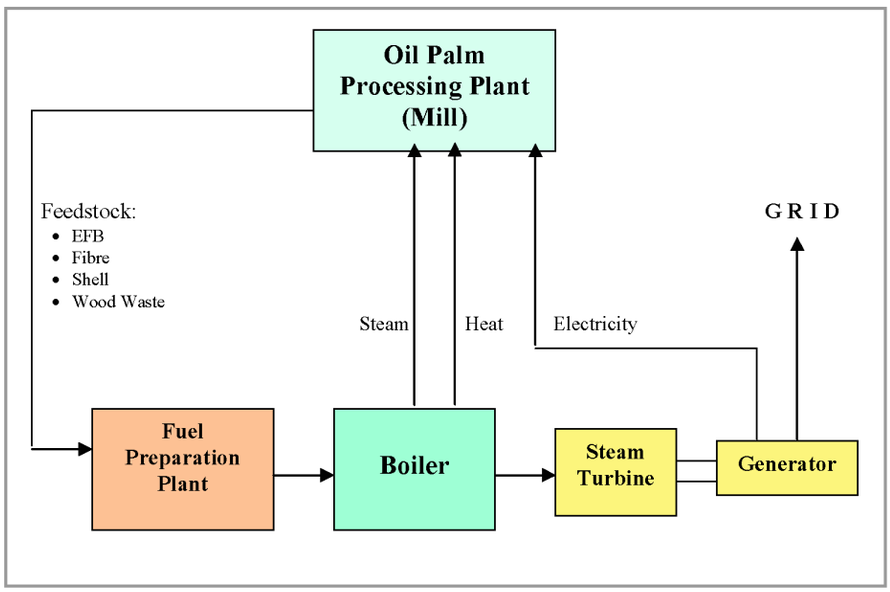

Figure 2: Biomass Power Plant Schematic Process

Courtesy: Sri Lakshmir Textile Ltd, Mysore, India. March 2001
Figure 3: Biomass Power Plant

The power range of steam cogeneration turbines is wide since they can produce from 500kW up to 240MW. According to the Alholmens Kraft report [6], plants of between 5MW and 20MW the electrical efficiency would be around 25%. The Lukut Biomass Power Plant installed capacity was 6.2MW similar to the Sri Lakshmir Textile power plant as shown in Figure 3. This plant uses rice husk and bagasse as feedstock. The boiler is a fluidised bed type.

6.0 CONCLUSIONS

This business framework has been successful in ensuring the technical implement-ability and long-term financial viability in the planting up of a Biomass Power Plant, tying the concept of waste-to-energy into an organic business structure. This was then coupled to the appropriate technology configuration and an extensive financial viability study was made using the Techno-Financial Model. With this business framework potential RE Developers find it much easier to structure the project implementation as well as raising funds to finance the project. ■

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