Handbook for Financial and Development Professionals

Chapter 4

Project Evaluation and Risk Management Issues

What are the characteristics that indicate that a renewable energy project is feasible?

A general answer goes something like this: **When land, fuel, technology, team, customers and permits are available and when putting these ingredients together makes financial, social and environmental sense, then a project is feasible.** It doesn't guarantee that a project will be funded or implemented – too many other things outside the project's control can go wrong -- but it does set the stage for a project to succeed.

This chapter introduces the main issues that must be evaluated and managed by finance and development professionals. It consists of:

1. Key Feasibility Questions
2. Natural Resources
3. Technology
4. Contracts for Fuel
5. Land
6. Permits
7. Customers
8. Local and National Energy Plans
9. Macroeconomic, Political and Social Setting
10. Project Team
11. Contractors and Suppliers

It also includes a section (#12) on preparing estimates of revenue, capital cost, operating costs and preparing preliminary financial analyses (#13). It also includes checklists to be used to evaluate general market conditions, evaluate the requirements of a project team and conduct due diligence.

1. Key Feasibility Questions

A renewable energy project makes sense and is feasible when:

1. Natural Resources – wind, water, biomass, and sunlight – are available in predictable and sufficient quantity.

2. The available natural resources can be converted to energy using available proven technology.

3. Contractual rights to use these natural resources (water and biomass) as fuel can be obtained.

4. Land needed for the project can be secured and access to the site assured.

5. All the permits needed to design, build and operate the project can be obtained in a timely manner.

6. The energy produced can be transmitted and sold to one or more credit-worthy customers.

7. The project is compatible with local and country energy plans for energy service delivery.

8. The commercial, political and social setting of the project will instill confidence in suppliers, contractors, investors, lenders and insurers.

9. The project team has sufficient experience and skills to design, build and operate the project or has access to qualified full service (Engineering, Procurement and Construction, EPC) contractors.

10. Qualified suppliers, contractors and consultants are available and have expressed interest in the project.

11. Reasonable estimates have been made of all revenue, capital and operating costs, including contingency allowances and taxes.

12. Project revenues are sufficient to pay operating costs, repay loans and provide adequate returns to investors.

13. There is local or international interest in providing loans and investment capital.

2. Natural Resources

Renewable energy projects deal with four types of natural resources – wind, water, biomass and sunlight. The simple question to be asked is "Do these natural resources exist in sufficient quantities to fuel the proposed project?"

- **Wind** – What wind speed measurements have been made? What data exist? Are the measurements site specific, using reliable equipment and accepted techniques? Have the results of these measurements been examined by a qualified and independent professional? What documentation exists to prove that sufficient wind resources exist?
- **Water** – What data exists regarding the flow of water and the "head" (proposed elevation drop)? For how long has this data been collected? By whom? How has it been documented? Has the water data been independently evaluated? Have seasonal and year-to-year variations been estimated? Have the site conditions been studied and integrated with the water data? What documentation exists to prove that sufficient water resources exist?
- **Biomass** – What is the proposed biomass source? Has the biomass source been evaluated for its energy (BTU/joule) content, moisture levels, collection, transport and storage characteristics? What quantities of this biomass source are available? Are there seasonal variations? How have the energy characteristics and quantities been documented? Has this biomass source been used before in this region in the manner proposed?
- **Sunlight** – What solar insolation data exist for the proposed project area? Have solar panels and balance of systems been operated in the project area? Is there any documentation of performance? Are there seasonal variations or extended periods of sub-optimal performance? How is the information documented?

3. Technology

Having established that natural resources exist in sufficient quantities, the next test of feasibility is to determine that the wind, water, biomass or sunlight can be converted into energy at the proposed project site at the scale envisioned.

- What technology will be used?
- Is it available at the project location?
- Have suppliers of the basic conversion technology – wind turbine manufacturers, hydro turbine manufacturers, biomass conversion equipment manufacturers and PV systems

integrators -- reviewed the wind, water, biomass and sunlight data and confirmed that their equipment can produce the desired energy output?

- What warranties do they offer?
- At what price and terms (do they offer supplier credit)?
- What other components are needed to assure energy output?
- Have suppliers of these been identified and price and terms determined?

4. Contracts for Fuel (water and biomass)

It is not enough that sufficient natural resources exist. In the case of water and biomass the right to use these resources must be assured generally through a contract[1], either with fuel suppliers or with the government through a concession for water rights.

- **Water** – What agreements are needed to secure the use of water at the proposed project site? Will a payment be required? What are the conditions of such a contract? For example, what percent of water flow is allowed to be diverted? What is the term of contract? Which lenders and investors will want to exceed their loan or investment term? What is the expiration date if project is not operational within the term? What other related contracts are required, such as an electricity generation contract, and permits, such as an environmental permit?
- **Biomass** – What is the length and terms of the proposed contract(s)? What percent of the project's biomass requirement will be met by this contract(s)? What assurances exist that the biomass supply will be continuous? What is the financial condition of the supplier and the underlying soundness of the industry[2]? What penalties exist for the buyer and seller for non-performance? What backup and supplementary supplies are available?

5. Land

Land is needed for the construction and operation of the project. Land can be secured by ownership, by lease (rental) arrangements or by royalty arrangements. Land is needed not only for the project's physical features themselves but to secure fuel supply (a watershed, for example) and to permit site access.

- What land is needed for the project's construction and operation?
- Has a land map, showing ownership, been prepared and presented?
- Has the ownership of each parcel been established, documented and verified?
- How will land control be secured and for what period of time?
- What access is needed for project construction and operation? How is it secured?
- Are any public lands involved? What approvals are needed?
- Is there sufficient land for storage of equipment and construction supplies during construction? What about worker quarters and site offices?

6. Permits

Every project setting has its own characteristics. It is important to determine, at the earliest possible point, the <u>complete</u> list of permits required and conditions to be met in obtaining approvals.

- Must the project and the project's company be registered? With what entity or entities? Must share capital be at a certain level?
- What are the requirements to obtain environmental permits and approvals? Must the consent of local communities and neighbors be obtained? Must a formal environmental impact assessment be prepared? Is there a public hearing or consultation process?
- What permits and approvals are needed to use natural resources, undertake construction, operate a project, interconnect with the electric grid or build a local grid and sell energy?

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[1] It is possible to buy biomass on an open market at the then current of "spot" price but most lenders and investors are uncomfortable with the uncertainty this implies.

[2] For example, a sugar mill may be able to supply all the bagasse needed for a co-generation project, but the mill may not be competitive due to factors linked to the world market for sugar rather than productivity within the mill itself.

- ❑ What licenses, permits or authorizations are needed to import equipment? What tariffs apply?
- ❑ Are there health and safety procedures to be followed? Must these be documented?
- ❑ Must the owners and managers register and report activities concerning their participation in the project?
- ❑ Must permission or a concession be obtained to provide energy services "off the grid?"
- ❑ Has the opinion of an independent qualified advisor been obtained to document that the list of permits and their requirements is complete?

7. Customers

There are basically two types of customers for energy projects. In the first category are electricity utility companies and large industrial firms with a significant demand for electricity or steam. The most common type of agreement between projects and these types of customers is a power purchase agreement, referred to as a PPA. Most PPA agreements pay for the purchase of capacity and energy separately. "Capacity" is the assured supply of the project (measured in kilowatts or megawatts) being sold to the utility or industrial firm. "Energy" is the actual output of the project, measured in kilowatt-hours or megawatt-hours actually produced and delivered. As electric utility companies become more competitive through the elimination of monopolies, long-term power purchase agreements are being replaced with Wholesale Market Mechanisms, which buy the energy output from projects based on its price when compared to other energy projects supplying the same electricity system (or grid) at the same time. Regardless of the size of the utility or industrial customer, it must be determined that this customer can and will pay for the capacity and energy provided. Many utility companies are technically bankrupt and depend on government subsidies to meet their obligations. These companies (and others) tend to be very poor payers. It is essential to determine that the buyer of energy and capacity can and will pay for the service provided over the life of the contract. The basic message here is this: just because the buyer is a large company do not assume that it will be a good payer. Some of the things to check:

- ❑ What is their net worth (the excess of their assets over their liabilities)?
- ❑ How much money do they owe (compared to their gross revenues and their total assets) and how has this changed in the last 5 years?
- ❑ How much have they been able to borrow in the last five years? In the case of a utility owned by the government has this debt been guaranteed by the government or is the credit of the utility itself good enough?
- ❑ Contact local banks or the local World Bank or IFC office. Contact local offices of well-respected international accounting firms or the bilateral Chambers of Commerce.
- ❑ If you are dealing with a private company that does not publish information, ask the company to supply information and ask them to let you speak with their bank.

The second category of energy customers consists of individual households, businesses and public facilities. The basis for the sale of energy to these types of customers is usually a contract to sell either hardware (a household PV system, a wind-PV combination, a very small hydropower turbine or a small biomass combustion, gasifier or digester unit) or an agreement to sell energy services, usually electricity, for a regular fee. In either case the essential quality of the customer that must be determined is the customers willingness and ability to pay. If the sale is for the full price based on cash then the risk of non-payment is low. However, if the sale is supported by a loan arrangement (credit model) or if the project is depending on a steady stream of monthly payments from the household or business (fee-for-service model), greater comfort is needed that payments will be forthcoming. Down payments by customers are important, as are procedures for the collection of payments from customers and the removal of hardware in the event of customer default. The energy entrepreneurs needs to plan (and perhaps test) these mechanisms.

8. Energy Plans

The proposed energy project must be aware of, and take account of, energy planning underway in the project area and in the country.

- Are there plans to extend the grid into the project area? What impact will this have?
- Are there plans for other decentralized energy projects in the project area? Are there bilateral or government supported programs underway? What impact will these have on the project's ability to sell its energy output?
- Are there plans to change the current energy sale and purchase policy (perhaps switching from a PPA arrangement to a wholesale market)?
- Is the government or the utility planning a major rural electrification initiative? Grid based? Off-grid? Both? How would this initiative impact the proposed project.

9. General Market Conditions

A project's feasibility is determined not just by factors under the project team's control. It is important that general market conditions – economic, commercial, political, social – instill confidence in the people needed to implement a project (for example, lenders, investors, suppliers, contractors, insurers). The most important of the general market conditions that need to be favorable are the following:

- **Macro-economy** - inflation, general economic stability and growth, currency stability, employment growth. While these conditions need not be perfect the general trend of the economy (improving versus declining) and the general perception of the regional and world economic community is important to assess. Sometimes – and this is very frustrating for an energy entrepreneur to hear – it is just better to put a project idea aside and wait until conditions improve.
- **Commercial -** are the rules for doing business, establishing a project company, making investments, recovering investments and importing goods and services clear? What are the appropriate banking, investing and trading laws and regulations? Is there a history of projects, such as the proposed one, being successfully implemented from a commercial perspective? Are in-country banks and investors involved in such projects? Is there a "commercial discipline" based on the general principles of socially responsible entrepreneurship and return on investment (versus top-down planning and state implementation)?
- **Politics** - this category includes the broadest possible definition of politics. Are laws and regulations transparent and enforceable in a reasonable manner? Is power transferred between political parties or factions in an orderly and predictable manner? Are policies transferred from one political appointee to another or does every appointment of a minister or election mean that a project is back to the beginning of the development process? Is corruption – payoffs, favors, conflicts of interest -- part of the process of project approval? Is there political support for the proposed project? Is it needed and will it be helpful (sometimes it is not)? What evidence exists of this political support, if needed and helpful, at the national or local level?
- **Social -** Will the project area benefit from the proposed project? What are the needs in the project area? Is the project compatible with local conditions and plans? Is there social support for the project? How is this support demonstrated?

10. Project Team

Whether proposing a large project producing electricity and selling to a national grid, or a smaller project providing energy services to individual households and businesses, the quality of the project team will be *THE* deciding point for many lenders and investors. For some of these lenders and investors it will be absolutely essential that the team include someone with very direct experience – successful experience – in a closely related project. For others it will be absolutely essential that the project team have substantial money at risk in the project from the very beginning. For others, these requirements may not be as crucial, but these will tend to be early stage lenders and investors who will provide small amounts of money on the basis of "one step at a time". The message here is clear: the energy entrepreneur must assemble the best possible team to plan and implement the best possible project.

- **Technical** - Are there specific engineering challenges that require specific skills on the team on a permanent basis? What are these challenges and what are these skills? Can this need be met through a contract relationship or must one of the core team be an expert?
- **Financial** - What are the financial aspects of the project? Will there be ongoing financial requirements over the life of the project? Can a chief financial officer be hired later or should the team include a financial expert from the outset?
- **Negotiations and Sales** - Are there ongoing business relationships, with suppliers and customers that require regular updating terms and conditions? Will the project always be seeking new customers and relationships or will this be a one-time event?
- **Legal** - Will the regulations and contractual relationships governing the project be fixed or will they change over time, requiring regular attention?
- **Political** - Will regulations and policies affecting the project's performance be evolving and require attention and lobbying?
- **Project Team Funding** - What is the minimum amount of funding needed to complete work underway and make the project attractive to lenders and investors? How much has the project team spent already (time and money) and on what? What will be realistically needed to complete all of the tasks identified? Even then, how much cash equity is needed to assure that the team retains a substantial portion of ownership and control? How much cash equity does the project team have?
- **Entrepreneur Skill, Experience and Resources** - Of the qualifications needed for the team, what skills do the team possess? Are there partners who round out this skill set? Are there advisors who can be hired to assure that all the skills needed are represented? Does the team have an experience base that will "impress" lenders and investors? If not, is there an addition to the team that could solve this problem? Is it possible to contract with an experienced party as part of the team? If not, how does the energy entrepreneur propose to convince lenders and investors that all the skills and experience needed are at hand? Does the team have the time and money needed to complete the work identified? What about the cash equity to be credible in negotiating with lenders and investors? Is there an early stage financial source available to supply these funds? What will the team be giving up and gaining by taking a financial partner?

11. Contractors and Suppliers

Suppliers and contractors, especially good suppliers and contractors, have choices as to the markets they serve. It is important to line up sources of equipment and services, and the terms and conditions that will accompany these contracts, as soon as practical. Suppliers will provide quotes for credible projects, thus getting as much fact-finding and feasibility analysis work documented as possible, and presenting it well, will get the attention of suppliers and contractors.

On larger projects, lenders and investors are going to be concerned that there be no "Completion Risk" that accrues to them. That is, once a project has commenced construction, the lenders and investors want assurances that the project will be completed and will commence operation. Contracts known as EPC, EPC-lump sum, Fixed Price or Turn-key are attractive to lenders and investors. "EPC" stands for engineering, procurement and construction, which is a type of contractor that pulls together all the tasks needed to design and build a project according to a set, pre-quoted, price to deliver the project fully operational. In these cases, the completion risk belongs to the EPC contractor and is secured by something called a Performance Bond. The EPC Contractor, in turn, contracts with sub-contractors and co-ordinates all the tasks involved. As an alternative to this, the project team itself can act as the prime contractor (the role of the EPC), hiring all the engineering, procurement and construction contractors. However, it needs to demonstrate conclusively that the project will be completed and that funds exist to handle cost overruns. A third choice is for the project team to hire a Project Management firm to co-ordinate the project; again, overruns need to be funded and completion assured.

On a larger project it is often a requirement that an operating and maintenance company be employed to run the project once its construction is completed.

On both large and small projects the availability and reliability of suppliers is crucial. Whether a company needs to buy 50 PV panels a month, twenty water pumps a year, 300 batteries every six months, ceramic liners for gasifiers and stoves, or a 25 MW hydroelectric turbine generator set, sources of supply are crucial. A components inventory and supplier network needs to be established as soon as practical and back-up sources identified. The inability to get replacement or spare parts on a timely basis can destroy a company trying to establish itself in the marketplace.

(Manufacture or Buy? There is a natural attractiveness to the idea of designing and assembling small components. Unless there is a decided (and permanent) cost advantage this can and has been a diversion for start-up rural energy companies.)

12. Preparing Revenue and Cost Estimates

Revenue:

The simplest revenue estimate is the one where a product is sold for cash. All that is required is the price per unit to be sold, which needs to include the cost of the unit, the cost of the time and money that goes into making the sale, a portion of the cost of running the company (called general and administrative expense or simply overhead) and the profit desired. Provided that the resulting price is attractive to the buyer, a revenue estimate can be prepared easily.

If the product is not being sold for cash, but will be repaid over time (an installment purchase), then it is necessary to factor in the time value of money by adding an interest component. The cost of administering such an arrangement must also be added.

If the product is not being sold as hardware, but its energy output is being sold to customers, estimates must be made of these revenues based on customer willingness and ability to pay. For the sale of energy services directly to households and businesses, this revenue estimate is based on the market price expected to be paid. There must be evidence to this effect either through test marketing, signed contracts or through a solid analysis that demonstrates that customers are willing to use a product that will substitute for expenses already being incurred (for example, through the purchase of candles, dry cell batteries or battery charging).

For the sale of energy to large customers, the terms of the power purchase arrangement must be converted to revenue estimates, including changes over time. For example, if the price fluctuates on the basis of the cost of fuel oil or inflation, data needs to be obtained as to the generally acceptable expectations of these factors. Central banks and utilities have and use such forecasts; World Wide Web sources, such as the Energy Information Administration have greatly improved the access to information for energy entrepreneurs.

For a feasibility analysis this information need not be perfect. What is needed are reasonable estimates covering a reasonable period of time:

The following are examples of sufficient information for this stage:

<u>Revenue from Sale of Household and Business Energy Systems</u>

# Units	1000
Cost per unit	390
Price per unit	550
Revenue	$550,000

<u>Revenues from Sale of Energy to Households and Businesses</u>

# Units Installed	1000
Cumulative	1000

Price per Unit	450
Revenue per Unit per month	15
Revenue/12 months	$180,000

Revenues from Sales of Electricity to the National Utility

# kW	2,600	
Capacity to be Contracted/kW	1,820	
Payment per month per kW	$10.50	
Energy to be Contracted	18,220,800	7008 hrs
Payment per kWh	0.038	
Revenue	$921,710	

Capital Cost or Cost of Goods Sold:

Whether selling a household energy system that costs $500, or building a 30MW hydroelectric peaking facility that costs $60 million, the same basic elements need to be considered in estimating the initial capital cost of what is being bought or built:

- **Design and engineering cost** – what is the cost of figuring out what to build or buy?
- **Land cost** – what land is needed to build what is proposed (for products being sold to households, this item is zero).
- **Purchase of equipment –**
- **Purchase of services** to assemble or construct the project (for large projects this includes all the civil construction – preparation of land – as well as putting the structured, mechanical and electrical pieces together).
- **Purchase of other services** – lawyers, financial advisors, accountants needed to get approvals, obtain funding or draw up contracts.
- **Insurance** – what is the cost of insuring the risks of people being injured, equipment being accidentally destroyed or not performing?
- **Interest During Construction** - if funds are borrowed to construct a project, part of the cost is the cost of the interest paid (or to be paid) for this period.
- **Payment to Project Team** – on large projects it is not uncommon for the project team to include its costs up to that date (and perhaps a fee on top of that) as part of the project cost and thus get reimbursed or rewarded for the effort to date. If, of course, investors and lenders are willing to include such a reimbursement or fee; otherwise the amounts will simply be counted as equity. In either event, these costs should be accounted for as part of the capital cost of a project.
- **Contingency Allowances** – these are the “what if” allowances in case any of the preceding estimates are wrong. Typically there are two types of contingency allowances. The first is called a construction contingency and is a percentage added to the amounts budgeted for engineering, procurement and construction (the first, third and fourth items, above) since an error in one of these items increases the overall cost to construct the project. The second type of contingency is called a project contingency and it is applied to all costs. This is an allowance for anything going wrong or being forgotten and usually reflects the confidence the entrepreneur has in the quality of each of the estimates received. Very often you will see a 15% construction contingency allowance, reflecting that the detailed engineering is not yet complete, on a large project as well as a 5-10% project contingency. On equipment purchase (rather than construction projects) construction (installation) contingency allowances may be lower but project contingencies may be higher because of the difficulty of estimating the “What ifs” of going to many customer locations rather than one construction site.

An example of a detailed estimate:

	US $	
Land	275,000	8.0%
EPC (includes contingency)	2,125,000	61.6%

Taxes (VAT)	71,600	3.5%
Legal and Financing	85,000	2.5%
Pre-construction	215,000	6.2%
Sponsor's fee	200,000	7.2%
Working capital	65,000	1.9%
Insurance	77,800	2.3%
IDC (interest during construction)	207,000	6.0%
Contingency	128,600	3.7%
Total	$3,450,000	100.0%

What about subsidy programs or government contributions?

Payments from governments or others that make a product more affordable to customers and a project more feasible should be treated in one of two ways:

- As a source of revenue; or
- As a reduction of the initial cost of a project.

The objective of a feasibility analysis is to determine the financial and non-financial factors influencing a project. If a subsidy program exists and can be attracted to the project it should be factored in. However, if no specific program exists to support the type of project being examined it is probably a waste of time to finish a feasibility analysis that the entrepreneur knows from the outset will result in a need for a subsidy that presently doesn't exist.

The inherent problem of many types of subsidies is that while they create specifically feasible projects, these types of projects and the companies that undertake them are not sustainable without continuous subsidies, which governments tend not to be able to afford.

From the business perspective two kinds of subsidies are attractive:

- Lifeline subsidies that target the poor and open up market segments otherwise out of reach.
- Start-up cost subsidies that get an operation up and running but do not become necessary once the operation has taken off.

Operating Costs

Operating costs include O&M, or Operating and Maintenance Costs, as well as other costs of running the project. Operating costs involve keeping equipment in good operating condition, providing regular maintenance and replacements and in some cases, providing periodic major maintenance (replacement of batteries at solar powered homes, replacement of boiler tubes in large bagasse-fired boilers). These also include the cost of revenue collection and the general management of the company. Typically, operating costs are easiest to estimate and present by separating the costs of labor from the cost of materials and supplies and the cost of third party contracts. For a feasibility analysis, a work paper should show all of the proposed employees and contract personnel, their salaries and benefits and their functions. The cost of supplies needed, rent due, communications expenses and so on should be itemized. Major maintenance items (batteries, boiler tubes) should be itemized separately. Where vehicles or capital equipment are needed for operating purposes these need to be included on a pro-rated basis (if a vehicle will last 5 years, one fifth of its initial cost should be included; its operating expenses – fuel etc – should be listed with supplies). Operating insurance costs should be shown and, finally, a healthy contingency allowance included to account for low estimates or completely forgotten items.

Depreciation and Taxes

Depreciation is the amount of the capital cost of a project to be allocated to each year of a project's life. For solar powered water pumps this could be 10-20 years. For a co-generation project it could be 15-30 years. For each year of a project's life a portion of this cost can be credited against Net Operating Income, thus reducing the amount that the project has to pay for income taxes. A project is also allowed to deduct the amount it pays for interest. At the feasibility analysis stage this interest allowance is a very rough estimate (because no financial plan yet exists).

At the feasibility analysis level it is therefore only important to provide an "allowance" for income taxes from the project on a simplified basis. Usually it is enough to take Net Operating Income (Gross Revenues less Operating Costs) minus a depreciation allowance and minus a rough estimate of interest cost for a typical year and then apply the prevailing tax rate to the result. It is sometimes easiest to compare this result to Revenue Estimate and use the resulting percentage as a substitute for a detailed calculation.

Step 1	Revenue Estimate = $900,000
Step 2	Operating Cost Estimate = $300,000 Equals Net Operating Income
Step 3	Determine Annual Depreciation Allowance Percentage, Apply to Capital Cost = 10% * $2,250,000 or $225,000
Step 4	Deduct Depreciation Allowance from Net Operating Income = $375,000
Step 5	Guess at what percent of capital costs will be financed and at what interest rate = 70% of $2,250,000 at 12% = $189,000
Step 6	Deduct Interest Estimate = $186,000
Step 7	Determine appropriate income tax rate = 20%
Step 8	Determine Tax = $37,200
Step 9	Determine Tax as a Percent of Revenue = $37,200 / $900,000 = 4.1% For feasibility analysis use 4.1% of Revenues as an estimate of taxes in any year where Revenue less operating expenses is a positive number.

13. Preliminary Financial Analysis

The project entrepreneur now has all the information needed to prepare a preliminary financial analysis on a "Checkbook" basis; that is by comparing cash flows to and from the project and estimating the overall project's internal rate of return or IRR (see Chapter 6 for instructions on IRR). Later this IRR calculation will become more sophisticated, taking into account not just the Project IRR, but estimating what the return to equity investors will be after a financing plan is put in place (Investor IRR or Return on Equity). The major difference between a feasibility analysis and a business plan is that a business plan proposes a specific financing plan whereas a feasibility analysis is trying to determine if the overall project "works" before determining how much debt (loans) a project can carry versus how much equity is needed.

<u>Cash Flow Out-Cash Flow In</u>

Just as in a checkbook, cash spent is shown as a negative figure and cash received is shown as a positive. Setting up a work paper in one of the three following ways is usually the easiest way to proceed.

<u>#1 - For a project where most of the capital is spent at the beginning</u>:

Year/Period	0	1	2	3	4	5	6	7	8	9	10
Capital Cost											
Revenue											
Operating Cost											
Net Revenue											
Allowance for Taxes											
Net Cash Flow											

Year or Period 0 represents when the construction or installation of a project is completed, and Year or Period 1 represents when revenue commences.

#2 - For a project selling product to a large number of customers for cash or on credit:

Year/Period	1	2	3	4	5	6	7	8	9	10
Revenue										
Cost of Goods Sold										
Operating Margin										
Operating Cost										
Start-up Costs										
Net Revenue										
Allowance for Taxes										
Net Cash Flow										

#3 - For a project installing product to a large number of customers and receiving fees for delivering services:

Year/Period	1	2	3	4	5	6	7	8	9	10
Capital Invested										
Capital Borrowed										
Revenue										
Operating Cost										
Start-up Costs										
Allowance for Taxes										
Net Cash Flow										

The minor differences among these work paper types actually demonstrate significant differences among the three different business models that tend to dominate energy projects:

- **Capital intensive model** of building and financing a project at the beginning and receiving revenues over time, usually from one or a few customers (e.g., Kanata – see Chapter 6).
- **Cash/Credit model** of obtaining and installing product and being paid in a relatively short period of time through a combination of customer payments and financing of the customer by some third party (e.g., Selco, see Chapter 6).
- **Fee for Service Utility model** of obtaining, financing and installing product (which the project continues to own) and receiving payment in the form of a fee for services provided (e.g., Soluz, see Chapter 6).

The job of the energy entrepreneur at this point is to complete this work paper for his or her project idea and evolve a reasonable estimate of the cash flow for the project. Three samples follow:

- Example # 1 is a company that proposes to install 5,000 solar home systems in a region. The raw data of this analysis consists of the following: 1000 systems per year to be installed at an average cost of $450 per system. Customers will pay an average of $15 per month for the service provided by these systems. Estimates have been made of operating expenses and a tax calculation was made for one year and it was determined that taxes (based on 20% of taxable income) will equate to about 4% of gross revenues, which was used for the analysis. It will cost about $150,000 to start this project, including the cost of setting up sales and service points, vehicles and marketing. The following basic analysis yields a PROJECT IRR of over ~16%. As the company believes it can arrange for financing of about 70% of the capital cost of the equipment at an interest rate of between 12% and 13%, the return on the balance of the required capital (the 30% not financed by loans and the cost of start-up) will be over 25% and therefore be attractive to investors.

Year		1	2	3	4	5	6	7	8	9	10
# Units Installed		1000	1000	1000	1000	1000	0	0	0	0	0
Cumulative		1000	2000	3000	4000	5000	5000	5000	5000	5000	5000
Price per Unit		450	450	450	450	450	500	500	500	500	500
Revenue per Unit per month		15	15	15	15	15	15	15	15	15	15
Capital Invested		450000	450000	450000	450000	450000	0	0	0	0	0
Revenue		180000	360000	540000	720000	900000	900000	900000	900000	900000	900000
Operating Cost		150000	175000	200000	300000	300000	300000	300000	300000	300000	300000
Startup Costs		150000	0	0	0	0	0	0	0	0	0
Allowance for Taxes(as % Revenue)	4%	7200	14400	21600	28800	36000	36000	36000	36000	36000	36000
Net		-577200	-279400	-131600	-58800	114000	564000	564000	564000	564000	564000
Project IRR		16%									

- Example # 2 is a hydroelectric project to produce electricity for sale to the national grid. The project team has assembled a few pieces of key data. From their analysis of hydrological data they have estimated the flow of water and been able to size a 2.6-3.0 MW project. They have decided to use the smaller size for their feasibility analysis and the higher cost estimate they have gotten from their own work (with a local engineer), as well as the budget quotes they have gotten from two suppliers, adjusted to include all related work (quotes range from $1300 per kW to $1500). The project will sell electricity to the national grid and the national utility has a "standard offer" for projects. The project team has made a low estimate of the capacity the project could sell (because there are penalties for failure to deliver on contracted capacity amounts) and used a mid-range estimate for both the quantity of energy (kWh) to be produced and the price. Because the net revenue of the project changes very little, (there are only minor adjustments to revenue and expenses) the analysis is only for six years. But, to this cash flow an estimate of the value of the cash flow for years 7-20 using a net present value estimate (See Chapter 6) is added. Using such an estimate instead of extending the analysis is relatively accurate. The NPV in this case ($4.7 million) is referred to as the project's TERMINAL or RESIDUAL value. The result is a PROJECT IRR of 17.8%. As it is likely that the project will be able to finance at least one-half the cost at ~12% there is sufficient return to pay debt and attract equity (which should earn returns between 20 and 25%. Again, the project team chose to use a "shorthand" method to estimate taxes as a percent of gross revenues. In this case, however, it would be a relatively easy matter to immediately proceed with a 20-year financial analysis beginning with a 50-50 debt to equity assumption and then testing the projects debt service coverage results (see Chapter 6) to propose a specific financing plan and prepare a more precise tax calculation.

Year	0	1	2	3	4	5	6	Yrs 7-20
Capital Cost	3,900,000							
Revenue		921,710	935,536	949,569	963,813	978,270	992,944	NPV
Operating Cost		191,318	196,101	201,004	206,029	211,180	216,459	12%
Allowance for Taxes		63,648	64,603	65,572	66,555	67,554	68,567	14 years
Net	-3,900,000	666,744	674,832	682,993	691,228	699,536	707,918	4,692,198
IRR	17.8%							
Revenue Escalation per Year	1.50%							
Operating Cost Escalation per Year	2.50%							
Capital Cost per kW	1500							
# kw	2600							
Capacity to be Contracted	1820							
Payment per month per kW	$10.50							
Energy to be Contracted	18,220,800	7008 hrs						
Payment per kWh	0.038							
Revenue	$921,710							
Operating Cost	$0.0105							

- Example # 3 is a company selling any product for cash. It doesn't matter if the product is a treadle pump, electric motors for milling equipment (or the milling equipment itself) or solar home systems or household biogas units. The analysis is very simple and basically the same regardless of product. Three kinds of costs need to be determined: the cost of the product itself, the cost of setting up and maintaining the company's operation (start-up plus fixed costs) and, finally the variable costs attached to each unit sold (it might be the cost of installation or sales or anything). All that remains at that point is to estimate selling price, revenue and provide an allowance for taxes. Only if the project plans to borrow capital for an extended period does such an analysis become much more complicated. Short-term borrowings to finance the cost of buying product, which is then repaid when the product is sold is called a WORKING CAPITAL LOAN and does not change this type of business analysis a great deal. The essence of this type of business and feasibility analysis is quite clear: the entrepreneur must be able to get the margins (or mark up) on the product and the entrepreneur must be able to get paid as soon as possible.

Year	0	1	2	3	4	5	6	7	8	9	10
Revenue		550000	687500	825000	962500	1E+06	1100000	1100000	1100000	1100000	1100000
Cost of Goods Sold		390000	475000	555000	630000	700000	700000	700000	700000	700000	700000
Margin		160000	212500	270000	332500	400000	400000	400000	400000	400000	400000
Margin (as % of Sales)		29%	31%	33%	35%	36%	36%	36%	36%	36%	36%
Operating Cost		120000	122500	127000	131500	132000	132000	132000	132000	132000	132000
Start-up Costs	165000	75000	75000	75000	75000	75000					
Allowance for Taxes		8000	18000	28600	40200	53600	53600	53600	53600	53600	53600
Net	-165000	-43000	-3000	39400	85800	139400	214400	214400	214400	214400	214400
	33%										
# Units		1000	1250	1500	1750	2000	2000	2000	2000	2000	2000
Cost per unit		390	380	370	360	350	350	350	350	350	350
Price per unit		550	550	550	550	550	550	550	550	550	550
Fixed Cost of Operation		100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Variable Cost per unit		20	18	18	18	16	16	16	16	16	16

Project Rate of Return

Based on cash flow projections it is relatively easy – with the aid of a financial calculator or spreadsheet software – to determine the project's internal rate of return. Combined with a few pieces of additional information it will be possible to conclude if a project is generally feasible from a financial perspective (all the other factors discussed in this chapter will combine with financial feasibility to determine if a project is fully feasible).

Combined with the project internal rate of return the energy entrepreneur needs to know:

- What is the current interest rate charged for loans in the local market?
- What is the current or projected interest rate for loans from outside the current market?
- What are investors demanding as a rate of return to make their funds available to projects as equity?

If a project's IRR is 16% and the cost of borrowing in the local market is 20% then there is little reason to borrow in the local market unless a large portion of the project capital will come from the energy entrepreneur or others who are willing to receive a low rate of return. The reason as follows, if half the project is financed with 20% debt then the other half must be financed by people willing to receive a return of 12% (50% financed at 20% combined with 50% financed at 12% equals 100% financed at an average 16%). Why would investors make risk capital (equity) available at a rate of return lower than a bank loan and take more risk in the process? There are reasons to organize such a project, but clearly these reasons must be clear at the outset. The most significant reason is the expectation by equity providers that the project is going to increase in value beyond the projections shown in the cash flow (which raises the question: why aren't these values being shown?[3]). Projects where the IRR is below the cost of borrowing are generally only feasible as projects with all or substantially all of the capital coming from equity.

[3] Where projects may increase in value for reasons other than basic cash flow AND where a project is going to be able to capture this value through, for example, a sale to someone, it is possible to show this value increase by inserting a "terminal" value in the year of the sale. However, there must be a reasonable expectation that this increase in value will be turned into a cash-producing event.

There are cases where lower interest loans are available. The situation where a loan from outside a market is willing to accept a lower interest rate than the rate demanded by the local market usually implies one or more of the following:

- Concessionary finance program by a government.
- Equipment or market opening financing by a company with or without the support of the exporting country's government.

Such financing can serve to lower the hurdle rate – the IRR a project needs to meet to be feasible, but usually comes with significant requirements to be met.

When then is a project <u>not</u> feasible from a financial perspective?

- First, if a project has a negative IRR.
- Second, if a project's IRR is too low for even the energy entrepreneur to invest his or her available cash.
- Third, (assuming the energy entrepreneur does not have all the capital required) if the project IRR is too low to attract other equity investors to supply their cash at risk.
- Fourth, (assuming an all equity transaction isn't feasible) if the project IRR cannot support the borrowing of funds through loans the project could rarely be feasible.

<u>The Hardest Task</u>

This is the stage of analysis where very often well-intentioned entrepreneurs refuse to see the reality staring across to them from the numbers THEY prepared. There is hope in "financial engineering", higher revenues than estimated, lower costs, eliminated contingencies, subsidy programs, lower loan costs, value increases and so on. It is OK (and normal) to refine estimates, but there is a point when only the entrepreneur can determine if he or she is fooling himself or herself. It is easy to change assumptions and improve the IRR. There is an old saying that statistics do not lie; only statisticians do. Notwithstanding the ability to manipulate data – and with the help of spreadsheets it is as easy as point and click -- the entrepreneur needs to decide if the project can truly be implemented and if refining the estimates and financial plan makes sense. At this point in the project's analysis **there should be a great deal of room for error**. If the project is just barely financially feasible, if the project absolutely depends on convincing others to make loans and equity investments, if the project estimates have been gone over and over mostly to make the result better, if the entrepreneur has gotten the opinion of others and it is still a very close call then continuing with the project is probably **a bad use of the most valuable commodity an energy entrepreneur has: time.**

General Market Condition Checklist

A project's feasibility is determined not just by factors under the project team's control. It is important that general market conditions – economic, commercial, political, and social, be documented and understood early in the project development process. These factors must instill confidence in the people needed to implement a project (for example, lenders, investors, suppliers, contractors, and insurers).

Macroeconomic conditions:

- ❑ Inflation, last 5 years___________________
- ❑ Growth, measured as % GDP change, last 5 years__________
- ❑ Currency performance (to foreign exchange, German Mark, US $, etc) __________
- ❑ Unemployment percentage, last 5 years ________.

While these conditions need not be perfect the general trend of the economy (improving versus declining) and the general perception of the regional and world economic community is important to assess.

Commercial conditions:

- ❑ What are the requirements for establishing a project company?

  ____

- ❑ What are the regulations governing the making of investments by foreigners and their recovering of investments?

  ____

- ❑ Are any special requirements for importing goods and services clear?

  ____

__

- ❑ What are the appropriate banking, investing and trading laws and regulations?

  ____

  _

- ❑ Is there a history of projects, such as the proposed one being successfully implemented from a commercial perspective?

  ____

- ❑ Are in-country banks and investors involved in projects?

  ____

- What are the most active NGOs involved in energy-environment-economic and social development?

  ___

–

Political conditions:

- Are laws and regulations transparent and enforceable in a reasonable manner?
- Is power transferred between political parties or factions in an orderly and predictable manner?
- Are policies transferred from one political appointee to another or does every appointment of a minister or election mean that a project is back to the beginning of the development process?
- Is corruption – payoffs, favors, conflict of interest -- part of the process of project approval?
- Is there political support for the proposed project? Is it needed and will it be helpful (sometimes it is not)? What evidence exists of this political support, if needed and helpful, at the national or local level?

Social conditions:

- Will the project area benefit from the proposed project?
- What are the needs in the project area?
- Is the project compatible with local conditions and plans?
- Is there social support for the project? How is this support demonstrated?

Project Team Checklist

Technical: Are there specific engineering challenges that require specific skills on the team on a permanent basis? What are these challenges and what are these skills? Can these needs be met through a contract relationship or must one of the core team be an expert?

Technical Skill Needed	Team Member or Advisor with Appropriate Skill and Experience

Financial: What are the financial aspects of the project? Will there be ongoing financial requirements over the life of the project? Can a chief financial officer be hired later or should the team include a financial expert from the outset?

Financial Skill Needed (When?)	Team Member or Advisor with Appropriate Skill and Experience

Negotiations and Sales: Are there ongoing business relationships, with suppliers and customers that require regular updating terms and conditions? Will the project always be seeking new customers and relationships or will this be a one-time event?

Negotiator	Contracts and Issues to be negotiated

Legal: Will the regulations and contractual relationships governing the project be fixed or will they change over time, requiring regular attention.

Legal Expert(s)	Their Credentials and Experience

Political: Will regulations and policies affecting the project's performance be evolving and require attention and lobbying?

Issues	Who Will Handle?

Project Team Funding: What is the minimum amount of funding needed to complete work underway and make the project attractive to lenders and investors? How much has the project team spent already (time and money) and on what? What will be realistically needed to complete all of the tasks identified? Even then, how much cash equity is needed to assure that the team retains a substantial portion of ownership and control? How much cash equity does the project team have?

Amounts Spent to Date	
Amounts to be Spent	

Entrepreneur Skill, Experience and Resources: Of the qualifications needed for the team what skills does the project entrepreneur possess? Are there partners who round out this skill set? Are there advisors who can be hired to assure that all the skills needed are represented? Does the team have an experience base that will "impress" lenders and investors? If not, is there an addition to the team that could solve this problem? Is it possible to contract with an experienced party as part of the team? If not, how does the energy entrepreneur propose to convince lenders and investors that all the skills and experience needed are at hand? Does the team have the time and money needed to complete the work identified? What about the cash equity to be credible in negotiating with lenders and investors? Is there an early stage financial source available to supply these funds? What will the team be giving up and gaining by taking a financial partner?

Skills and Experience Needed	Team and Advisors	Strength or Weakness?
Technical		
Financial		
Negotiating		
Legal		
Other		
Near-term $$$ Needs		

Due Diligence and Risk Analysis Checklist

In preparing an investment proposal for funding consideration, an entrepreneur needs to address numerous project issues to demonstrate the sustainability of the project and ways to mitigate any risks. The following checklist outlines the required information.

When a financial institution reviews a renewable energy investment package, the following project components need to be answered to gain a full understanding of the viability of the project and assess the risks.

I. Market

- Would this technology be cost-competitive with existing sources of electricity (kerosene, candles, diesel generators, etc.)?
- How would the product or services be marketed?
- What is the market potential?
- Do customers have the ability and willingness to pay for the products or services?
- What is the country's energy regulatory policy?

II. Technical

- <u>Fuel Resources:</u>
- What fuel resource (eg: water, sun, bagasse) is being used?
- What fuel supply contracts are needed and which have been secured? Even waste to energy projects need to enter into fuel supply contracts. "Waste" can become an economic value in the future; assumptions that today's waste will be tomorrow's free fuel are not viable.
- What fuel resource data is available? How long has it been analyzed?
- Is historic data available? Site specific and long term data is needed especially for wind and water projects.
- <u>Licensing/permits:</u>
- What licenses or permits are required to complete this project?
- What is the status and schedule for each of these?
- What contracts are needed?
- <u>Energy Purchase Agreements</u>:
- Who will buy the energy produced? Creditworthiness of buyer needs to be verified. Sale of energy needs to be assured through customer contracts, distribution company purchases or regulatory regime. In each case the ability to pay of the purchasing entity needs to be assured, a back-up plan needs to exist and the long-term viability of the purchasing entity needs to be examined.
- What is the status of energy purchase agreements? Is there a PPA or, is this a wholesale market? If so, what is the structure of the market and what are the tariffs? Is it a newly established market or is it already operational? Are there any special considerations for Renewable Energy?
- What risks are there?
- Is there a back-up purchaser for the energy?
- When selling renewable energy equipment directly to customers, revenue collection plans and devices must be in place to assure repossession of non-performing energy assets sold on credit, leased or provided in fee-for-service arrangements. Re-marketing plans must also exist.
- <u>Wheeling:</u>
- If the energy is being sold to other than the local utility, are there expenses to "wheel" the energy to the purchaser? Are they included in the economics?
- <u>Interconnection issues:</u>
- Have the interconnection costs been considered in the investment costs? If not, will the purchaser of the energy pay for this?
- <u>Land ownership issues.</u>
- What is the risk that a developer may lose access to the site in which the project would be implemented? Costs of the land? Relocation of human population? Concessions?
- <u>EPC contracting.</u>
- Will an EPC contractor be retained?
- What is the status of identifying and securing a commitment from an EPC contractor?

- What are the EPC contractors qualifications?
- Is financing available through the EPC contractor?
- Quality of equipment/guarantees.
- What type of equipment is being used (new vs refurbished)? Who is the manufacturer?
- Who will supply the equipment?
- What guarantees will be provided?
- Is financing available through the supplier?
- Is there a local representative for the supplier? If so, what is his experience?
- Concessions/Permits:
- What permits, licenses or concessions are needed?
- What is the schedule for obtaining the necessary items?
- Technical Capability:
- Who will provide technical capability?
- If outside technical assistance is needed, how will this be funded?
- Time Schedule:
- How realistic is the workplan and schedule?
- What financial resources are available if there is slippage in the schedule?
- Operations and Maintenance:
- How will O&M be handled and by whom?
- What is their experience and level of commitment?

III. Sponsors

- Sponsor Credentials:
- What is the overall structure of the company?
- Who are the owners?
- Are there any conflicts of interest?
- Legal Standing:
- Has the Project Company been incorporated?
- Experience of the Company:
- How many years have the entrepreneurs been in business?
- Have they been successful?
- Managerial Strengthen/Depth of company:
- Describe the technical and managerial experience of the team and what is required to ensure that the venture is profitable and sustainable?
- Has the project/energy enterprise secured collaboration with applicable third parties such as equipment suppliers, engineers, site owners, etc.?
- Development of Operations:
- How will the project operate on a day-to-day basis?
- Does the project developer live near the project site? If not, how will the project steadily advance?

IV. Financial

- Financial viability:
- What financial information is available: audited company financial statements, project cashflows?
- What is the company's current financial situation?
- What is the total project cost? A working capital plan must be defined.
- Structure:
- What is the financial structure of the project?
- Have revenues losses from theft or non-payment been estimated?
- Component and operating cost escalations must be estiamted and back-up supplies identified.
- What are the financing and refinancing plans?
- How much has the developer invested to bring the project to this point?
- What percentage of equity will the developer's investment equal?
- How has this been valued?
- Are other organizations investing? Debt or equity? Under what terms?

- Does the developer have financial resources to handle unexpected delays?
- <u>Terms:</u>
- What are the proposed terms?
- Is this a loan, equity, or quasi-equity?
- What type of guarantees can be provided?
- Will this be a dollar denominated investment?
- Can funds be repatriated?
- What is the exit mechanism?

V. Risks

- What risks are associated with this project?
- Country, Political
- Currency, Inflation and Interest Rate
- Managerial Capacity
- Access to balance of project funding/other investors (bankability of project)
- Ability of customers to pay
- Construction Risk
- Environmental Risk
- Contractual Liability Risk (energy purchase/sale agreements, fuel supply contracts), Contract Enforceability
- Competition
- What is the level of risk-sharing with the developer and other partners?

VI. Impact

- <u>Social:</u>
- How does the energy enterprise or project improve the quality of life through the provision of energy services (lighting, cooking, water)?
- Are there productive uses involved with this project? If so, what are they?
- How many people will benefit from this project?
- If the project is grid-connected, who will benefit from increased supply to the grid? Will there be long-term benefits (permanent jobs, access to water, grid extension) or will there be short-term (temporary jobs during construction)?

- <u>Environment:</u>

A thorough analysis of environmental assessment and permitting requirements needs to be undertaken independently and linked back to fuel, energy generation, site access, construction mobilization and other issues in the public domain.

- What are guidelines and record-keeping requirements for:

- ❑ Effluent Discharges
- ❑ Air
- ❑ Hazardous materials
- ❑ Solid waste
- ❑ Noise
- ❑ Relocation
- ❑ End-use Efficiency
- ❑ Greenhouse gases
- ❑ Other _________
- ❑ Resource studies (wind, hydrology, etc.).

- Will the project improve or protect the local, national, and global environment?
- What other energy sources such as diesel, kerosene, candles or firewood will be displaced?
- If displacing carbon, can this be quantified now?
- Does the project have any negative environmental effects?
- Has an environmental impact assessment been done?