# WIND PROJECT DEVELOPMENT AND FINANCING

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## INTRODUCTION

Landowners, electrical utilities, developers and financial institutions are collaborating to develop wind energy as the fastest growing source of generating electricity in the world. In the USA it has the potential of supplying about one and a half times the current electricity consumption. Wind power is competing with fossil fuels as an electrical power source.

A single large 1.5 MW wind turbine can provide the energy needs of 600-800 residential homes at 1.875-2.5 kW of electrical power need for each. However, the initial capital cost of constructing wind turbines is high causing a problem in financing wind projects. A single medium size turbine costs about $900,000 dollars for the structural tower, turbine and installation. For an installation with 3-4 commercial turbines the cost could rise to at least one million dollars per turbine. Because of the high initial capital cost, landowners seek collaboration with a developer, investors, financial institutions, as well as take advantage of grants and tax breaks.

## WIND TURBINE LAND LEASES

Landowners should assess whether the rent received for a wind power installation on their land justifies the costs. These costs include the cost of taking land out of production for the bases of the turbines, the buried power lines, drainage tiles or ditches, the access road easements and the maintenance vehicles area around the turbine.

Wind turbine leases may prohibit crop production within 50 feet of the turbine and may prevent any subsurface disturbance within 500 feet of the turbine to protect the underground electrical wiring and storage facilities.

The rent received may be based on a guaranteed payment or may be determined by the amount of electricity generated as a royalty. The pricing structure is usually specified in the lease.

Installation of wind turbines on a piece of land significantly increases its assessed value and hence could make the landowner responsible for a substantial real estate tax burden.. Ideally these taxes should be assessed directly to the energy company.

Special use permits may be required by zoning ordinances, such as road and setback requirements which restrict the location of the turbines away from frequented roads or human dwellings. The energy companies may demand a complete freedom in the choice of the location of the wind turbines. Landowners must thus develop a site plan with the energy companies to identify tentative turbine locations that would avoid their hazards such as stray voltages, blades ejection, ice shedding, noise and light and electromagnetic flutter. A requirement of landowner approval of the final locations and site map is crucial in land lease agreements.

Due diligence regarding potential wind farm tenants must include an investigation of the company reputation, technical knowledge, longevity in the power business and its financial stability.

An escrow fund must be set to ensure sufficient payment for the removal of the equipment including the steel structures, concrete bases, underground cables and associated equipment at the end of the project lifetime.

Leases must ensure that the energy company tenants cannot assign leases except to other financially firms that are acceptable to the landowner.

Wind farming being basically an industrial process, can result in environmental contamination such as oil spills, land compaction, crop destruction and accidents to maintenance and operational crews. Specified levels of liability insurance against such risks must be available during the construction, operation and the decommissioning stages.

Wind farm leases will vary from location to location. They should be carefully reviewed by experienced and legal counsel before signing.

The trend is that landowners find that the economics of land leasing justify the incurred costs and risks incurred. Land leasing for wind production is a new reality on the landscape much like land leasing for hydrocarbons production.

## PROJECT INITIATION

The development of a successful wind power production project from initial prospect to commencement of construction is a process that can take two to three years. In some circumstances it may take longer. No two sites are ever the same and each poses its own unique set of problems to be solved.

A general process would proceed along these lines:

1. Identifying areas with promising wind resources and available power transmission lines.
2. Identifying and mapping the landowners at the sites using plat books.
3. Establishing relationship with landowners and negotiate wind measurement agreements and/or land leases.
4. Maintaining strong relationships with local stakeholders, including local government, lending associations, environmental groups, power utilities, county government and community groups.
5 Establishing an engineering design and construction team for project planning and design.
6. Moving projects through the approval and the permit process.
7. Overseeing the establishment of project interconnection and transmission agreements with transmission operators.
8. Participating in negotiations with power and project suppliers.

## ASSESSING THE WIND RESOURCE

Before committing to a wind turbines project, on site wind monitoring is advised. Wind energy can change dramatically with precise location even within an 80 acres expanse. The site must show a substantial and consistent wind resource with a consistent wind speed in the range of 7-11 mph.

In the absence of available local meteorological data, say from airport locations, a small meteorological station including an anemometer can be used to collect wind data, or a small turbine can be built initially to assess the wind resource.

To ensure a good wind resource, wind turbines need to be in a rural setting or on water bodies' shores. The location must be free from obstacles such as tall buildings or trees and it must be elevated above the surrounding terrain. Topographical and wind resource maps can be used to assess the wind resource.

## PROJECT REQUIREMENTS

A wind turbine does not require a lot of land: a single turbine and its associated access road take up less than ½ acre of land. In addition the land surrounding it can continue to be grazed by cattle or planted into cash crops.

There is a need for an existing infrastructure to support the wind turbines. It is not just necessary to have a location with high winds, but it is necessary to be located near a high voltage three phase power line to allow connection to the electric power grid to transport the produced electrical energy.

To make a connection to distribute wind electricity, a producer has to fill an interconnection application paying a fee of about $280, and to sign a general buy/sell agreement with the local power utility. The application must provide information on the kind of turbines being installed as well as the electrical inverter and disconnect systems used.

The general buy/sell agreement would identify the rate or the value of the electricity the turbine produces, which can range from 3.5-8.5 cents/kW.hr of energy produced. Once a rate is agreed upon, a copy of a certificate of insurance must be provided to the power utility.

The power utility is obligated within 10 days from receiving an application to send an engineering crew to the site to inspect the utility system. In most cases an upgrade of the existing transformer installations will not be needed. If the nearest existing transformer is too small to handle the power produced, the producer may be charged for the cost to have it upgraded by the utility. A larger transformer would be needed for a power situation of larger than 11 kWe.

Upon construction of the turbines, the staff of the power company would inspect the site for proper connection and wiring.

## WIND FARM ENGINEERING AND DESIGN

The general engineering development work of wind farms includes:

1. The foundation design.
2. The electrical collection system design.
3. The construction of a transformer substation.
4. Roads design and construction.
5. A detailed turbine suitability analysis.

The engineering management activities of a site developer include:

1. Development of a site detailed design.
2. Procurement of all long lead materials such as the substations and cabling.
3. Generating bid and award all subcontracts.
4. Directing all onsite construction, testing and commissioning activities.
5. Providing onsite management focused on cost, schedule and quality issues.
6. Administration of an onsite safety program.
7. Maintaining relationships with client, local stakeholders, county boards and environmental groups.

The development of a commercially successful wind farm that is sensitive to the local environment and community depends greatly on technical expertise. There is a need to streamline the development process and create value whilst integrating constructability and turbine siting issues early on in the project.

The technical expertise needed for a successful wind project includes the following areas:

1. Wind Data Analysis. The wind speed climate prediction is the single most important driver of the cost of wind energy. This includes calibrating the anemometers, installing a meteorological tower, quality controlling the data, and long term climate estimates.
2. Wind farm layout design for energy optimization. The energy yield prediction takes into account the site climatic conditions, wind speedup effects due to local terrain and roughness changes, obstacle effects such as those due to forestry, wake or array effects due to interaction between turbines, and the power curves of the turbines considered.
3. Computational Fluid Dynamics (CFD) modeling for turbine siting in complex terrain.
4. Mesoscale wind modeling to generate wind maps.
5. Wind Farm Visualizations. These are used pre-construction to determine where the wind farm can be seen from and what it will look like from any given location. Fly-through animations are sometimes generated.
6. Sound level analysis to protect the quality of the local environment.
7. Radar, electromagnetic and microwave avoidance and mitigation.

## PROJECT STRUCTURE

### INTRODUCTION

Wind farm projects must have the developer and the landowner comply with the existing local public policy. In some cases the landowner reaches out, and in some others the developer will work with a county or state board to inform the community about the wind energy potential. There exist three ways to structure the wind project: contracting with a wind developer, forming a joint venture, or personal ownership of the project.

### DEVELOPER CONTRACTS

This approach is the most common in wind project development and it involves the least time involvement, effort and risk by the landowner, but it is also associated with the least reward.

In this case the developer obtains the necessary permits, locates the needed equipment and arranges the financing and the construction. He assumes all the financial obligations and liabilities, leaving the landowner with a low involvement with the project.

Developers are looking for land with good wind resources and would typically approach the landowners with projects in mind. The developers are willing to sign contracts with the landowners providing a guaranteed payment. The payment is typically in the range of $4,000-$6,000 per installed 1.5 MW wind turbine per year.

The developers and the landowners would sign a lease agreement, with the developer leasing or renting the land over the expected lifetime of the installed turbines, which is typically 20-30 years. This allows the renter to maintain his land ownership.

Other contract options include wind easements or the developer purchasing the land outright.

### JOINT VENTURES

A joint venture can be more lucrative than a developer contract but also involves a higher risk.

One approach is a pass-through entity, which allows the tax credits and operating gains and losses to be allocated to the individual members instead of the whole entity.

A cooperative approach would give ownership and control to those who use its services. In this case the returns are based on patronage, not investment.

A partnership approach allows for joint liability.

A Limited Liability Company (LLC) creates a critical mass among many landowners, finances a project and takes the responsibility if things go wrong, the owners being not liable. This approach offers the owners some legal protection in the case of accidents and disasters.

### INDIVIDUAL OWNERSHIP

The individual ownership of a wind farm involves assuming all the risks, as well as receiving all the profits. Individual ownership may result in a payoff that is 2-3 times greater than working with a developer. It takes a large investment in time and the owner assumes all the responsibility for the work involved as well as the risks that the developer typically takes.

This is particularly useful for any industrial or farm entity that consumes a significant amount of electrical power such as a livestock or poultry operation. An individual investor can install a single small or large size turbine for his own electricity needs and sell his surplus production to the local electric utility.

The installation price of wind turbines depends on the size of the installed turbine. Accordingly, securing financing for an individual investor is an excellent approach to offset the initial costs. For a small wind farm composed of 4-5 turbines, having potential investors take the corresponding tax credits, helps with the initial cost. Once the tax credits are used up, the individual investor owns the turbines and all the revenue reverts to him.

## SOURCES OF FINANCING

Wind development is capital intensive requiring raising the capital cost of the project. Financing a project is a difficult and time consuming task. Lenders prefer to consider large size projects to a multitude of smaller ones since they can generate correspondingly large incomes.

In the process of financing, lenders who are people with money to invest get together with borrowers who are people without money and needing capital. The contact could be direct or through the intermediary of the international and national lending institutions as part of the banking system as retail or merchant banks or through other lending entities such as insurance companies or credit unions. Loan packages can be arranged incorporating a mixture of different types of financing. These can be arranged with banks in the form of project financing.

There exist three possible distinct forms of finance:

## 1. EQUITY FINANCING

Equity investment is capital that is placed at high risk with a low priority of repayment. Consequently equity investors expect a very high rate of return on their investment. The project developer could provide a large part of the necessary equity investment. Equity capital is the true risk taking capital which is invested in a project.

The stock owning shareholders of a corporation or company can provide equity to a project. Ordinary or equity financing is the most important source of external funding for the corporate sector. Holders of equity as ordinary shareholders are the legal owners of the company. They share the risks associated with company operations.

Success of the project means high rates of return on equity investment to the shareholders. Failure means no compensation on the loss of investment. When issuing shares, a company is obligated to first offer existing shareholders the opportunity to invest, usually at discount rates. Shareholders are interested in minimizing the level of investment while maximizing the rate of return, and would expect an after tax nominal Internal Rate of Return or IRR of between 15-25 percent.

Returns can be the form of dividend payments, or alternatively capital gains through the sale of appreciated stock or share holdings.

An alternative to ordinary equity shares associated with lower risk are preferred shares issuances of different classes. These are half way between debenture or loan stock on the one hand, and equity on the other. Their holders normally receive a fixed dividend each year, provided the company has generated a profit. The dividend is paid out before any issue of dividend to the ordinary shareholders. There is less risk to the preferred share holders, but also reduced share in the success of the company since those shares usually are denied the voting rights.

Corporate internal reserves can provide equity to a project. In the early stages of a project such as during the site wind resource assessment and planning application procedure there will be a reliance on equity finance, before any stage is reached where securing debt finance is possible. At the early stages the project developer would be expected to provide a large amount of the necessary equity finance.

Multiple sources of equity finance exist:

1. Project developers.
2. Equipment suppliers and contractors with a vested interest in the project through sale opportunities.
3. Community groups such as county boards benefiting from a scheme, possibly through electricity supply, tax revenue, as well as dividend payments if acting as shareholders.
4. Public utility electricity suppliers looking for a means of creating an unregulated income.
5. Institutional investors such as pension funds, insurance companies or credit unions
6. Local businesses and individuals.
7. Environmental or ethical funds.
8. Government and private grant awards.

A developer may agree, if unable to find equity and debt finance or unwilling to spend the time and money in pursuing the financial bodies, to jointly develop the project with a financially capable third party. This third party may provide large amounts of equity, or a safer investment in the form of debt finance, in order to continue with the development of a project. This may involve handing the project over completely to the third party, while maintaining a level of participation through carried interest as a percentage of the shares of the company, options to purchase company shares in the future, or warrants as entitlement to a share of the dividend stream, or a share of proceeds of sale if the company is sold in the future.

## 2. SENIOR DEBT FINANCING

This source of funding originates from authorized lenders such as banks or credit unions and has a lower investment risk than equity investment. It receives a lower rate of return, making it a cheaper source of capital in return for having a high priority repayment as a condition for extending the loan.

It is accessed in situations when the equity capital raised for a project is not sufficient. Such debt finance is usually obtained from a retail bank. The debt repayments have a higher priority than equity shareholder dividend, and hence a lower risk, however the IRR is necessarily lower.

The bank lending rates are typically in the range of 2-3 percent above the prime rate in the USA or the London Inter Bank Offer Rate (LIBOR) in the UK. The rates can be fixed rates, adjustable, or floating for the period of repayment.

There usually exists an issuance fee for the loan, as well as an annual management fee. The size of these extra fees depends upon the size of the loan.

As a bank considers lending to a project, it carries out a "due diligence" test to ensure that the associated risks of the debt are not excessive. The cost of carrying out this due diligence process is similar whatever the size of the project and loan.

Banks providing senior debt to a project will prefer to make reasonably large loans in the range of $10 million, in order to ensure that the charges for the loan arrangement which is 1-2.5 percent of the total capital cost of the project, covers the costs incurred during the due diligence process.

Senior debt financing can take two forms:

1. The loan may be a draw over a line of credit established with a bank. It is considered

high cost in terms of the interest payable on the borrowed amount. It may require a security or a collateral depending upon the size of the borrowing requirement. This type of debt is usually used by corporations on their bank accounts, to deal with the constant fluctuations of income and expenditures over a given month. Thus it is a tool for cash flow fluctuations management, not as a significant long term debt source.

2. For larger debt capital, corporations prefer to obtain project finance. Project finance requires a mix of equity and debt, with a higher debt proportion to keep the costs of financing low. The presence of equity assures the lending bank that a part of the risk has been absorbed elsewhere.

For a developer, debt finance is cheaper than equity finance, since equity investors expect an IRR of between 15-25 percent whereas debt lenders expect an interest payment on the loan of about 2-3 percent above the prime rate.

The level of debt of a project is usually called the leverage or gearing, and indicates the level of risk retained by the developer. The gearing or leverage is defined as:

$$Gearing, leverage = \frac{Debt}{Equity} \tag{1}$$

Banks are usually willing to provide a higher level of debt to what they perceive as a low risk project but wind developments are considered as medium to high risk projects.

The repayment of debt finance can be annualized, where the total amount due for each payment is constant, or the amount repaid can vary to correspond to variations in the expected project cash flows. This could be beneficial to wind developments where the income from electricity sales fluctuates according to the wind regime and the wind turbines performance. Repayments of principal are usually made every 4 or 6 months, with the interest also paid at specific periods of 6 or 12 months.

When arranging project finance, a bank usually has control over some aspects of the project cash flows. This means that the bank can specify the level of reserves needed in the project bank account before there is any distribution of profit to equity investors via dividend payment. The level of reserves prescribed by the bank for a project is described by the Debt Service Coverage Ratio defined as:

$$\text{Debt Service Coverage Ratio} = \frac{\text{Cash flow available for debt service}}{\text{Scheduled debt service}} \tag{2}$$

Whereas gearing or leverage is the debt to equity ratio, the debt service coverage ratio is the ratio, for any period of time, of cash flow available for debt service divided by the debt service. Gearing affects the debt service coverage ratio, and the two ratios are closely related.

The standard debt service coverage ratios required by banks for renewable energy sources projects are in the range of 1.35-1.5 for lower risk projects. This may rise to 2 for very high risk projects.

Banks vary the parameters within a projected cash flow analysis, looking at negative scenarios, to assess the sensitivity of the debt service coverage ratio to possible events within the debt lifetime. The coverage ratio is effectively a cushion to reduce risk and ensure that the lender receives debt repayment.

### 3. SUBORDINATE DEBT FINANCING

This is an intermediate level between equity and senior debt financing, possessing some characteristics of each. It has a lower risk than equity but yields a higher rate of return than senior debt ranking after it from the perspective of repayment priority.

It receives a fixed margin above the prime rate, LIBOR or other reference lending rates of between 3-6 percent

This type of finance is not always appropriate, and is rarely available to wind projects. Subordinate debt is also known as privatization in the USA and mezzanine finance in the UK and is often used in situations of management buyouts of their own firms from their shareholders allocating themselves a large advantage.

There are some institutional investors such as pension funds who are willing to provide privatization funding, and some senior debt providers may provide subordinate debt to top up the borrowed capital.

## PROJECT FINANCING OPTIONS

Typically, in financing a project, the developer would seek to maximize the level of debt finance and reduce the level of equity finance. This reduces the costs of finance for the developer.

Equity finance carries a larger risk than debt finance with the result that the debt lender or the bank will usually prefer a level of equity finance to provide shareholder commitment to take some of the project risk.

Project financing has considerable set up costs on the part of the debt finance provider, and so bank charges for arranging project finance are typically 3-5 percent of the total capital cost.

There are two general types of project finance: limited recourse project finance and on balance sheet project finance.

### 1. LIMITED RECOURSE FINANCING

In the case of limited recourse project financing, there are no extra obligations by the shareholders to the bank, aside from the agreement to subscribe to a certain level of equity. The project would be financed on a standalone basis, with no recourse to other company assets to support the debt repayment. The lender repayments are only secured by the project assets and cash flow.

This type of arrangement involves a complex series of contracts between the bank and the developer, and is costly to arrange. By offering such form of financing, a bank will be interested in ensuring that payments are secured, and for wind development, a single project company may use debentures or book debts for the single project. The development fixed assets, such as machinery, equipment and property, could also be used as collateral, as could bank accounts, share holdings or endowments.

### 2. ON BALANCE SHEET FINANCING

In the case of on balance sheet project financing, the lender can consider guarantees that are external to the project in securing the debt repayment.

This could be in the form of other balance sheet cash flows, assets, or external collateral that the developer has control over. This process of recourse to other assets for debt repayment reduces the risk level to the lender and results in lower interest rates on the loans.

## CORPORATE FINANCING OPTION

For a small company, debt financing that does not use project financing may be the only option available. In this case the developer would be expected to secure a large amount of the required project capital from equity sources. This may reach up to 50 percent of the total capital cost.

The loan from the senior debt provider would be secured in this case against the liquidation value of the business, including the value of land and equipment acquired for the project. A bank will usually lend around 60-90 percent of a property value that is held as collateral.

There may a need to provide personal guarantees, through the provision of external capital, if the liquidation value of the company is lower than the borrowing requirement from the bank. Other security possibilities, dependent on individual arrangements with the bank, include company bank accounts, share holdings, endowments, debentures, and book debts.

Banks consider longer term debt to have a higher financial risk, and will determine loan repayment terms based upon the capacity to be repaid. Although debt repayment of a corporate loan may average a 10 year period, the term of the loan will vary from one project to another.

## GOVERNMENT FINANCING INCENTIVES

To encourage the development of wind power, national and state governments in different countries have provided financing incentives that a potential developer must seek to assure the financial viability and competitiveness of his project.

Different states in the USA have different rules about "net metering." Under this process, owners of small renewable energy sources are entitled to receive retail credit for the electricity they generate from the local power company. All states in the USA provide energy credit to small turbine owners to be deducted from their energy bills. Some states like Iowa provide credit only, whilst some other states such as Wisconsin provide credit as well as, upon request, payment for any surplus electrical energy wheeled into the grid.

In Denmark since 1985, the electrical utilities have been obligated to purchase all electricity generated from renewable energy that was offered to them, and to pay 85 percent of the average consumer cost of a unit of electricity for that power. About 74 percent of the installed capacity is privately owned, the remainder belonging to utilities.

The Danish government also gives tax incentives to renewable generation companies.

In Spain, the public utilities are obligated to purchase offered electricity that is generated from renewable sources. The price paid depends upon the classification of the renewable source in terms of the certainty of supply, with the “guaranteed” category sources receiving 95 percent of the consumer price for their power, the “programmed” category sources receiving 90 percent, and the “other” category receiving 85 percent of the consumer electricity price. Generators can also receive capacity payments for short notice availability.

In Germany, the utilities are obligated by legislation, to purchase all power from renewable sources which is offered to them. The price paid is set at between 65 percent and 80 percent of the price paid by small consumers, although solar and wind power receive a higher amount of 90 percent of that price. The utility passes on these extra costs to the electricity end users in their supply prices.

In Italy the state owned utility Ente Nazionale per l’Energia Elettrica (ENEL) is the only market for the generated electricity. Legislation dictates the tariffs paid by this utility for electricity from renewable sources. The tariff offered for conventional generating plants is based on the avoided costs to ENEL. Increased tariffs are payable to generators using a renewable energy sources. ENEL pays premium prices for renewable generators and raises money for this directly from the consumers.

## DEVELOPMENT OF A BUSINESS PLAN

A lender asked to finance of a project will require a detailed business plan covering the financial projections and cash flow analysis of the project. The lender must ensure that the project is financially viable, and that loan repayments are assured.

Of relevance to the lender are the history of the developer key staff and company, the assets and liabilities of the company and the market place and associated business risk.

A wind generator with experience of the electricity market, with generation plants existing within the company portfolio and guaranteed sale of electricity through a contract to the local electrical utility, would be considered a relatively low risk to the lender.

On the other hand, a first time developer with no experience of the market, no utility contract, or dependent upon one company for short term power purchase agreements in order to sell its generation capacity, would be a relatively high risk to a lender considering debt finance.

A viable business plan would ideally cover the following aspects at the different stages of the project:

**1. Development stage:**

a) Site choice and plan of access roads and electrical connections,
b) Contract with landowner,
c) Site legal and planning requirements,
d) Environmental impact statement,
e) Choice of turbines and machinery manufacturer,
f) Power purchase agreement,

g) Sought form of bank financing and equity sources,
h) Financial projections and cash flow analysis.

**2. Construction and Installation:**

a) Proposed contractors and contracts used in installation and construction,
b) Equipment warranties.

**3. Operational Stage:**

a) Site operators and their contracts,
b) Management team members and their credentials and experience.

As part of the business plan, the lender will scrutinize the contracts arranged for the project, since risk can be transferred to outside parties through the use of contracts. The contracts of importance to a wind development are:

1. The power purchase agreement with the local electrical utility,
2. The machinery and electrical equipment purchase agreement,
3. The construction and installation contract,
4. The agreement with landowners for land use terms,
5. The operation and maintenance agreement,
6. The planning permissions with local zoning and county boards,
7. The insurance policies arrangements.

These contracts would ideally cover the duration of the sought loan and give reasonable accuracy within the cash flow analysis to ensure loan repayment. A project should seek a 15-30 years power purchase agreement according to the design lifetime of the equipment.

A difficulty is that suppliers would not be likely to offer contracts longer than 1-2 years, since they are concerned about fluctuating electricity prices and legislative changes to the market place.

Operation and maintenance agreements typically cover a 4-5 year period. Banks arranging a loan are usually flexible in terms of security of repayments and term of repayment for a viable project, and thus loan negotiations are based on the individual needs of the project.

To be able to obtain acceptable and profitable financing, the burden is however on the wind developer to assure the potential lender that all the financial risks associated with the project have been reduced as much as possible.

## SOURCES OF FINANCE TO THE INDIVIDUAL DEVELOPER

Alternative borrowing possibilities for the individual exist. Some countries like Denmark have been mostly dependent on individual ownership to develop their wind energy resources. For an individual wishing to exploit a wind resource on his property, or develop a wind farm on a small scale in his locality, capital for such small ventures is likely to come in the form of equity from the individual’s savings, friends and family contributions or from supportive community groups. It is advisable to the borrower to obtain legal and financial advice to ensure that the risks have been absorbed by the external parties through contract arrangements.

Since the needs of a small scale development are small, the borrowing arrangements are straightforward:

**1. Line of credit:** This is an option made available on a customer's bank or credit union current account. There is likely to be an agreed limit to the credit line. The advantage of using a credit line is that it is flexible allowing the borrower to take no more than is required. The loan is repayable on demand, however, which leaves the borrower vulnerable. Lines of credits are usually associated with high interest rates.
**2. Home equity loans:** These loans use the individual's home equity as collateral. Their advantage is that the interest paid could be deducted as interest expense on the individual's tax return.
**3. Personal loan:** This is for a fixed period, with repayments made in installments over that period. Personal loans are usually given without the need for any collateral or security. Personal loans have high interest rates.
**4. Credit cards:** The value of the loan on a credit card is linked to the value of the purchases, and so this means the loan is flexible, allowing the borrower access to no more than is necessary. A percentage of the loan is usually required as repayment every month, and interest rates are very high. This option is not recommended, since the interest paid may be drastically increased on a short notice.
**5. Equipment purchase loans:** The loan is linked to the purchase of a piece of equipment, and so the borrower has access to only what level of finance is required for the purchase. The loan is for a fixed period, with regular payment of installments over that period until ownership is finally passed to the borrower once the loan is fully paid off.
**6. Mortgage:** The loan is secured by property, and is for a fixed period that is usually long term around 15-30 years. This can be a relatively cheap form of finance, with tax relief on payments and a secured loan that provides little risk to the lender.

## ALTERNATIVE SOURCES OF CORPORATE FINANCE

Corporations and companies have a larger choice of alternative sources of finance than individual investors. These comprise:

**1. Internal funds:** Profits from existing projects are reinvested back into the business to fund new ventures, rather than being paid out in dividends. This may not be popular with the shareholders, but is attractive to the company since they avoid the issue costs associated with external funding. The balance of the funding may then be found from alternative, external sources.
**2. Bonds and debentures:** These are securities with a fixed interest rate, to be paid on a specific date. Bonds and debentures are usually secured against company assets to ensure repayment to the holders. Bonds generally have lifetimes of 10-40 years.
**3. Trade finance:** Corporations sometimes finance working capital by delaying payment to their creditors. This action gives effectively free short term loans, but misses the opportunity of prompt payment discounts.
**4. Banker acceptances:** A customer, instead of immediately paying for goods received, may send the supplier a bill of exchange, promising to pay an amount to the supplier in

the future. The customer may first have to pay a bank a fee to guarantee the bill. The supplier gets a choice of keeping the bill and presenting it to the customer upon maturity for payment, or of selling the bill at below face value to a bank or lender company and receive the reduced amount at an earlier date.

**5. Commercial paper:** This is a bill of exchange sold by a corporation to raise short term finance which, due to the reputation of the institution, does not require an acceptance or guarantee.

**6. Venture capital:** This is finance provided to companies, in the form of loans or equity, at the early stages of development.

## PROJECT EXAMPLES

### TRIMONT AREA WIND FARM

**Fig. 1: Trimont energy wind farm, Minnesota. Photo: PPM Energy.**

Landowners numbering 44 individuals in Martin and Jackson counties in Minnesota launched in 2001 the Trimont Area Wind Farm Limited Liability Company (LLC) near the Lakefield Junction station power plant.

As part of the LLC, each landowner received 1 percent of the company's shares by contributing 80 acres of wind rights and an equity contribution of $7,500.

The Trimont Area Wind Farm LLC operated 67 General electric (GE) wind turbines of 1.5 MW rated maximum power each for a total capacity of 67 x 1.5 = 100.5 MW. This was Minnesota's first commercial scale landowner developed wind farm.

In 2005, the LLC was sold to PPM Energy from Portland, Oregon, which became the operator of the wind farm.

Under the arrangement, the landowners benefit from revenue participation in shares of PPM Energy, a Scottish Company, as well as from traditional easement payments. The present contract of PPM Energy with the Trimont Wind's landowners stipulates that for every 1 percent share of the company they own, they receive 4 percent of the gross energy produced per year up to a cap. The cap will be reached in 10-20 years depending on the wind power extraction. The landowners also receive $4,000 per installed wind turbine per year. In addition, they continue farming or grazing their land around the wind turbines. This project provides more benefits to the landowners than the typical wind farm project.

An extra benefit accrues from the project to Jackson and Martin counties in the form of production tax revenues in the range of $350,000-$400,000 yearly payment.

## MINNESSOTA WIND PARK

### Description

The total Minnessota wind park project includes twelve wind farms located on twelve sites in south western Minnesota. The project was developed by DanMar and Associates, Inc., a Minnesota based development company. The Wind Turbines were supplied by Suzlon Wind Energy Corporation from India. The power produced is sold to Northern States Power Company, a subsidiary of Xcel Energy, Inc. and to Great River Energy.

### Production Incentives

The projects qualify to receive cash Minnesota Small Producer Incentive, MSPI payments of $0.015/kWh produced for 10 years. The project is also eligible to utilize the federal Production Tax Credit, PTC of approximately $0.018/kWh generated and sold (escalated by the annual change in the Consumer price index, CPI) for 10 years.

The MSPI provides cash payments per kWe.hr of energy produced for 10 years to encourage wind farms projects. Each project is owned by a local farmer or small businessman and qualifies for the MSPI.

The project was conceived as a means of allowing local farmers and businesses to benefit from south western Minnesota's considerable wind resources through actual ownership of the facilities.


**Fig. 2: Raising nacelle at a Minnesota wind park project.**


**Fig. 3: Installing nacelle at Minnesota wind park project.**

**Technology**

The projects have been constructed using Suzlon S.64/950 kW wind turbines with 64 m rotor diameter and 64.5 m hub height. Some of the features of the wind turbines are:

**1. Micro-pitching:** Full span blade pitching is used with 0.1 degree resolution and a response time of 30 msec for fine tuned power extraction.
**2. Minimum stress and load:** Well balanced weight distribution ensures lower static and dynamic loads.
**3. Grid-friendly power quality:** High speed asynchronous generator with a multi stage intelligent switching compensation system delivers power factor up to 0.99 with harmonics free sinusoidal power.
**4. Higher performance:** Designed to achieve high efficiency and coefficient of power.
**5. Power Output**: Wind resource analysis utilizing three and a half years of wind data

has been performed for each location. The estimated energy output from these projects is approximately 86 million kW.hr per year.

## DISCUSSION

Whether collaborating with developers, joining a partnership, or going at it alone, harvesting the wind promises to be profitable, as long as the process is conducted with emphasis on safety and environmental stewardship.

## REFERENCE

1. Katie Sauk, “Wind Power Your Future,” Farm Industry News, pp. 12-18, Dec. 2006.