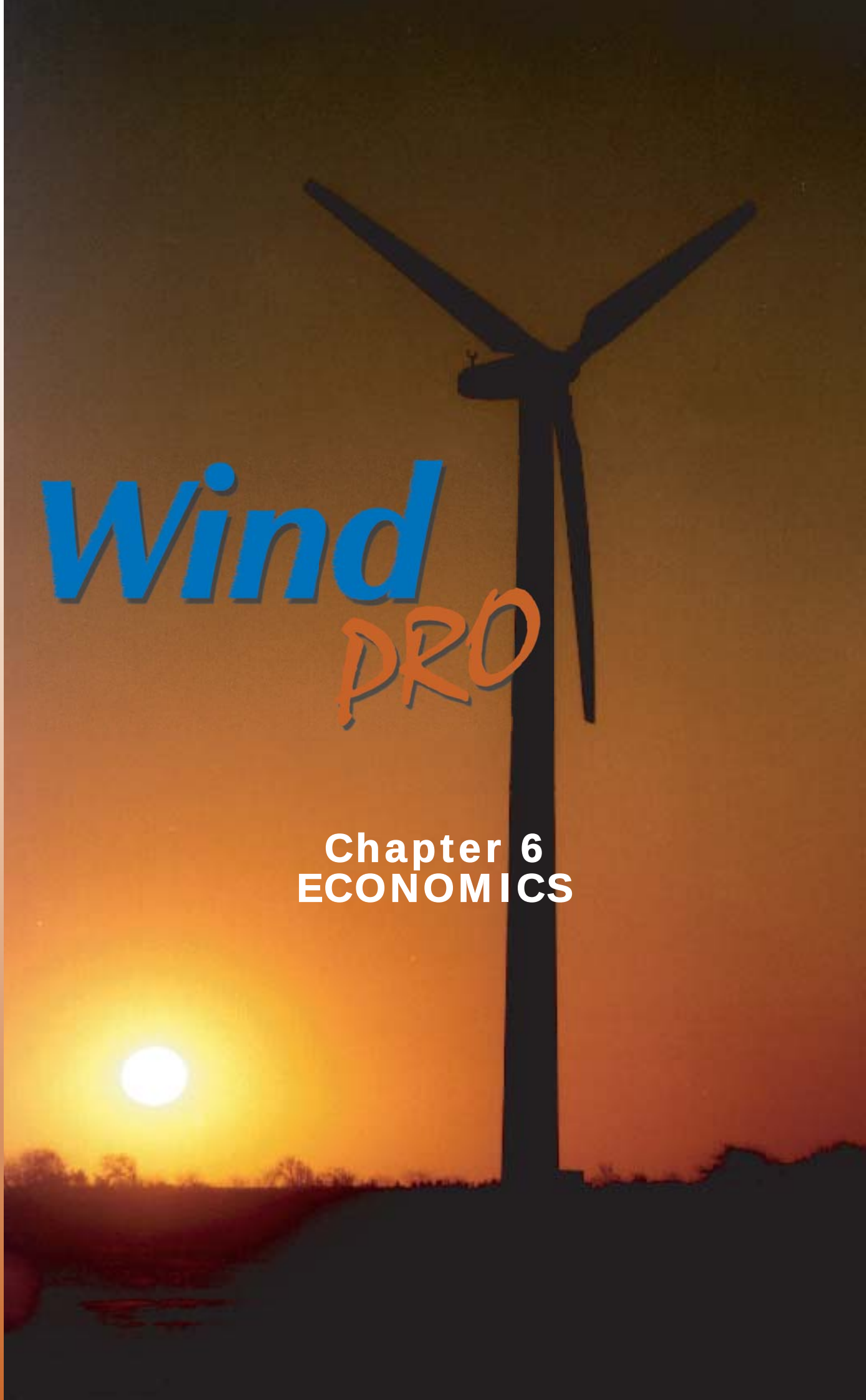


Chapter 6
ECONOMICS

EMD
www.emd.dk

6. ECONOMY - WINDBANK

6.0 WINDBANK – Introduction and step-by-step guide

6.0.1 Introduction to WINDBANK

The financial evaluation of a wind energy project may be the most important project development task. It is, in the end, when all needed approvals are settled, the financial circumstances of the project, which decide whether or not the project will be realized. With the WindPRO module WINDBANK such a decision will be taken on a well-documented basis.

All the documentation, as well as a survey with few key figures and a complete budget, which will satisfy bankers and other qualified office managers, can be printed.

The WindPRO module WINDBANK is, in the present version, furnished with a line of specific facilities which correspond to the Danish tax law, but it will operate under more general conditions when investor is located in other countries.

WINDBANK handles 4 different “owner constructions”:

Cooperatives - where special calculations for each coop can be generated
Private owned – where the owners private tax issues can be mixed with the wind farm investment
Company owned – “standard” company investment
Company coop – more companies has shares in the project, prints for a specific share possible.

WINDBANK can also be used for economic evaluation (the value for the community), it is just a question of proper selection of the relevant input data.

The WINDBANK module is based on templates, which makes it fast to define a new calculation based on previous calculations, where only minor corrections has to be made.

6.0.2 WINDBANK Step-by step-guide

- Calculate the energy production with PARK or METEO/MODEL (to be able to transfer WTG-type, size and energy production automatically)
- Start the WINDBANK module – load a template from "Standard" or other previous calculation.
- Go through all tab-sheets in order to define all parameters.
- Calculate and Print reports.

6.1 WINDBANK – Calculation methods and key figures

6.1.1 Calculation methods

As previously mentioned, WINDBANK is furnished with special features which are constructed for calculations based on Danish regulations (especially tax regulations), but in all other cases, WINDBANK operates after the often standardized general taxation and depreciations regulations which are used in most other countries. Facilities for calculations based on specific regulations in other countries but Denmark will be developed upon request.

Basically, an annual account is divided into the following items (based on general accounting principles):

Operation budget:
+Income (sale of electricity + evt. value of replaced consumption generated by the WTGs)
-Expenditures (O&M + Book Depreciations = reduction in the value of the Installations)
=Working Profits, Ordinary, before tax and interests

-Financing (Interests only)
-Taxation
=Working Profits

Balance budget:
ASSETS
Installations (value of hardware after Book Depreciations)
Cash Balance (amount on account where the annual liquidity is accumulated)

LIABILITIES
Net Worth (own capital)
Debts

The Annual Liquidity consists of the annual growth of the cash balance. It is important to face the difference between “operation budget” and “liquidity budget”.

The liquidity budget (or cash flow) gives the year by year amount available for investor including taxation.
The operation budget expresses the year by year value of the project. Here the depreciation reflects the annual loss in value, whereas in the liquidity budget, the depreciation is “replaced” with the annual repayment of loans and thereby the amount that “in real” is withdrawn from the cash balance.

Operation budgets as well as liquidity budgets can be printed.

6.1.2 Key figures

An essential print from WINDBANK is the RATIOS. With these a fast look will tell if the calculation setup is reasonable or some unit has been wrong leading to wrong result.

Below an example of key figures (ratios)

RATIOS

		/kW	/m2	/MWh
Preliminary expenses	US$	1.967	-	770
O&M costs	average US$/years	53,2	-	20,8
Energy production	kWh/Years	2.554	-	-

Minimum life span for redemption of loan	13,2 Years
Simple pay back time	9,9 Years
Acc. liquidity, deflated	105 [mio. US$]
in % of investment	35,5 %
Net present value (Interest rate=6,0%)	51 [mio. US$]
Internal rate of return	8,5 %
Return on investment	35,5 %
Production price at calculation interest 5,0%	9,9 cent/kWh

Key figures, explanations:
Minimum life span for redemption of loan is the year, where accumulated liquidity (amount on saving account for all liquidity) exceeds the remaining debt.
Simple pay back time is the number of years needed to pay back the investment + operation costs within pay back time. Finance costs, tax and inflation are not included.
Acc. liquidity, deflated, is the total accumulated profit at the end of the project (includes tax etc.), deflated. Same in % of investment is a good indicator of the expected value of the project for the private investor.
Net present value (interest rate
Internal rate of return is the discount rate that results in a net present value of zero for the cash flow. Here is included all payments; investment, O&M, sales of energy etc., but not tax and finance. Should minimum be X as defined above.
Production costs at calculation interest X% is calculated as investment + discounted costs over life time with interest rate X divided with energy production over life time. The calculation interest X is defined as above.

Apart from the text above, following evaluations can be performed based on “modern turbines” > 500 kW:

Preliminary expenses (investment) should be (ultimo 2009 based) 1300 – 2500 US$ or 1000 – 2000 € per kW for onshore projects. Very deciding is the specific power – large rotor area per kW is in the high end. E.g. A Vestas V90 (90 m rotor diameter) is sold with as well 1.8 as 3 MW generator, the first mentioned will have an essential higher cost per kW.
Price per MWh should be between 400 – 800 US$ or 300-600 €.
O&M costs should be 15-25 US$ or 10 - 20 € per MWh.
Energy production 1500-6000 kWh/year/kW (full load hours) – this is a wide span reflecting that wind recourses can be very different over the world.

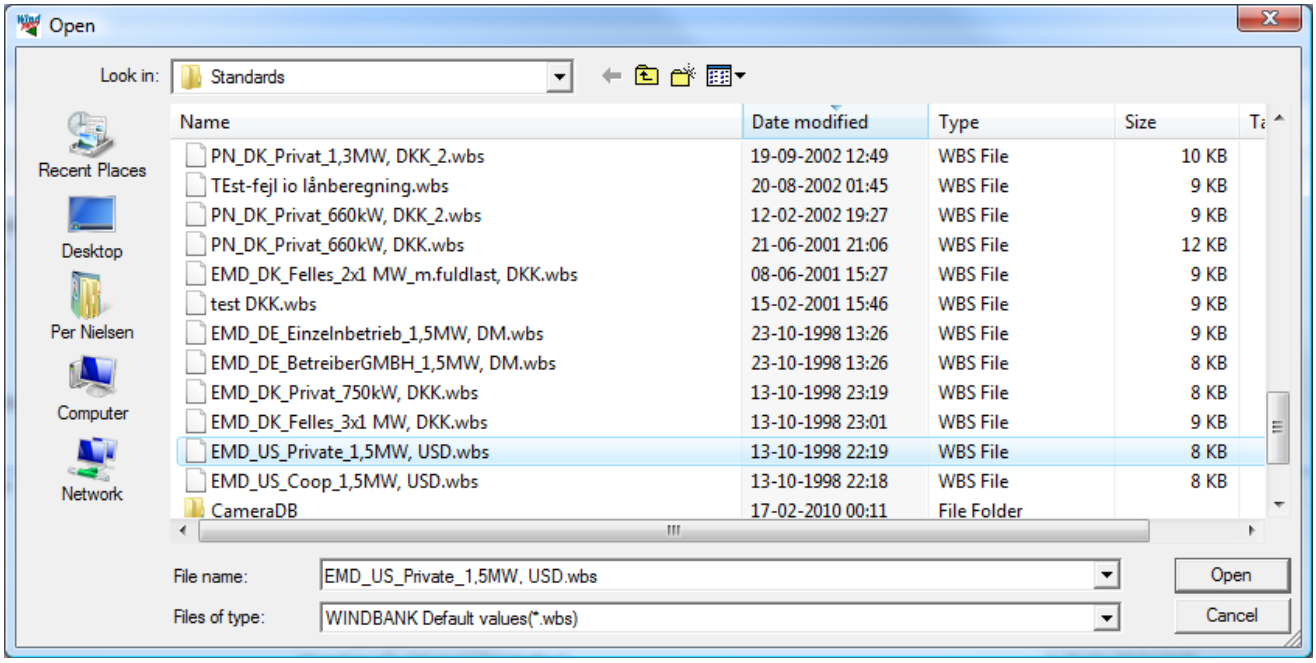
See http://www.emd.dk/files/Vindmøllers%20økonomi_EMD-Feb2010.pdf for more info on as well on as offshore project statistics and key figures.

6.2 WINDBANK – Entering data

6.2.0 Start the WINDBANK module

Click the green (or yellow for DEMO-mode) arrow in front of the WINDBANK module in the WindPRO main menu, and the input form will appear. But before you do this, you must enter some basic information in WindPRO Project properties (country, etc.) (See Chapter 2.BAISIS for further information on how to create a WindPRO project).

6.2.1 Open a template



The first item that will appear is the option of selecting a Template. A Template is a file, which contains some predefined data, which makes it faster to fill-in the input forms.

Some demonstration templates is offered in the folder WindPRO Data\Standards\

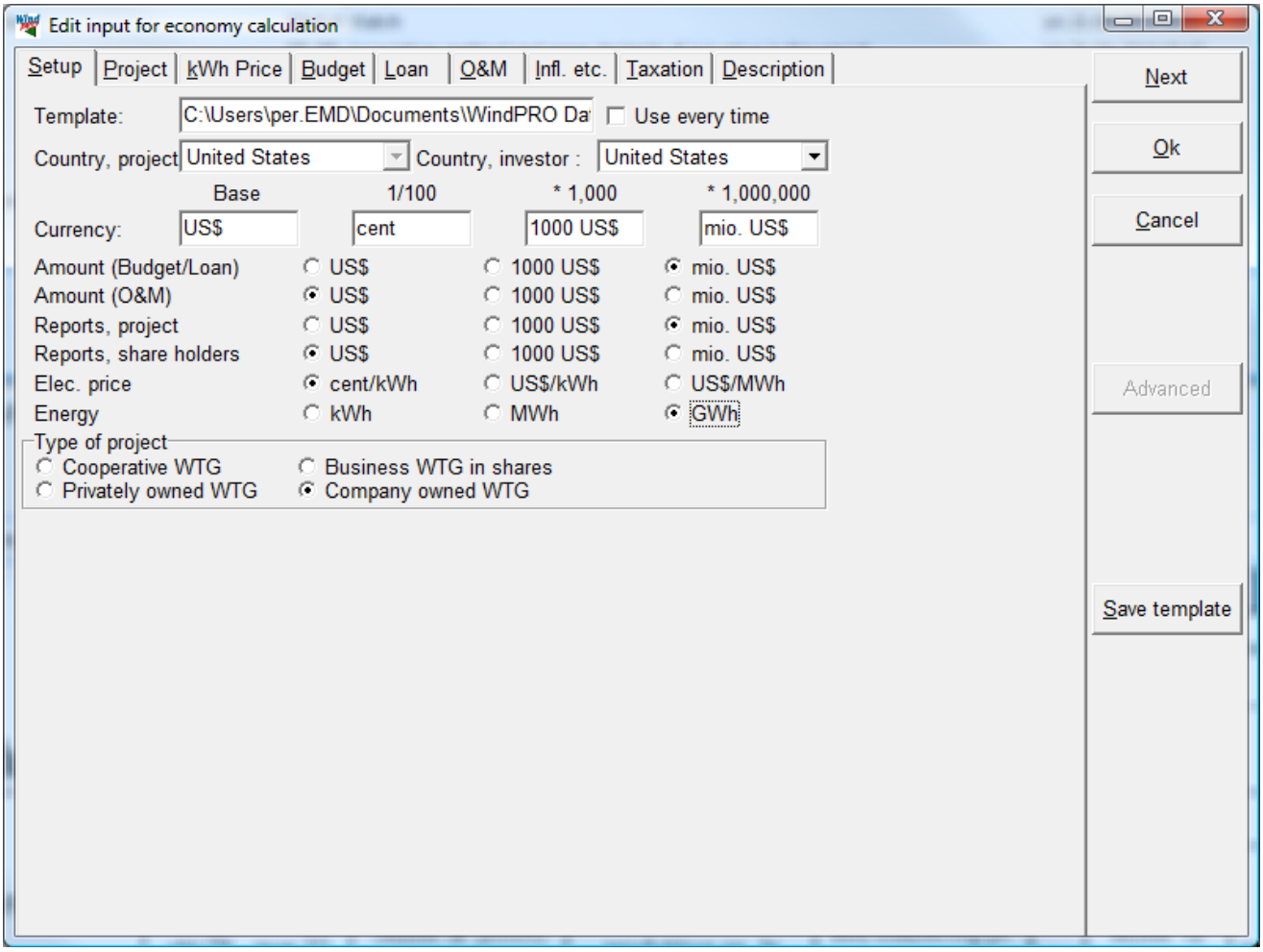
You can always save your own current WINDBANK calculation as a Template and load from another project.

Templates can, of course, be copied and distributed to other users. This will ensure uniform presentations and calculations. Make sure not to delete these templates when WindPRO is installed/reinstalled or you tidy up in the file structure. We recommend that you save a backup of these templates.

6.2.2 Setup

In Setup you specify:
Country, project; The name of the country for the project location in question has already been selected under Project Properties.
Country, Investor – gives at present only any difference if the investor is located in Denmark, while this gives access to specific Danish tax regulations.
Currency can be entered freely - this is only a text, which is appended to all printed figures. The choices for amounts/reports shall reflect the size of the project you are going to calculate.

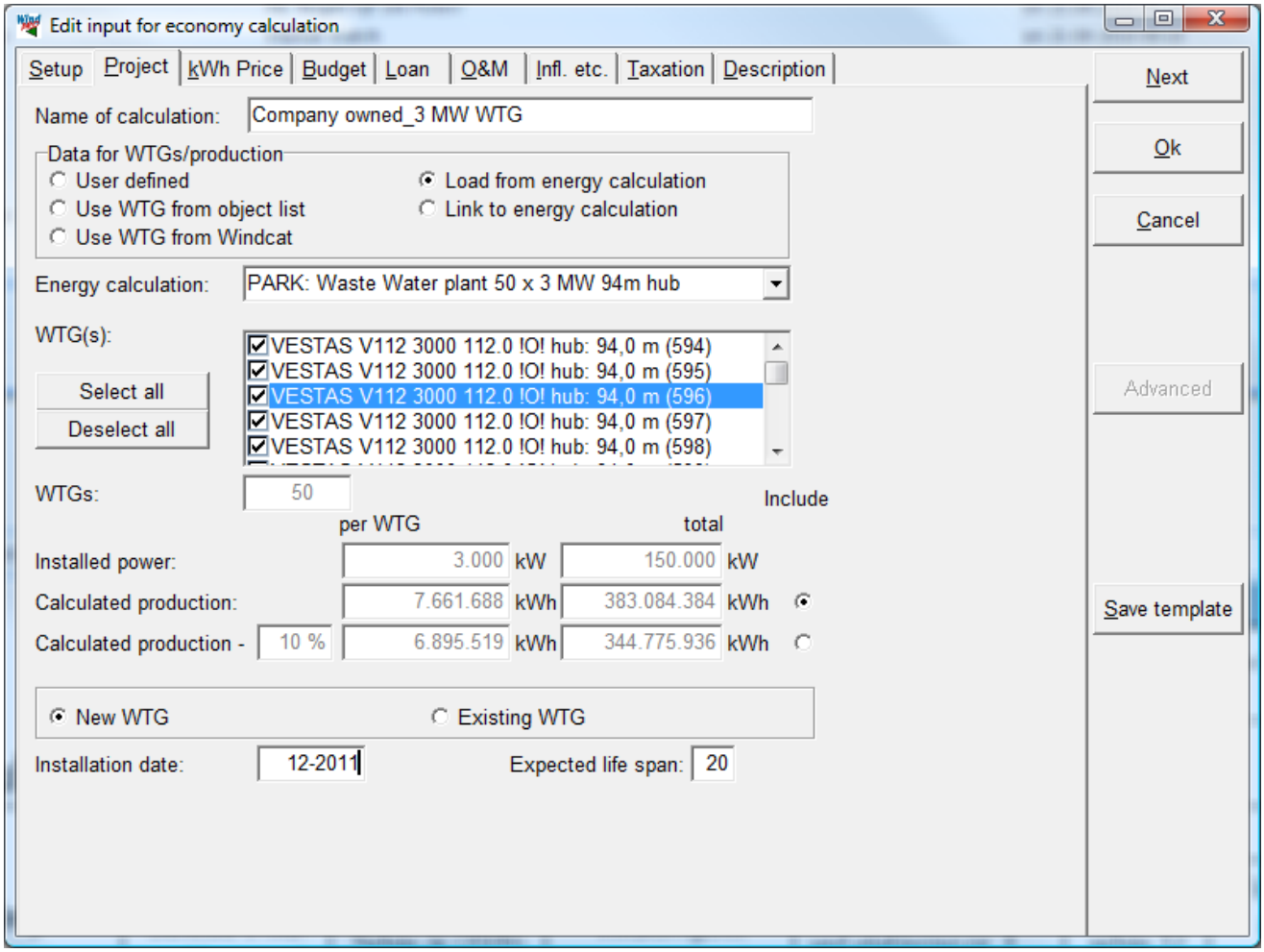
Type of project refer to the owner type, which for some input options gives access to different features.



If you mark the 'use every time' under Template you will always begin with this template when you activate WINDBANK.

If you mark 'Cooperative owned' as project type, you must enter the size of a share (in kWh) and number of shares for the "typical" Coop you wish to make a calculation for.

6.2.3 Project



The name of the calculation will appear on all the printed pages. This can be used to specify the particulars of the calculation in question - e.g. High Inflation Rate, Low kWh Price, etc.

The data regarding the production of the WTGs can be entered in various ways:

- Ø User defined: All data input are free.
- Ø Use WTG from object list: You get a list box with the names of the WTGs established as objects in the project (if any).
- Ø Use WTG from WindCat: You get a list box with the names of all the WTGs in the WTG Catalog.
- Ø Load from Energy Calculation: You import information from an already performed Energy Calculation into this project.
- Ø Link to Energy Calculation: As the above option, but with an automatic update of the calculation whenever the information in the Energy Calculation is changed.

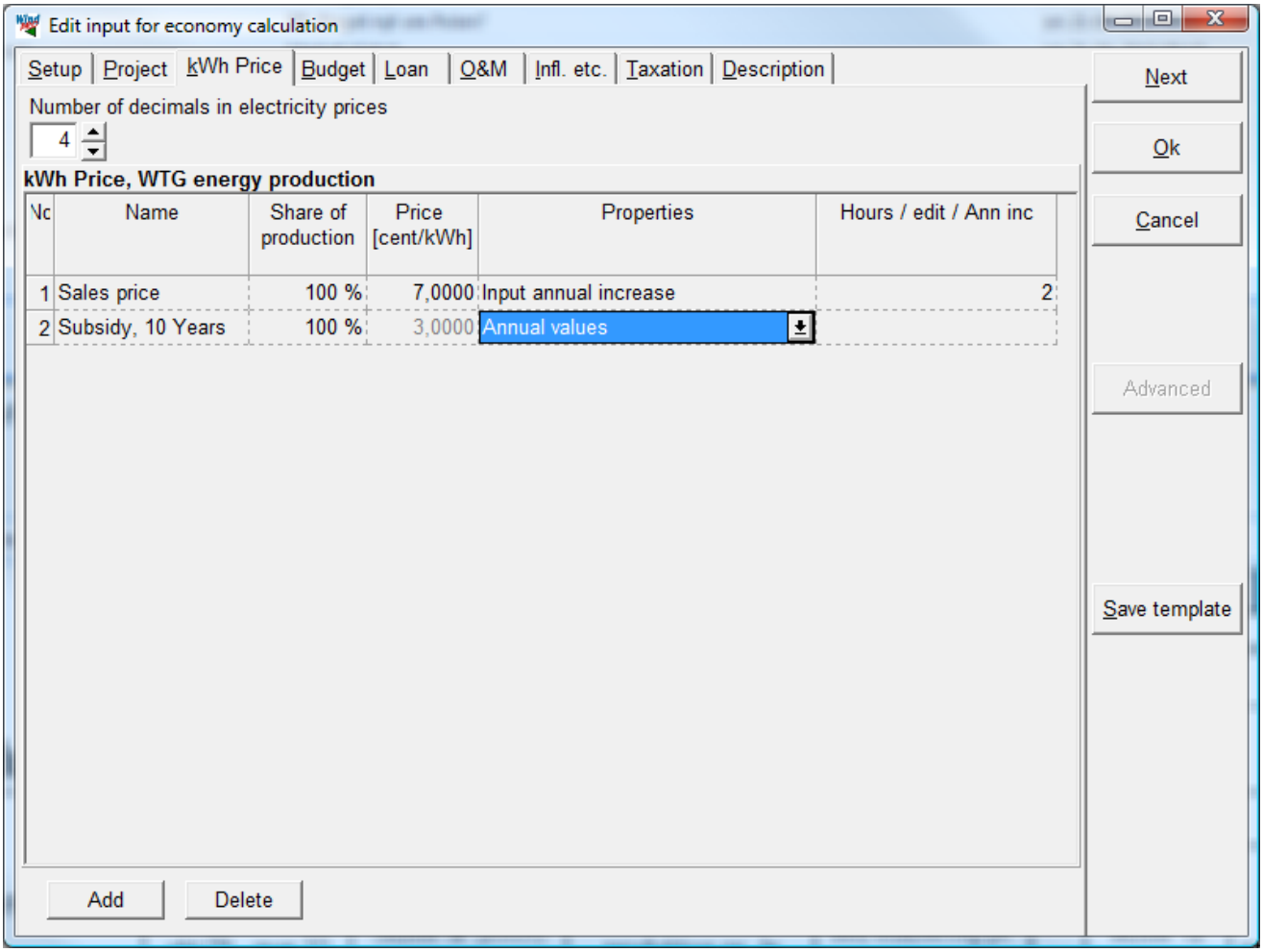
The field 'Calculated Production - 10%' will often be used to balance the uncertainties of the Energy Calculation. The 10% will often not be sufficient, as the estimated figure depends heavily on the terrain conditions and the available Wind Data. The 10% can be set to other value in the energy calculation and will by "load from energy calculation" be transferred to WINDBANK.

You can choose to perform calculations on "existing WTG", meaning that instead of Expected life span, you are asked to enter Remaining life span. The life span of a turbine project is normally 20 years, while the design basis of turbines typically is 20 years.

Installation date is very important to know how works: If the month 12 is used, the project is assumed installed the 31.12 and thereby there will be tax savings due to depreciation for the year "0" (installation year), but no income or costs – these will be 12 months based for the year 1. If another month is used, it will be the

end of the month installation is assumed. So installation in month 1 will give 11 months income and costs. There will be 12 month based depreciation

6.2.4 kWh Price

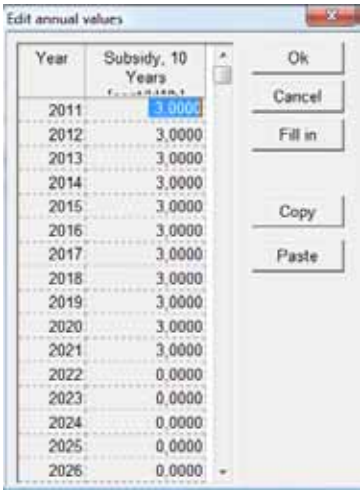


You can construct your own specific profile for the expected kWh price over the life span. If a part of the electricity is used for own consumption and another part is sold, both parts can be given individual pricing profiles.

The options for each input line are:
Name; e.g. Market price or Subsidy etc.
Share of production; If production is sold to different purchasers, or some of the production is used by owner specific prices can be given for specific parts of the production. In most cases there is only one and 100% is used.
Price; remember to input in the right unit as specified in tab “Project”.
Properties, the options are (in combination with the field **Hours…** to the right):

- Input annual increase – input the annual increase percentage in field to the right.
- Inflated – the inflation specified at the “Infl. Etc” tab is used for increasing the annual price.
- Annual values – freely defined annual values, see below.
- Limited by full load hours - input the number of full load hours with the increased price in field to the right.

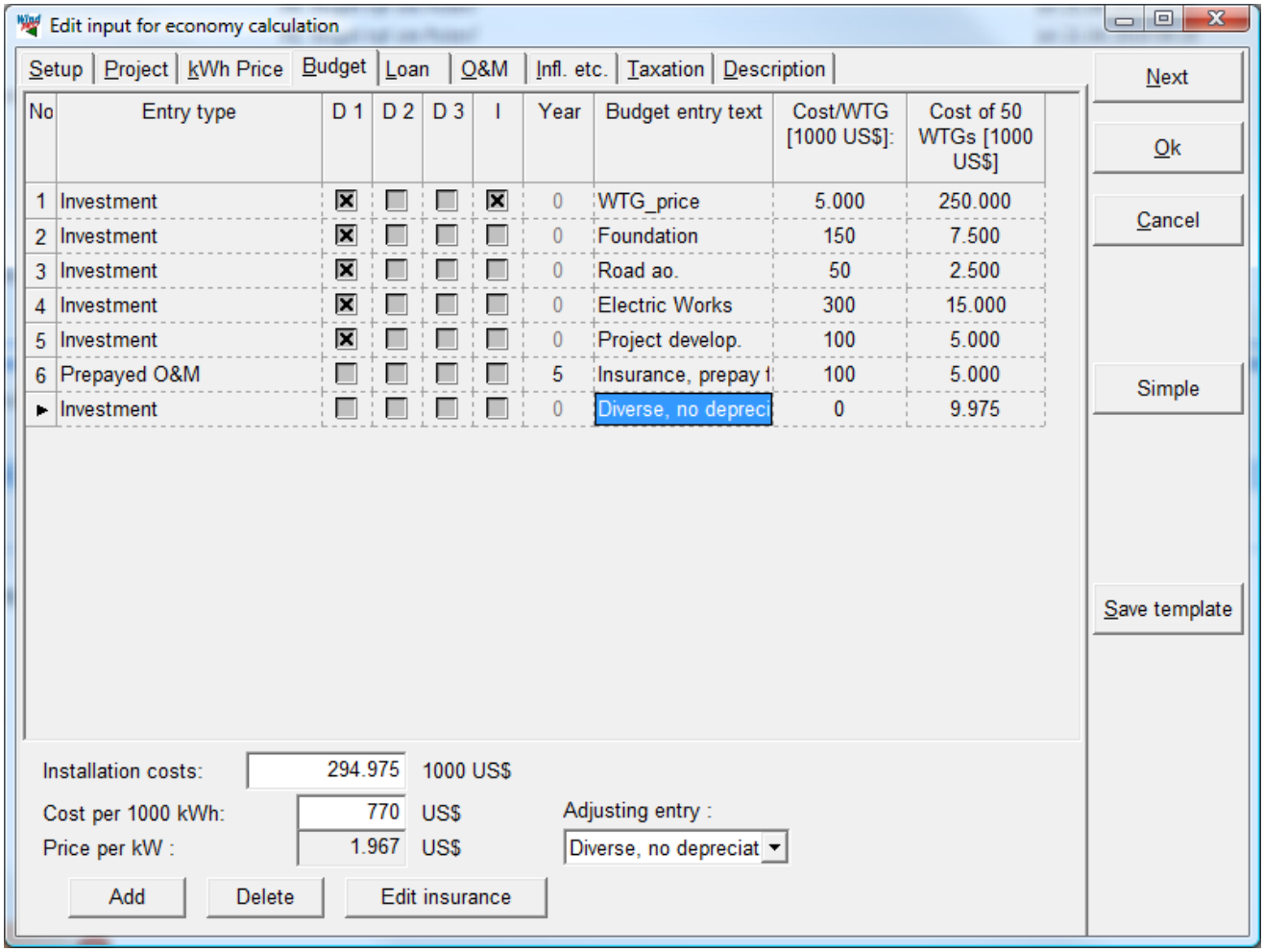
When “Annual values” is chosen, the input form below appears:



Here year by year values can be entered. With the “fill in” button, the current (selected) field value will be filled down to all remaining fields.

To review/edit annual values, just click in the field to the right.

6.2.5 Budget



A simple budget can be entered, or you can activate the “Advanced/Simple” button to get access to a detailed description of each budget line (see the above figure). The following items can be specified:

Entry type:

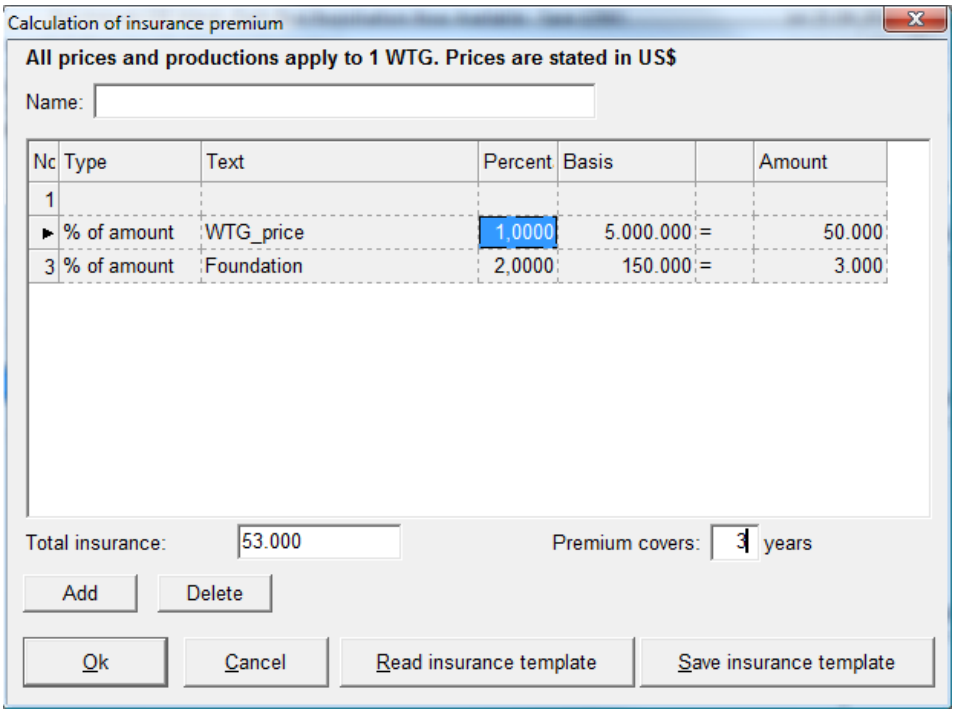
- Ø Investment - normal
- Ø Prepaid O/M - e.g. Service and Insurance for five years (which is included in the budget, but treated as O/M costs) – filled in combination with the "**Year**" column!
- Ø Automatically calculated Insurance - An AUTO- Insurance calculator can be loaded (see below).

For each entry type, different properties are available:

- Ø D: Depreciations: 3 different depreciation methods can be chosen. These can be defined at the "taxation" tab, where different percentages etc. can be chosen.
- Ø I: Insurance: - specifies whether or not the component shall appear in the insurance calculator

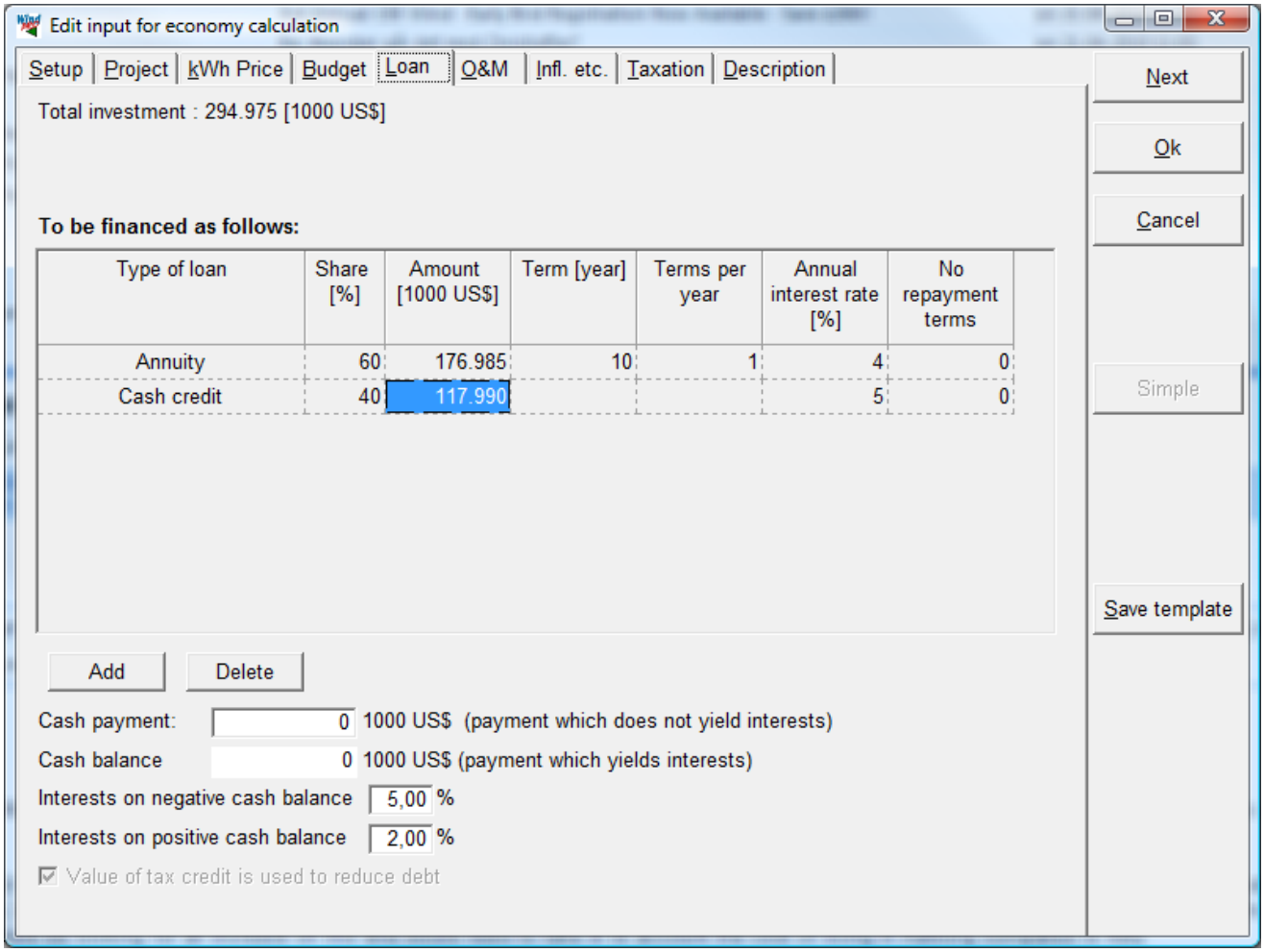
Adjusting Entry: One of the budget components can be chosen as an "adjusting entry" item. This makes it easy to get a nice round figure for the total budget price.

6.2.5.1 Insurance Calculator



Any budget entry marked under "I" under "Advanced" will appear, and can be multiplied with entered multipliers. It is not unusual to calculate insurance amounts in this way.

6.2.6 Loan



For a non-coop project only this type of loan can be selected. For coops project, this loan means that it is taken individual by each coop.

The following types of loan can be selected:

- Annuity (constant annual payment =(repayment + interest))
- Series (constant annual repayment)
- Index series (inflation adjusted principal)
- Cash Credit (repayment will automatically be calculated as the total profit each year).

Under 'Cash Credit' no Term shall be entered - it will be calculated automatically and 'Terms per year' will automatically be 1.

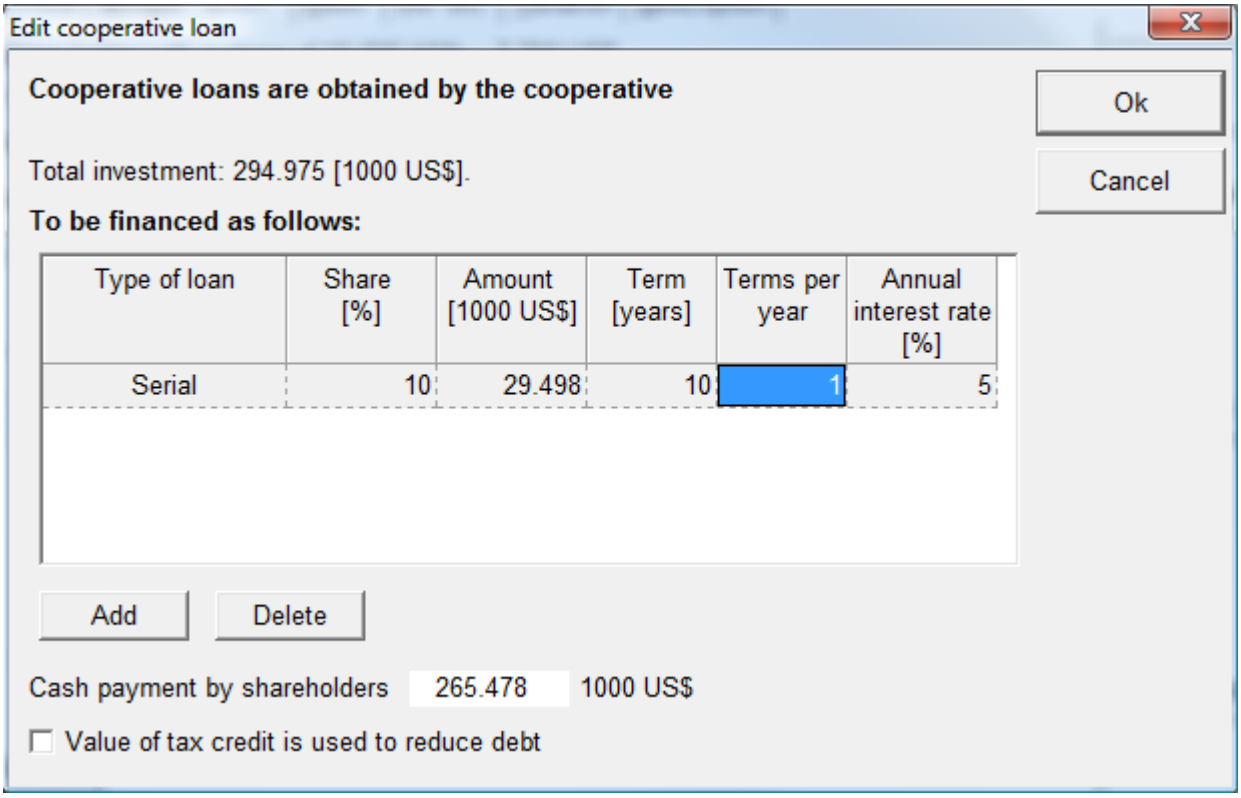
'Cash Payment' can be calculated with or without an Interest Calculation.

You can enter Interest Rates on as well negative as positive Cash Balances. A Cooperative Cash Balance is always positive or equal to zero.

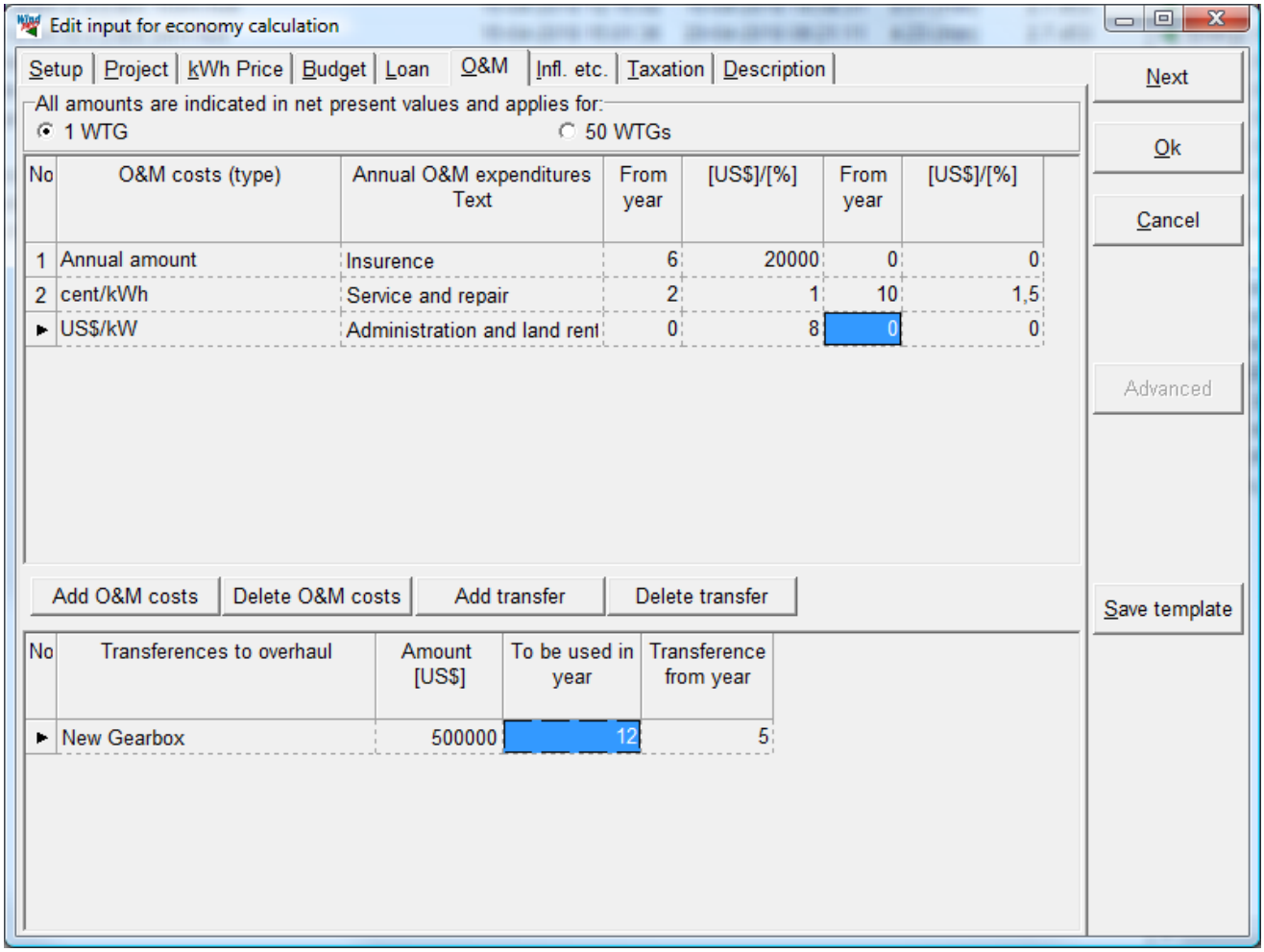
6.2.6.1 Loan by Coops (common loan for coops)

If the project type is a Coop, there can be specified loans granted to the Cooperative as collective loan, and not to the individual member of the Coop.

The input form for the loan follows the structure given previous, see input form below.


Edit cooperative loan
Cooperative loans are obtained by the cooperative
Ok
Cancel
Total investment: 294.975 [1000 US$].
To be financed as follows:
Type of loan
Share [%]
Amount [1000 US$]
Term [years]
Terms per year
Annual interest rate [%]
Serial
10
29.498
10
1
5
Add
Delete
Cash payment by shareholders
265.478
1000 US$
Value of tax credit is used to reduce debt

6.2.7 O&M (Operation and Maintenance)



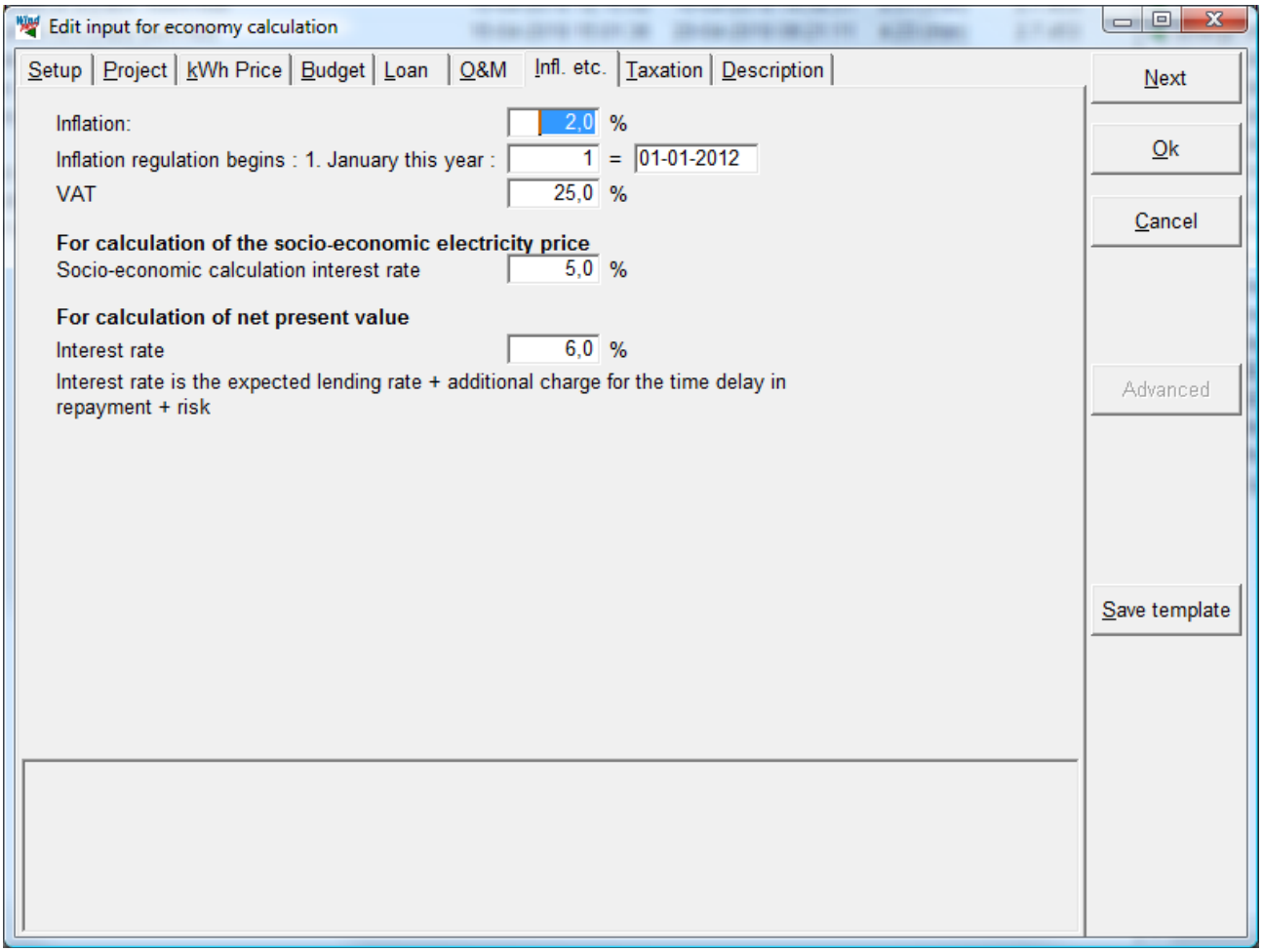
There can be specified 2 periods with different O&M costs.

O&M can be specified as several different components, where each and all of the components can be listed as:

- Annual amount
- % of investment (project costs)
- % of Electricity sale (annual income)
- Costs in specified Currency/kWh - e.g. 0.01 US$ pr. kWh produced electricity
- Costs in specified Currency/kW - as the above item, but pr. installed capacity
- Annual amount, no inflation – as first item, but not inflated

Transferences to overhaul - major investments will have to be expected during the lifetime of the wind turbine - e.g. new Gear box after 12 years, which will be saved during year 5-12 in example above.

6.2.8 Inflation, etc.

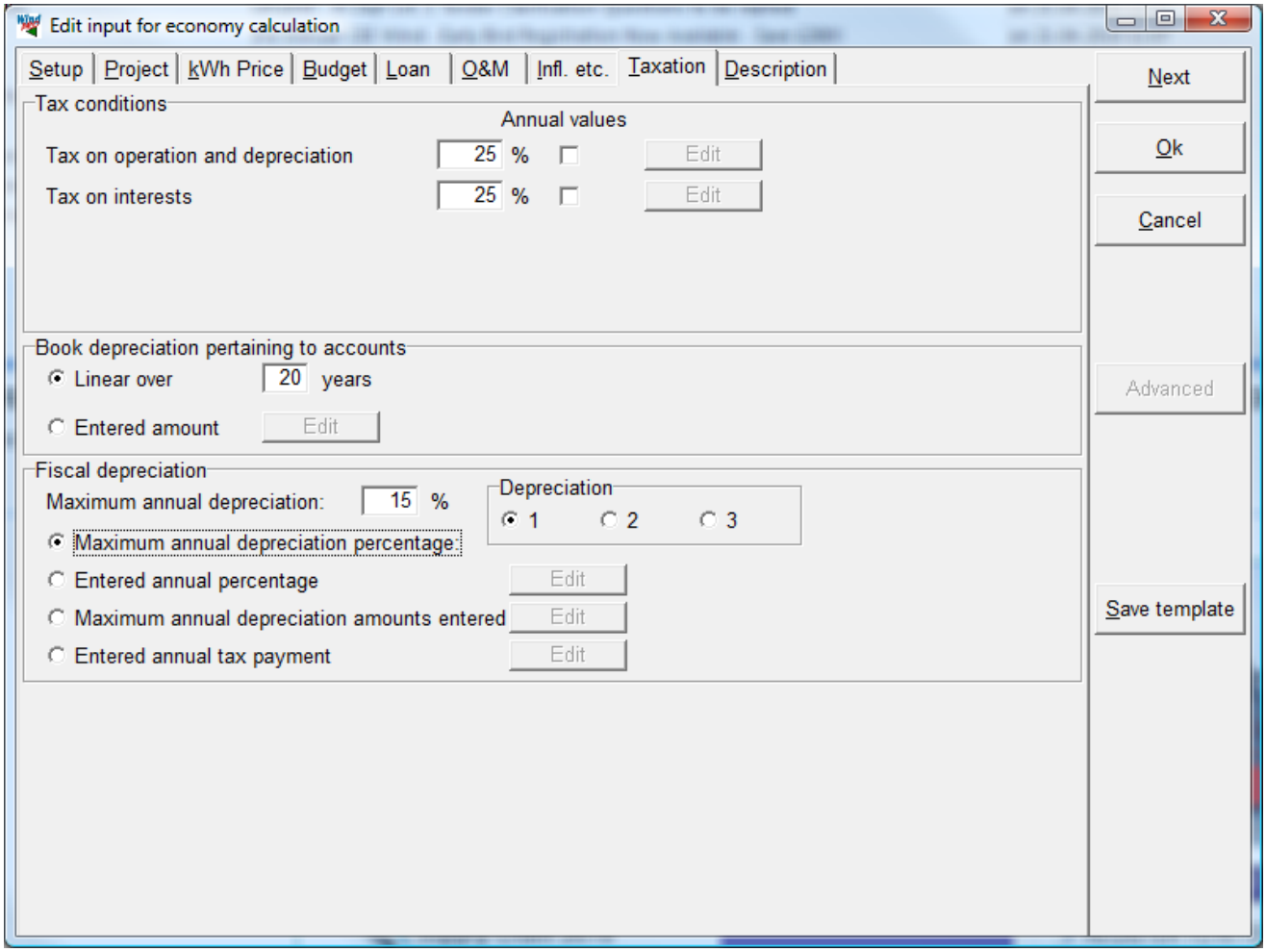


The VAT taxation amount will not affect the results in this version of WINDBANK - all amounts are assumed to be excl. VAT.

For a socio economic evaluation of project, the price per produced kWh can be calculated. For this a socio-economic calculation interest rate must be used. This is normally given by the government. The value is decided based on a combined evaluation of the interest level and the risk by the type of technology. The Government can based on the cost/kWh seen in a long term perspective tell which technology is cheapest to use for electricity production.

For net present value calculation, similar can be given a interest rate, where it is the investor who decides the interest rate based on expected risk etc.

6.2.9 Taxation



The Tax item can be divided into taxation concerning Operation & Depreciation and Interests. In some countries there will be different ways of treating tax savings on interests and on negative profit – if any.

The item 'Book Depreciations' affects the annual 'balance sheet', which is different from the 'annual liquidity' (cash flow). For the balance sheet, the typical way to handle depreciation is linear over the expected lifetime of the project, telling that the value of the project is decreased with a the same amount every year. But regarding tax, it is often allowed to make a faster depreciation. These regulations are made by the governments to give investors an incentive to investments, to make the county develop faster and be more competitive. That's why the "Fiscal Depreciation" can be handled separately, but it might not be useful in all countries.

The item 'Fiscal Depreciation', affects the 'annual liquidity', if the depreciation gives tax savings. The input of the depreciation can be given in several different ways. And there can be defined up to three different sets, which link to the budget lines, where one of the three different sets can be chosen. For the different ways to input, the first two will always work, while the last two only work in combination with the loan type "Cash credit". These work so the repayment on cash credits is adjusted in combination with the depreciation amount, so the fist years always will give a liquidity of zero. In other words, the project is handled so the repayment is as fast as possible, based on the project profit including tax savings due to depreciation. The four different depreciation input methods:

1. Maximum percentage: Each year the fiscal depreciation amounts to a given percentage of the project value, which is not written off in the balance sheet.
2. Entered annual percentage - the annual depreciation percentage can be entered separately for each year by using the 'Edit' bitmap button.

3. Maximum annual depreciation amount - gives you the possibility of letting the software calculate the annual percentage for depreciation based on the investors' capabilities of exploiting the tax allowances.
4. Entered annual income tax payment - as the above item, but where the software calculates the depreciation percentage from the tax allowances and income tax percentage.

Which methods and percentages that can be used depends on the local tax regulations, please confirm with an auditor.

6.2.10 Description

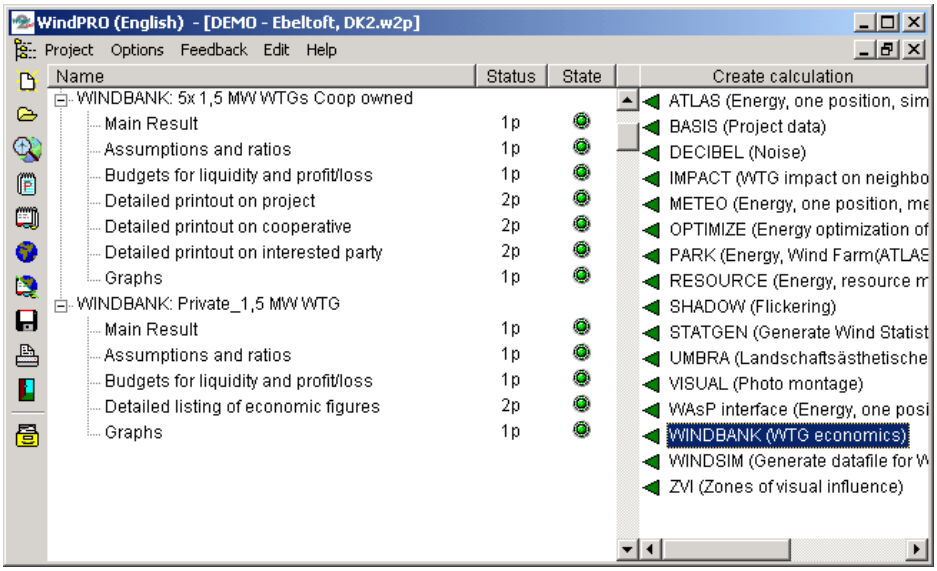
Any comments can be entered and will appear on each printed report page.

6.3 WINDBANK – Calculation and printouts

6.3.1 Starting calculation

When you activate the bitmap button 'OK' the calculation will start automatically.

After the calculation has been completed the following reports will appear:
Below as well an example of coop's owned as private/company owned WTG project are shown. The Coop's calculation produces 2 more reports than the private/company owned.



The Printouts can be activated for preview purposes by double clicking on the report name. You can also mark a report and click on the printer symbol. For a printout of all the reports, right click on the main heading.

6.3.2 Printouts

The printouts are divided into 5 different report types:

- Main result, with main figures (budget, financing and result).
- Assumptions and Ratios, with more detailed assumptions and some key figures.
- Budgets for liquidity and profit/loss estimates. Time Series with main figures (Cash Flow).
- Detailed financial statement for the "project" - with Time Series of all the calculated values.
- Graphs - graphic presentation of most of the important time series.

For Coop's 2 more printouts will appear:

- Ø Detailed financial statement for the Cooperative including how the economy for the Cooperative will interact with the Coop Members.
- Ø Detailed financial statement for the individual Coop Member (the interested party)

The printouts should be fairly self-explanatory - if not, don't hesitate to call at EMD.

But in order for you to understand the basic concepts of the economic figures, an overview of the main budget is given in part 6.1.