“How to use SinaSave” (Status: September 2009)

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SinaSave® 4.0

Products

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	SinaSave 3.0	SinaSave 4.0
VSD (low voltage)	Micromaster 430 / 440	Micromaster 430 / 440
	SINAMICS G150	SINAMICS G150
	---	SINAMICS G110 / G120 /G130 (NEW)
VSD (medium voltage)	---	Robicon Perfect Harmony (NEW)
	---	SINAMICS GM150 (NEW)
HTDD	---	HT-direct – air-cooled - (690V) (NEW)
FSD	IEC motors	IEC motors
	NEMA motors	NEMA motors

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Calculation Module (NEW)

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Fixed Speed Drives
Mechanical system assessment

Variable Speed Drives (LV / MV)	High Torque Direct Drives
Infrastructure costs	HT-direct - SINAMICS G150
Discount for drive converters	Gear unit - N-compact - SINAMICS G150
Business economic data	Gear unit – third-party induction motor - SINAMICS G150
Subsidies	Gear unit – third-party induction motor – third-party drive converters
	Operating characteristics
	Saving operating expenses
	Working machine

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Functions (NEW)

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Automatic update function
Resetting input values
Mechanical system assessment for 4-pole motors (Fixed Speed Drives)
Conversion – metric into the Anglo-American system of dimensions
Resetting input values
Central screen form to select the language, currency, pressure units / flow units and project data
Dynamic exchange rate update through EZB
Export to Microsoft Office
Optimized lifecycle cost calculation (VSD)

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User-friendliness

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SinaSave 3.0	SinaSave 4.0
The information area for the help relating to the input and output fields is centrally arranged	The help for the particular input and output field is associated with the specific input and output field
When entering data, a check is not made for errors	When entering data, a check is made for errors
Result sheet	Improved output structure of the result sheet

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Download from the Internet - Part I

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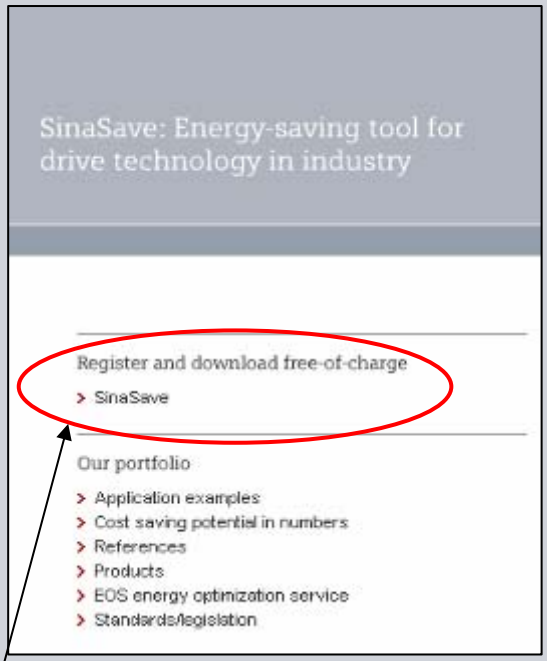
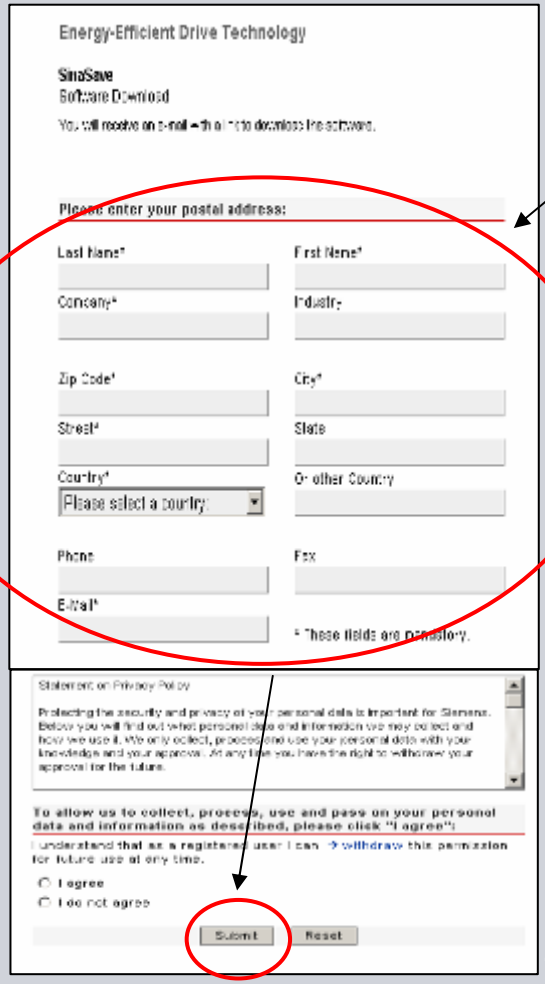
www.siemens.com/energysaving (general information about energy saving)

Link to SinaSave: www.siemens.com/sinasave



Click here and register

Fill in the form and submit



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Download from the Internet - Part II

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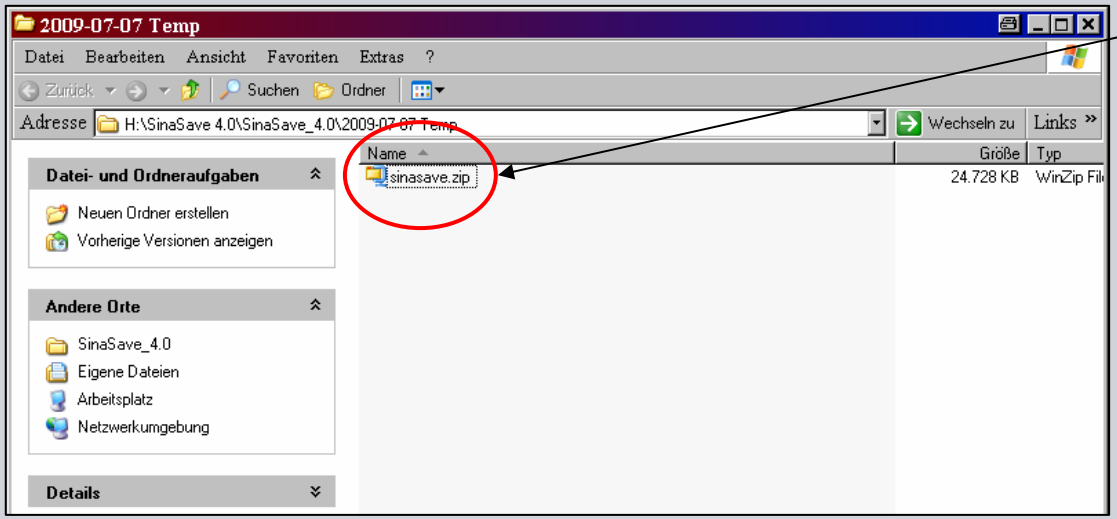
Dear Mrs./Mr. Chrimes,

thank you very much for choosing SinaSave.
Here you can download the software:

http://www.automation.siemens.com/cgi-extern/send-file_ld.pl/9456/sinasave.zip

E-Mail

Click on the link and open with WinZip



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Download from the Internet - Part III

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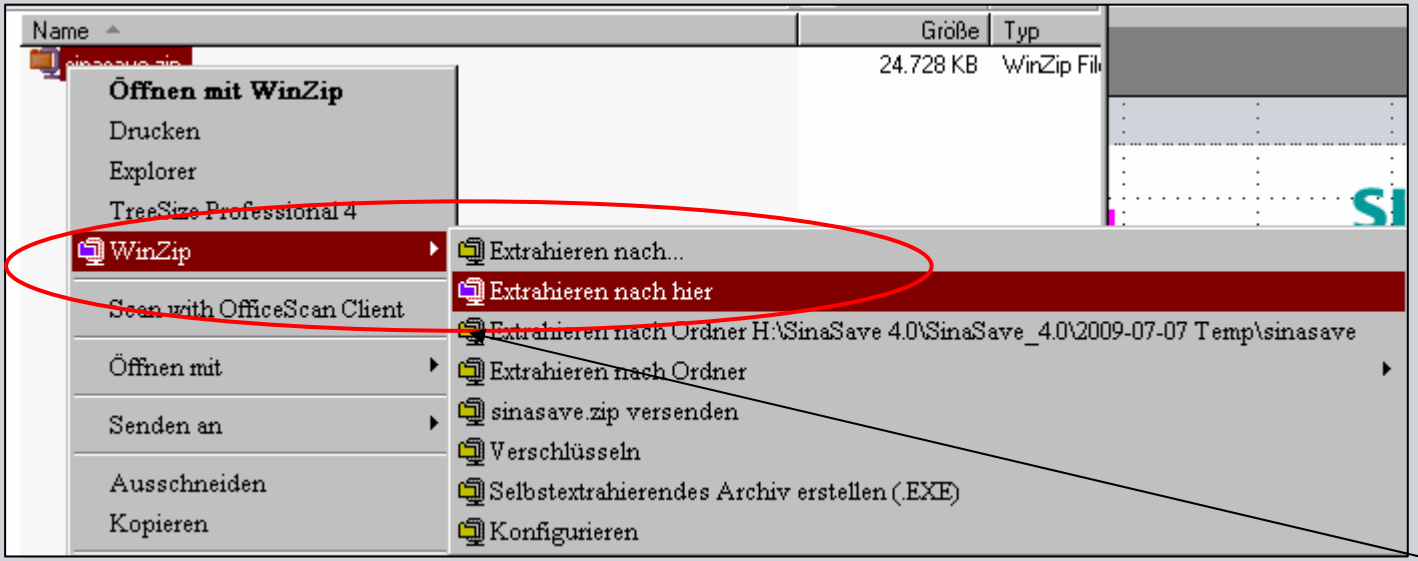
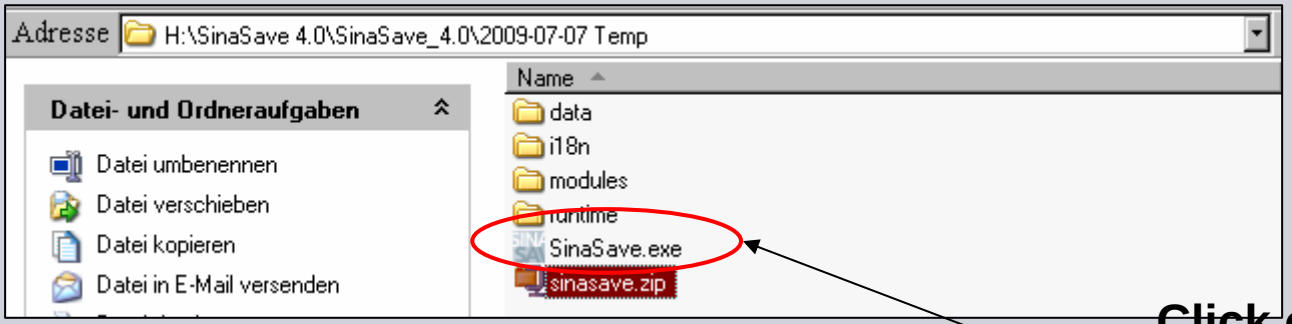


Righthand mouse click and select “extract to here”



Click on SinaSave.exe

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SinaSave® 4.0

Start / update

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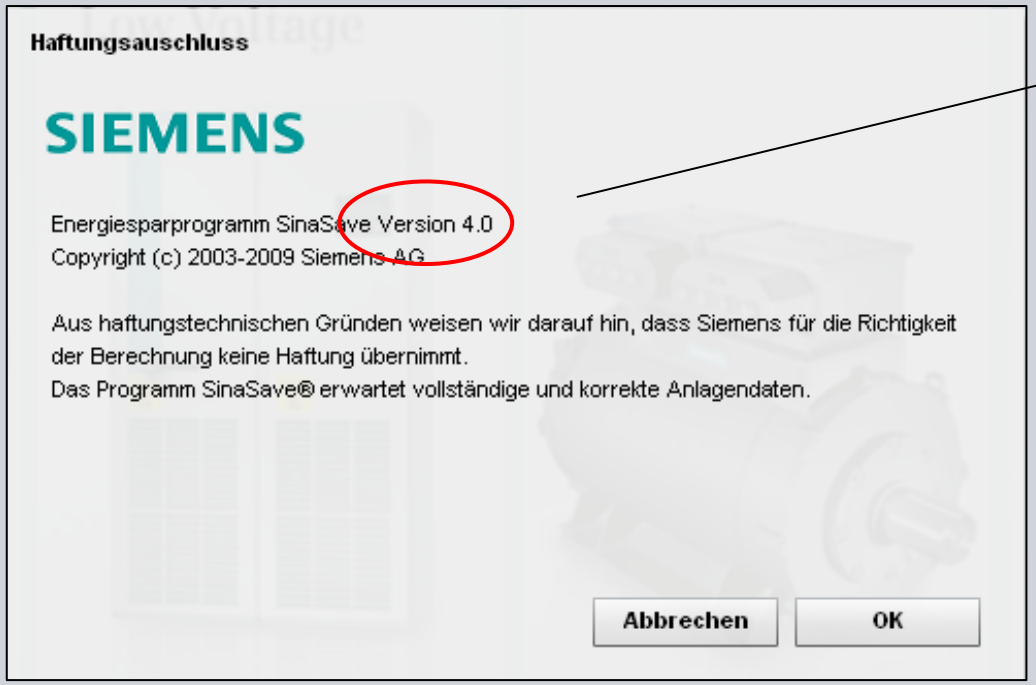

Current version

NEW: Automatic update function → runs when connecting with the internet (it involves, e.g. product prices)

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Project management

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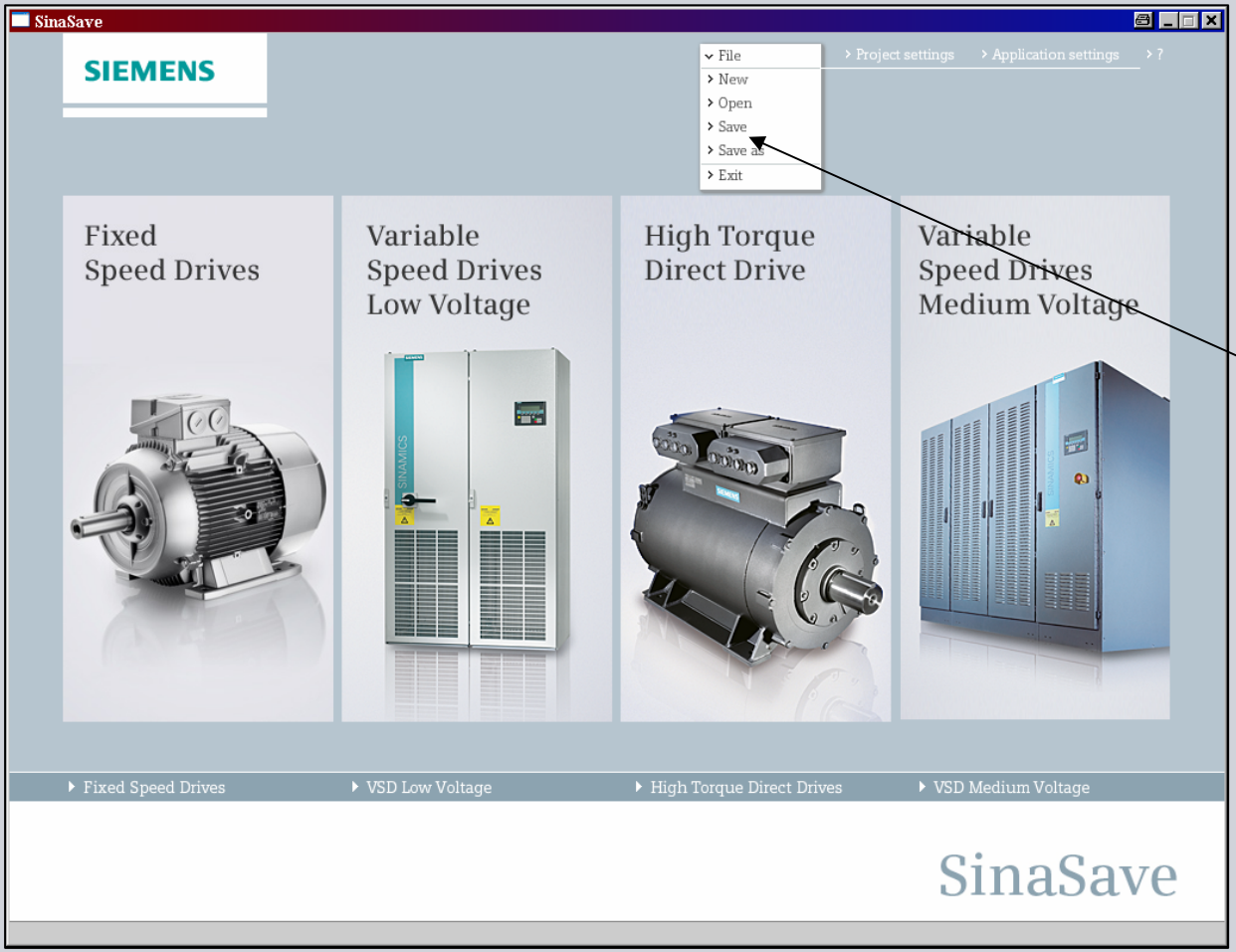

Set-up a new project, open and save

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Project settings

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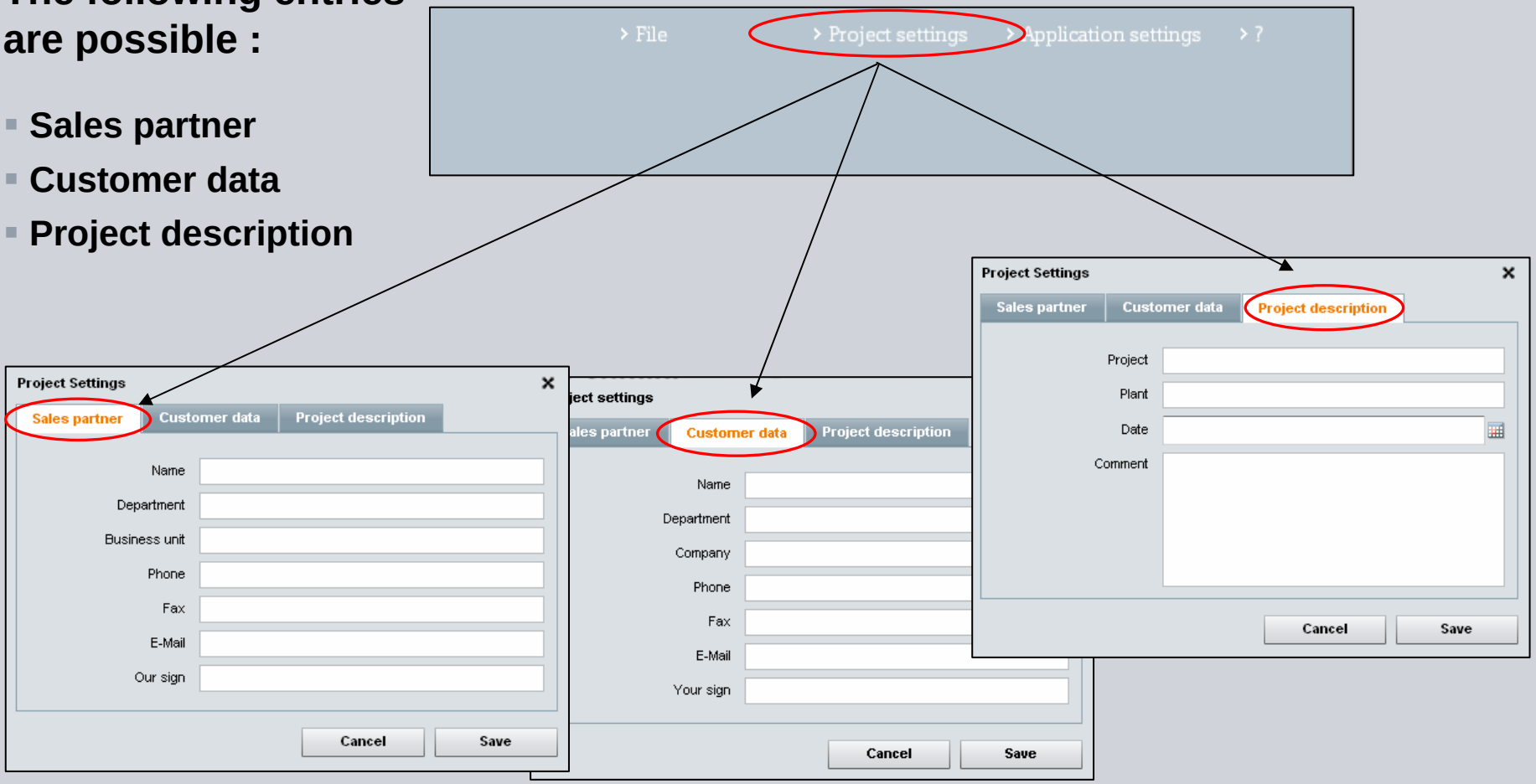
The following entries are possible :

- **Sales partner**
- **Customer data**
- **Project description**



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Application settings – language and currency

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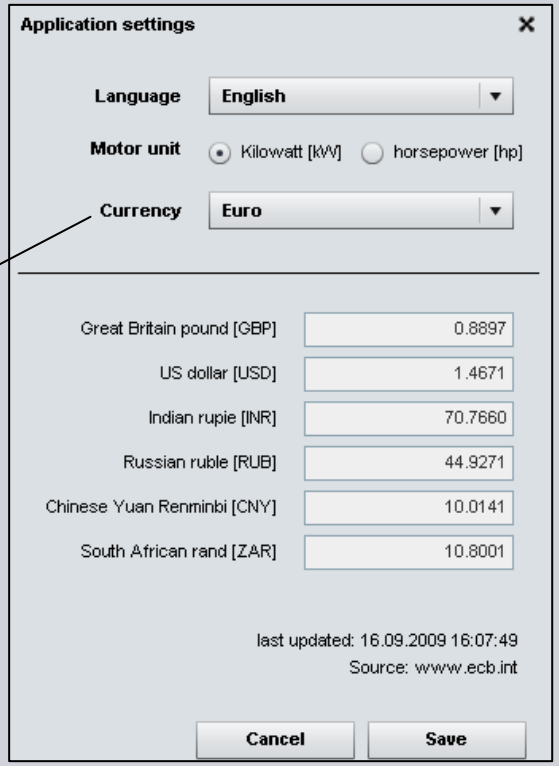
9 languages

German, English, Chinese, Spanish, Italian, French, Portuguese, Russian, Turkish



Up-to-date currency table

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Additional functions

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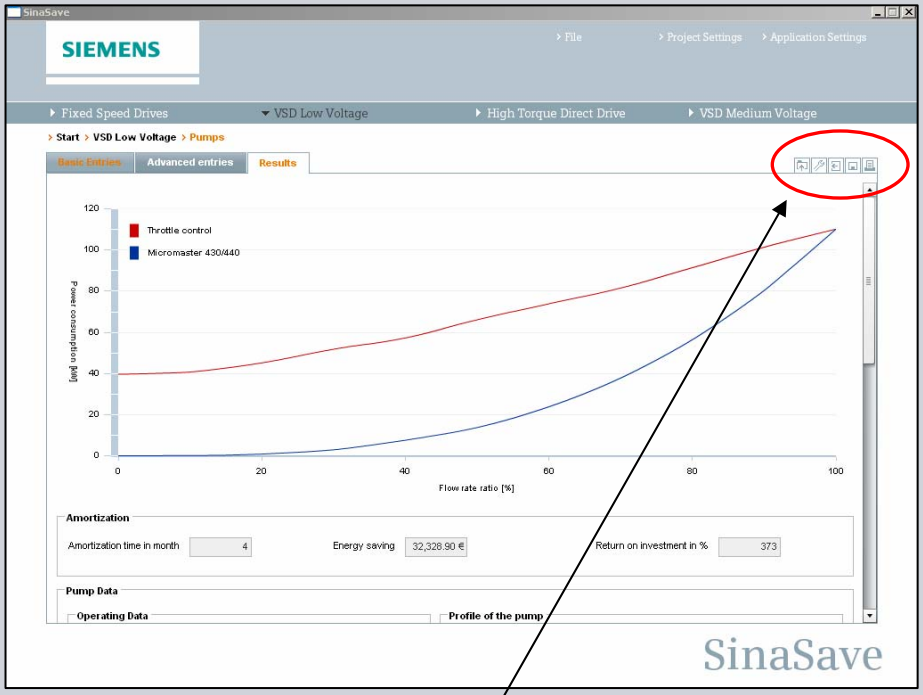
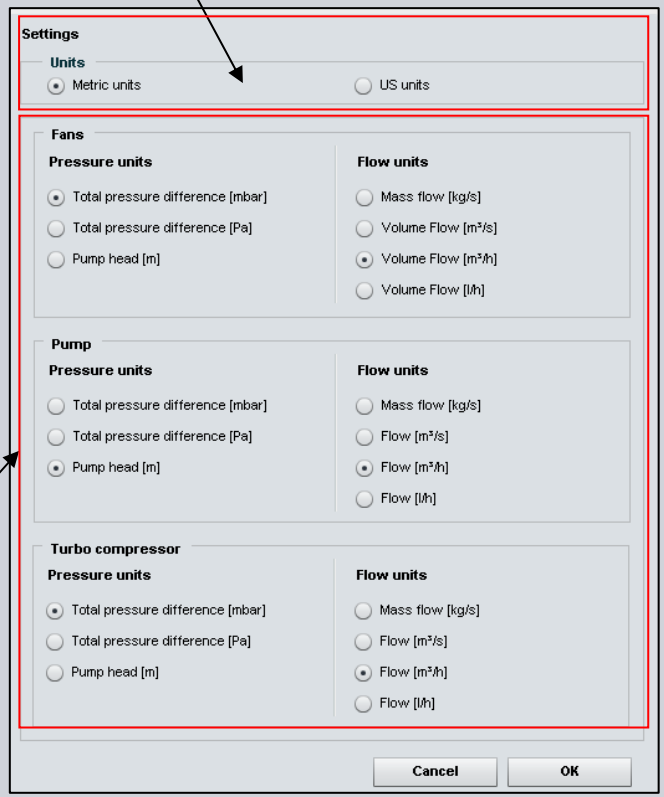


- **Export to**
- **(Project) setting**
- **Reset of the entered data**
- **Save**
- **Print**

Settings

Conversion from the metric into the Anglo-American system of dimensions



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Fixed Speed Drives

Basic entries - (IEC energy-saving motors) - EFF1 to EFF2

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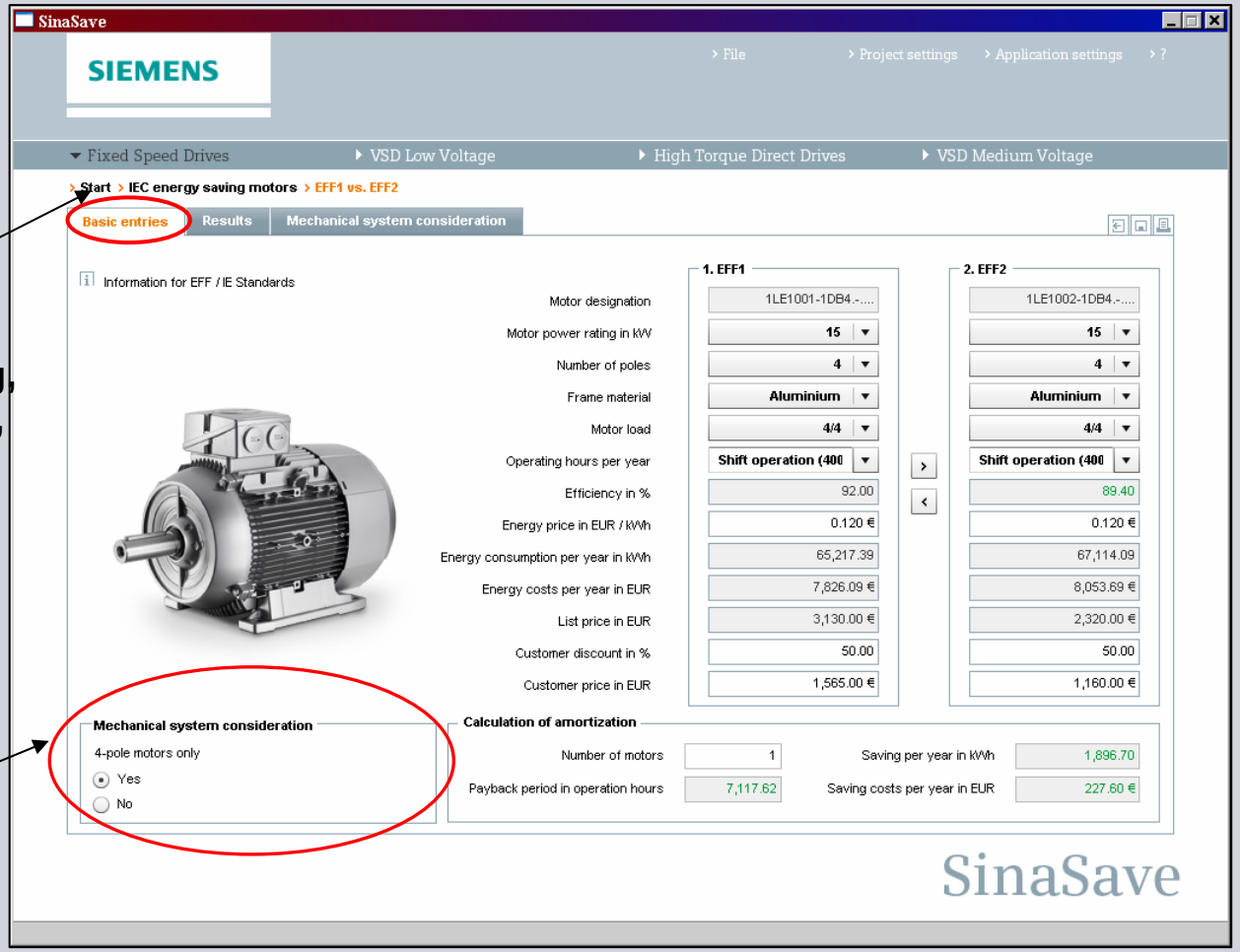
Enter the motor power rating, pole number, frame material, motor load, operating hours, discount, price, quantity of motors (when calculating a plant or system with several motors)

Mechanical components (4-pole motors only)
(NEW)



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Fixed Speed Drives

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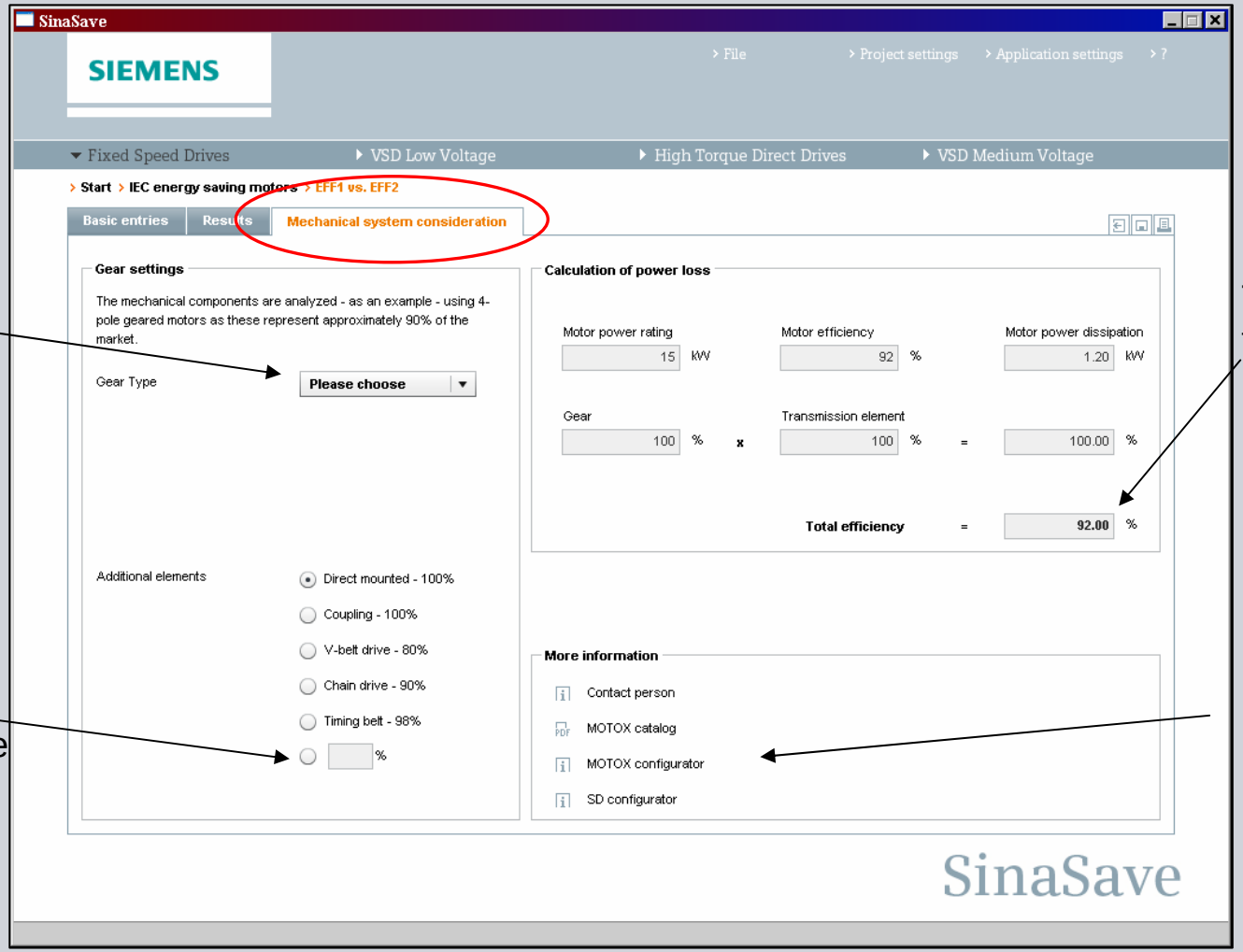
Mechanical system assessment - (IEC energy-saving motors) - EFF1 to EFF2

5 different transmission categories selectable

Individual value can be entered



The calculated total efficiency is not included in the results

Internet links to actual catalogs and configurators

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Fixed Speed Drives

Results - (IEC energy-saving motors) - EFF1 to EFF2

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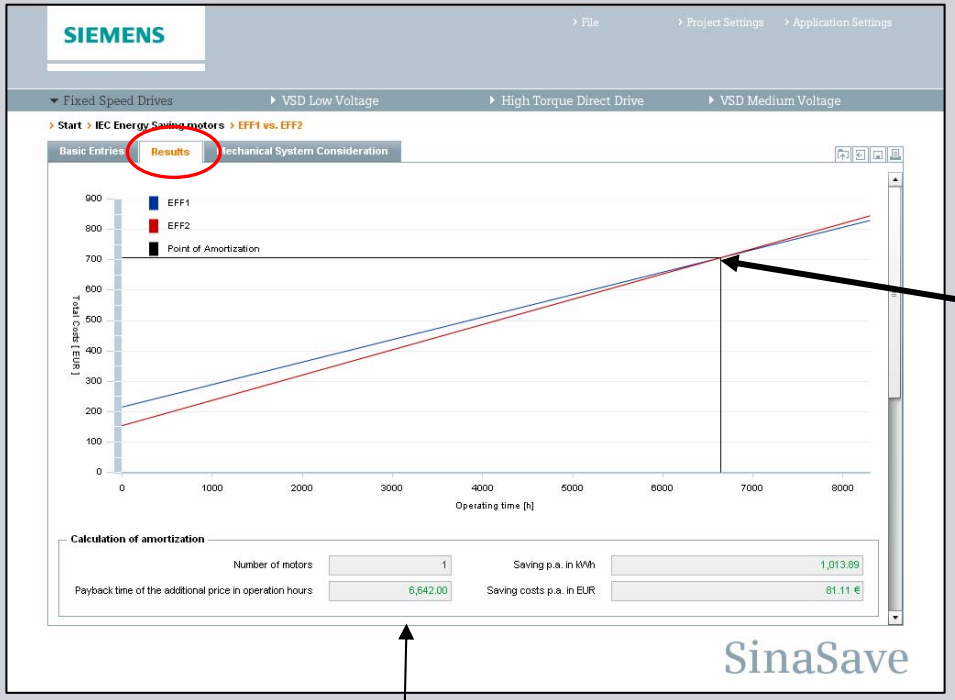

Graphic analysis:

Visual analysis of the payback time with two graphs.

Breakeven point - it's your cash from this point onwards

EFF1 vs. EFF2

	EFF1	EFF2
Motor	1LA9083-4KA..	1LA7083-4AA..
Motor output in kW	0.75	0.75
Pole number	4	4
Frame material	Aluminium	Aluminium
Motor load	1	1
Operating hours p.a.	8,760.00	8,760.00
Efficiency in %	81.00	72.00
Energy costs per kWh	0.080 €	0.080 €
Power consumption p.a. in kWh	8,111.11	9,125.00
Energy costs p.a.	648.89 €	730.00 €
List price	430.00 €	307.00 €
Customer discount in %	50.00	50.00
Customer price	215.00 €	153.50 €

Numerical analysis:

Analysis of the entered data: payback time, saving in kW and saving in € p.a.

Mechanical system consideration

Total efficiency	79.38	%	Additional transmission element	Direct mounted - 100%
Motor efficiency	81	%	Gear Type	--
Motor power dissipation	0.14	kW	Number of stages	1-stage
Power dissipation (mechanical components)	98.00	%	Ratio	--

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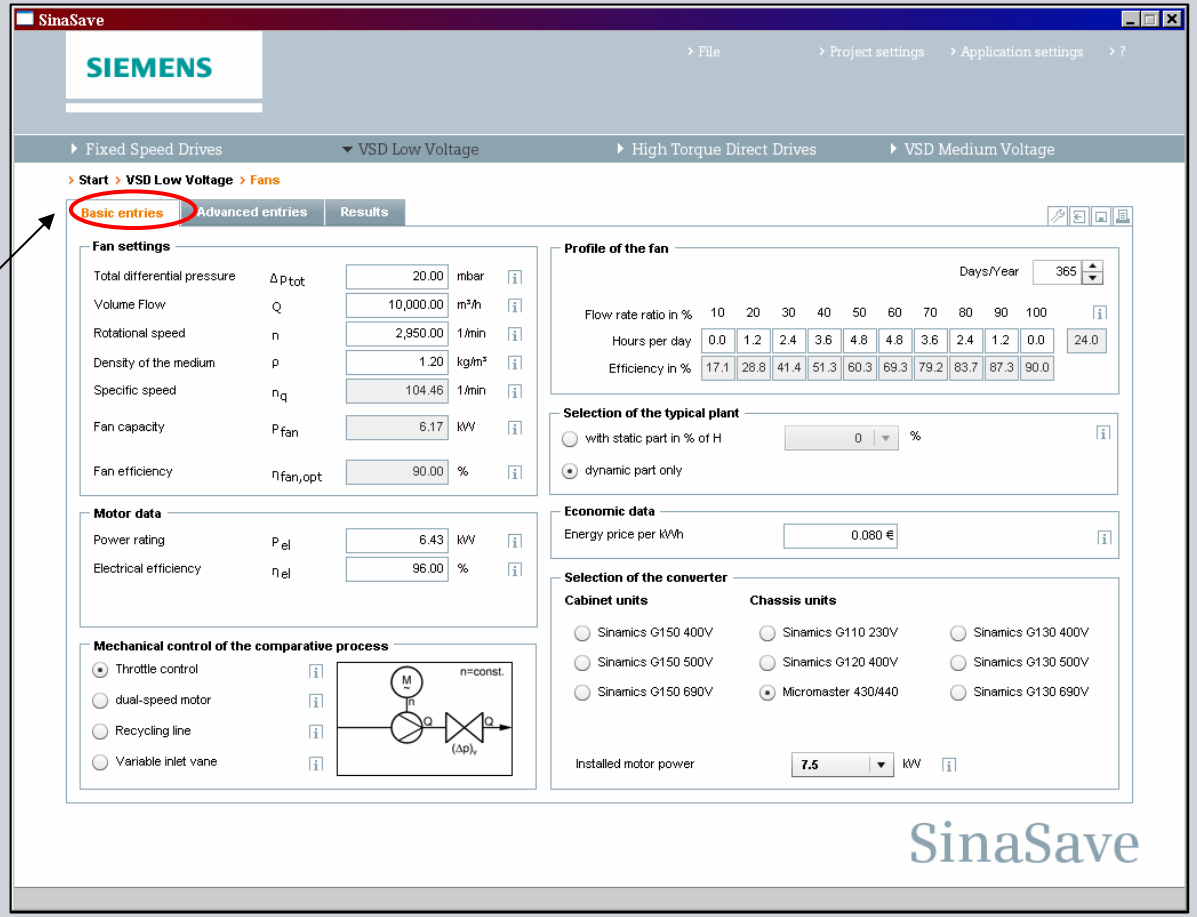
Variable Speed Drives (Low Voltage)

Basic entries - Fans

SIEMENS

- **Fan settings**
- **Motor data**
- **Mechanical control of the comparative process**
- **Profile of the fan**
- **Selection of the typical plant**
- **Economic data (energy costs)**
- **Selection of the converter**



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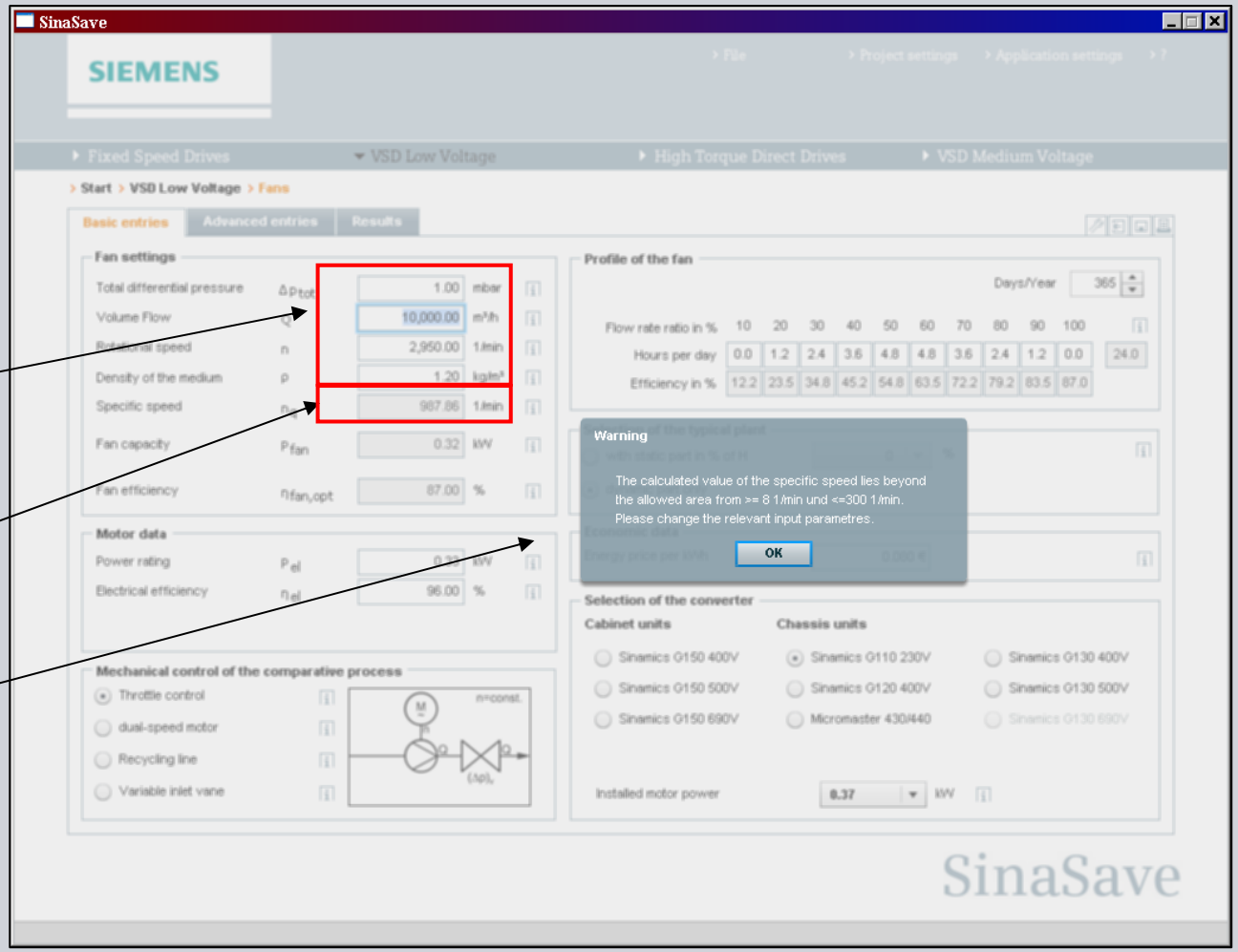
Variable Speed Drives (Low Voltage)

Basic entries - Fans

SIEMENS

When entering the relevant data, the value for the specific speed is checked. If this value is not plausible, then an alarm is output and the data that has been entered must be appropriately corrected.



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Variable Speed Drives (Low Voltage)

Advanced entries - Fans

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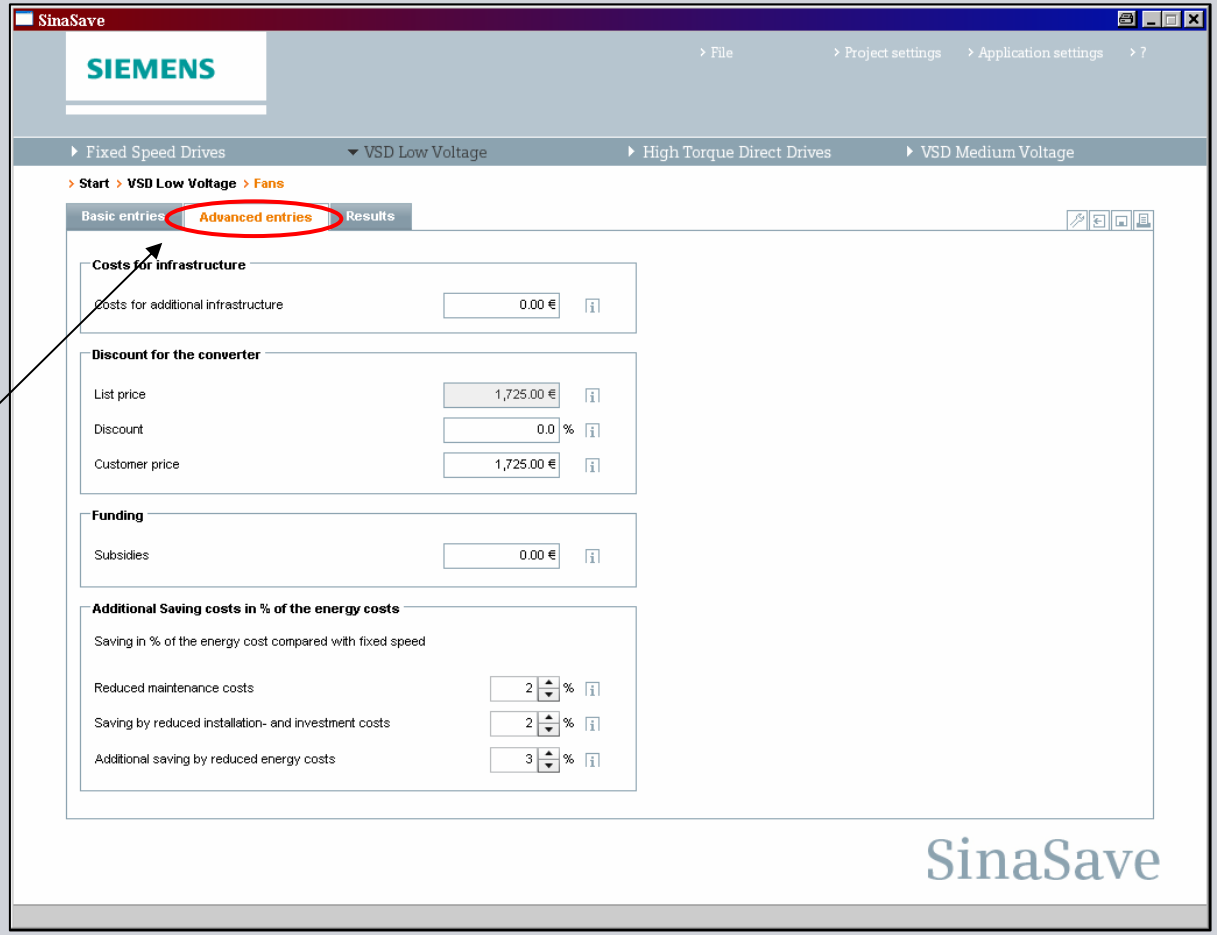

- **Costs for infrastructure**
- **Discount**
- **Funding/subsidies**
- **Additional cost saving**

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Variable Speed Drives (Low Voltage)

Results - Fans

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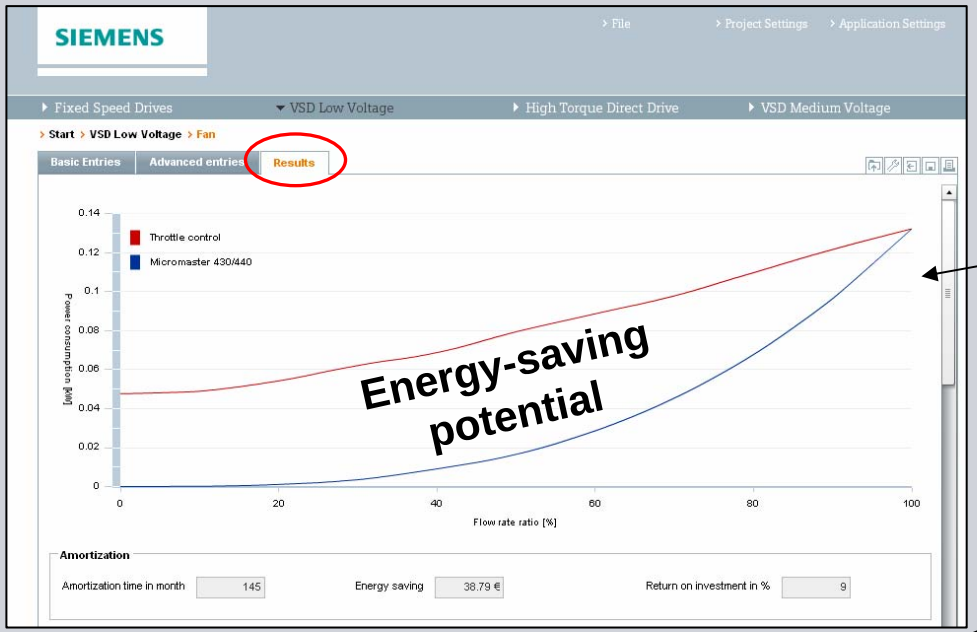
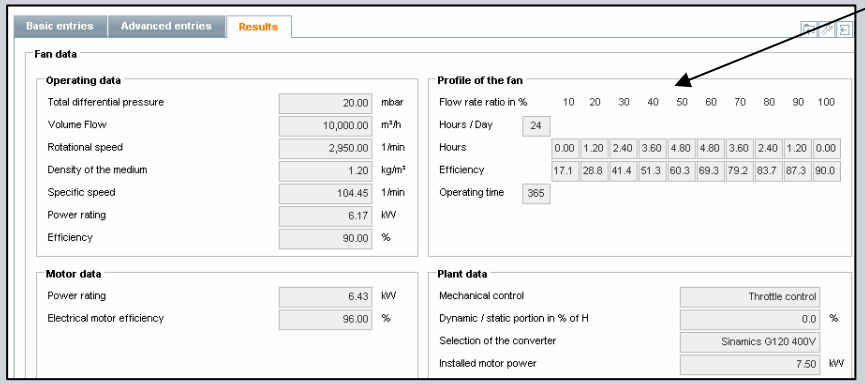
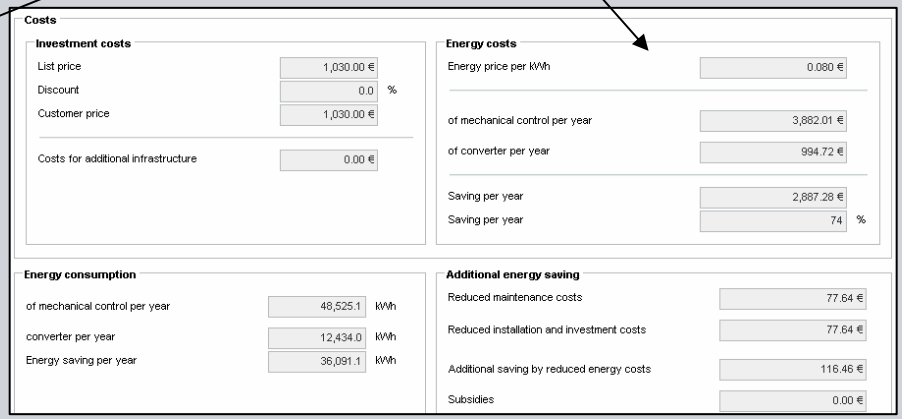


Results:

Graphic analysis of the entered data

Numerical analysis of the entered data





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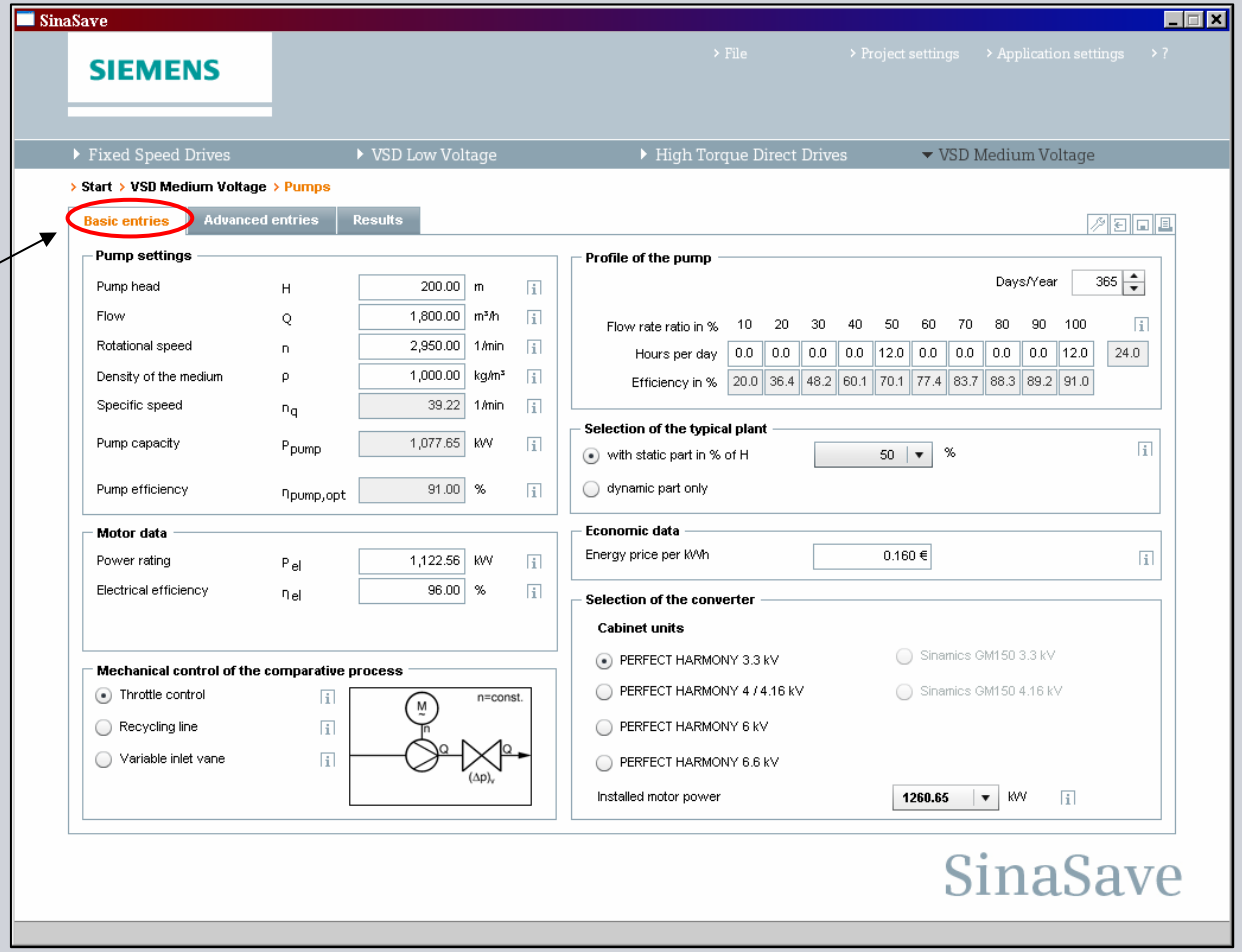
Variable Speed Drives (Medium Voltage)

Entries - Pumps

SIEMENS

- **Fan settings**
- **Motor data**
- **Mechanical control of the comparative process**
- **Profile of the fan**
- **Selection of the typical plant**
- **Economic data (energy costs)**
- **Selection of the converter**



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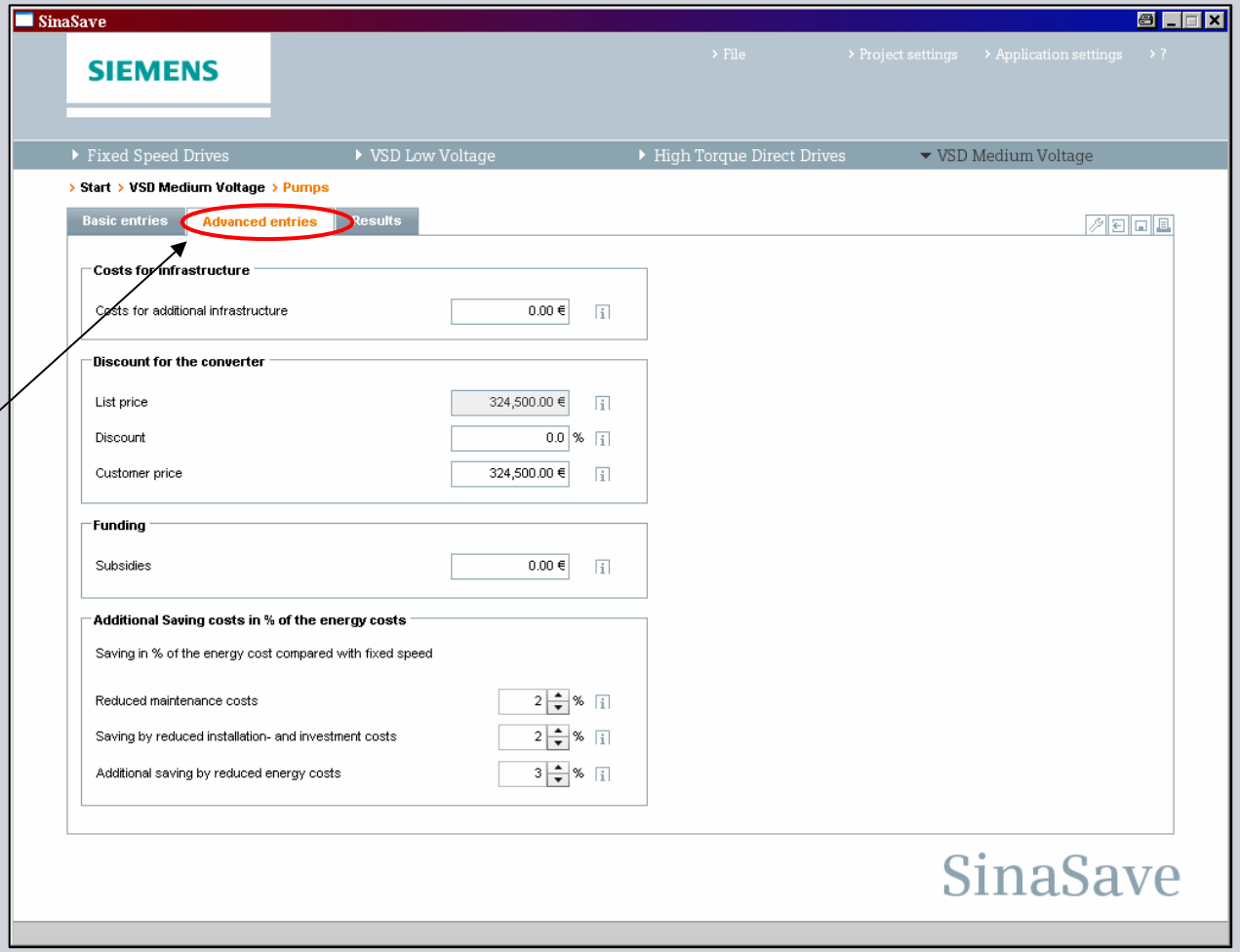
Variable Speed Drives (Medium Voltage)

Advanced entries - Pumps

SIEMENS

- **Costs for infrastructure**
- **Discount**
- **Funding/subsidies**
- **Additional cost savings**



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Variable Speed Drives (Medium Voltage)

Results - Pumps

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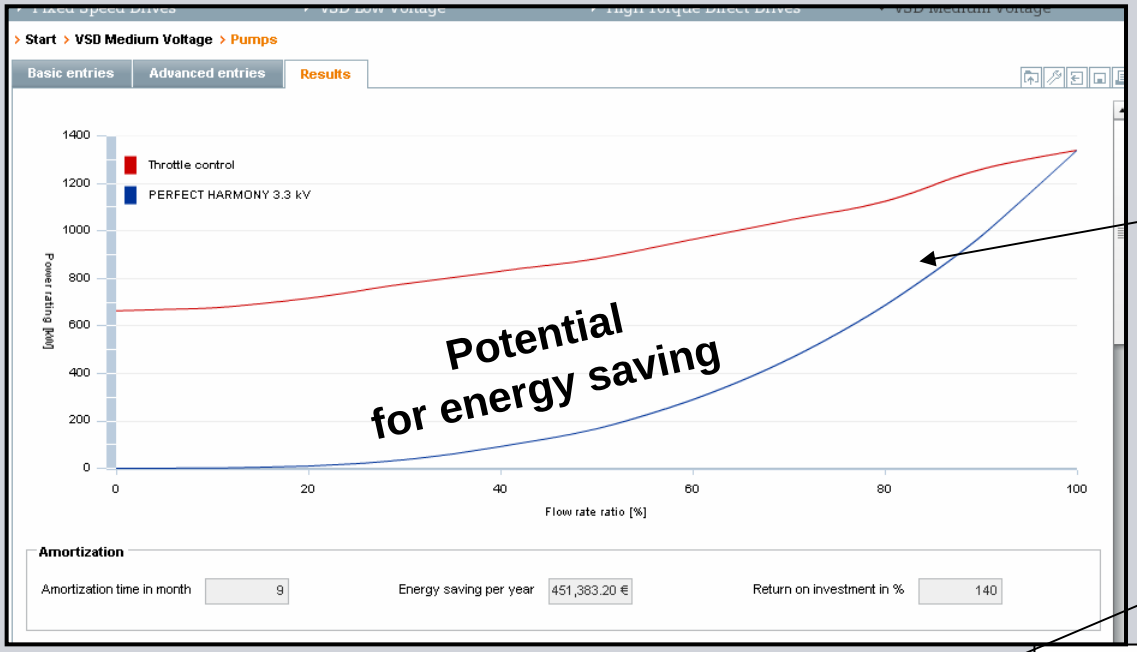
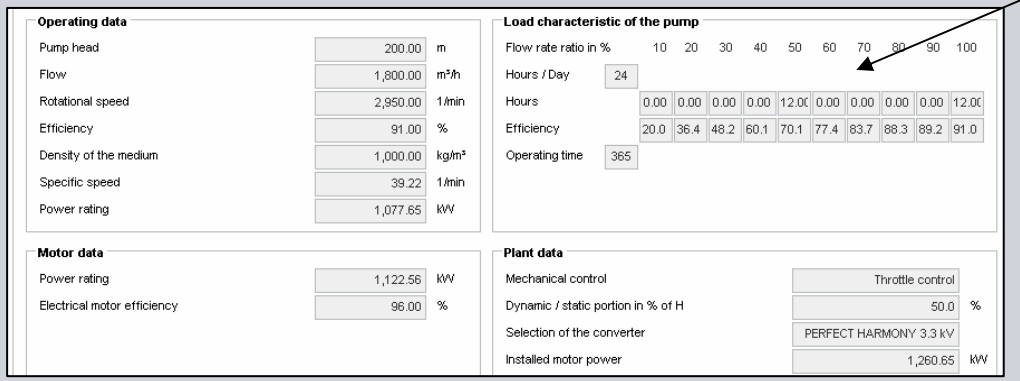
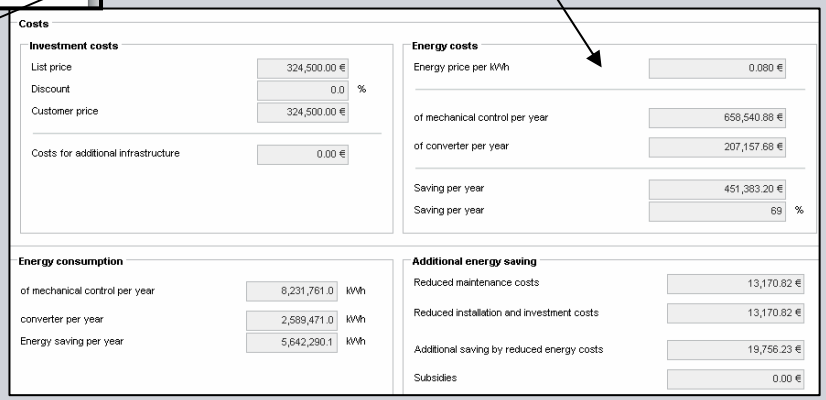


Results:

Graphic analysis of the entered data

Numerical analysis of the entered data





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High Torque Direct Drives
Background

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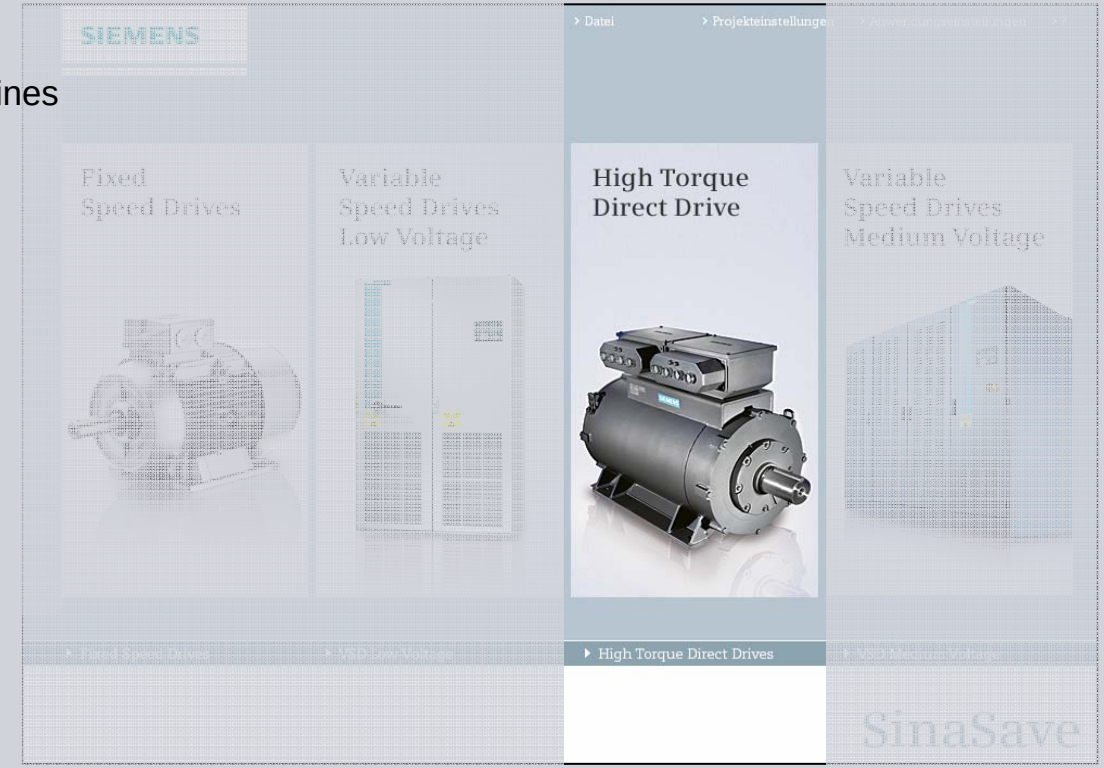
The “High Torque Direct Drive“ module determines potential **savings** relating to

- **Energy consumption** and
- **Operational cost**

using a High Torque Direct Drive instead of a conventional drive system with gearbox and induction motor.

HTDD also calculates

- **Investment costs** and
- **Payback time**



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High Torque Direct Drives

Comparison settings

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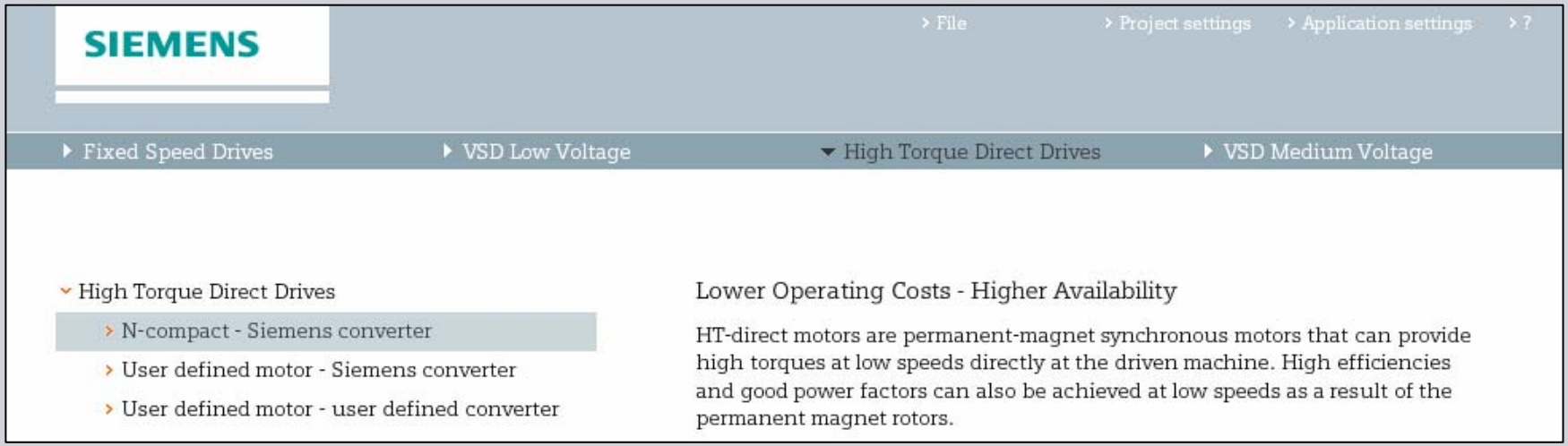

The “High Torque Direct Drive” module of SinaSave 4.0 contains three different comparison settings.

A drive system comprising an HT direct drive fed from a SINAMICS G150 low-voltage converter is always compared to a conventional drive system existing of gearbox – induction motor – converter.

There, users can compare the system HT-direct – SINAMICS G150 with a drive system comprising user-defined products a system comprising a user-defined-motor and Siemens converter - or a system comprising Siemens motor and Siemens converter.

The HTDD module takes into consideration air cooled systems and a 690V power supply voltage.

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High Torque Direct Drives
Entries

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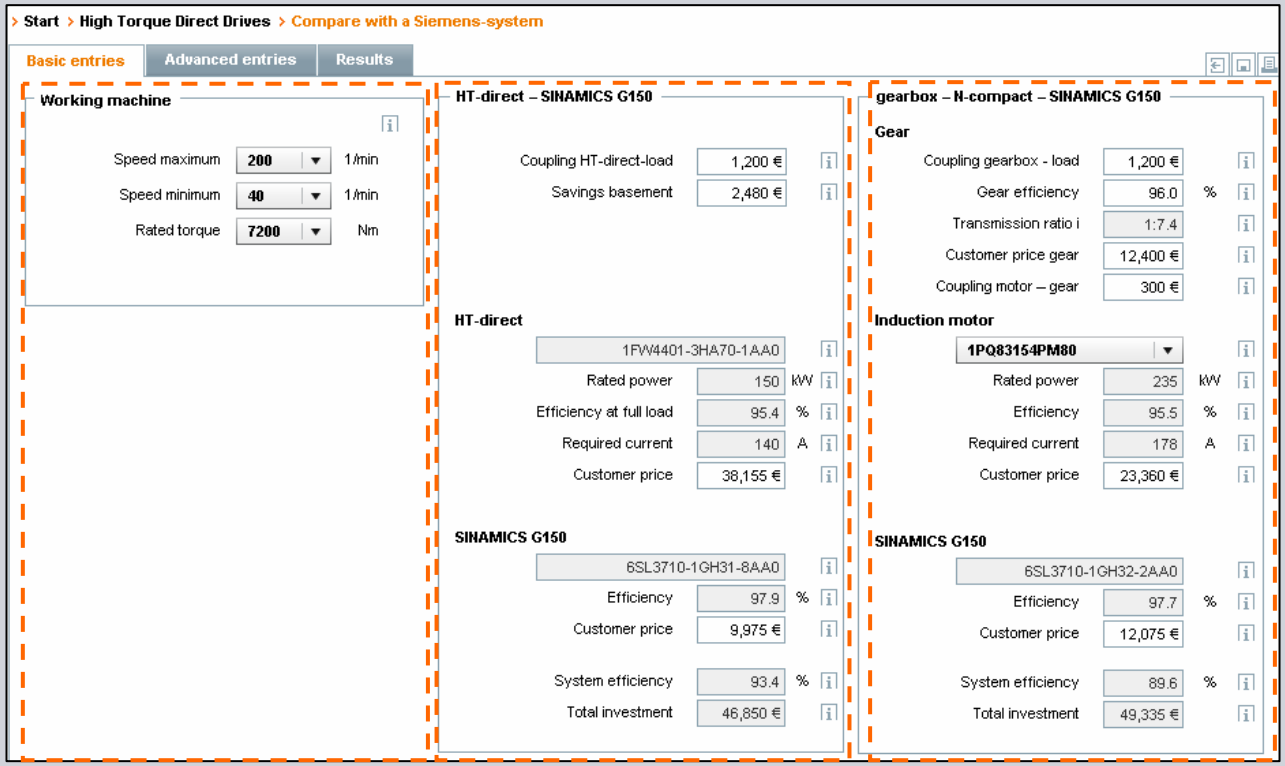
The “Basic entries” tab is divided into three areas:

Left: The driven load (driven machine) is defined here

Center: The components of the drive system using an HT-direct motor are defined here

Right: The components of a conventional drive system using gearbox and induction motor are defined here



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High Torque Direct Drives

Entries - defining the load

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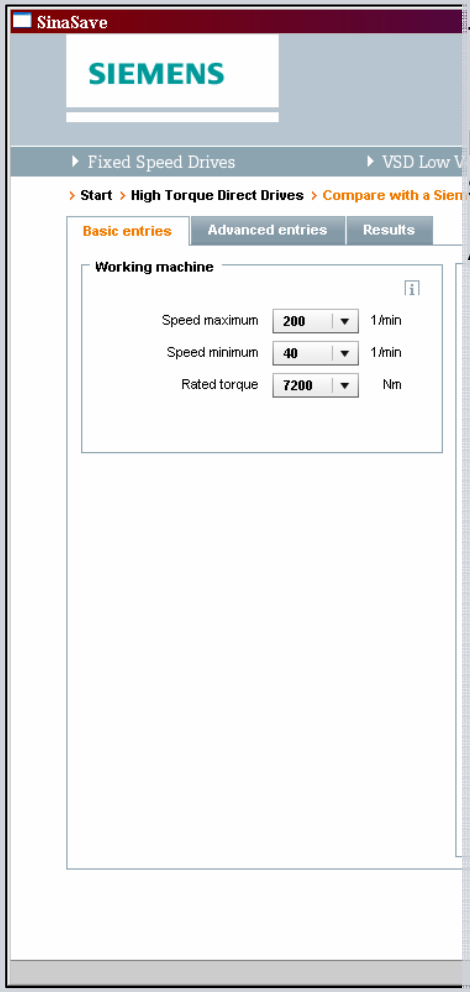

The first step is to define the load.

For this purpose, a driven load with a constant load torque is used as basis. This means that the selected torque is available over the complete speed setting range (minimum speed up to maximum speed).

All comparison scenarios use this step in the same way.

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High Torque Direct Drives

Entries - defining the HT-direct drive system

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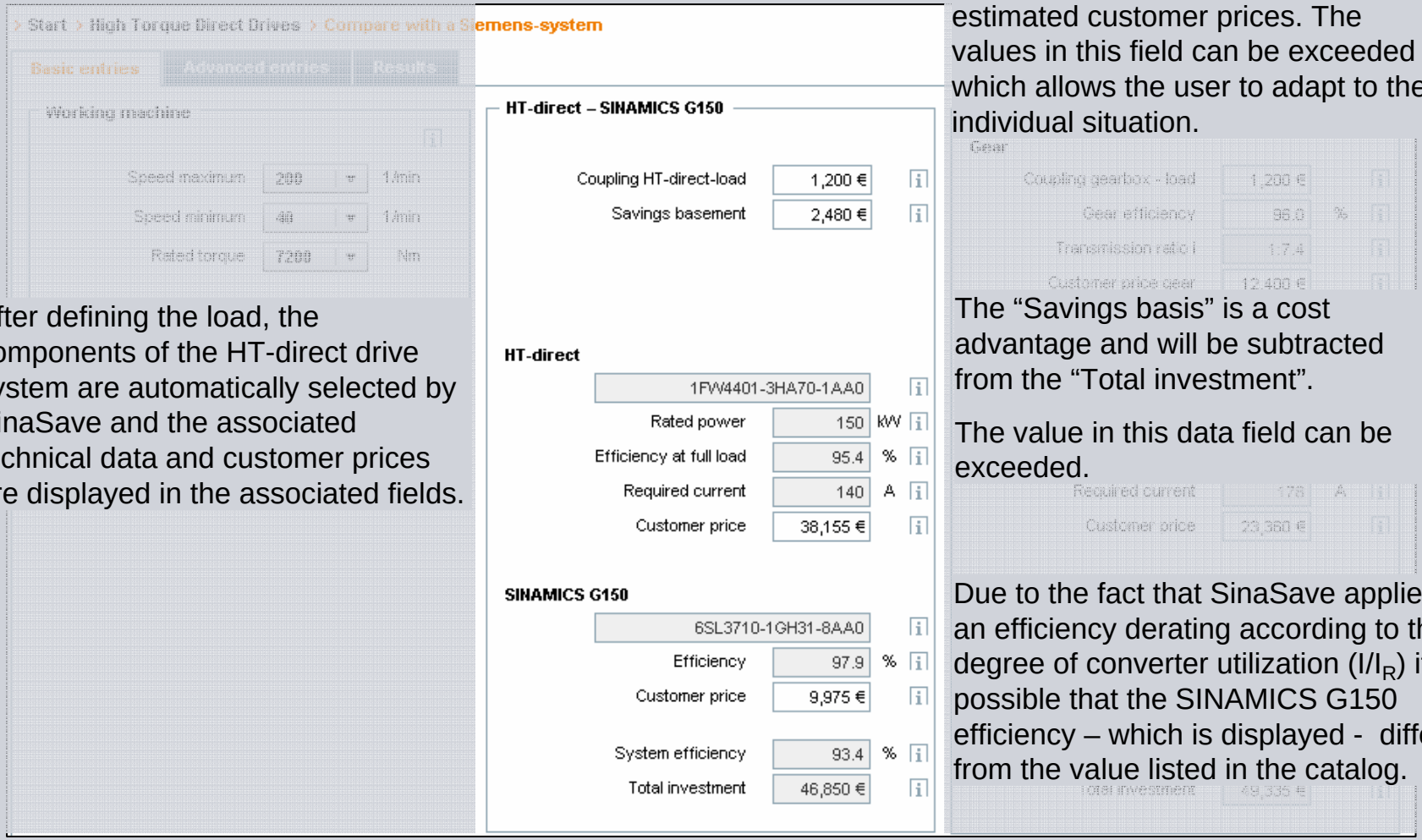

After defining the load, the components of the HT-direct drive system are automatically selected by SinaSave and the associated technical data and customer prices are displayed in the associated fields.

All of the prices that are shown are estimated customer prices. The values in this field can be exceeded - which allows the user to adapt to the individual situation.

The “Savings basis” is a cost advantage and will be subtracted from the “Total investment”.

The value in this data field can be exceeded.

Due to the fact that SinaSave applies an efficiency derating according to the degree of converter utilization (I/I_R) it is possible that the SINAMICS G150 efficiency – which is displayed - differs from the value listed in the catalog.

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High Torque Direct Drives

Entries - defining a drive system comprising gearbox and induction motor

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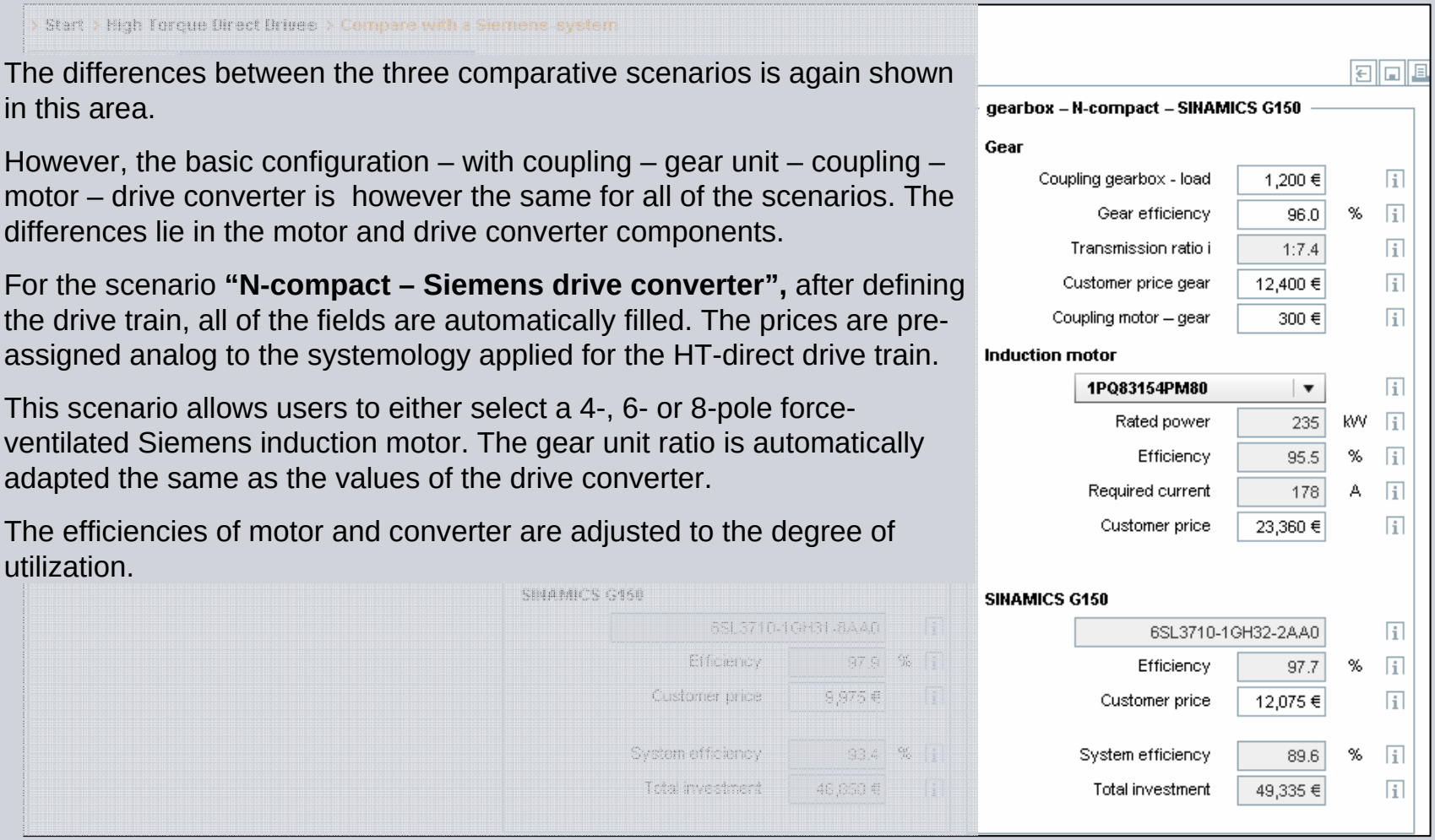
The differences between the three comparative scenarios is again shown in this area.

However, the basic configuration – with coupling – gear unit – coupling – motor – drive converter is however the same for all of the scenarios. The differences lie in the motor and drive converter components.

For the scenario **“N-compact – Siemens drive converter”,** after defining the drive train, all of the fields are automatically filled. The prices are pre-assigned analog to the systemology applied for the HT-direct drive train.

This scenario allows users to either select a 4-, 6- or 8-pole force-ventilated Siemens induction motor. The gear unit ratio is automatically adapted the same as the values of the drive converter.

The efficiencies of motor and converter are adjusted to the degree of utilization.



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High Torque Direct Drives

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Entries - defining a drive system comprising gearbox and induction motor

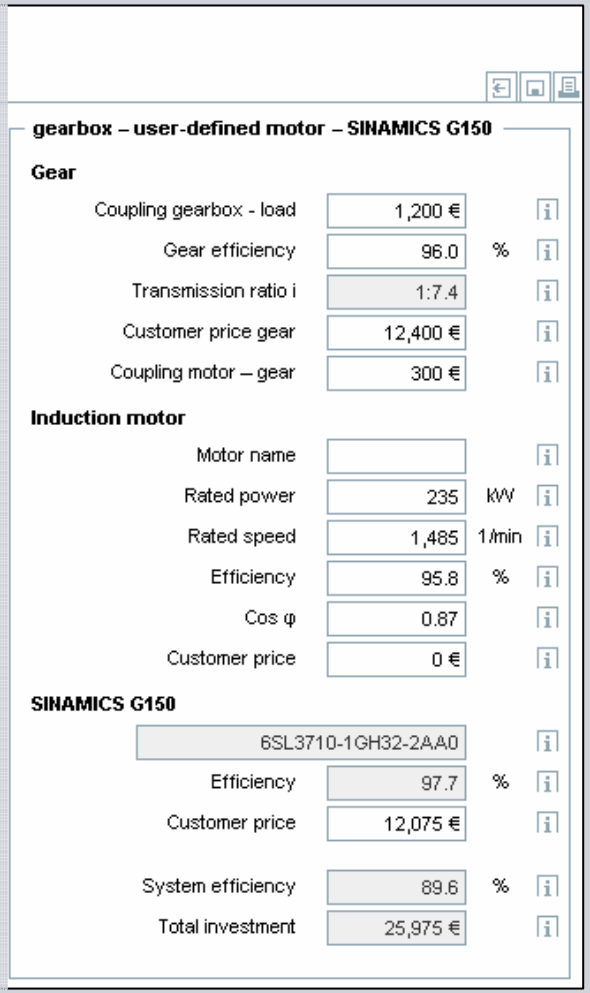
Also for the scenario **“user-defined motor – Siemens converter”,** after defining the drive train, the data blocks for the gear unit and drive converter are filled. The fields for the motor data should only be considered as a space retainer. The **catalog values** of a matching induction motor must be entered into these fields.

The gear unit and converter data are automatically adapted.

The prices are pre-assigned according to the schematic already described.

The efficiencies of the motor and converter are adapted to the degree of utilization. This is the reason why the value of “system efficiency” is not the product of the individual efficiencies that are displayed.

The efficiency of motor is reduced based on the catalog value according to the degree of utilization.



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High Torque Direct Drives

Entries - defining a drive system comprising gearbox and induction motor

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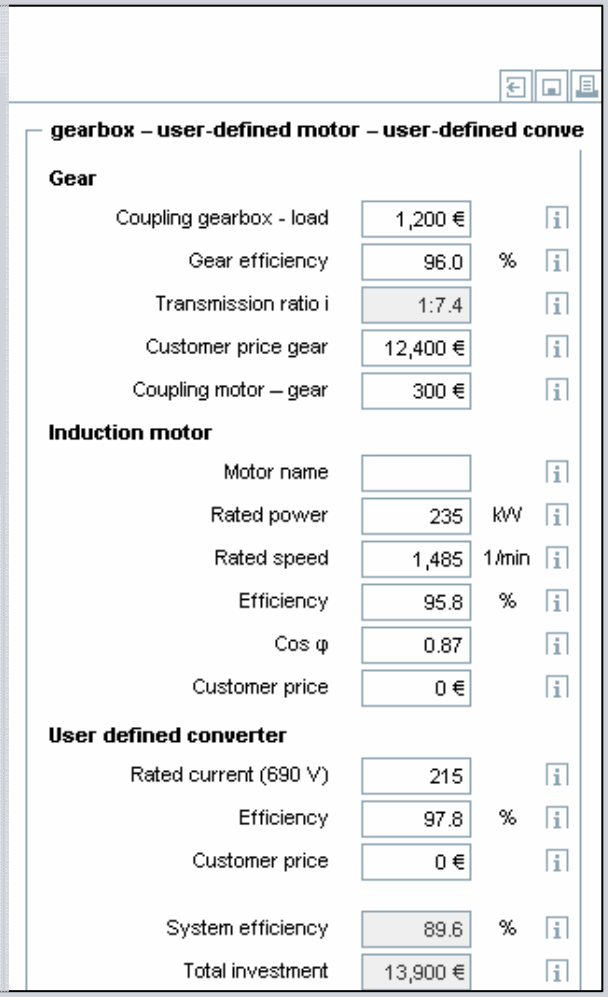
The default values shown in the data blocks of the motor and gear unit should initially be considered as space retainer in the scenario **“user-defined motor – user-defined converter”.** The **catalog values** of a suitable motor and drive converter must be entered into these data blocks.

In this case, as well, the value “system efficiency” is not the product of the individual efficiencies that are shown.

The efficiency of the motor and converter were reduced based on the catalog value according to the degree of utilization.



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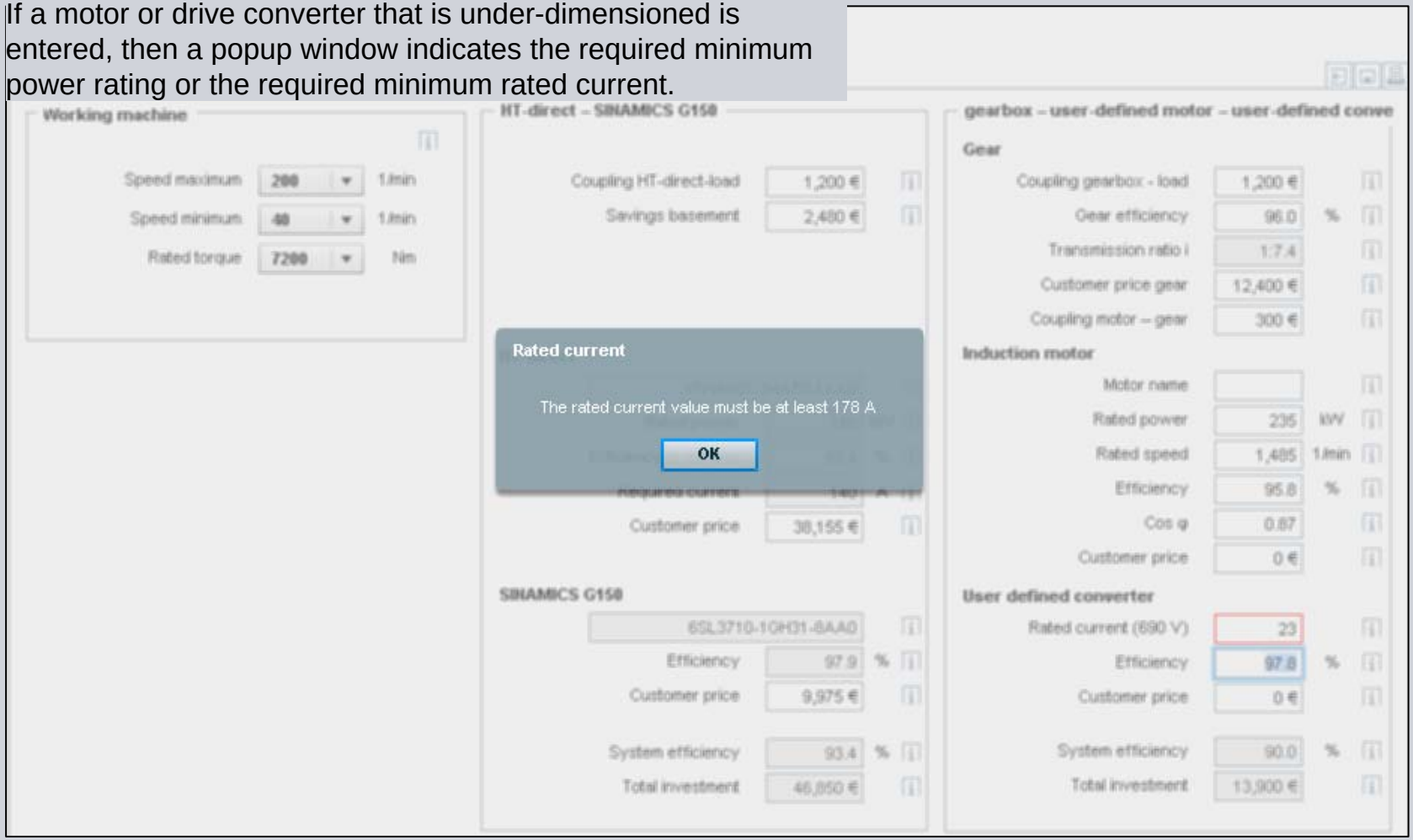
High Torque Direct Drives

Entries - defining a drive system comprising gearbox and induction motor

If a motor or drive converter that is under-dimensioned is entered, then a popup window indicates the required minimum power rating or the required minimum rated current.



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High Torque Direct Drives

Advanced entries

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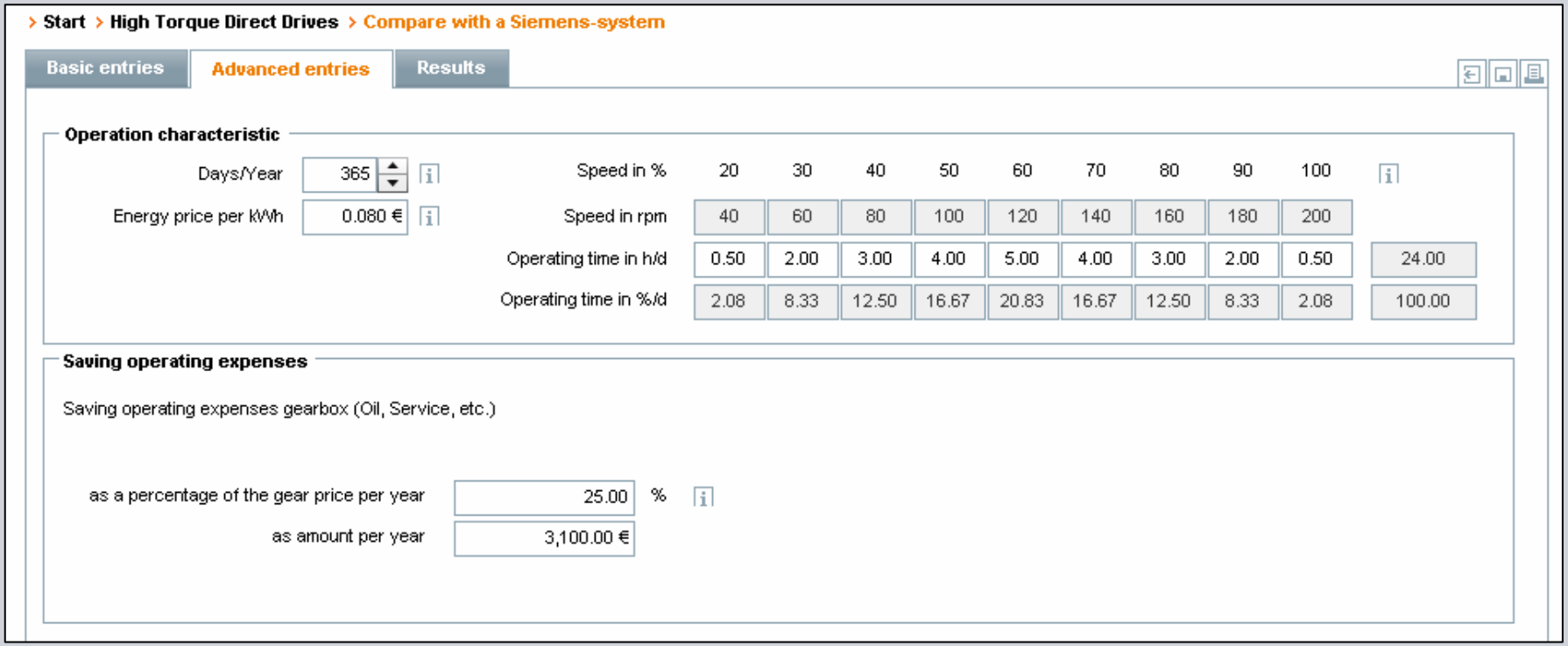

The number of hours per day and the number of days per year that the driven load is operated at the various speeds must be entered under “Operation characteristic”.

The value “Savings operating expenses” represents the annual cost for service and spare parts as a result of the gearbox. The value first entered into the field depends on the gear unit size and can be naturally exceeded.

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High Torque Direct Drives
Results

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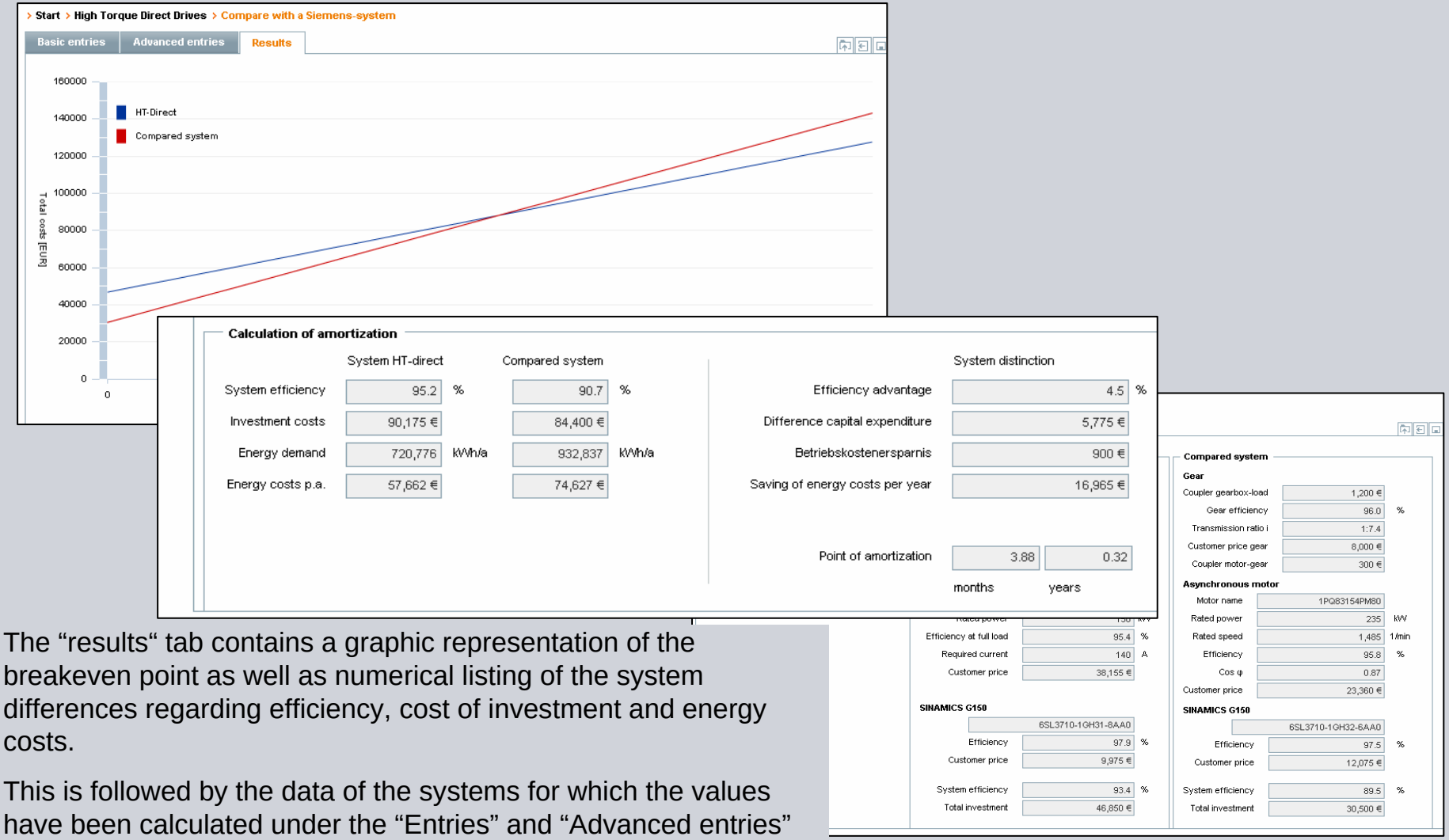

The “results“ tab contains a graphic representation of the breakeven point as well as numerical listing of the system differences regarding efficiency, cost of investment and energy costs.

This is followed by the data of the systems for which the values have been calculated under the “Entries” and “Advanced entries” tabs.

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Exercise
- Fixed Speed Drives -

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Exercise 1:

How long is the payback time (in hours) for an EFF1 motor in comparison to an EFF2 motor with the following technical data?

- 15 kW
- Pole number 4
- Material: Aluminum
- Motor load 4/4
- Shift 4000 hours
- Energy costs 0,12 €/kWh
- Customer discount 50%

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Exercise

- Fixed Speed Drives -

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Results:

Calculation of amortization

Number of motors	1	Saving per year in kWh	1,896.70
Payback period in operation hours	7,117.62	Saving costs per year in EUR	227.60 €

EFF1 vs. EFF2

	EFF1	EFF2
Motor designation	1LE1001-1DB4.-....	1LE1002-1DB4.-....
Motor power rating in kW	15.00	15.00
Number poles	4	4
Frame material	Aluminium	Aluminium
Motor load	1	1
Operating hours per year	4,000.00	4,000.00
Efficiency in %	92.00	89.40
Energy price per kWh	0.120 €	0.120 €
Energy consumption per year in kWh	65,217.39	67,114.09
Energy costs per year	7,826.09 €	8,053.69 €
List price	3,130.00 €	2,320.00 €
Customer discount in %	50.00	50.00
Customer price	1,565.00 €	1,160.00 €

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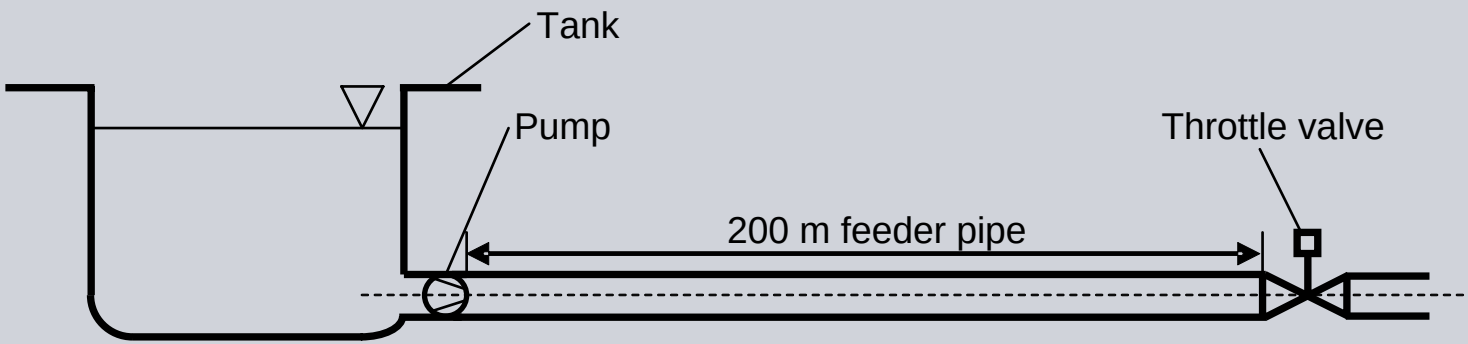
Exercise 2:

In a large chemical plant, a nitric acid solution is pumped through a long piping system as shown in the diagram below.



Given:	Flow rate in operating state 1:	1800 m³/h
	Resulting pressure loss in the pipe:	10 bar = 100 m delivery height
	Flow rate in operating state 2:	900 m³/h
	Specific gravity of the nitric acid solution:	1068 kg/m³

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Exercise 2:

The plant essentially comprises a tank to which a 200 m long horizontal steel pipe is connected – as well as a pump and a throttle, which are installed in the pipe. The pump has been dimensioned so that it operates at its optimum at operating point 1. Operating point 2 corresponds to a 50% pumping rate and this is adjusted using a throttle valve. The pump is operated 12 hours/per day at operating point 1 – and 12 hours/per day at operating point 2. Using Sinasave, the energy saving that can be expected when using a frequency converter is now calculated.

The following values are obtained for the base settings (refer to the diagram):

- Flow rate and delivery height of the pumps at the optimum operating point (1800 m^3/h / 100 m)
- Specific gravity of the fluid/liquid being pumped (1068 kg/m^3)
- Operating hours per operating point per day (12 h, 100% flow rate, 12 h, 50 % flow rate)
- Power costs per kWh (0.08 Euro/kWh)
- Discount for the drive converter: (25%)

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Exercise

- Variable Speed Drives (low voltage) -

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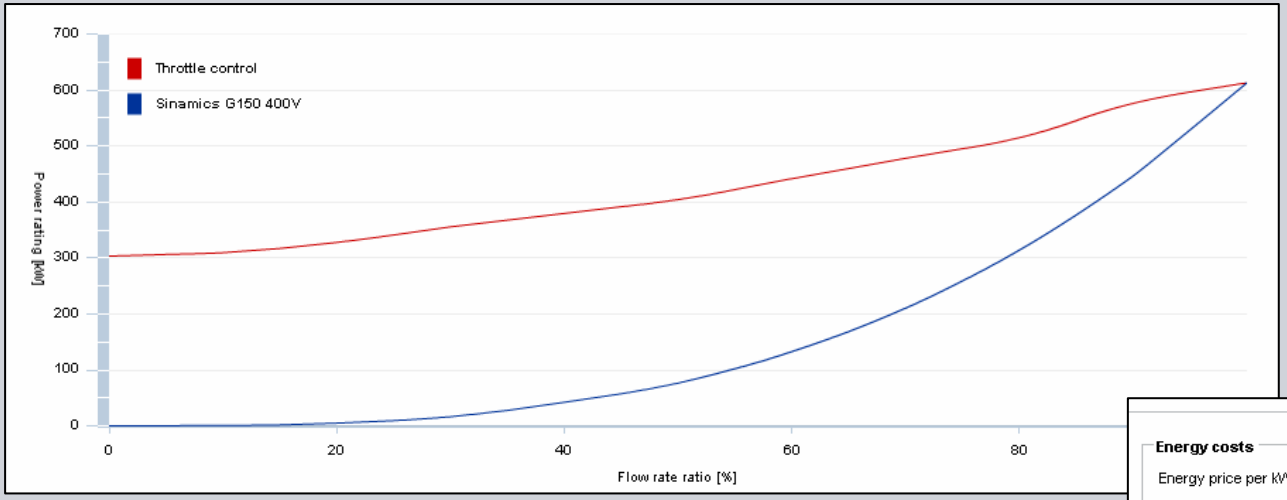
Results 2:



Costs

Investment costs

List price	49,100.00 €	
Discount	25.0	%
Customer price	36,825.00 €	
Costs for additional infrastructure	0.00 €	

Energy consumption

of mechanical control per year	4,456,386.9	kWh
converter per year	3,020,141.7	kWh
Energy saving per year	1,436,245.2	kWh

Amortization

Amortization time in months	4	Energy saving per year	114,899.61 €	Return on investment in %	313

Pump data

Operating data

Pump head	100.00	m
Flow	1,800.00	m³/h
Rotational speed	2,950.00	1/min
Density of the medium	1,068.00	kg/m³
Specific speed	65.96	1/min
Power rating	588.40	kW
Efficiency	89.00	%

Load characteristic of the pump

Flow rate ratio in %	10	20	30	40	50	60	70	80	90	100
Hours / Day	24									
Hours	0.00	0.00	0.00	0.00	12.00	0.00	0.00	0.00	0.00	12.00
Efficiency	19.6	32.9	44.5	55.2	65.0	73.9	80.1	84.6	87.2	89.0
Operating time	365									

Motor data

Power rating	612.92	kW
Electrical motor efficiency	96.00	%

Plant data

Mechanical control	Throttle control	
Dynamic / static portion in % of H	0.0	%
Selection of the converter	Sinamics G150 400V	
Installed motor power	630.00	kW

Energy costs

Energy price per kWh	0.080 €	
of mechanical control per year	356,510.95 €	
of converter per year	241,611.34 €	
Saving per year	114,899.61 €	
Saving per year	32	%

Additional energy saving

Reduced maintenance costs	7,130.22 €	
Reduced installation and investment costs	7,130.22 €	
Additional saving by reduced energy costs	10,695.33 €	
Subsidies	0.00 €	

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Exercise

- Operating type, Variable Speed Drives (medium voltage) -

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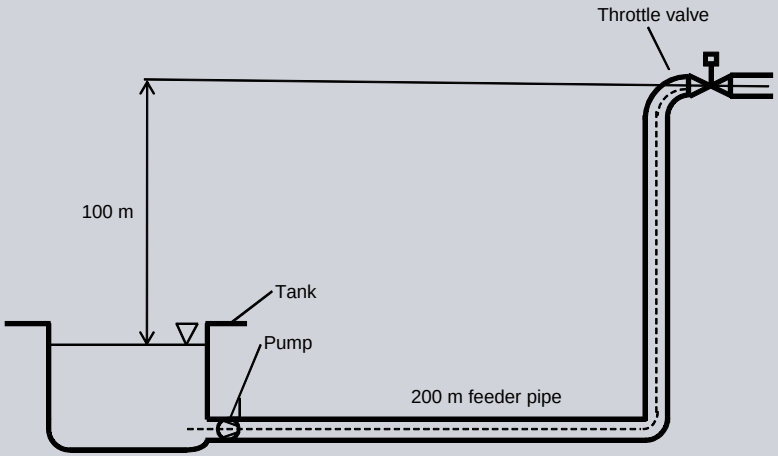
Exercise 3:

A factory is supplied with water as shown in the diagram below.



Given:	Flow rate in operating state 1:	1800 m³/h
	Resulting pressure loss in the pipe:	10 bar = 100 m delivery height
	Flow rate in operating state 2:	900 m3/h
	Specific gravity of water:	1000 kg/m³
	Discount for the drive converter:	25%

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Exercise

- Operating type, Variable Speed Drives (medium voltage) -

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Exercise 3:

The plant essentially comprises a reservoir, to which a 200 m long pipe is connected. This pipe initially runs horizontally and then vertically upwards to the factory. A pump and a throttle valve are installed in the pipe. The pump is dimensioned so that at operating point 1 it operates at its optimum. Operating point 2 corresponds to a 50% flow rate and is adjusted using a throttle valve. The pump is operated 12 h per day at operating point 1 and 12 h/per day at operating point 2. The energy saving is calculated, which can be expected when using a frequency converter in the following.

The following values are obtained for the base settings (refer to the diagram):

- Flow rate and delivery height of the pump at the optimum operating point (1800 m^3/h / 200 m)
- Speed (2950 rpm)
- Specific gravity of the medium (1000 kg/m^3)
- Operating hours per operating point per day (12 h, 100% flow rate, 12 h, 50 % flow rate)
- Energy costs per kWh (0.16 Euro/kWh)
- Discount for the drive converter: (25%)
- Selection of the typical system with a static component of H: 50 %

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Exercise

- Variable Speed Drives (low voltage) -

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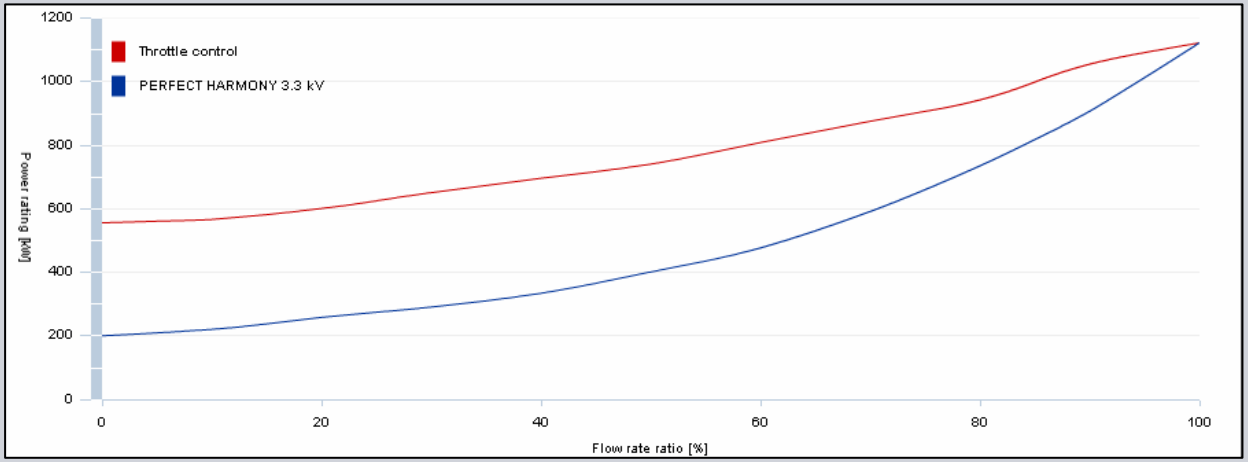
Results 3:



Costs

Investment costs

List price	253,900.00 €	
Discount	25.0	%
Customer price	190,425.00 €	
Costs for additional infrastructure	0.00 €	

Energy consumption

of mechanical control per year	8,161,880.8	kWh
converter per year	6,672,091.7	kWh
Energy saving per year	1,489,789.1	kWh

Amortization

Amortization time in months	10	Energy saving per year	238,366.25 €	Return on investment in %	126

Pump data

Operating data

Pump head	200.00	m
Flow	1,800.00	m³/h
Rotational speed	2,950.00	1/min
Efficiency	91.00	%
Density of the medium	1,000.00	kg/m³
Specific speed	39.22	1/min
Power rating	1,077.65	kW

Load characteristic of the pump

Flow rate ratio in %	10	20	30	40	50	60	70	80	90	100
Hours / Day: 24										
Hours	0.00	0.00	0.00	0.00	12.0(	0.00	0.00	0.00	0.00	12.0(
Efficiency	20.0	36.4	48.2	60.1	70.1	77.4	83.7	88.3	89.2	91.0
Operating time: 365										

Motor data

Power rating	1,122.56	kW
Electrical motor efficiency	96.00	%

Plant data

Mechanical control	Throttle control	
Dynamic / static portion in % of H	50.0	%
Selection of the converter	PERFECT HARMONY 3.3 kV	
Installed motor power	1,260.65	kW

Energy costs

Energy price per kWh	0.160 €	
of mechanical control per year	1,305,900.93 €	
of converter per year	1,067,534.68 €	
Saving per year	238,366.25 €	
Saving per year	18	%

Additional energy saving

Reduced maintenance costs	26,118.02 €
Reduced installation and investment costs	26,118.02 €
Additional saving by reduced energy costs	39,177.03 €
Subsidies	0.00 €

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Results 3:

The characteristics graphically show (as difference between the red and blue lines) the different energy demand as a function of the flow rate. It can be clearly seen that the savings increase, the further the flow rate deviates from the optimum (100%).

For the plant being investigated here, the frequency converter payback time is just 10 months and that for an electricity price of 0.16 Euro per kilowatt hour. The higher the price of electricity, the faster the investment costs are paid back and the more profitable operation is with a frequency converter.

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Exercise

- High Torque Direct Drives - (new plant)

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Exercise 4:

What is the efficiency advantage and the annual energy cost saving potential and how long is the payback time under the following conditions ?

Torque:	10.8 kNm (constant)
Speed:	160 to 400 rpm
Savings for the foundation:	0€
Customer price gearbox:	9000€
Third-party motor and SINAMICS G150	
Rated power	545 kW
Rated speed	1491 rpm
Efficiency (catalog)	96.5 %
Power factor (catalog)	0.88
Customer price	40,000€
Operating days/year:	200
Operating time:	2.00h/d in each case for 160, 200, 240, 280, 360 and 400 rpm 4.00h/d for 320 rpm
Operating cost savings:	10% of customer price gearbox

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Exercise

- High Torque Direct Drives - (new plant)

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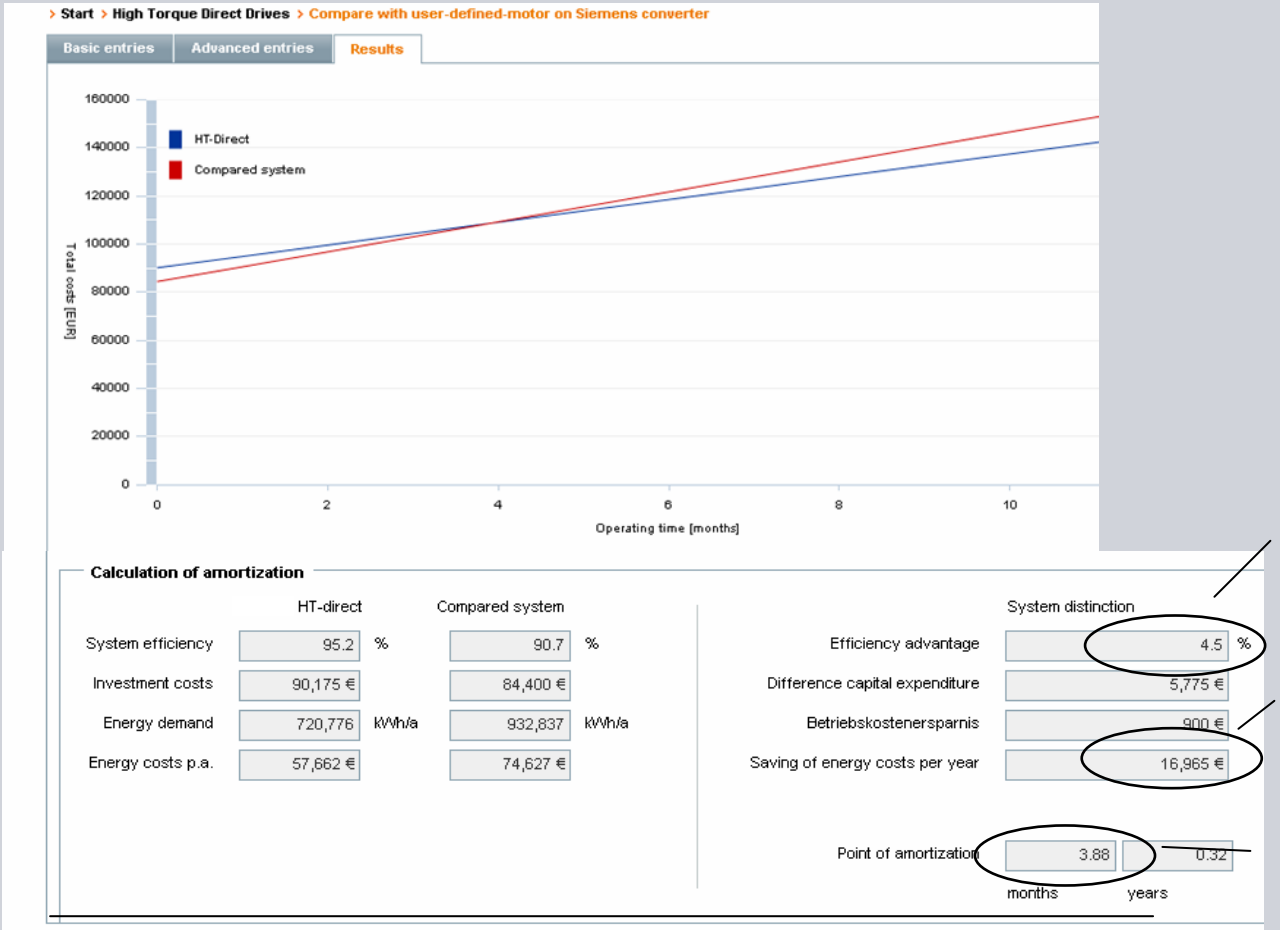
Results 4:



Efficiency advantage: 4.5 %

Annual energy cost saving potential: 16,965 €

Payback-time: 3.88 months

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Exercise 5:

How long is the payback time for plant modernization?

Torque:	11.2 kNm (constant)
Speed:	180 to 600 rpm
Gear unit	
Savings for the foundation:	0€
Coupling, gearbox- load:	0 €
Customer price gearbox:	0 €
Coupling, motor-gearbox:	0 €
Operating costs per year	2000€
Third-party motor	
Rated power	880 kW
Rated speed	1489 rpm
Efficiency (catalog)	96.5 %
Power factor (catalog)	0.86
Customer price	0 €
Third-party converter	
Rated current	1050 A
Efficiency (catalog)	96.8 %
Customer price	0 €

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Exercise

- High Torque Direct Drives - (plant modernization)

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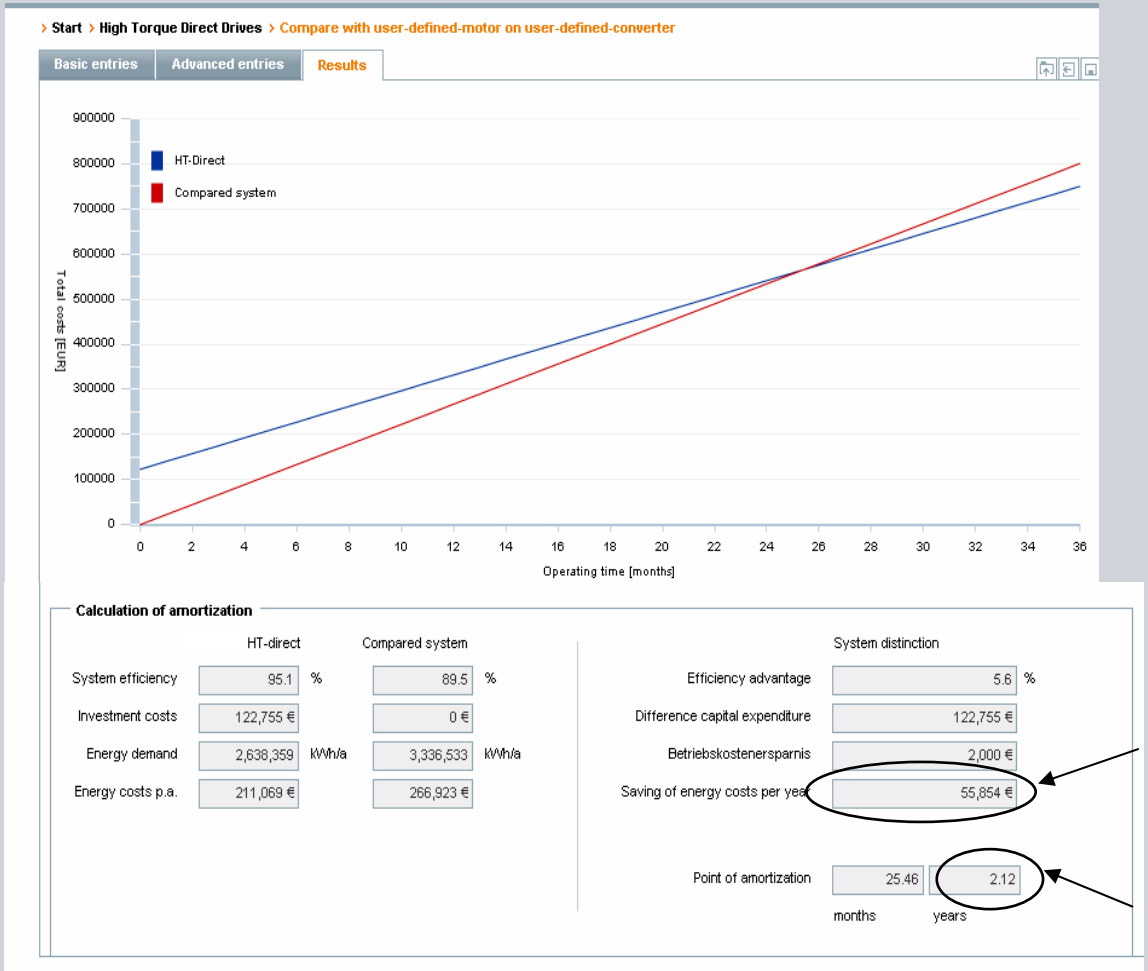
Results 5:



Annual energy cost saving potential: 55,854 €

Payback time: 2.12 years

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Links

Downloads:

SinaSave 4.0: http://www.siemens.com/sinasave

Training slide – How to use SinaSave 4.0: http://www.siemens.com/sinasave

Website:

Energy saving: http://www.siemens.com/energysaving

Portfolio Motors and Converters:

Low- voltage-motors: http://www.siemens.com/low-voltage-motors

AC-converters: http://www.automation.siemens.com/_en/portal/html/products/products_ac-converters.htm

AC-motors: http://www.automation.siemens.com/_en/portal/html/products/products_ac-motors.htm

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