

How to convince the world that there is money in

Saving the
world?



PUMP **AUDIT**

Pump Audits

& why we should do them



An aerial photograph showing a large ice floe in the Arctic. A ship is breaking through the ice, leaving a dark trail of open water behind it. The ice is a deep blue color, and the ship's shadow is visible on the ice surface.

Being responsible

By pointing out how energy savings can be made, we take our share of the responsibility for climate changes seriously.

And we enable you to make informed, responsible choices.

Why focus on Cost of Ownership?

Global electrical power consumption

- 20 - 25% is used for pump operation
- Political incentive to reduce the power consumption of pumps



Why focus on Cost of Ownership?

Case stories show that the cost of pump operation over it's lifetime is divided as shown:

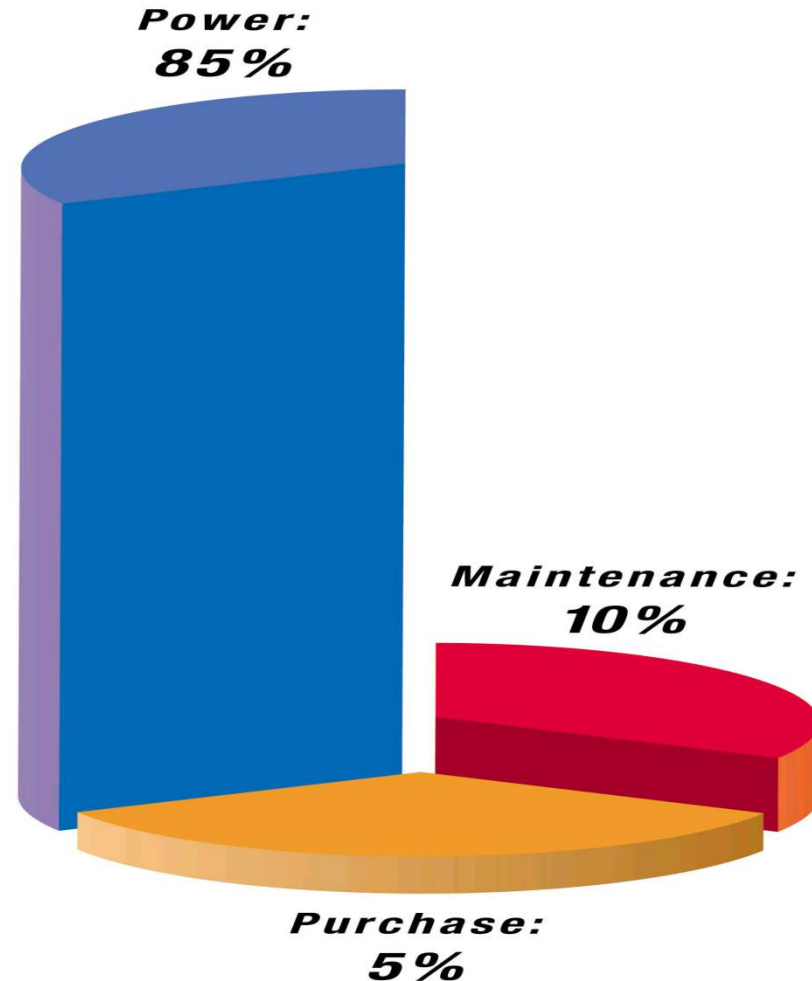
- Price:
- Maintenance:
- Operating costs:

- Show of hands which costs the most.

Why focus on Cost of Ownership?

Case stories show that the cost of pump operation over its lifetime is divided as shown:

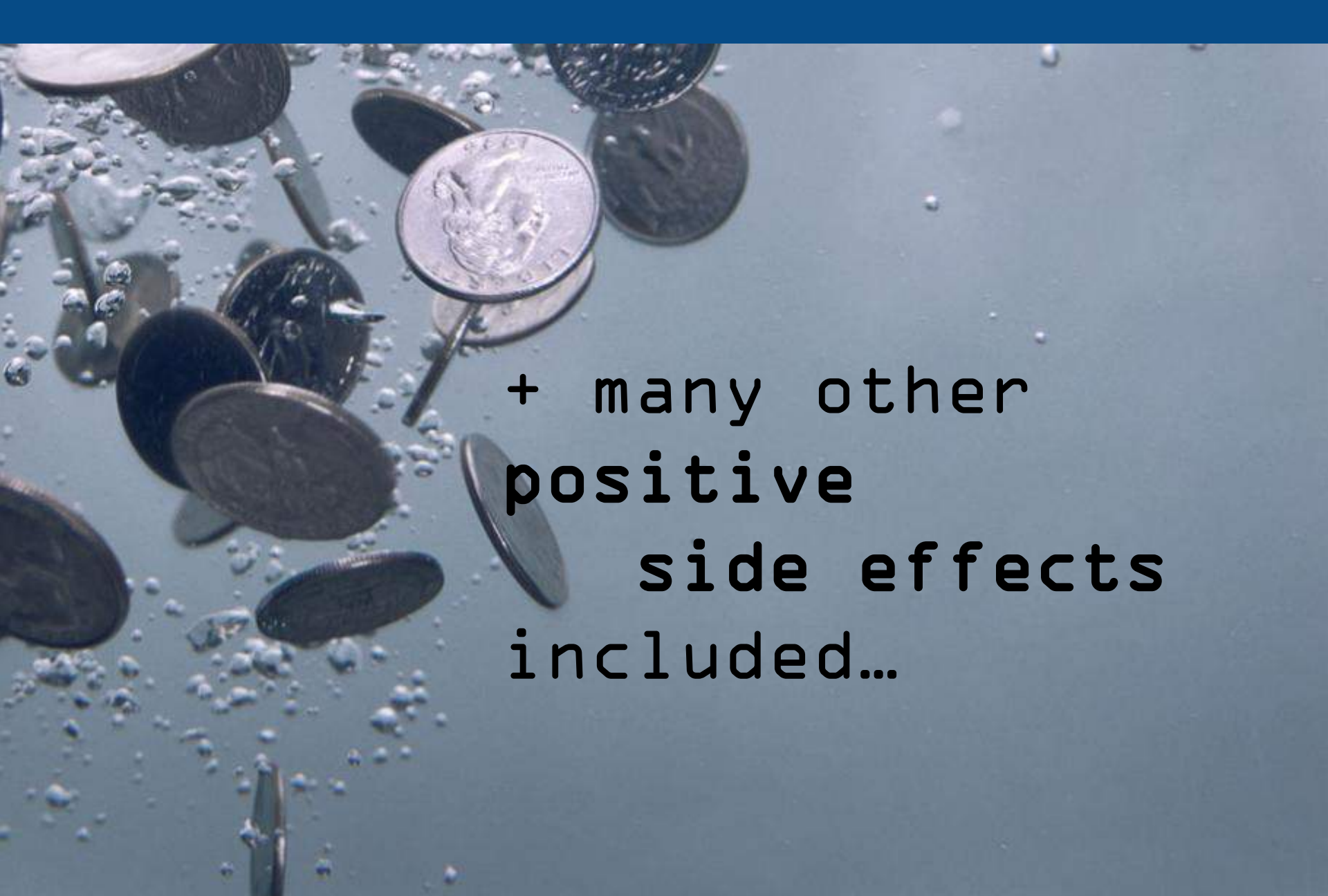
- Price: 5%
- Maintenance: 10%
- Operating costs: 85%



An upgrade that pays for itself

The investments
recommended
in a pump audit report
will pay
for themselves very
quickly.
Often in less than 3
years.





+ many other
positive
side effects
included...

A hand holding a stopwatch next to industrial pumps. The background shows a row of industrial pumps with vertical cylinders and a control box with a digital display and a red emergency stop button. The scene is set in a concrete environment, possibly a water treatment plant.

Reduce downtime

New pump solutions mean more reliable operation



Save on everything

Getting a new pump solution saves more than energy.

It reduces the total life cycle costs in many ways.

- Which parameters do we need to consider/measure in connection with an Pump Audit?

➤ Examples:

- Power consumption
- Flow
- Pressure
- Temperature
- Decommissioning of old system
- Installation of new system
- Maintenance costs

- Others ??

How is it done?

What is it that makes us able to help you find the right pump to cover your needs



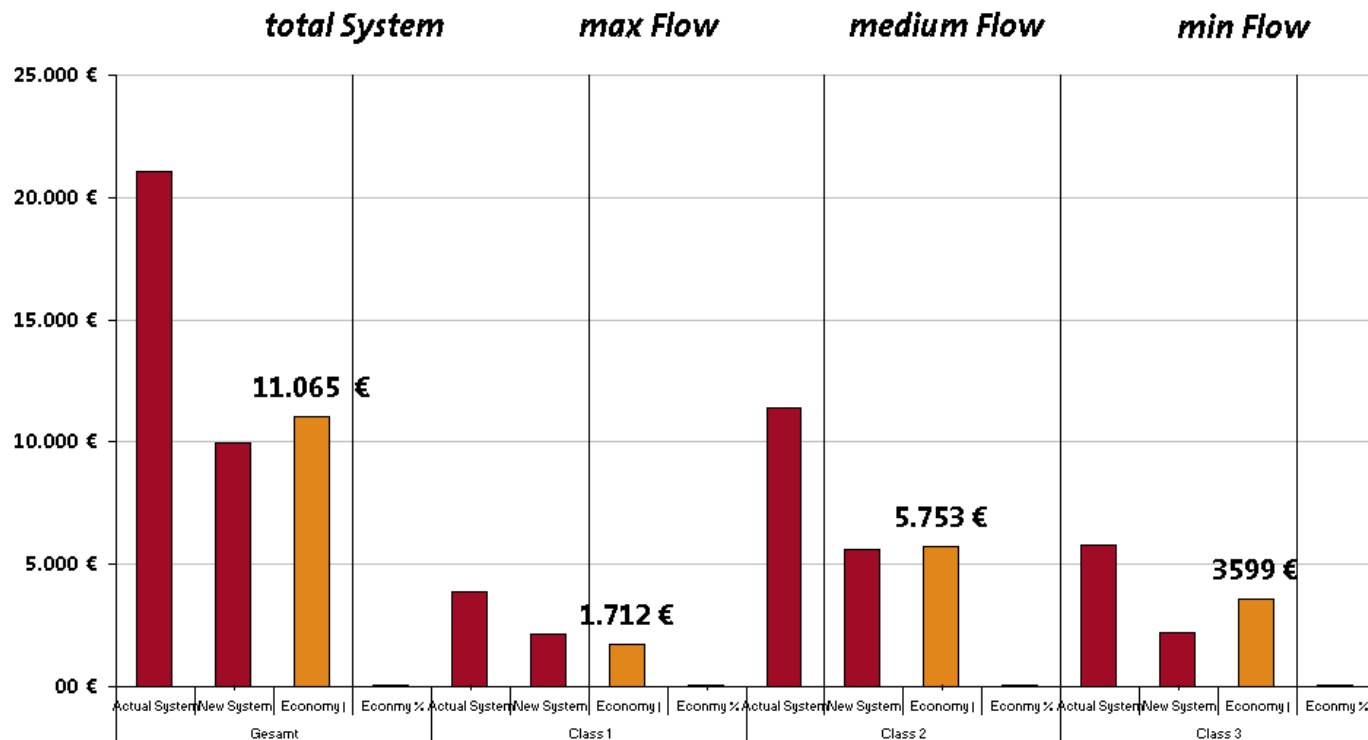
The Process

- ✓ Equipment setup on site
- ✓ Logging the measurements
- ✓ Disconnection of equipment
- ✓ Mapping the load profile
- ✓ Pump selection
- ✓ System comparison
- ✓ Cost specification
- ✓ Calculations...



A pump audit report is concrete proof:

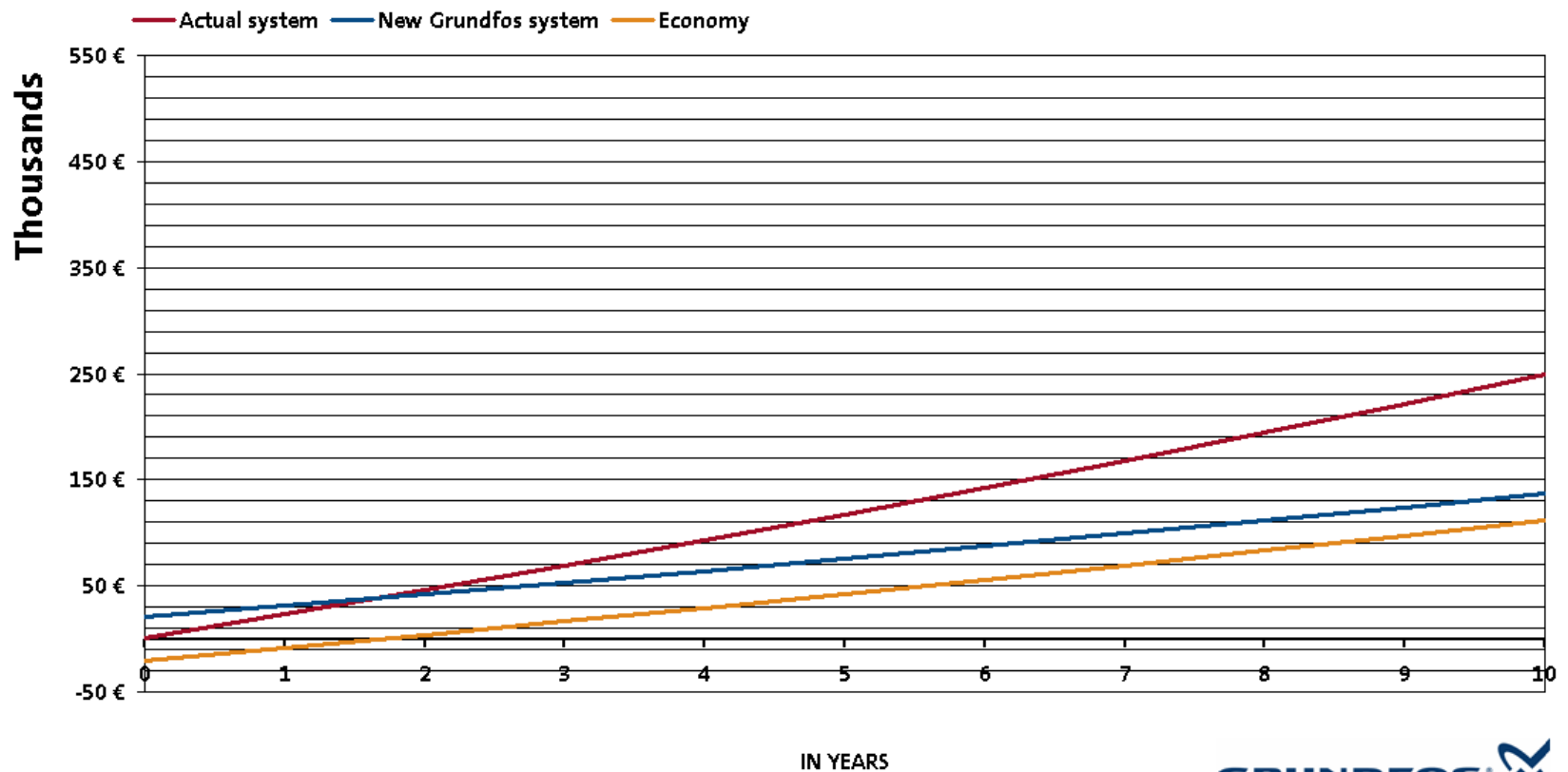
Comparison of the anual energy consumption



A pump audit report is concrete proof:
 “We take almost everything
 into consideration”

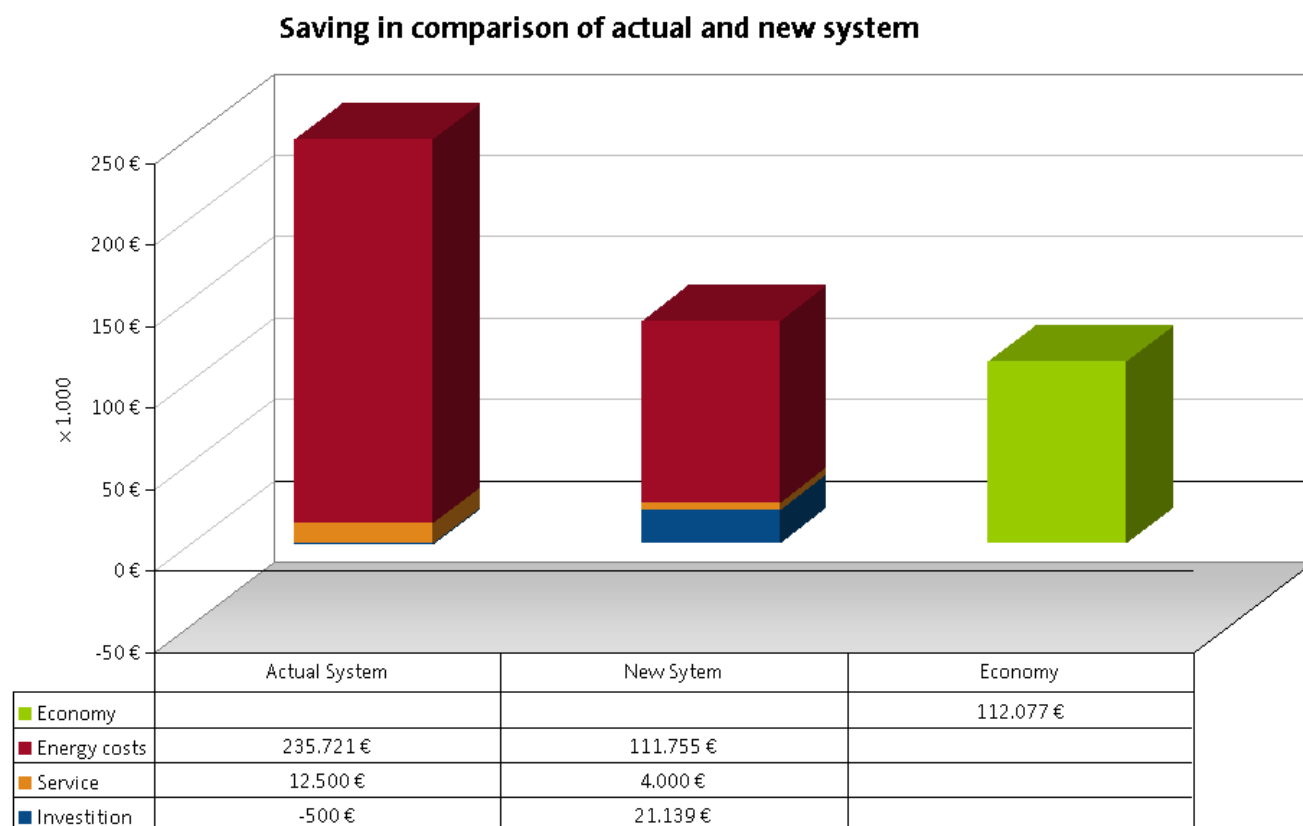
LCC DATA				
Customer	0			
Address:	0			
Phone No:	0			
Project:	0			
System:	0			
Date:	29-9-2007			
Energy price increase			2,5 %	
Change of pump efficiency			1,0 %	
INVESTITION				
	Actual system		GRUNDFOS	
	Vogel 2x55kW fixed speed		Bitte Pumpe / System eingeben	
	Description	price	Description	price
Pump / System	Vogel 2x55kW	500 €	MPC-E4 CRE 64-2-2	19139 €
Control box		0 €		0 €
Accessories		0 €		0 €
Installation	Sold	-1000 €	Labour and parts	2000 €
total investition		-500 €		21139 €
annual costs				
Service				
	Actual system		GRUNDFOS	
	Description	price	Description	price
	Inspection	Labour	500 €	Labour
Maintenance	Spares and labour	750 €	Spares and labour	200 €
Total		1250 €		400 €
Data of load profile				
		Bitte Pumpe / System eingeben		
Flow		620571 m³	620571 m³	
Energy		175335 kWh	83126 kWh	
Energy costs		21040 €	9975 €	
Annual economy		11065 €		

A pump audit report is concrete proof:
“This investment makes financial sense.”



GRUNDFOS® 

A pump audit report is concrete proof:
 “In case you are still not convinced, we
 show you the potential
 savings in 10
 years.”



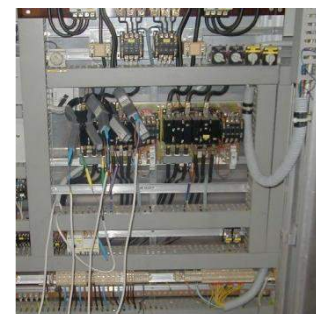


The equipment used



Power meter

up to 480 V, Motor size
from 7,5 to 650 kW



Digital/event sensor
is the pumps on/off etc.



Data logger From Eltek



Ultrasonic flow meter

Measure pipes from 50 - 1000 mm. in diameter
media temperature from -30°C to 130°C .

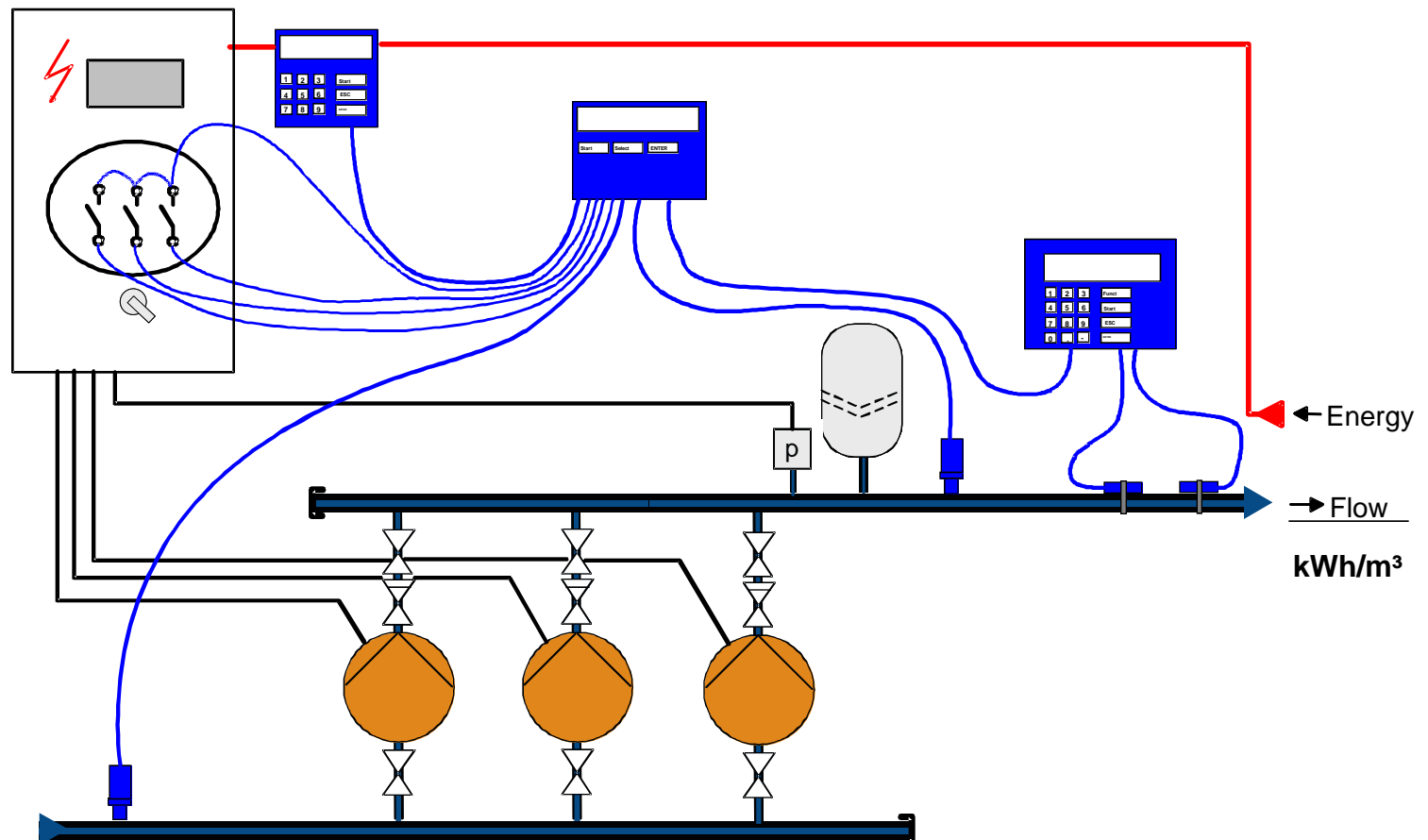
1 digital + 1 analogue output.



Analogue sensor
Pressure, temperature, etc.

➤ How do we obtain the right data for a Pump Audit?

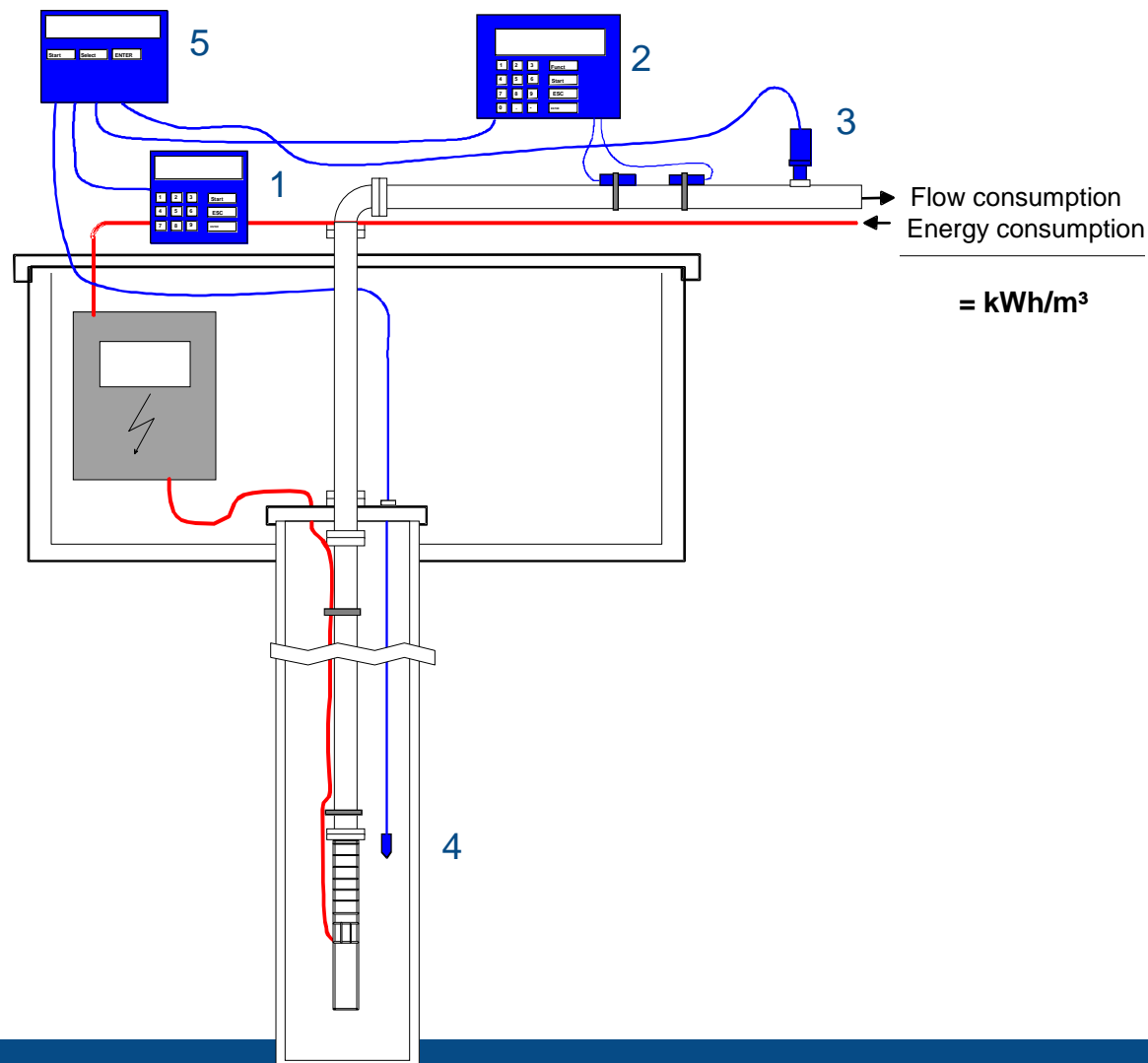
An example for a Booster system



➤ How do we obtain the right data for a Pump Audit?

An example for a ground water extraction system

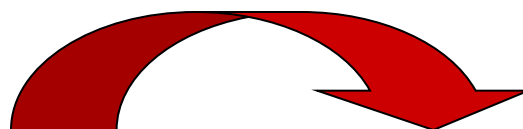
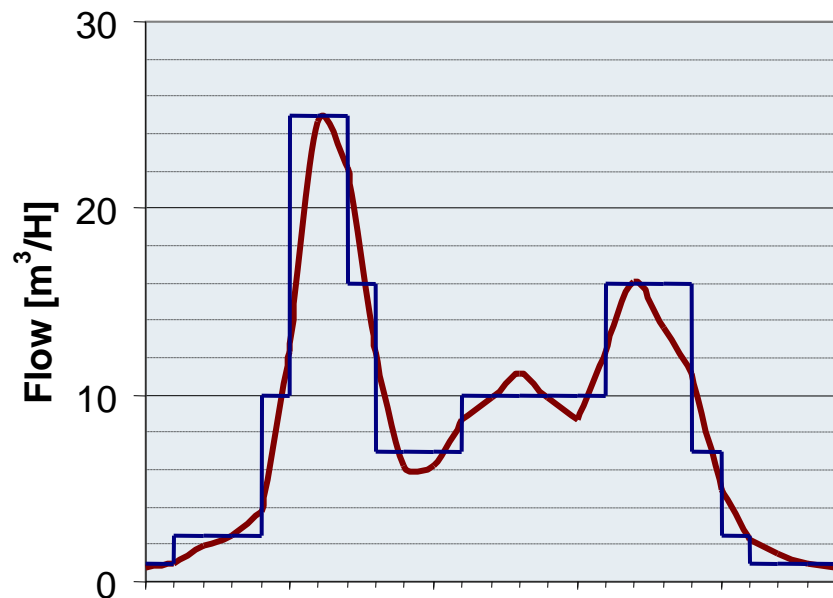
1. Watt meter
2. Flow meter
3. Pressure sensor
4. Level sensor
5. Data logger



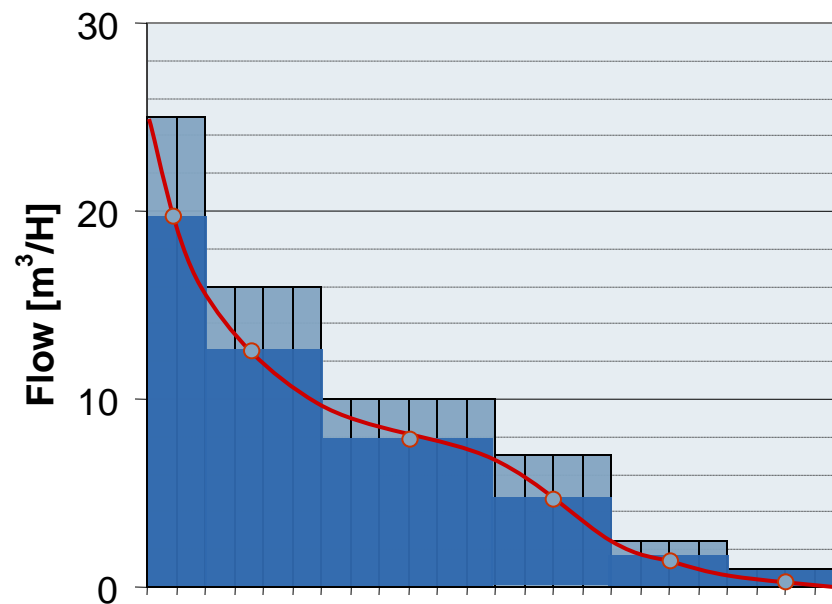
➤ How do we obtain the right data for a Pump Audit?

The most important information we get from the measurement is the
loadprofile

- User profile
 - Flow consumption
 - Energi consumption



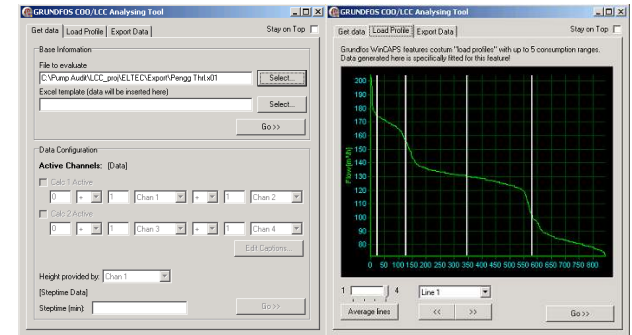
- Load profile
 - Flow consumption
 - Energi consumption



➤ Software for analysing.

➤ Dedicated software to generate a load profile from the raw data

➤ An EXCEL template to convert data to Caps format for a LCC comparison



Prepared data for Load profile

Statistical base data				
	minimum	average	maximum	total
Height	2.50	2.93	3.10	0
Flow (m³/h)	71.40	121.44	204.60	17123
Energy (kWh/h)	28.80	34.31	44.40	4638

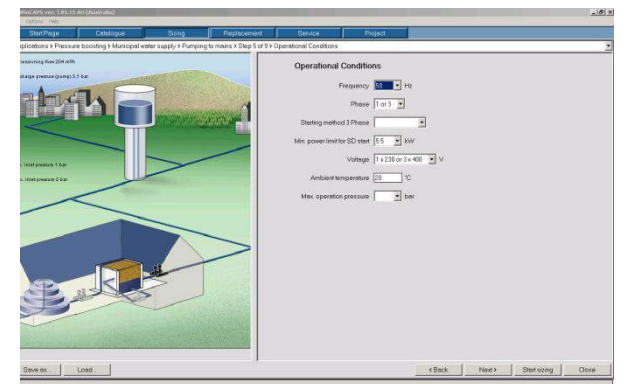
annual operation	days	h/day
	365	12

Dimension data

Pressure (m)	3.10
Flow (m³/h)	204.60
Total Flow / year	531918.38
Total Time (h/year)	4380.00

Analysed data for Load profile

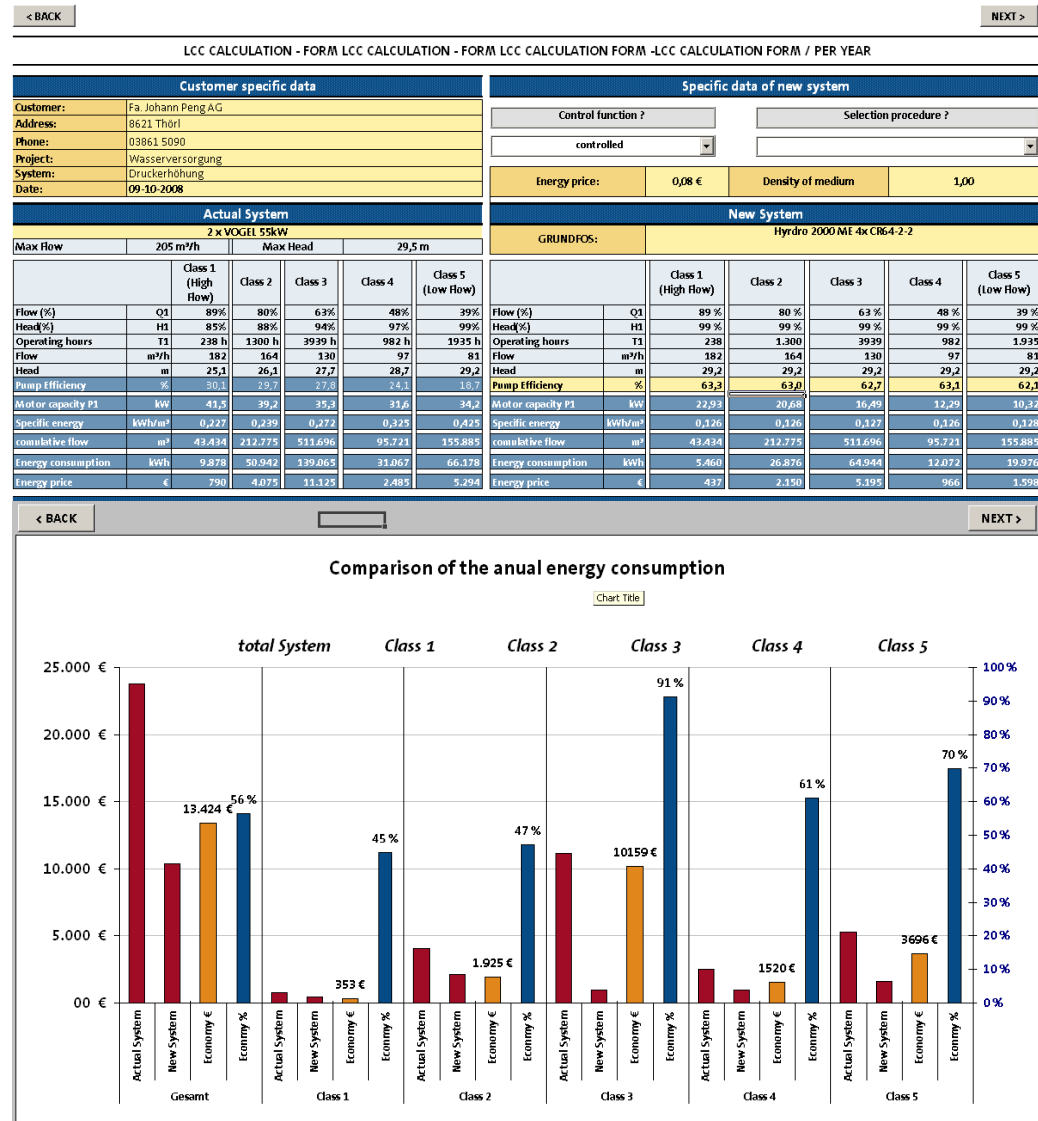
	Flow Q	Pressure H	Time
Class 1	89.03%	80.65%	134.61
Class 2	81.69%	80.65%	548.79
Class 3	86.33%	87.10%	1066.52
Class 4	36.46%	90.32%	1258.08
Class 5	31.09%	93.55%	1371.98



➤ Software for analysing.

➤ The Excel template enables the user to compare the actual system with the new Grundfos system

➤ The Excel template automatically generates a energy comparison



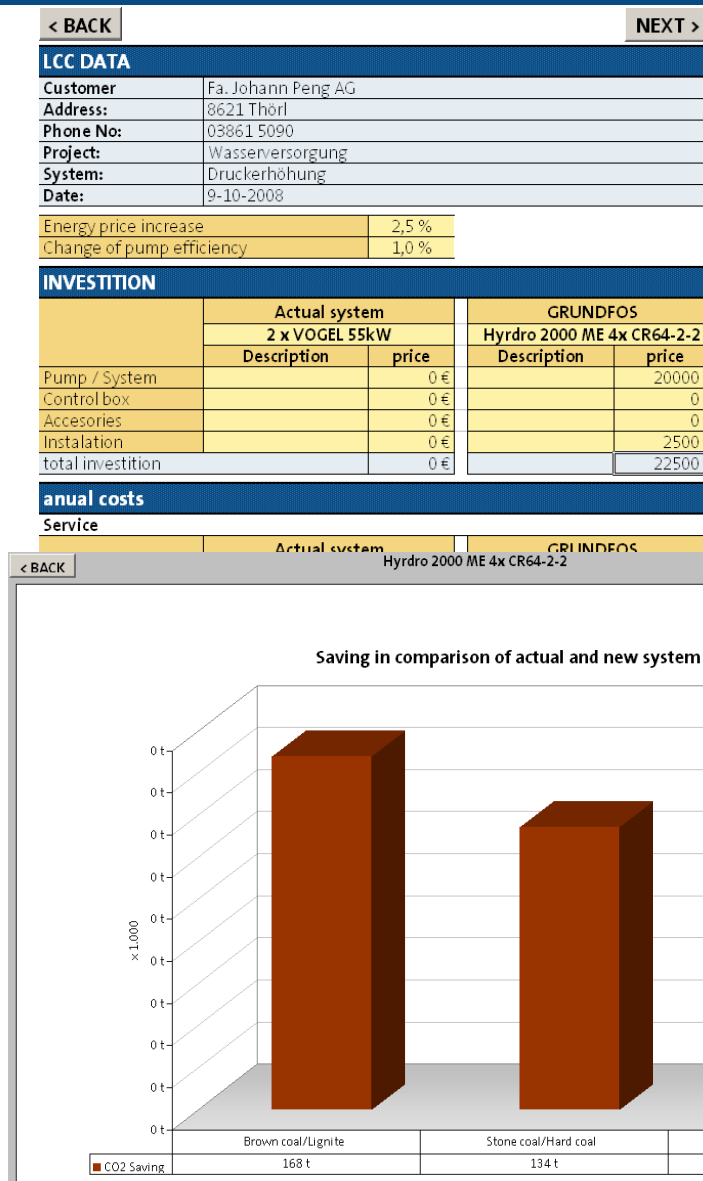
➤ Software for analysing.

➤ All you have to do after comparing the two systems is to fill in the price of the new solution

➤ The template then generates a pay back curve

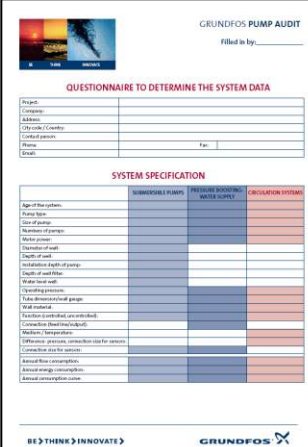
➤ A graph that shows the savings in the first 10 years

➤ A graph that shows the environmental savings in the first 10 years



Pump Audit workflow

- Prepare visit
- Setting up sensors
 - Flow
 - Power
 - Pressure
- Using the data logger to log all measurement – 1 to 7 days
- Extracting data from data logger
- Preparing the data with COO/LCC software
- Analyzing data in Excel spreadsheet template
- Finding a better suitable pump
- Generate a report to the costumer



The image shows a 'GRUNDFOS PUMP AUDIT' questionnaire form. It includes a header with the Grundfos logo and a 'Filled in by:' field. The main section is titled 'QUESTIONNAIRE TO DETERMINE THE SYSTEM DATA'. Below this, there is a 'SYSTEM SPECIFICATION' table with columns for 'SUBMERSIBLE PUMPS', 'PRESSURE/SUCKING WATER SUPPLY', and 'CIRCULATION SYSTEMS'. The table lists various system parameters such as 'Age of the system', 'Piping type', 'Type of pump', 'Number of pumps', 'Pump power', 'Number of pipes', 'Depth of well', 'Installation depth of pump', 'Depth of well flow', 'Water level well', 'Type of system', 'Pipes diameter and length', 'Pipes material', 'Pipes (cathodic protection)', 'Connection (material and type)', 'Medium/temperature', 'Operational pressure (connection data for sensors)', 'Connection (sensors)', 'Annual flow consumption', 'Annual energy consumption', and 'Annual consumption cost'. The form is designed to be filled out by a user, with some fields already pre-filled with data.

Doing the measurements

- Flow
- Power
- Pressure

Flow measurements

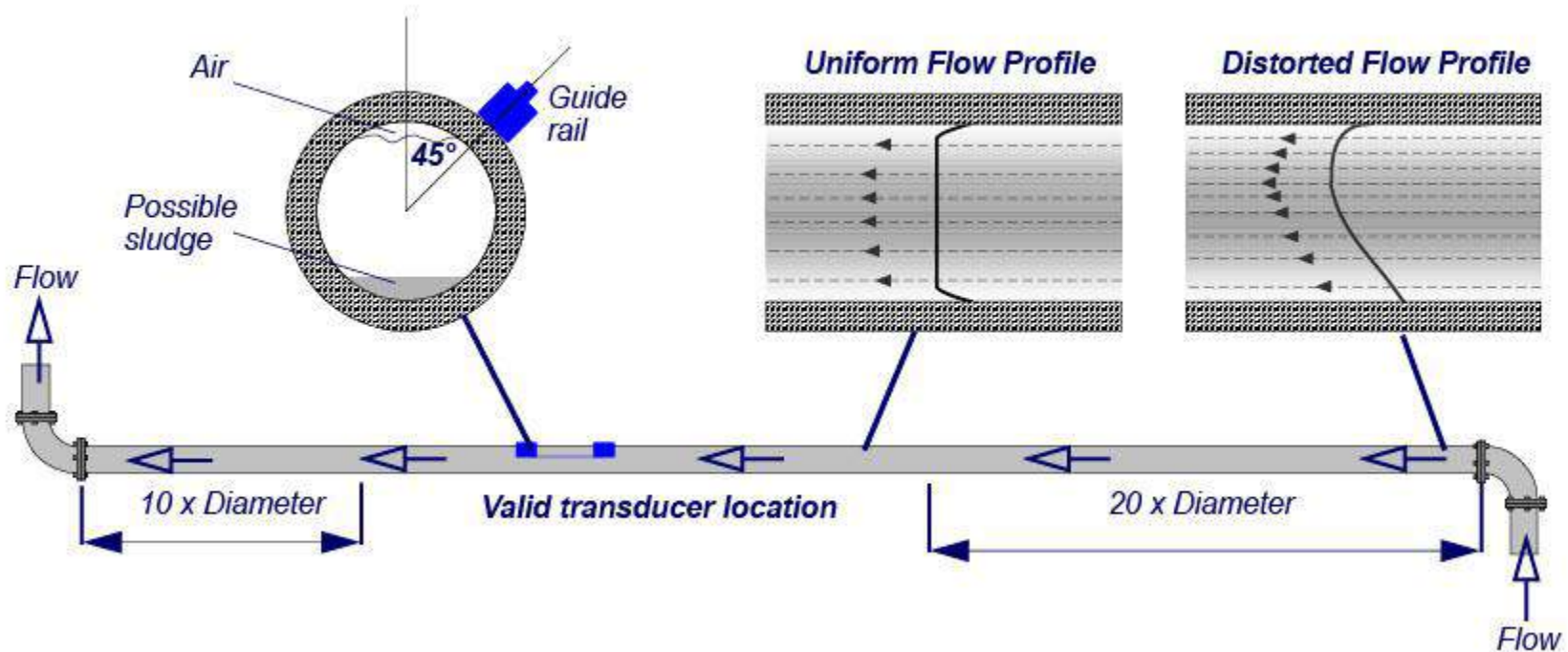
Three ways to get the actual flow:

1. Customers own log
2. Using a snap-on ultra sonic flow meter like the Micronics PF220
3. Using an existing flow meter



Flow measurements

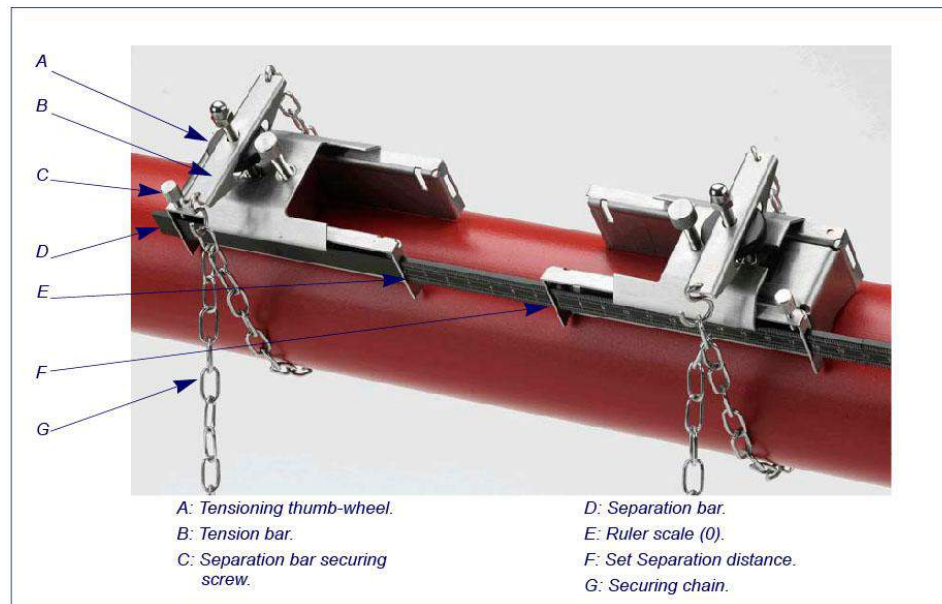
Using a snap-on ultra sonic flow meter like the Micronics PF220



Flow measurements

Using a snap-on ultra sonic flow meter like the Micronics PF220

Use TT130 to measure the pipe-wall thickness



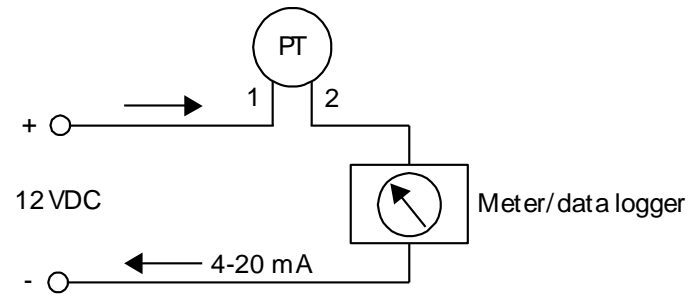
Pressure

- Differential pressure over the pump needed
 - By using two direct pressure transmitters
 - Using on single differential transmitter



Pressure

- In principle



Power consumption

- PM700
 - Current transformers
 - 1/100A = motorsize < 45kW
 - 5/1000A = motorsize > 45kW
 - Maximum 480 V !
 - 4 different connection types:
 - 2 wire phase-neutral
 - Phase-phase
 - 3 wire 3 phase
 - 4 wire 3 phase + neutral



Caps data

The load profile
is now converted
into data that
can be put directly
into caps

Microsoft Excel - coo_lcc_e_04_20061

File Edit View Insert Format Tools Data Window Help

Arial 10 B I U D

140%

134

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

A B C D E F G H

NEXT >

Prepared data for Load profile

Statistical base data				
	minimum	average	maximum	total
Height	2,50	2,93	3,10	0
Flow (m³/h)	71,40	121,44	204,60	17123
Energy (kWh/h)	28,80	34,31	44,40	4838

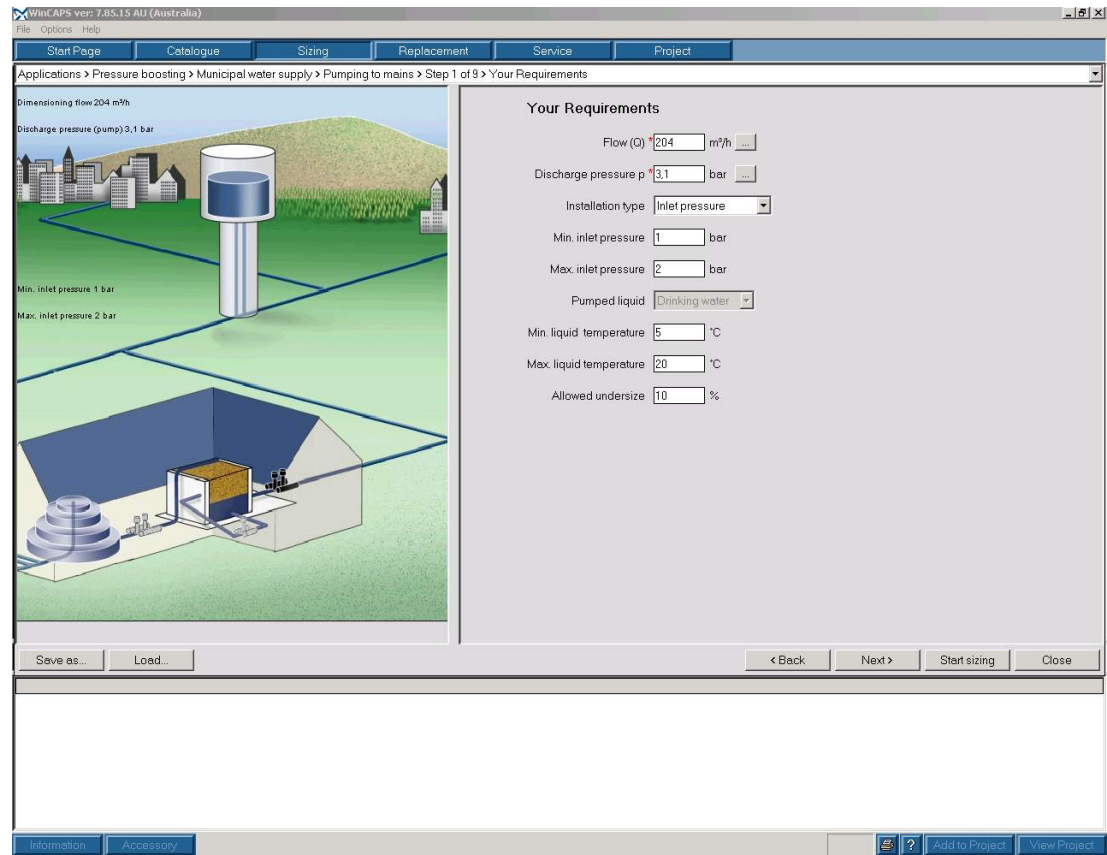
anual operation	days	h/day
	365	12

Dimension data	
Pressure (m)	3,10
Flow (m³/h)	204,60
Total Flow / year	531918,38
Total Time (h/year)	4380,00

Analysed data for Load profile			
	Flow Q	Pressure H	Time
Class 1	88,83%	80,65%	134,61
Class 2	81,59%	80,65%	548,79
Class 3	66,33%	87,10%	1066,52
Class 4	36,46%	90,32%	1258,09
Class 5	31,09%	93,55%	1371,99

From load profil to Caps

Always put in the max. flow and head to make sure that



From load profil to Caps

Always put in the max. flow and head to make sure that the new pump can meet the max demands from the system

The screenshot displays the WinCAPS software interface, version 7.85.15 AU (Australia). The main window is titled "Your Requirements" and shows a 3D visualization of a pump system on the left and a configuration panel on the right. The configuration panel includes fields for Flow (Q), Discharge pressure (p), Installation type, Min. inlet pressure, Max. inlet pressure, Pumped liquid, Min. liquid temperature, Max. liquid temperature, and Allowed undersize. The values entered are: Flow (Q) = 204 m³/h, Discharge pressure (p) = 3.1 bar, Installation type = Inlet pressure, Min. inlet pressure = 1 bar, Max. inlet pressure = 2 bar, Pumped liquid = Drinking water, Min. liquid temperature = 5 °C, Max. liquid temperature = 20 °C, and Allowed undersize = 10 %.

Flow (Q) * 204 m³/h ...

Discharge pressure p * 3.1 bar ...

Applications > Pressure boosting > Municipal water supply > Pumping to mains > Step 1 of 9 > Your Requirements

Dimensioning flow 204 m³/h

Discharge pressure (pump) 3.1 bar

Min. inlet pressure 1 bar

Max. inlet pressure 2 bar

Your Requirements

Flow (Q) * 204 m³/h ...

Discharge pressure p * 3.1 bar ...

Installation type: Inlet pressure

Min. inlet pressure: 1 bar

Max. inlet pressure: 2 bar

Pumped liquid: Drinking water

Min. liquid temperature: 5 °C

Max. liquid temperature: 20 °C

Allowed undersize: 10 %

Save as... Load...

< Back Next > Start sizing Close

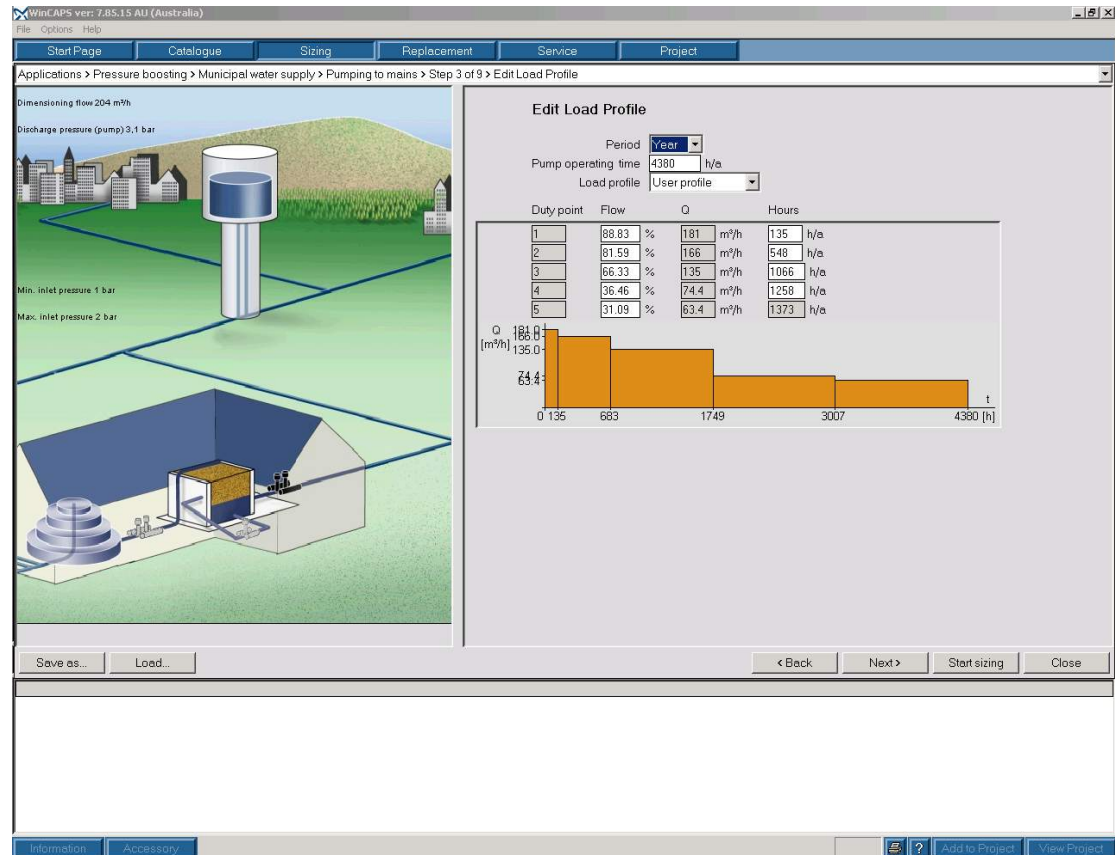
Information Accessory

?

Add to Project View Project

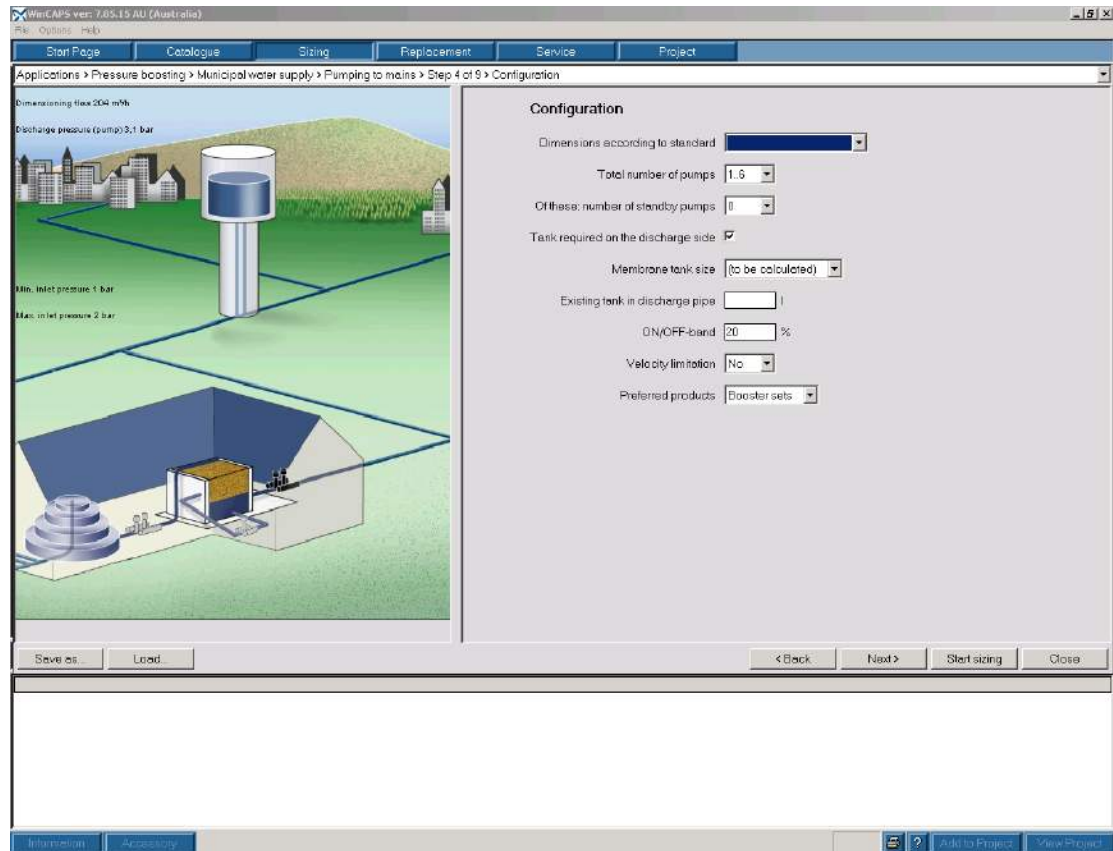
From load profile to Caps

Type in the



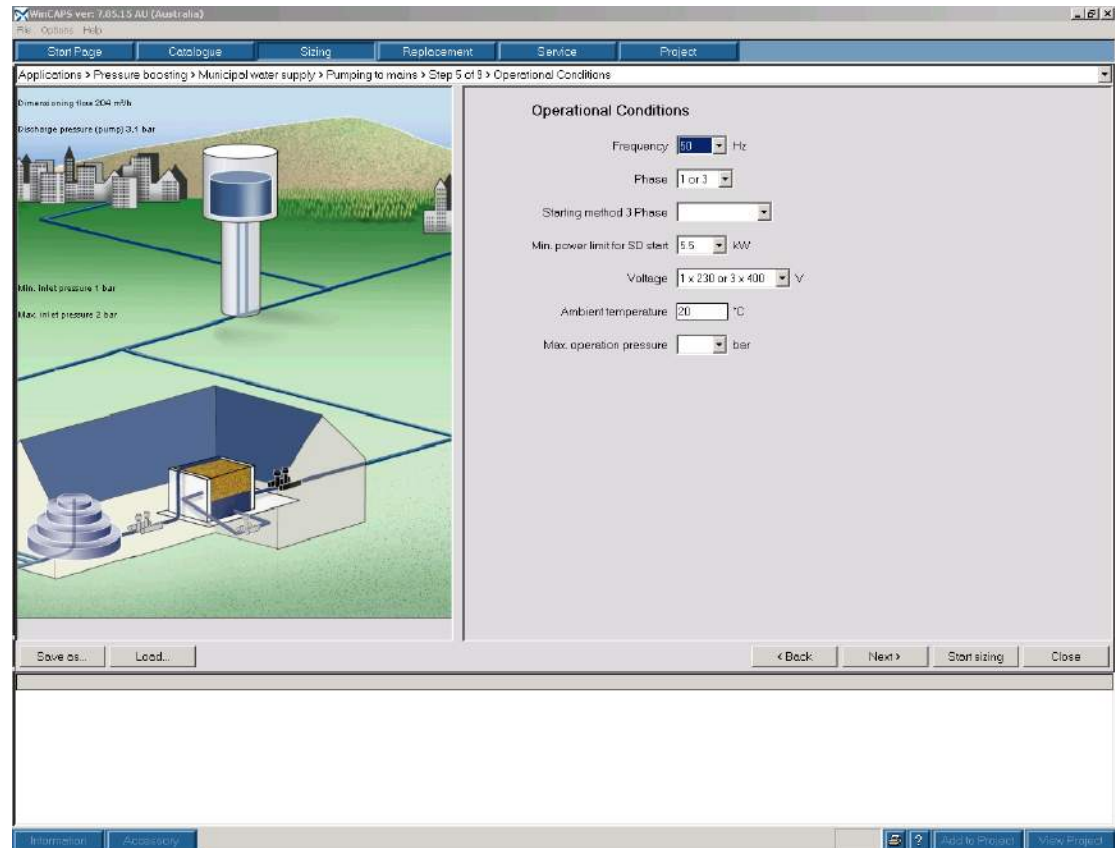
From load profile to Caps to pump

Type in the system configuration for the new system



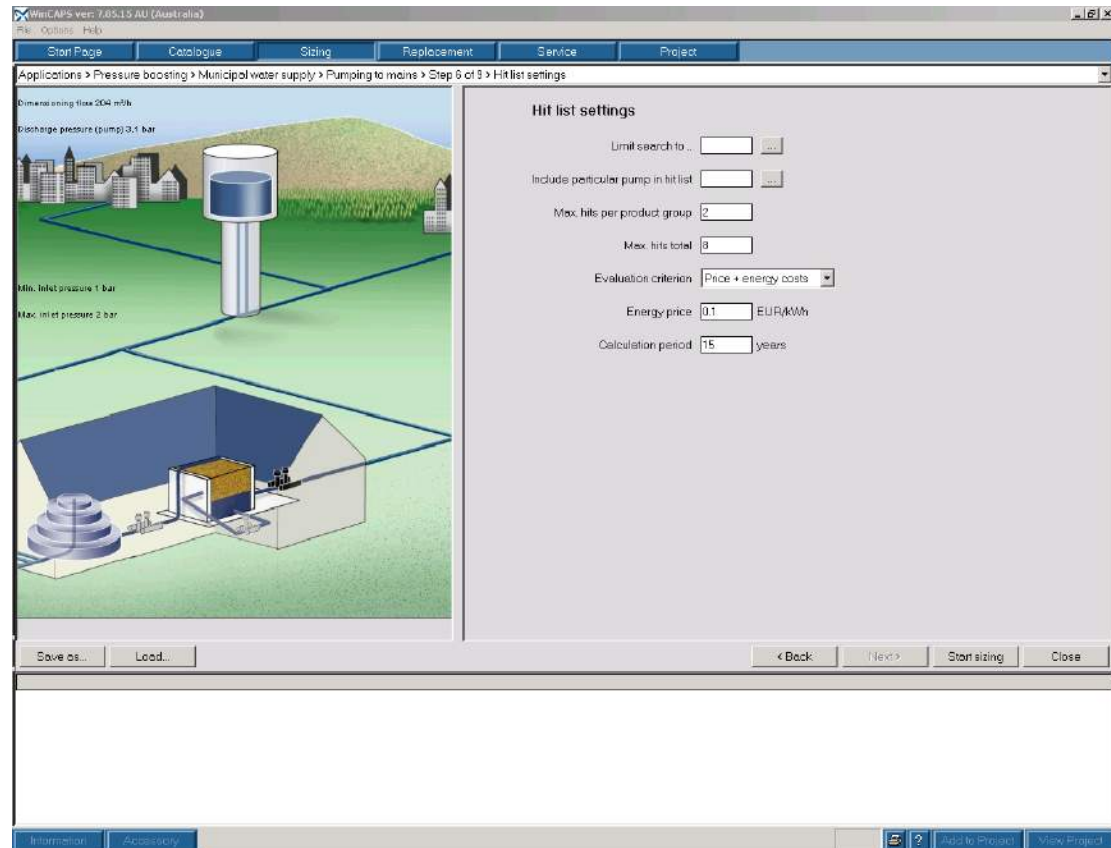
From load profile to Caps to pump

Type in the system operational conditions for the new system



From load profile to Caps to pump

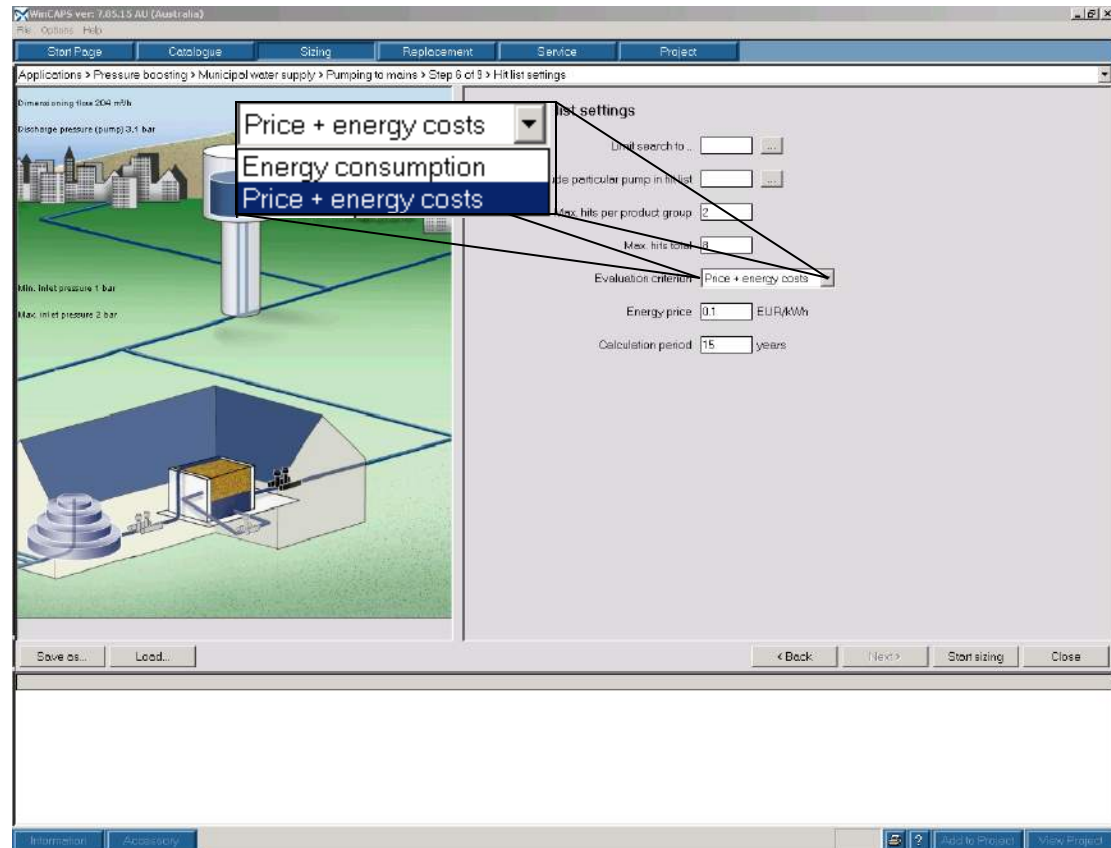
Type in the hit list settings



From load profile to Caps to pump

Type in the hit list settings

Be sure to choose if you want price + energy consumption or only energy consumption

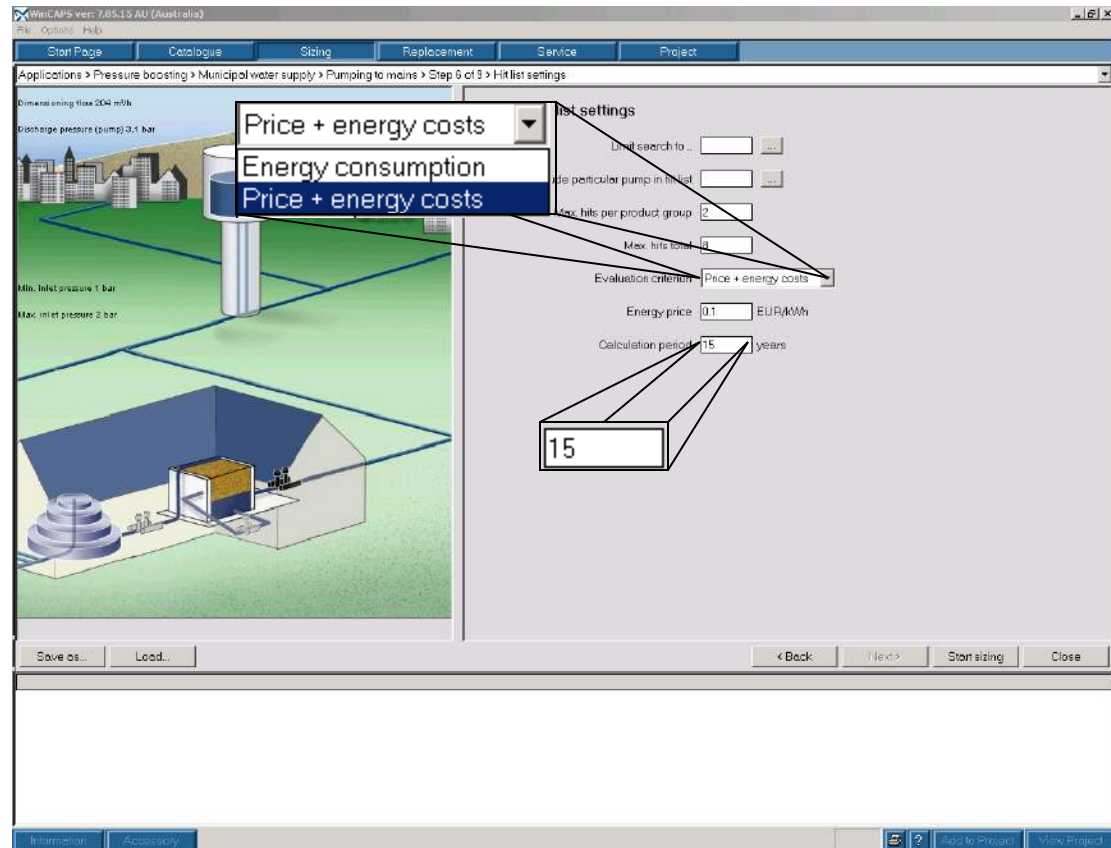


From load profile to Caps to pump

Type in the hit list settings

Be sure to choose if you want price + energy consumption or only energy consumption

Remember to set the lifetime for the new system



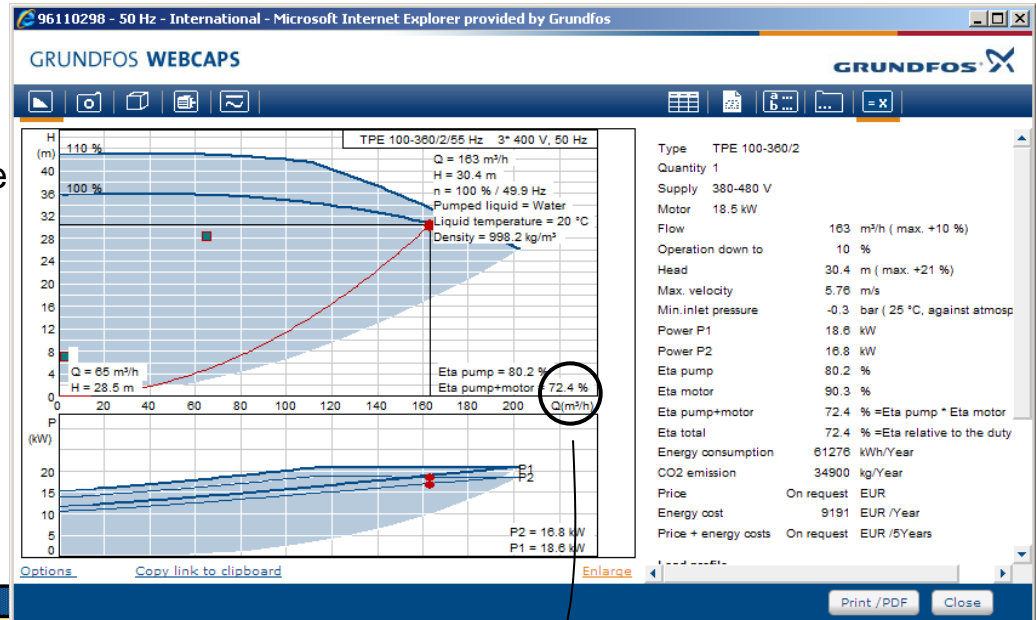
Excel Calculations

- Transferring WebCaps data into Excel
 - Select controlled mode
 - Transfer each head setpoint from the original system to new system

Customer specific data						Specific data of new system							
Customer:						Control function ?		Selection procedure ?					
Address:						controlled							
Phone:													
Project:													
System:													
Date:	19-10-2010					Energy price:		0,10 €		Density of medium			
										1,00			
Actual System						New System							
Please insert the actual System						Please insert Pump / System							
Max Flow	163 m³/h		Max Head	30,4 m		GRUNDFOS:							
		Class 1 (High Flow)	Class 2	Class 3	Class 4	Class 5 (Low Flow)		Class 1 (High Flow)	Class 2	Class 3	Class 4	Class 5 (Low Flow)	
Flow (%)	Q1	92%	86%	80%	60%	40%	Flow (%)	Q1	92%	86%	80%	60%	40%
Head (%)	H1	88%	88%	88%	89%	94%	Head (%)	H1	Setpoint ?	Setpoint ?	Setpoint ?	Setpoint ?	Setpoint ?
Operating hours	T1	1375 h	1367 h	1367 h	1367 h	1367 h	Operating hours	T1	1375 h	1367 h	1367 h	1367 h	1367 h
Flow	m³/h	151	141	130	98	65	Flow	m³/h	151	141	130	98	65
Head	m	26,7	26,6	26,6	27,2	28,7	Head	m	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Overall Efficiency	%	45,2	45,3	45,5	46,2	42,9	Overall Efficiency	%	60,0	60,0	60,0	60,0	60,0
Motor capacity P1	kW	24,2	22,5	20,7	15,7	11,8	Motor capacity P1	kW	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Specific energy	kWh/m³	0,161	0,160	0,159	0,160	0,182	Specific energy	kWh/m³	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
cumulative flow	m³	206.860	192.203	177.349	133.694	88.373	cumulative flow	m³	206.860	192.203	177.349	133.694	88.373
Energy consumption	kWh	33.271	30.766	28.224	21.426	16.092	Energy consumption	kWh	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Energy price	€	3.327	3.077	2.822	2.143	1.609	Energy price	€	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

Excel Calculations

- Transferring WebCaps data into Excel
 - Transfer efficiency from WebCaps



New System						
GRUNDFOS:		Please insert Pump / System				
		Class 1 (High Flow)	Class 2	Class 3	Class 4	Class 5 (Low Flow)
Flow (%)	Q1	92 %	86 %	80 %	60 %	40 %
Head (%)	H1	88 %	88 %	88 %	89 %	94 %
Operating hours	T1	1.373	1.367	1.367	1.367	1.367
Flow	m³/h	151	141	130	98	65
Head	m	26,7	26,7	26,7	27,0	28,5
Overall Efficiency	%	72,4	72,4	72,4	72,4	72,4
Motor capacity P1	kW	18,8	18,8	18,8	18,8	18,8
Specific energy	kWh/m³	0,101	0,101	0,101	0,102	0,107
cumulative flow	m³	206.860	192.203	177.349	133.694	88.373
Energy consumption	kWh	20.793	19.320	17.827	13.591	9.489
Energy price	€	2.079	1.932	1.783	1.359	949

Excel Calculations

- Transferring WebCaps data into Excel
 - Observe final savings
- Finally make a report to the customer

ANNUAL ACCOUNTS		ACTUAL SYSTEM	NEW SYSTEM	SAVING				
Flow capacity	in m³	798.480	798.480	0				
Energy Consumption	in kWh	129.778	81.019	48.760				
Energy costs and economy	in €	12.978	8.102	4.876				
SAVING	in %			38				