



# Xylem VSD Payback Tool

**xylem**  
Let's Solve Water

Significant opportunities exist to reduce pumping system energy consumption through smart hydraulic system design, retrofitting to variable speed performance and operating practices. Significant energy savings can be achieved in a pump system by reducing the pump rotational speed. Variable speed drives (VSD) are one of the primary devices used to control pump rotational speed.

This tool calculates the estimated energy and cost savings that would result from installing a VSD on a pump system. Required inputs include nameplate pump performance, efficiency, motor load, annual operating hours, pump system type and cost of electricity. Using these inputs and the duty cycle, the tool calculates the current energy use, potential energy use with a VSD, and potential cost savings.



#### **Pump Model: e-Line**

Pump Size	LNE 40-125 / 2900 RPM / 50Hz
Motor Efficiency	85%

#### **Duty Point**

Flow	25 m <sup>3</sup> /h
Head	18 m
Max Head of Pump	23 m
Rating Efficiency	62%
Power at Rating	2 kW
Motor Power	2.2 kW

## Step 1

Select **Pump Calculator**

## Step 2

Within the **System Overview** tab

Select **Liquid** (i.e. Water); units of measure can be adjusted by selecting units (kg/m<sup>3</sup>).

Select **System Type**: Liquid Circulating System or Lifting System can be chosen.

## Step 3

Add pump performance, motor data and hydraulic duty point required.

**Static Head of the System** is dependent on system design; 30% of pump total design head (TDH) may be used if this information is unknown.

Once pump, motor and hydraulic performance, plus system characteristics are input, **System Curve** and **Pump Curve** are created (see below).

File Tools Help

1 Select System

Pump Calculator  Fan Calculator  Compressor Calculator

Fast Savings Calculator

System Overview Load Profile Payback Carbon Dioxide Emissions

2 Liquid

Select Liquid Water Add New Delete

Liquid Density ( $\rho$ ) 1000 kg/m<sup>3</sup>

System

System Type Liquid Circulating System

System Preset Default Save Delete

3 Pump Nominal Flow (Qn) 25 m<sup>3</sup>/h

Nominal Head (Hn) 18 m

Maximum Head of the Pump (Hmax) 23 m

Static Head of the System (Hst) 5.4 m

Rated Power of the Motor (Pn) 2.2 kW

Calculated Power of the Motor 2.02 kW

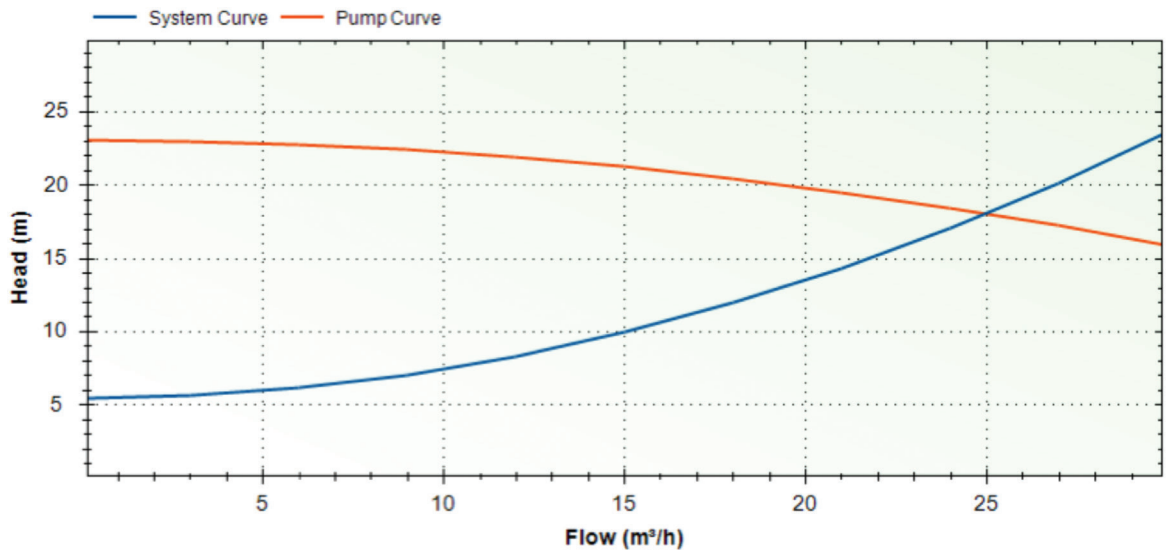
System Voltage (V) 380 V

Nominal Efficiency of the Pump ( $\eta_p$ ) 62 %

Nominal Efficiency of the Motor ( $\eta_m$ ) 85 %

Nominal Efficiency of the Transmission ( $\eta_t$ ) 98 %

Nominal Efficiency of the Drive ( $\eta_d$ ) 97 %



## Step 4

### DEFINE LOAD PROFILE

Select **Load Profile** tab

Within the Load Profile tab, define operation **Hours in Use / Year**. The example at right shows use of 10 hours per day for a full year. This demand rate can be adjusted for specific applications.

Next, **Load Profile %** can be adjusted. Almost always there will be variation of flow rate demand when using a variable speed drive. The load profile can be adjusted by using slider bars or input into **Time %** column.

## Step 5

### SELECT RELATIVE ENERGY USE – THROTTLE VALVE VS. VSD

Select **Throttling, Drive** and **Savings**

Within the graph, the load profile is shown (bar graph – secondary axis). The **Throttling** curve will follow the load profile.

The **Throttle** and **Drive** line curves show the energy (kW) demand as flow demand requirements vary. The **Savings** line curve graphically shows the energy savings at varying flow rates.

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File Tools Help

Select System

Pump Calculator  Fan Calculator  Compressor Calculator

Fast Savings Calculator

System Overview Load Profile Payback Carbon Dioxide Emissions

Hours in Use / Year 3650 h year = 8760 h

Load Profile (%) of 3650 h at Flow

	Flow Rate	Time %	Hours	
Specify time portions in given flow rates	0 - 10 %	0	0 h	
	10 - 20 %	0	0 h	
	20 - 30 %	0	0 h	
<input type="button" value="Import..."/>	30 - 40 %	0	0 h	
	40 - 50 %	5	182 h	
	50 - 60 %	15	547 h	
	60 - 70 %	25	912 h	
	70 - 80 %	30	1095 h	
	80 - 90 %	20	730 h	
	90 - 100 %	5	182 h	
	Total	100	%	

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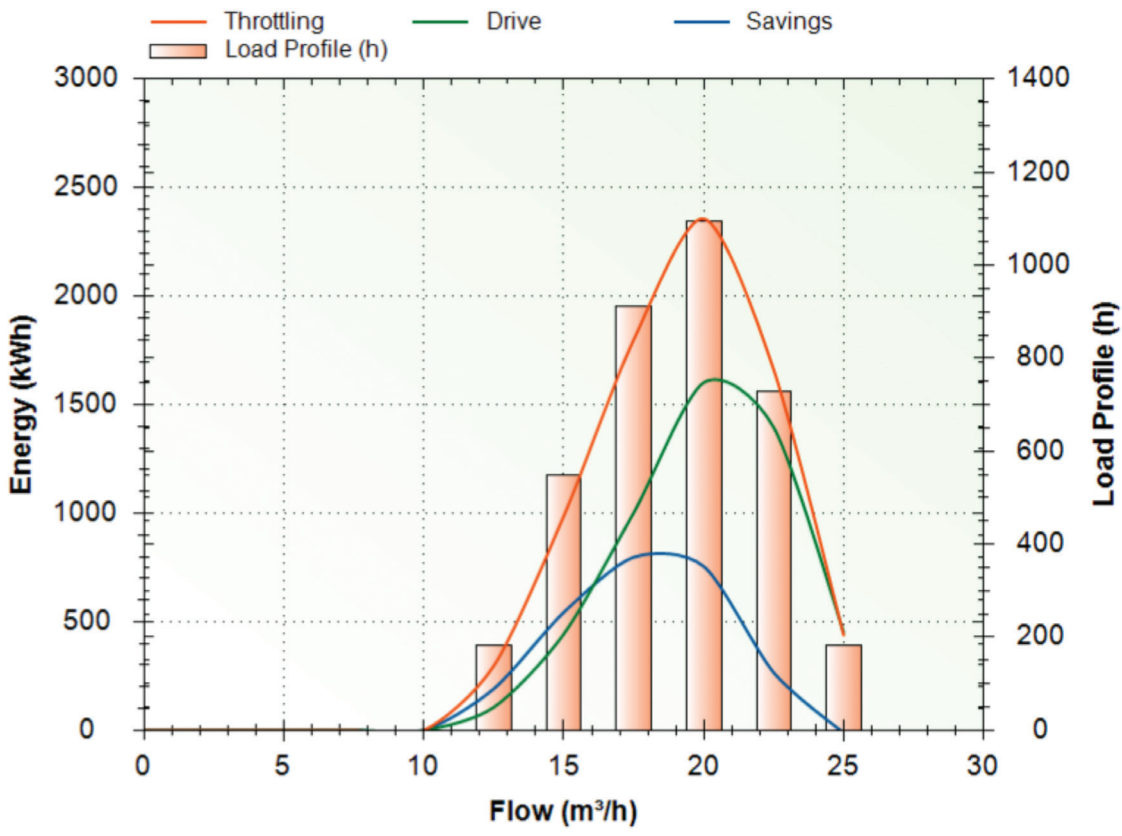
Curves

Throttling  Throttling

Drive

Savings

Energy Required Over One Year



## Step 6 DETERMINE PAYBACK

Input **Installation Costs** and **Component Costs** for both the **Drive System** and **Throttling Control**. Ignore **On-Off Control** inputs and results as variable demand requirements will not suit this solution.

Input **Energy Price**. For this example, energy costs of 19.18 \$/kWh is input to simulate the energy costs of Great Britain.

The output with the Xylem VSD Payback tool shows substantial savings using VSD as opposed to throttling control valve.

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File Tools Help

Select System  
 Pump Calculator  Fan Calculator  Compressor Calculator  
 Fast Savings Calculator

System Overview Load Profile Payback Carbon Dioxide Emissions

System Cost

System	Installation Cost	Component Cost
Drive System	500 \$	1000 \$
Throttling Control	300 \$	600 \$
On-Off Control	0 \$	0 \$

Energy Calculations

Energy Price: 19.18 \$ / kWh

Energy Used Per Year

Drive System	5000 kWh
Throttling Control	7540 kWh
On-Off Control	3152 kWh

Energy Cost Per Year

Drive System	95904 \$
Throttling Control	144612 \$
On-Off Control	60453 \$

Payback

Energy Cost Savings

Cost Difference (Drive vs. Throttle)	48708 \$
Cost Difference (Drive vs. On-Off)	-35451 \$

Payback Time

Payback Time (Drive vs. Throttle)	0.01 years
Payback Time (Drive vs. On-Off)	0.00 years

System Cost

System	Installation Cost	Component Cost
Drive System	500 \$	1000 \$
Throttling Control	300 \$	600 \$
On-Off Control	0 \$	0 \$

Energy Calculations

Energy Price: 19.18 \$ / kWh

Energy Used Per Year

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On-Off Control	3152 kWh

Energy Cost Per Year

Drive System	95904 \$
Throttling Control	144612 \$
On-Off Control	60453 \$

Energy Required Over One Year

System Overview

Liquid	Water
Liquid Density (g)	1000 kg/m <sup>3</sup>
System Type	Liquid Circulating
Pump Nominal Flow (G)	250 G/h
Nominal Head (m)	18 m
Maximum Head of the Pump (m)	25 m
Rated Power of the Motor (hp)	2.2 kW
Calculated Power of the Motor	2.02 kW
System Voltage (V)	380 V
Nominal Efficiency of the Pump (g)	62 %
Nominal Efficiency of the Motor (m)	85 %
Nominal Efficiency of the Transmission (p)	98 %
Nominal Efficiency of the Drive (d)	97 %

Load Profile

Hours in Use / Year: 3650 h	Flow Rate	Flow %	Hours
0 - 10 %	0	0 %	0
10 - 20 %	0	0 %	0
20 - 30 %	0	0 %	0
30 - 40 %	0	0 %	0
40 - 50 %	5	182.5 h	5
50 - 60 %	15	547.5 h	15
60 - 70 %	25	912.5 h	25
70 - 80 %	30	1095 h	30
80 - 90 %	20	730 h	20
90 - 100 %	5	182.5 h	5

Customer: Xylem, Holliston - Anne Sheehan  
 Project: VSD Payback Tool  
 Date: 6/2/2018

Disclaimer: The results used in this calculator are based on Xylem's application experience. Intentional, actual results may vary significantly in application. This calculator is to be used as an estimation tool only and is not to be used for actual results.

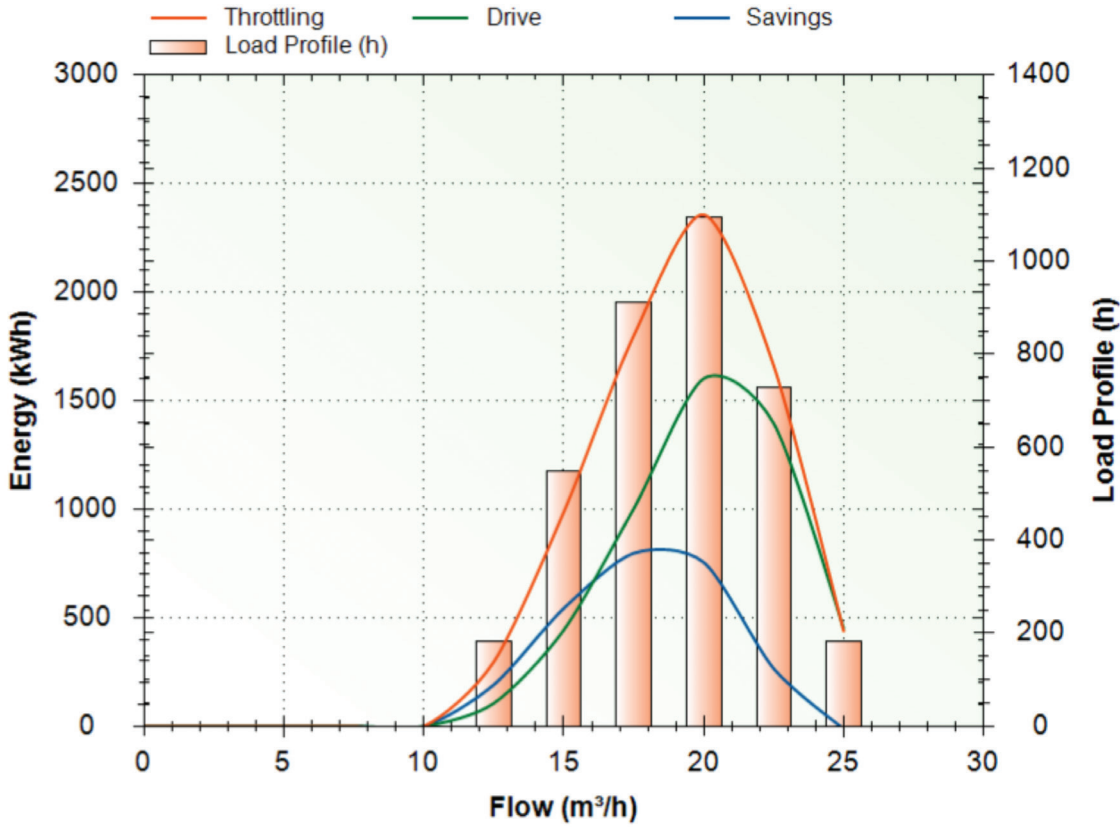
Curves

Throttling  Throttling

Drive

Savings

### Energy Required Over One Year



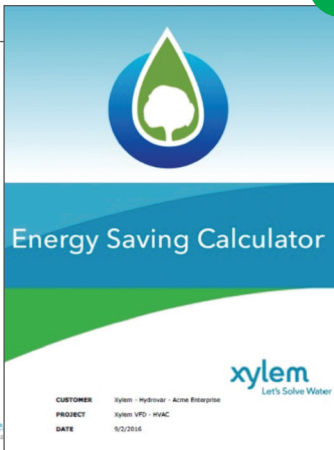
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## Step 7

### SAVE AND CREATE CUSTOMER SUBMITTAL

Select **File**, select **Save As** and define appropriate file name. File can be edited at later date if needed.

Select **File**, select **Export - as PDF**. PDF file will be created and can be used as part of project submittal for end-user.



# Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're a global team unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

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Xylem, Inc.  
1 International Drive  
Rye Brook, NY 10573  
Tel +1.914.323.5700  
Fax +1.914.323.5800  
[www.xyleminc.com](http://www.xyleminc.com)

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