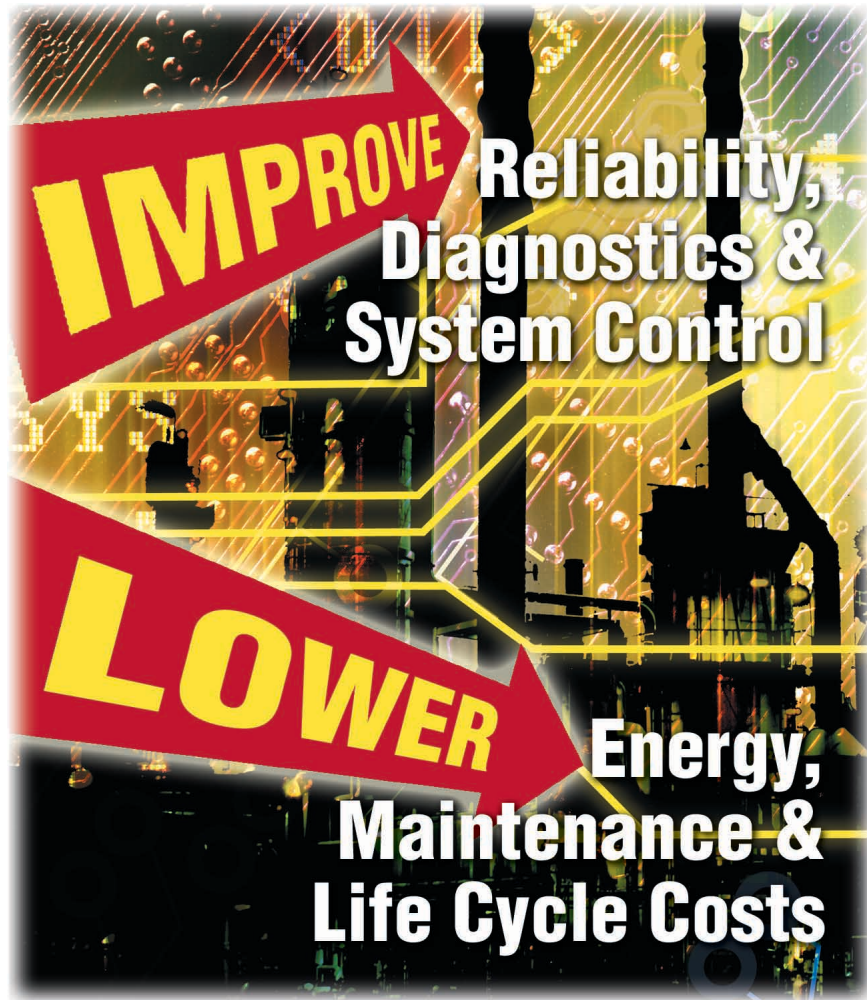


# VARIABLE SPEED PUMPING

## A GUIDE TO SUCCESSFUL APPLICATIONS



### **Variable Speed Drives: A Way to Lower Life Cycle Costs**

#### **The most complete, authoritative VSD guide includes:**

- Overview of pumping system hydraulic characteristics
- Types of pumping systems
- Introduction to variable speed pumping
- Complete guide to pumps, pumping systems, control applications and effects of VSDs
- How to estimate pumping energy costs
- All about motors - types, application and control
- All about variable speed drives - VSDs for induction motors, ac motors, dc motors, control algorithms, integrated motors and drives
- Control Principles for Variable Speed Pumping
- How to select and specify VSDs for retrofitting or new installations
- Benefits, drawbacks, operational considerations
- Integrated diagnostics and protection to help reduce and identify faults
- Financial justification - including Life Cycle Cost analysis
- VSD Case Studies
- Plus an extensive Appendix and Glossary

*“Brilliant, unique, well organized. Focused on problem-solving.”*

## How many ways can you save with variable speed pumping?

Applying speed control can save energy, reduce equipment and maintenance costs, increase reliability and optimize pumping system performance by utilizing the most cost-effective variable-speed pump for a given application. The key is to design all elements of the pumping system to function optimally together, for lowest life cycle cost.

**Variable Speed Pumping, A Guide to Successful Applications** brings together everything you need to know to design, specify and operate successful variable-speed pumping systems - all in one amazingly comprehensive volume. It shows you, step-by-step, how to take a system approach to incorporating VSDs in your applications. If there's a viable way for variable speed control to help generate savings on your pumping costs while improving system performance and reliability, **Variable Speed Pumping, A Guide to Successful Applications** will show you how.

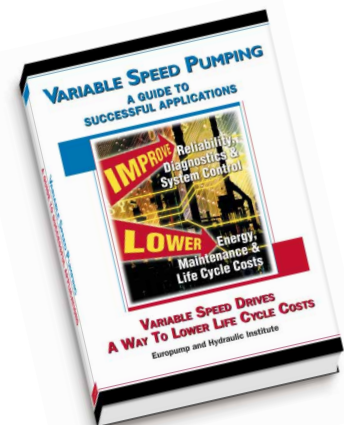
## Everything you need to know in one comprehensive volume.

In over 150 information-packed pages, **Variable Speed Pumping, A Guide to Successful Applications** covers various types of pumps, types of variable-speed and variable-frequency drives and multiple applications. Information is presented clearly and concisely, with a helpful abundance of system and performance curves, tables, illustrations, color photographs, case studies and flow charts that help you choose the appropriate specification methodology.

Compiled, written, edited and critiqued by pump, motor and drive experts in academia and industries the world over, **Variable Speed Pumping, A Guide to Successful Applications** from Europump and the Hydraulic Institute provides authoritative, accurate, comprehensive and completely up-to-date information.

### Variable Speed Pumping, A Guide to Successful Applications Condensed Table of Contents

1. **Introduction**
2. **Pumping System Hydraulic Characteristics**
3. **System and Process Requirements**
4. **Pumps** - Classification, Types, Effects of Speed Variation
5. **Concepts for Estimating Pumping Energy Costs**
6. **Motors**
7. **Variable Speed Drives**
8. **Control Principles for Variable Speed Pumping**
9. **Selection Process** - New Systems
10. **Selection Process** - Retrofitting to Existing Equipment
11. **Benefits, Drawbacks and Operational Issues**
12. **Financial Justification** - Including Life Cycle Cost Analysis
13. **Case Studies** - Eight examples show how VSDs reduced costs
14. **Appendix**
  - Electric Motors: Energy Efficiency and Labeling, (Europe and North America), Motor Sizing
  - Frequency Converters: Design and Sizing
  - Legal Obligations on Manufacturers and Users
  - Frequently Asked Questions
  - Effects of Pump Speed and Impeller Diameter on Magnetically Driven Pumps
  - Efficiency of Variable Speed Drive Systems
  - Abbreviations and Glossary



This authoritative reference to variable speed pumping is available from Europump and Hydraulic Institute.

*“... The form of this guide is a brilliant idea and, to my knowledge, unique. Theory - well balanced sections, amalgamating technical disciplines (pumps, electric motors and controls), which are normally distinct and not easily accessible to non-specialists; the structure is well organized and focused on problem solving.”*

Professor Pietro Giobone  
Chair of Industrial System Engineering  
Department  
Genoa University, Italy

Order at [www.pumps.org](http://www.pumps.org) or at [www.europump.org](http://www.europump.org)

## Why Should You Consider Variable Speed Drives?

Traditional flow-control methods - using throttling valves or bypass lines - waste energy and frequently increase operating and maintenance costs. However, when properly applied, VSDs have the potential to significantly lower energy costs, improve overall system reliability and minimize pumping system life cycle costs.

Here's just one example of many from the Guide. In systems with only friction head, reduction in pump speed results in a substantial reduction in power consumption, while the pump continues to operate near its Best Efficiency Point (BEP).

You can consult the Guide for detailed, immediately usable information like this for various types of pumps, motors and drives in a variety of pumping applications.

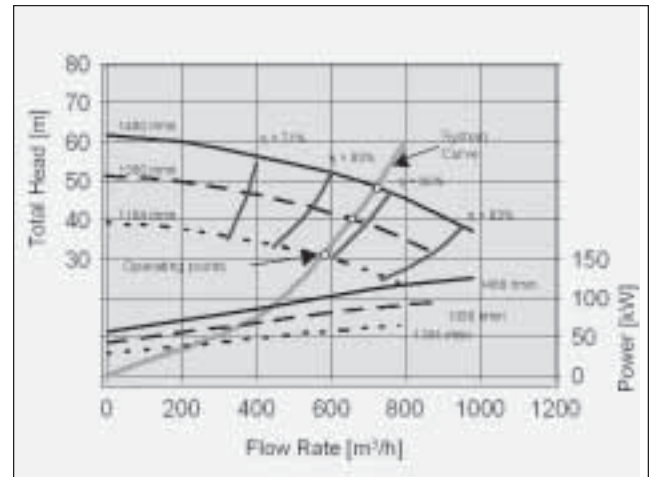
## Making the right choice.

**Variable Speed Pumping, A Guide to Successful Applications** is the only reference you need for comprehensive guidance in making the right specifications for various types of pumps and pumping systems.

- **Top Level:** You can make informed decisions with flow charts that take you step-by-step through the selection process, whether you're retrofitting an existing installation or designing a new one.
- **Specification and Selection:** You have at your fingertips the most current, the most accurate, most detailed information for matching pump, drive and motor, application and economic characteristics to your application.
- **Life Cycle Cost:** The technical and system-level information in the Guide will help you design and specify pumping applications that minimize life-cycle cost. The Guide's reference section covers Life-Cycle Cost analysis to assist in formulating financial justification. Readers are encouraged to obtain a copy of the HI & Europump "Pump Life Cycle Costs: A Guide to Pump LCC Analysis for Pumping Systems." A complimentary copy of the Executive Summary of the Guide can be downloaded from the "Energy Savings" section of the Hydraulic Institute website, [www.pumps.org](http://www.pumps.org).

## How to Order...ORDER TODAY!

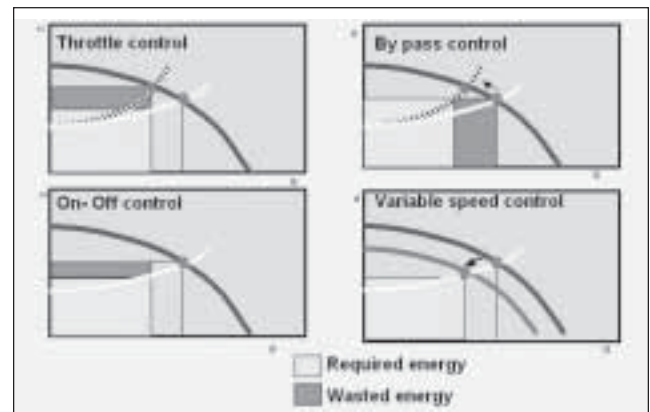
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Example of the effect of pump speed change in a system with only friction loss, permitting the pump to operate near its Best Efficiency Point.

*“One really important point - and it's unique - is the book tells which applications will save energy, and which may not (and even so, the user may benefit from improved process control).”*

Geoff Brown  
Drive Application Consultant  
ABB Ltd



These examples show the energy savings benefits of variable speed control compared to other methods of operation.

*“I think what is special with this book is that it looks at the whole system and tries to teach the reader about the interdependencies of the various components that make up the system. It tells you what happens in the system as a result of changes to one component and that the result is not always what you expect it to be. It also gives you the tools and the knowledge to figure out what the result is when you make changes.”*

Gunnar Hovstadius  
Pump Consultant & Contributing Editor

## Learn how to reduce pumping costs & improve reliability.

*“Variable Speed Drives are widely acknowledged as having a key role in saving energy in pumping systems, but without an understanding of the pump systems that they control, much of this potential will remain untapped. This much needed book at last bridges the gap between the worlds of variable speed drives and pumps, and is essential reading for everyone with a responsibility for pumping systems. Based on the combined knowledge of leading VSD and pump experts, it presents highly practical information on both the opportunities and the pitfalls to consider when contemplating the installation of a VSD.”*

Dr Hugh Falkner, Future Energy Solutions, UK

### Avoiding the Pitfalls.

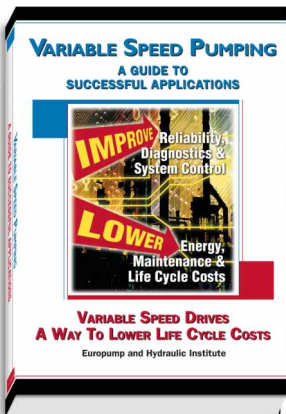
**Traditional control methods such as throttling or use of bypass valves can be wasteful. Inappropriate application of VSDs can unnecessarily increase energy usage and costs, or generate wasted expenditures.**

The use of variable speed drives in pumping systems is now an accepted practice for reducing costs and improving reliability ... if the technology is applied appropriately for each application.

HI/Europump's **Variable Speed Pumping: A Guide to Successful Applications** covers both the basic principles of pump, motor and drive technology as well as more advanced, specific and detailed concepts. The Guide encourages the use of variable speed pumping in appropriate applications, helping to avoid design, specification and application errors. Use of the information in the Guide can lead to cost savings from reduced energy consumption as well as from increased pump system reliability.

### The most complete, authoritative VSD guide.

Only **Variable Speed Pumping: A Guide to Successful Applications** brings together all the concepts, metrics and step-by-step decision-making support that can help you decide which VSD strategies are appropriate for your specific application requirements and which specific systems will yield the greatest Life Cycle Cost benefits. Make sure that your pump resource library also includes the **Pump LCC Guide**, a companion, for minimizing pump life cycle costs.



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*“The Appendices give a view on the regulatory mechanisms in both Europe and the US, which are difficult to find in one place.”*

Geoff Brown, Drive Application Consultant  
ABB Ltd



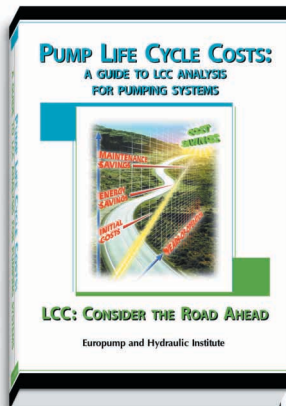
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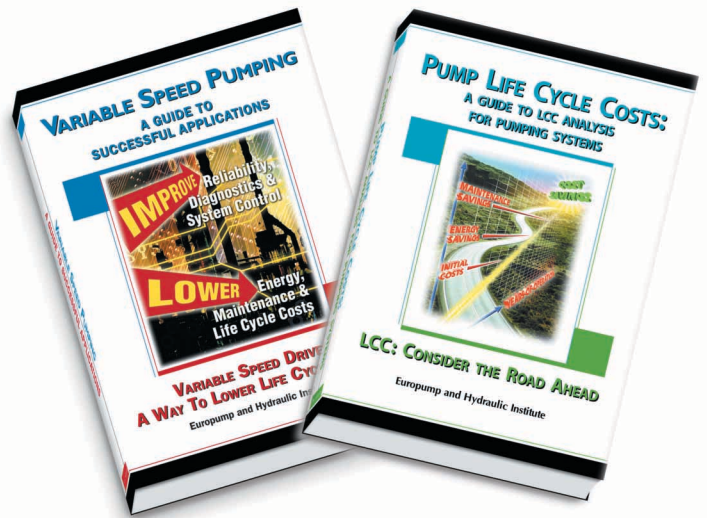
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The Hydraulic Institute, established in 1917, is the largest association of pump producers in North America. HI serves member companies and pump users by providing product standards and valuable forums for the exchange of industry information. HI has been developing pump standards for over 80 years. For information on membership, organization structure, member and user services and energy and life cycle costs visit the HI website at [www.pumps.org](http://www.pumps.org) or email: [publications@pumps.org](mailto:publications@pumps.org)

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#### ABOUT EUROPUMP

Europump, established in 1960, acts as spokesman for 16 national pump manufacturing associations in Europe and represents more than 450 enterprises. Europump serves and promotes the European pump industry. It provides information on technical and other pump related matters. For information regarding Europump work in the field of life cycle cost issues, please email: [secretariat@europump.org](mailto:secretariat@europump.org)

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