Ecodesign Requirements for Electric Motors – Towards a System-Approach

Demonstrating the benefits of motor starters for fixed speed applications

CAPIEL

european coordinating committee of manufacturers of electrical switchgear and controlgear

A message from the CAPIEL Presidents

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As outlined in the Kyoto Protocol, climate change is one of mankind's key challenges for the 21st century. In the context of an ever-growing demand for electricity, the EU has committed itself to substantial greenhouse gases emissions reduction including a 20% cut in Europe's annual primary energy consumption by 2020.

Improving the energy efficiency of products has been flagged as presenting a significant potential for energy savings. Ecodesign – an engineering challenge today – can play a great role by minimizing environmental impact, thus leaving a greener planet to the next generation.

At CAPIEL, it is our duty to work with decision-makers to ensure that legislation will achieve better energy efficiency and reflect real-life conditions. It is also our responsibility to make sure that these regulations are well understood and correctly interpreted by designers and users of electrical products, systems and solutions.

This brochure provides information and guidance as regards ecodesign for electric motors and related control modes to achieve real-life energy efficiency.

We hope that you will find it of interest.

Yours sincerely,

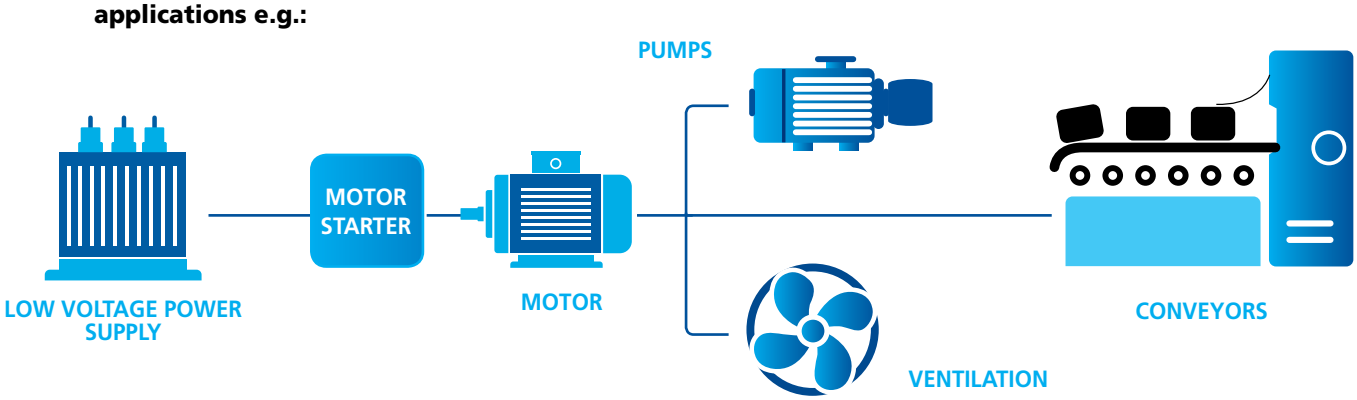
Philippe Sauer and **Karlheinz Kaul**

CAPIEL is the European Coordinating Committee of Manufacturers of Electrical Switchgear and Controlgear

The scope of the CAPIEL industry covers all the equipment, products fittings, systems installed and services required for operations of low voltage switchgear and control gear (products, systems and assemblies).

CAPIEL notably provides various **start & control solutions for induction motors** (e.g. direct-on-line, Star Delta or soft-starter):

Start & control solutions are particularly energy-efficient for fixed-speed applications e.g.:

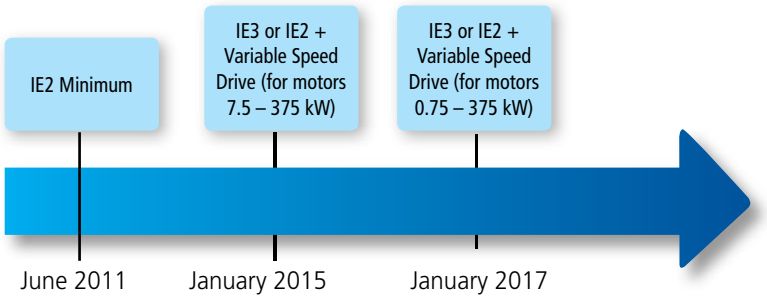


EU Ecodesign – Electric motors
what is at stake?

Towards better energy efficiency

The Ecodesign Directive 2009/125/EC aims to improve the energy and environmental performance of products throughout their life cycle by systematically integrating environmental aspects at the earliest stages of product design.

Following the Lot 11 study, the Ecodesign Regulation 640/2009/EC introduced mandatory efficiency requirements for electric motors:



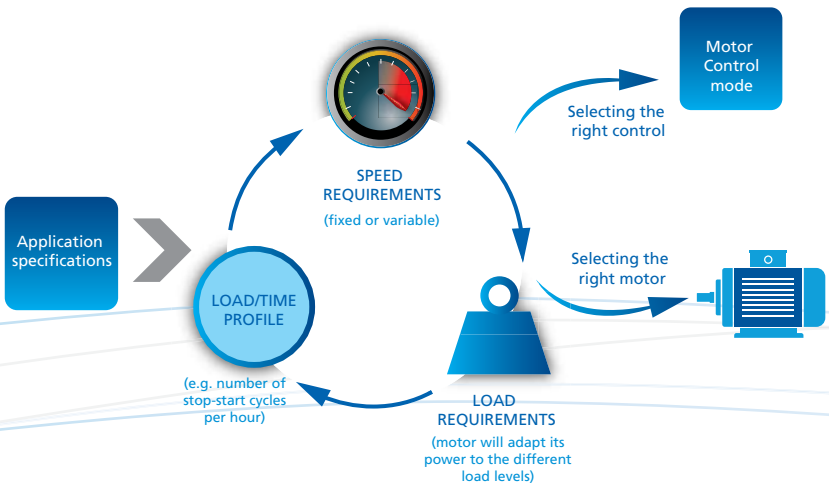
IE: International Efficiency

The Lot 30 aims to identify the energy saving potential of electric motors that are not covered (or are excluded) by Regulation 640/2009/EC such as those outside the power range 0,75 kW to 375 kW.

In addition, the Lot 30 also looks into the impact of motor controllers on the efficiency of motor systems.

The need for a system-approach

Real-life energy efficiency can only be achieved through a **system-approach**. Both the **motor and its control mode must match the intended application requirements:**



Ecodesign requirements for electric motors will influence purchase decisions and impact real-life energy savings. Assessing the energy-efficiency potential of motor control solutions requires a system-approach.

Motor starters
the best solution for fixed speed applications

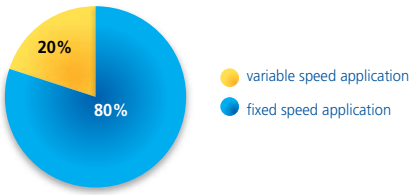
One size does not fit all

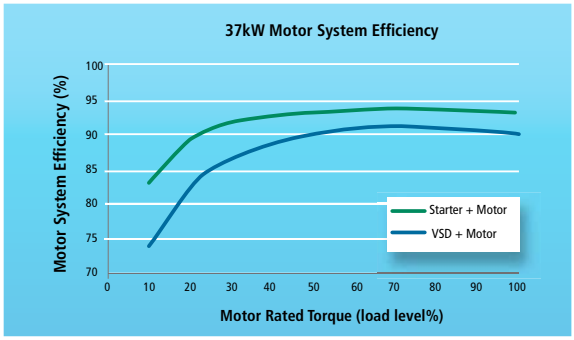
A **Variable Speed Drive** (VSD) is an electronic device used to control motor speed.

Regulation 640/2009/EC (Lot 11) **can be misinterpreted** as saying that a less energy-efficient motor, if fitted with a Variable Speed Drive, has an equivalent level of efficiency as a more energy-efficient motor.

Grasping the energy efficiency potential of motor starters for fixed-speed applications

- Majority of applications are **fixed speed** where varying load levels are automatically balanced by the motor torque:
- Motor starters are highly efficient for fixed speed and variable load applications
- Above 30% load level, a motor equipped with motor starters will allow substantial energy savings compared to a motor with VSD:





source: Motors with Adjustable Speed Drives: Testing Protocol and Efficiency Standard - de Almeida et a.- EEMODS 2009

While VSD is the best option for some applications, motor starters are the most energy-efficient solution for fixed-speed applications.

5 advantages
of Motor Starters

Motor starters (**direct-on-line, Star Delta or soft-starter**) offer many advantages as control solutions:

1. **Negligible energy losses**
2. **Optimal control cabinet design** (no need for additional cooling meaning lower energy consumption)
3. **Simple implementation** (no need for additional power supply)
4. **Robust motor system** (no EMC issues, high level of safety & reliability, long life-time)
5. **Low cost** (affordable price, simple installation, operation & maintenance)

Achieving energy-efficiency
a correct motor control for each application

A Case Study: Bulk material conveyor

Typical fixed speed application:

- Fixed speed driven by a 37kW motor
- Variable load carried requiring the adaption of the load level according to the duty profile
- Operating time (estimate): 3,600 h/year.

Using a motor starter instead of VSD would save 4.3 MWh per year (6.1%):

	Efficiency		Energy [MWh] per year	
Load	Contactor + Motor	VSD + Motor	Contactor + Motor	VSD + Motor
0%	Off	Standby	0.0	1.6
20%	90%	83%	3.0	3.2
40%	92%	87%	17.4	18.4
80%	94%	91%	45.3	46.8
Total			**65.7**	**70.0**

Potential energy losses due to an inappropriate motor control mode

Total energy consumption for electric motors: 850 TWh/year

Fixed speed applications **= 80%** market share (estimate)

Variable speed applications **= 20%** market share (estimate)

If all motor starters are replaced by VSD (5% additional losses)

+ 34 TWh/year **=**

x 1.5

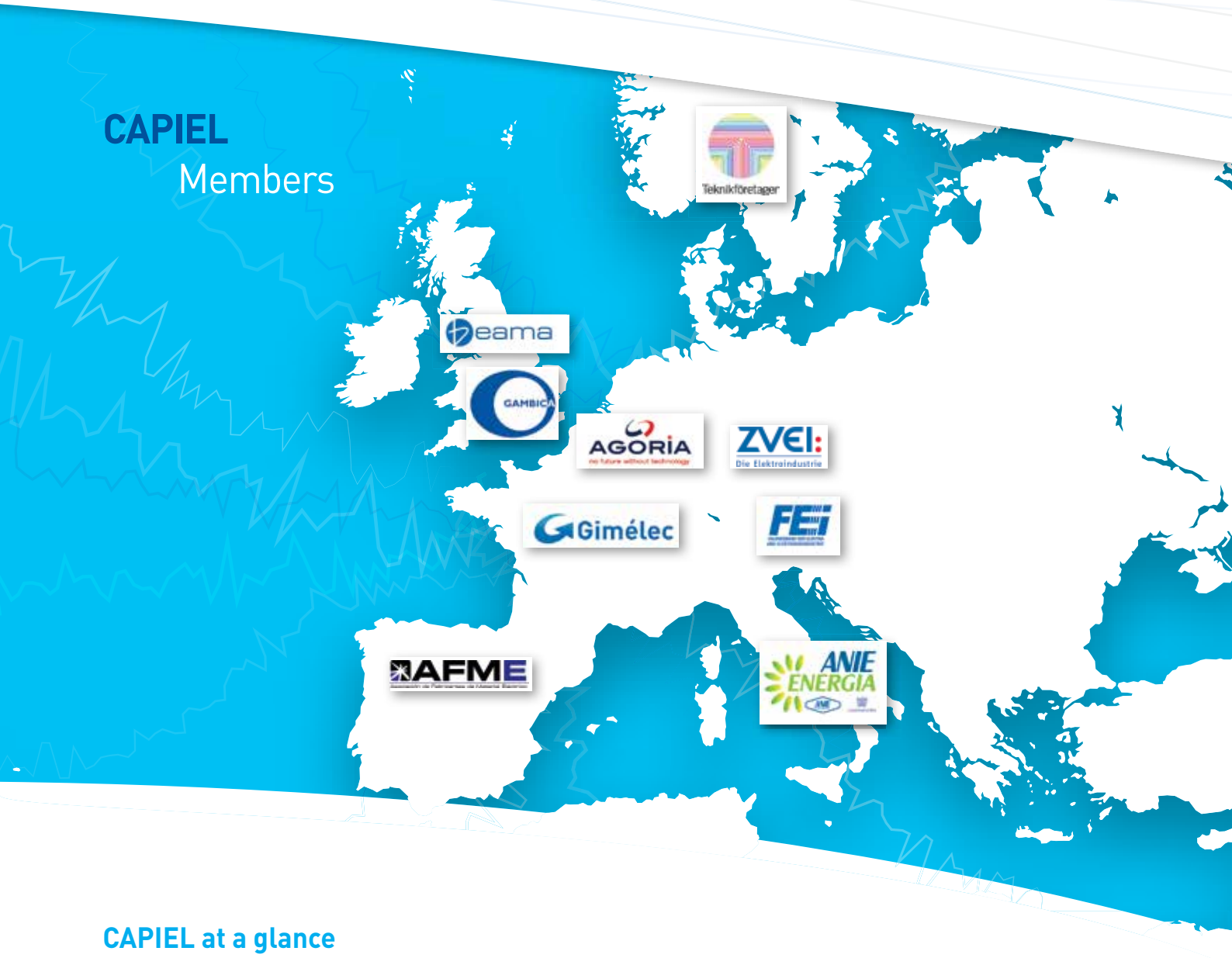
Nuclear plant energy production =23 TWh/year (average)

Ecodesign requirements must follow a system-approach to ensure that the motor control will match the application requirements. Inappropriate motor control selection will result in substantial energy losses.

- Energy-efficiency must be assessed through a **system approach: the motor control mode must match the application requirements.**
- **Motor starters are the most efficient control solutions for applications with a fixed speed and variable load.**
- **VSD if incorrectly fitted** can result in an **energy efficiency loss** equivalent to twice the potential gain from IE2 to IE3 (17 TWh/year*).

*Source: CEMEP

CAPIEL
Members



CAPIEL at a glance

CAPIEL represents **9 national associations** from 8 European countries comprising **more than 550 manufacturers**.

Members of national associations represented by CAPIEL include small, medium and large-sized companies **employing 120,000 people** directly in Europe and have a combined turnover of **€18.25 billion**.

CAPIEL membership includes **global players** like Siemens, Schneider Electric, ABB, Eaton, Rockwell Automation, etc.

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