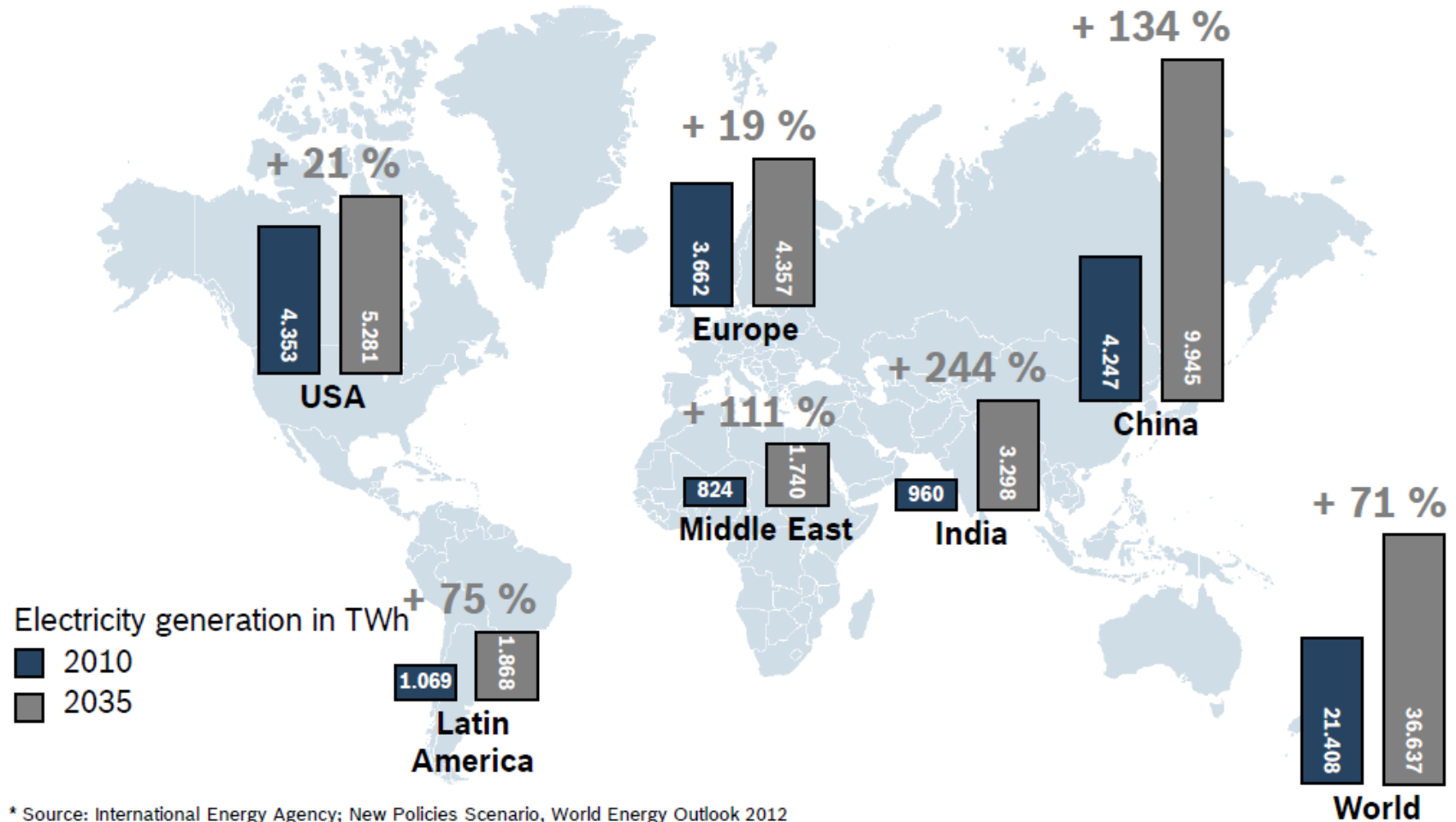


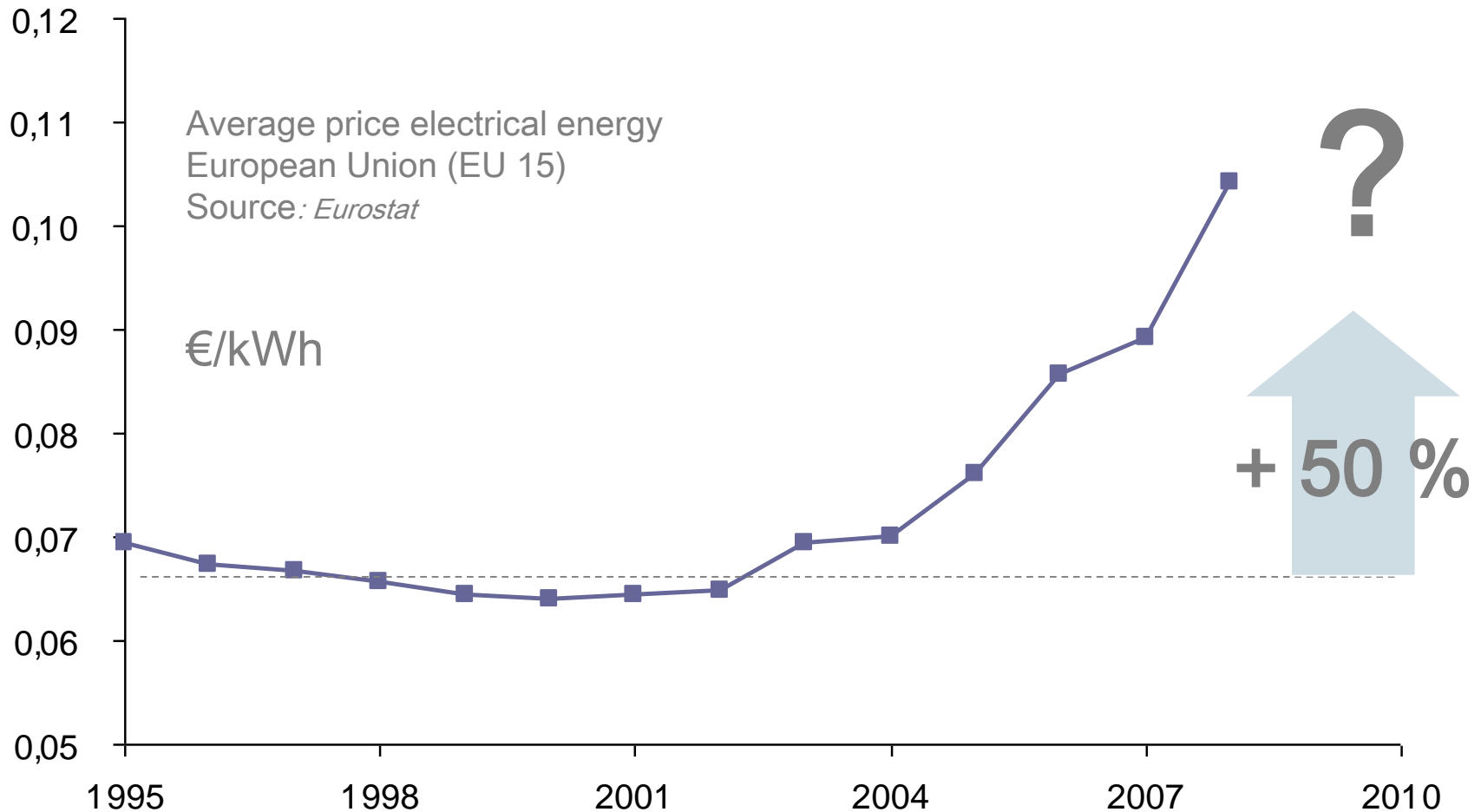
4EE – High Performance Energy Efficiency for Hydraulic Machine Drive

Wagner Mattos, Bosch Rexroth Brazil

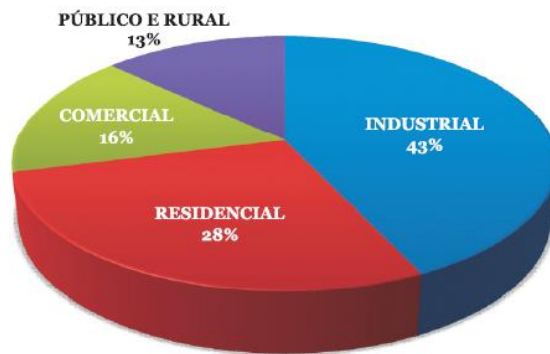
Electricity Generation by Region



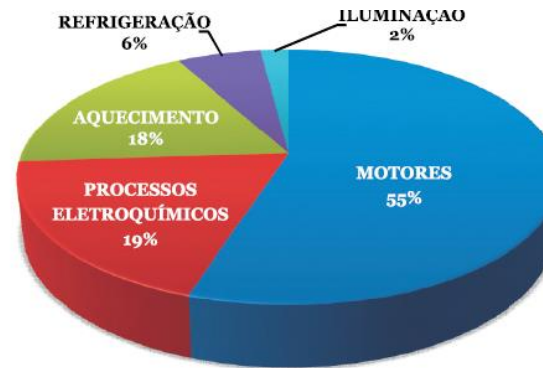
Energy Prices for Industrial End-User



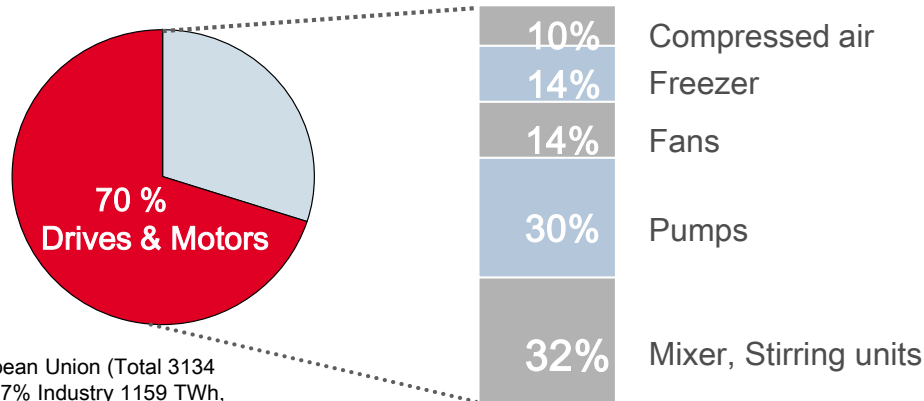
Energy Consumption – Brazil



Consumption Brazil



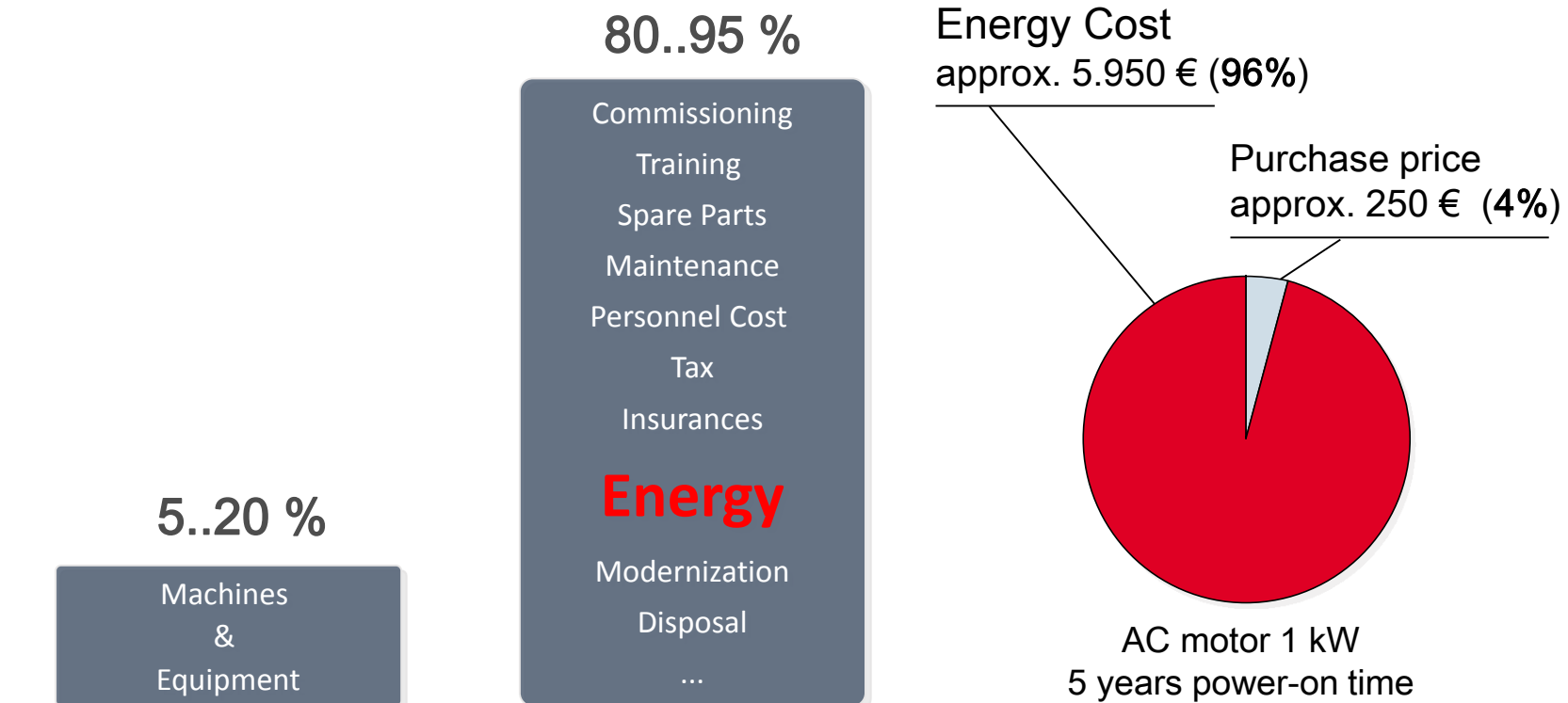
Industrial Brazilian consumption



Almost 70% of the industrial energy consumption is drives and motors

* European Union (Total 3134 TWh, 37% Industry 1159 TWh, Drives & Motors 800 TWh)

Life Cycle Cost / Total Cost of Ownership (TCO)



Saving Energy and Increasing Productivity with Rexroth:

Efficient Components



Products and systems with optimized efficiency

Energy Recovery



Recovery and storage of excess energy

Energy on Demand



Energy usage on demand, stand-by mode

Energy System Design



Systemic overall view, design, simulation, consulting

Implementation across Complete Machine Life Cycle

Concept

Design

Engineering

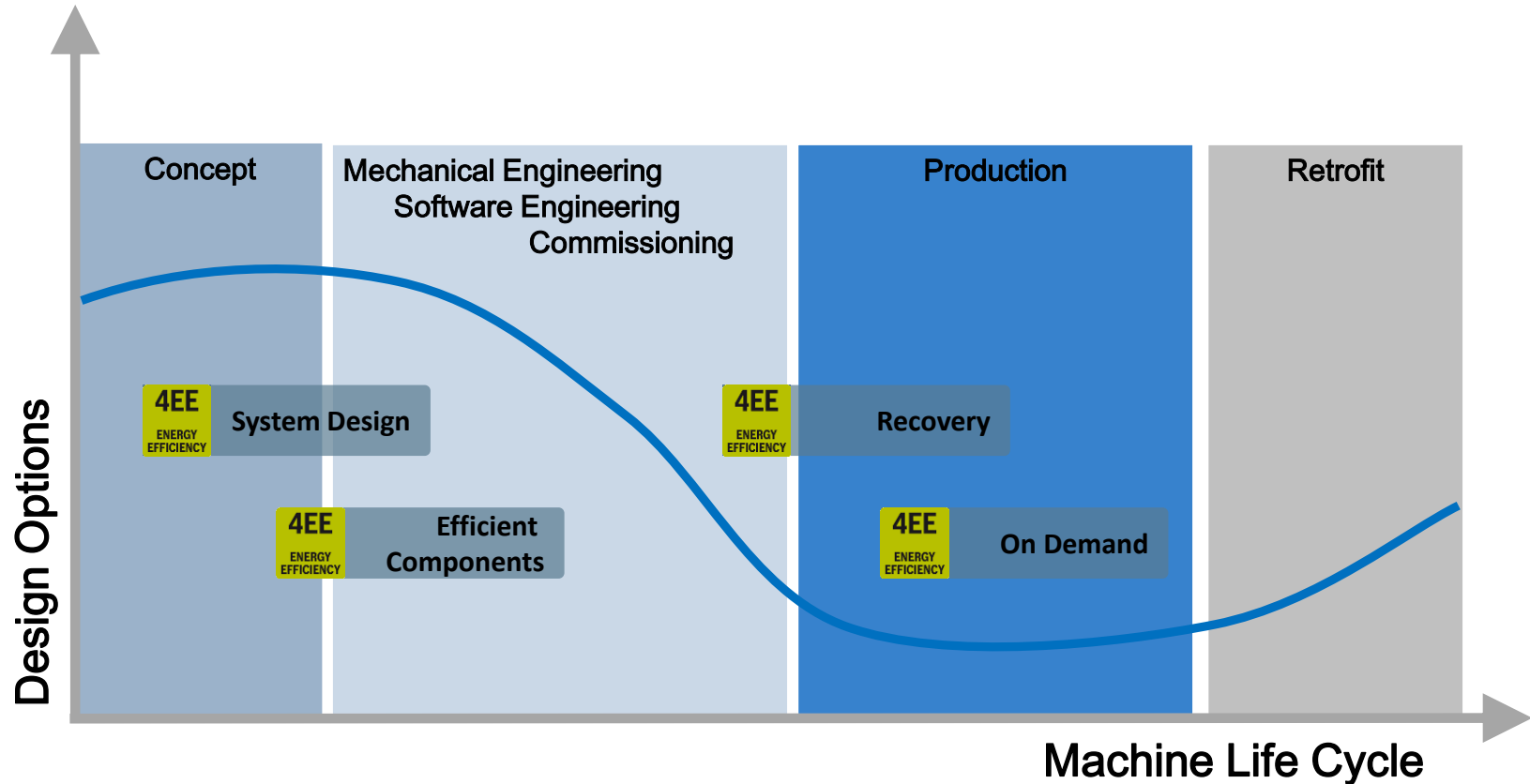
Commis-
sioning

Production/
Operation

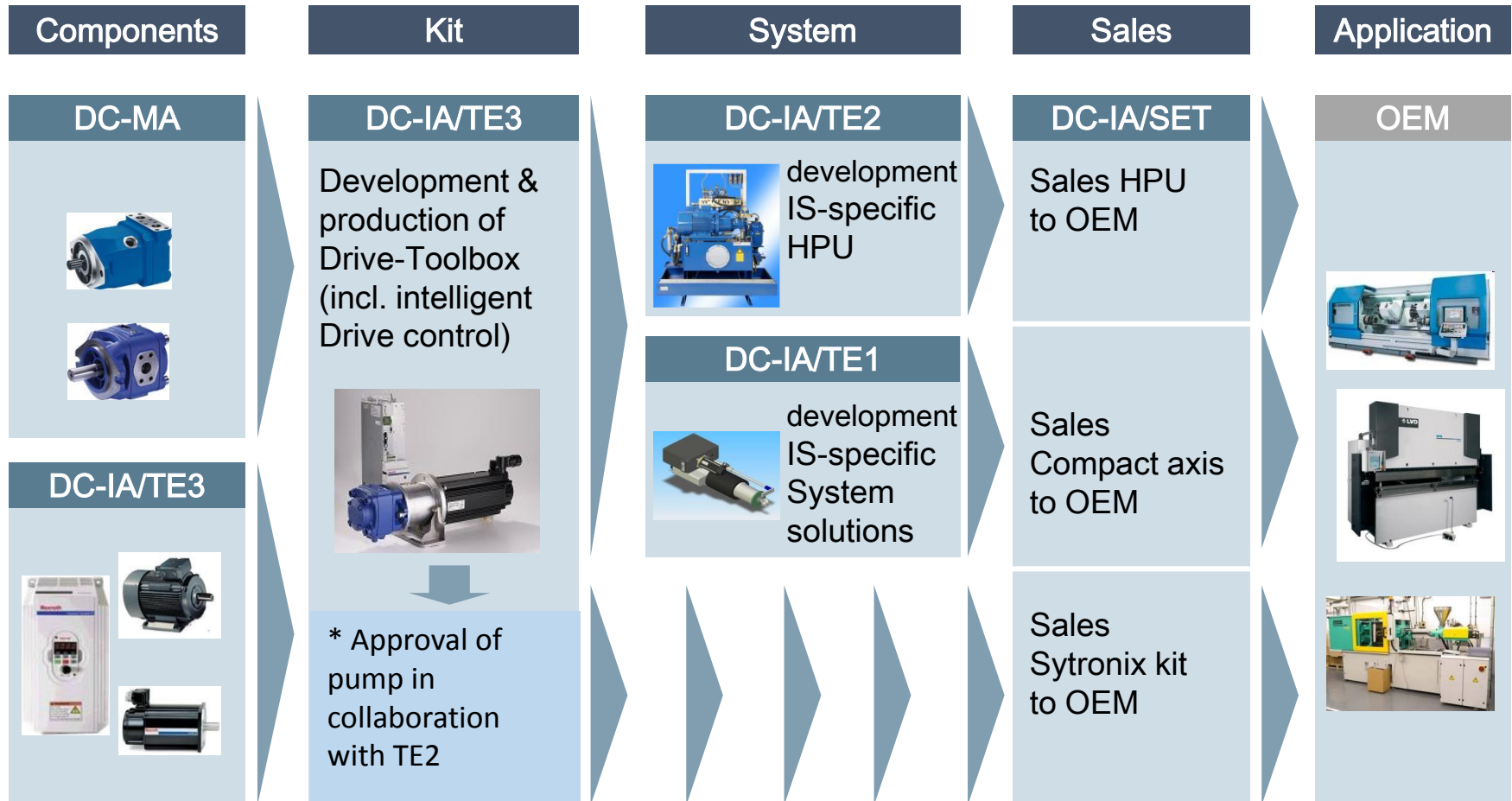
Moderni-
zation



Design Options







Focus Applications

Machine Tools



Sytronix

FcP

Basic Dynamics

Wood & Paper



Sytronix

FcP

Basic Dynamics

Metallurgy



Sytronix

FcP

Basic Dynamics

Presses



Sytronix

FcP

Basic Dynamics

Die Casting machines



Sytronix

SvP

High Dynamics

Sytronix

DFE

High Dynamics &
High Power

Plastic Machines



Sytronix

SvP

High Dynamics

Sytronix

DFE

High Dynamics &
High Power

Sytronix

DFE

High Dynamics &
High Power

Sytronix

DFE

High Dynamics &
High Power

Sytronix

SvP

High Dynamics

Sytronix

DFE

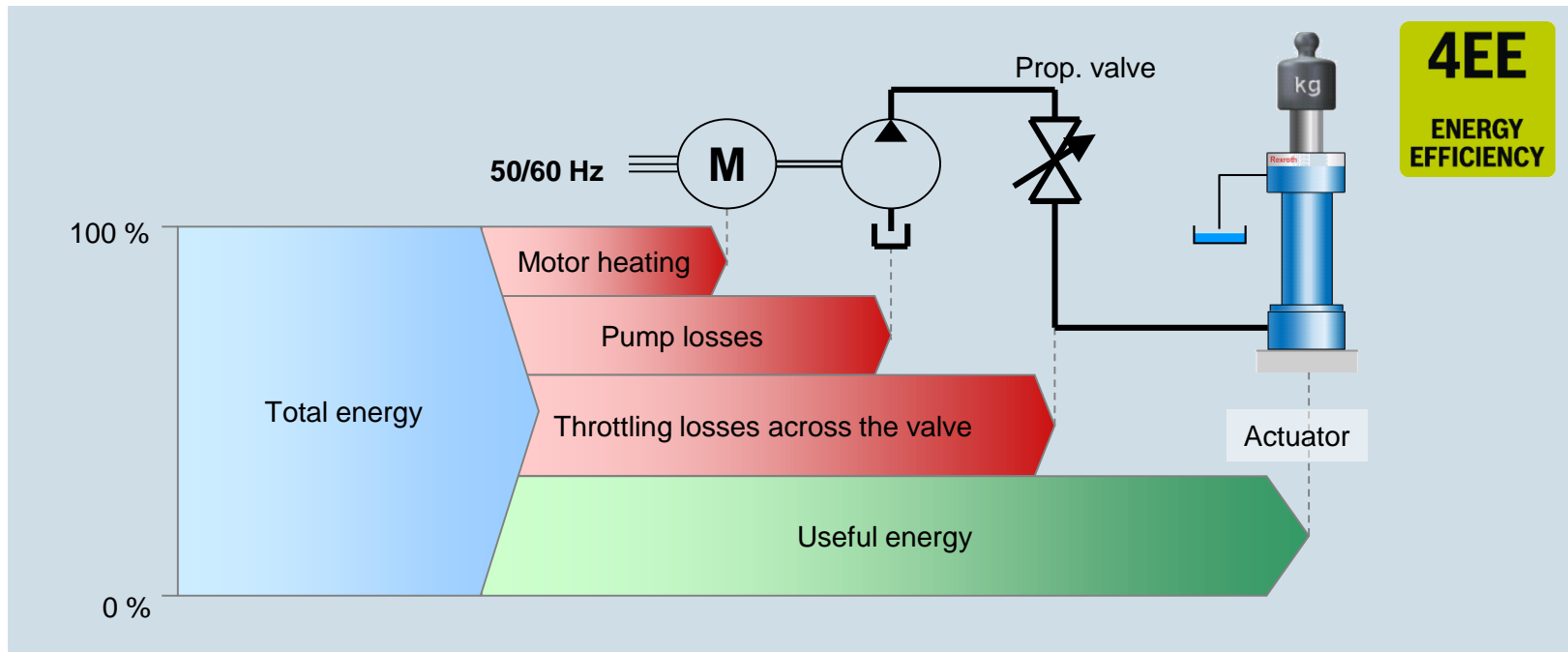
High Dynamics &
High Power

		Efficiency	Dynamics	Costs	
	AC motor + fixed pump				
	AC motor + variable pump				
	VFD + AC motor + fixed pump				FCP
	VFD + AC motor + variable pump				DFEn
	VFD + PM motor* + fixed pump			 (esp. for >60kW)	SVP
	VFD + PM motor* + variable pump			 (esp. for >60kW)	

Energy balance

Classical solution

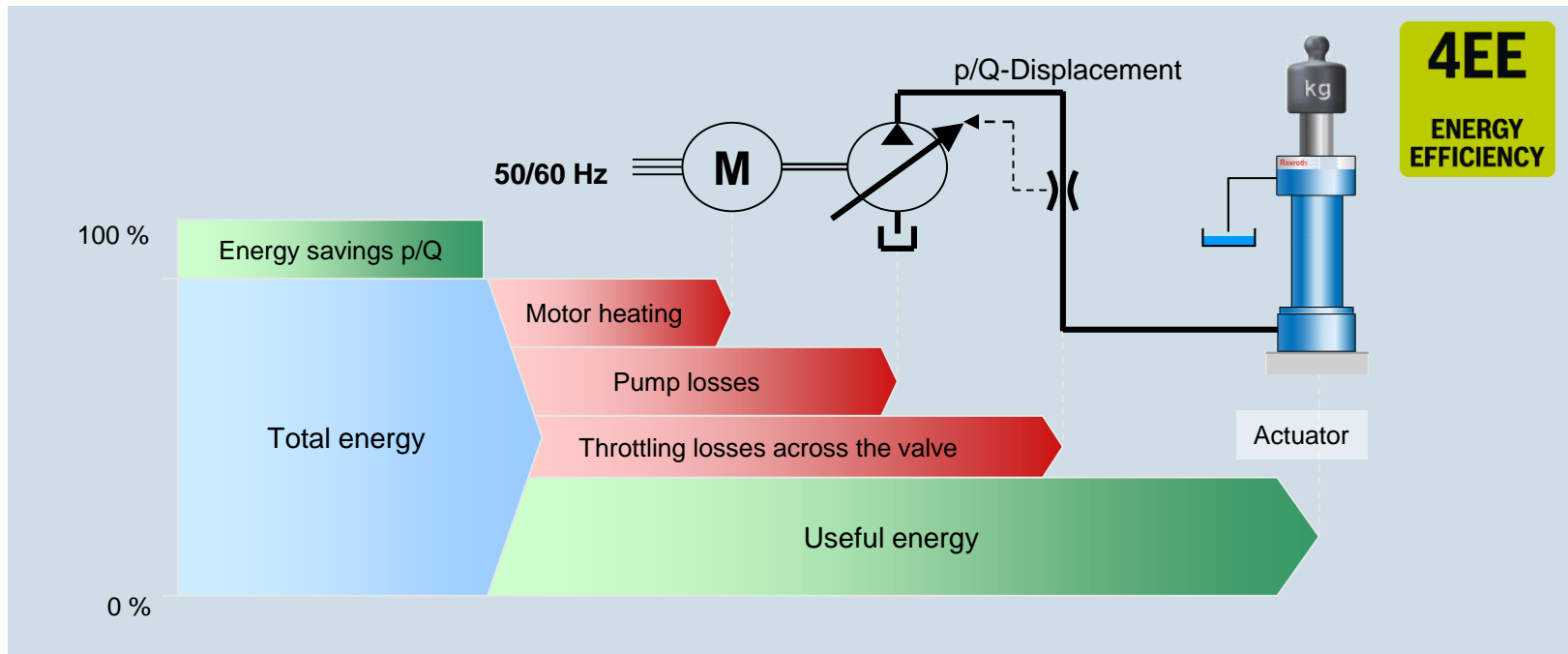
Constant rotation speed – fixed displacement pump – control via proportional valve



Energy balance

Mechanical p/Q-Displacement

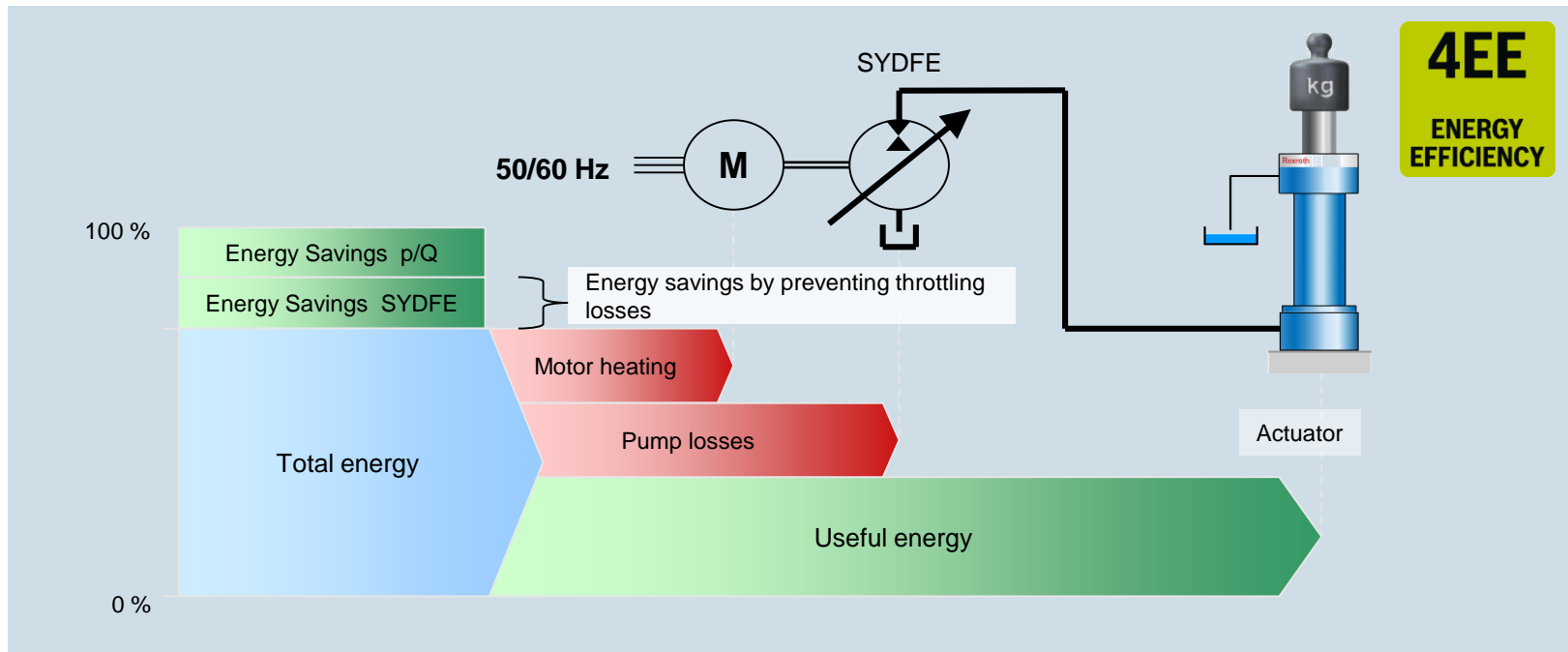
Constant rotation speed – fixed displacement pump – control via p/Q-valve



Energy balance

SYDFE - solution

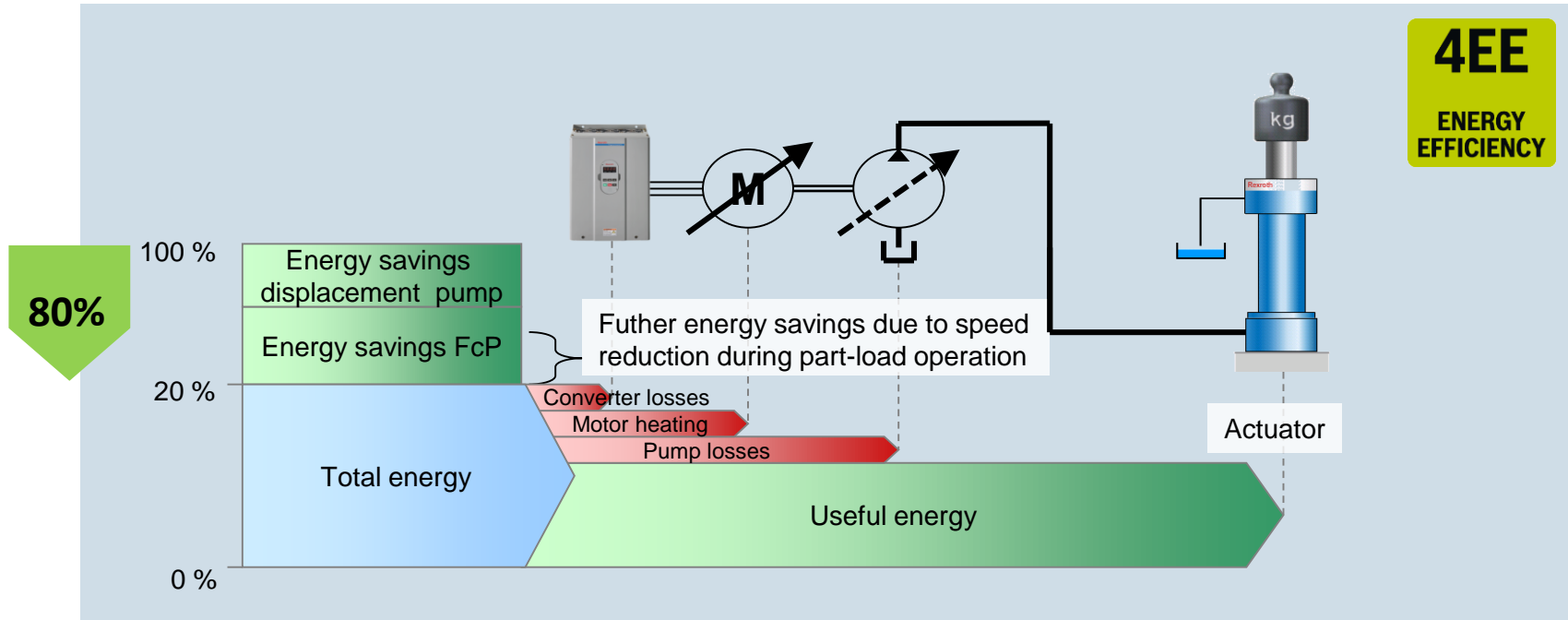
constant rotation speed – variable
displacement pump – control via electronic
adjustment



Energy balance

Sytronix FcP

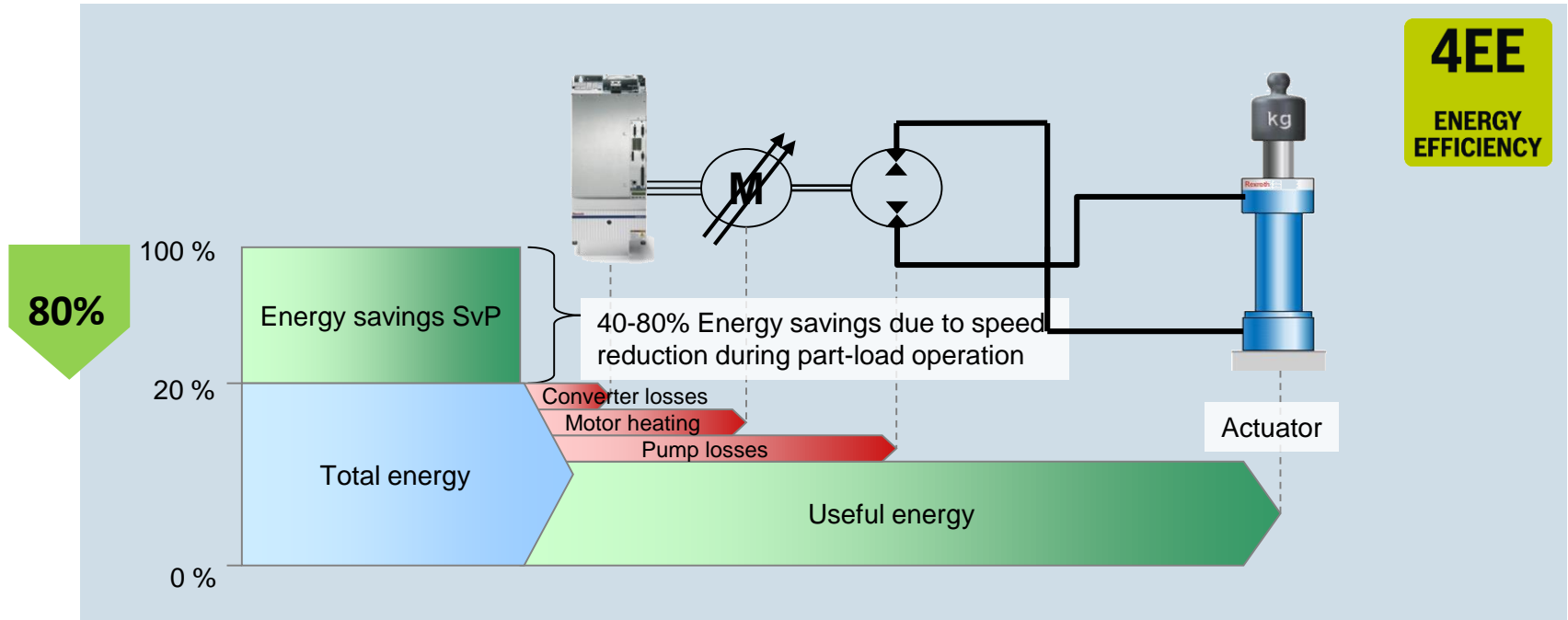
Variable speed – constant or displacement pump – speed control



Energy balance

Sytronix SvP

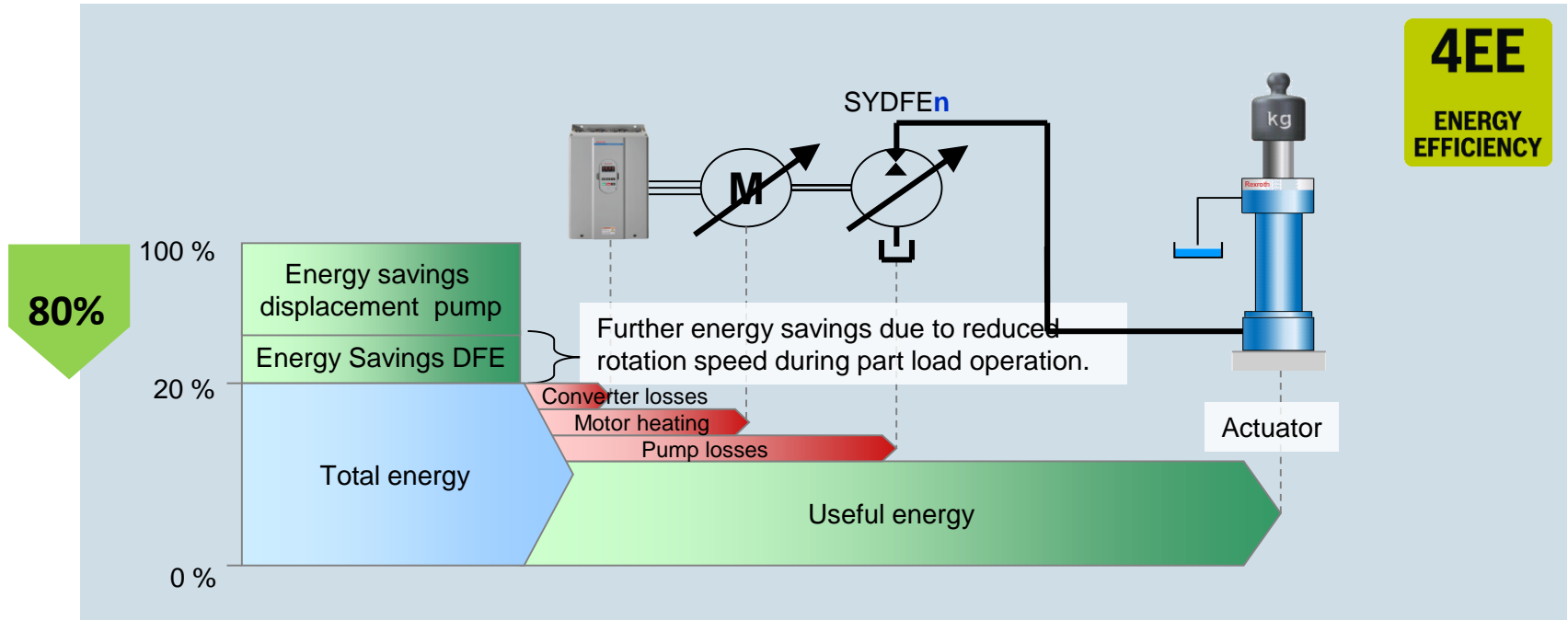
Servo-variable speed – constant pump – axis control



Energy balance

Sytronix DFE

Variable speed – variable displacement –
speed- and swivel angle control



Advantages

Reduced energy consumption

Energy savings up to 80% to decrease operating costs and reduce CO₂ and thus reducing the „Carbon Footprint“

Lower noise emission

Sytronix drives can reduce the noise emission of the hydraulic power unit up to 20 dB(A). Meeting stringent noise specifications in certain market areas is easier and may be accomplished with noise control measures

Easier installation and commissioning

Pre-configured Sytronix hydraulic pump drives and assemblies utilize matched components to provide complete pump drive systems. This results in short installation and commissioning times. Rexroth offers more than 100 drive configurations in three different performance classes

Advantages

Easier cooling

By lowering the average pump drive speed, variable-speed pump drives can significantly reduce generated heat, minimizing the cost and energy required to cool the hydraulic system

Lower space requirements

Using Sytronix drives can lower space requirements for the hydraulic system:

- Compact design
- Simpler valve technology and reduced requirements for control electronics
- Reduced hydraulic fluid volume resulting in smaller reservoir requirements
- Reduction in space for cooling due to reduced heat loads and elimination of most noise containment hardware

More reliable operation

- Integrated system design using proven hydraulic and electrical components
- Condition monitoring and diagnosis available in the drive control electronics

Advantages

Retrofit design assistance

Rexroth can provide customers with support throughout the retrofitting process, from planning to assembly to on-site commissioning

Compliance with regulatory requirements

Sytronix variable-speed pump drives can assist with compliance for noise control (EU Directive 2003/10/EC) and electric motor energy efficiency (EU Regulation (EC) no. 640/2009)

Optimizing a Milling Machine



Former drive solution

Series production with constant rotation speed (2.2 kW motor) with variable displacement pump and 6 min. cycle time

Energy consumption 1.04 kW



Rexroth 4EE solution

- Variable speed pump
- No hydraulic cooling

Energy consumption 0.66 kW



Energy System Design



Efficient Components



Energy on Demand

Energy savings 2,280 kWh/a

228 €/a **

CO₂ reduction

0.5 t/a *

– 36 %

* CO₂ Emission: 0,24 kg CO₂/kWh

** Current price: 0,10 €/kWh

Optimizing a Lathe Machine

4EE
ENERGY
EFFICIENCY



Former drive solution

Series production with constant rotation speed (5.5 kW motor)
With variable displacement pump and 45 sec cycle time

Energy consumption 3.7 kW



Energy
System Design



Efficient
Components



Energy
on Demand

Rexroth 4EE solution

- Variable speed pump

Energy consumption 2.2 kW

Energy savings 6,750 kWh/a
675 €/a **
CO₂ reduction 1.6 t/a *

– 40 %

Noise level 82 / 72 dB(A) (former solution)
(Peak / Ø) 72 / 62 dB(A) (4EE solution)

– 10 db



* CO₂ Emission: 0,24 kg CO₂/kWh

** Current price: 0,10 €/kWh

Optimizing Press Brake Machine

4EE
ENERGY
EFFICIENCY



Abkantpresse



Sytronix SvP7000

* CO₂ Emission: 0,24 kg CO₂/kWh

** Current price: 0,10 €/kWh

Original drive solution

One center aggregate with constant pump
Two open loop control blocks with control valves

Energy consumption 57,300 kWh/a

Rexroth 4EE Automation solution

- Two Sytronix SvP 7000 Axial drives
- Axial control without valve (in the drive)
- High efficient synchronous motors

Energy consumption 32,700 kWh/a

Energy savings 24,600 kWh/a
2,460 €/a **

CO₂ reduction 5.9 tCO₂/a *

Noise level 87.6 / 74.6 dB(A) (Original solution)
(Peak / Ø) 76.3 / 67.6 dB(A) (Rexroth solution)



Energy
System Design



Efficient
Components



Energy
on Demand

– 43 %

– 11 db

Die Casting Machine

4EE
ENERGY
EFFICIENCY



Original drive solution

Displacement pump system with DFEE-Pump
Clamping force: 50t
Cycle time: 30s

Energy consumption 16,280 kWh/a



Energy
System Design



Efficient
Components



Energy
Recovery



Energy
on Demand

Rexroth Sytronix solution

- Servo-variable pump drive SvP
- Smaller cooling system
- Reduced noise level

Energy consumption 9,620 kWh/a

Sytronix SvP



Energy savings 6,660 kWh/a

666 €/a **

CO₂ reduction

1.6 t/a *

– 41 %

* CO₂ Emission: 0,24 kg CO₂/kWh

** Current price: 0,10 €/kWh

Injection Molding machine

4EE
ENERGY
EFFICIENCY



Machine size:
From 110 to 430 t



Former solution

Hydraulic – DFEC-variable pump, asynchronous motor, constant speed
Installed power: 11 kW bis 75 kW
Operation: 24h/240days

Energy consumption 28,000 kWh/a



Energy
System Design



Efficient
Components



Energy
Recovery



Energy
on Demand

Rexroth Sytronix solution

- Double pump combination
- DFE – variable pump, variable speed
- Smaller cooling system
- Reduced noise emission

Energy consumption 18,000 kWh/a

Energy savings 10,000 kWh/a

1,000 €/a **

CO₂ reduction 2.4 tCO₂/a *

– 34 %

* CO₂ Emission: 0,24 kg CO₂/kWh

** Current price: 0,10 €/kWh

Thank you!!!

