



Oscar Avella – Business Unit Manager

Motors/Generators/Mechanical Power Transmission – ABB Colombia

# BALDOR/ABB

## Soluciones eficientes en motores eléctricos para aplicaciones industriales



**ABB**

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**DODGE**<sup>®</sup>

# La fórmula de valor

$$V_p = \frac{Q_p \times S_p}{C \times T}$$

*“To be the best as determined by our customers”*



**EL PROBLEMA**



**EL FABRICANTE**



**EL USUARIO**



**LA SOLUCION  
GESTIÓN ENERGÉTICA  
(FABRICANTE+USUARIO)**

# Alta eficiencia?, porque la preocupación..

↗ \$/kWh

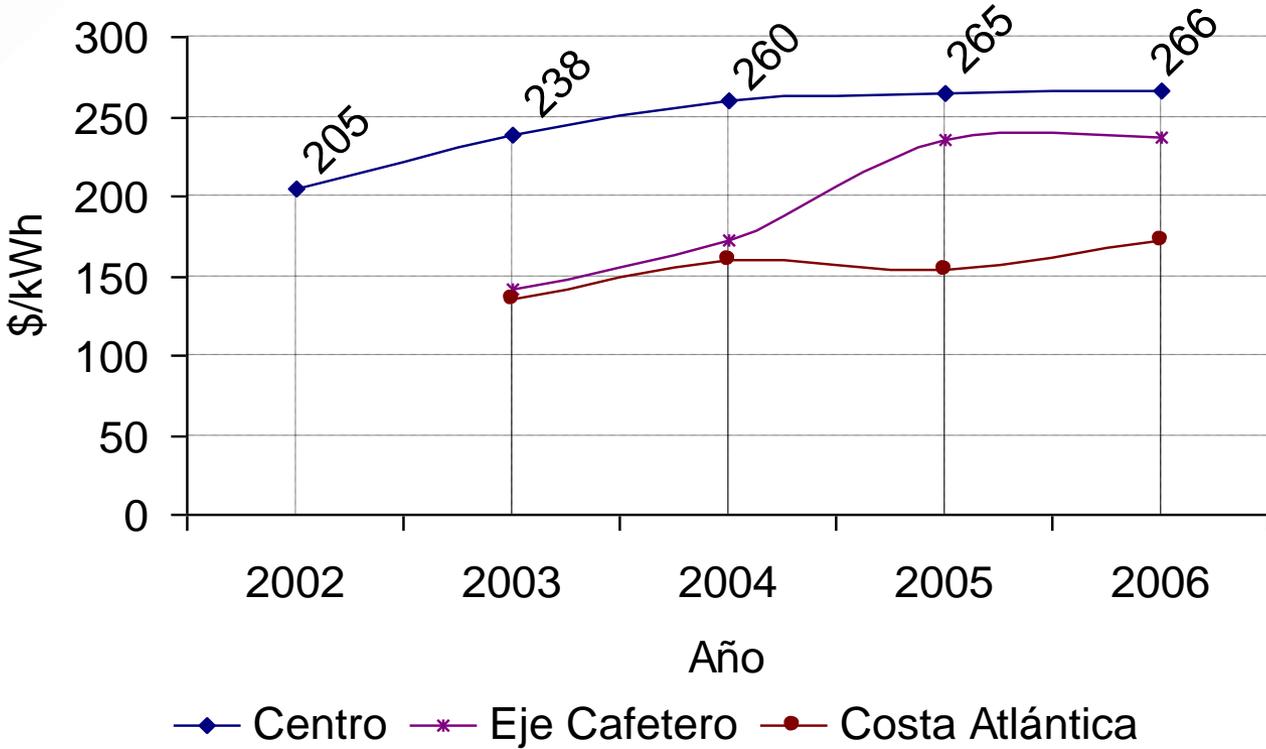
10.02 > Costos > Energía cara, una amenaza que tiene en jaque a la industria

**Energía cara, una amenaza que tiene en jaque a la industria**

Febrero 4 de 2013

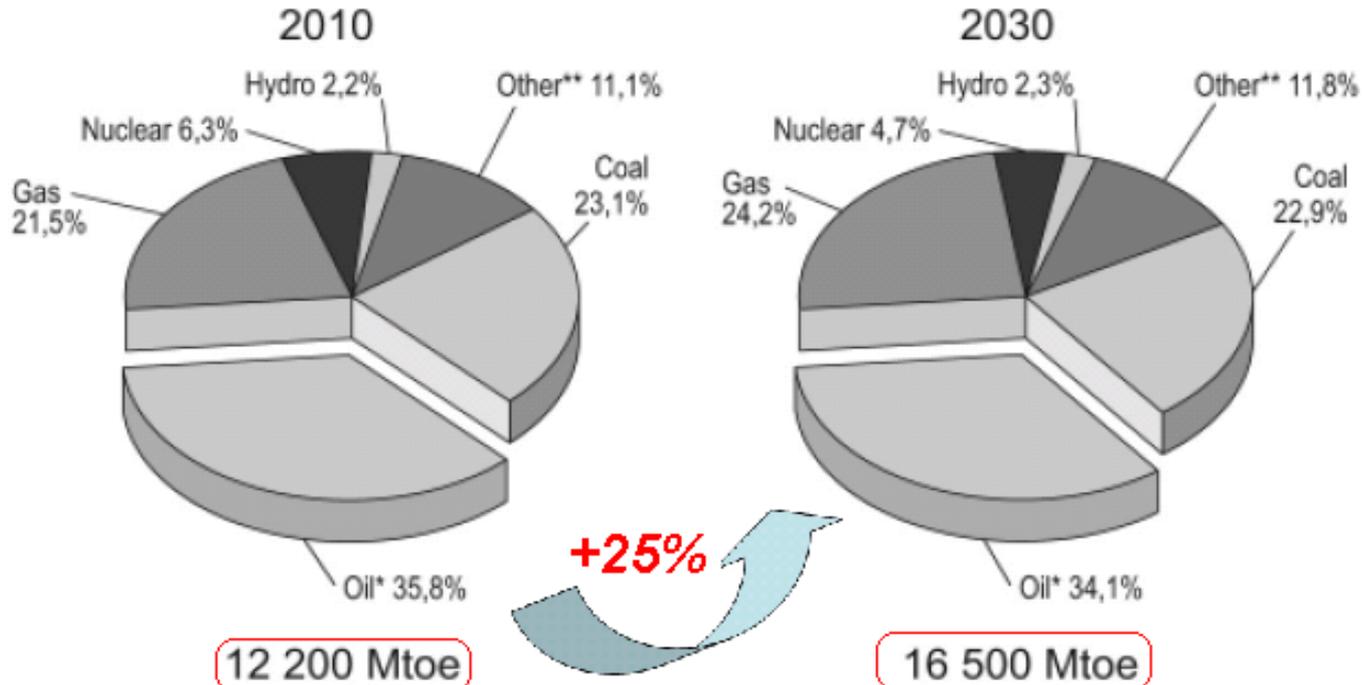
Empresarios pagan costos eléctricos mayores a los de otros países de la región. Piden medidas de defensa, ante posibles subsidios en países competidores.

Tarifa media de energía - Industria (Regulados)



# Alta eficiencia?, porque la preocupación..

➔ kWh



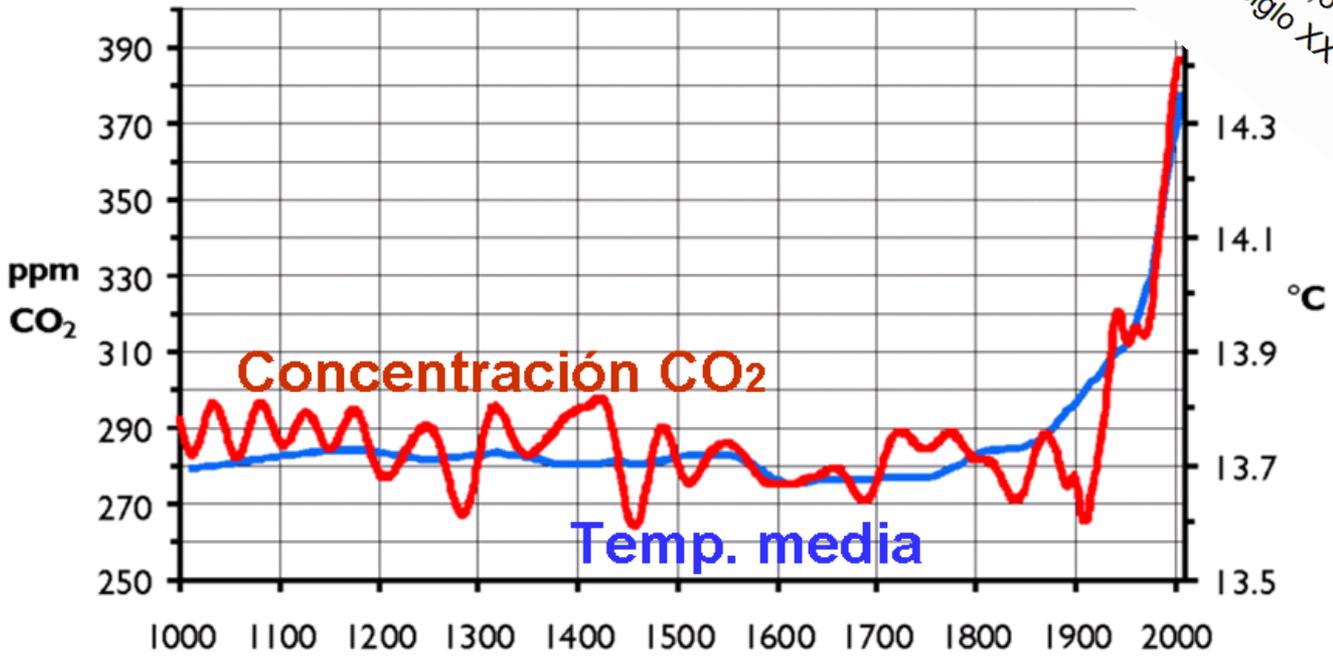
\*\* Other includes combustible renewables & waste, geothermal, solar, wind, tide etc.  
1 TOE = 11,63 MWh (TOE = ton oil equivalents)



# Alta eficiencia? porque la preocupación..

2013  
20:50 CET  
Nuevos datos de la NASA muestran el calentamiento global en 2012  
A. R. | Madrid  
La temperatura media en el planeta el año pasado fue de 14,6 grados, 0,6 grados más que a mediados del siglo XX

↗ °C – CO<sub>2</sub>

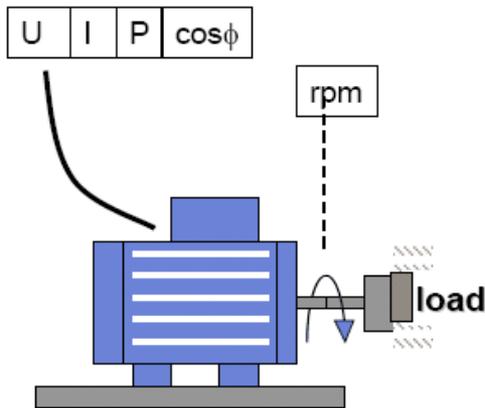


# Cambio en los métodos de medida IEC/EN 60034-2-1: 2007-09

Proporciona nuevas reglas en relación con la metodología utilizada para la medición de eficiencia por parte de los fabricantes

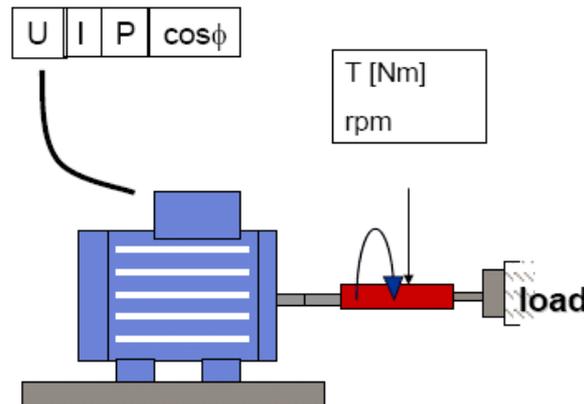


Old standard  
(IEC60034-2 1996)



New standard  
(IEC60034-2-1 2007)

■ Shaft torque is measured



OUTPUT:	3400.0 kW
VOLTAGE:	6000.0 V
FREQUENCY:	50.0 Hz
CONNECTION:	Star
CURRENT:	399.1 A
TORQUE:	65442.8 Nm
SPEED:	496.1 rpm
POLES:	12

WEIGHT	
Rotor	0 kg
Total	23190 kg

LOSSES	
Friction	9.00 kW
Iron	22.25 kW
Stator	31.66 kW
Rotor	26.78 kW
Additional	17.54 kW
Total	107.26 kW

Weighted to stator	53.83 kW
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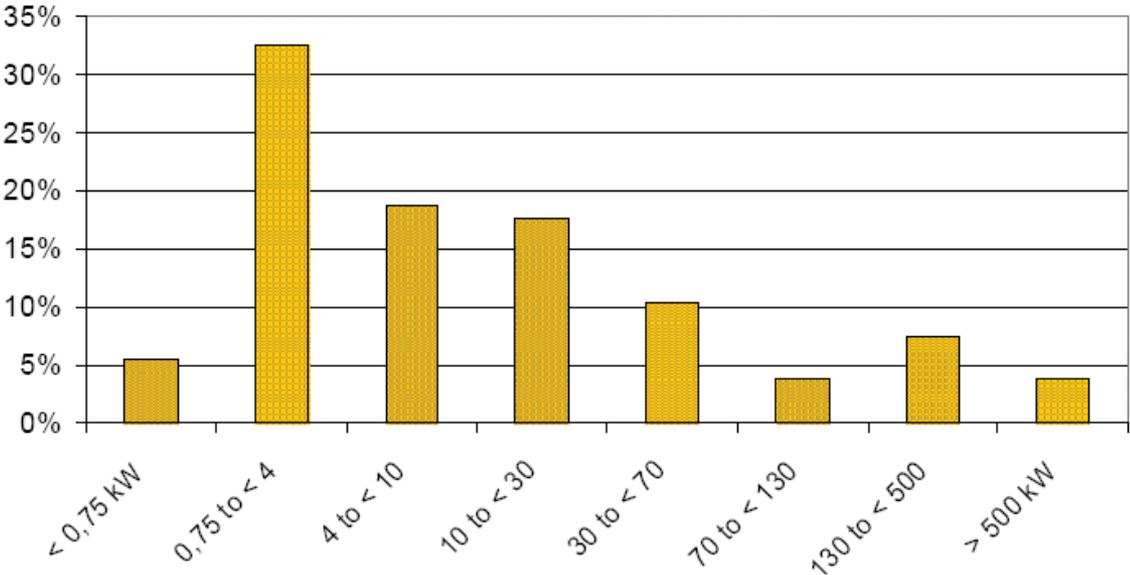
# El nuevo código IE - IEC 60034-30

Futuros requerimientos de eficiencia energética para la CE	
<b>Año 2011</b>	<b>Los motores deben exceder o igualar rangos de eff. IE2 (0.75-370kW)</b>
<b>Año 2015</b>	<b>Los motores deben exceder o igualar rangos de eff. IE3 (0.75-370kW)</b>
<b>Marquillado</b>	
<b>Año 2011</b>	<b>Motores con código IE implementado y comercializados</b>

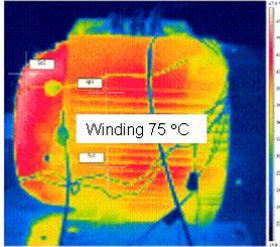


	<b>IEC</b>	<b>NEMA</b>
<del>EFF3</del>		
<del>EFF2</del>	<b>IE1</b>	
<del>EFF1</del>	<b>IE2</b>	<b>E-PAct</b>
	<b>IE3</b>	<b>Premium</b>
	<b>IE4</b>	<b>S Premium</b>

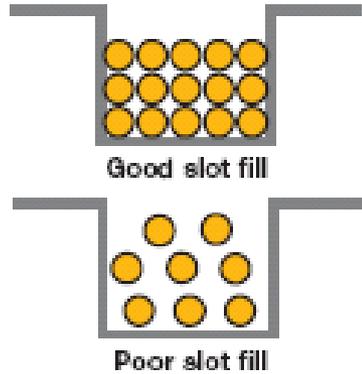
Allocation of the saving potential by installed motors in the industrial sector (installed capacity multiplied by the average efficiency improvement)



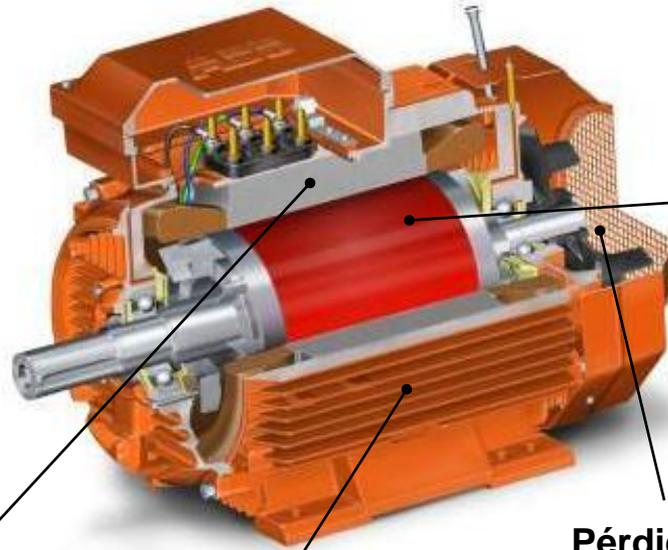
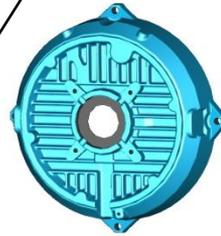
# De que manera el fabricante mejora la eficiencia



**Distribución uniforme de la temperatura**



**Estator**  
Sis. aislamiento  
Utilización de slots

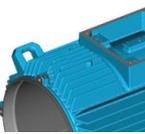
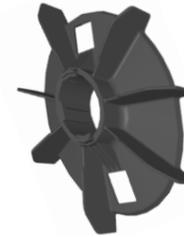
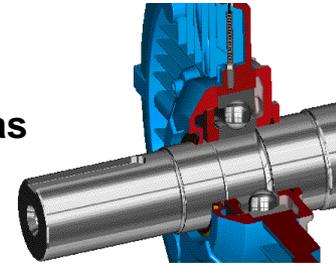


**Rotor**

-Material y sección barras de la jaula  
-Mayor sección anillo de cortocircuito

**Pérdidas mecánicas**

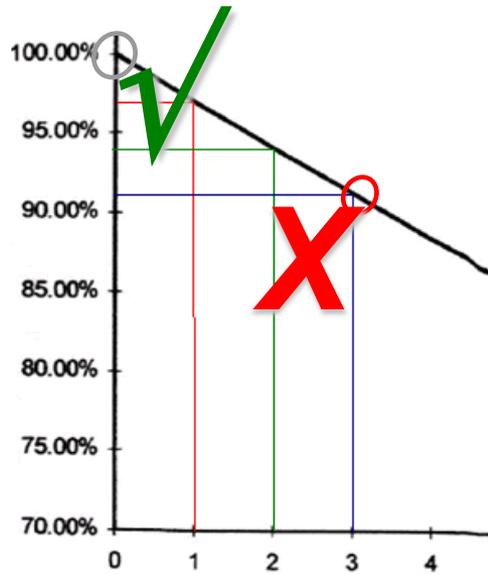
Diseño ventilador  
Calidad rodamiento  
Precisión en el balanceo de rotor



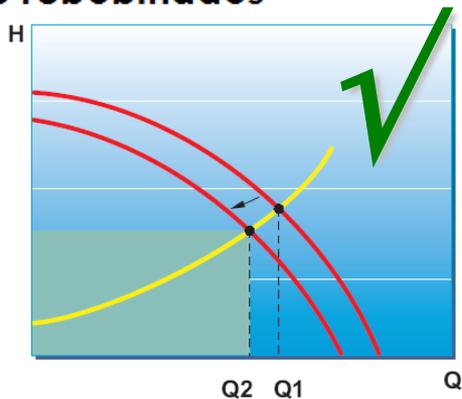
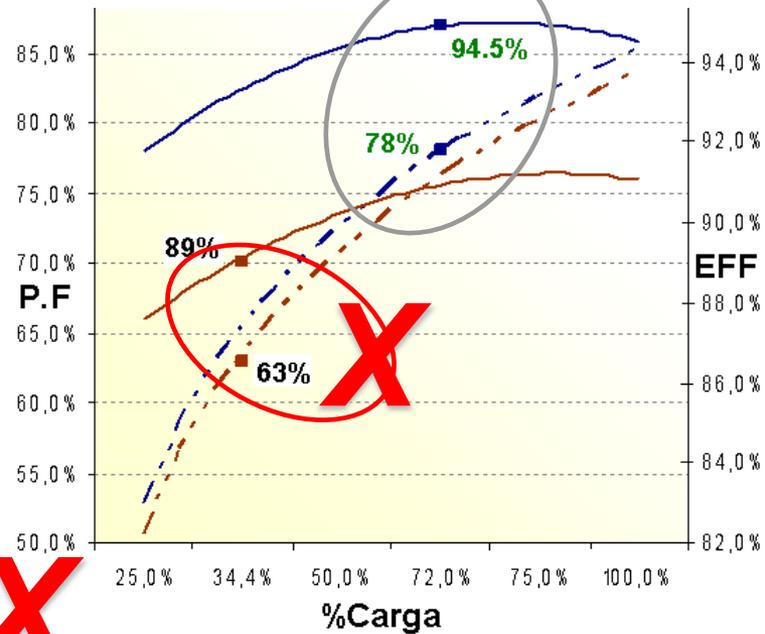
**Optimización refrigeración**  
**Reducción de niveles de ruido**

**Area de refrigeración**  
5 – 10 °C Reducción temp. Rod.  
20 – 40 % Incremento tiempo med entre fallas

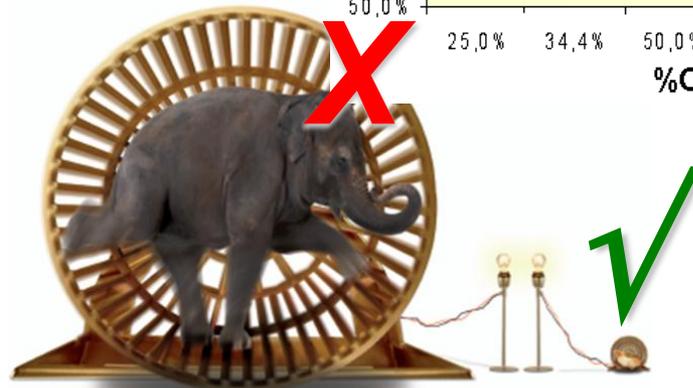
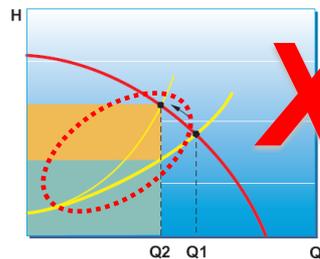
# De que manera el usuario optimiza el uso del motor



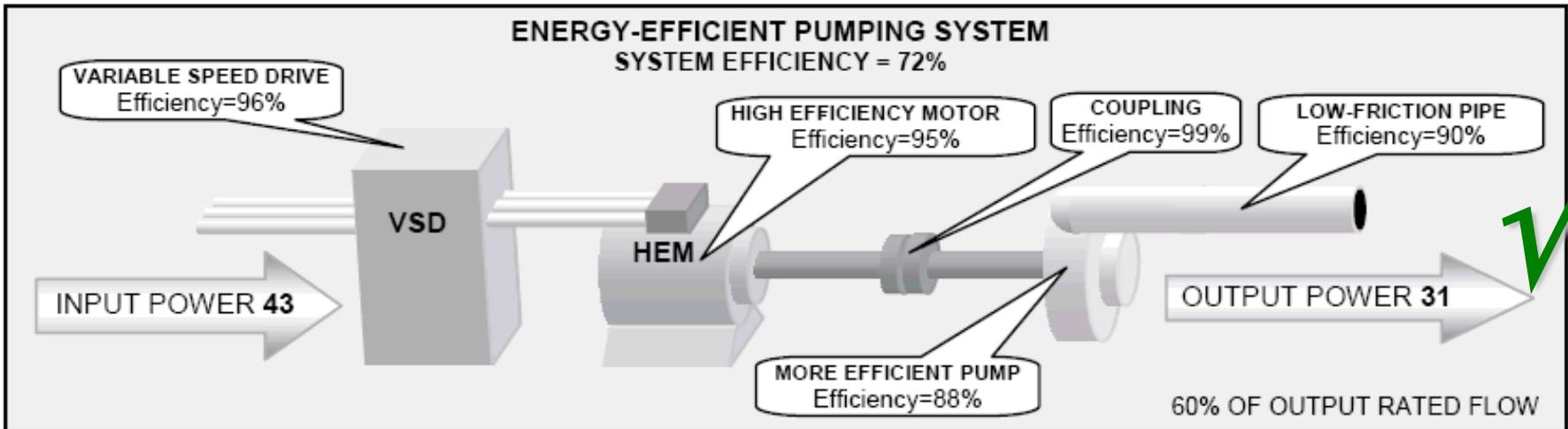
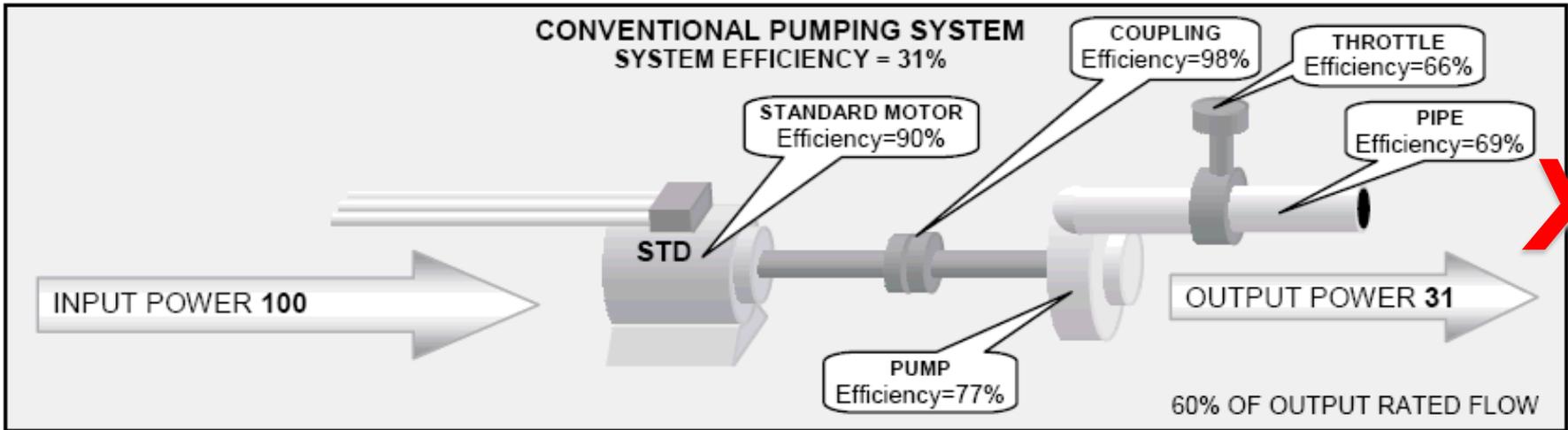
Número de rebobinados



3



# De que manera el usuario optimiza el uso del motor



Source: Energy Efficient Motor Driven Systems, 2004, by European Copper Institute

Figure 1 - a) Conventional pumping system (total efficiency = 31%)  
b) Energy-efficient pumping system combining efficient technologies (total efficiency = 72%)

# De que manera el usuario optimiza el uso del motor

Motor, higher efficiency	Type	Power [kW]	Pole number	Efficiency [%]
	High Eff	132	2	95.5

## Economy:

### Annual energy cost:

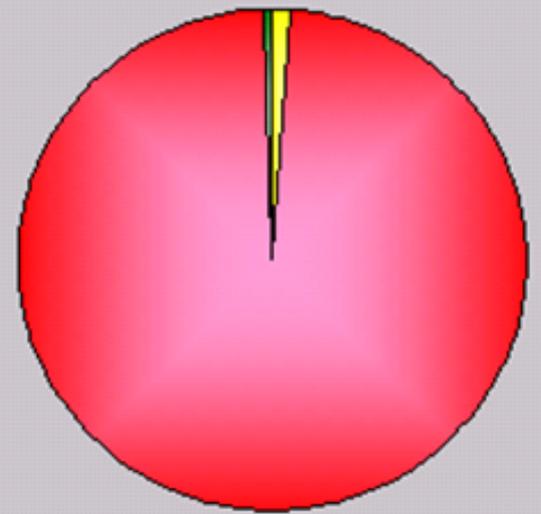
Motor for comparison:	211,370	TCOP
ABB Process Performance Motor:	205,837	TCOP

### Life cycle cost (net present value):

Motor for comparison:	1,627,024	TCOP
ABB Process Performance Motor:	1,591,839	TCOP

Annual savings:	4,876	TCOP
Payback period:	12.3	months

Life cycle cost - high efficiency motor



## Environment:

Greenhouse gas reduction:	13,833	kg/year
Greenhouse gases:	0.5	kg/kWh

■ Motor price   
 ■ Energy   
 ■ Maintenance cost

Currency:	TCOP	
Energy price:	0.2	TCOP/kWh
Service life of motor:	15	years
Maintenance cost/year:	5%	of motor price
Interest rate:	10%	

# De que manera el usuario optimiza el uso del motor

**EQUIPMENT DATA - NEW**

Improved Flow Control by:

ABB industrial drive ACS800

**ACS800-01-0165-5** Copy to clipboard

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**RESULTS**

**Saving percentage** **30.4 %**

**Annual energy consumption:**

with existing control method	<b>1,050</b>	MWh
with improved control method	<b>731</b>	MWh
<b>Annual energy saving</b>	<b>319</b>	MWh
<b>Annual CO<sub>2</sub> reduction</b>	<b>96</b>	t

CO<sub>2</sub> emission/unit  kg/kWh

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**Economic Data**

Currency unit	<b>TCOP</b>
Energy price	<b>0.2</b> TCOP/kWh
Investment cost	<b>28,000</b> TCOP
Interest rate	<b>5%</b>
Service life	<b>15</b> years

**RESULTS**

**Energy Consumption**

Control Method	Energy Consumed (kWh)
Throttling	1,050,000
VSD	731,000

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**Power (kW)**

Legend: — Throttling — AC drive control

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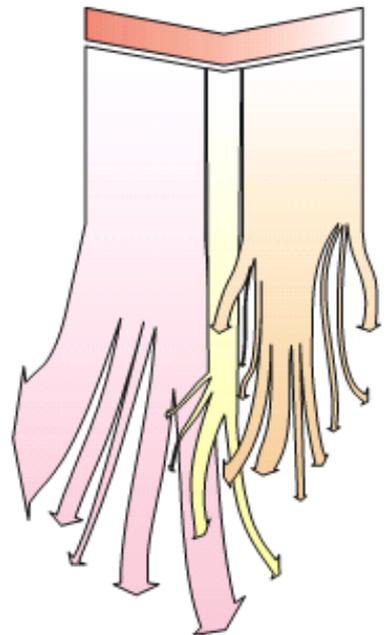
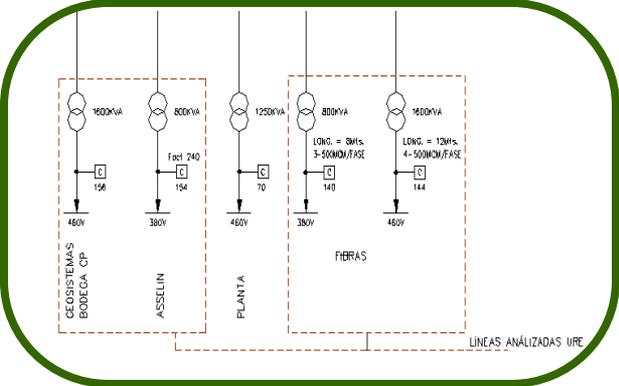
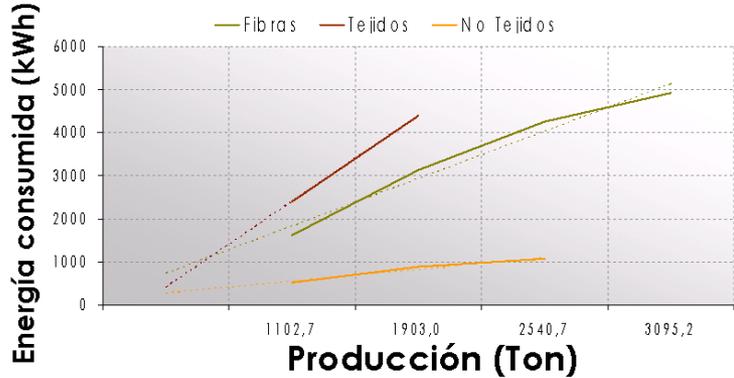
**Economic Results**

Annual saving	<b>63,826</b>	TCOP
Payback period	<b>0.4</b>	years
Net present value	<b>634,496</b>	TCOP



# Esquema de gestión energética

## Step 1 – Foco del estudio



## Step 2 - Información

ABB Oy, Motors  
Vaasa, Finland

3~Motor M3BP 315 SMB 4 B3  
IEC 315 S/M 80

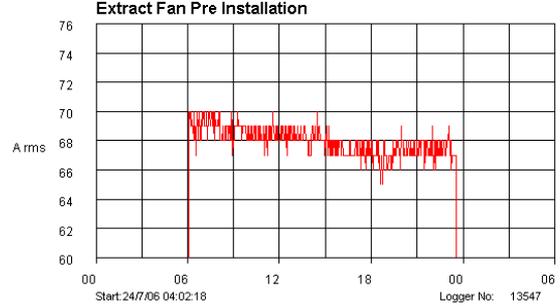
S1		No. 32911117711 SM				
		Ins.cl F		IP 55		
V	Hz	kW	r/min	▲	cosφ	Duty
690 Y	50	160	1487	166	0,85	
400 D	50	160	1487	287	0,85	
660 Y	50	160	1485	171	0,86	
380 D	50	160	1485	298	0,86	
415 D	50	160	1488	279	0,84	
440 D	60	185	1785	295	0,86	

Prod. code 3GBP312230-ADG

		Nmax 2300 r/min	
6319/C3	6316/C3	1000 kg	

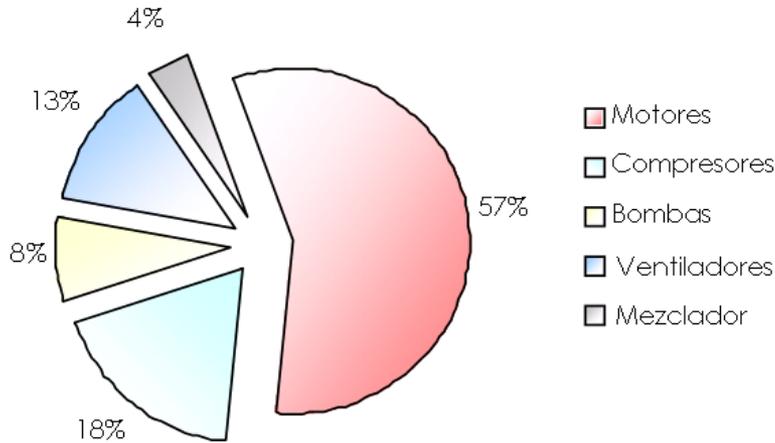
**ABB** IEC 60034-1

## Step 3 - Medición



# Esquema de gestión energética

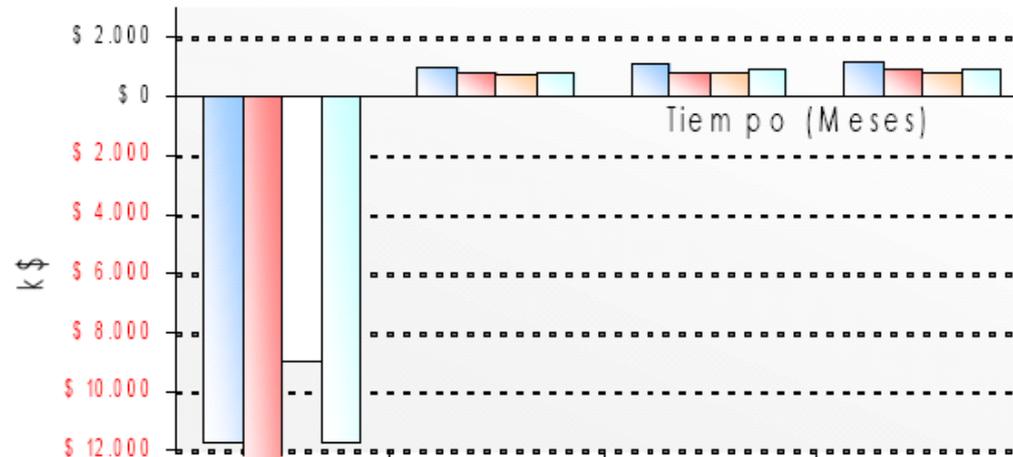
## Step 4 - Análisis



Quantity	ABB Article Id	Pole	Power [kW]	Savings in % of total
50	M3BP 225 SMB	4	45	20.01 %
40	M3BP 160 L	4	15	14.58 %
27	M3BP 250 SMA	6	37	9.87 %
26	M3BP 180 L	4	22	9.07 %
23	M3BP 280 SMA	4	75	5.45 %
42	M2BA 132 54 A	4	5.5	5.29 %
24	M2BA 132 M6 B	6	5.5	5.18 %
47	M2BA 100 L4 B	4	3	5.11 %
29	M3BP 200 MLA	6	18.5	4.17 %
23	M3BP 160 L	6	11	4.09 %
4	M3BP 315 SMA	4	110	3.10 %
3	M3BP 315 SMA	6	75	2.33 %

Total savings / year: 234,783 USD  
1,235,702 kWh

## Step 5 – Inversión y seguimiento





**EL PROBLEMA**



**EL FABRICANTE**



**EL USUARIO**



**LA SOLUCION  
GESTIÓN ENERGÉTICA  
(FABRICANTE+USUARIO)**



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