



Energetická účinnost pohonů

Cesta k úsporám

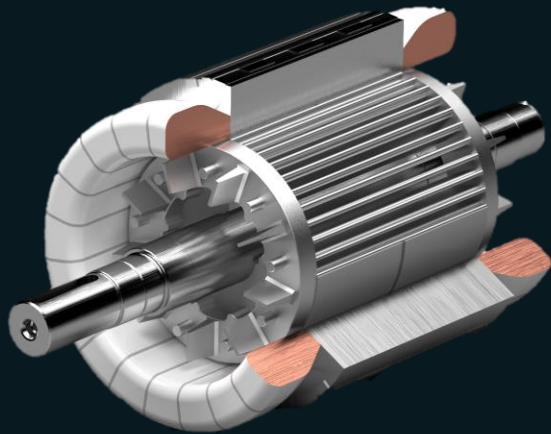
INNOMOTICS

Cesta k úsporám

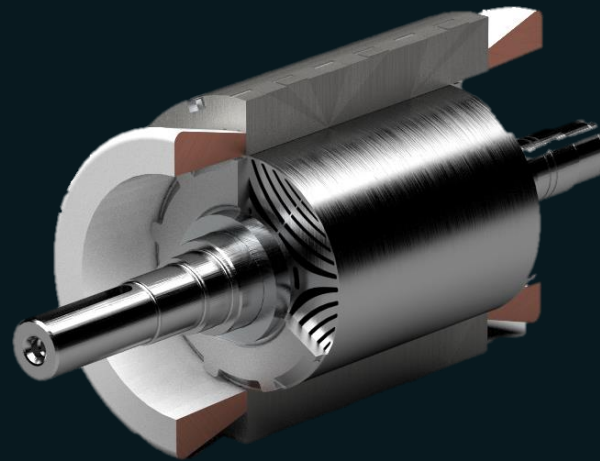
IE4



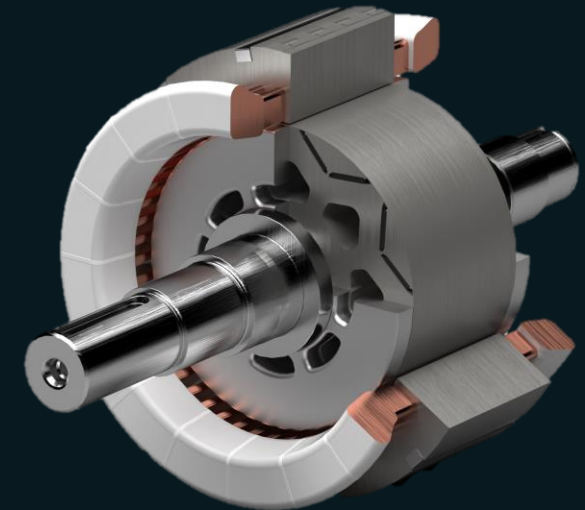
IE5 IE6



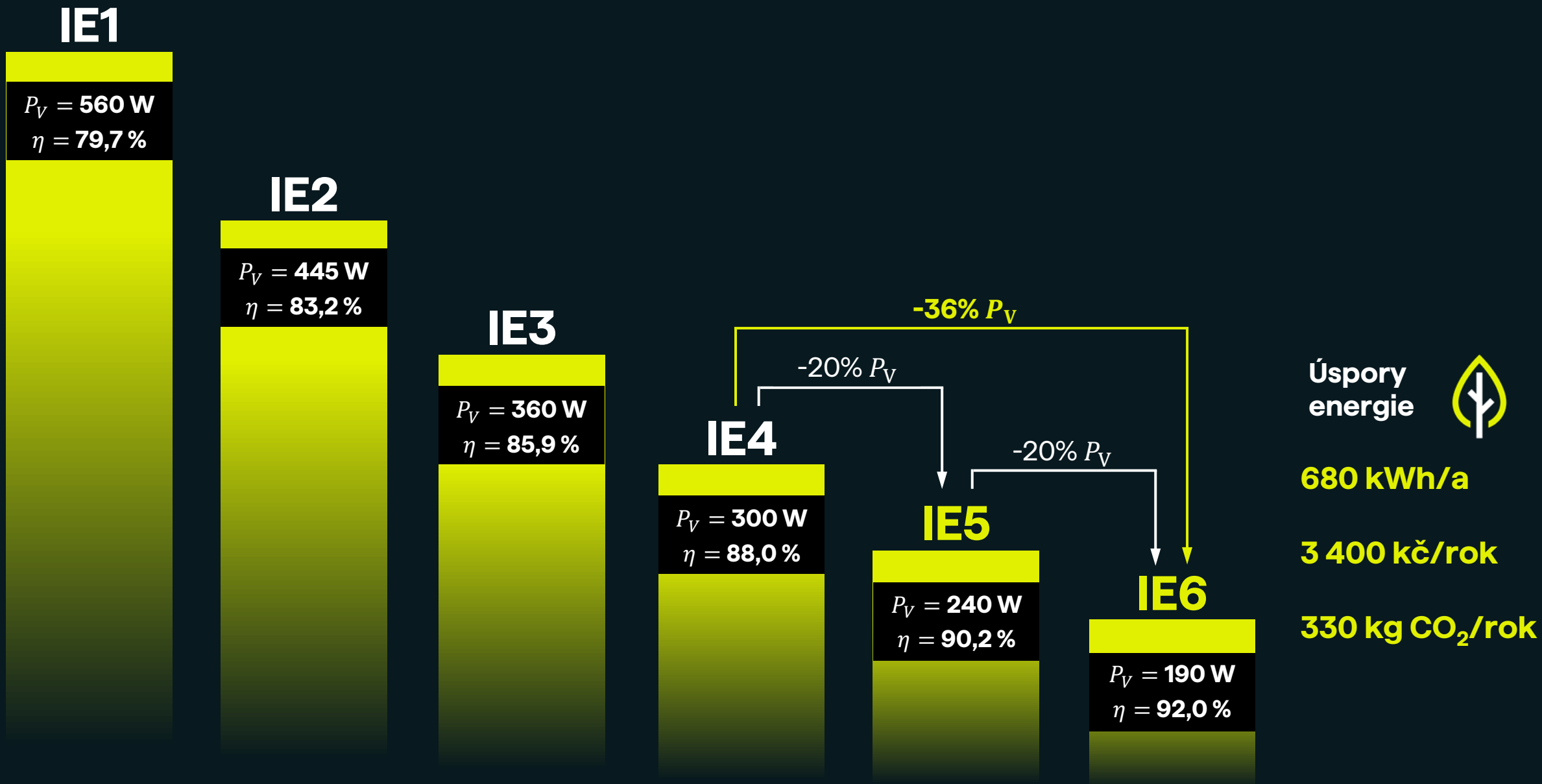
Indukční asynchronní motor



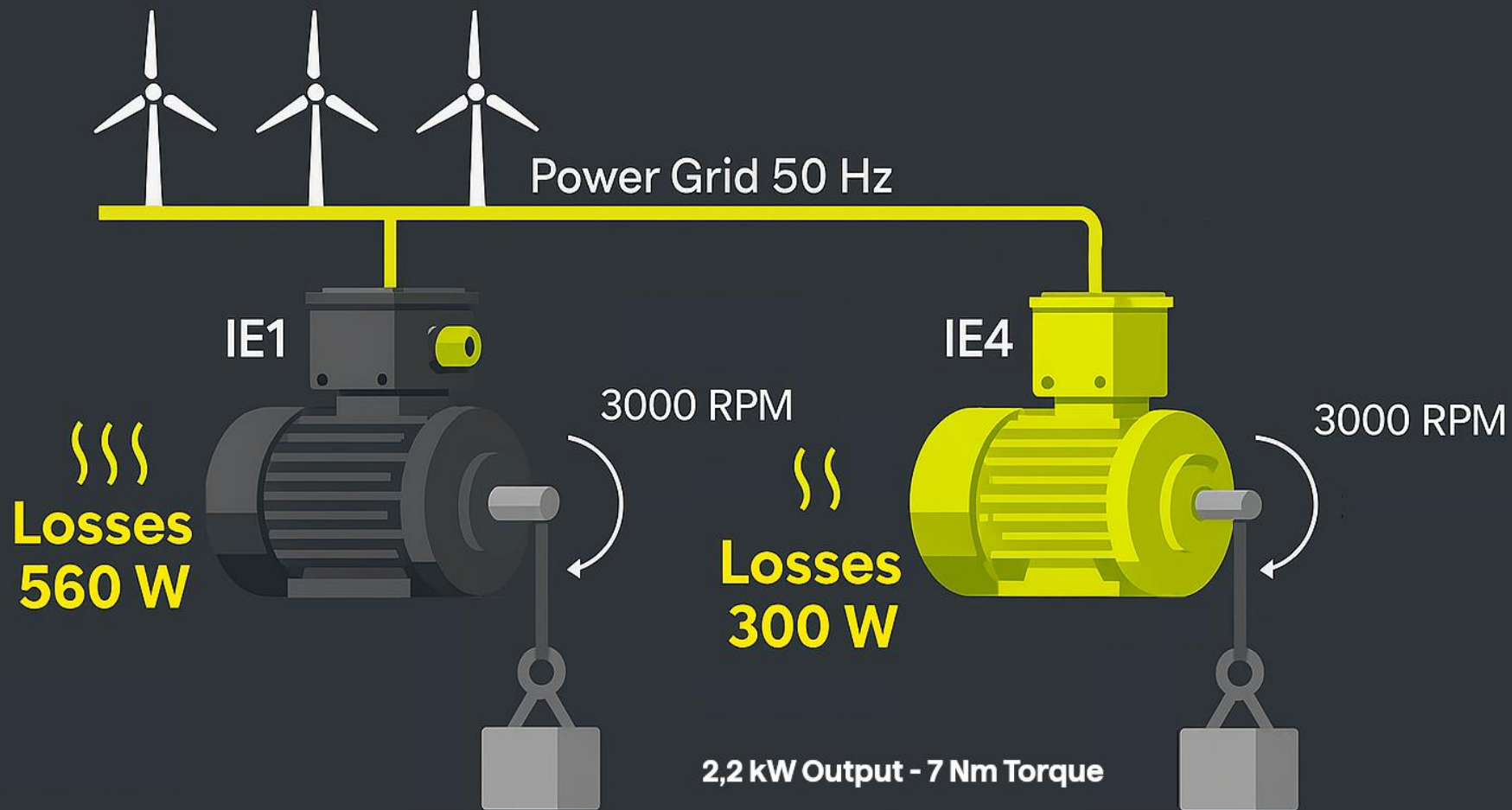
Synchronní reluktanční motor



Motor s permanentními magnety



Například : 2,2kW FS90 2- 50Hz | IE6 vs. IE4 s 8760 h provozního času za rok při 75% zatížení, cena za energie 5 Kč/kWh, CO2 ekvivalent 0,49 kg/kWh



$$8760 \text{ h} \times 560 \text{ W} \times 5 \text{ Kč/kWh} = 24\,520 \text{ Kč}$$

$$8760 \text{ h} \times 300 \text{ W} \times 5 \text{ Kč/kWh} = 13\,140 \text{ Kč}$$


Prestižní cena ZLATÝ AMPER v kategorii „Nejlepší řešení pro trvalou udržitelnost“




INNOMOTICS

12 nejdůležitějších vlastností motorů s permanentními magnety


Downsize motor frame size




Higher power density



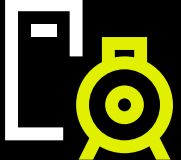
Higher torque at low speed




Precise control w/o encoder



Higher power factor ($\cos \phi$)



Constant power up to 150 %




IE5 efficiency




High efficiency at partial load




Reduce CO₂ production (PCF)




Lower motor weight



Constant torque

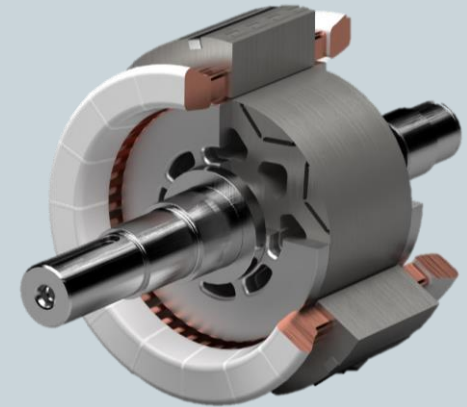
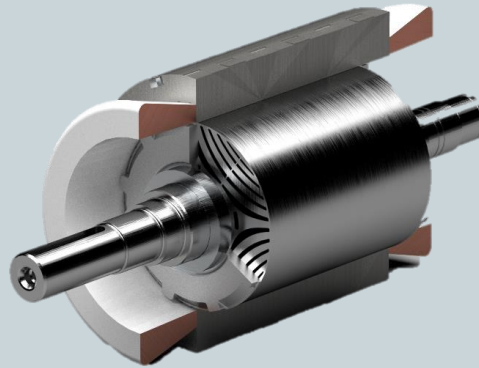
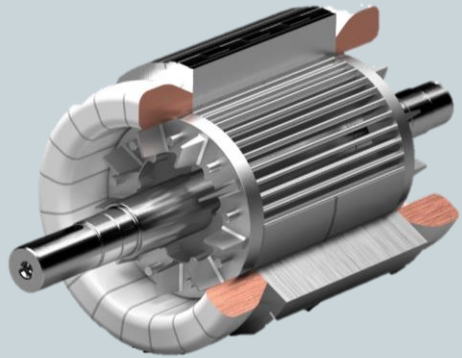


High overloadability



Motorové technologie

Porovnání



Asynchronní motor (ASM)

- Robustní a spolehlivý
- Bez kartáčů
- Téměř **bezúdržbový provoz**
- **Provoz přímo na síti**

Synchronní reluktanční motor

- Bez magnetů v rotoru
- **1:1 retrofit** s ASM
- **Jednoduchá údržba**
- Spolehlivý motor s jednoduchou konstrukcí rotoru

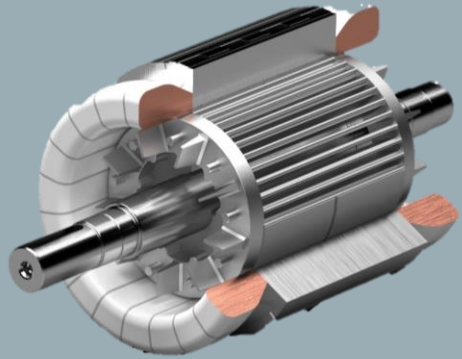
Motor s Permanentními magnety

- Magnety pro tvorbu vysokého točivého momentu
- **Vysoká hustota výkonu a momentu**
- Až **o 3 osově výšky menší motor** při stejném výkonu
- **Extrémně vysoký účinník** (~0,99)
- Precizní otáčková kontrola bez enkodéru

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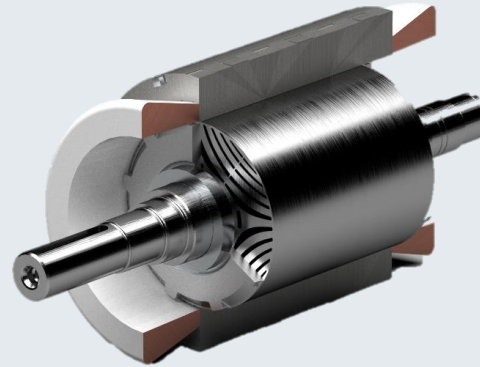
Motor technology

Comparison



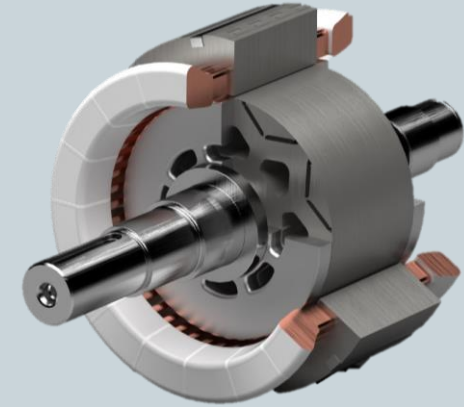
Asynchronní motor

- Obtížná otáčková regulace bez enkodéru
- Nízká účinnost v částečných zatíženích a nízkých rychlostech
- Nutnost nuceného chlazení při nízkých otáčkách a velkých momentech



Synchronní reluktanční motory

- Velmi nízký účinník (~0,75)
- Vysoký jmenovitý proud
- Nízká hustota výkonu v porovnání s motory s permanentními magnety

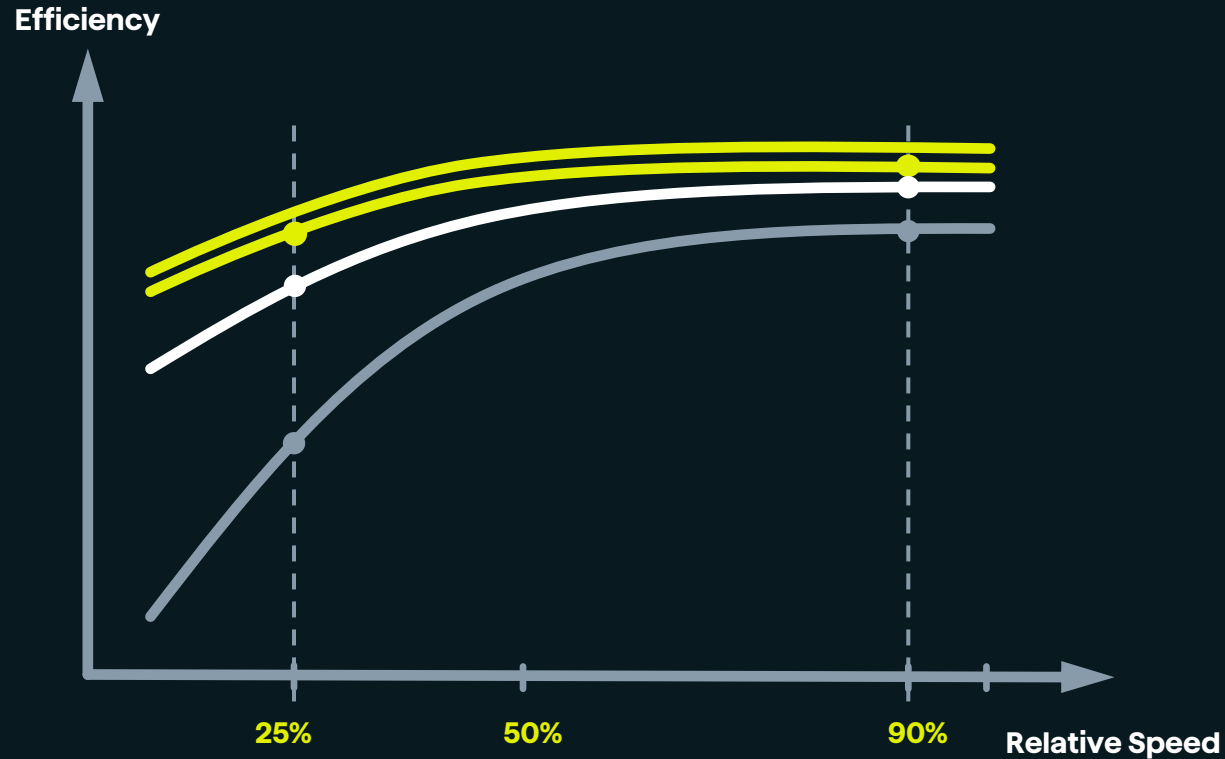


Motory s permanentními magnety

- Využívají vzácné zeminy
- Nutnost úpravy Servisních / Provozních předpisů → magnetické síly
- Vysoké zpětné - EMF (Electric and Magnetic Field) → Bezpečnostní koncept **INNOMOTICS**

Motory s permanentními magnety

Aplikace s konstantním momentem



- System with Permanent magnet motor
- System with Synchronous reluctance motor
- System with induction motor

Motor

45 kW, 1.500 rpm

PM motor IE6

92,5 %

97,0 %

PM motor IE5

91,9 %

96,3 %

SRM IE5

91,1 %

96,1 %

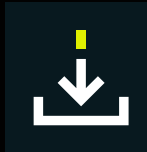
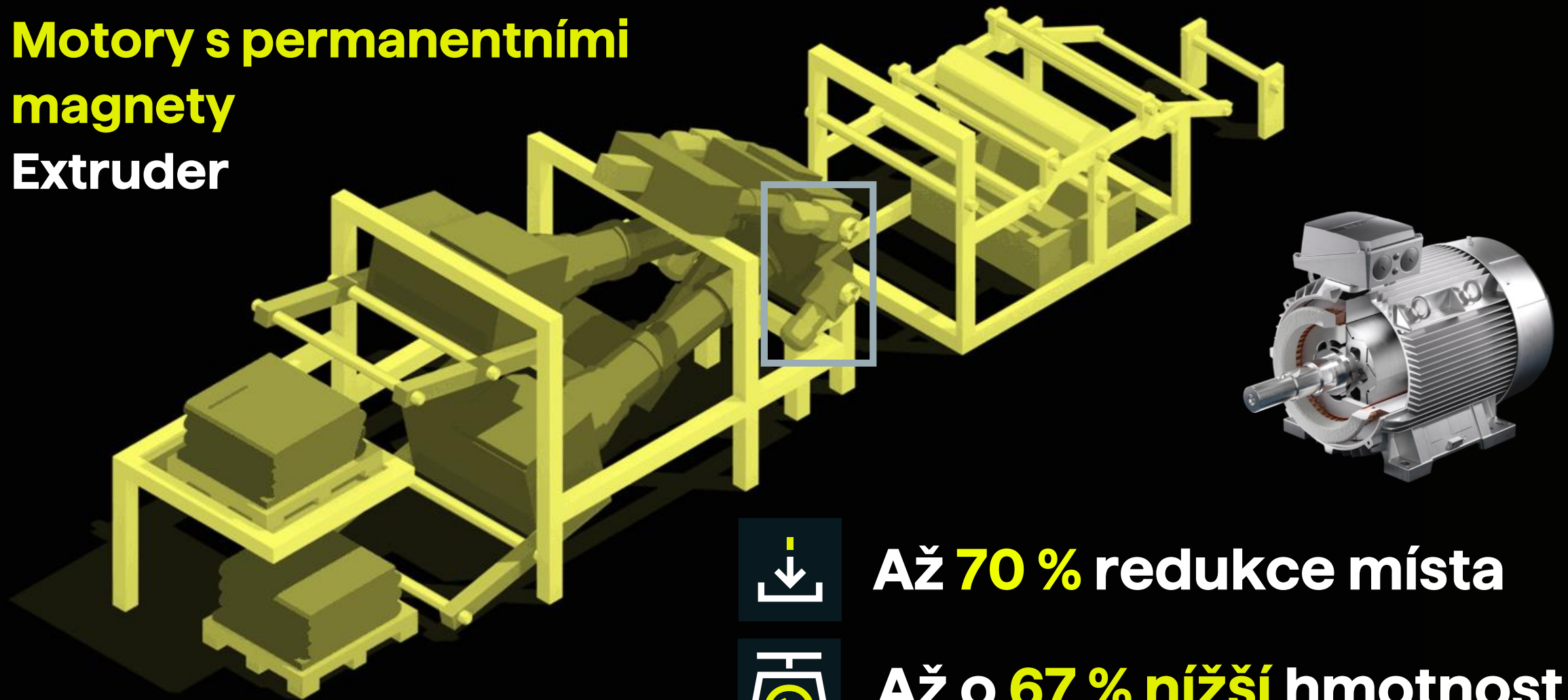
ASM IE4

87,8 %

94,6 %

Motory s permanentními magnety

Extruder



Až **70 %** redukce místa




Až o **67 % nižší** hmotnost



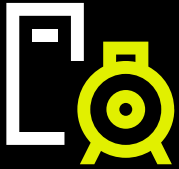
Vysoká přetížitelnost

160 kW, 1500 rpm


Downsize motor frame size



Higher power factor ($\cos \phi$)



Lower motor weight



IE5 efficiency



Innomotics	Innomotics	Competitor
PM motor	ASM (IE4)	SRM (competitor)
SH 280	SH 315	SH 315
0,93 $I_n = 270 \text{ A}$	0,85 $I_n = 280 \text{ A}$	0,75 $I_n = 343 \text{ A}$
684 kg	1200 kg	965 kg
97,2	96,6	97,1

PM motors = Permanent Magnet Motors

SRM = Synchronous Reluctance Motors

ASM = Asynchronous Motors

Opravdu úsporné průmyslové řešení

160 kW, 1500 rpm

Asynchronní motory (DOL katalogové hodnoty)

IE2 265 A
IE3 275 A
IE4 280 A

Motor s permanentními magnety (VSD provoz)

IE5 270 A

Synchronní reluktanční motory (VSD provoz)

IE5 341 A

Stíněný kabel

2YSLCY-JB 292 A



302 A



Stíněný kabel

2YSLCY-JB 382 A



377 A

VSD = Variable Speed Drive
DOL = Direct On Line





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Měničový systém s motorem s permanentními magnety (1/4)

- Pump system
- 400V, 7.5 kW, 1500 /min
- Comparison:
 - Asynchronous motor
 - Direct On Line, IE3

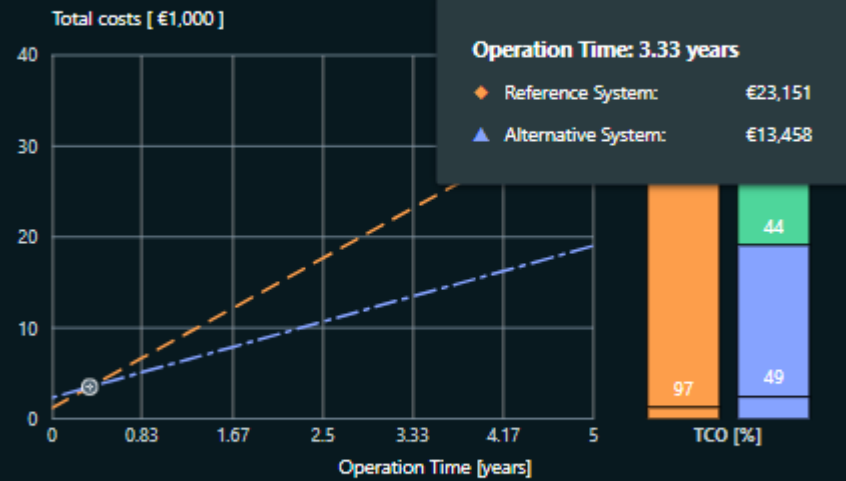
vs

- Permanent Magnet motor
- Variable Speed Drive, IE5
- Siemens G120 + PM240-2

Reference System [?] Motor - Switchgear	Alternative System [?] Motor - Converter	Switchgear [?] SIRIUS	Converter [?] SINAMICS G120 PM240-2
 <p>Application Pump</p> <p>Control Mode Throttle</p> <p>Line supply 3AC / 400 V / 50 Hz</p>	 <p>Application Pump</p> <p>Control Mode Converter</p> <p>Line supply 3AC / 400 V / 50 Hz</p>	<p>List price 269 €</p> <p>Discount 20.0 %</p> <p>Customer Price 215 €</p> <p>Get technical data →</p>	<p>List price 1,319 €</p> <p>Discount 25.0 %</p> <p>Customer Price 989 €</p> <p>Get technical data →</p>
<p> Motor [?] GP General Purpose</p> <p>List price 3,231 €</p> <p>Discount 70.0 %</p> <p>Customer Price 969 €</p> <p>Get technical data →</p>	<p> Motor [?] GP Permanent Magnet</p> <p>List price 2,120 €</p> <p>Discount 37.0 %</p> <p>Customer Price 1,336 €</p> <p>Get technical data →</p>	<p>\$→ Additional Investment [?]</p> <p>Installation 0 €</p> <p>+ Add new</p> <p>Sum Additional Investment 0 €</p>	<p>\$→ Additional Investment [?]</p> <p>Installation 0 €</p> <p>+ Add new</p> <p>Sum Additional Investment 0 €</p>
		<p>Total Investment 1,185€</p>	<p>Total Investment 2,049€</p>

Měničový systém s motorem s permanentními magnety (2/4)

Results
Lifetime costs



TCO 5 years Financial saving potential

Reference System

Expected energy costs for 5 years €32,950
Required Investment costs €1,185

— 0,12 EUR / kWh

Alternative System

Expected energy costs for 5 years €16,700
Required Investment costs €2,325
Expected energy costs savings in 5 years €16,250
Investment difference €1,140

**4,2 months
payback time**

Expected total costs savings €15,110 (In 5 years)
Expected amortization time 4.2 mo.

**15,110 EUR
savings in 5 years**

Commercial system result

Comparing the Reference System and Alternative System, the Alternative System is the more economical solution. The investment payback is within the planned operation time.

Měničový systém s motorem s permanentními magnety (3/4)

Control Mode	Control Mode
Converter controlled	Converter controlled
Motor	Motor
Inverter Capable	Inverter Duty
Standard Direct-On-Line motor, capable for converter operation	Exclusively and optimized for converter operation
Power P_N : 7.5 kW	Power P_N : 7.5 kW
Rated speed: 1,470 1/min	Rated speed: 1,500 1/min
Efficiency class: IE4	Efficiency class: IE5
Technology: Asynchronous	Technology: Permanent Magnet
Casting: Aluminum	Casting: Aluminum
GP General Purpose	GP Permanent Magnet

Converter	Converter
Siemens	Siemens
Converter for PFC from Siemens	Converter for PFC from Siemens
Rated current I_N : 18 A	Rated current I_N : 13.2 A
Rated Power P_N : 7.5 kW	Rated Power P_N : 5.5 kW
Efficiency η_N : 97.0 %	Efficiency η_N : 97.0 %
Design type: Chassis	Design type: Chassis
SINAMICS G120X	SINAMICS G120 PM240-2

Line Supply
3AC / 400 V / 50 Hz

— Oba motory jsou 7,5 kW, 1500 rpm

— Rozdílná technologie přináší opravdové **BENEFITY** na straně zákazníka

ASM IE4
 $I_n = 14,4 \text{ A}$
0,81

PM motor IE5
 $I_n = 12,8 \text{ A}$
0,95

G120 X
 $I_n = 18 \text{ A}$
7,5 kW

G120
 $I_n = 13,2 \text{ A}$
5,5 kW

Měničový systém s motorem s permanentními magnety (4/4)

<p>Motor ② GP General Purpose</p> <p>List price: 4,137 €</p> <p>Discount: 70.0 %</p> <p>Customer Price: 1,241 €</p> <p>Get technical data →</p>	<p>Motor ② GP Permanent Magnet</p> <p>List price: 2,120 €</p> <p>Discount: 37.0 %</p> <p>Customer Price: 1,336 €</p> <p>Get technical data →</p>
<p>Converter ② SINAMICS G120X</p> <p>List price: 1,480 €</p> <p>Discount: 25.0 %</p> <p>Customer Price: 1,110 €</p> <p>Get technical data →</p>	<p>Converter ② SINAMICS G120 PM240-2</p> <p>List price: 1,319 €</p> <p>Discount: 25.0 %</p> <p>Customer Price: 989 €</p> <p>Get technical data →</p>

Netto Investment
2,351€

Netto Investment
2,325€



Reference System

Expected energy costs for 10 years	€34,700
Required Investment costs	€2,351

Alternative System

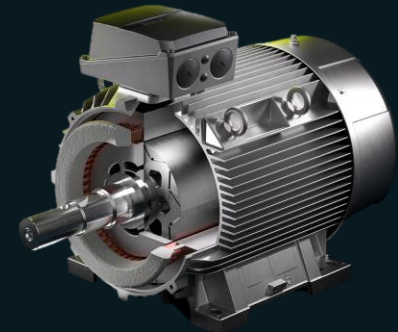
Expected energy costs for 10 years	€33,400
Required Investment costs	€2,325

Expected energy costs savings in 10 years	€1,300
Investment difference	-€26

Expected total costs savings
€1,326
(in 10 years)

Expected amortization time
Immediately

PM motor IE5 + G120
Lower Investment Cost



Return On Investment
from Day 1

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Kde můžete čerpat výhody

při použití systému s motory s permanentními magnety ?

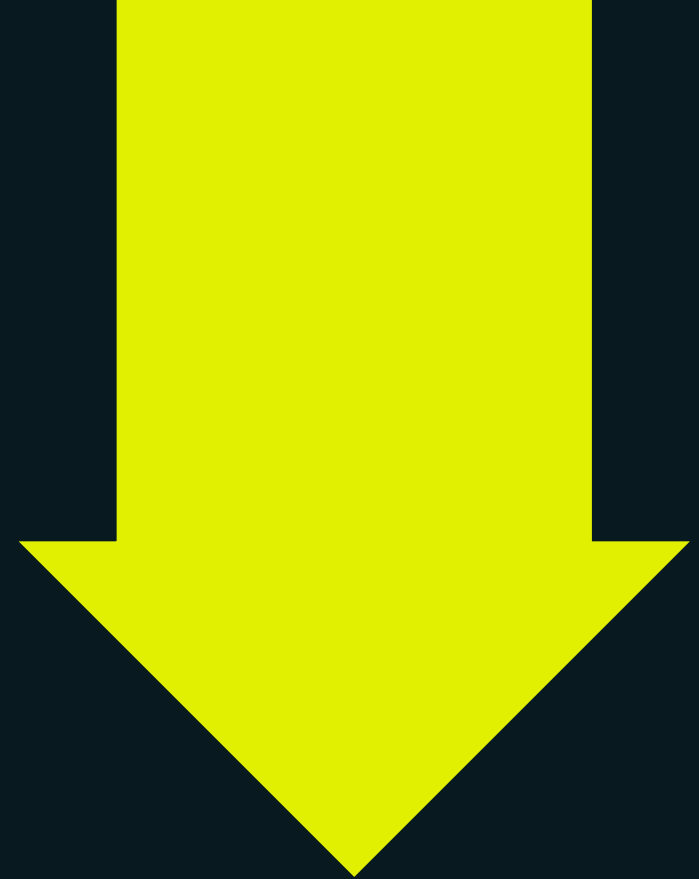
Full MLFB IE5	SH	Power [kW]	SH benefit	Smaller drive	Speed
1FZ1505-0CK32-1AB4	71	0,37	0	0	1500
1FZ1505-0CK42-1AB4	71	0,55	1	0	1500
1FZ1505-0CK52-1AB4	71	0,75	1	1	1500
1FZ1505-0CK62-1AB4	71	1,1	2	1	1500
1FZ1505-0EK42-1AB4	90	1,5	0	1	1500
1FZ1505-0EK52-1AB4	90	2,2	1	1	1500
1FZ1505-0EK62-1AB4	90	3	1	1	1500
1FZ1505-0EK72-1AB4	90	4	2	1	1500
1FZ1505-1CK02-1AB4	132	5,5	0	1	1500
1FZ1505-1CK22-1AB4	132	7,5	0	1	1500
1FZ1505-1CK32-1AB4	132	11	1	0	1500
1FZ1505-1CK42-1AB4	132	15	1	1	1500
1FZ5505-1EK22-1AB4	180	18,5	0	1	1500
1FZ5505-1EK42-1AB4	180	22	0	1	1500
1FZ5505-1EK52-1AB4	180	30	1	0	1500
1FZ5505-1EK62-1AB4	180	37	2	0	1500
1FZ5505-1EK72-1AB4	180	45	2	1	1500
1FZ5505-2BK22-1AB4	225	55	1	0	1500
1FZ5505-2BK32-1AB4	225	75	2	0	1500
1FZ5505-2BK42-1AB4	225	90	2	0	1500
1FZ1505-2DK22-1AB4	280	90	0	0	1500
1FZ1505-2DK32-1AB4	280	110	1	0	1500
1FZ1505-2DK42-1AB4	280	132	1	0	1500
1FZ1505-2DK52-1AB4	280	160	1	0	1500
1FZ1505-2DK62-1AB4	280	200	1	0	1500

Full MLFB IE5	SH	Power [kW]	SH benefit	Smaller drive	Speed
1FZ1505-0CL32-1AB4	71	0,55	0	0	3000
1FZ1505-0CL42-1AB4	71	0,75	1	1	3000
1FZ1505-0CL52-1AB4	71	1,1	1	1	3000
1FZ1505-0CL62-1AB4	71	1,5	2	1	3000
1FZ1505-0EL42-1AB4	90	2,2	0	1	3000
1FZ1505-0EL52-1AB4	90	3	1	1	3000
1FZ1505-0EL62-1AB4	90	4	2	1	3000
1FZ1505-0EL72-1AB4	90	5,5	3	1	3000
1FZ1505-0EL82-1AB4	90	7,5	3	1	3000
1FZ1505-1CL22-1AB4	132	11	1	0	3000
1FZ1505-1CL32-1AB4	132	15	1	1	3000
1FZ1505-1CL42-1AB4	132	18,5	1	1	3000
1FZ1505-1CL52-1AB4	132	22	2	1	3000
1FZ5505-1EL32-1AB4	180	30	1	0	3000
1FZ5505-1EL42-1AB4	180	37	1	0	3000
1FZ5505-1EL52-1AB4	180	45	2	1	3000
1FZ5505-1EL62-1AB4	180	55	3	1	3000
1FZ5505-2BL22-1AB4	225	75	2	0	3000
1FZ5505-2BL32-1AB4	225	90	2	0	3000
1FZ5505-2BL42-1AB4	225	110	3	0	3000
1FZ5505-2BL52-1AB4	225	132	3	0	3000
1FZ1505-2DL32-1AB4	280	110	1	1	3000
1FZ1505-2DL42-1AB4	280	132	1	0	3000
1FZ1505-2DL52-1AB4	280	160	1	0	3000
1FZ1505-2DL62-1AB4	280	200	1	0	3000
1FZ1505-2DL72-1AB4	280	250	1	0	3000

Smaller drive = 1 → o jeden výkon menší frekvenční měnič

SH benefit = o kolik osových výšek je PM motor menší oproti asynchronnímu motoru

Redukce CO₂ během provozu

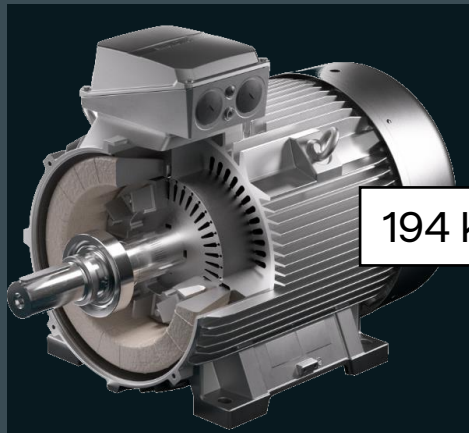


36 %

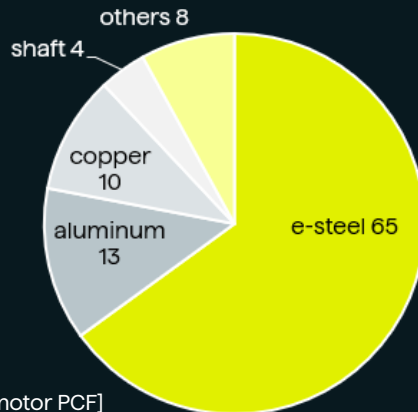
Comparison of the CO2 emissions of two 5.5 kW motors

UPSTREAM

ASY IE4
FS132

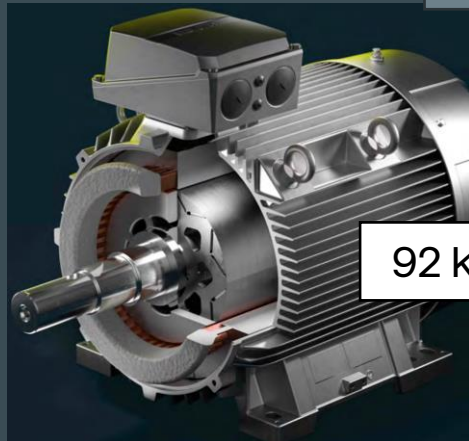


194 kg CO2e

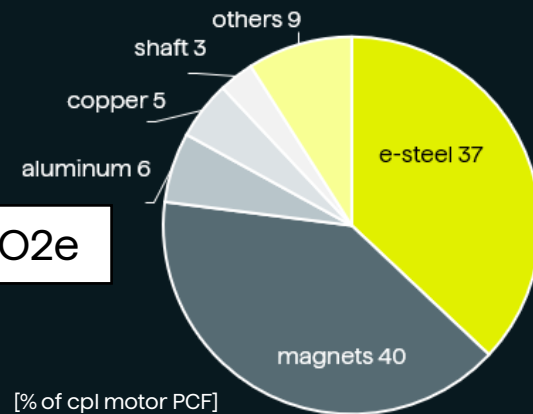


-53%*

PMSM IE6
FS90

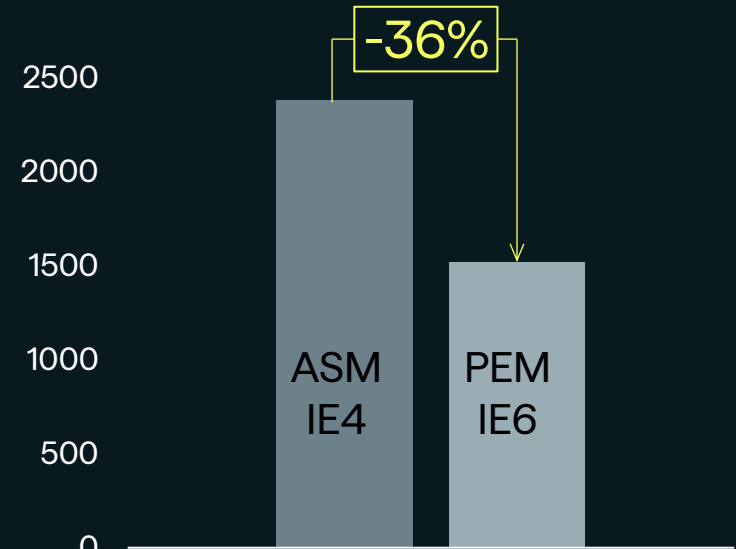


92 kg CO2e



DOWNSTREAM

CO2 emissions [kg]**



5.5 kW

- 1LE10040CA034AA4 (IE4)
- 1FZ10060EL721AB4 (IE6)

** Boundary conditions of the calculation

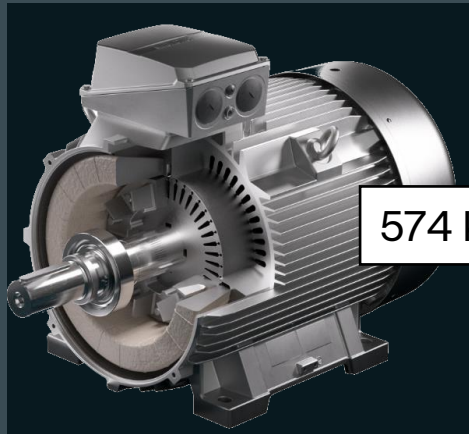
- CO2 emissions based on power losses (motor as intermediate product)
- Use phase scenario acc. to OECD market study based on rated efficiency and output power
- Operation 3000 h/a for 7.7 years (values from OECD study)
- Based on Europe, standard mix acc. to One Siemens LCA Database

*: the amount of savings for upstream emissions is very specific on the compared motors and can not be transferred to other comparisons without further evaluation. Weight comparison can provide a first indication

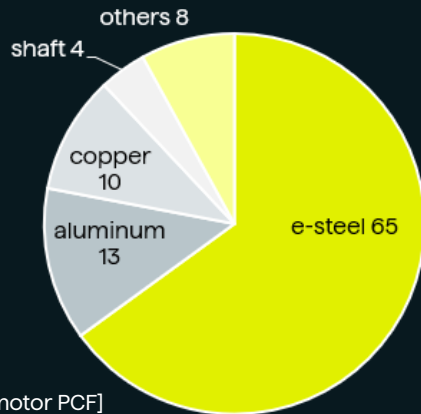
Comparison of the CO2 emissions of two 15 kW motors

UPSTREAM

ASY IE3
FS160

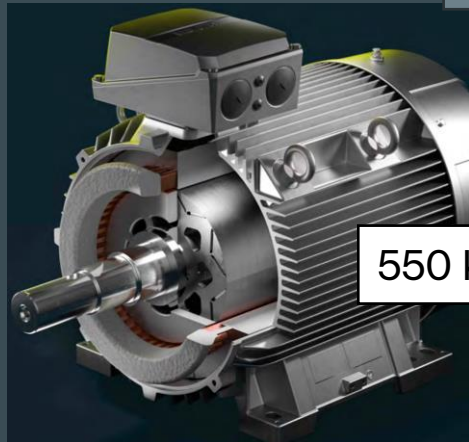


574 kg CO2e

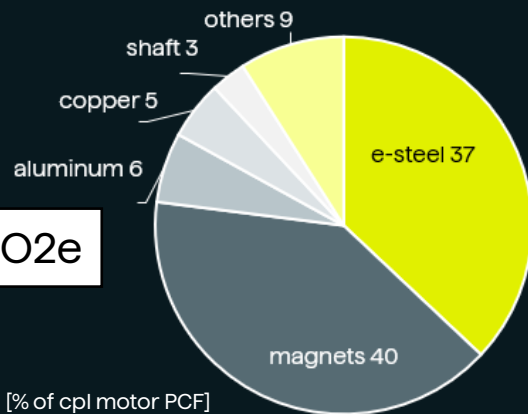


-4%

PMSM IE5
FS132

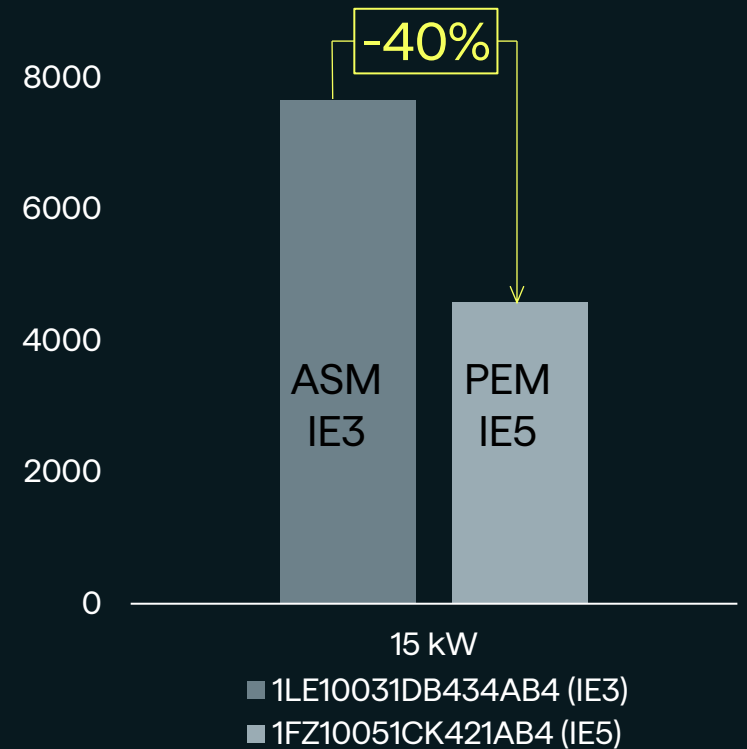


550 kg CO2e



DOWNSTREAM

CO2 emissions [kg]*



- * Boundary conditions of the calculation
- CO2 emissions based on power losses (motor as intermediate product)
 - Use phase scenario acc. to OECD study based on nominal operating point
 - Operation 3000 h/a for 7.7 years (values from OECD study)
 - Based on grid mix EU-28



IE6 ready



AŽ 70 % redukce místa



AŽ o 67 % nižší hmotnost



Ultra vysoký účinník



AŽ 53 % úspora CO2



INNOMOTICS

**Využijte příležitost
a vylepšete Vaše
aplikace.**

Permanently.



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