Levensduurverlenging en hergebruik elektromotoren

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Slotevent
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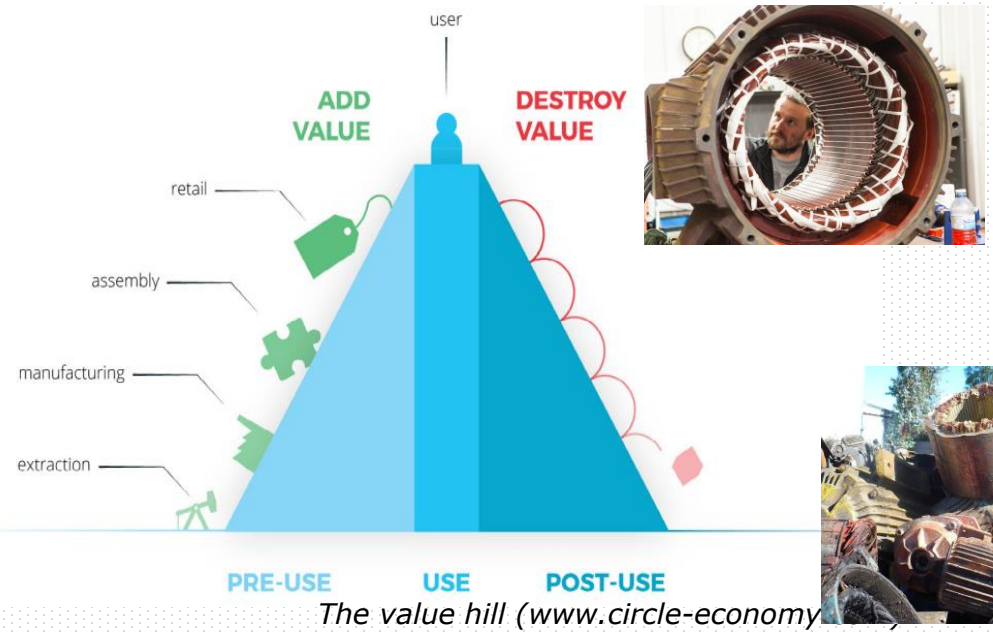
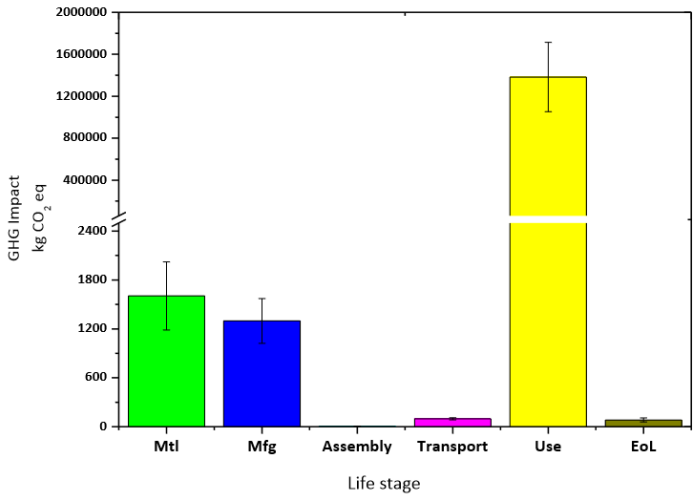
Introduction

The life cycle of an electric motor

- Manufacturing & retail
- USE PHASE
- End of life:recycling



The value hill (www.circle-economy



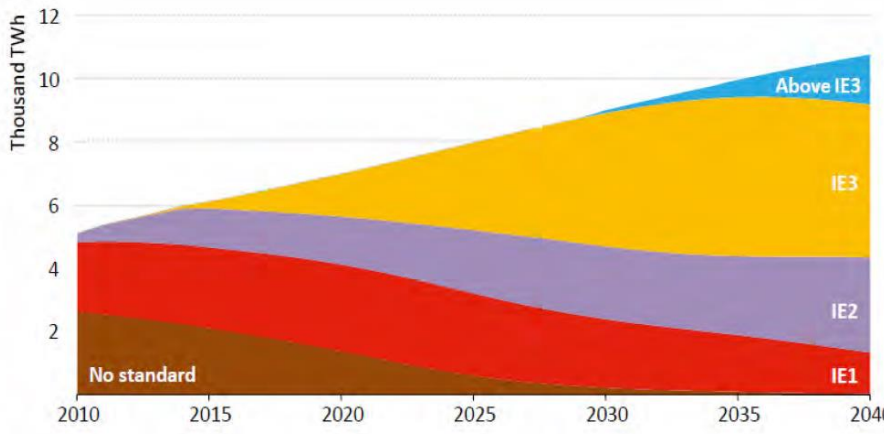
CO_2 impact of an 18,5 kW induction motor [NEMA]

Questions to answer

- Should we replace motors with more efficient versions?
- Or can we keep and maintain the old motor?

Current situation in the field

- Large installed base of electric motors: old and not premium efficiency. Replacement rate < 5% per year



*New Policies Scenario OECD/IEA 2017 World Energy Outlook

- What to do with the low efficient motors?
  - Maintain as is
  - Replace with more efficient version
  - Refurbish
- Knowledge on actual motor condition is growing
  - Smart motor sensors
    - Condition monitoring: vibrations, thermal, magnetic, MCSA, …
    - Energy consumption

A case study at Evonik: IE3 90 kW, 2p induction motor, 24/24

Data collection phase

- Historical data
- Additional measurement campaign
- Conclusion: oversized motor (28 kW), life time prediction: good

Options

- Continue as before, traditional maintenance
- Replace with new motor: lower power rating, higher IE class
- Refurbish

Maintain the current situation

Catalogue efficiency values (IE3 class):

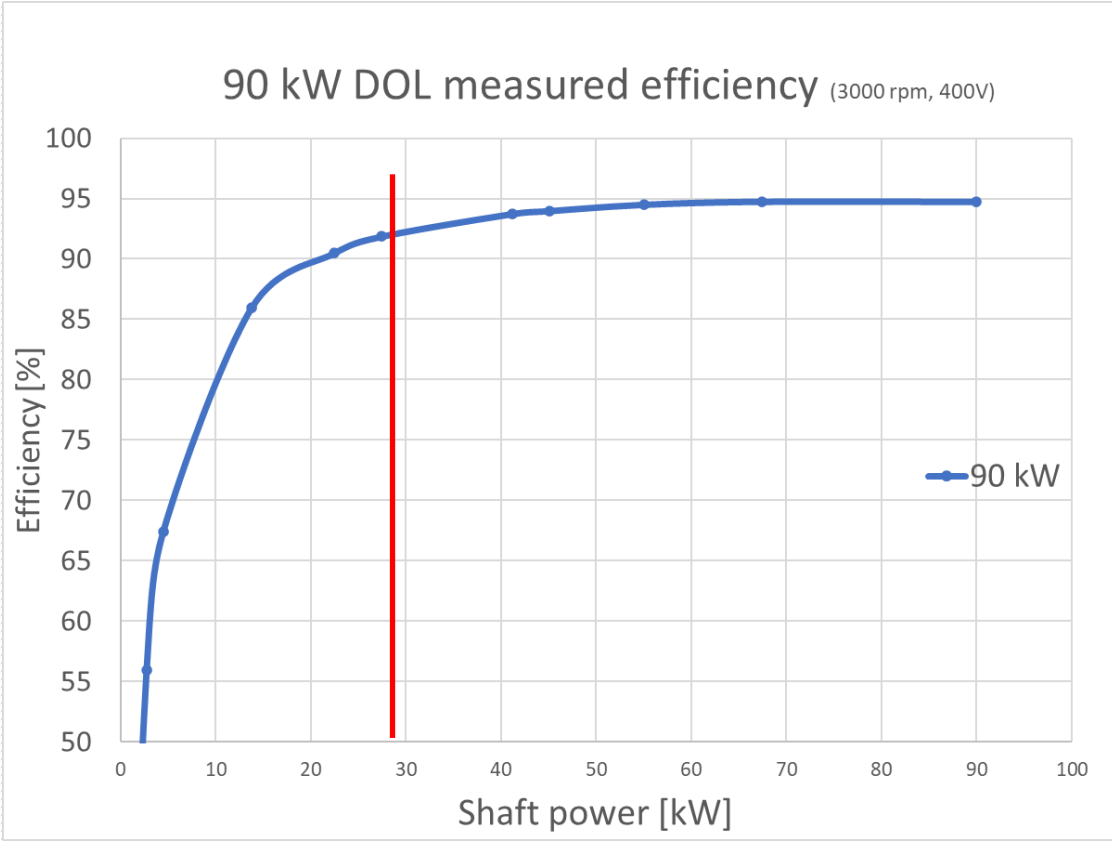
η = 95,0%/94,5%/94,0%

Actual efficiency in load point

η = 91,8% (measured Direct On Line)

A typical situation in industry …

Below 50% loading strong drop in efficiency



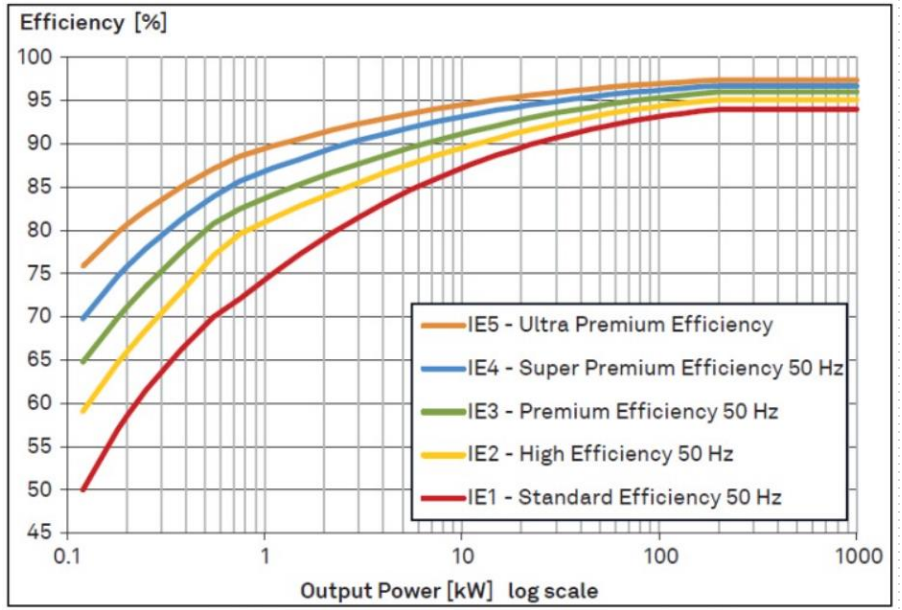
New motor alternatives

Various options!

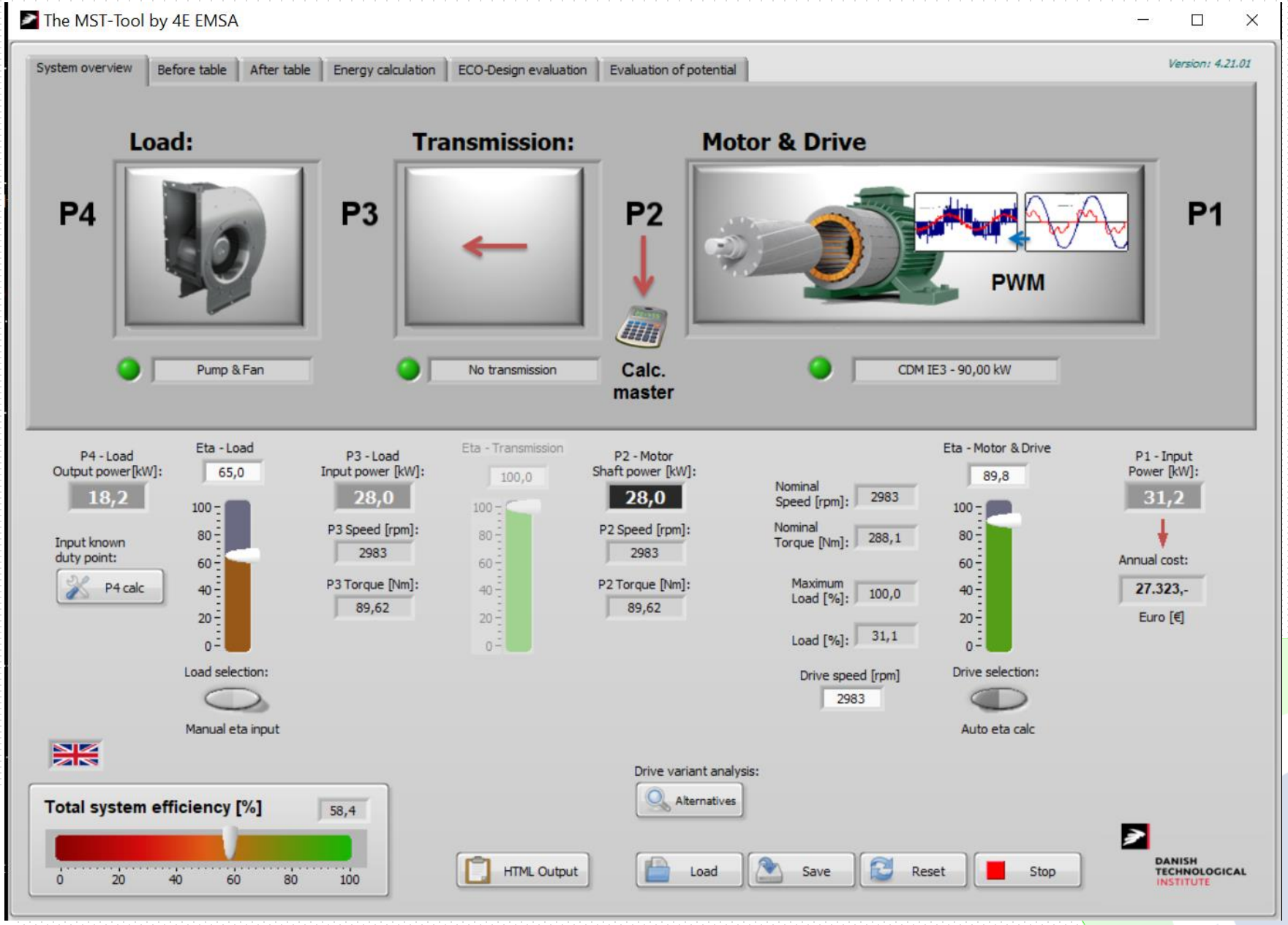
- Replace with 90 kW IE4 technology
- Or 55 kW IE3, IE4?

How to analyse these options?

- Ask your motor manufacturer
- Or use the Motor System Tool
  - Brand independent tool for motor system assessment
  - Freeware: www.iea-4e.org/emsa/our-work/emsa-tools/
  - Electric input power measurement as a starting point !



New motor alternatives: Motor System Tool



New motor alternatives

MST analysis for the given operating point: 28 kW shaft power

0,1 €/kWh 24/24 Induction motor + variable speed drive

Motor	Efficiency class	Efficiency @ 28 kW	Yearly Energy Cost	Yearly savings	Δη
90 kW	IE3	89,8 %	€ 27.323	Benchmark	Benchmark
	IE4	91,3 %	€ 26.865	€ 458	+ 1,5%
55 kW	*IE2*	*91,0 %*	*€ 26.954*	*€ 369*	*+ 1,2%*
	IE3	92,4 %	€ 26.537	€ 786	+ 2,6%
	IE4	93,7%	€ 26.174	€ 1.149	+ 3,9%

90 kW IE4: marginal savings due to oversized motor

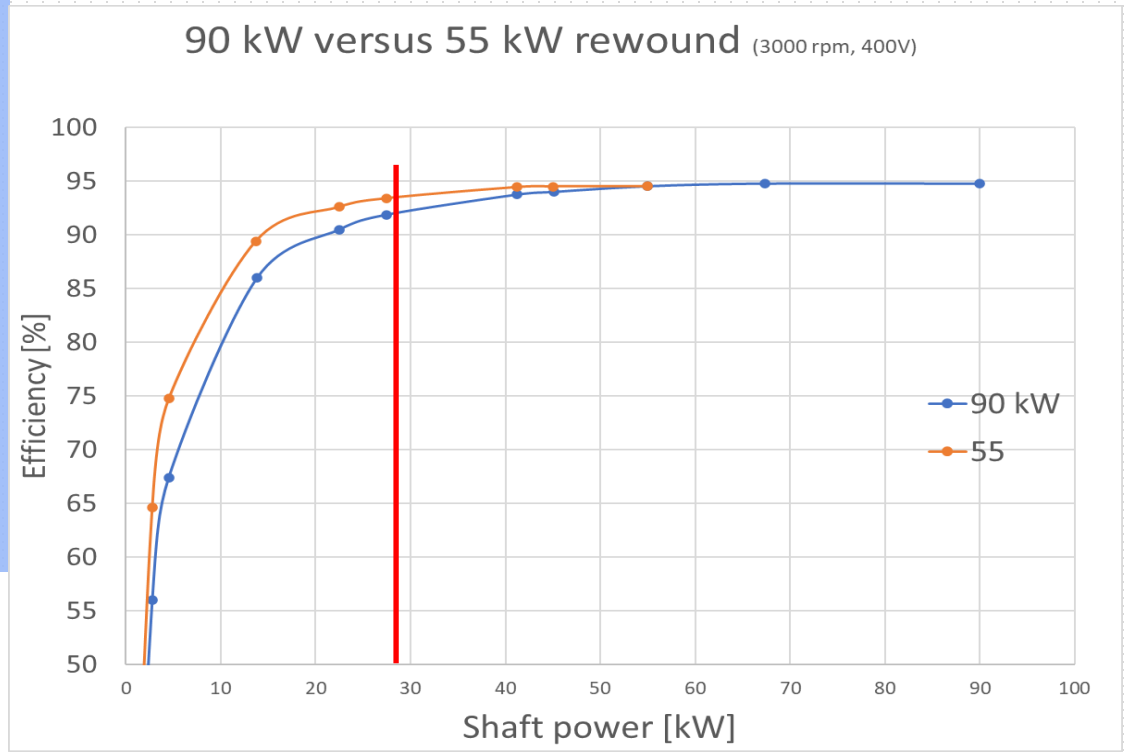
55 kW IE4: looks interesting but mechanical adjustments required (different frame size)

90 kW motor refurbishment ⇒ 55 kW version

Can we reuse the original motor but slightly modified?

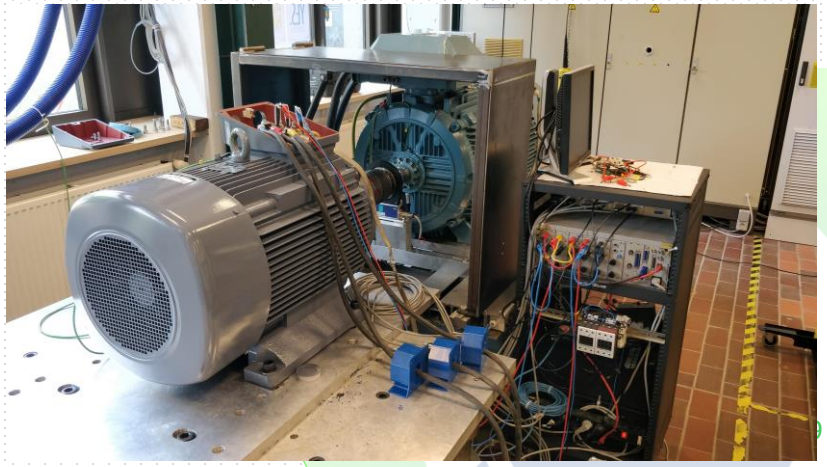
- no mechanical modification required
- less scrap

Rewind the stator to better fit the load point!



- Measured efficiency in operating point 28 kW (DOL):
  - 90 kW: 91,8%
  - 55 kW version: 93,4%

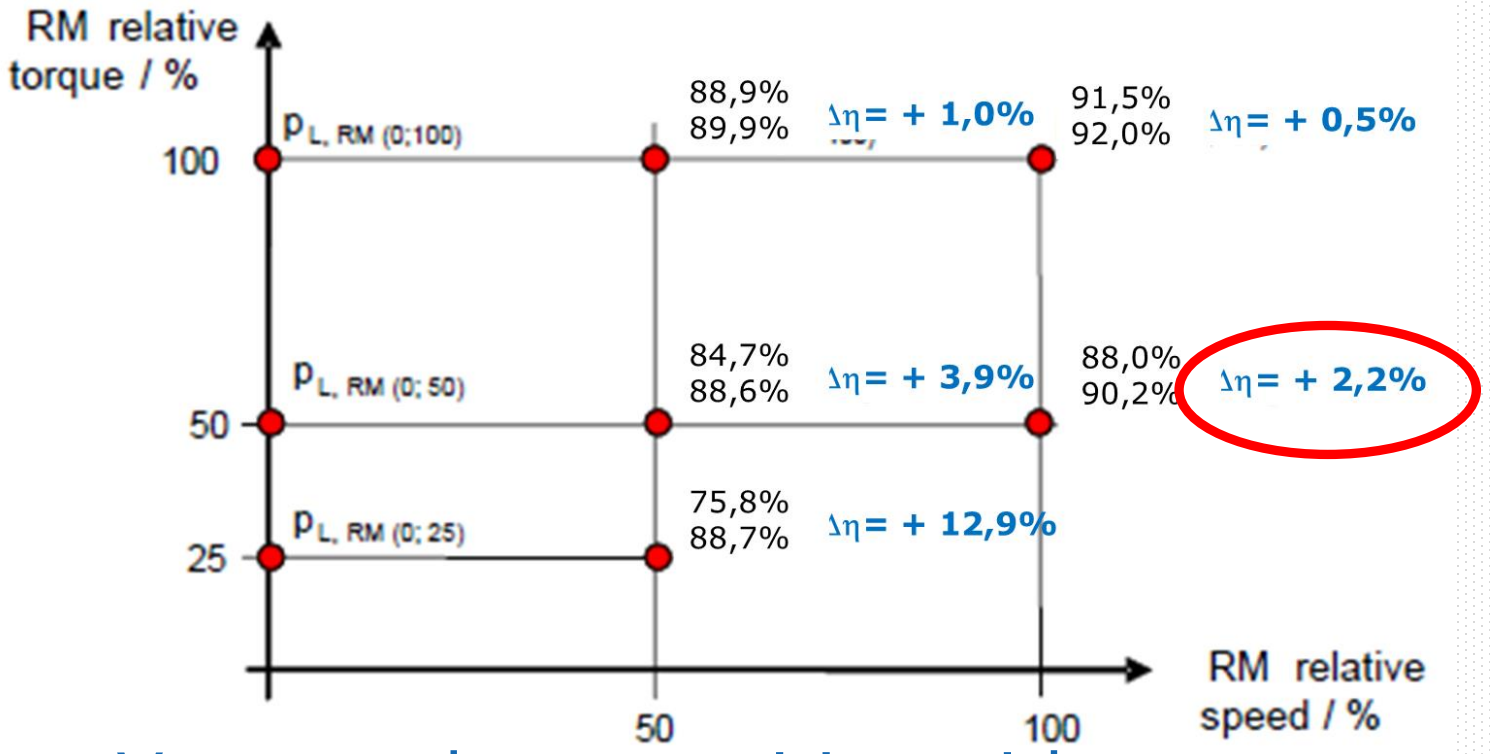
$\Delta\eta$ = + 1,6%



90 kW motor refurbishment ⇒ 55 kW version

Performance with variable speed drive: measured values

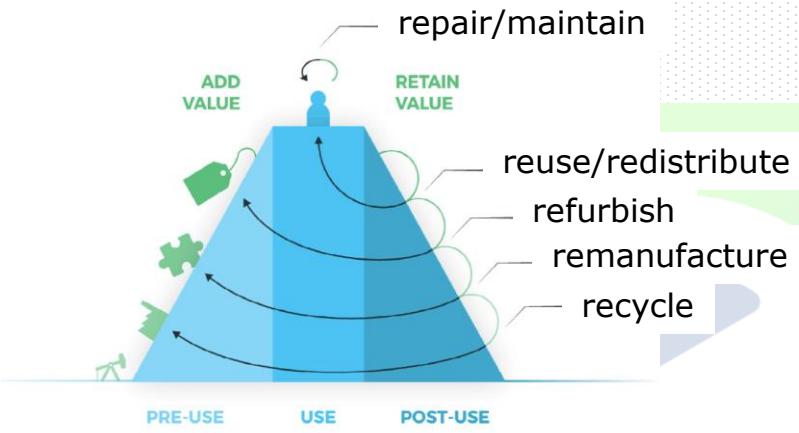
(reference 100% is 55 kW at 3000 rpm)



Very much competitive with new motor 55 kW IE3, but strong reduction of scrap and no additional mounting costs!

Strategy & stakeholders perspective

- Modify your motor management system based on actual motor conditions (DATA)
  - Select best candidates (big/oversized/… motors)
  - Analyze options for replacement/refurbishment well in time
    - Easy to use software tools are available
    - Digital motor passport
  - Use a third party for the data analysis or DIY
- Take refurbishment options into account during planned maintenance operations
- End up with the best of both worlds
  - Higher efficiency
  - Less environmental impact



- Motor driven system: more than just a motor !