Analysis of possible cost reduction effects for energy-efficient electric motors by economies of scale and experience

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Introduction

- Energy efficiency is the main option for greenhouse gas abatement
- Improving efficiency is often linked to higher investment costs
- Efficient technologies are still regarded as new and have relatively low market shares
- With an increasing market share the costs of new technologies converge towards the costs of standard technologies → cost difference is reduced by Economies of Scale (EoS) or Economies of Experience (EoE)
- Analysis until now concentrated on the energy-supply-side
- Study aims to contribute to a more reliable estimation of costs
- Electric motors are a highly relevant demand-side technology – especially in industry

Methodologies

- Classification of energy-efficient motors within a market analysis
- Expert survey
- Calculation of composite price indices for the years 1995 until 2006
  - Production costs for the year 2006 can be deduced from those of the year 1995 by considering volume and price effects due to changes in material use and labor intensity
  - Possibility to deduce cost reduction effects due to improved labor productivity and more efficient material use
  - Development of composite price indices that combine the indices for single cost drivers and can be compared with producer price indices
  - Basis of the index generation: Laspeyres formula which recalculates final year prices from base year conditions by keeping all components fixed

Composite Indices (1)

- Three statistical categories:
  - Electric motors, generators, transformers and components
  - Engineering
  - Appliances for electricity generation and allocation
- Producer price index and different cost components

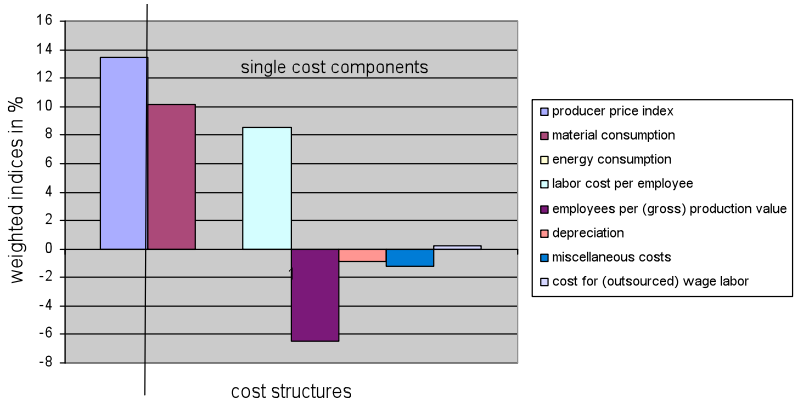


Figure 1: Index development for “Engineering”

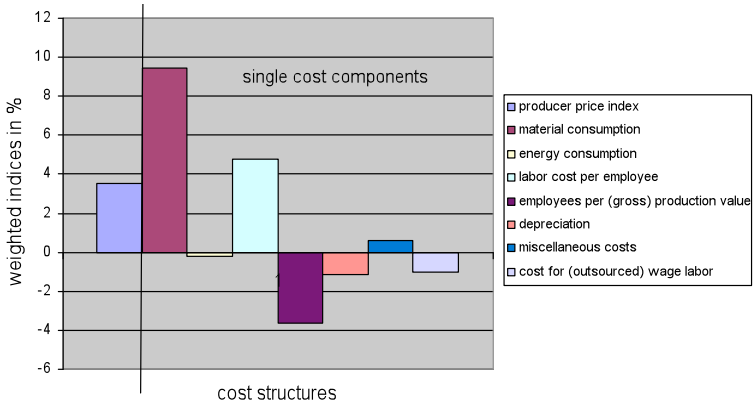


Figure 2: Index development for “Appliances for electricity generation and allocation”

Composite Indices (2)

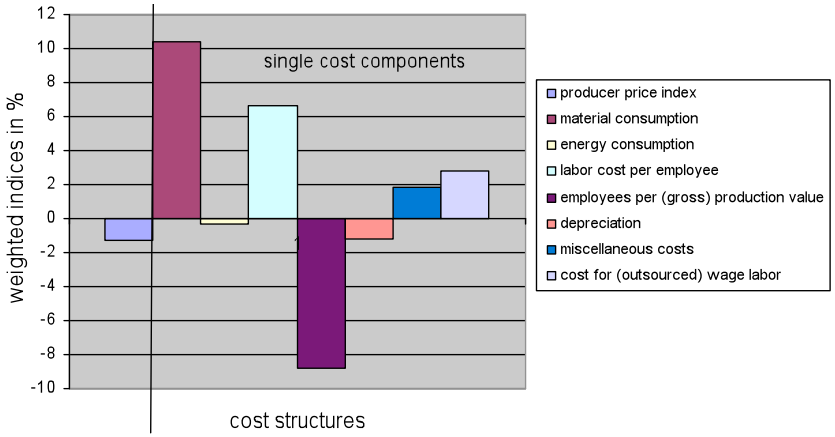
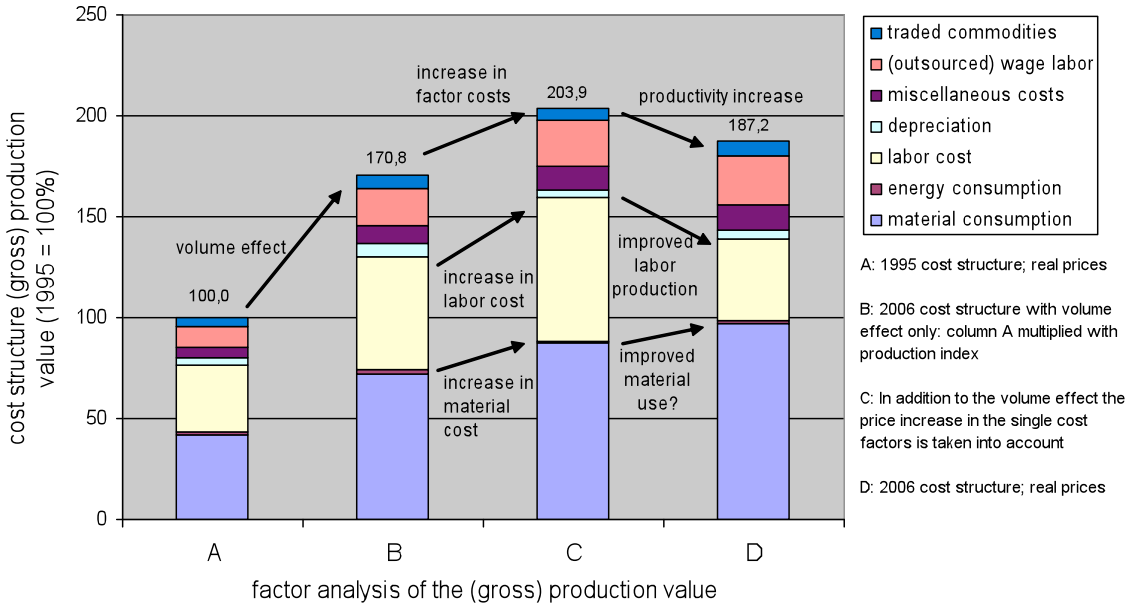


Figure 4. Index development for “Electric motors, generators, transformers and components”

- Determination of cost reductions – 4 steps:
  - A: Real cost structure of the year 1995
  - B: Volume effect caused by increasing production
  - C: Volume and price effect
  - D: Real cost structure of the year 2006

Composite Indices (3)



A: Real cost structure of the year 1995

B: Volume effect caused by increasing production

C: Volume and price effect

D: Real cost structure of the year 2006

Figure 4: Cost structure of the production value between 1995 and 2006 for “Electric motors, Generators, Transformers and Components”

- For the categories “Engineering” and “Appliances for electricity generation and allocation” the cost structure development is more or less the same.

Composite Indices (4)

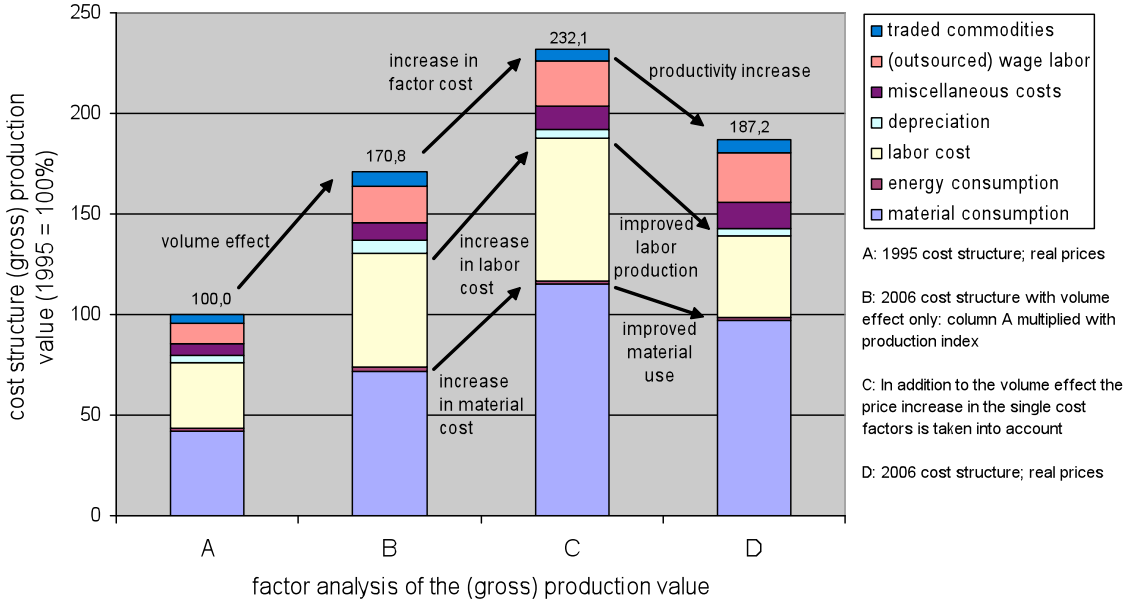


Figure 5: Cost structure of the production value between 1995 and 2006 for “IE1” motors”

- Cost reductions for “IE1” motors: 20%
  - EoS material costs: 15%, EoS productivity improvement in labor: 43%

Learning rate – Policy support measures

- CEMEP agreement: IE1 motors market share increased from 30% in 1995 to 85% in 2006
- Volume effect in the same time period: 71%
- Increase in the IE1 motor market by a factor of five
- Calculated learning rate: 9%

- Policy support measures
  - Minimum efficiency standards
  - Promotion of highly efficient motors
- Outcomes can be integrated into energy system models
- This study presents evidence of cost reductions occurring for efficient electric motors while these are penetrating the market

Thank you for your attention!

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