

# Coating as a way to reduce energy consumption

- About the research shown in this paper
- What is coating (introduction)
- Why use coating / case from paper mill
- Conclusions part 1 (pumps)
- Part 2 – ventilators in tough environment (agriculture)
- Characteristics new - versus new coated surface
- Characteristics used - versus new surface
- Conclusions about coating for ventilators in agricultural sector
- What about the industrial sector, radial ventilators ?
- Next step



ELFORSKFORUM

# About the paper

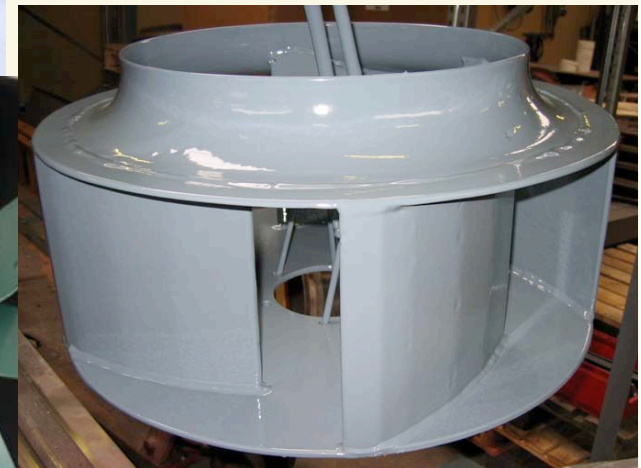
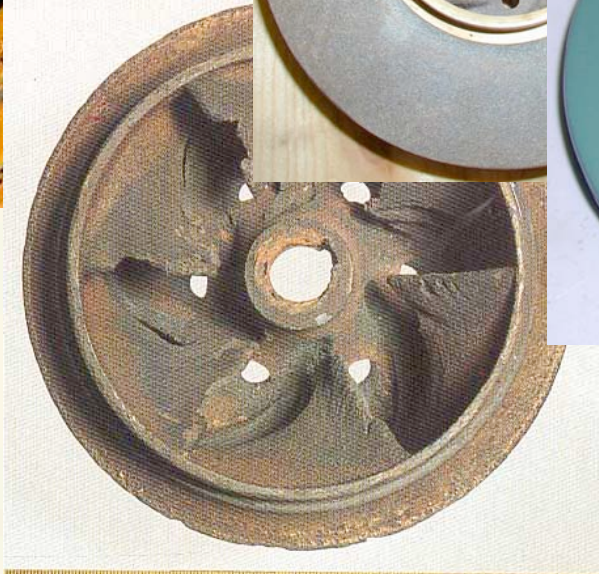
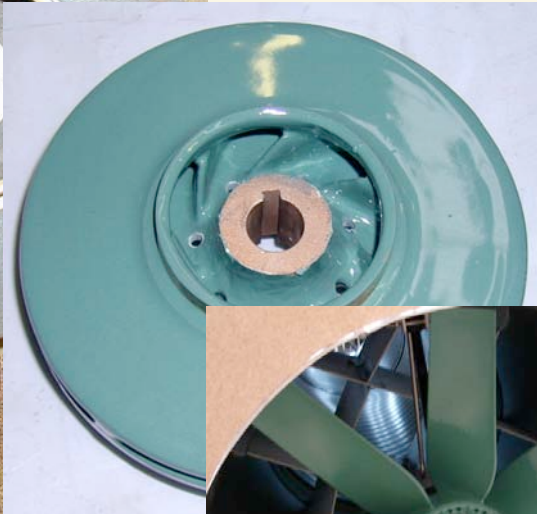
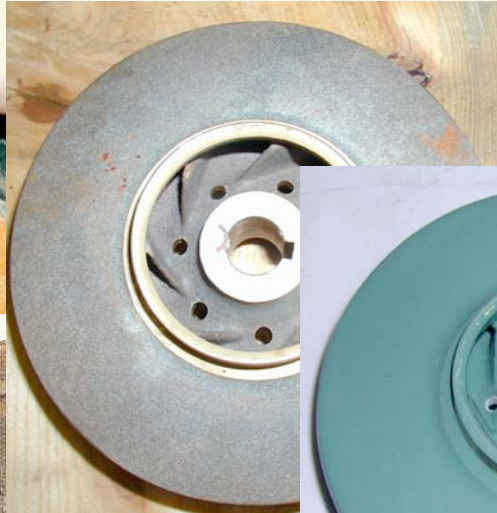
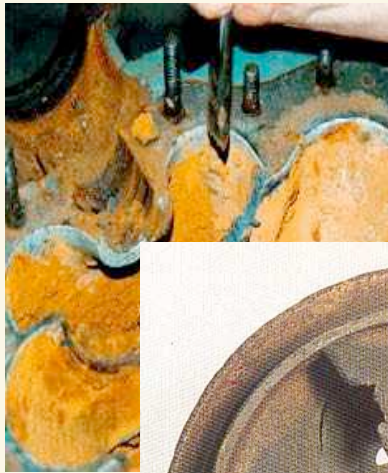
- Research project partly financed by ELFOR, see more on [www.elforsk.dk](http://www.elforsk.dk)
- EEMODS
- Partners of the project
  - Danish Technological Institute (measurements, analyses)
    - Hans Andersen (co- author)
  - Desmi (pumps), SKOV (ventilators)
  - Mastertech (Ceramic coatings)
  - Bygholm (Danish Agriculture Research)
  - Jakob Albertsen A/S (coating factory)
  - LokalEnergi (dissemination)
- Purpose of the project
  - Collect information about the coating technology
  - Dissemination of knowledge about the coating technology in DK
  - What is it - how does it work - what kind of benefits are there ?



Vi giver dig råd, så du får tid!

[eg@lokalenergi.dk](mailto:eg@lokalenergi.dk)

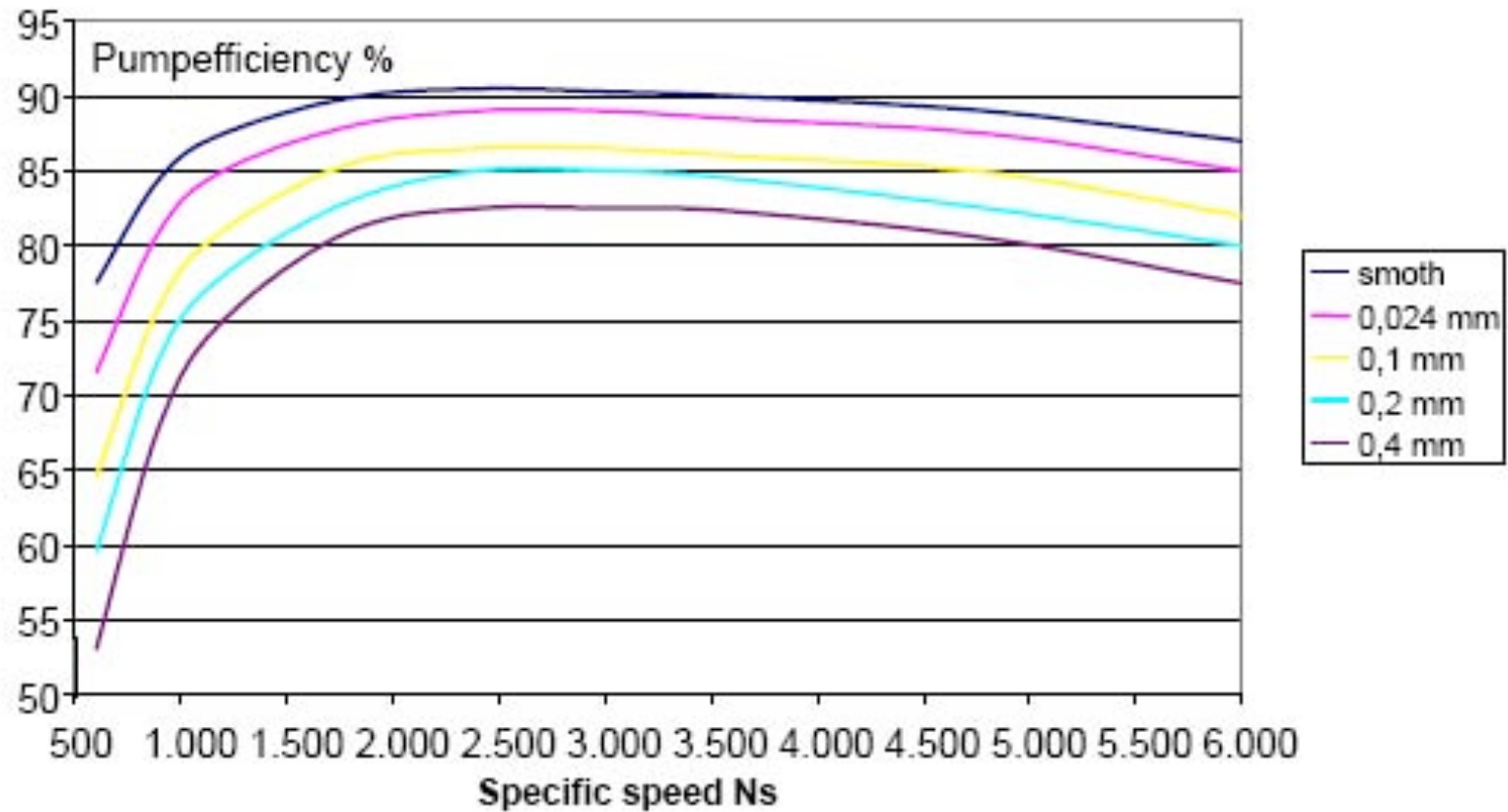
# What is coating - introduction





ELFORSKFC

## Pumpefficiency versus roughness



## Why ? - Case paper mill !

Lifetime economics		
	<b>Coated</b>	<b>Uncoated</b>
Pump cost	7000	7000
Maintenance - sealing	4875	4875
Maintenance - wheel	0	4875
Electricity	360000	420000
Coating cost (twice)	10000	0
<b>Total cost 15 years period</b>	<b>381875</b>	<b>436750</b>

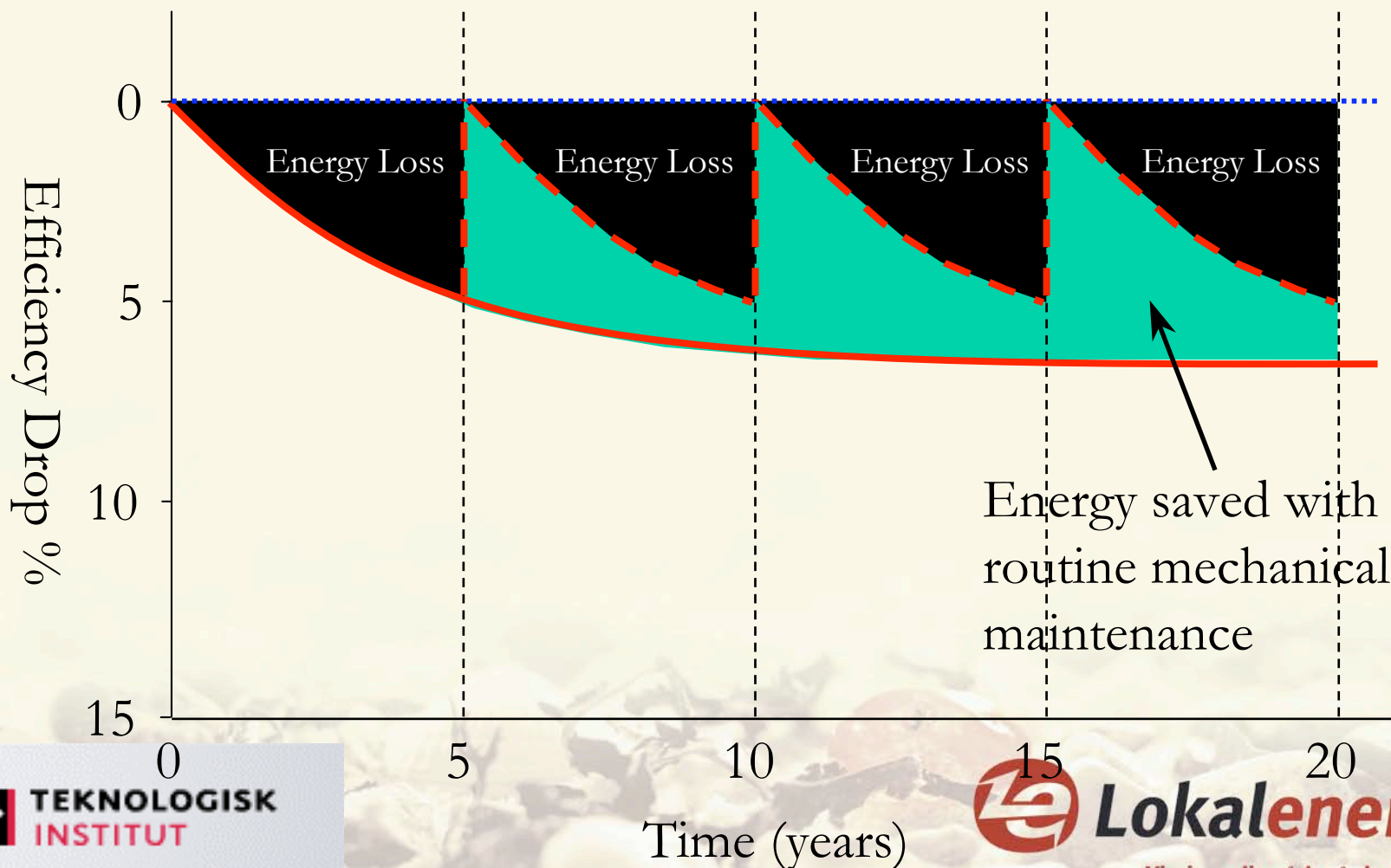
55 kW water pump , electricity price 8 Euro cent pr. kWh

Plus reduced “down time”



ELFORSKFORUM

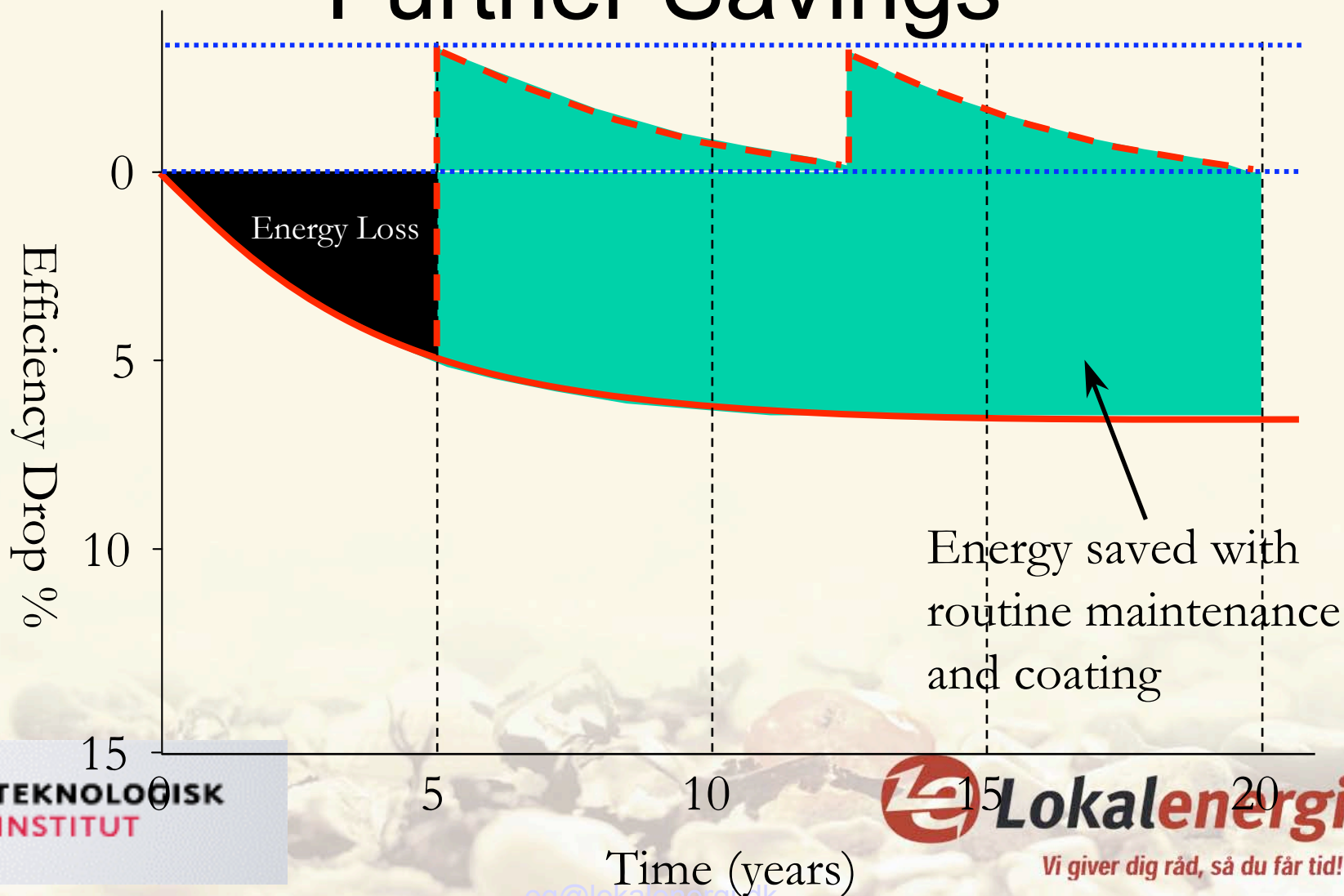
## Improvement during lifetime with planned maintenance !





ELFORSKFORUM

# Further Savings







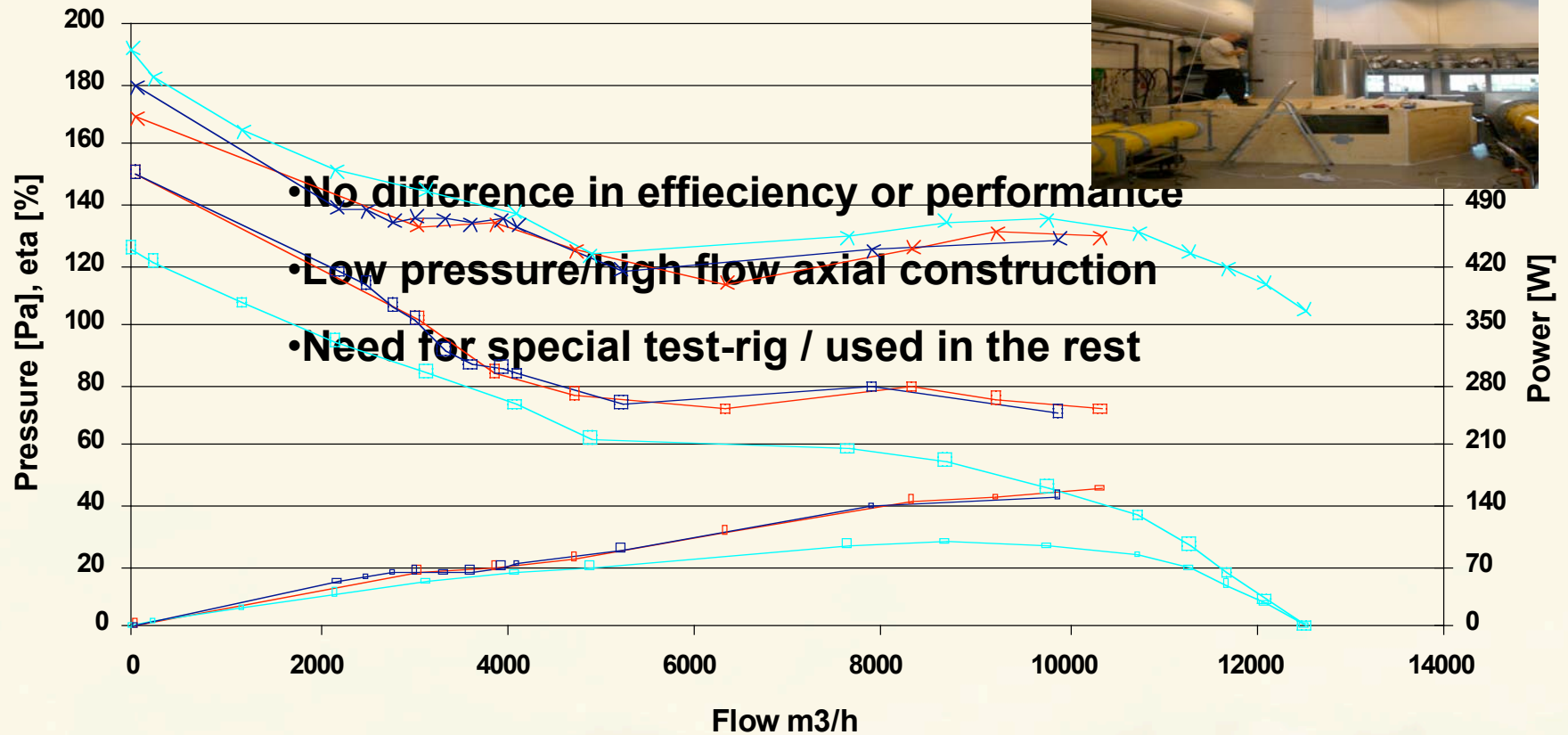
## Part 2 – Agricultural sector





ELFORSKFORUM

# New versus new coated single ventilator

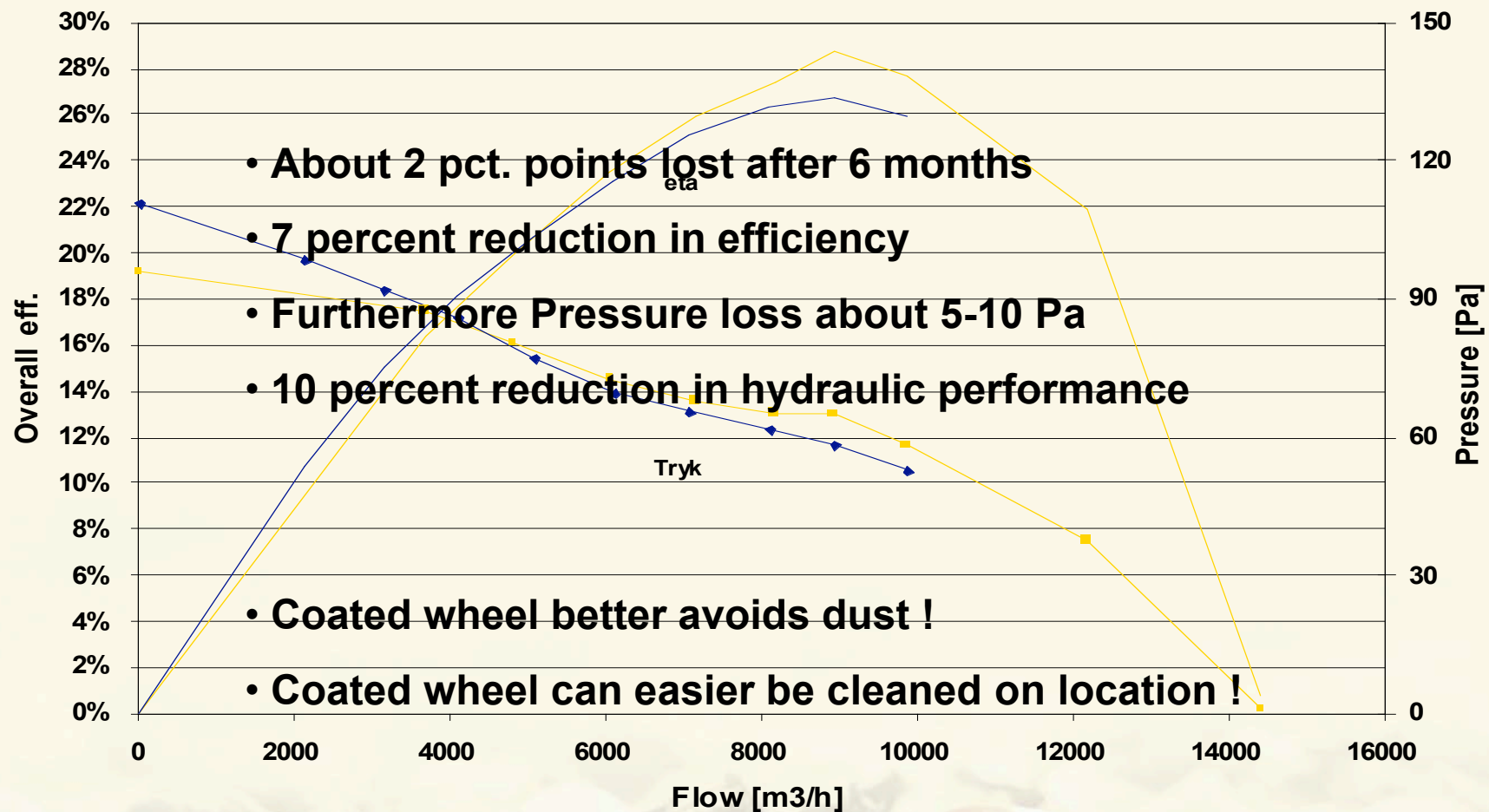


—□— Pressure coat	—□— Eta Coat	—□— Pressure Catalogue
—□— Eta Catalogue	—□— Pressure No Coat	—□— Eta No Coat
—×— Power coat	—×— Power Catalogue	—×— Power No Coat



ELFORSKFORUM

# Used versus new unit (channels & ventilator)



- About 2 pct. points lost after 6 months
- 7 percent reduction in efficiency
- Furthermore Pressure loss about 5-10 Pa
- 10 percent reduction in hydraulic performance
- Coated wheel better avoids dust !
- Coated wheel can easier be cleaned on location !

—■ Eta New      —◆ Eta Used  
—■ Pressure New      —◆ Pressure Used



Vi giver dig råd, så du får tid!

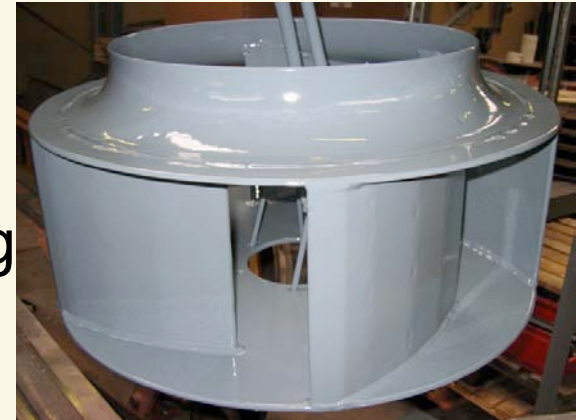
[eg@lokalenergi.dk](mailto:eg@lokalenergi.dk)

## Conclusion agricultural sector

- No start potential – axial, low-pressure fans
- A lot of potential during lifetime / 7% after 6 months!
- A lot of potential in possible more accurate dimensioning / 10% loss of hydraulic performance after 6 months!
- A lot of additional potential by focusing on maintenance in general
- Still expensive technology according to energy-consumption for each ventilator.

## Industrial sector

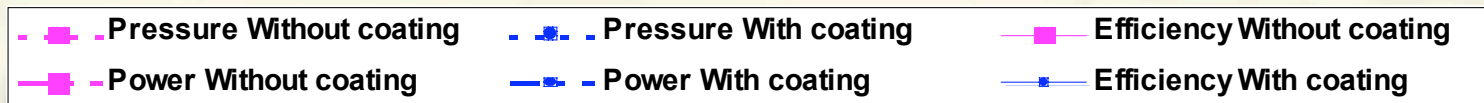
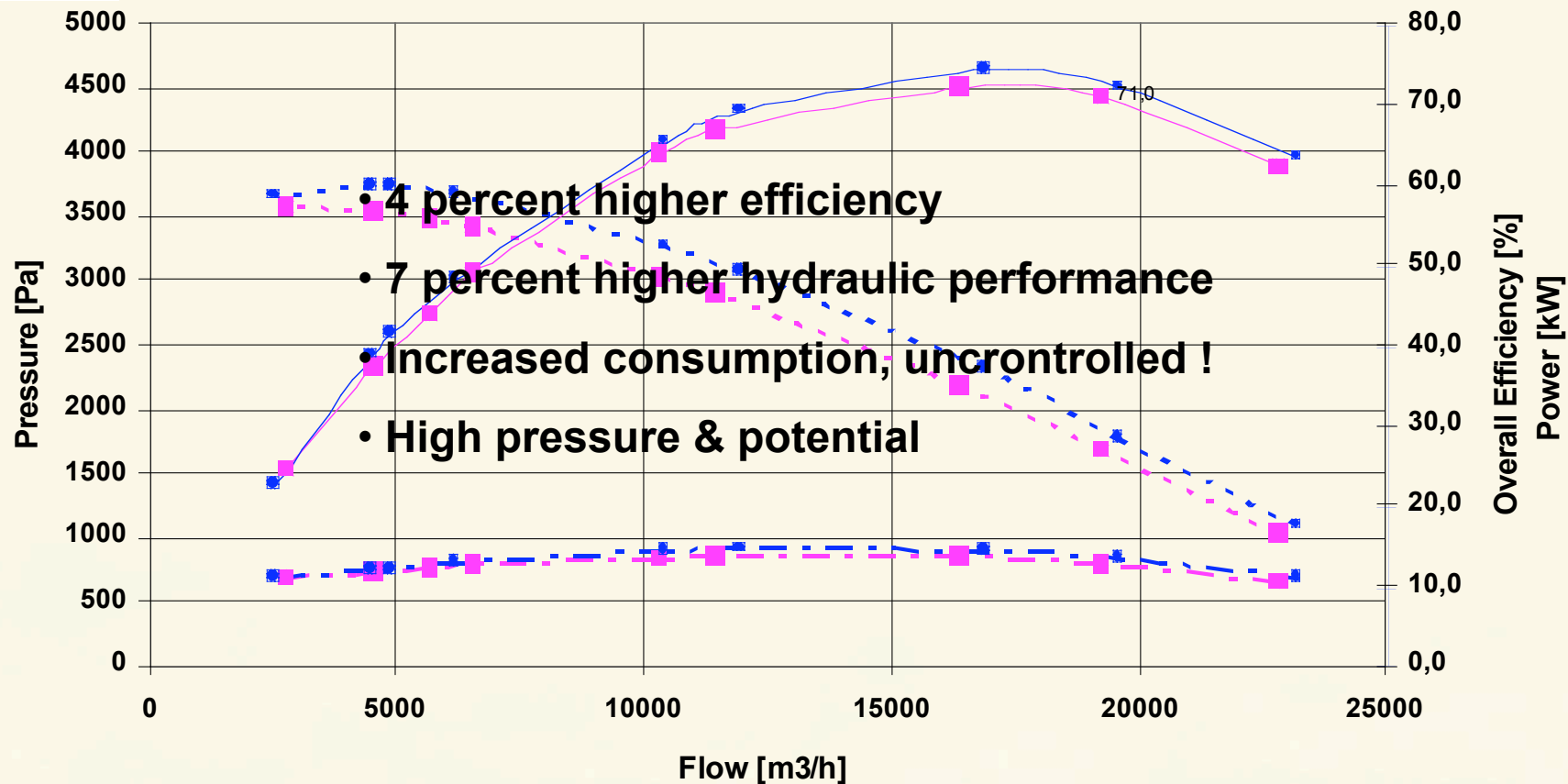
- Assumed start potential – radial, high-pressure fans / larger hydraulic losses due to friction in the ventilator housing
- Several types of use with a lot of potential during lifetime!
- A lot of additional potential by focusing on the need of air in general
- The price of technology better match energy-consumption for each ventilator
- One example measured already:





ELFORSKFORUM

# Industrial sector



Vi giver dig råd, så du får tid!

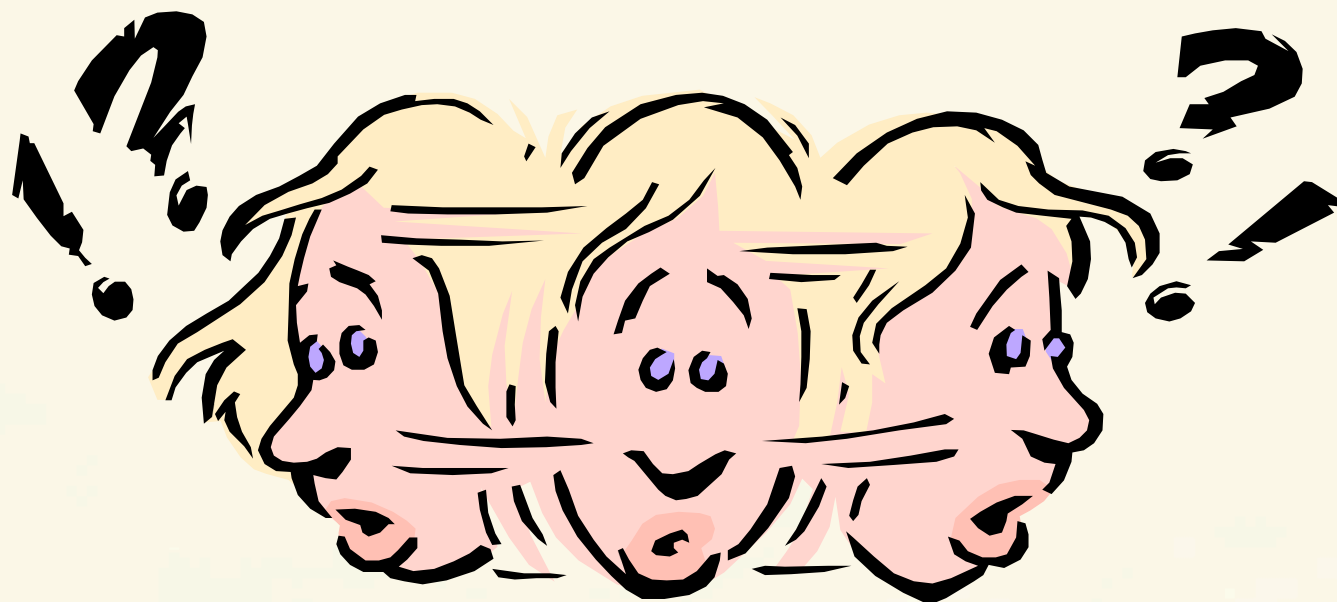
[eg@lokalenergi.dk](mailto:eg@lokalenergi.dk)

## Next Step

- Development in ventilaton for agricultural use – coatings & in general
- New research projects about industrial ventilators
- Dissemination for end-users as energy service.
- Further research regarding coating material according to the application
- Penetration among OEM's



ELFORSKFORUM



TEKNOLOGISK  
INSTITUT



**Lokalenergi**

*Vi giver dig råd, så du får tid!*

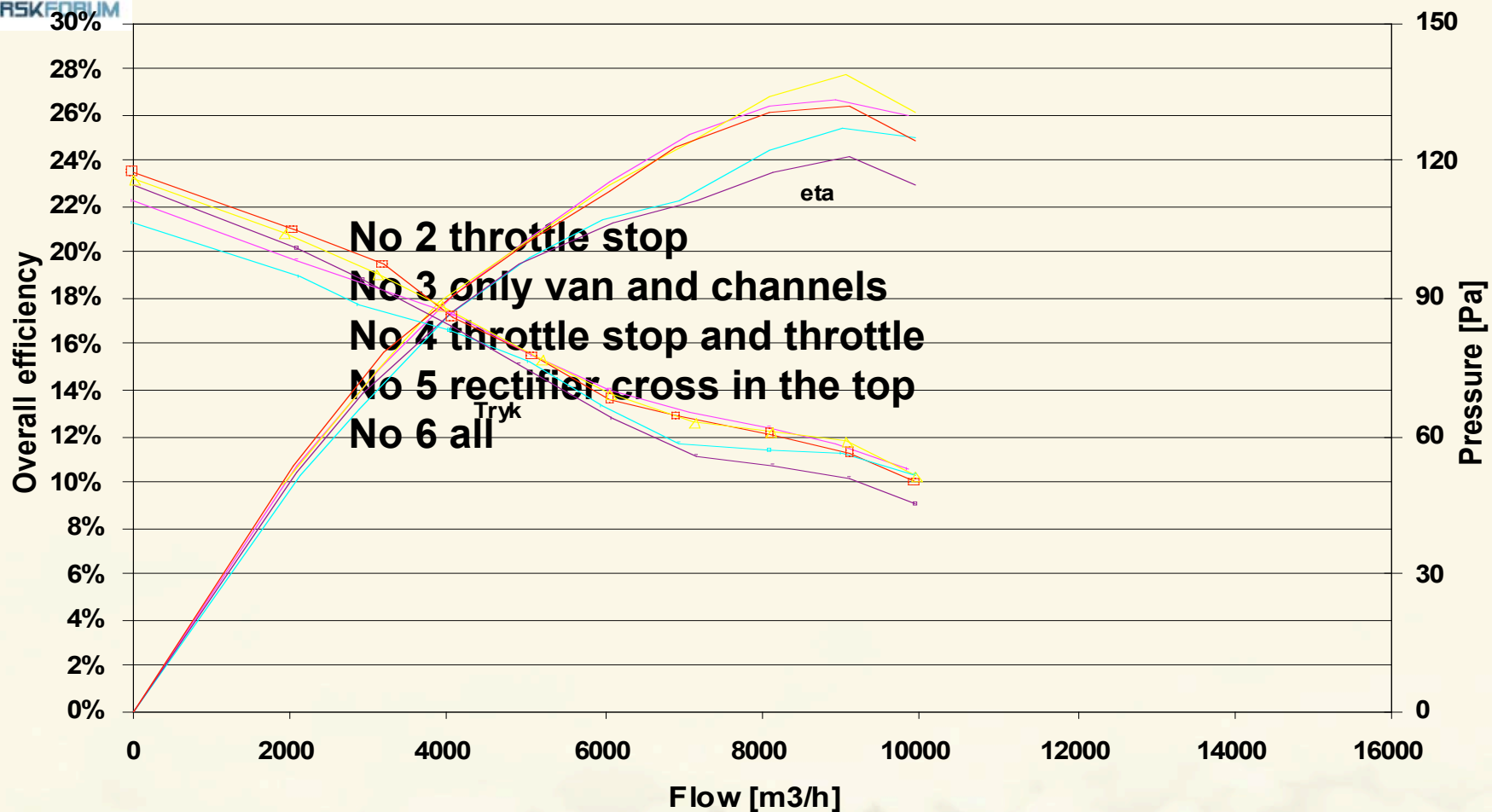
[eg@lokalenergi.dk](mailto:eg@lokalenergi.dk)





ELFORSKFORUM

# Maintenance in general – is important !



eta måling 3	eta måling 4	eta måling 5	eta måling 6
eta måling 2	pressure måling 2	pressure måling 3	pressure måling 4
pressure måling 5	pressure måling 6		

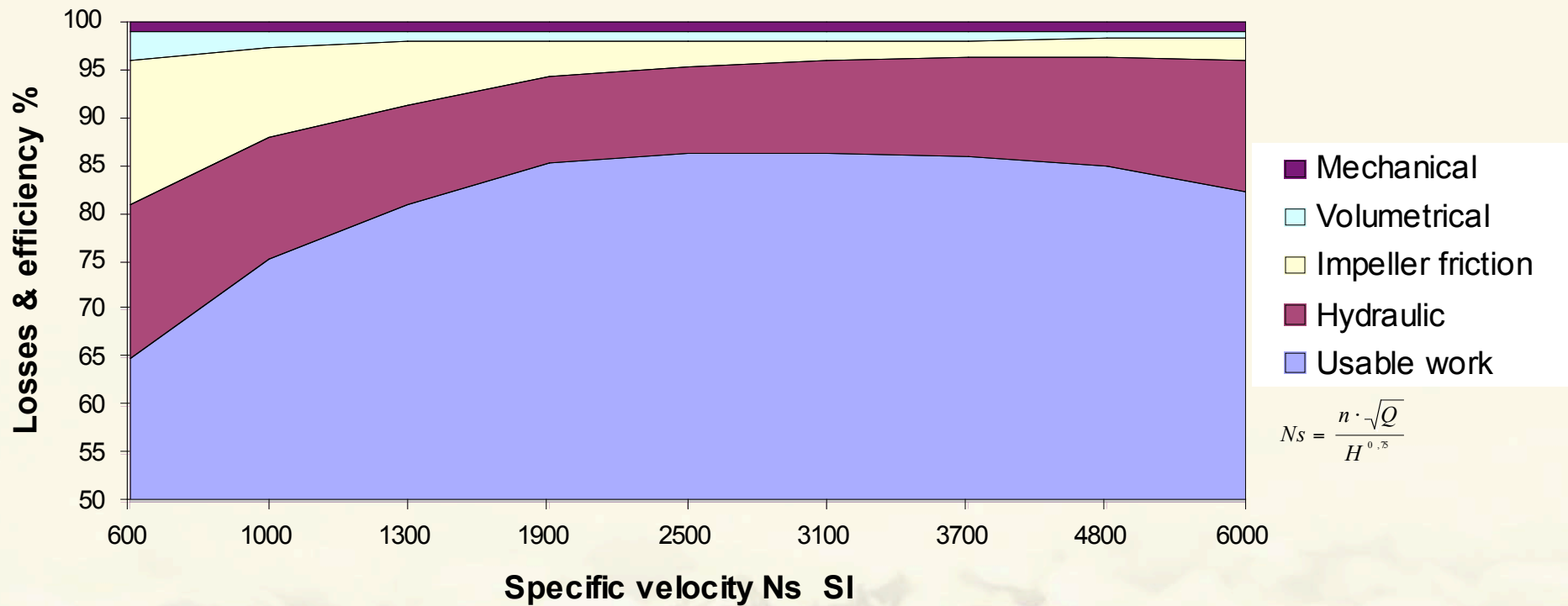


Vi giver dig råd, så du får tid!

[eg@lokalenergi.dk](mailto:eg@lokalenergi.dk)

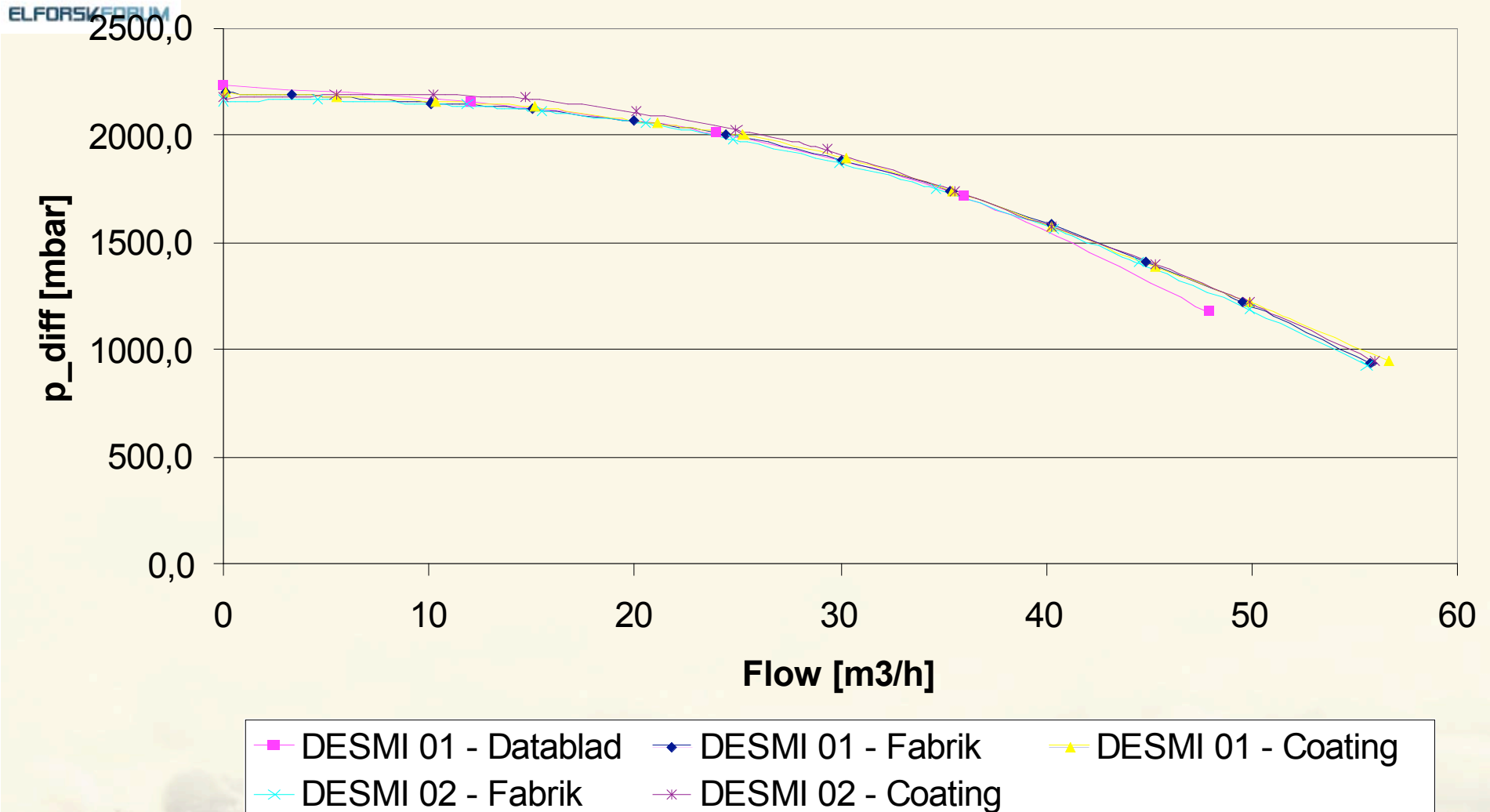
# How and why !

## Energy use in centrifugal pumps





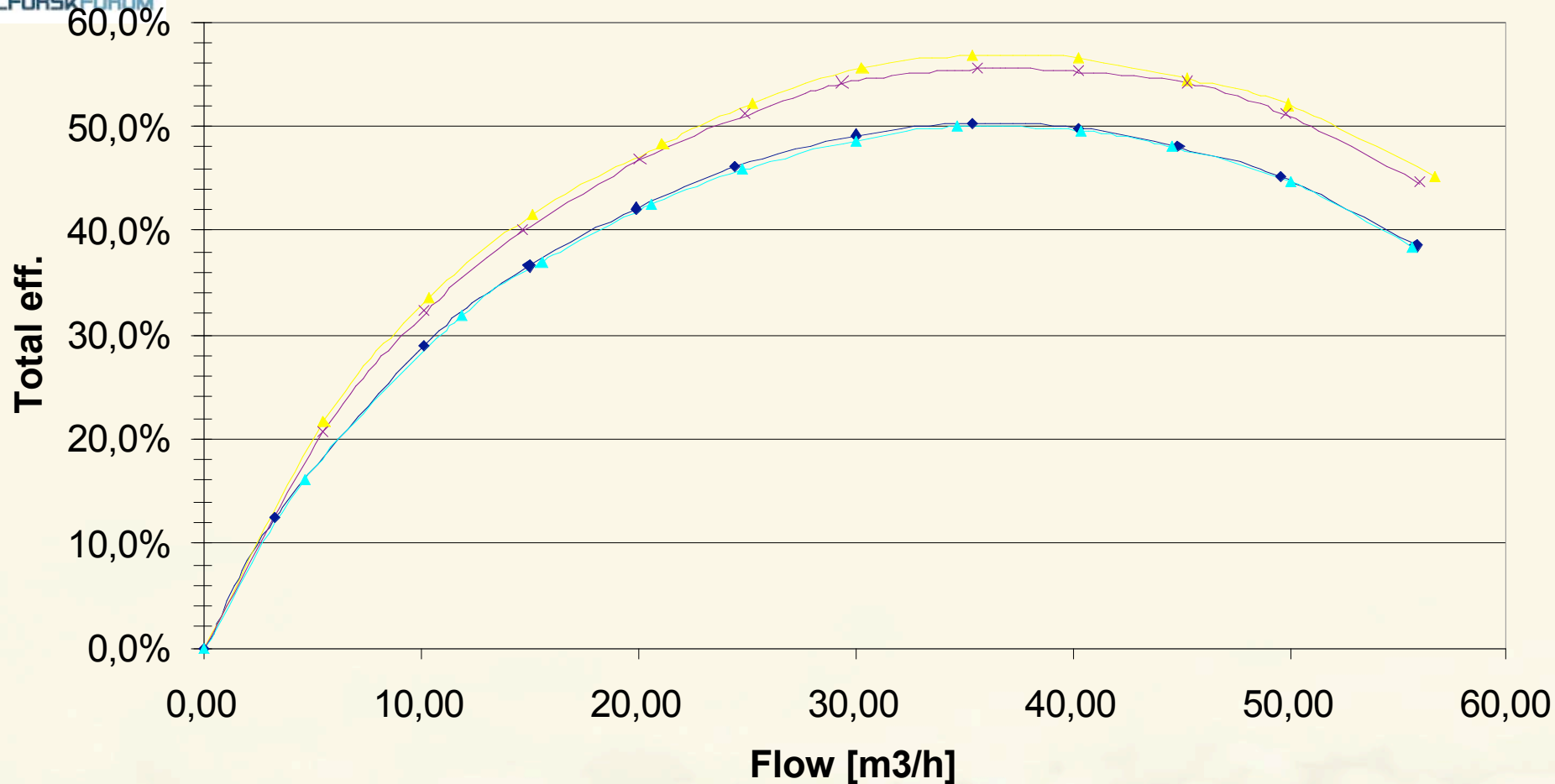
# Performance, new pump – 2,2 kW





ELFORSKFORUM

# Efficiency, new pump – 2,2 kW



◆ DESMI 01 - Fabrik    ▲ DESMI 01 - Coating    ▲ DESMI 02 - Fabrik    ✕ DESMI 02 - Coating



Vi giver dig råd, så du får tid!

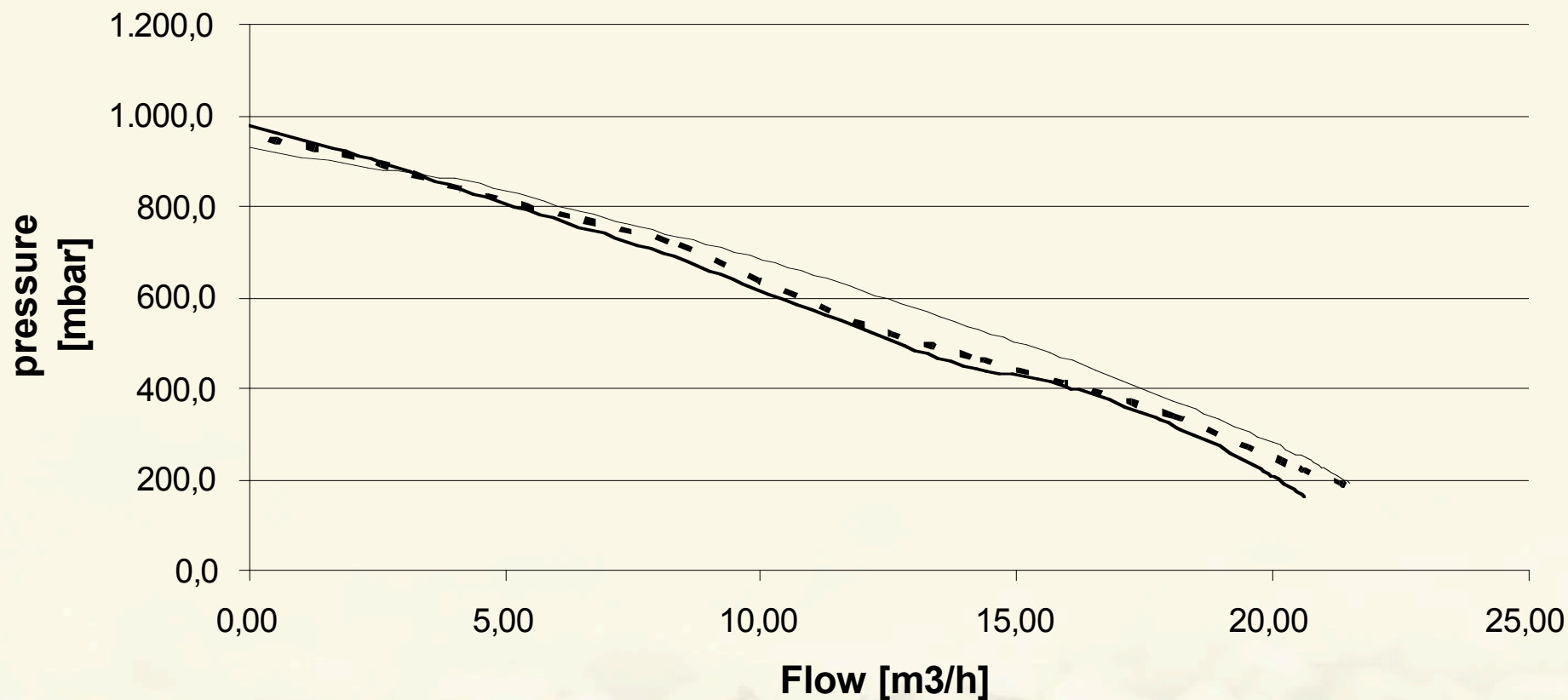
[eg@lokalenergi.dk](mailto:eg@lokalenergi.dk)



ELFORSKFORUM

# Performance, small pump – 0,2 kW

Performance 3000 rev./min



— New pump - - Coat impeller — Total coat

 **TEKNOLOGISK  
INSTITUT**

 **Lokalenergi**

*Vi giver dig råd, så du får tid!*

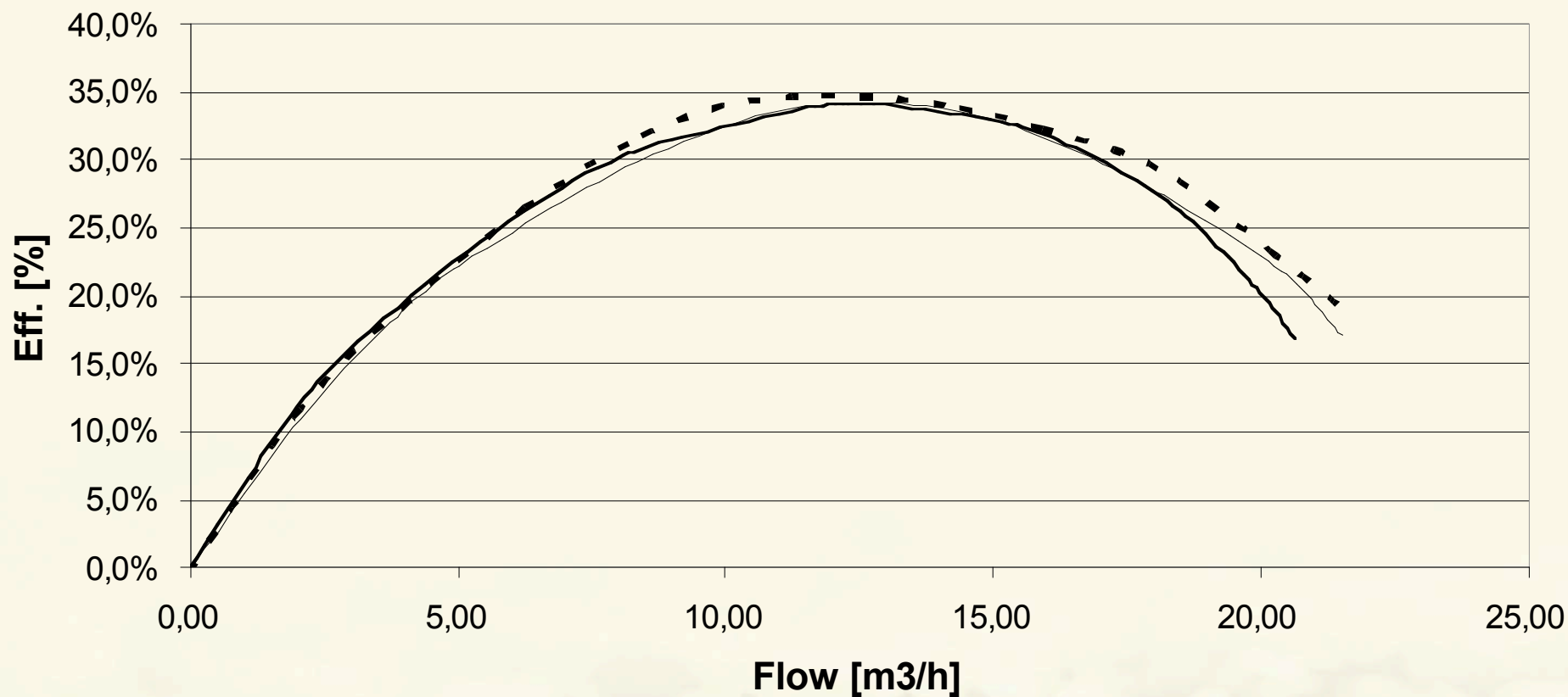
[eg@lokalenergi.dk](mailto:eg@lokalenergi.dk)



ELFORSKFORUM

# Efficiency, small pump – 0,2 kW

## Overall efficiency



— New pump - - Coat impeller — Total coat



Vi giver dig råd, så du får tid!

[eg@lokalenergi.dk](mailto:eg@lokalenergi.dk)