



EXPERTISE IN INDUSTRIAL POWER ELECTRONICS

## Lappeenranta University of Technology **ELECTRICAL ENGINEERING**



Focus on Industrial Electronics Systems

6 professors

90 staff members

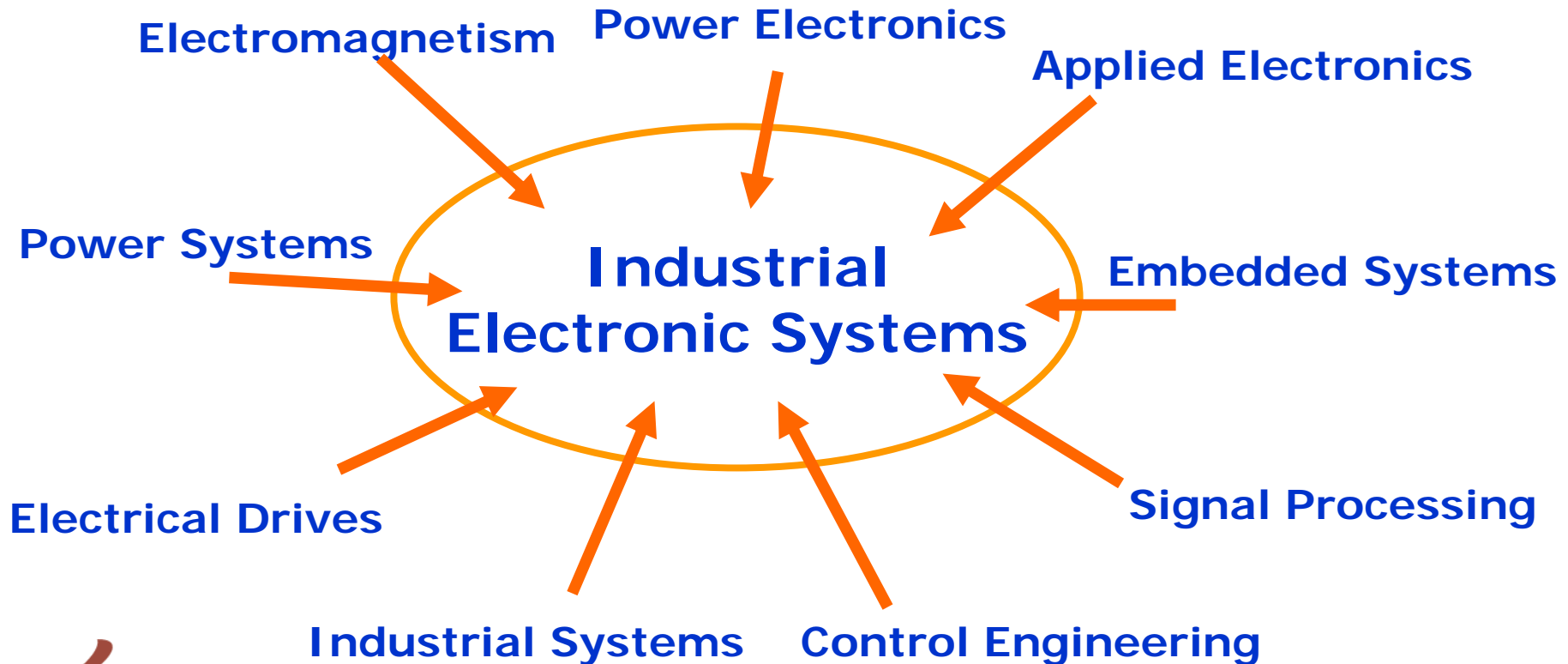
5 D.Sc. dissertations annually



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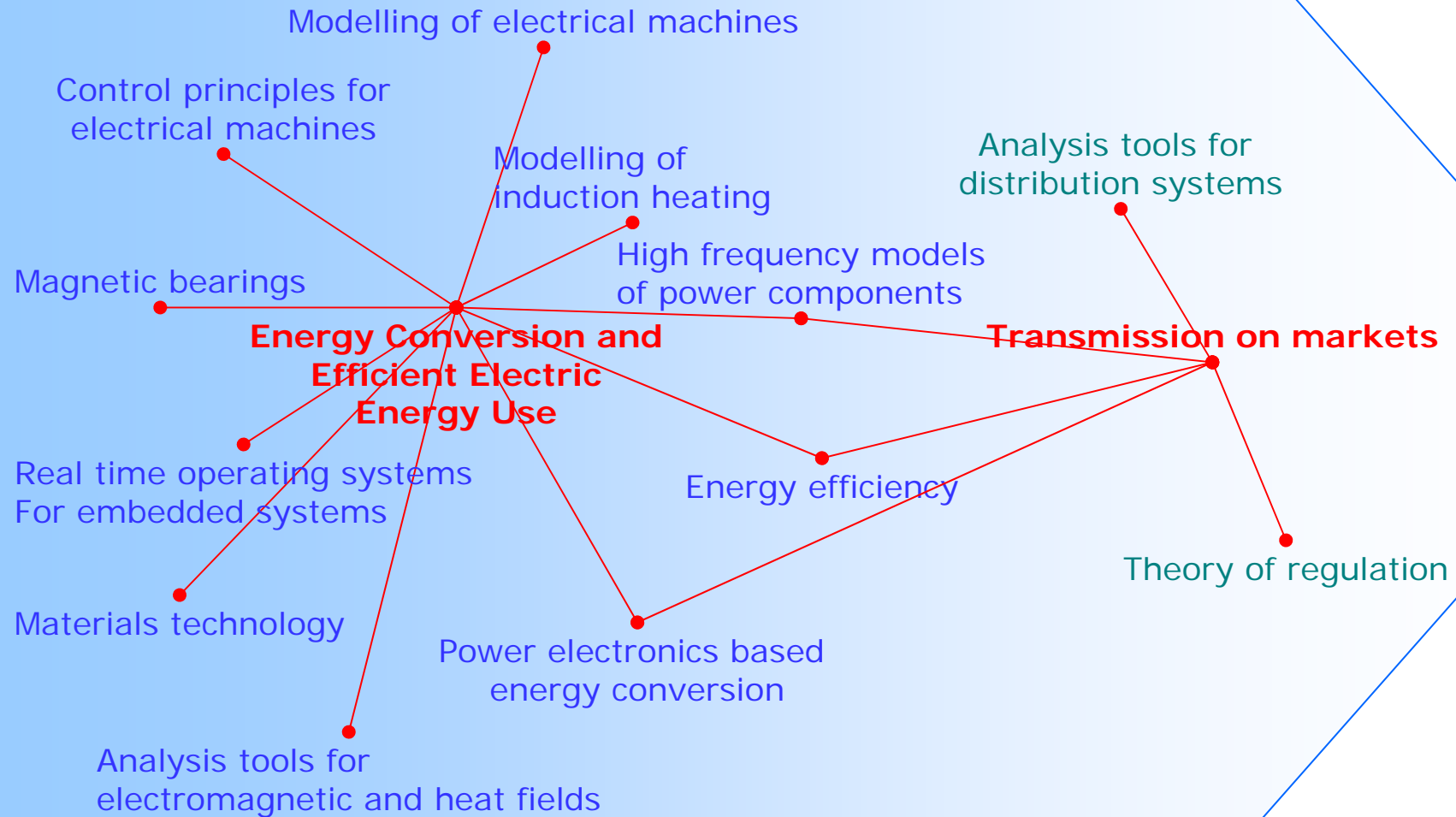
[www.lut.fi/energy/ee](http://www.lut.fi/energy/ee)

# Core Expertise

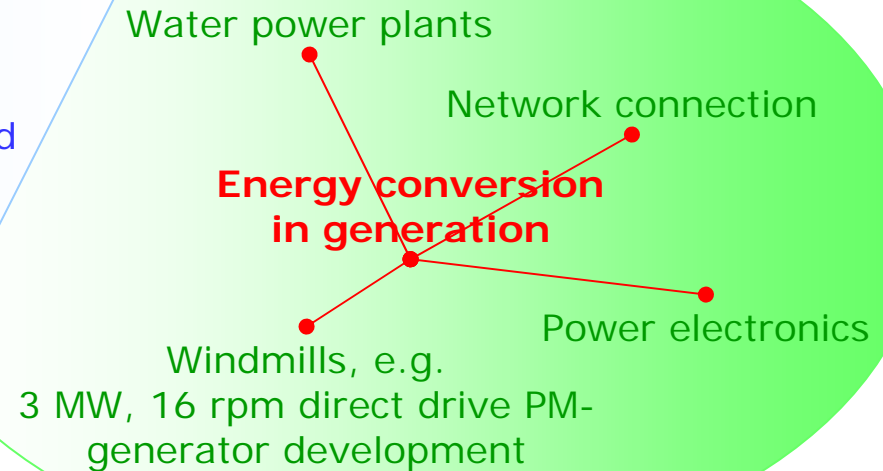
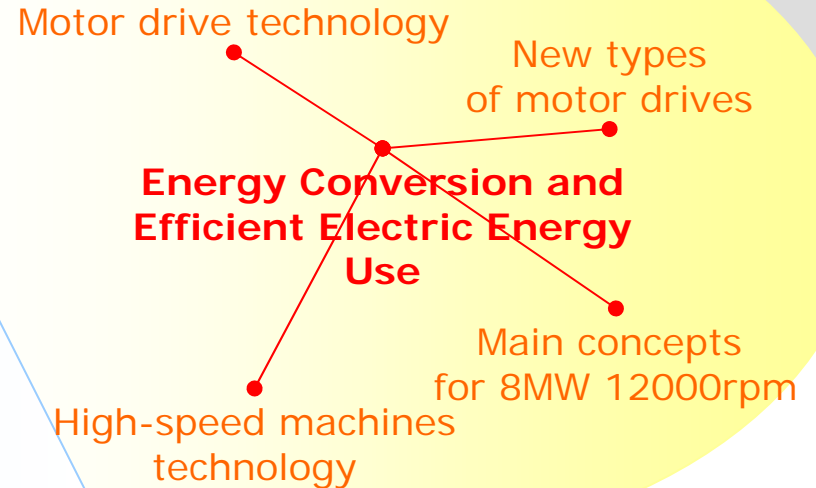
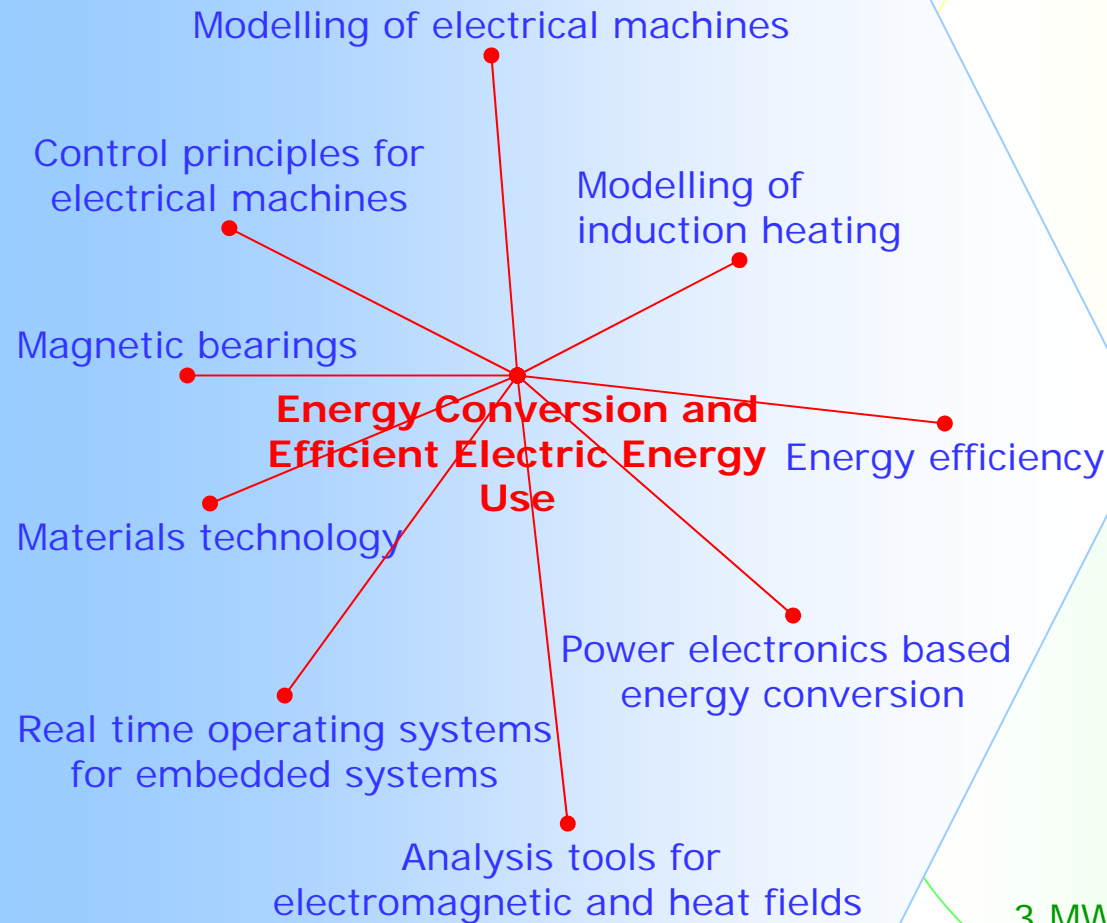


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# Expertise in basic research - What we have done -



# Expertise in applied research - What we have done -



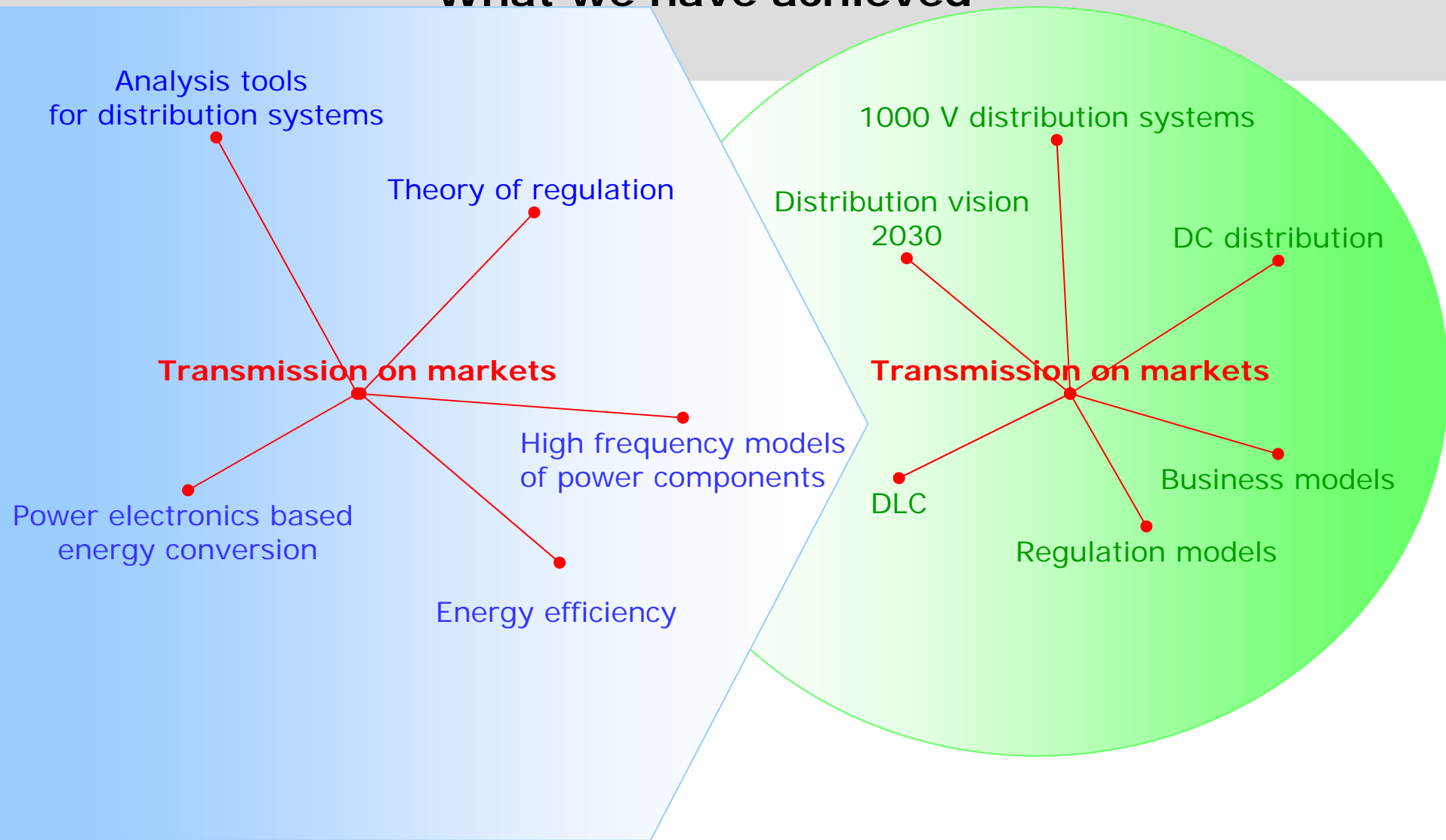
Expertise in areas of  
application  
- What we have achieved -

windmill generators 3.8 MW 16 rpm



# Expertise in areas of application

## - What we have achieved -



# Expertise in areas of application

- What we have achieved - 1000 V distribution -



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## Example of 1000 V distribution

36 customers

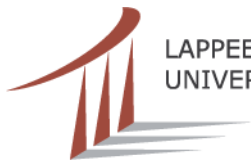
Total power: 180 kW

Costs [k€]	20 kV lines	0.4 kV lines	Transformers	Total
Investments	110.5	81.0	30.4	221.8
Losses	0.14	9.0	6.1	15.2
Outages	110.3	0.02		110.3
Fault repair	8.4	3.6		12.0
Maintenance	9.9	5.3		15.2
<b>Total</b>	<b>239.2</b>	<b>98.9</b>	<b>36.4</b>	<b>374.6</b>

Costs [k€]	20 kV lines	1 kV lines	0.4 kV lines	Transformers	Total
Investments	56.4	59.0	58.1	29.7	203.3
Losses	0.12	3.7	6.0	9.7	19.6
Outages	56.4	0.04	0.01		56.4
Fault repair	4.3	2.4	2.6		9.3
Maintenance	5.1	3.6	3.9		12.6
<b>Total</b>	<b>122.3</b>	<b>68.8</b>	<b>70.7</b>	<b>39.4</b>	<b>301.1</b>

Compared to 20/0.4 kV system:

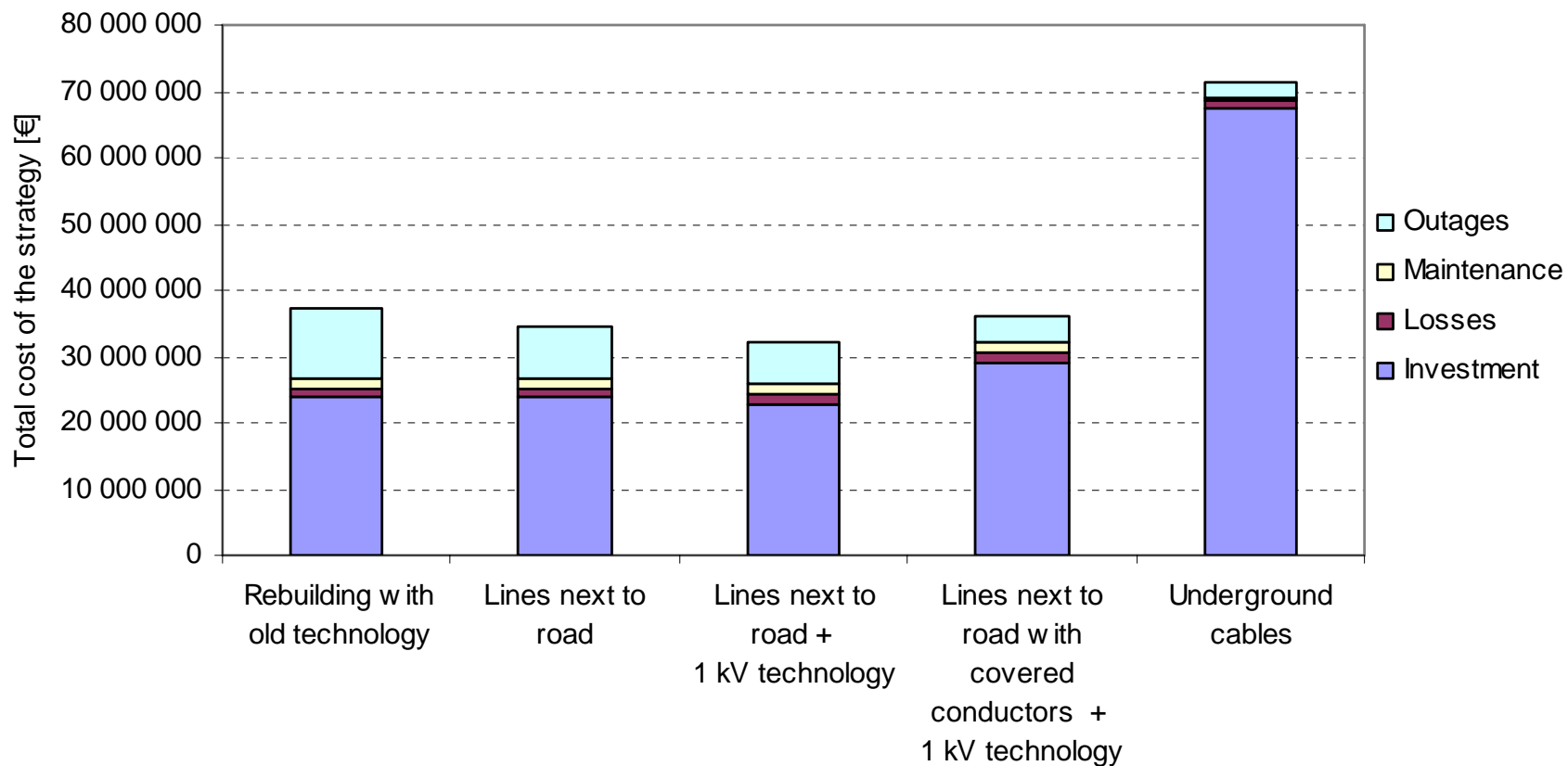
- 8 % lower investment costs
- 20 % lower total costs



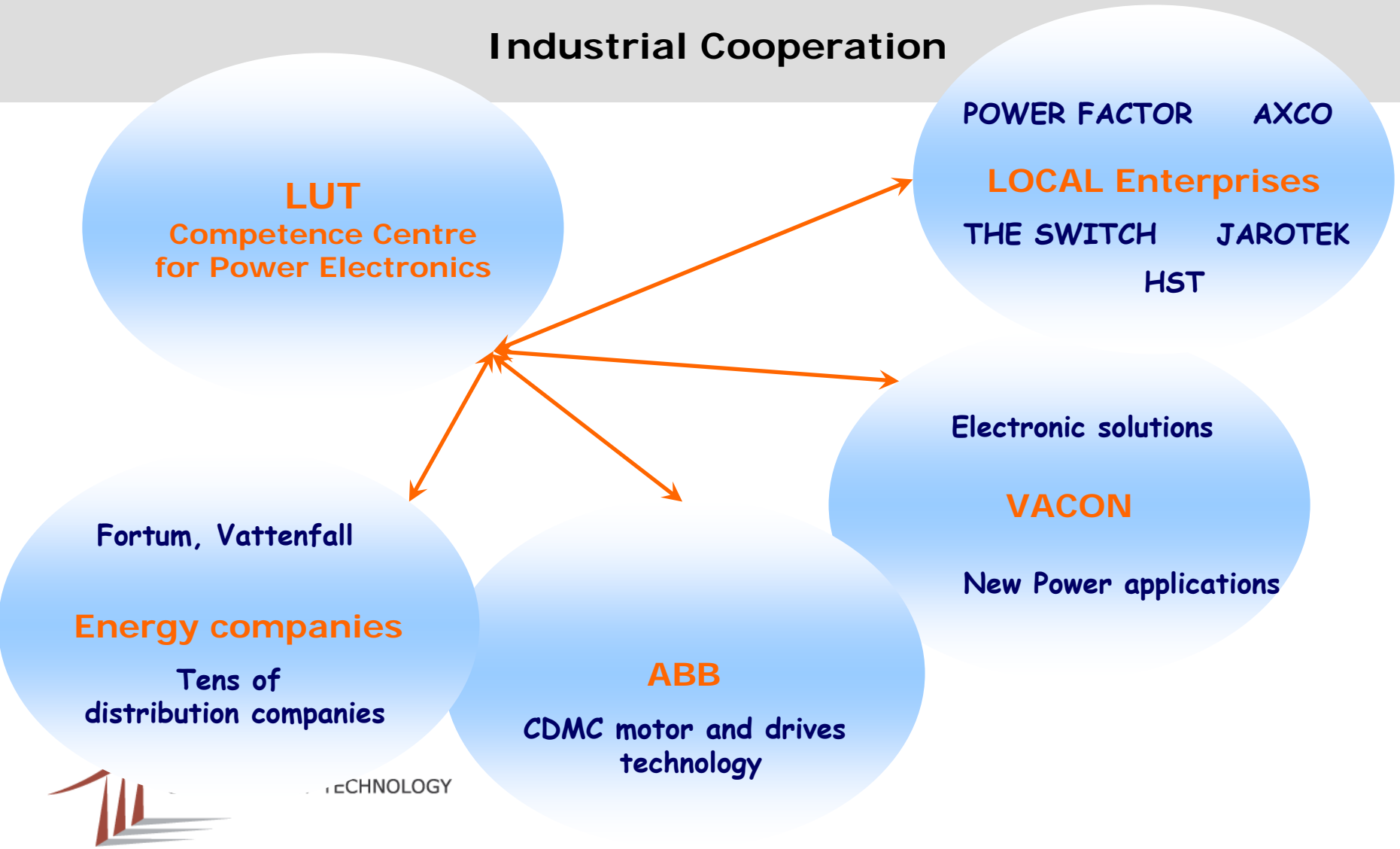
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## New technologies - Cost of different investment strategies -



## Industrial Cooperation



## Industrial Application Results

**ABB:** PMSM-series and ACS 600/800 PMSMDTC

ACS 600/800 active network bridge

ACS 6000 synchronous machine drives

Motion control research, ACS M1

**VACON:** New frequency converter technology

**Heatmasters:** induction heating

**The Switch:** large windmill generators 3.8 MW, 16 rpm, High-speed technology  
8 MW, 12000 rpm, BioCHP 1000 kW, 14000 rpm

**AXCO-Motors:** Special electric machines machines e.g. for small windmills and hydro power

**Robert Bosch:** SR-drive for automotive use

**Metso:** paper drying system, condition monitoring systems

**Waterpumps:** automation and new small water power generators

**KONE:** lift motor development work

**1000 V electricity delivery system**

**Wärtsilä:** New Genset technology



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