

Energy efficiency in business and farming

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Agenda



University of Stuttgart
Institute for Energy Efficiency
in Production EEP

- 1 Energy Efficiency: Why is it important?**
- 2 Energy Efficiency in practice: Barriers and enablers**
- 3 Digital transformation and energy efficiency**

Energy Efficiency: Definition



Definition of energy efficiency and and energy savings¹:

“Energy efficiency is measured as the amount of energy output for a given energy input (...), energy efficiency means the ratio of output of performance, service, goods or energy, to input of energy.”

„Energy savings are the reduction of energy use, without reference to output produced.“



-Energy efficiency is about using energy efficiently not about producing less
-Energy efficiency raises productivity²

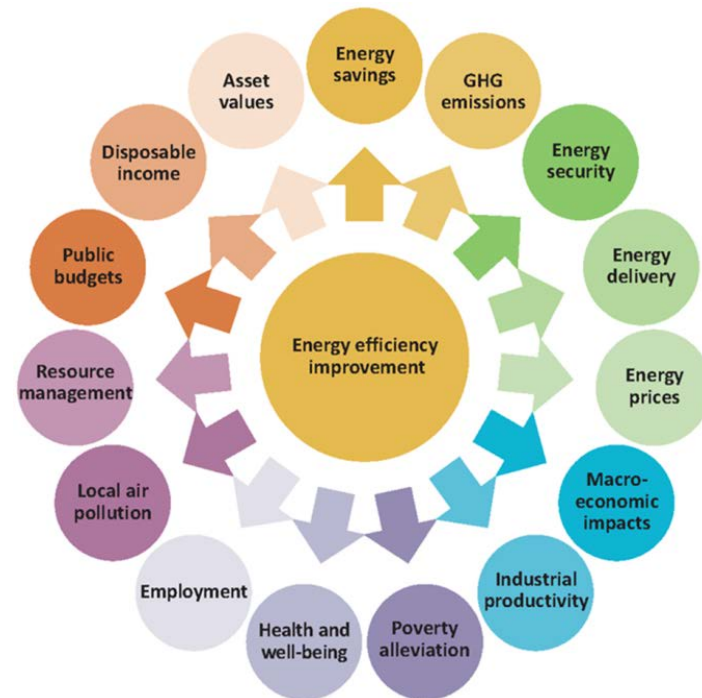
Why companies should care about energy efficiency: Self-interest



- **Decrease** your energy **costs**
- **Increase** your **independence** from increasing energy prices
- Increase your **competitiveness**
- And much more:



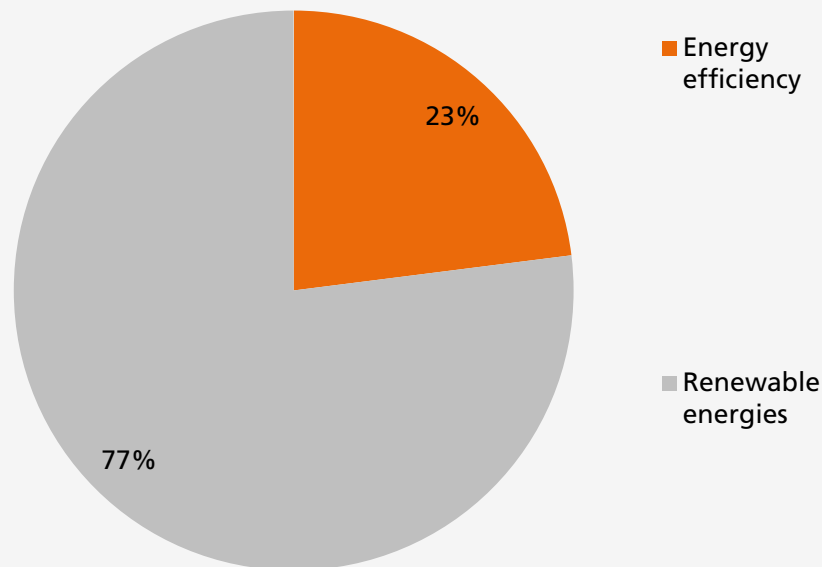
- **Self-interest meets public spirit**
- **Energy efficiency as a company virtue**



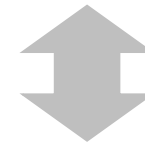
OECD/IEA (2014): Capturing the Multiple Benefits of Energy Efficiency, S. 28, 134-135

Energy efficiency in the public eye: The „ugly duckling“

Public reporting on energy
efficiency and renewables



Renewables



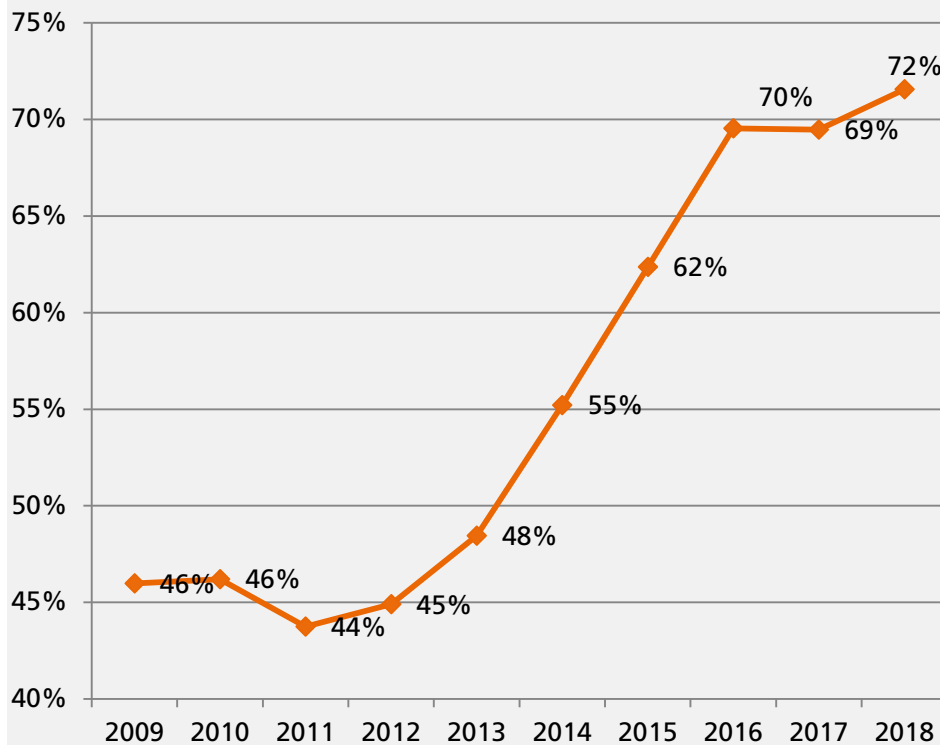
Energy Efficiency

Source: EEP

Energy efficiency in the public eye: The „ugly duckling“

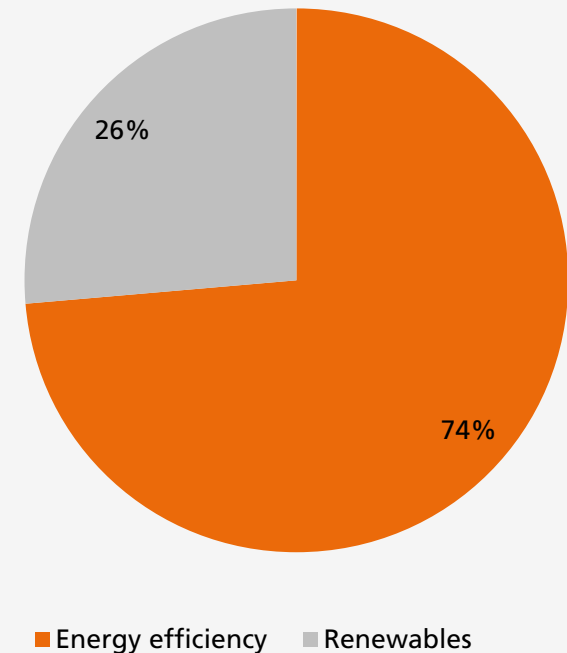


Share of patents regarding energy efficiency compared to renewables



Source: EEP

Share of scientific paper regarding energy efficiency compared to renewables



Source: EEP



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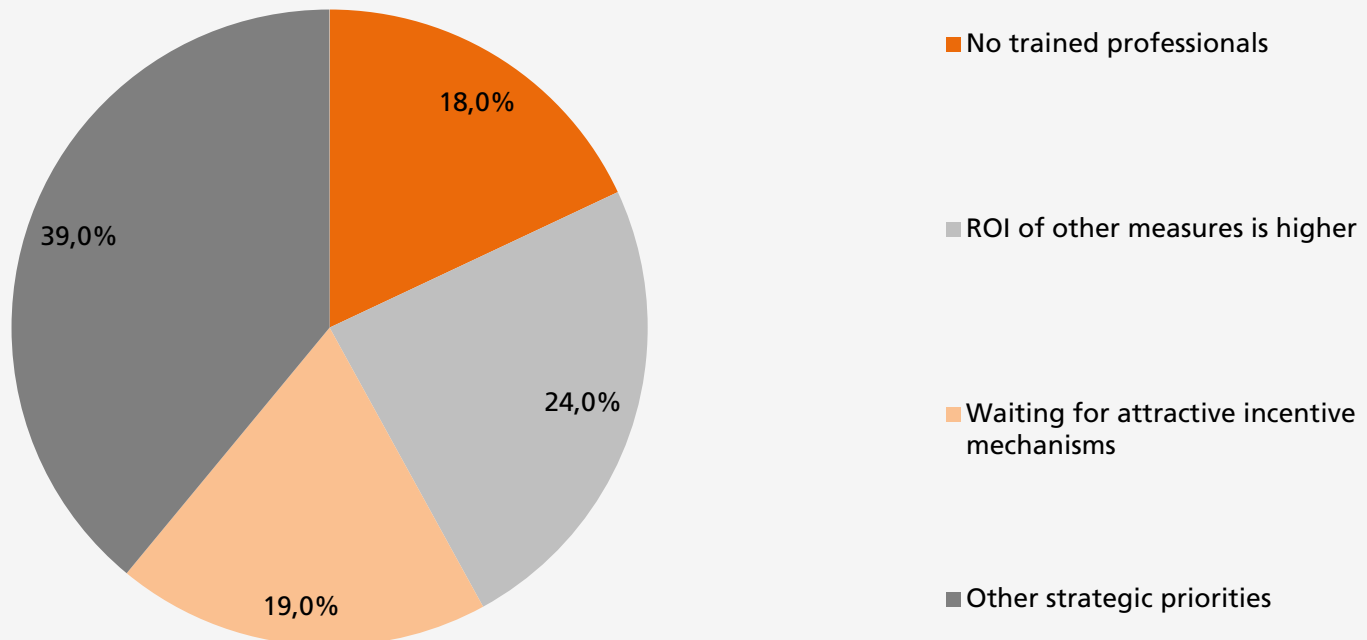
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Barriers for energy efficiency



For what reasons does your company not realize energy efficiency potentials? (n=580)



Enablers for energy efficiency: Management strategies & employees



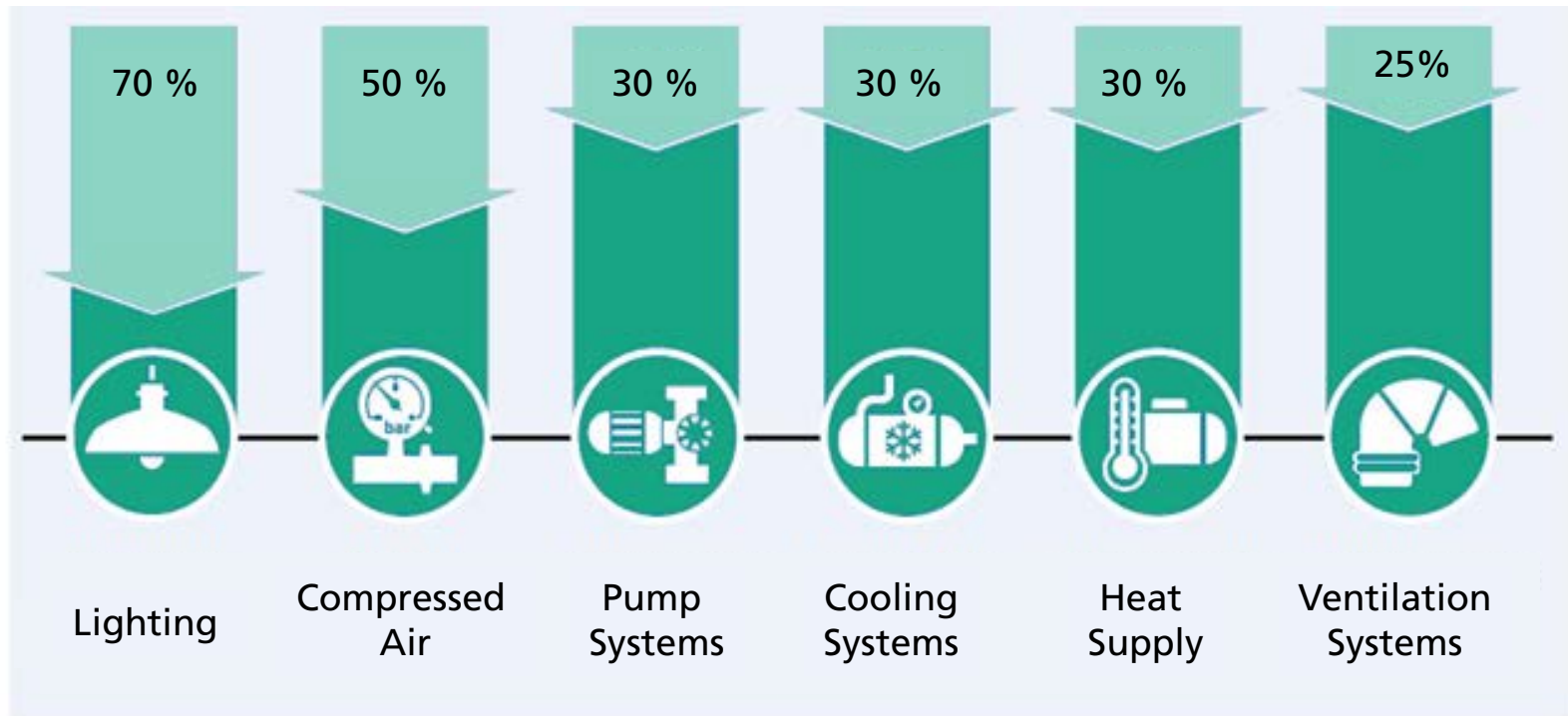
Strategy	Example	Goal & Logic
Sensitization	Information and education	Awareness, interest
Motivation	Incentives, Roles and responsibility	Increase self-interest
Rules	Rules of conduct, from vague to explicit	conformity
Automization	Technical equipment	Avoidance of human errors

Source: EEP & HS Reutlingen




- Energy efficiency is not just a technical problem
- Educate and utilize employees as energy efficiency experts

How to increase energy efficiency?



Source: German Energy Agency / dena 2013

 **Take home message:** Address cross sectional potentials for energy and cost savings

Practical example: Optimization of the compressed air system



Optimization measures

- Merging two compressed air networks to a network
- Lowering the pressure level and pressure tolerances
- Elimination of idle share
- Use of an efficient screw compressor

Annual savings and reductions

- Absolute energy: 775.000 kWh
- Percent energy: 59 %
- Cost: 55.000 €
- CO₂: 300 t

Investments: 62.500 €

Amortisation time: 1,1 a

Source: dena (Projekt: Steigerung der Energieeffizienz durch konsequente Optimierung des Druckluftsystems)

Practical example: Optimization of production processes in the food industry



Optimization measures

- Energetic optimization of cold water supply:
 - Raising the set temperature
 - Integration of external cooling
 - Improvement of the control
- Ventilation system:
 - Airflow control
 - Find and repair compressed air leaks

Annual savings and reductions

- Absolute energy: 1.130.000 kWh
- Percent energy: 11 %
- Cost: 158.000 €
- CO₂: 1.102 t

Investments: 258.000 €

Amortisation time: 1,6 a

Source: dena (Projekt: Optimierung von Produktionsprozessen in der Nahrungsmittelindustrie)

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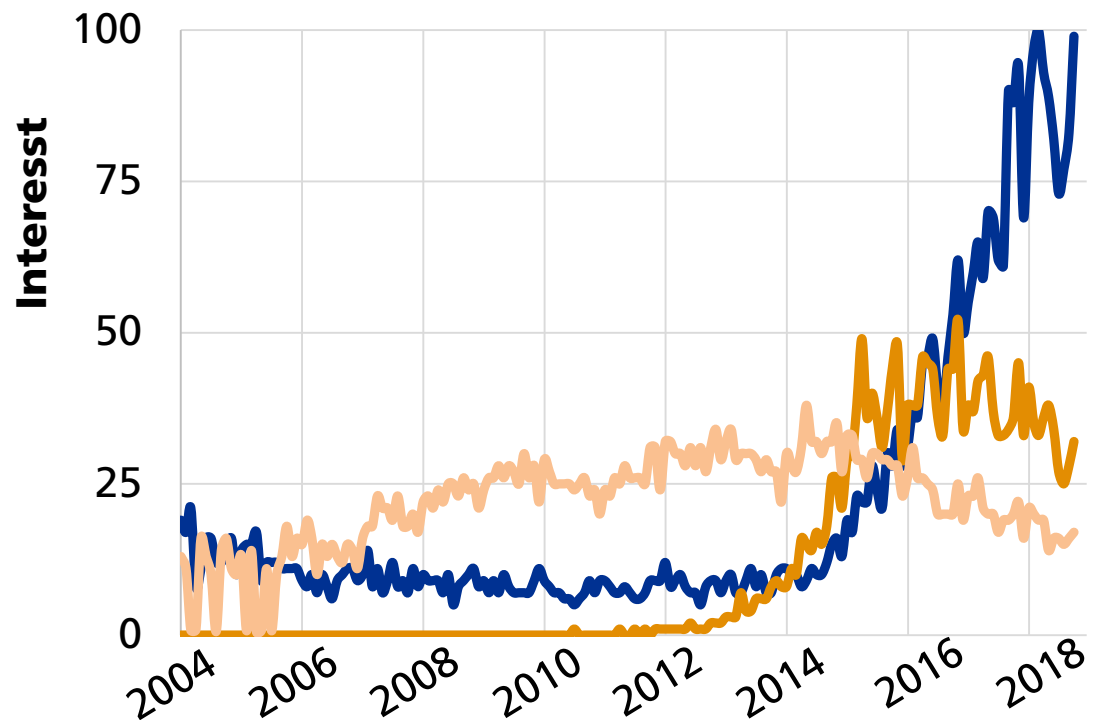


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Digitalization and Energy Efficiency

What's trending?



Source: EEP

■ Digitalization

■ * 1930er

■ Transistors

■ Industry „4.0“

■ * around 2011

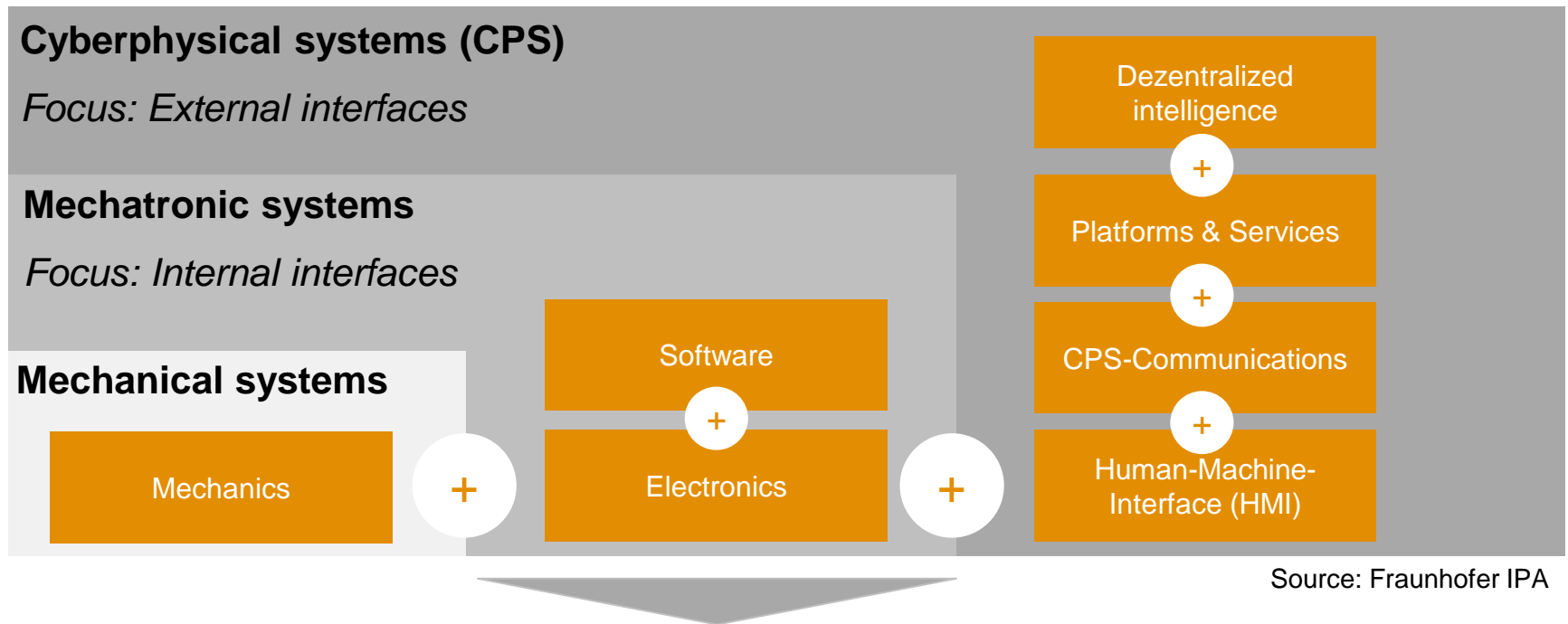
■ German term

■ Cyberphysical systems

■ Energy efficiency

Cyberphysical systems (CPS)

What's that?

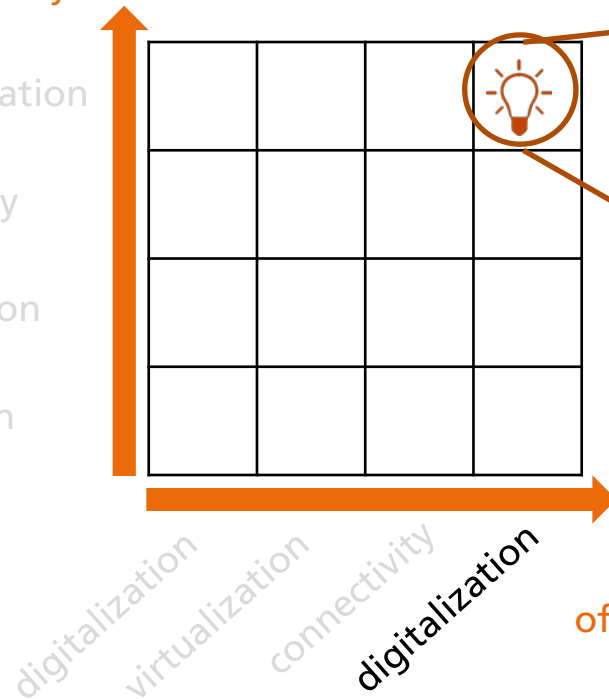


Cyberphysical systems as an enabler for „plug and play efficiency“

Energy efficiency and the digital transformation

Digital Transformation
of management systems

autonomization
connectivity
virtualization
Digitalation



Digital Transformation
of efficiency technologies

Future Vision

Self optimizing systems
that adapt to the local
energy minimum



„Plug’n’play efficiency“

Energy efficiency and the digital transformation – What will it look like

Digital Transformation
of management systems

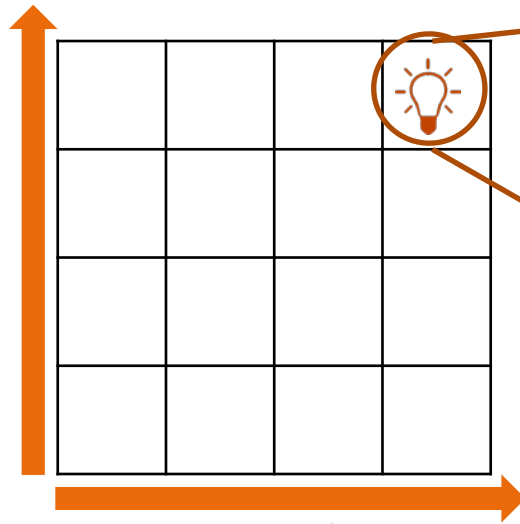
autonomization

connectivity

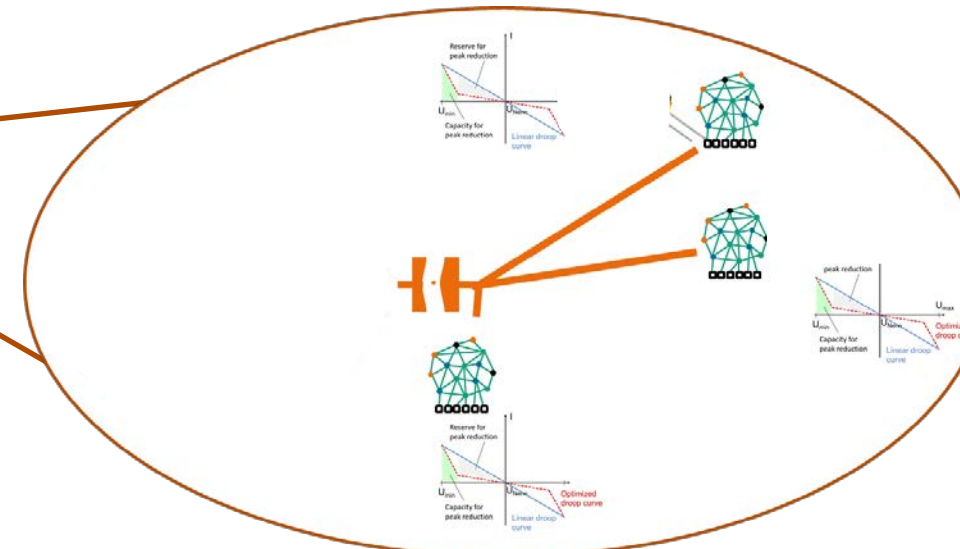
virtualization

Digitalation

digitalization
 virtualization
 connectivity
 digitalization



Digital Transformation
of efficiency technologies



Conclusion



- Energy efficiency is directly related to a company's self-interest
 - Decrease costs
 - Increase independence from increasing energy prices
- Energy efficient companies are more competitive in local and globalized markets
- “Energy efficiency spirit”
 - Educate your workforce as a low-risk/high reward strategy for companies
- Cross sectional technologies should be look into
- The digital transformation gives us new means to increase energy efficiency
- Future developments are characterized by autonomous energy efficiency measures/devices

Thank you for your attention!



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