Federal Ministry
of Education
and Research

Technological Design
and Development

Franz Bonn: *Lustige Botanik und Mineralogie*. 2. Auflage. Braun & Schneider, München [1880], Seite 48. Digitale Volltext-Ausgabe bei Wikisource, URL: https://de.wikisource.org/w/index.php?title=Seite:Lustige_Botanik_und_Mineralogie.djvu/56&oldid=1066053 (Version vom 1.4.2010).

Resilience in the German Energy Transition – Useful for Giving Orientation or As Useless As a Millstone Around the Neck

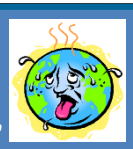
Urte Brand, Arnim von Gleich

1st International Conference on Anticipation

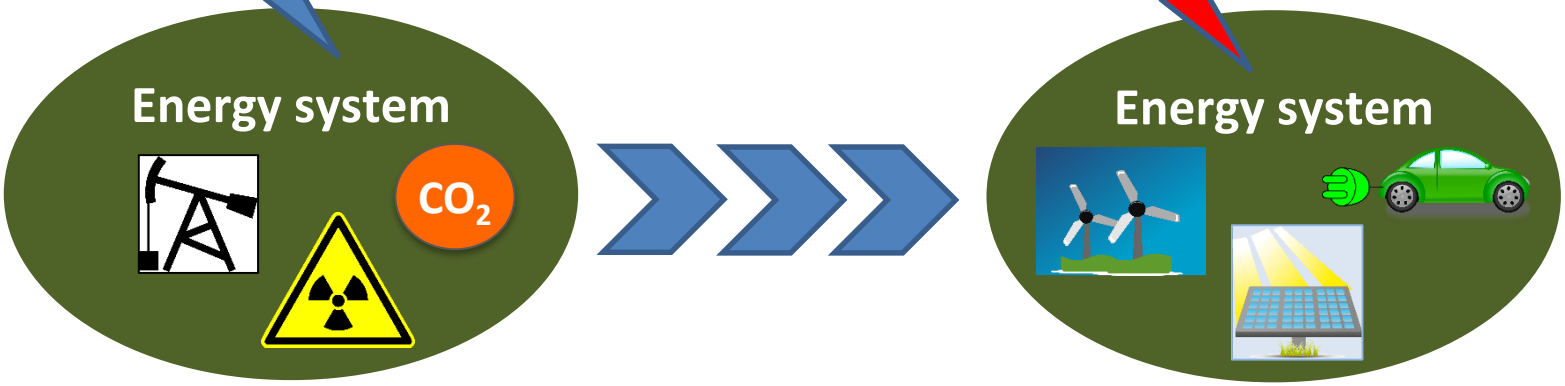
07.11.2015

Background

Problem
Climate change, finite resources, nuclear disasters

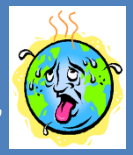


Risks
Increasing renewable energies, unstoppable effects of climate change >>
Supply shortages, electricity grid overloads etc.



Values:
Equity
Stability
Precaution
Security
Power
Profitability
...

Problem
Climate change, finite resources, nuclear disasters



Risks
Increasing renewable energies, unstoppable effects of climate change >>
Supply shortages, electricity grid overloads etc.

Values:
Equity
Stability
Precaution
Security
Power
Profitability

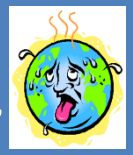
Energy system

CO_2

Energy system

Instability
Uncertainty
…

Problem
Climate change, finite resources, nuclear disasters



Risks
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Supply shortages, electricity grid overloads etc.

Values:
Equity
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Power
Profitability

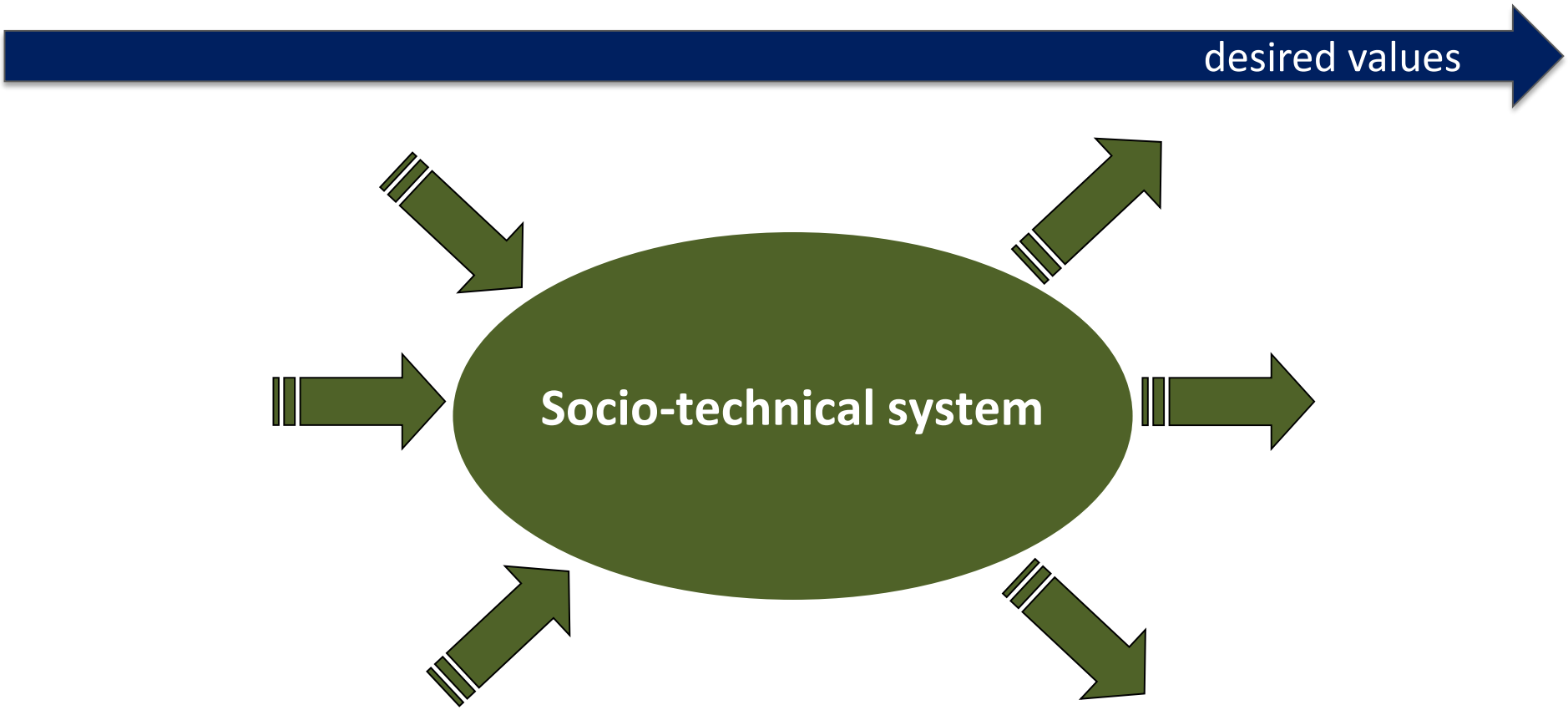
Energy system

CO_2

Energy system

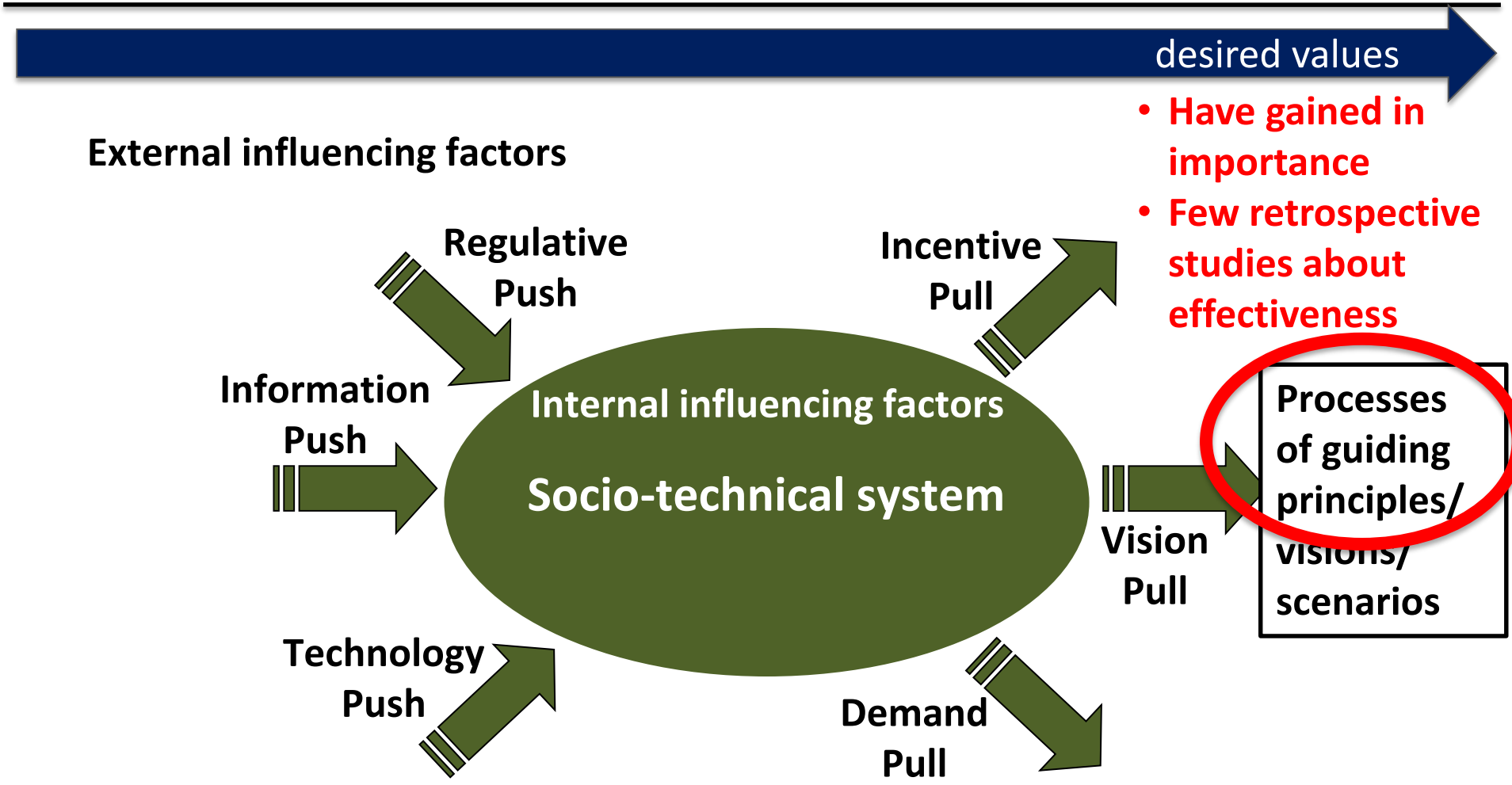
Need to give orientation

Turtles Model



Author's illustration based on Hemmelskamp (1999), Ahrens et al. (2006), Fichter et al. (2007)

Background – Turtles Model

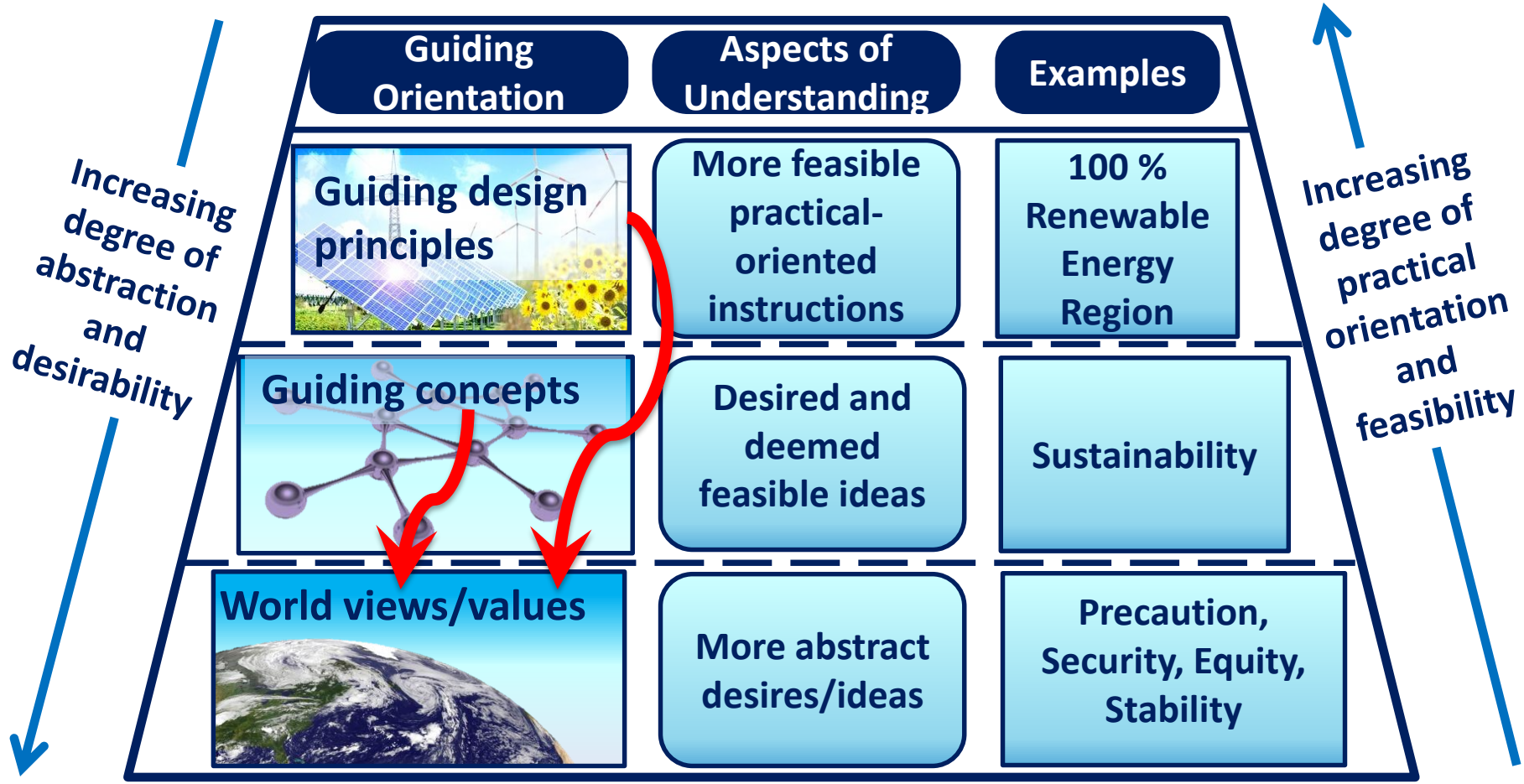


- **Have gained in importance**
- **Few retrospective studies about effectiveness**

Author's illustration based on Hemmelskamp (1999), Ahrens et al. (2006), Fichter et al. (2007)

Background

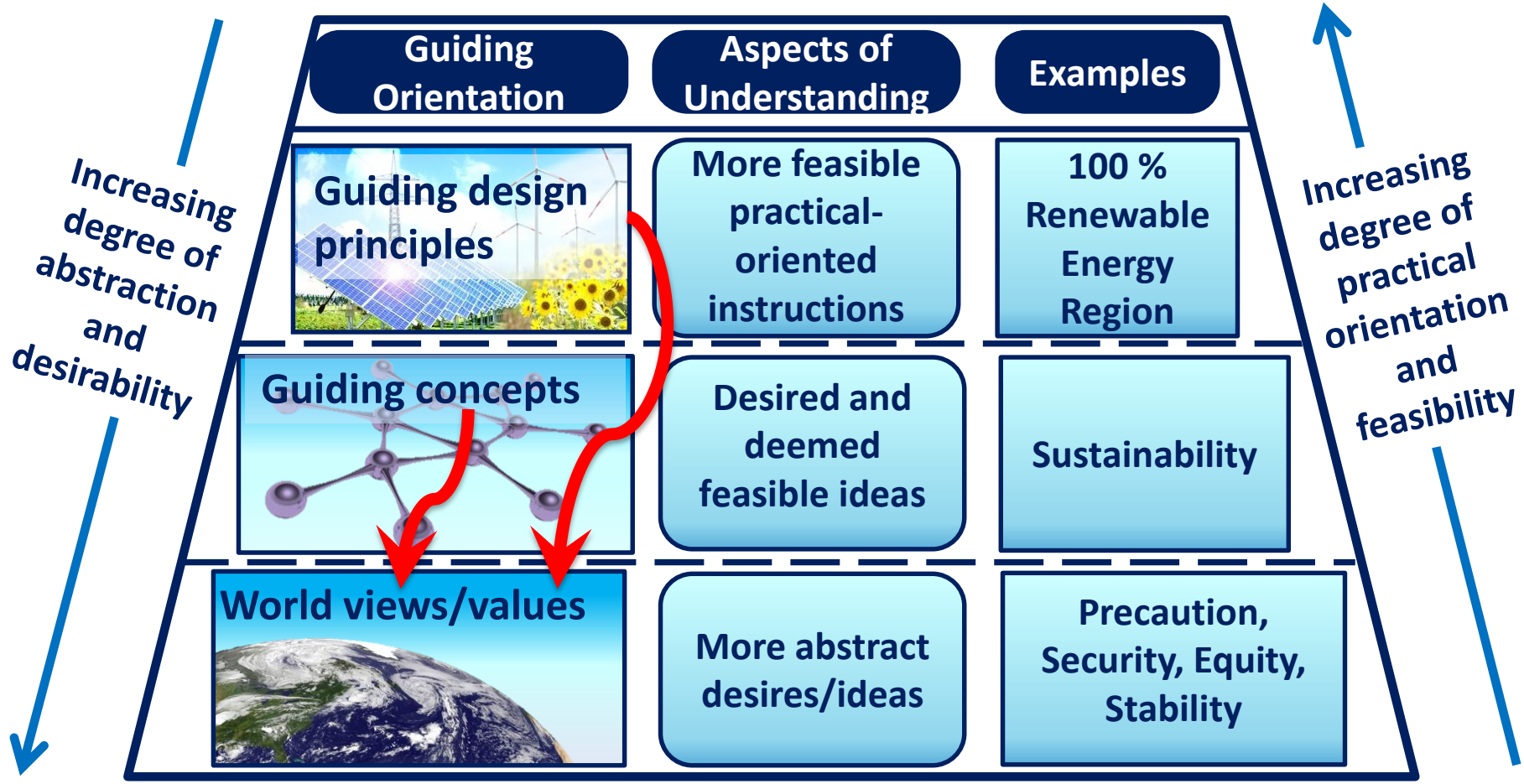
3-Level Model of Guiding Orientations



Author´s illustration based on Stührmann, S.; Brand, B. (2011): Resilient Energy Systems for the Future – The Conceptual Framework of Northwest2050. Poster on conference Resilient Cities 2011.

Background

3-Level Model of Guiding Orientations



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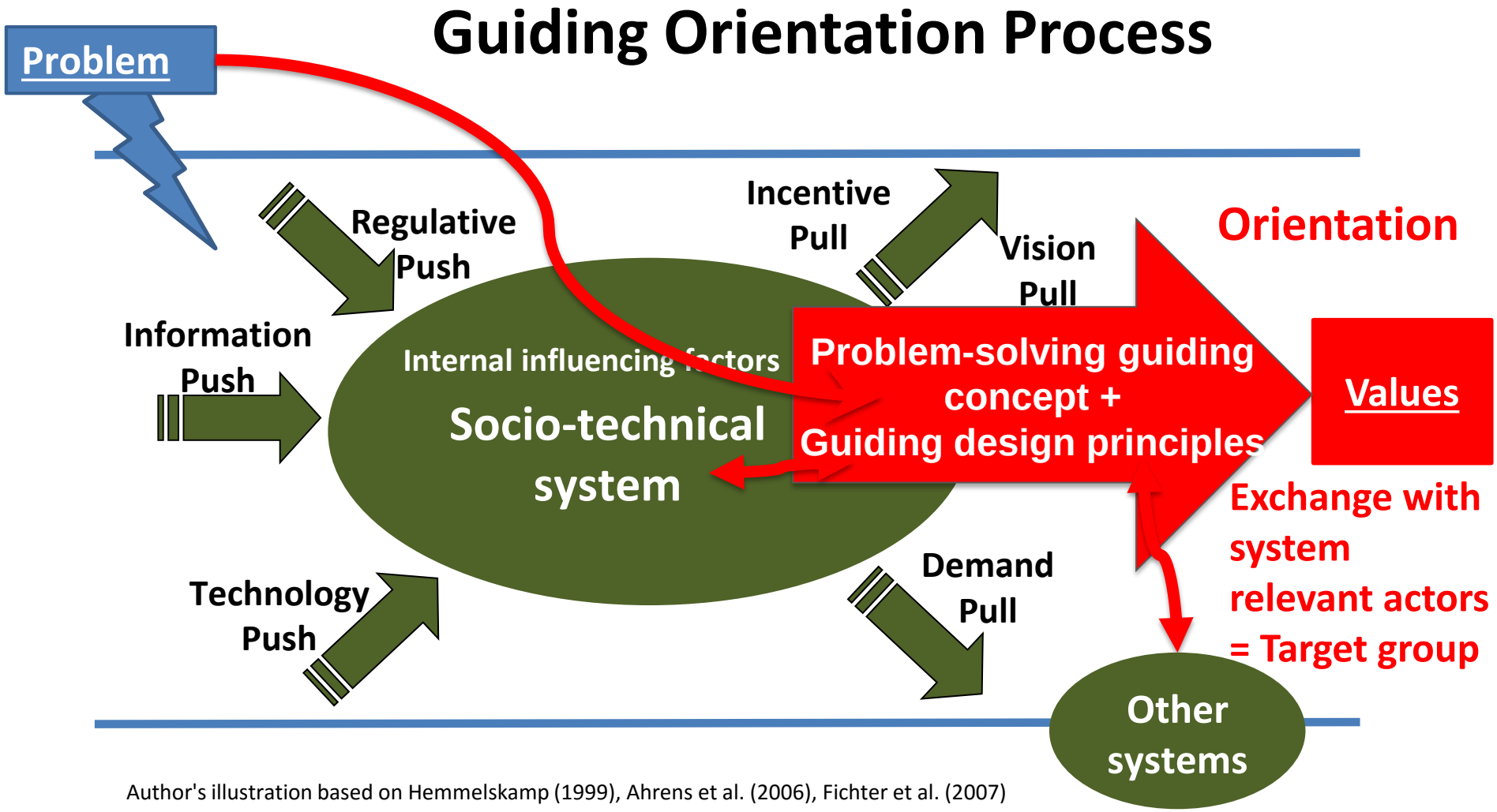

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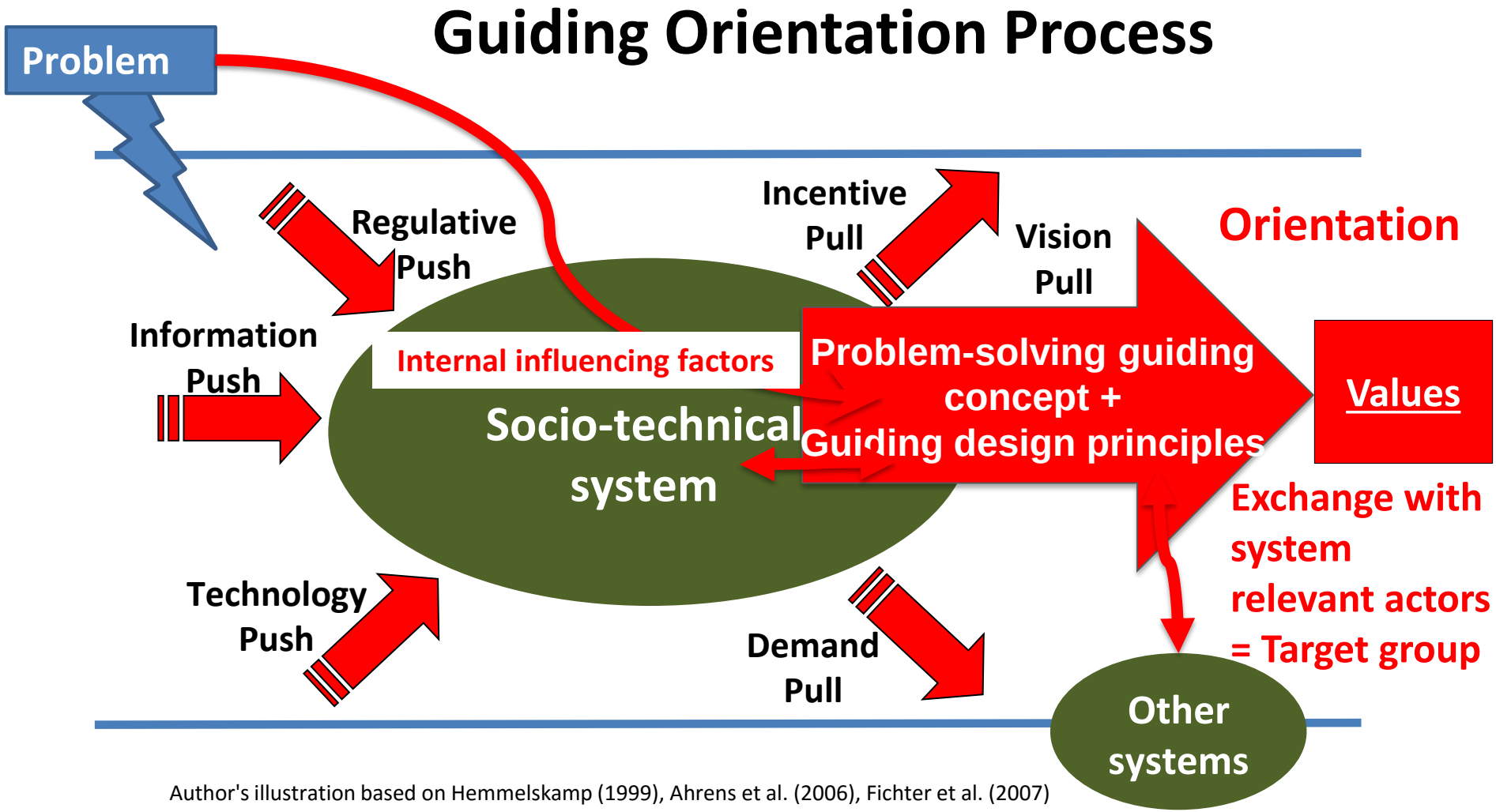


Author's illustration based on Hemmelskamp (1999), Ahrens et al. (2006), Fichter et al. (2007)

Research Questions

- Are guiding orientation processes able to give orientation in transformation processes in the long term?

Research Questions

Effectiveness of guiding orientation processes

if they lead to the **integration** of the guiding concept and/or its guiding design principles with the meaning of

- **Thought-guided**: considering as relevant or necessary in the social exchange
- **Action-guided**: a willingness to transfer (willingness to take action) or an actual implementation (factual action)

Research Questions

- Are guiding orientation processes able to give orientation in transformation processes in the long term?
- Which limitations do guiding orientation processes offer?

Research Questions

- Are guiding orientation processes able to give orientation in transformation processes in the long term?
- Which limitations do guiding orientation processes offer?
- Under what conditions are guiding orientation processes effective?

Case Study

Federal Ministry
of Education
and Research

Project: Nordwest2050

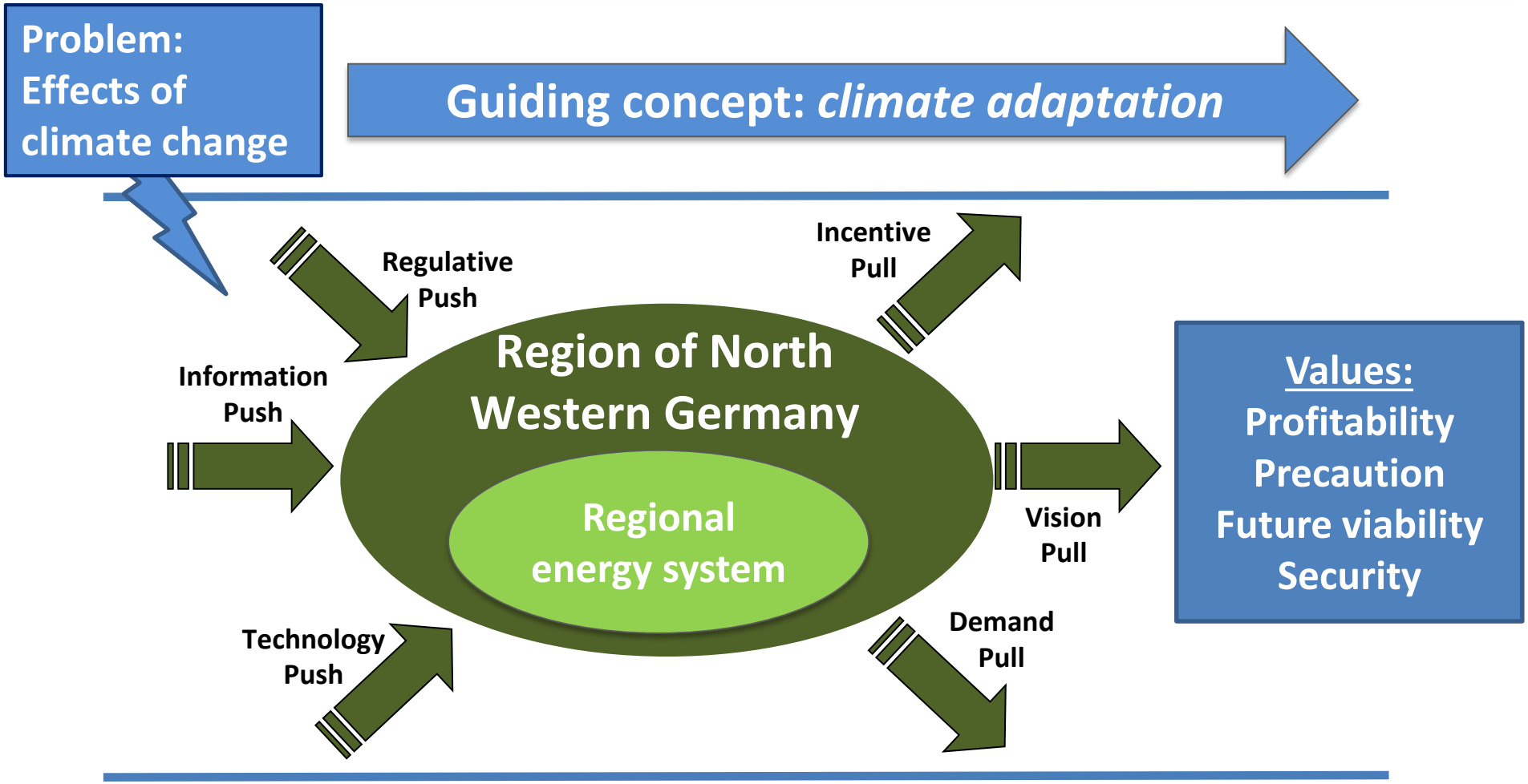
Duration: 2009 – 2013

Region: Metropolitan Region Bremen-Oldenburg in **North Western Germany**

Inhabitants: about 2.7 m

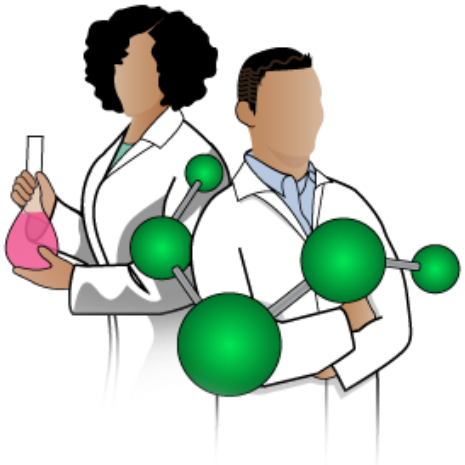
http://homepages.rootsweb.ancestry.com/~kobie/germanyrivers.gif

Case Study



Author's illustration based on Hemmelskamp (1999), Ahrens et al. (2006), Fichter et al. (2007)

Case Study – Energy System



http://sciencedigitalportfolios.wikispaces.com/Vanessa

Research group:

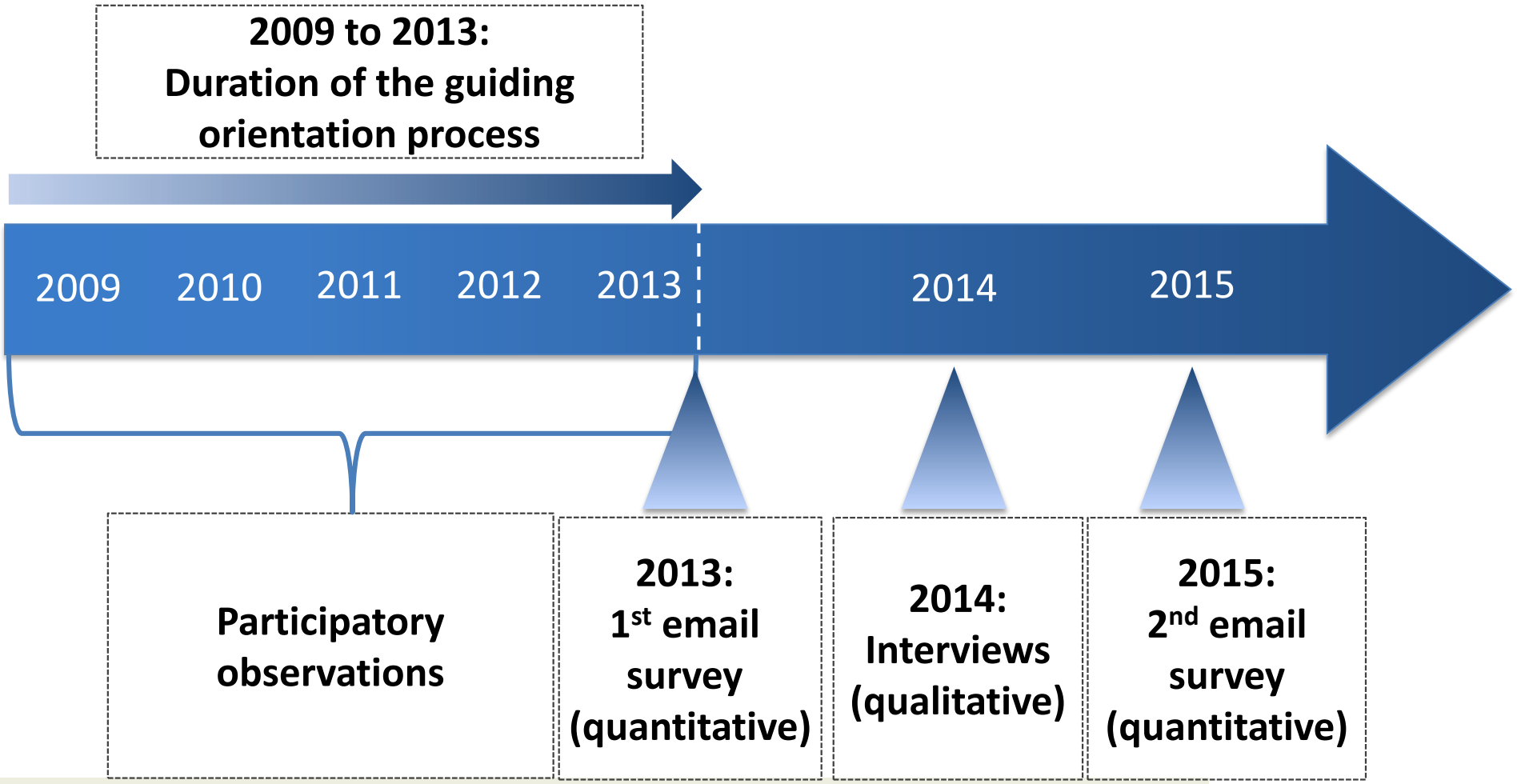
- University of Bremen
- University of Oldenburg

System relevant actors:

- Regional energy suppliers
- Actors from regional heat and cooling industry
- Actors from state administration

My position as observer

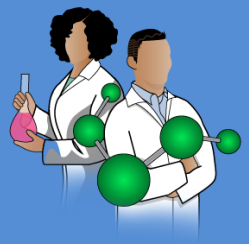
Case Study


2009 to 2013:
Duration of the guiding orientation process
2009
2010
2011
2012
2013
2014
2015
Participatory observations
2013:
1st email survey (quantitative)
2014:
Interviews (qualitative)
2015:
2nd email survey (quantitative)

Case Study

Taking-up | **Specifying** | **Implementing** | **Spreading**

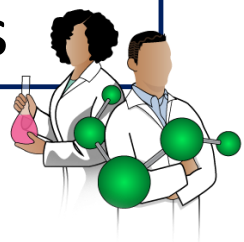
with problem-solving guiding concept



Problem: effects of climate change
Values: profitability, precaution, future viability, security

~~*climate adaptation*~~ ⟷ *resilience*

Unforeseeable effects



Case Study

Taking-up | Specifying | Implementing | Spreading

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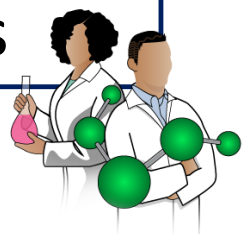
Problem: effects of climate change
Values: profitability, precaution, future viability, security

~~*climate adaptation*~~ ⟷ *resilience*

Unforeseeable effects

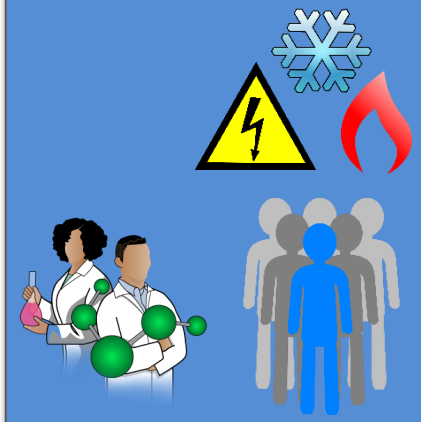


- **Resilient systems** can maintain their system services in spite of internal or external disturbances.
- Capability to **adapt, resist, innovate** and **improvise**

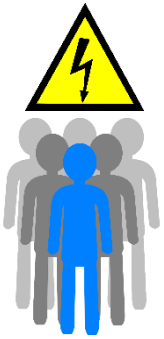
Case Study

Specifying → Implementing → Spreading

Resilience **into guiding design principles**

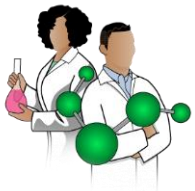


~~Direct effects~~ ⟷ **Indirect effects**



Need for measures taking the strain off the electricity grid

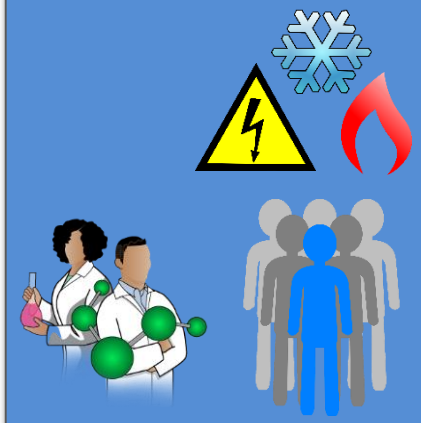
Low exergy solutions



Case Study

Specifying → **Implementing** → **Spreading**

Resilience **into guiding design principles**



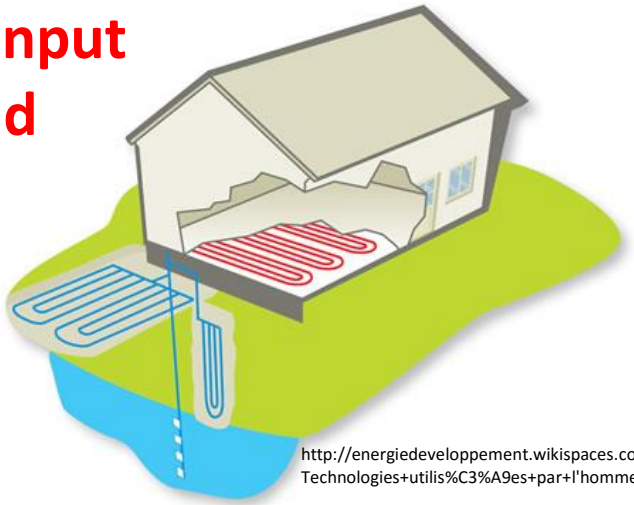
Lower energy input > Electricity grid overloads ↓

Heat and cold from industrial processes

Heat from biogas plants

https://www.yumpu.com/en/document/view/2789398/haase-images-haase-energietechnik-ag/7

Geothermal heat and cold



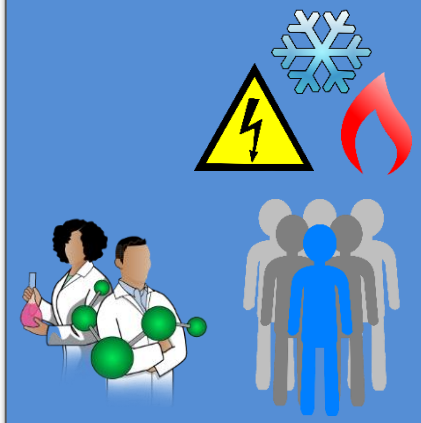
http://energiedeveloppement.wikispaces.com/Technologies+utilis%C3%A9es+par+l'homme

- **More efficient**
- **Streams and technologies are available**

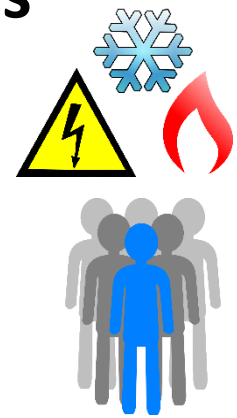
Case Study

Specifying | **Implementing** | **Spreading**

Resilience **into guiding design principles**



~~**Direct effects**~~ ⟷ **Indirect effects**



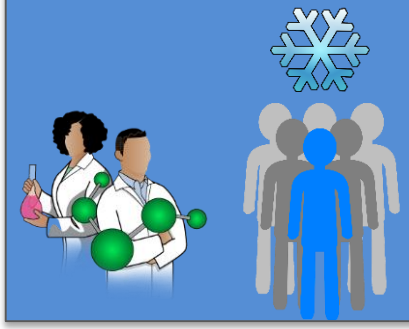
Need for measures taking the strain off the electricity grid:
Low exergy solutions

Need for cooling services + connection to efficiency:
Climate-adapted and energy-efficient cooling solutions

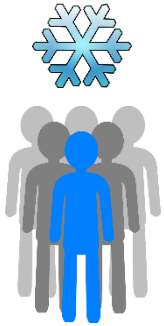
Case Study

Implementing → **Spreading**

Climate-adapted and energy-efficient cooling solutions

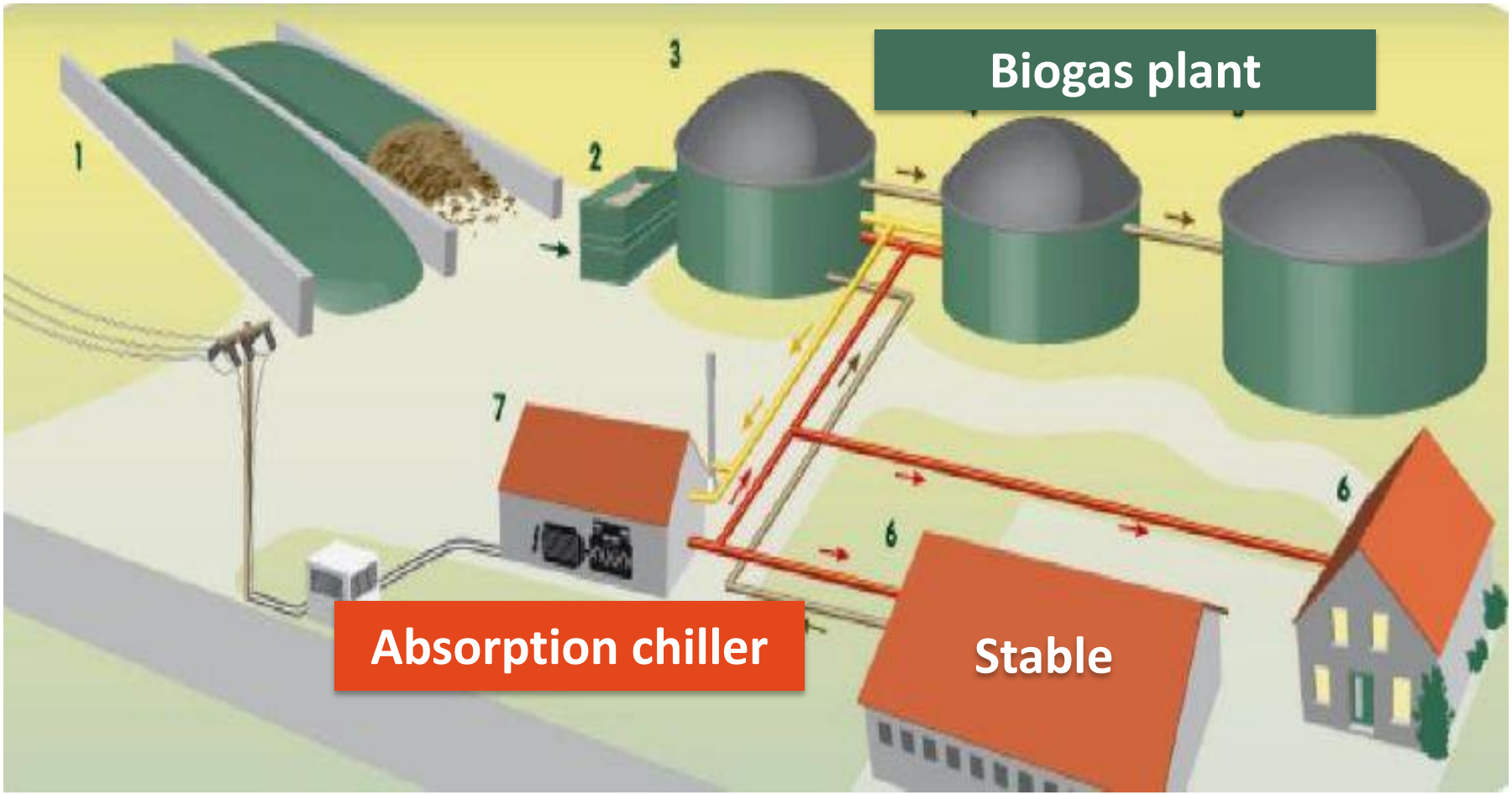


<u>Pilot projects</u> as models for region



Case Study

Pilot project



http://www.smh-luedinghausen.de/fileadmin/daten/mandanten/sml/download/Energiekonzept/Biogasanlage.jpg

Case Study

Spreading

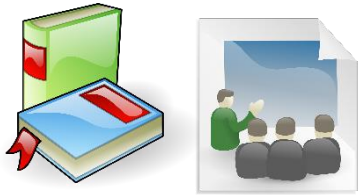
Climate-adapted and energy-efficient cooling solutions

Spreading channels:

1.) Series of events > visit of pilot projects and discussion of other influencing factors

2.) Workshop > relevance and drawing attention to inhibiting factors

3.) Publications



Results

Are guiding orientation processes able to give orientation in transformation processes in the long term?

Which limitations do guiding orientation processes offer?

Results

The interviewed **energy suppliers** consider a **long-term** implementation of *resilience* as **necessary.**

They **exchanged** the presented ideas on *low exergy solutions* in their companies but **have not implemented** them yet.

Profitability is still missing and **no pressure** to act!

*Low exergy solutions will **not** be an **issue in the next years**, only from 2020 or later **when the amount of renewable energies is so high** that they are **profitable**.*

Results

Increasing demand for cooling services

*I have a client who **stores chocolate**. So far, he has not needed any air conditioning but now he **depends** on it because **the climate has changed.***
(planner)

Results

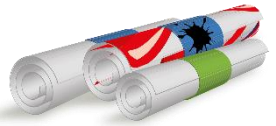
Regulations apply pressure on cooling industry

*The **new EU-law** regulating the gradual replacement of chemical cooling mediums by natural ones by 2030 is not easy for us because we have **no adequate alternatives** yet.*
(installer)

Results

- **All** of the questioned actors gained **qualifications** about the presented *cooling solutions* after the process.

- **85%** took *cooling solutions* in **planning processes** into account and partially **offered** them to clients.



- One installer discovered the *absorption chiller technology* as **future business** for himself.

But they have not built and put *cooling solutions* into operation yet after guiding orientation process!

Results

High investment costs for presented *cooling solutions*

Subsidies can be helpful but conditions change permanently

Insufficient networking

No cooperation between architects and cooling experts

Insufficient information

No offer > no information for installers and operators

Results

Are guiding orientation processes able to give direction in transformation processes in the long term?

Thought-guided effectiveness > Yes!

Action-guided effectiveness > Willingness to transfer, but no factual action!

Results

Which limitations do guiding orientation processes offer?

Limitations: other influencing factors

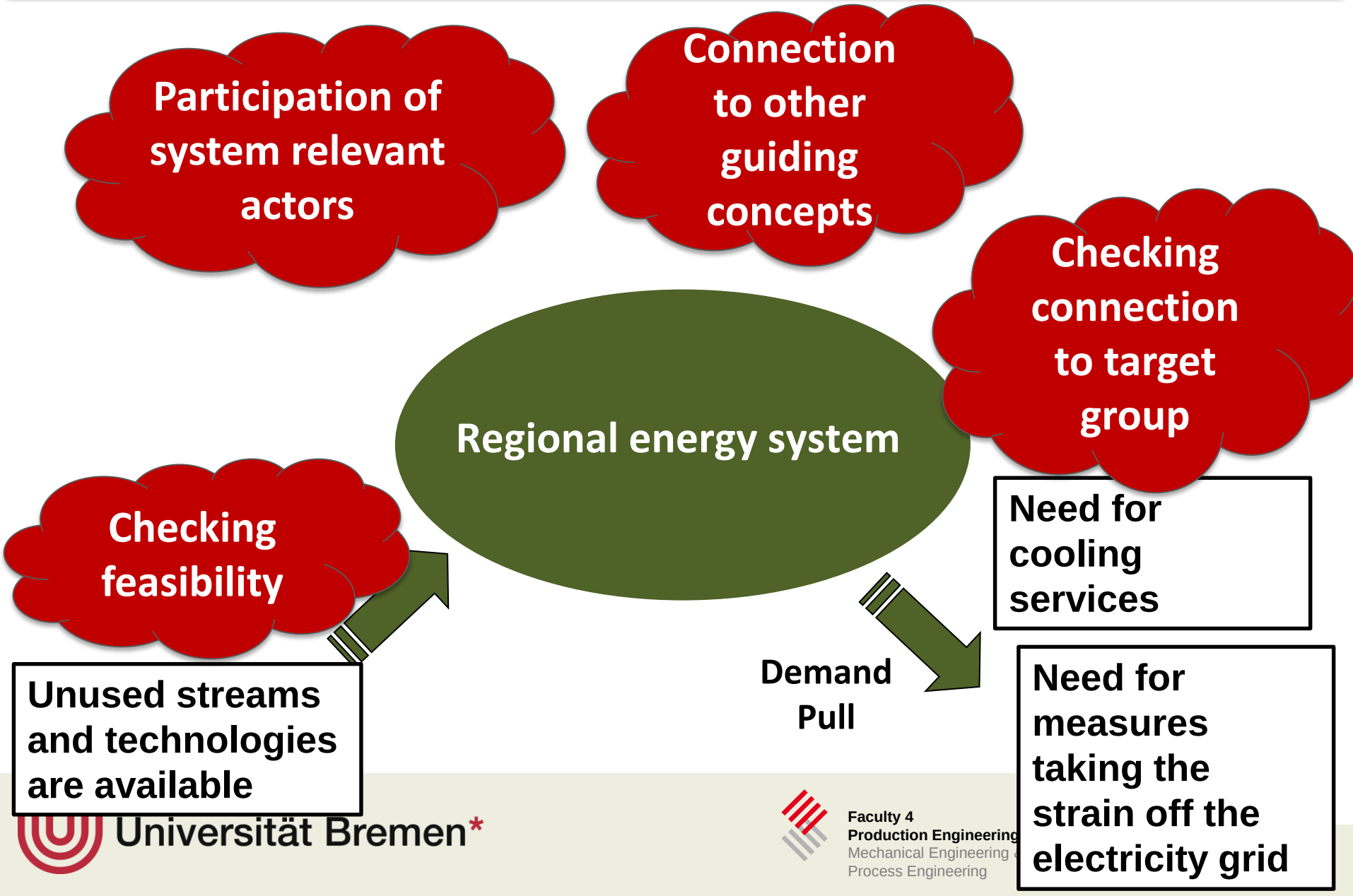
missing profitability, invisible subsidies, insufficient information,…

Compatibility of influencing factors is important!

Results

Under what conditions are guiding orientation processes effective?

Results


Participation of system relevant actors
Connection to other guiding concepts
Checking connection to target group
Regional energy system
Checking feasibility
Need for cooling services
Demand Pull
Unused streams and technologies are available
Need for measures taking the strain off the electricity grid

Conclusions

- **Giving orientation** with *resilience* was **possible.**
- Producing a **common understanding of *resilience*** beyond the science context was a **challenge**.
- Specifying **feasible** and **compatible guiding design principles** was helpful and necessary.

Climate-adapted and energy-efficient cooling solutions

>> **But** the challenge is to **convey** *resilience* in its **holistic meaning.**

>> **But** the research group **itself** defined the guiding concept and guiding design principles**.**

Outlook

Transferability of results?

Federal Ministry of Education and Research

RESYSTRA

On the road to resilient energy systems!

- Greater participation in the stage of specification
- Extent of resilience in comparison with other guiding concepts

New publication:

Brand, U.; Gleich, A. von (2015): Transformation toward a Secure and Precaution-Oriented Energy System with the Guiding Concept of Resilience—Implementation of Low-Exergy Solutions in Northwestern Germany. Energies, 8(7), S. 6995-7019. DOI: 10.3390/en8076995.

Thank you for your attention!

Funded by

Federal Ministry of Education and Research

RESYSTRA