



IHTC
SINCE 1951

The role of transdisciplinary collaboration in thermal science to meet societal challenges

Peter Stephan

Technische Universität Darmstadt

Societal Challenges

... and R&D funding from a European perspective



HORIZON 2020

The EU Framework Programme for Research and Innovation

- The programme focuses on 7 **societal challenges**:
 - ✓ Health, demographic change and wellbeing;
 - ✓ Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy;
 - ✓ **Secure, clean and efficient energy**;
 - ✓ **Smart, green and integrated transport**;
 - ✓ **Climate action, environment, resource efficiency and raw materials**;
 - ✓ Europe in a changing world - inclusive, innovative and reflective societies;
 - ✓ Secure societies - protecting freedom and security of Europe and its citizens.

3 out of 7 societal challenges address Thermal Sciences!

Societal Challenges

... and R&D funding from a European perspective



RESEARCH & INNOVATION Energy

- 9 energy relevant research topics were defined:

Solar Energy  <ul style="list-style-type: none"> » Photovoltaics » CSP 	Wind Energy  <ul style="list-style-type: none"> » Wind energy 	Bio Energy  <ul style="list-style-type: none"> » Bioenergy
Other renewable energies  <ul style="list-style-type: none"> » Ocean » Hydro » Geothermal 	Fuel cells and hydrogen  <ul style="list-style-type: none"> » Fuel cells and hydrogen 	Energy networks  <ul style="list-style-type: none"> » Smart grid
Clean coal/CCS  <ul style="list-style-type: none"> » Clean coal/CCS » Coal and steel (RFCs) 	Energy efficiency  <ul style="list-style-type: none"> » Efficiency and savings 	Horizontal aspects  <ul style="list-style-type: none"> » Socio-economic research » Future emerging technologies & materials

Funding strategy EU:

“A challenge-based approach will bring together resources and knowledge across different fields, technologies and disciplines, including social sciences and the humanities.”

EU funded: top-down approach with transdisciplinary collaboration

Societal Challenges

... and the German “Energiewende” and the DFG



- Energy transition goals defined by Government & Ministries:
 - ✓ **greenhouse gas reductions**: 80–95% reduction by 2050 compared to 1990
 - ✓ **renewable energy targets**: 55-60% share by 2035 (hydro, solar and wind power)
 - ✓ **energy efficiency**: electricity efficiency up by 50% by 2050

Ministry funded vs. DFG funded =
Top-down vs. bottom-up approach



- The German Science Foundation DFG still follows **bottom-up approaches** without defining any priority topics. However, **transdisciplinary research proposals** are specifically welcome and more and more pushed.

Transdisciplinary collaboration

... and my personal experience with it

1: Research Cluster at TU Darmstadt

- founded 2007 and financed until 2014 by German Science Foundation (> 100 scientists from different disciplines, ~ 6.5 Mio. € p.a.)
- adopted by the University as a multi- or transdisciplinary center from 2015 bridging 5 faculties (financial support for some overhead only)



Mechanical
Engineering

Mathematics

Physics

Chemistry

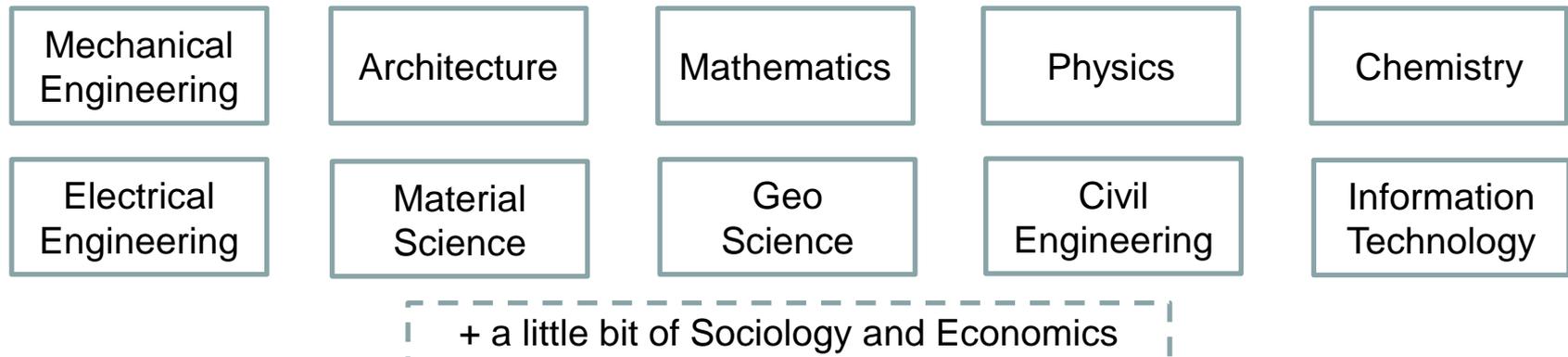
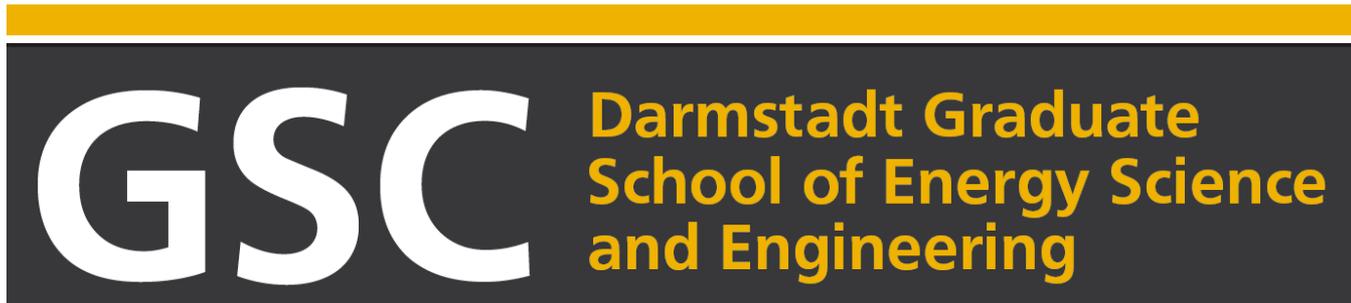
Material
Science

Transdisciplinary collaboration

... and my personal experience with it

2: Graduate School at TU Darmstadt

- founded 2012 and financed until 2017+x by German Science Foundation (~ 35 PhD students, ~ 2 Mio. € p.a.).
- transdisciplinary M.Sc. / PhD programme to “educate tomorrow’s leading Energy Engineers” involving 10 faculties



Transdisciplinary collaboration

... and my personal experience with it

Very positive experiences

- I understood and learned a lot about **other research methods, trends, and possibilities**.
- I started understanding the sometimes quite **different thinking and culture of scientists from different disciplines**.
- We clearly work towards **broader solutions** or the **most energy-efficient system solution** instead towards an optimum solution of a small subsystem disregarding the overall system.



My conclusion here could be:

“Transdisciplinary research is mandatory to solve the upcoming energy problems and it makes my life as a researcher much richer.”

Transdisciplinary collaboration

... and my personal experience with it

Very negative experiences

- Transdisciplinary projects sometimes do not show the usual **scientific depth** from each disciplinary perspective.
- **Misunderstanding** between colleagues occurs more often.
- The **evaluation process** of transdisciplinary proposals often is extremely difficult:
 - ✓ **peers** from multiple disciplines are necessary
 - ✓ different disciplines have **different performance indicators** (specific journals, h-index, patents, attracted third-party money, ...)
 - ✓ each discipline has his **specific arrogance** (physicist about engineer: “he is not a real scientist”; engineer about physicist: “he doesn’t solve real life problems”)



My conclusion here could be:

“I should stop pushing myself for transdisciplinary research and proposal writing and concentrate on my narrow expertise. The success ratio is much higher there and my life would be easier.”

Transdisciplinary collaboration

... and can we do something to promote it?

“The Dilemma”

- Transdisciplinary collaboration is definitely **needed to solve societal challenges**
- It looks straight forward and easy on paper, but it can be **hard and sometimes frustrating in real life**

Ideas how to promote transdisciplinary collaboration

- Should we organize transdisciplinary **sessions** on conferences such as IHTC with e.g. one topic addressed from very different disciplines ?
- Should we start more **bottom-up** transdisciplinary projects ourselves instead of waiting for **top-down** calls which we cannot influence ?
- Can we make **performance indicators** of different disciplines more transparent and accepted ?
- ...
- *... let's start a discussion!*