How can institutes of technology participate in the problem solution process of societal challenges?

Prof. Dr.-Ing. Jörg Steinbach
Wien, Sept 24th, 2011

Profile

The Technische Universität Berlin regards itself as an international well reputated university placed at the German capital in the center of Europe:

- Third largest Institute of Technology in Germany

- Research and Education conducted in combination of natural sciences, engineering and humanities

- Fundamental and applied research:
  - Fundamental research in its classical meaning
  - applied research centred on problems relevant to society today and in the future

- Regional, national and international networking

Zahlen und Daten

Students	29.510
female (ca. 34%)	*9.729*
foreign students (ca. 20%)	*5.988*
Professors	320
Guest professors and ext. lecturers	396
Scientific Assistance	2.264
Staff (techn and admin.)	4.402
Drs (2010)	470
Habilitationen (2010)	17
Budget:	
State funding (2010)	264,81 Mio. €
Third party research funding (2010)	146,5 Mio. €

A positive perspective for our future can only be anticipated if the following challenges are met successfully:
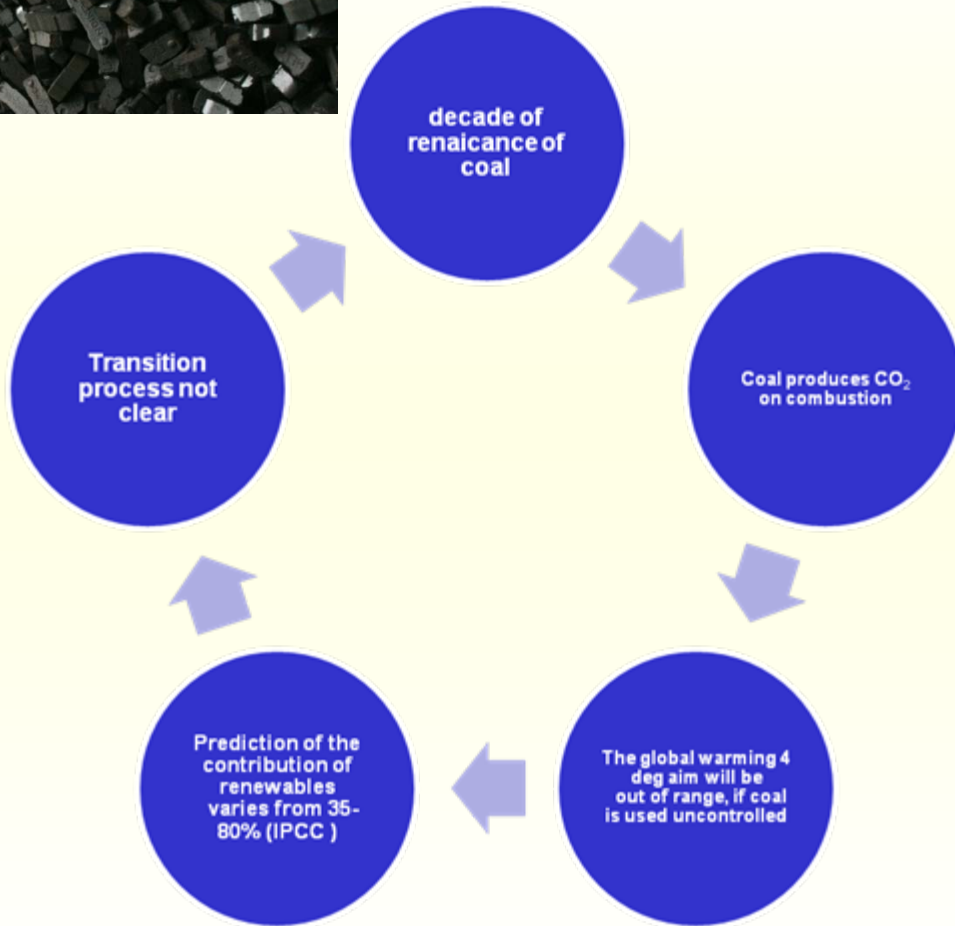
- climate change
- urbanisation
- infrastructure
- resource management, intelligent handling of

- water, the gold of the future

- energy (efficiency)

- food

- health in an aging society

These fields not only require inventions and innovations but also sufficient finances
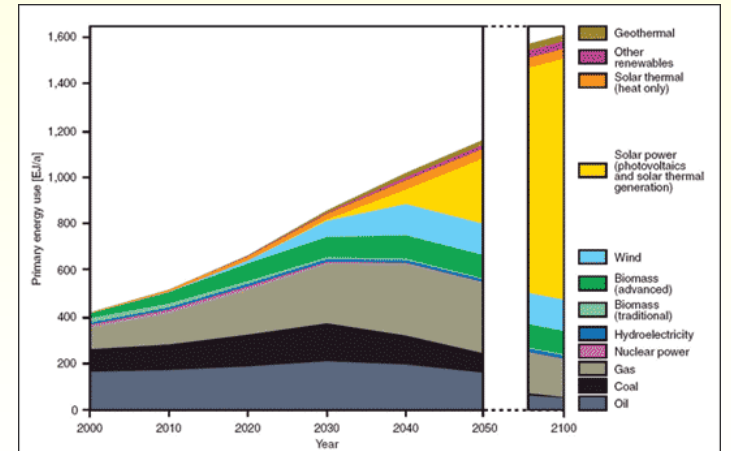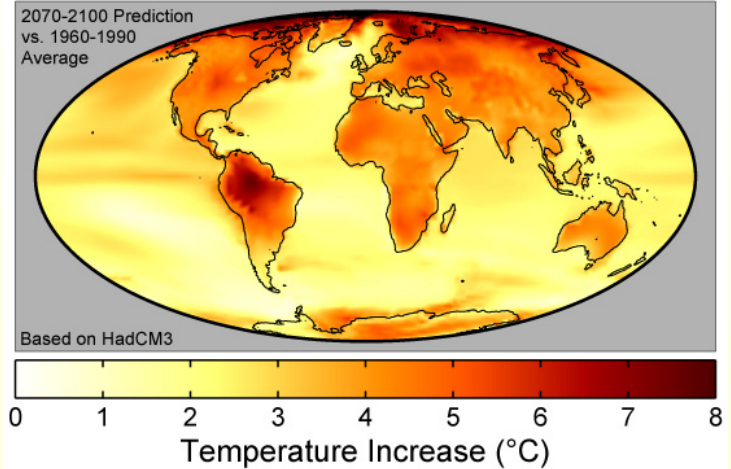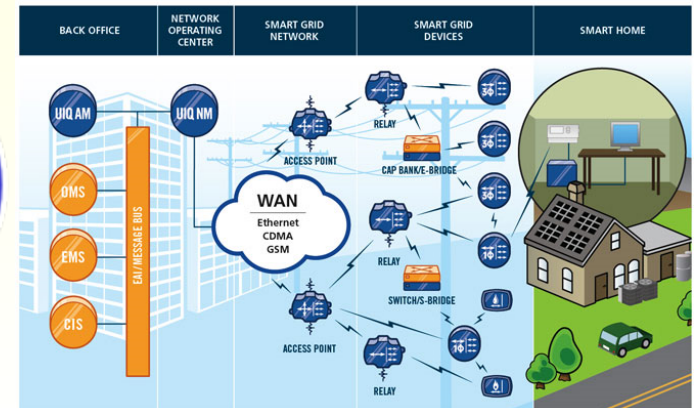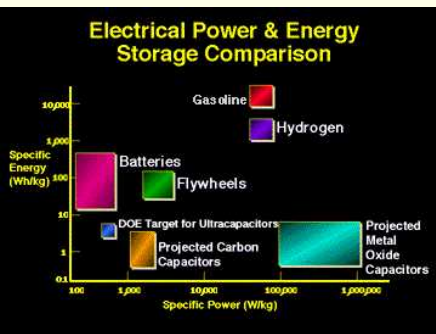
Challenges

decade of renaicance of coal

Coal produces CO_2 on combustion

The global warming 4 deg aim will be out of range, if coal is used uncontrolled

Prediction of the contribution of renewables varies from 35-80% (IPCC)

Transition process not clear

Global Warming Predictions

2070-2100 Prediction vs. 1960-1990 Average

Based on HadCM3

Temperature Increase (°C)

Challenges

E-Mobility

Infrastructure and Logistics

Car technology

Storage technology

Net technology
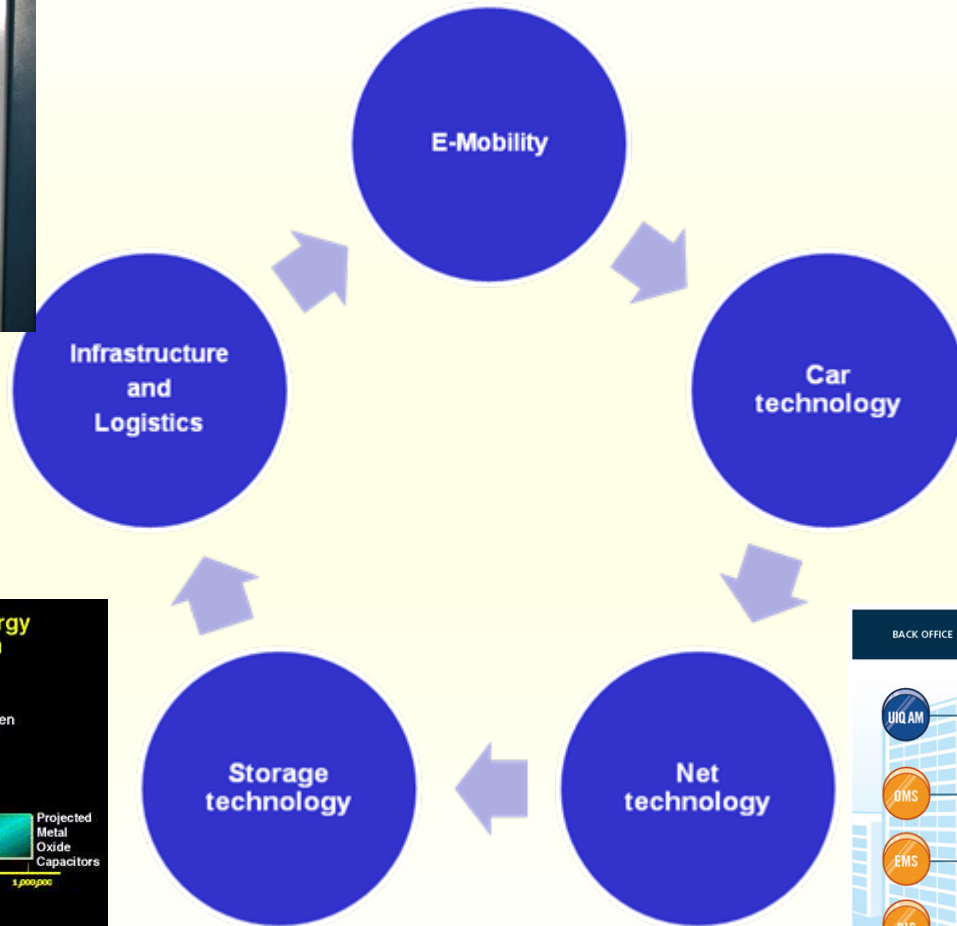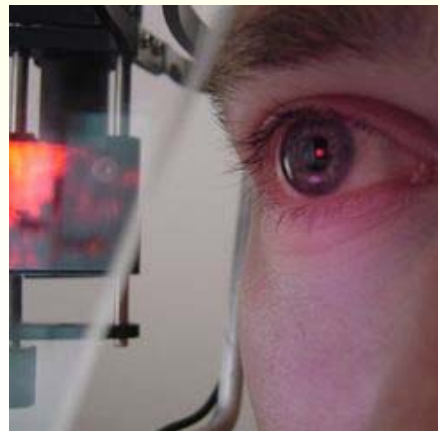
Innovation

From invention to innovation:

- inventions require the spending of money
- innovations produce profit
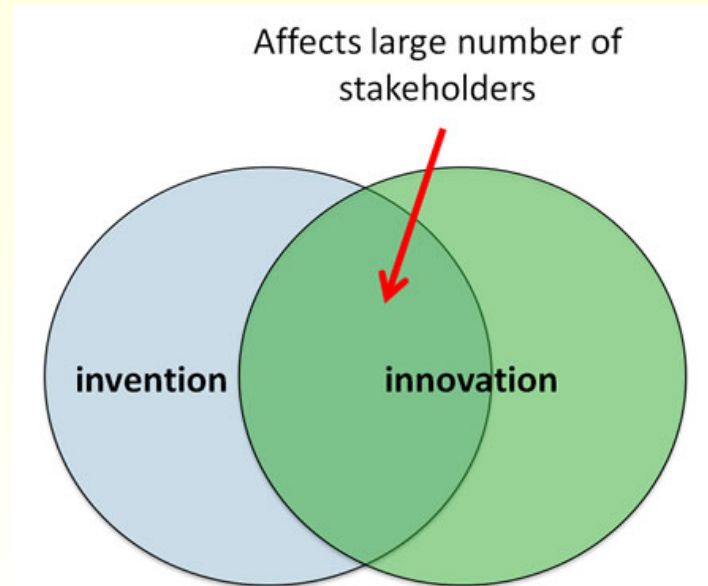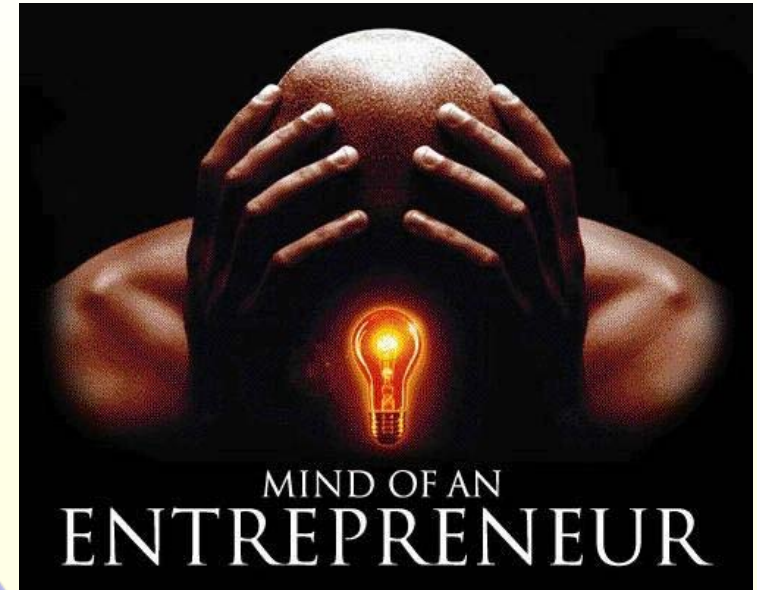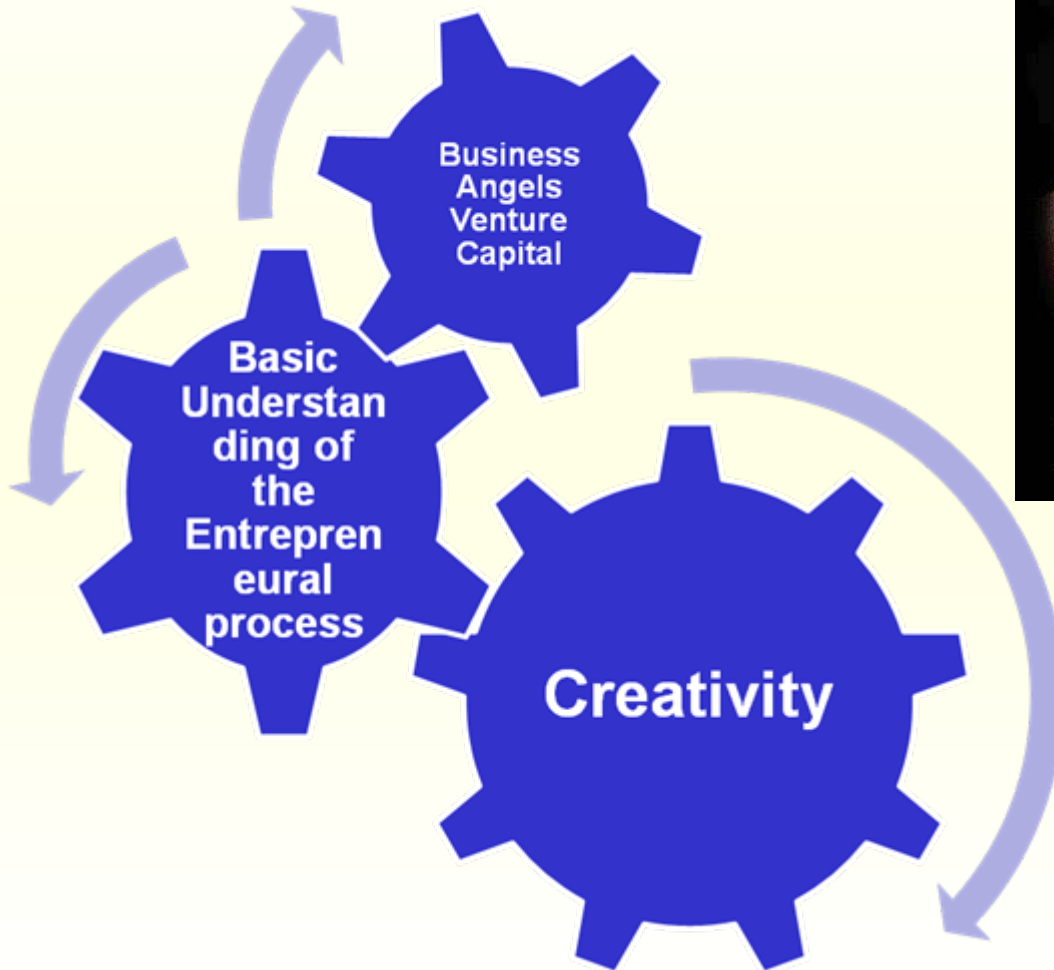- how to bring these cultures together?

Affects large number of stakeholders

invention   innovation

Innovation

Business Angels Venture Capital

Basic Understanding of the Entrepreneural process

Creativity

MIND OF AN ENTREPRENEUR

The Answer:

Soft Systems Engineering

Human Factors Engineering

Software Engineering

Requirements Engineering

Verification Engineering

Enterprise Management

Systems Engineering

Hardware Engineering

Project Management

http://easyweb.easynet.co.uk/~iany/consultancy/syste
ms_engineering/systems_engineering.htm

Deficits in our current organisations to face the challenges
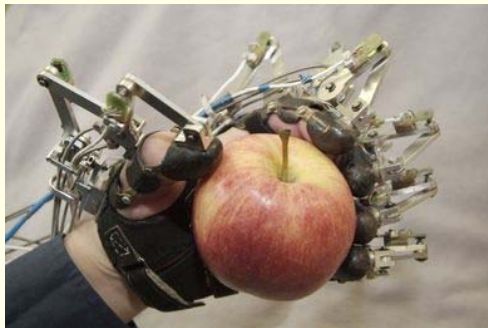
Research

▪ **Introduce „problem based research based on a system engineering approach on European/International scale"**

Faculties and schools are not adequate structures for future research. Research today is done in interdisciplinary teams sometimes forming even new transdisciplinary sciences.

Combine researchers project wise from all relevant faculties and different institutions and provide them with their own budget

▪ Cultivate **„risky research"**

15% of the budget of a university should not be subject to financial efficiency assessment.

Formation of thematic research networks based on strategic partnerships to conduct system engineering research

How to prepare for the future

Setup organisation of universities

- Make the university structure more flexible and support young scientists at the same time:

- 50% of chairs are defined monodisciplinary to cultivate the mono-disciplines on the Bachelor level

- 20% of chairs are defined interdisciplinary and **5% as „seed chairs"**

- **25% of all chairs are time limited assignments** for young scientists to respond to structural project needs

Education

- Place „methodolical skills" based on a sound basis of fundamentals in to the centre of Bachelor curriculum development

- Include entrepreneural aspects in the curricula

- Place Master curricula preferable on the interface of two disciplines , but keep them broad and away from hype-topic

- Try to focus on system´s approach in order to balance specialisation for a following doctorate and generalisation enough to keep the graduates placable in different disciplines