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Canada

and the World of Ocean Renewable Energy Symposium

Royal BC Museum, Victoria, BC

International Policies and Strategies

■ Germany

Lochen Bard

Head of Energy Conversion

Institute for Solar Energy Supply Technologies (ISET)

Kassel University, www.iset.de



Systems Technology for the Use of Renewable Energies and Efficient Energy Conversion

Applications-oriented Research and Development



- Wind Energy
- Photovoltaics
- Use of Biomass
- Hydropower, Ocean Energy Technologies
- Energy Conversion and Storage
- Hybrid Systems
- Energy Economy
- Information and Training



Executive Board: Prof. Dr.-Ing. Jürgen Schmid

Dr. rer. nat. Oliver Führer

Personnel: 75 employees, total of 120 people

Budget: approxim. 8 Mio. Euro

Information: www.iset.uni-kassel.de



What is going on in Germany?

Energy and climate: German policy

Actual energy supply

Resources

Actual involvement of institutions and companies

Conclusions: strategic interest

Kyoto:

**Reduction of green house gas emissions by 21% between 2008 and 2012
based on 1990 levels**

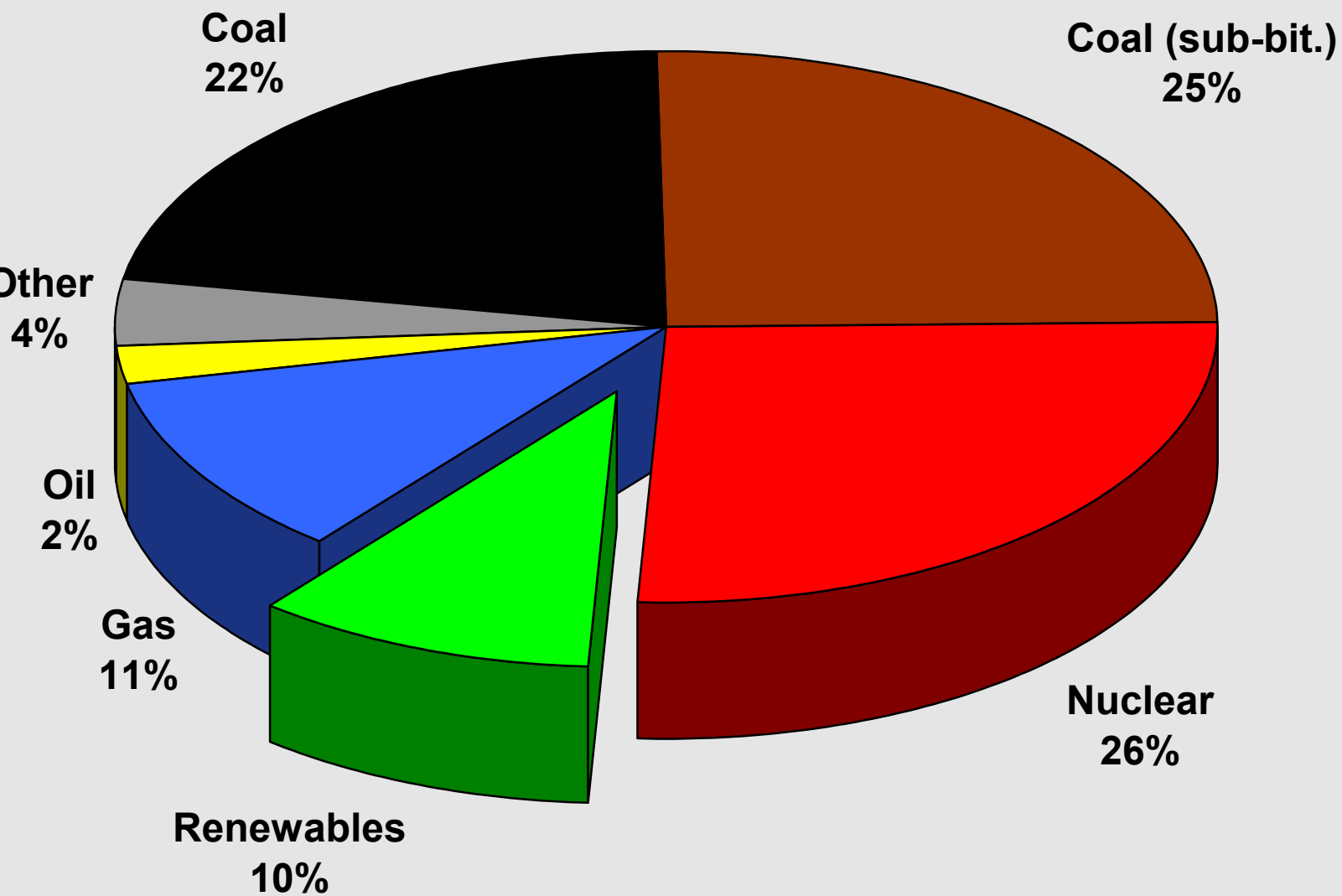
- Kyoto targets are legally binding since ratification in 2001
- end of 2003: reduction of 18.5% achieved
- proposal for EU: 40% reduction by 2020 – if EU decides on 30% reduction

National Climate Protection Program

- ecological tax reform in April 1999
 - to reduce emissions in the transport and building sector (2 ct/kWh)
- Energy Saving Ordinance
- CO₂ Building Rehabilitation Program
- Renewable Energy Sources Act (EEG) in 2000
 - ⇒ 20% of electricity from renewables in 2020
- introduction of emissions trading in January 2005
- further improvements in energy efficiency required
 - mainly in transport and private households

- reduction of 53 Mil. t CO₂ in 2003, 85 Mil. t CO₂ in 2010

German Electricity Market in 2005

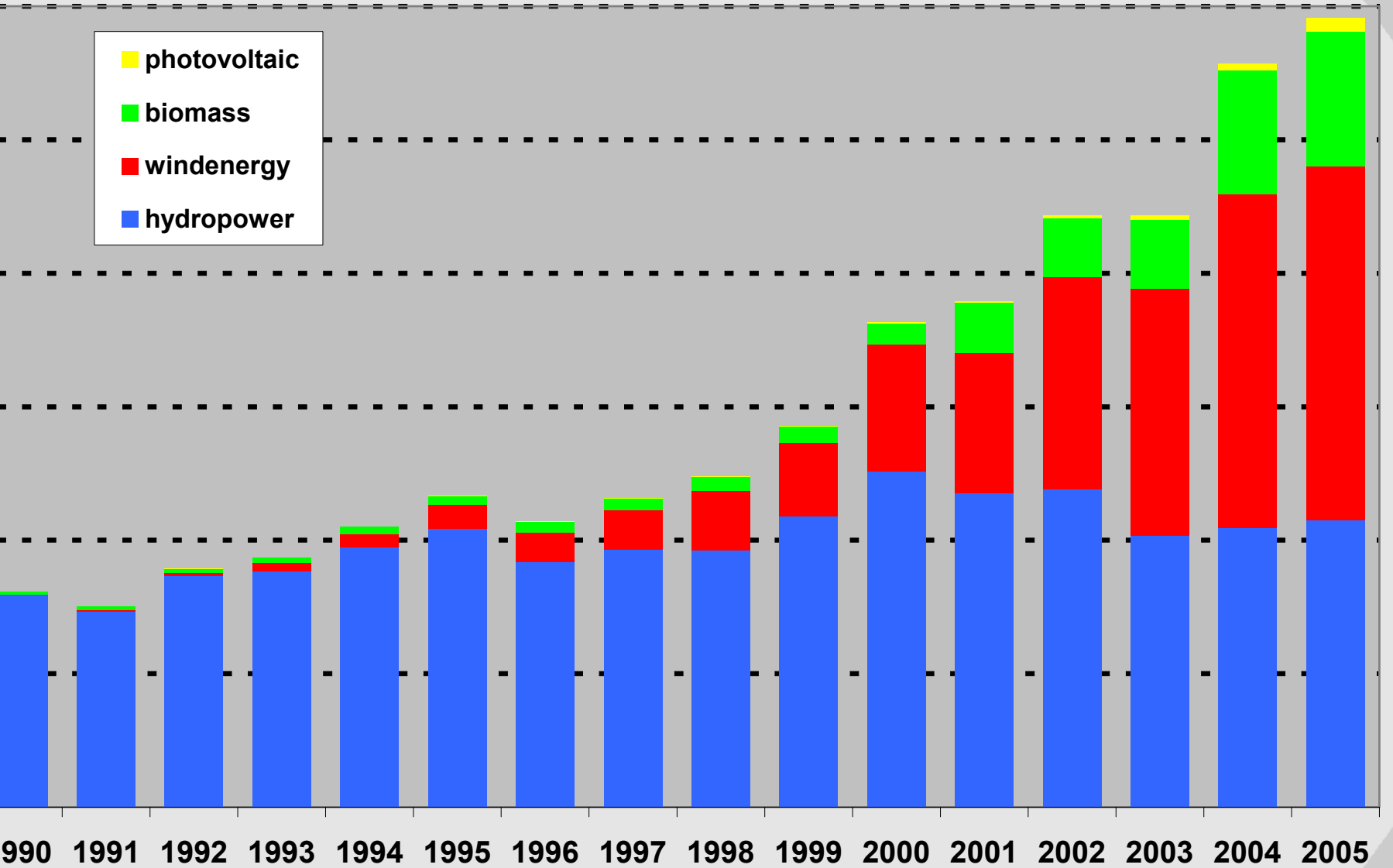


Total electricity production 600 TWh (billion kWh)

72 TWh or 12.0% from renewables

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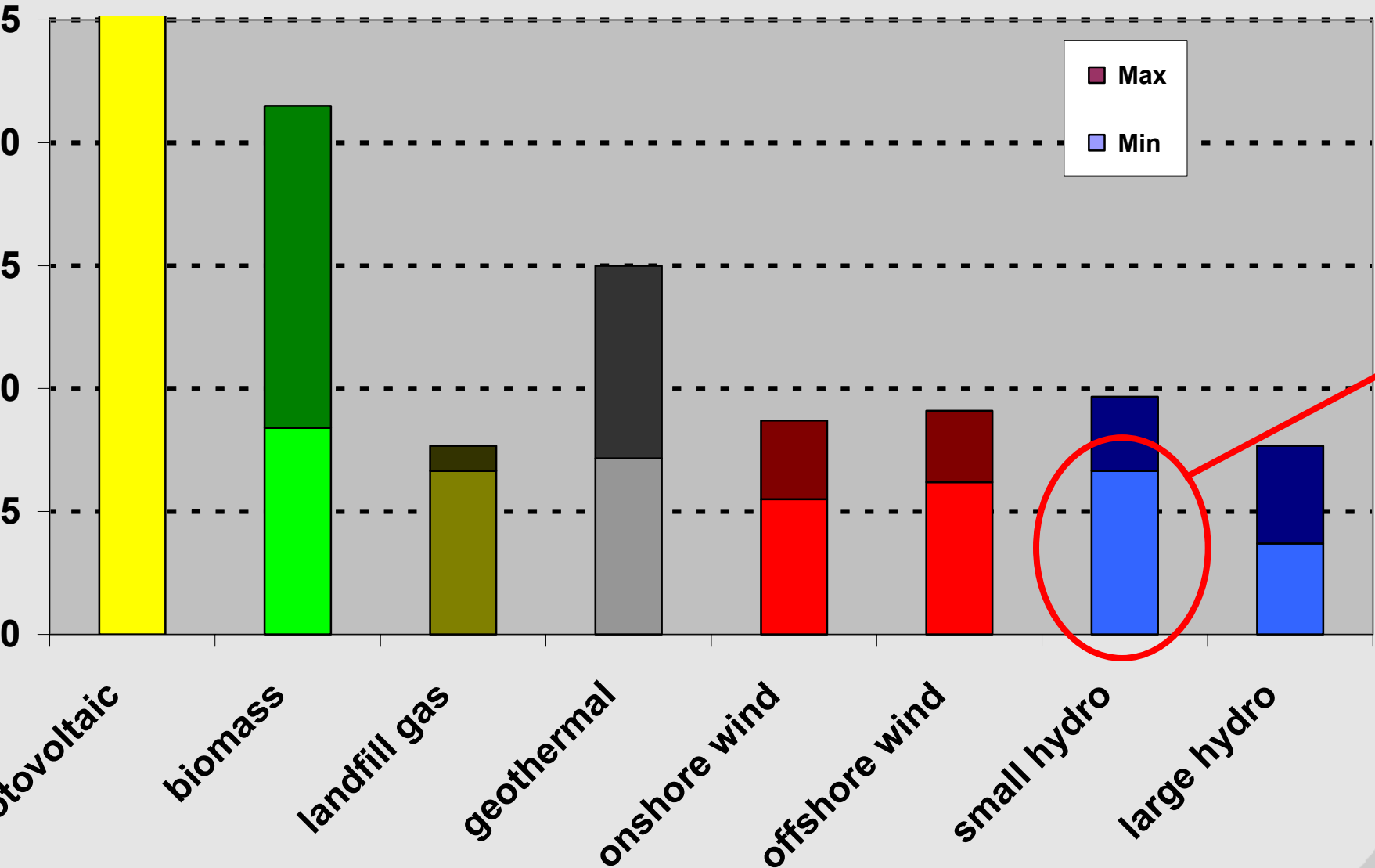
Development of renewable electricity in Germany



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2005 tariffs under renewable energy act

40-55



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reduction 1 to 6.5 %/a

1.5 €/month average household

Ocean Energy Resources in Germany

Tidal range at the German Coast:

1.2m (Borkum) up to 3.7m (Wilhelmshaven)

Waves

North Sea 10-20 kW/m, Baltic Sea 5-10 kW/m

50 km coast length North Sea

1.5-3.5-5 TWh

Currents

Example case of the Island of Sylt: 50 MW

Osmosis

Mean fresh water discharge to the

North Sea: 1331 m³/s

Baltic Sea: 117 m³/s

→ 13 TWh

(Rhine: 20 TWh, Oder 4.7 TWh)

→ total resources in the range of 2% of consumption

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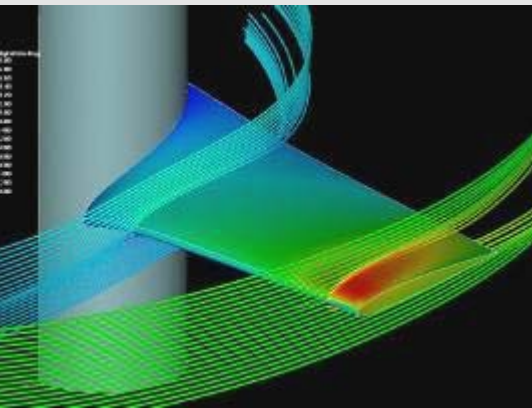
onshore in 2005: 18500 MW

offshore wind farms in 2020:

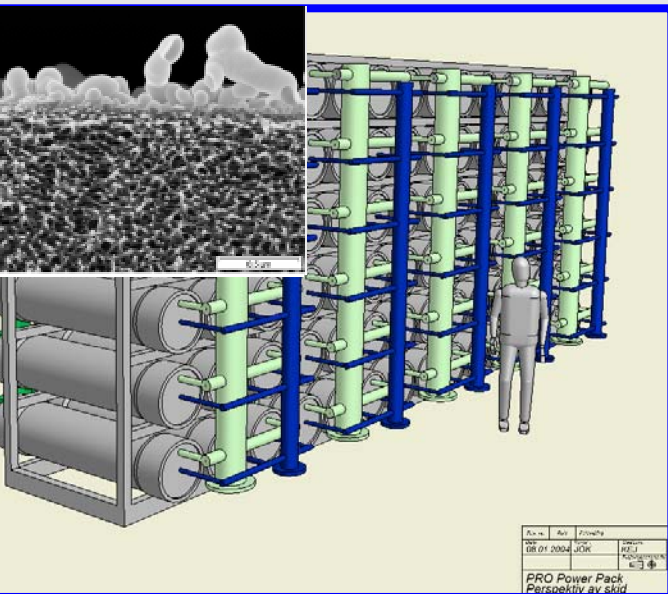
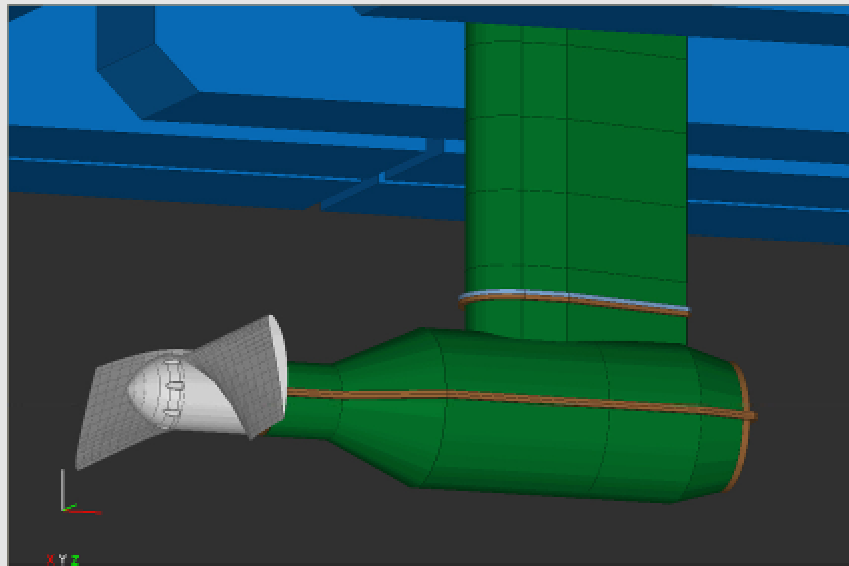
North Sea (AWZ) 18.600 MW

Baltic Sea (AWZ) 1.700 MW

Actual involvement into ocean energy projects: R&D



HS, University of Stuttgart
Hydraulic design of rotors
for tidal turbines



KSS Research Center, Geesthacht
Membrane development for



Coastal Research Centre
(FZK), Hannover,
experimental work in the
large wave tank (HYDRALAB
I, II, ...)

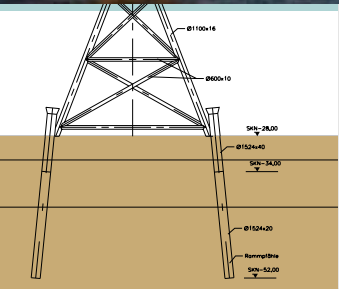
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Actual involvement into ocean energy projects: R&D

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Fluid Mechanics Laboratory (FLM) Technical University Munich
Wave Dragon – turbine design etc.

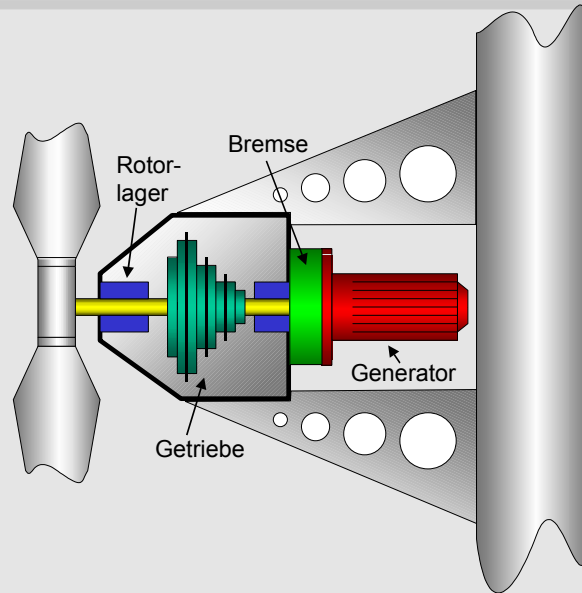


Research platform
Fino 1



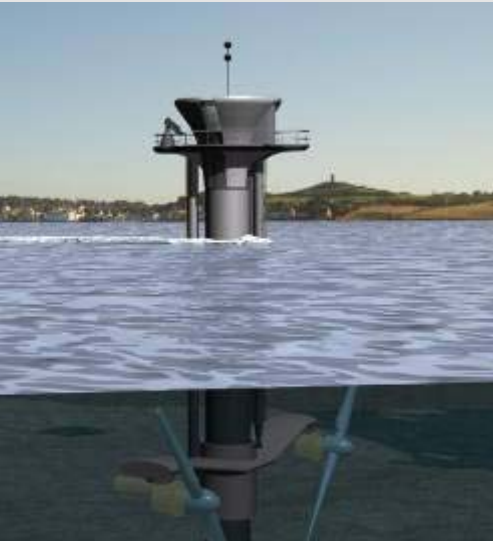
fred-Weegener-Institut Polar and Marine research, Bremerhaven
environmental impact of marine renewables:

Contributions to the SEAFLOW project: R&D/industry



- dynamic simulations
- electrical engineering
- testing/monitoring

630 000 €
National funding
mainly for hardware



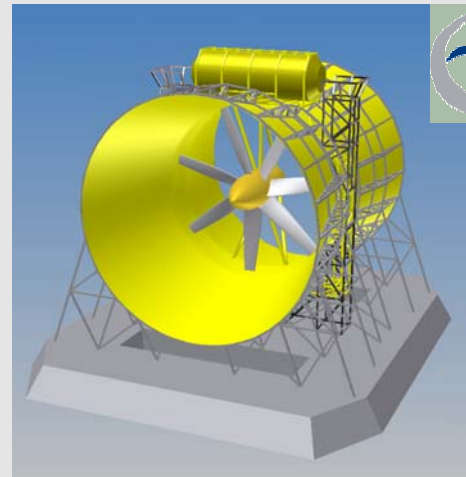
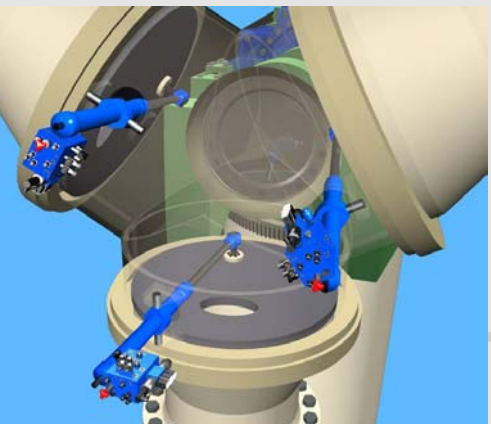
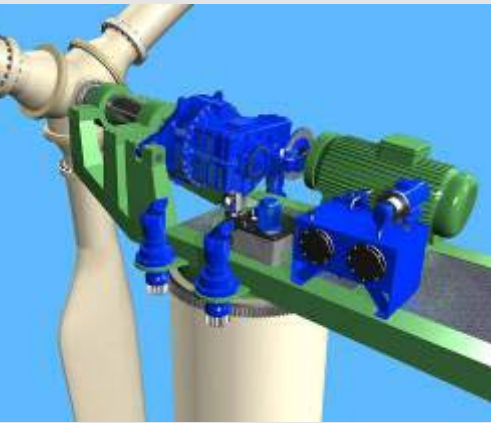
700 000 €
National funding
Partner:
Lust Drivetrionics (Pitch)



- improved simulation model
- new pitch system

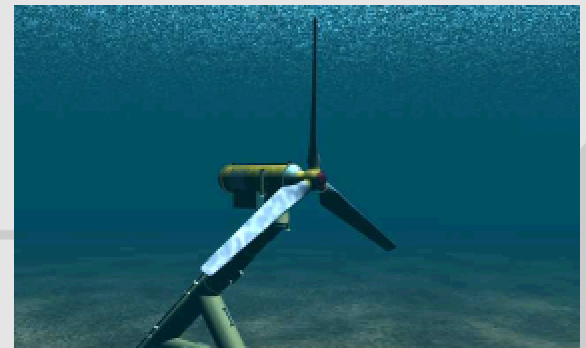
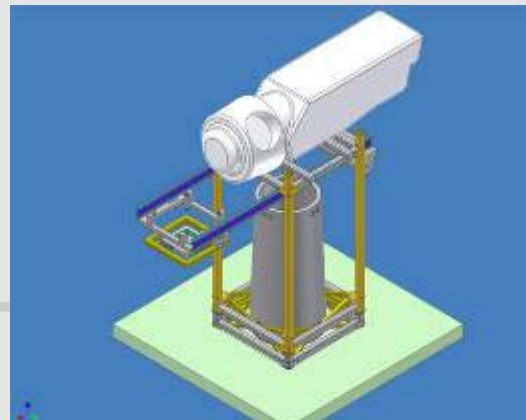
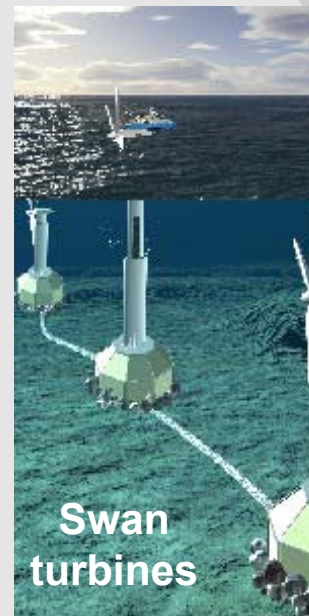
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Actual involvement into projects: Industry



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Rexroth
Bosch Group



First wave energy plant in Germany

Joint project of Voith Siemens Hydro and EnBW (utility)

announced in March 2006

site at the North Sea coast (Niedersachsen) to be identified

technology from Wavegen (Limpet plant in Scotland)

integration into new civil structure planned

250 kW installed capacity, 400 MWh per year, 1600 full load hours

installation planned for 2008 to 2010



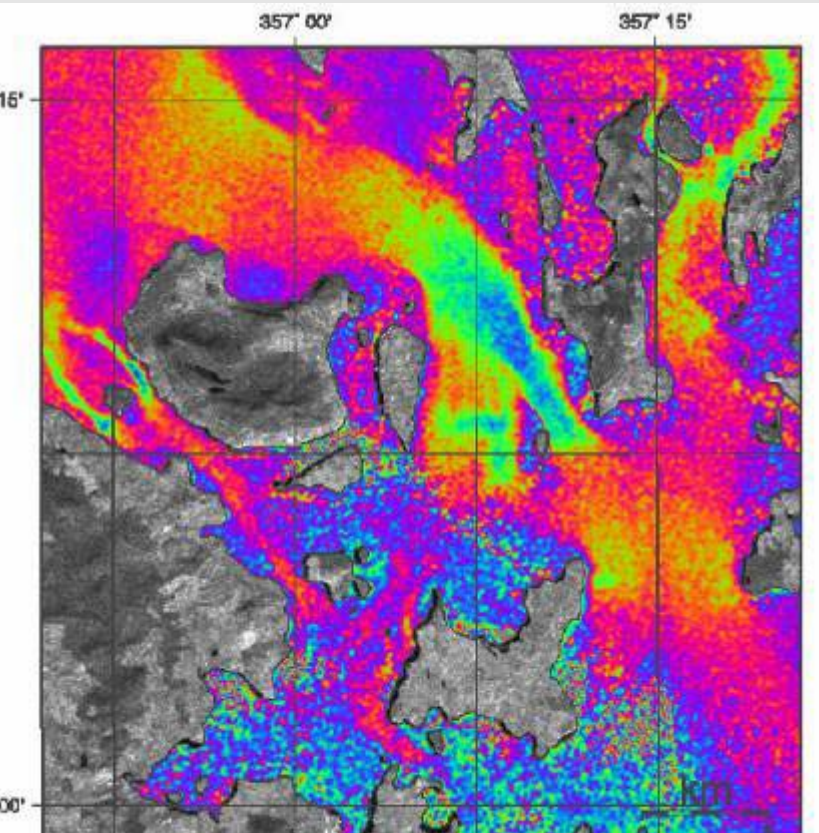
WAVEGEN Limpet project, Scotland

Future research in Ocean Energy

Grid integration

- power forecasting (combination of wind and waves)
- cluster management
- transport and congestion management
- grid management: security, frequency control

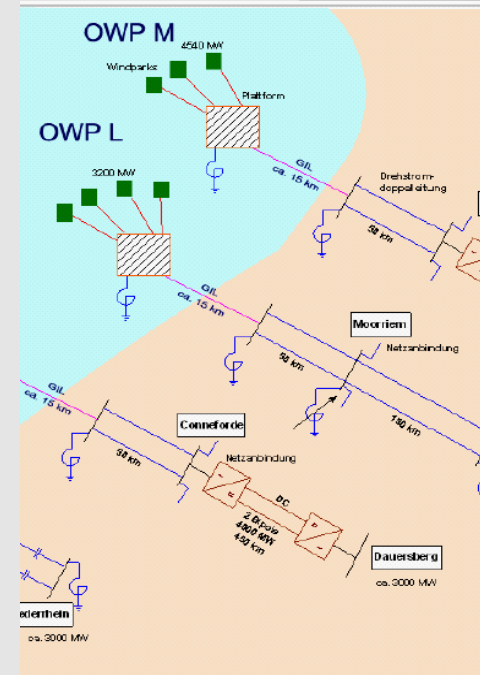
Remote Sensing of Ocean Surface by SAR Along Track Interferometry



„velocity maps“
derived by special
InSAR „Ocean- Processor“

SRTM –data
Orkney islands
DLR, Oberpfaffenhofen

TerraSAR:
possibility of world wide
surface current maps



Events scheduled

INTERNATIONAL CONFERENCE OCEAN ENERGY

October 23rd/24th, 2006
Bremerhaven, Germany



Field Experience

Components and Systems Technology

Market/Economics/Finances

Resource and site evaluation methods

Environmental Aspects



Conference Location:

Bremerhaven built in 1827 is situated where the river Weser enters the North Sea. Well known by its famous international "Windjammer Festival" also the world's oldest hanseatic cog is anchored in Bremerhaven's National German Maritime Museum.

Deutsches Schiffahrtsmuseum
Hans-Scharoun-Platz 1
27568 Bremerhaven, Germany
www.dsm.de

Conference Chairman

Prof. Dr.-Ing. Jürgen Schmid
Institut für Solare Energieversorgungs-
technik (ISET) e. V., Kassel, Germany

Scientific Committee

Yves Bamberger (tbc)
EDF Research, France

Jochen Bard
ISET, Germany

Peter Frankel
Marine Current Turbines, United Kingdom

Prof. Kai Uwe Graw
Universität Dresden, Germany

Prof. Ian Bryden
Robert Gordons University, United Kingdom

Dr. Tony Lewis
University College Cork, Ireland

Kim Nielsen
Ramboll, Denmark

Prof. António Sarmento
Wave Energy Centre, Portugal

Prof. Jürgen Schmid
ISET, Germany

Johan Hustad
Sintef, Norway

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Conclusion

limited National ocean energy resources
compared to wind and biomass

public interest

political interest

- to co-fund companies/institutes involved into international projects
 - to support development of sustainable energy technologies
reference case: solar thermal power plants
 - to generate an export market (wind energy: >50% of world market)
- ⇒ an opportunity for the environment, innovation and employment

industrial interest and engagement

RE Industry announced to invest

100 Mil Euro in Renewables (40 Mil € electricity, 30 Mil € heat & fuels) until 2010

200 Mil Euro until 2020