

**SDC Sustainable Energy
IEA EGRD Workshop
Developments in Energy Education
DTU 9 & 10 May 2012**

Birte Holst JØRGENSEN, DTU
Principal Coordinator

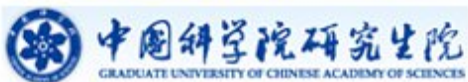


Outline

- What is SDC
- Common challenges
- Building on previous and ongoing Sino-Danish R&D activities
- The mission and vision of SDC
Sustainable Energy
- Research and education activities

What is SDC?

CHINESE PARTNER



- 36,000 STUDENTS – 50% MA students and 50% PhD students (GUCAS)
- 37,500 SCIENTISTS (CAS)
- 92 RESEARCH INSTITUTES IN CHINA (CAS)



- 100 SCIENTISTS
- 75 PhD STUDENTS
- 300 MA STUDENTS
- DANISH/CHINESE - 50/50

DANISH PARTNERS

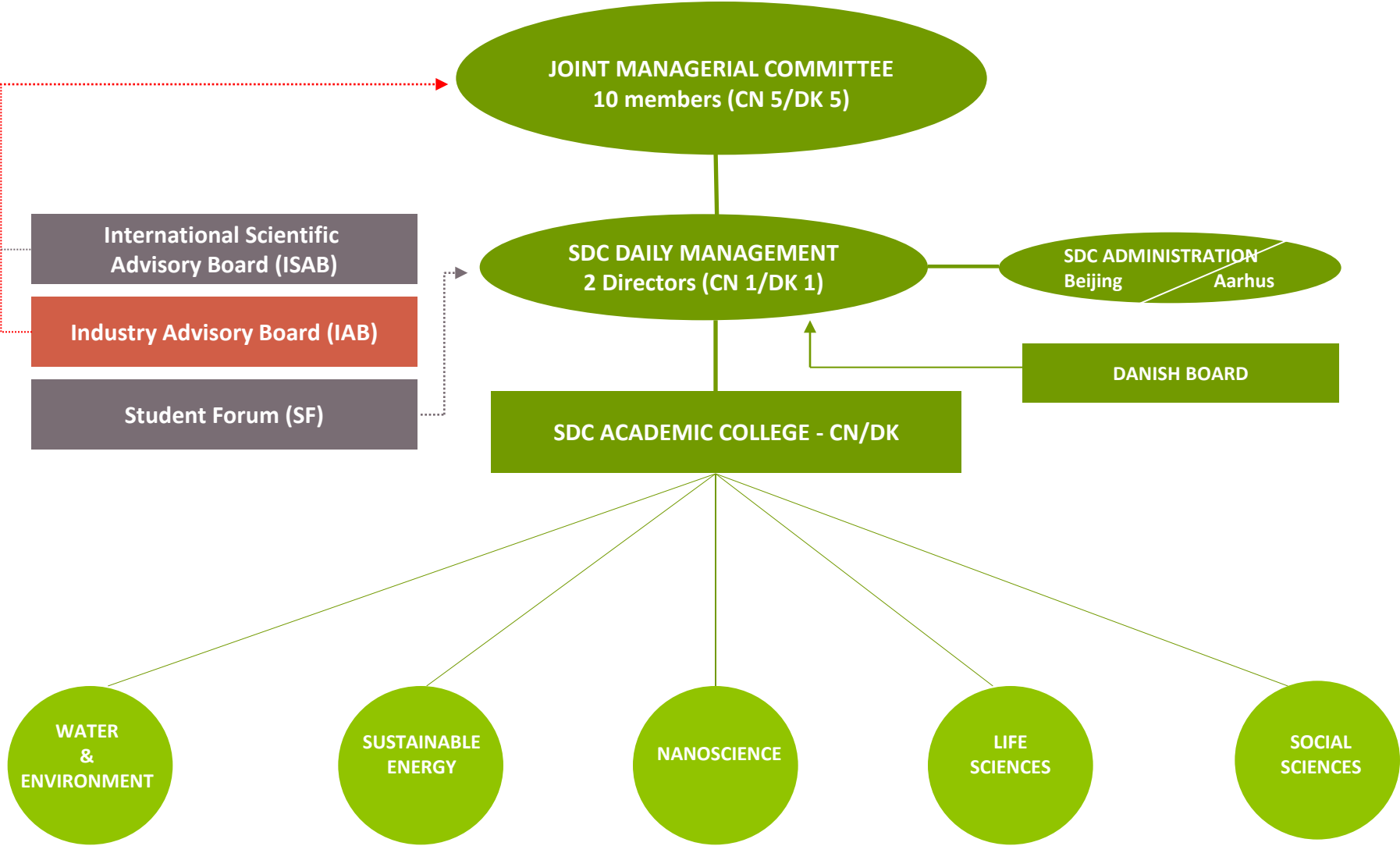


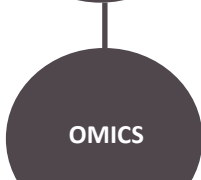
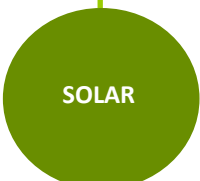
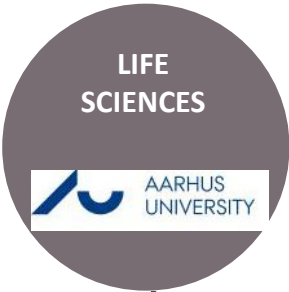
High level commitment



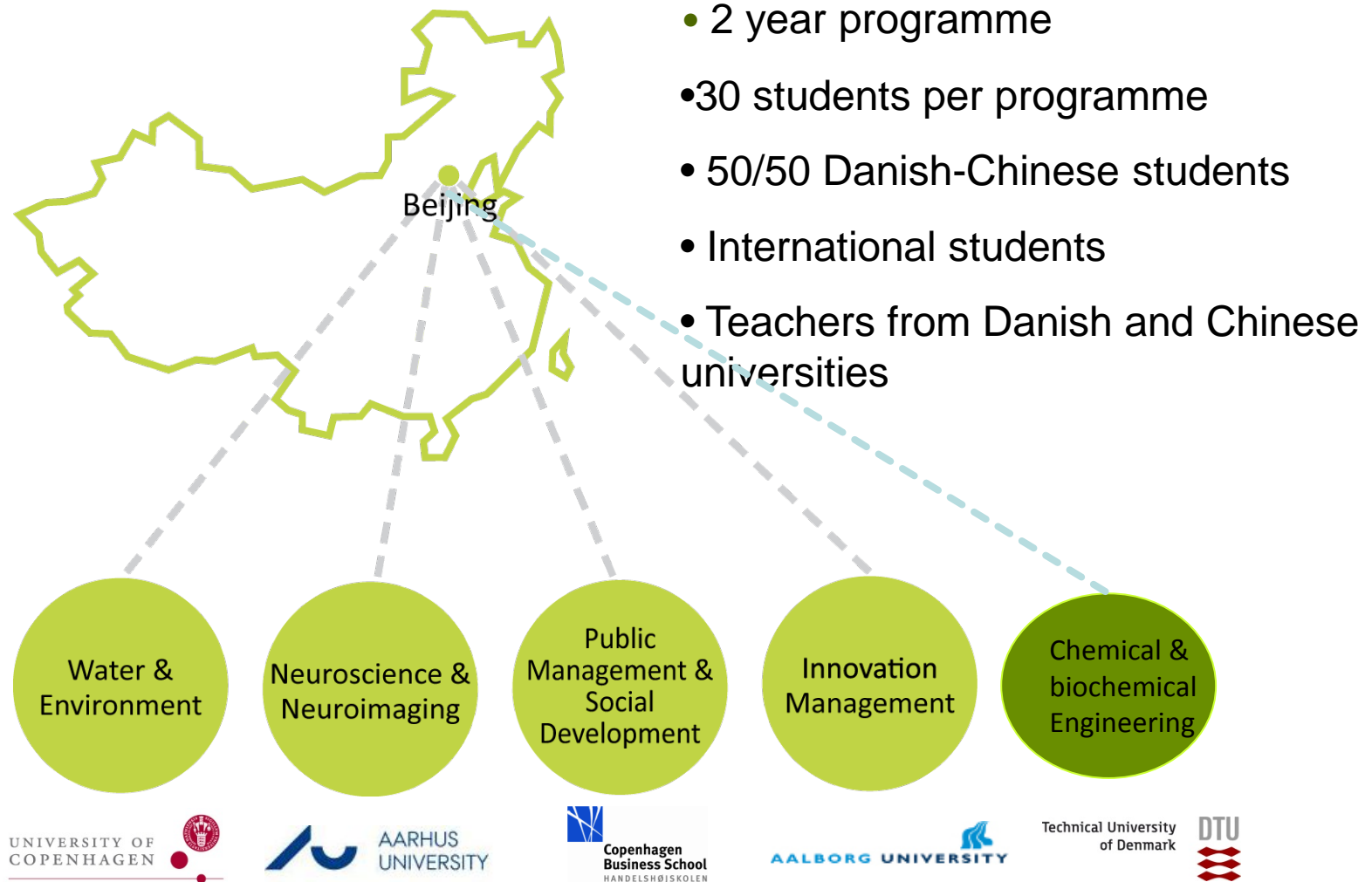
Signing ceremony, April 12, 2010.

Chinese Premier Wen Jiabao and Danish Prime Minister Lars Løkke Rasmussen, Prof. Bai Chunli, President of the CAS and the GUCAS, Danish Science Minister Ms. Charlotte Sahl-Madsen and Prof. Jens Oddershede, Chairman of Universities Denmark





Master programmes



Master programmes

- New programmes, currently non-existing
- Double degrees – one from the leading Danish university and one from GUCAS
- High standards – accredited in Denmark and China
- Internships in private companies
- Emphasis on problem-oriented approach



The House of the Danish Industry Foundation

THE BUILDING:

- Sponsorship of 80 mio. DKK from the Danish Industry Foundation
- Located at the brand new Yanqihu campus 80 km. from the centre of Beijing
- Designed by the Danish architects Lundgaard & Tranberg
- Includes teaching facilities, accomadation for researchers, social spaces and conference areas – 8,000 m²
- Inauguration in 2013

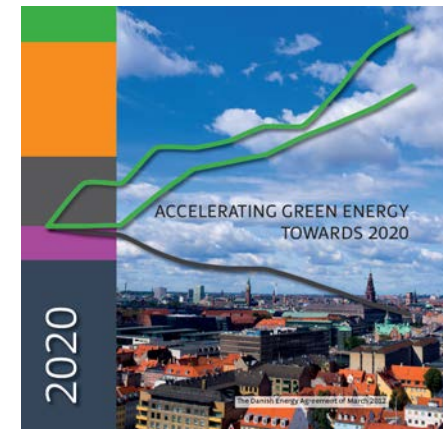


LUNDGAARD & TRANBERG 2011



One world one energy dream

- **Assure energy security of supply**
 - **Combat environmental degradation and climate change**
 - **Create sustainable economic growth**
-
- January 2010: The National Energy Commission China, headed by Premier Wen Jiabao
 - March 2012: The Danish government's Energy Agreement on accelerating green energy towards 2020



Our common future

Key energy indicators 2008	Denmark	China
Total Population (million)	5.5	1,325.6
Total Primary Energy Supply (Mtoe)	19.01	2,131
Total Primary Energy Supply / Population (toe/capita)	3.46	1.60
Total CO ₂ (Mt of CO ₂)	48.41	6,508.24
CO ₂ / Population (t CO ₂ /capita)	8.82	4.91
CO ₂ / Total Primary Energy Supply (t CO ₂ /toe)	2.55	3.08
Share of RE in gross final energy consumption (2010)	18.8%	9%*
- RE goal by 2020	35%	15%*
Share of RE electricity in gross electricity consumption (2010)	26.1%	-
- RE-E goal by 2020	50%	-

Source: Key World Energy Statistics, IEA, 2010; a.o. sources

Building on previous and existing Sino-Danish activities

- Centres of Excellence supported by the Danish National Research Foundation (DNRF) and National Natural Science Foundation of China (NSFC)
 - Danish-Chinese Center for Organic-based photovoltaic cells with morphology control. DTU and Zhejiang University. 2010-2013.
 - Danish-Chinese Centre for Nanometals – Bridging the Length Scales. DTU and Institute of Metals Research, Shenyang. 2010-2013.
 - Danish-Chinese Center for Intermediate Temperature Proton Conducting Systems. DTU Chemistry and CAS Green Chemistry and Process Laboratory. 2010-2013.
- Strategic Energy Research projects supported by the Danish Strategic Research Council and MOST, 2010-2015, incl.
 - Wind projects (e.g. dynamic wind turbine model, aerodynamics and optimisation of wind power systems, DC network connection with noel wind power generator, wind blade materials performance)
 - Solar projects (e.g. solar space heating and water heating, photovoltaics)
 - Buildings (e.g. Activating the Building Construction for Building Environmental Control)
 - Bio oils
 - Super bright light emitting diode

Sino-Danish RE programmes

Wind Energy Programme

- 2007-2010
- 45 MDKK and Chinese co-funds
- Hosted by ERI / NRDC
- Components:
 - Meso- and micro scale modelling
 - Grid codes, connection, absorption and WindPro training
 - Feasibility studies and training



Wind atlas for NE China. Site visit at mast by CMA and Risø DTU experts

RED Programme

- 2009-2013
- 100 MDKK + ~35 MDKK from China (and in kind)
- Hosted by ERI / NDRC
- Component 1:
 - National Centre for Renewable Energy
 - Three subsector strategies / roadmaps (wind, solar and biomass)
- Component 2:
 - Sino-Danish technology cooperation in wind, solar and bioenergy

Signing ceremony of CNREC, Feb 2012



Head of CNREC and Deputy Director of ERI
Mr. WANG



Danish Minister for Export and Investments
Ms. Pia Olsen Dyhr

SDC Sustainable Energy 2009-

- The *mission* of SDC Sustainable Energy is to conduct research and education activities at internationally excellent level in order to achieve a sustainable, affordable and clean energy system and economic growth.
- The *vision* of SDC Sustainable Energy is:
 - To achieve international excellence in research and education in sustainable energy
 - To establish and sustain a dynamic and ambitious research and education programme
 - To be an attractive partner for research collaboration
 - To attract top students and lecturers

Programme Management



Danish Principal Coordinator
BIRTE HOLST JØRGENSEN
Deputy Director

**DTU Management
Engineering**



**Chinese Principal Coordinator
and Head of Education**
ZHANG HONGXUN
Executive Dean, Professor
**College of Resources and
Environment,**
**Graduate University of
Chinese Academy of Sciences**



Danish Head of Education
KIM DAM JOHANSEN
Head of Department

DTU Chemical Engineering



SDC Sustainable Energy Sub-themes



Fusion 核聚变

PI CN: Dr. Jiangang LI, IPP CAS

PI DK: Dr. Volker Naulin, Risø DTU



Solar 太阳能

PI CN: Prof. Songyuan DAI, IPP CAS

PI DK: Dr. Peter Sommer-Larsen, Risø DTU



Wind 风能

PI CN: Prof. Honghua XU, IEE CAS

PI DK: Prof. Zhe Chen, AAU



Bio Energy 生物能

PI CN: Dr. Jian XU, QIBEBT CAS

PI DK: Prof. Kim Pilegaard, Risø DTU



Bio Thermal 生物质

PI CN: Prof. Weigang LIN, IPE, CAS

PI DK: Prof. Kim Dam-Johansen, DTU



Energy systems & policy
能源系统和政策

PI CN: Prof. Ji WANG, IPM, CAS

PI DK: Ass. Prof. Kenneth Karlsson, DTU

Chinese partners



- 12 branches
- 100 institutes



- College of Resources and Environment

FUSION

- CAS Institute of Plasma and Physics, Hefei
- CAS Institute of Metal Research, Shenyang
- Tsinghua University

SOLAR

- CAS Institute of Chemistry, Beijing
- State Key Laboratory Pol. Phys. Chemistry
- Changchun Institute of Applied Chemistry
- CAS Institute of Physics
- Zhejiang University

WIND

- CAS Institute of Electrical Engineering
- CAS Institute of Engineering Thermo Physics
- CEPRI

BIO-ENERGY

- CAS Institute of Botany
- CAS Institute of Biology
- CAS Qibebt
- CAS Institute of Process Engineering (Thermal)

SYSTEMS AND POLICY

- CAS Institute of Policy and Management
- Energy Research Institute / Chinese Center for RES (CNRES)

Danish partners

	Fusion	Solar	Wind	Bio-energy biology	Bio-energy thermal	Energy systems and policy
DTU	x	x	x	x	x	x
AAU		x	x	x		
AU		x				
KU				x		x
SDU	x			x		
CBS						
RUC						
ITU						

Fusion



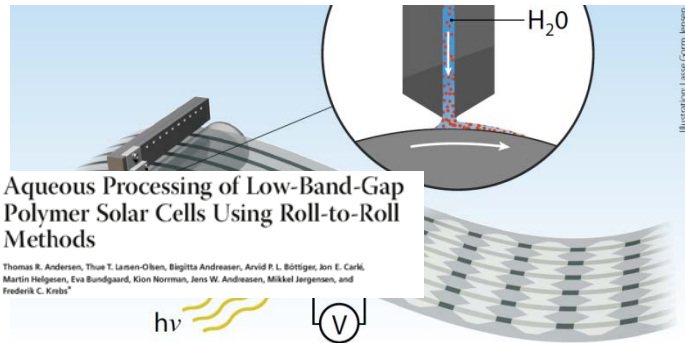
Beidahe, August 2011



Yan Ning: *"It is my honour to be a PhD student of the SDC collaboration between Denmark and China..... The study experience will be a precious memory in my life."*

- 1st SDC Plasma Physics Autumn School, September 2010, Hefei
 - IPP and DTU; 85 participants
- 2nd SDC Plasma Physics Autumn School, September 2011, Beijing
- SDC Materials Summer School, August 2011, Beidaihe.
 - IMR, DTU, Chongqing Uni and Tsinghua Uni.; 81 participants
- 4 Ph.D. scholarships, 2011-2014:
 - Ph.D. candidate Yan Ning on fusion edge turbulence, May 2011 (DTU and IPP CAS)
 - Ph.D. candidate Zhenbo Zhang on nanoscale steel to start shortly (DTU and IMR CAS)
 - Ph.D. scholarship on thermal stability of tungsten. Candidate to be selected (DTU, IPP CAS and Tsinghua University)
 - Ph.D. scholarship on ion temperature measurements, position and simulations. Candidate to be selected (DTU, IPP CAS)

Solar energy



Thomas Rieks Andersen is staying in Hangzhou with Prof. Hongzheng Chen (Zhejiang University) and Prof. Zhan Xiaowei (Inst. of Chemistry CAS) as supervisors, April to October 2011.

- SDC finances 3 Ph.D. candidates during research stays in China, 2011-2013:
 - Ph.D. candidate Thomas Rieks Andersen on Organic-based PV cells with morphology control (DTU, Institute of Chemistry CAS and Zhejiang University)
 - Ph.D. candidate Lasse Riisager on self-assembled high efficiency conjugated photovoltaic polymers (DTU, Institute of Chemistry CAS, Beijing Normal University)
 - Ph.D. candidate Arvid Piehl Lauritsen Böttiger on Nanostructure of organic based PV cells (DTU, State key lab. Pol. Phys. Chem., Changchun Institute of Applied Chemistry)
- Two SDC master courses under development:
 - Course in Solar Thermal
 - Course in Photovoltaics with special emphasis on third generation PV
- Annual workshop in solar energy technologies, starting in 2012 in Beijing
- Joint research proposals (DSF, MOST)

Wind energy



- 4 Ph.D. scholarships, 2011-2014:
 - Ph.D. scholarship on advanced control of wind power conversion system. Candidate to be selected (AAU and IEE CAS)
 - Ph.D. scholarship on wind farm integration. Candidate to be selected (AAU and IEE CAS)
 - Ph.D. scholarship on dynamic modelling and ancilliary services in large scale wind power. Candidate to be selected (DTU, IEE CAS and CEPRI)
 - Ph.D. scholarship on coordinated control of wind power plants and storage systems. Candidate to be selected (DTU Electrical Engineering and IEE CAS)
- Joint research proposals (DSF, MOST)

Middelgrunden offshore wind farm

Bio-energy - biology



- 4 SDC Ph.D. scholarships, 2011-2014:
 - Ph.D. scholarship in Biorefinery technology (enzymatic hydrolysis). Candidate to be selected (AAU and Institute of Biology CAS)
 - Ph.D. scholarship on Waste to value (enzymatic hydrolysis). Candidate to be selected (AAU and Institute of Biology CAS)
 - Ph.D. scholarship on Micro-algae and efficient biodiesel production. Candidate to be selected (DTU and Qibebt CAS)
 - Ph.D. scholarship on Genome-wide scan of cereal genes for bioenergy. Candidate to be selected (KU and Institute of Botany CAS)
- SDC symposium "Breeding for bio-energy crops", late autumn 2012

Bio-energy - thermal



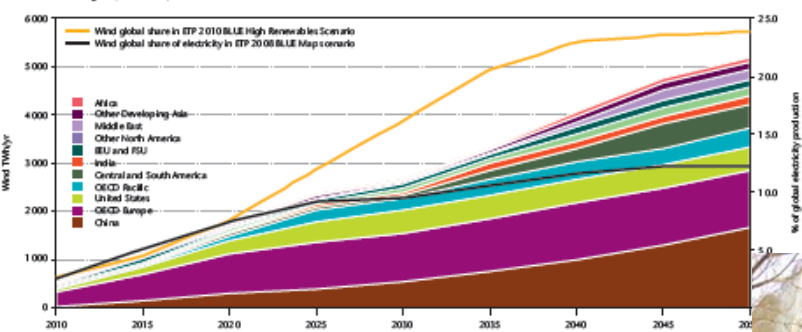
Kim Dam-Johansen receives the honor title Einstein Professor by **professor Jinghai LI**, Vice President of the Chinese Academy of Sciences and President of the Association of Academies of Sciences in Asia
July 2011

- 2 SDC 3 Ph.D. scholarships in 2011-2014 in thermal and catalytic conversion of biomass and waste
 - DTU Chemical Engineering and Institute of Process Engineering CAS
 - Some research activities will be performed in close cooperation with industrial partners
- Summer school with Ph.D. courses in thermal and catalytic conversion in 2012
- Exchange of postdoctoral fellows to enhance daily supervision of Ph.D. students
- Possible association with Nordic cooperation to be evaluated
- Possible association with Guangzhou Institute of Energy Conversion re Ph.D. education



Energy systems and policy

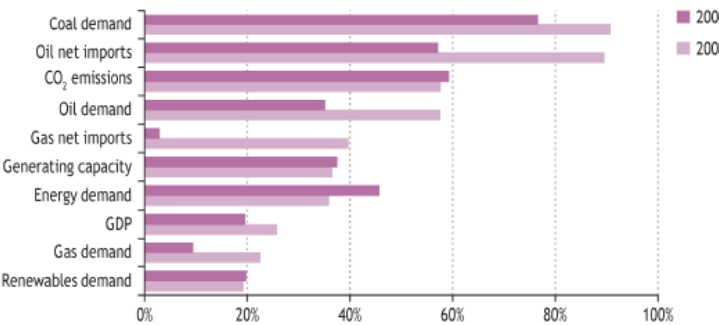
Regional wind power shares of global electricity (TWh), 2000-2050



- 1 Ph.D. scholarship in energy systems (DTU and CAS IPM in cooperation with the modelling group at CNREC/ERI)

Wind Energy Technology roadmap, 2010

China's share of the projected net global increase for selected indicators in the New Policies Scenario



World Energy Outlook, 2010



Ready to roll!



DOUBLE YOUR INSIGHT –
DOUBLE YOUR OUTCOME

Thank you for your attention