2nd Germany - China Forum on Climate Change and Energy

28 – 30 April 2009
University of Cologne, Germany

Sponsors:

Die Landesregierung Nordrhein-Westfalen

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Ministerium für Wissenschaft und Technologie, VR China

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1. Summary

The 2nd Germany-China Forum on Climate Change and Energy took place between 28.04 and 30.04.2009 in University of Cologne, with the participation of more than 65 German and Chinese scientists, government officials and industry representatives. The forum highlighted the great potential for collaboration between the two countries in climate change and energy. The forum participants reviewed the recent developments in the fields of climate and energy and proposed to establish a German – Chinese Institute for Climate Change and Energy. The core objectives of the joint institute are to combine the strengths of scientists from both countries

- To carry out high standard research on climate change and energy, including climate policy and energy economics;
- To facilitate the dialogue of energy and environmental technology; and
- To provide education and training programs with focus on climate science and renewable energy technology.

Figure 1: Group photo of the Chinese and German delegates in front of the main building of the University of Cologne.

2. Opening Adresses

Professor Liu Yanhua, Vice Minister of the Ministry of Science and Technology of China, and Professor Pinkwart, Minister of NRW Ministry for Innovation, Science, Research and Technology, attended the forum and contributed with seminal speeches.

Figure 2: Opening address by Vice Minister Professor Liu Yanhua (left) and Minister Prof. Dr. Pinkwart (right).

Professor A. Freimuth, President of the University of Cologne, and Professor H. Bolt, Member of Board of Directors, Forschungszentrum Jülich GmbH, also addressed the forum. Professor Jiang Zhenghua, President of the China Science Centre of the Eurasia Academy of Science and former Vice President of the People Congress of China, attended the forum and delivered a key note speech.

Figure 3 Minister Prof. Dr. Pinkwart, Prof. Jiang Zhenghua, Prof. Liu Yanhua and Prof. Dr. A. Freimuth at the opening session.

3. Key Notes

Figure 4: Prof. Jiang, Zhenghua, a former Vice President of the Peoples Congress of China, President of the China Science Centre Eurasia Academy of Sciences, gives a key-note speech to the forum entitled “The Future of Environmental Protection”.

Prof. JIANG focused on China’s perspective of climate change and energy consumption. He pointed out that the whole world is concerned about environment and the crisis promotes change. We should, with the same courage and the support of rigorous scientific research, call on all the people around the world to take actions. Forum is necessary, but actions are more needed.

In 2006, China enacted the Renewable Energy Resources Law. Later on, many supporting policies, laws and regulations were enacted in succession, including the Medium and Long-term Development Program for Renewable Energy Resources and the 11th Five-Year Plan for Development of Renewable Resources. According to these plans, the consumption of renewable energy resources in the country will reach 10% of total energy consumption by 2010 and 15% by 2020. In 2007, China saw a total investment of 12 billion US dollars in new energy and renewable energy resource development projects, the world’s second largest investment, second only to that of Germany. In the field of New and renewable energy, Germany has a large wealth of new technology and experience and China has a huge demand, which provide an ample room for our cooperation. Thirdly, Intensify scientific research and promote cooperation and innovation. I believe scientists should move governments to promote negotiations for better results from the following perspectives:

a. Combine economic recovery with environmental protection
b. Combine multilateral consultations with bilateral ones
c. Combine intergovernmental negotiations with communication among NGOs
d. Combine negotiations on emission objectives with consultations on technology transfer

HD Dr. Fink gave an overview of future energy mix strategy of the Government. Furthermore he presented new research results to regionalization of Global Models for Integrated Impact Research.

Detailed regional climate change projections with uncertainty estimates are pertinent to a range of climate impact assessments ranging from water availability, food security, over health to energy production. In the latter context, the fractional contribution of renewables to the German electricity demand is expected to almost double from 2007 until 2020 from 14% to 27%. Thus a reliable estimation of the future wind energy potential may be crucial to the calculation of profitability of wind energy farms. Furthermore, the temperature of river water during hot summers may significantly limit the power generation of thermal power plants – as was the case during the Central European heat wave in summer 2003.

The presentation will focus on the state-of-the-art approach to generate usable regional climate change projections. It will detail the four pillars of this approach: (a) global climate models, (b) methods of regionalization, (c) analyses of historical data, and (d) understanding of processes that govern regional climate change. Under (b) dynamical and statistico-dynamical regionalization approaches will be discussed. Results for Europe regarding changes in seasonal mean temperatures, precipitations, extreme heat and windiness and wind energy resources will be shown at the end of this century.

A proper application of downscaled and/or post-processed climate model data in climate impact research calls for integrated, trans-disciplinary approaches. Such an approach in combination with the use of the aforementioned four pillars has been conducted in the GLOWA-IMPETUS West Africa project. The talk will allude to the GLOWA-IMPETUS approach with a focus on the methods of integration in this project.

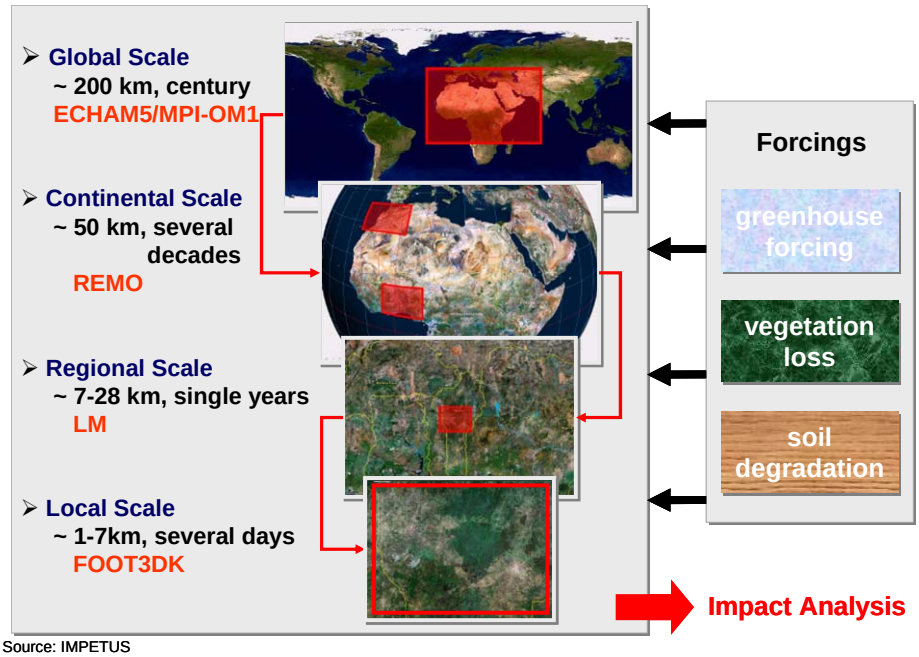


Figure 5: HD Dr. Fink gives a realisation of dynamical downscaling approach.

5. Session Climate Change

In this session, Prof. Wang Huijun, presented an overview of the recent climate modeling activities at the Institute of Atmospheric Physics, Chinese Academy of Sciences activities and discussed the climate projections using the Flexible Global Ocean- Atmosphere-Land System Model (FGOALS). He reported that the increased frequency and intensity of drought in the northern parts of China have been a serious issue in the recent 20-30 years. Their study in the near future will focus on advanced downscaling methods (higher resolution, nesting) and more detailed impact studies (climate extremes, water cycle, ecosystem, agriculture etc.) should be developed.

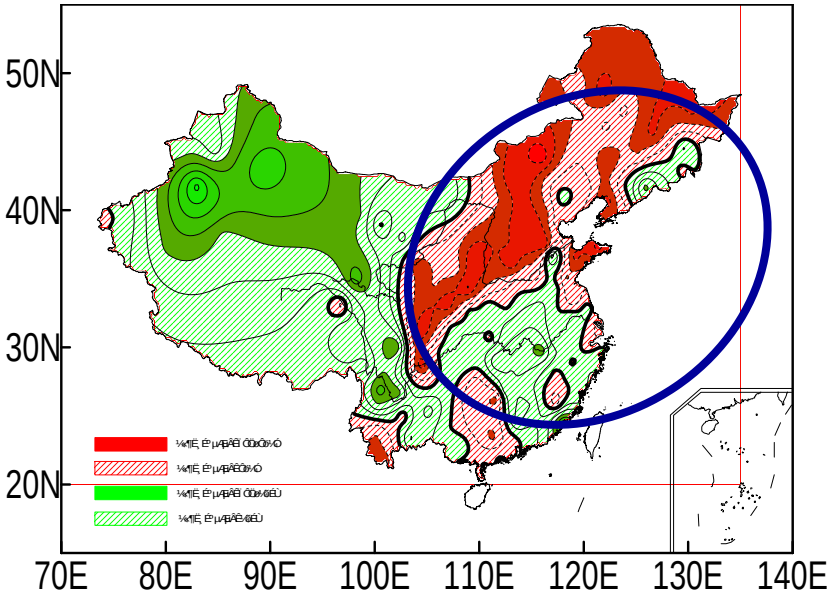


Figure 6: Prof. Wang Huijun, Director of the Institute of Atmospheric Physics, Chinese Academy of Sciences, presented an overview on global climate modeling and climate projections. He pointed out that drought in North China has been a serious issue in recent 20-30 years.

Prof. Klaus Fraedrich from the University of Hamburg presented alternative an approach to studying extreme climate events. His talk focused on past extreme climate events in the Changjiang River region and methods of their predictions. His study suggests that for that region the characteristics of future climate (2000 to 2040) are:

=> monsoon season lasts longer
=> monsoon-precipitation correlation strengthens
=> wetness increases / dryness decreases
=> temperature increases (but not in summer)
=> largest precipitation increases in september
=> typhoon number and intensity decrease
=> typhoon landfall decreases in number, but increases in intensity

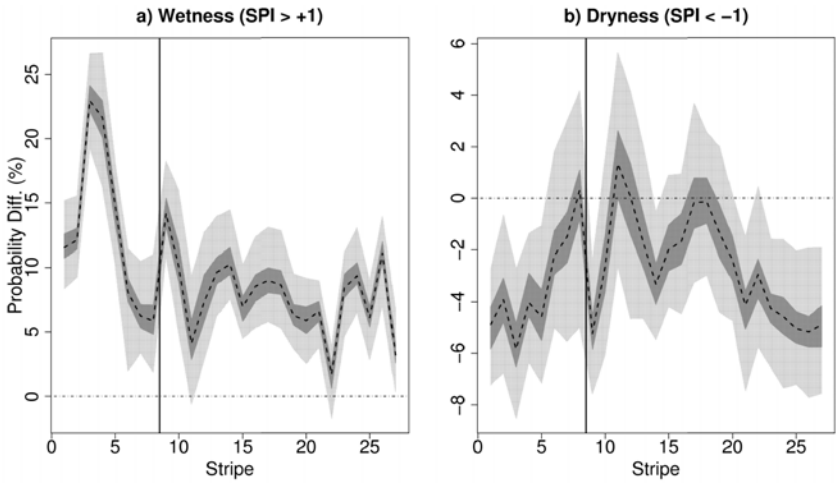


Figure 7: Prof. K. Fraedrich, a Max-Planck Fellow from the University of Hamburg, discussed the modelling of extreme climate events. Future change of extremes annual wetness/drought along the Yangtze indicates increasing wetness and decreasing dryness.

Dr. R. Zhu from the China Meteorological Administration presented the major initiatives by the National Climate Centre of the CMA on the national wide assessment of the long-term changes of wind and solar energy resources and the high-resolution simulation of wind energy distributions. In 2005, China wind atlas has been compiled based on measured wind speeds at more than 2000 meteorological stations for more than 50 years mostly at 10m height.

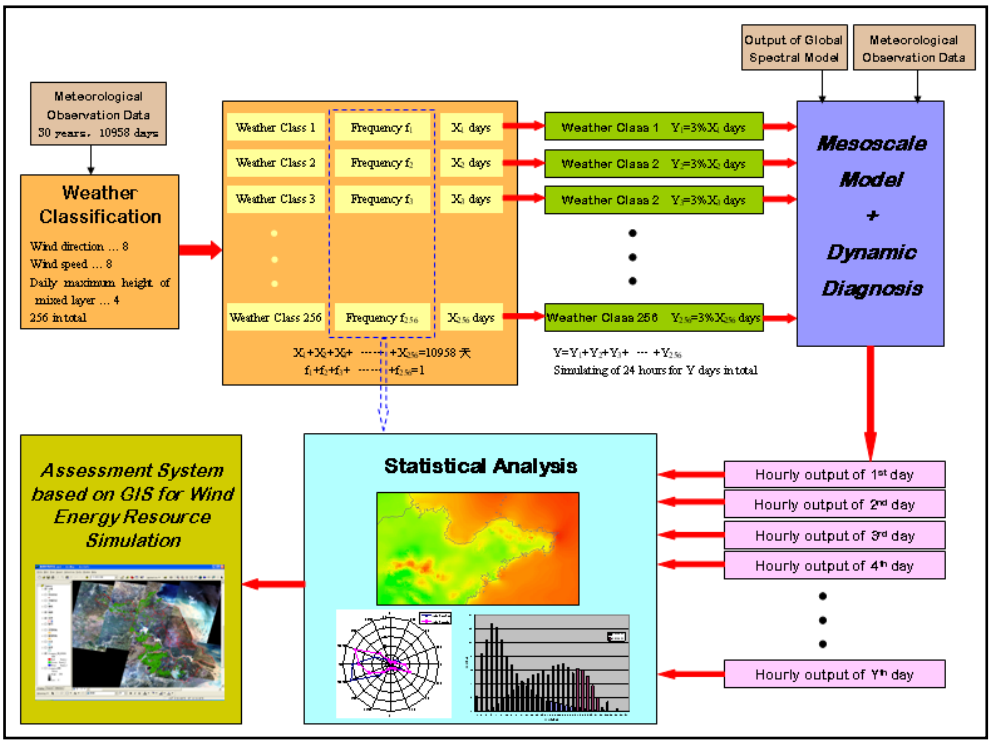


Figure 8: The modelling system of the China National Climate Centre for wind energy resources.

A most recent study is the investigation on the potential of developing wind power on a large scale in China to examine whether the wind energy resources of China can meet the demand for developing 200-300 GW installed capacity of wind power by 2030. A feasibility study for a 100 MW offshore wind farm located in the Jiangsu area is also in progress.

Advanced future regional climate change studies should based on statistical hypotheses building through ensemble simulations for regional climate change detection and attribution. In his presentation, Prof. A. Hense discussed the key areas for collaboration on climate research between Germany and China. He pointed out that regional climate modelling and applications should be one of the focal research topics.

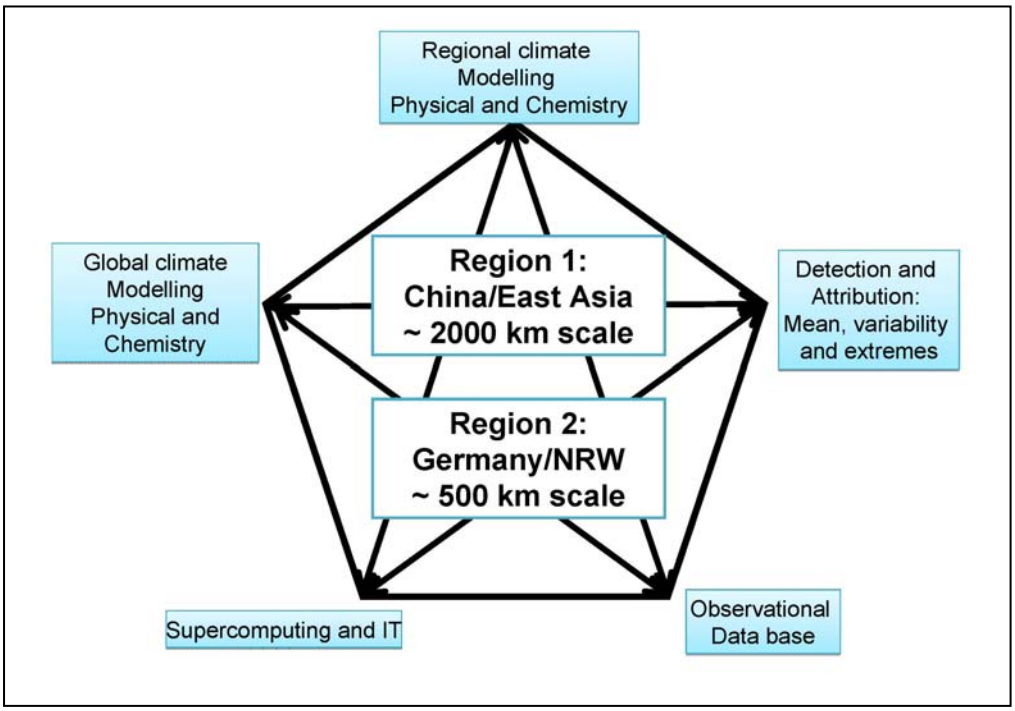


Figure 9: A proposal from Prof. Hense of Bonn University for collaboration in climate research between China and Germany.

6. Session Climate Disaster

The session focussing on natural disasters included five invited speakers. Prof. J. C .L. Chan presented a study on the relationship between urbanization and climate change in South China. Among other variation, a significant increase in temperature, haze days, and a decrease of solar radiation and relative humidity in recent decades were detected in South China, including Hong Kong. Prof. Chan discussed the strategies currently developed in order to understand effects of urbanization (focussing on the Pearl River Delta region), and to estimate what might be expected in future given current projections of changes in urbanization. Further, some new results on the link between global warming and the intensity of tropical cyclones were presented. The finding was that tropical cyclone activity in the western North Pacific shows no significant signal and hence does not follow the trend in the global increase in atmospheric or sea-surface temperature.

Prof. L.Y. Liu reported on the main natural disasters affecting China. Meteorological disasters in China are frequent, widespread, and include many different types of events (from typhoons to droughts). Hydro-meteorological disasters are, together with earthquakes, the most impact factor, and account for 80-90% of the total losses due to natural catastrophes in China. Frequency and intensity of typhoons making landfall in China affecting mostly the southern and eastern shoreline provinces were analyzed. Additionally, results on snow/ice storms (e.g. January 2008), and dust storms (e.g. mid-April 2006 event affecting Beijing) were reported. For the latter event, impacts on air quality over the affected areas were considered. Prof. Liu pointed out that there is a major need in China to establish climate disaster monitoring, prediction and reaction system.

Figure 10: Impact of a winter storm on traffic in southern China.

Dr. J.G. Pinto reported on meteorological extreme events under climate change and implications to the insurance industry. An overview of natural catastrophes worldwide and mechanisms developed by the insurance industry in order to deal with natural catastrophes were explored. Natural catastrophes and their climate related forcing with special focus on European winter storms were discussed. The conclusion was that even though climate change is a threat (enhanced risks), it may also be seen as a chance: insurance companies adapting their strategies earlier to the new conditions may have better chances to consolidate their market position.

Prof. S. Crewell reported on remote sensing applications for the diagnostic of natural catastrophes. Such applications are pertinent for both the preparation for such events (e.g. forecasting) and for latter evaluation of their impacts. Examples were provided, which cover

very different phenomena like the Elbe flood from 2002, droughts in Australia, monitoring of sea ice, wild fires, dust storms in China, and which include information about different observation techniques/satellites. Prof. Crewell demonstrated that remote sensing provides additional possibilities to detect the impact of natural hazards in near real time and this is especially important in a variable climate. In a next step, information from remote sensing needs to be connected with models in order to set up effective early warning systems.

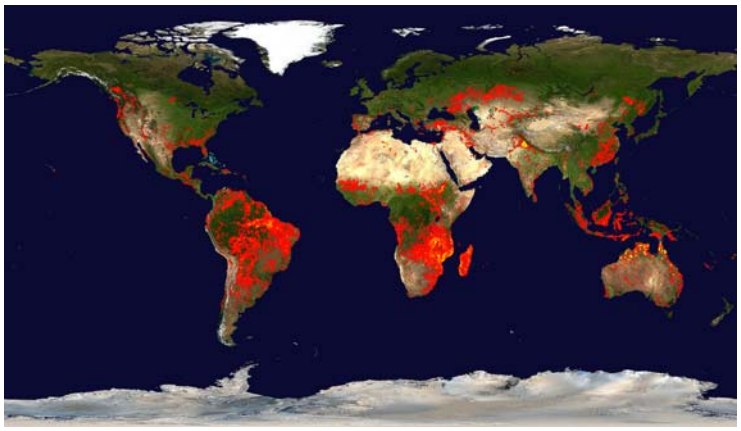


Figure 11: MODIS rapid response system. 10 day global fire maps 10/18/09 - 10/27/09. Extreme high temperature associated with global warming may lead to increase forest fire.

Prof. K. Schneider reported on modelling of plant growth, biomass production and plant water use under global change conditions. Water is one of the key environmental resources and serves a multitude of natural and socio-economic functions. The requirement of integrated modeling in the global change context was pronounced exploiting examples from the DANUBIA project. The impact of climate change upon plant growth and water and nitrogen fluxes was discussed with respect to socio-economic consequences associated with an increasing demand for food and water. Several (adaptation) strategies are being developed to increase food and biomass production and to balance biomass production, water demand and supply.

7. Session Energy Technology

The emphasis of this session is placed on the applications and industrial aspects of new energy technologies.

Prof. Wang Jiyang gave a talk on the opportunities of Sino-Germany collaboration in geothermal energy. He reviewed the status and developments of thermal energy in the world and gave numerous examples of thermal energy applications in China. He concluded that "Geothermal energy is a realistic, reliable & competitive energy source and independent of weather condition. Presently, the most rapidly growing sector of geothermal utilization is heat pump (GHP) application. The main reason for this is: GHP can be installed economically all over the World. The total CO2 emission reduction potential of GHP has been estimated to be 1.2 billion t/a or about 6% of the global emission. There's bright future in Sino-Germany cooperation in geothermal development".

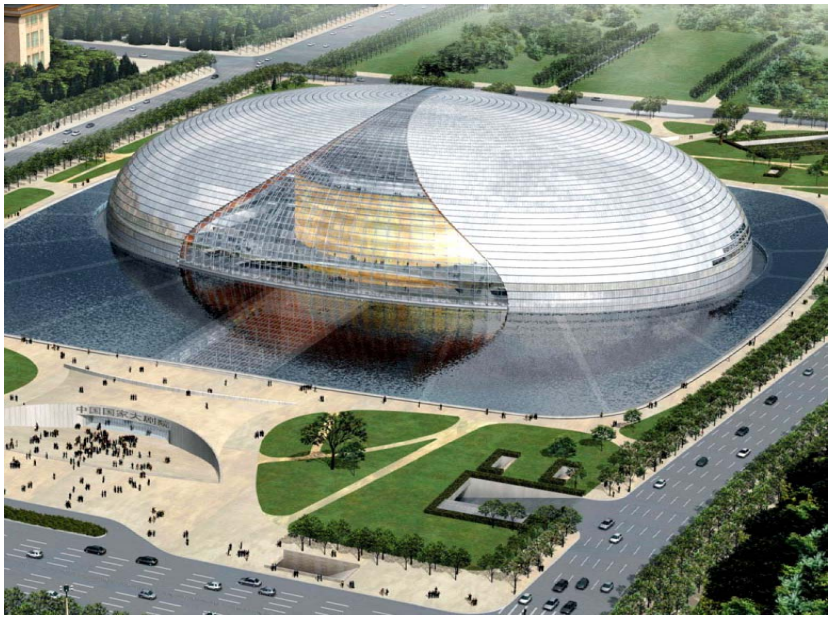


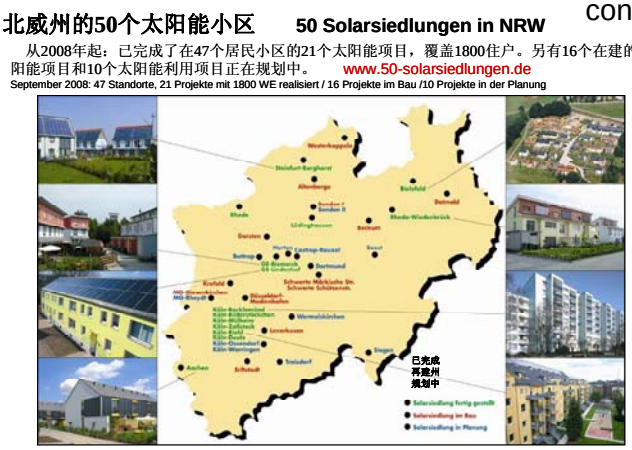
Figure 12: Geothermal technique used to provide heating for the national opera house in Beijing.

Figure 13: Mr. Du Deli, CEO of Deli Solar Technology Ltd, at the forum.

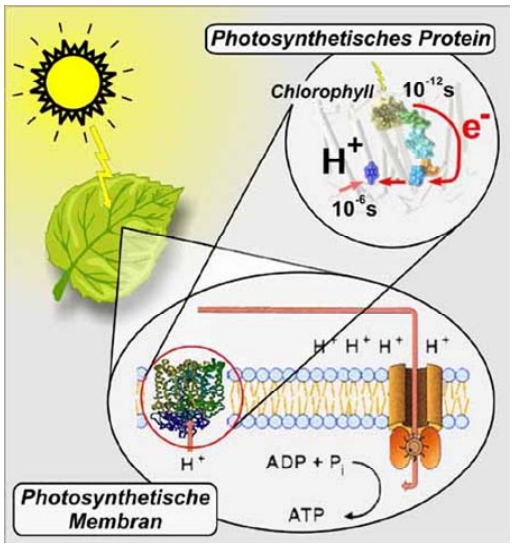
The Deli Solar Technology Ltd is primarily engaged in the field of investment, development, production, distribution and related construction projects, major technology and products in the areas: the use of solar energy, biomass energy use, a new type of fuel (Light hydrocarbon, ethanol), energy-saving stoves, biomass stoves and energy-saving technologies and products in the development and application. Mr. Du presented that as the overseas listing of domestic early in the new energy, a high-tech company, the Deli Solar has been operating with a new energy integration as its mission, aimed at reducing emissions for all sectors to provide energy-saving system planning, design, implementation, applications, and promote the overall solution.

RWE Power is the electricity producer in the RWE Group in Continental Europe. Dr. Keller pointed out that coal is essential for the energy mix, but has to become more climate-friendly. A strategy for new build plants at RWE Power consists of Clean Coal Power Plant Projects has been presented. The new power plant generation are special IGCC-CCS (Integrated Gasification Combined Cycle-Carbon Capture & Storage) plants. The advanced technology can achieve an efficiency of 48.5 %.

The Energy Agency of North Rhine-Westphalia (NRW) acts as an operational platform with a wide range of competence in the energy domain: from the all-through funding of research, technical development, demonstration and market launch to energy consultancy and continuous training. Dr. Baumann, Director of the Energy Agency, focused his discussion on future energies from the North Rhine-Westphalia (NRW) perspective and described the activities of the NRW industry in China. NRW is highly qualified to further develop energy technologies. In comparison to other regions, the development can be managed on an existing basis (tradition). The Know-How exists for the complex coherences in the energy branch. North Rhine-Westphalia has been known as the „Power-House“ of Europe.



Artificial photosynthesis as an instrument for getting more renewable energy has been discussed by Prof. Yang Chunhong. Solar energy is a non-limited renewable energy source. Photosynthesis is a process in plants that has been refined for 3.5 billion years. Photosynthesis is the most efficient process in harnessing solar energy.



Photosynthesis: a process in plants that has been refined for 3.5 billion years!

$$CO_2 + H_2O + [\text{light energy}] \longrightarrow O_2 + \text{carbohydrate}$$

Figure 14: Photosynthesis is the most efficient process in harnessing solar energy.

8. Key Notes of Academician Yan Luguan and Prof. A. Wahner

One of the highlights of the presentations was the key note about an estimation of large non-hydro renewable power generation in China by Prof. YAN Luguang, an Academician of Chinese Academy of Sciences. Prof. Yan provided an overview of the general situation and main features of energy development in China and presented the estimates of energy development in China till 2050. He emphasized the importance of large-scale non-hydro renewable power generation such as wind, PV, solar thermal and biomass power generation.

Prof. Yan pointed out that China is entering the phase of establishment of the sustainable energy system. It is very urgent to promote the energy structure change along the direction of significant coal percentage reduction and non-hydro renewable energy percentage increase. Large scale development of non-hydro renewable power is very important for the success.

It is needed to have a long term National Large-Scale Non-hydro Renewable Power Program to provide enough and stable support for a continuous, step by step and fast development. The international cooperation is very important. Prof. Yan concluded that non-hydro renewable energy should be large scale to provide about 15 % total primary energy in China by 2050.

Figure 15: Prof. YAN (right) has given an overview about Chinas energy strategy.

Prof. Wahner from the Jülich Forschungszentrum discussed the relation between air quality and climate change. As an example, the relationship between air quality and mortality was shown for the heat-wave case in August 2003. Fine particles have a major impact on human health. Therefore, Chemistry-Climate-Interaction is one of the most important research topics. Anthropogenic and biogenic emissions influence to a large extend the chemical and physical state of the troposphere and change air quality and climate

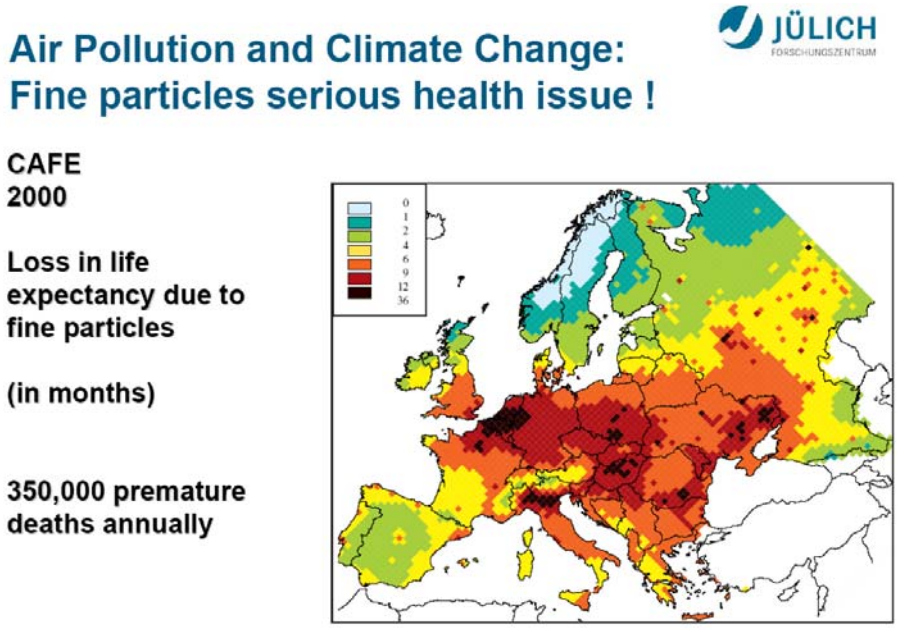


Figure 16: Prof. Wahner discussed the impact of air pollution on human health and the relation between air chemistry and climate change.

9. Session Air Quality and Climate Change

Regional Air Quality Modelling and Data Assimilation have been discussed by Dr. Strunk. Air Quality (AQ) has a strong impact on human health, vegetation and climate (biogenic/anthropogenic aerosols, ozone). Modelling is an important tool for managing Air Quality, regulation impact studies (*scenarios*), short term warning system for person at risk and for monitoring (*feed-back to public authorities/governmental agencies*).

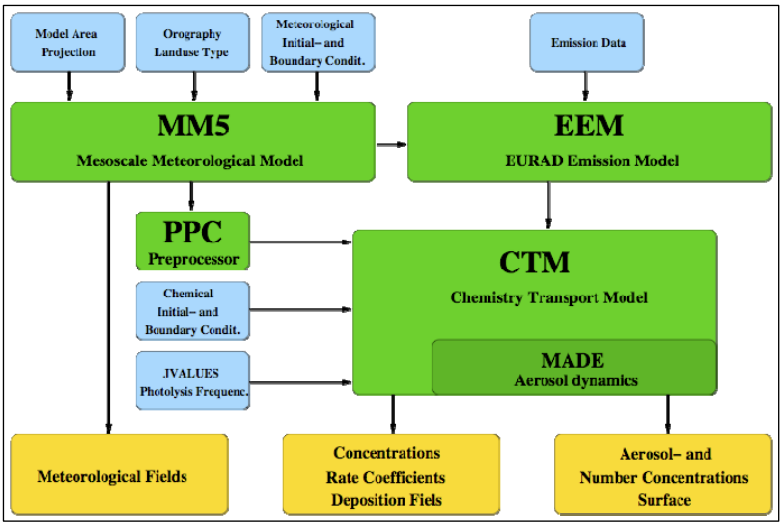


Figure 17: EURAD-IM-System (European Air Pollution Dispersion Inverse Model)

Regional air quality involving advanced data assimilation may generate reliable analysis based forecasts, help improving unknown / uncertain model parameters, reveal model deficiencies / strengths and help identifying climate forcings and their attribution.

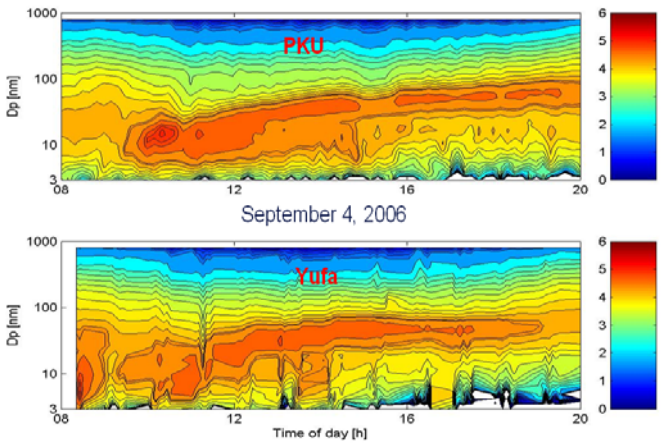


Figure 18: Regional New particle formation in Beijing.

Detailed discussions on aerosol characteristics have been presented by Prof. Hu Min from the Peking University. The primary source of aerosols is natural (biogenic) and anthropogenic. The connection between aerosols and air pollution, with a special focus to mega cities was shown. Increasing population, vehicles, expansion and economic development can be driving forces for air pollution. An understanding of the transport and transformation of primary emissions and gaseous precursors is necessary to understand regional air pollution. Aerosol characteristics is basic to understand its role for climate change.

Figure 19: Prof. Emeis presents an overview about air quality in megacities as a challenge for interdisciplinary research.

The link between land-use, energy, transportation, air quality, climate change and health demonstrates the interaction and tackles central problems in a megacity. Research focus with respect to megacities consists on the development and validation of innovative techniques for the assessment of emissions and air quality (e.g. road traffic, airports) incl. remote sensing and inverse modeling. Air quality and health impact assessment studies are essential prerequisites for mitigation and adaptation strategies. In an additional aspect, Prof. Song discussed the issue of biomass burning emission in China. China is an agricultural country with vast areas. Biomass burning is still popular in agriculture families. Emissions from biomass burning in China could be very large, which have significant effect on climate and atmospheric environment.

10. Session Energy and Climate Strategy

PD Dr Lindenberger presented the European and German Climate and Energy Strategy with the Focus of Renewable Energy. In March 2007 the European Council declared the following EU Objectives until 2020: Reduce Greenhouse Gas Emissions by at least 20%, increase Energy Efficiency as to Reduce (Final) Energy Consumption by 20% and to increase Renewable Share in (Final) Energy Consumption to 20%. The changes are based to the Kyoto base year 1990. Examples of model-based Renewable Policy Analysis are as follows:

- Renewable expansion up to 45% until 2030 (EU 27) is feasible under a number of conditions
- In the scenarios electricity generation from wind power (onshore and offshore) expands considerably
- Biomass expands considerably (result sensitive to biomass price assumptions)
- Market penetration of new technologies like Photovoltaics, Geothermal Power sensitively depends on technology-specific financial support
- Economic Efficiency gains through EU harmonisation of financial support, inducing competition between plant sites and technologies, reach between 100-200 Bill. Euro (scenario-dependent, accumulated 2008-2020)

The simulations also show that:

- There is considerable demand for (dispatchable) generation capacity providing reserve and balancing power (capacity credit of additional wind power in Germany is only about 5%)
- Utilization of conventional (non-renewable) power plants decreases: base-load capacities (>7000 h/a) are approx. halved until 2030
- Considerable flexibility is needed in the power system: electricity storage (e.g. CAES), wind in-feed management, demand side management
- Electricity grids (mainly transmission) need to be expanded

Long-run vision: “European Super-Grid“

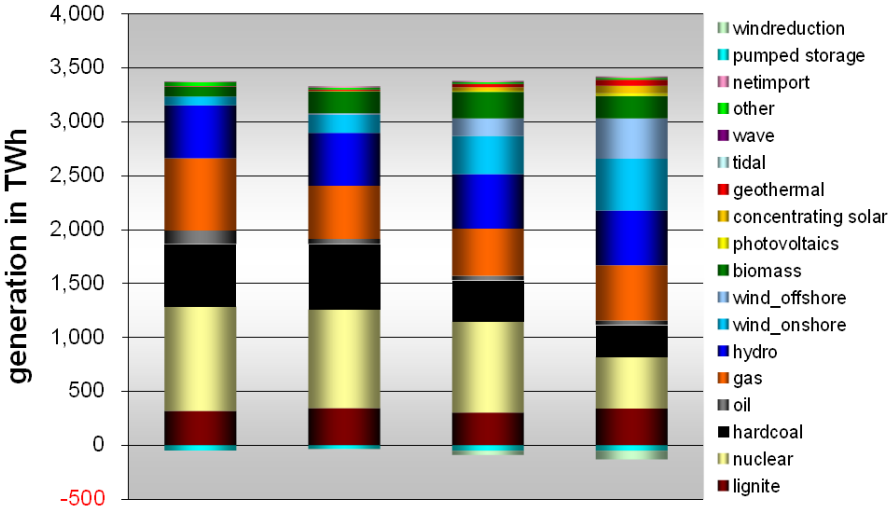


Figure 20: Example of model-based Renewable Policy Analysis Harmonized Quota Scenario – Electricity Generation EU 27.

Clean Development Mechanism (CDM) is an efficient instrument for realizing more renewable energy projects. An introduction to China CDM Fund is given by Dr. Wen. The establishment of China CDM Fund is a pioneering effort of great international significance made by the Government of China to take actions of addressing climate change, and it will play a piloting role in tackling climate change through international cooperation. This clearly shows that the Government of China attaches great importance to global climate change, and is very supportive of developing climate change related business and industries. The China CDM Fund is created as a policy-oriented and development served fund. The mandate of the Fund is to support national activities of addressing climate change so as to promote national sustainable development. China CDM Fund will operate its business to integrate scattered financial resources and to make integrated efforts for the better and faster national development.

In order to support national actions of tackling climate change, new financing channels and ways will be explored and established to mobilize national and international, and government, private sectors and other institutions owned financial resources. China CDM Fund is developing strategic partnership with the World Bank, Asian Development Bank, United Nations Industrial Development Organization. Under the strategic partnership, concrete cooperation has been initiated.

China CDM Fund is working with line Ministries to promote local governments enhancing their actions of addressing climate change, including to explore new areas and resources for international economic cooperation at local level.

Dr. Fischer compared the energy and climate policies in Germany and China. Her talk “Same Bed, Different Dreams or Vice Versa” generated much interested debate among the participants.

The challenge of wind power generation in offshore regions has been presented by Dr. Türk. He has been summarizing the offshore wind conditions, environmental conditions like corrosive environment and sea state, opportunities, advantages, risks, disadvantages and the challenge of grid integration. The European Community (EU) is supporting the sustainable integration of Renewable Energy Systems (RES) in the electricity supply system by means of:

– Describing common requirements
– Develop quality criteria
– Support international pre standardisation activities
– Propose test and certification procedures concerning connection, safety, operation and communication
– Collaborate and create (joint) facilities

11. Session Cooperation

Forum participants have reviewed the existing collaborations among the groups and identified potential areas for future collaborations. It has been pointed out the natural science and social science must go hand in hand in the research on climate and energy.

The forum again highlighted the great potential for collaboration between the two countries in climate change and energy. Forum participants emphasised the need for coordinating the various research programs and collaborations and need for establishing the Germany – China Joint Research Institute on Climate and Energy (GCRC). Such a joint institute will be of great benefit to both countries.

Figure 21: Prof. P. Speth (left) and Prof. A Wahner at the discussion session.

Prof. Jiang and Prof. Speth gave speeches at the closing session of the successful forum. Prof Jiang pointed out the great potential of the Germany-China cooperation in the field of climate change and energy. Due to high quality of the presentations and the in-depth discussions, the spirit of optimism becomes very convincing. It was concluded by Prof. Speth that we should take prompt and concrete actions on the closer cooperations.

13. Visiting energy facilities and research institutes

13.1 Wind energy systems

Since 1998, Windtest Grevenbroich Gmbh has been operating a test field for wind energy systems on the Neurather Höhe hill south of Grevenbroich near Neuss. It is the largest inland test field in the world. Prototypes and test systems with a capacity of 600 kW to 2,500 kW are currently tested there and measured according to international standards. After completion of the work, the systems are dismantled and replaced by new prototypes.

Clients and owners of the wind energy systems are generally the manufacturing companies. Windtest Grevenbroich provides the test field with the necessary infrastructure, the measuring technology and the services. The collected data from various measurements, such as stresses, performance curves or electrical characteristics, are used by the system manufacturers to optimize the components as well as the mechanical, dynamic or electrical characteristics of their wind energy systems.

Figure 22: Overview of the inland test field.

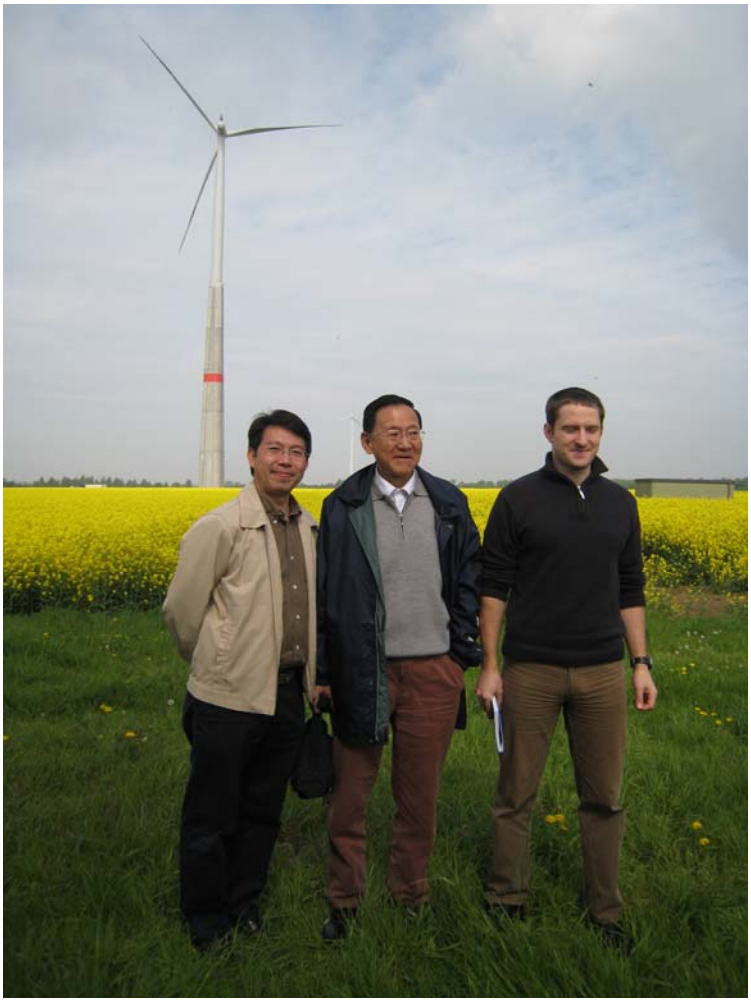


Figure 23: Some participants at a wind turbine with 160 m height hybrid tower.

13.2 Lignite-fired power plant

The RWE Power core competencies are the construction and operation of power plants and the extraction of energy raw materials. Here we are experts of long standing.

The beginning of Rhinish lignite mining goes back nearly 150 years. In 1898, RWE was already generating power in a small municipal utility. At RWE, progress has a long tradition. By now, our power plant portfolio, including affiliates, consists of 24 large-scale power plants and numerous smaller generating facilities. RWE Power, with two registered offices in Essen and Cologne, operates a number of power plants in many federal states, from Lingen in Emsland to Gundremmingen in Bavaria/Swabia. Including the power acquired from third parties, we make available some 205 billion kWh of electricity a year. This is enough to cover the power needs of 45 million households. RWE Power also produces a considerable quantity of heat. And we have one more invaluable resource to market: our knowledge. Over 40 countries import our technical, economic and ecological expertise in the areas of mining, recultivation, power generation and lignite upgrading.

Three reasons speak for German lignite: economic efficiency, environmental compatibility and security of supplies. In the base load range, it makes a crucial contribution toward maintaining a secure and low-cost energy supply as a subsidy-free and domestic source of energy.

Our lignite deposits will be available for generations to come. We extract just less than 100 million tons of lignite per year, a quantity ensured until the middle of this century by existing approvals for opencast mines based on deposits of up to 4 billion tons. These facts make it clear that lignite plays a key role in the energy mix of RWE Power.

Since our lignite is located just under the surface, it is mined in opencast operations. In the opencast mines of Garzweiler, Hambach and Inden, gigantic bucket wheel excavators dig the brown gold out of the earth. These excavators are the hallmark of the state-of-the-art mining technology used by RWE Power: standing 90 meters tall and 200 meters long and weighing some 13,000 tons, they are some of the world’s largest mobile machines.

Lignite-based power generation places heavy demands on the efficiency of power plants, particularly where climate protection is concerned. The finest example of their technical performance is our lignite-fired power plant with optimized plant engineering (BoA) at Niederaußem. With over 43 per cent efficiency, this unit is setting standards worldwide. Compared with legacy systems, it can reduce CO2 emissions by up to 3 million tons per year.

Furthermore, we are bundling our research projects for lowering and converting CO2 in this plant and its technology. Research and development projects are an important component in our CO2 climate-protection strategy, and these activities have turned Niederaussem into a "Coal Innovation Centre". Here, we are gaining invaluable insights that can be ported to other plants. This is also where RWE Power wishes to cultivate an increased exchange with international experts.

Figure 24: Group photo at RWE representation centre (Castle Paffendorf).

Figure 25: Overview presentation at RWE centre (Castle Paffendorf).

Figure 26: Group photo at RWE lignite coal power plant Niederaußem.

Figure 27: Some detailed discussion with the tour guide.

14. Acknowledgements

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- Prof. Dr. Jiang, Zhenghua, Vice President of the 9th People's Congress of China
- Prof. Dr. Pinkwart, Minister for Innovation, Science, Research & Technology
- Prof. Dr. A. Freimuth, President of University of Cologne
- Prof. Dr. H. Bolt, Member of Board of Directors of the Forschungszentrum Jülich

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- Dr. P. Zygojannis (Rektorat, University of Cologne)
- Ms. Y. Y. PAN (China Science Centre, IEAS)

15. Appendix A: Forum Program

Date	Event	Speakers
28 April		
8:30 – 9:00	Registration	
9:00 – 9:30	Opening address	Prof. A. Freimuth, President, Uni. Cologne Prof. A. Pinkwart, Minister für Innovation, NRW Prof. LIU, Y. H., Vice Minister, MOST Prof. H. Bolt, Vorstandsmitglied, JFZ
9:30 – 10:00	Coffee Break, Press, Group Photo	
10:00 – 11:00	**Key Note:** Climate Change and Energy, China's perspective **Key Note:** Climate Change and Energy, Germany's perspectives	Prof. JIANG, Z. H (30 min) HD Dr. A. Fink (30 min) *Chair: Prof. PENG, G. B.*
11:00 – 12:40	**Item 1: Climate change** Keywords: Global climate change; Regional climate variability; Climate disaster; Climate modelling and monitoring	Prof. WANG, H. J. (20 min) Prof. K. Fraedrich (20 min) Dr. ZHU, Rong (20 min) Prof. A. Hense (20 min) *Chair: Prof. C. Simmer*
12:40 – 14:00	Lunch	
14:00 – 16:00	**Item 2: Climate disaster** Keywords: Climate disaster; Warning system	Prof. CHAN, J. C. L. (20 min) Dr. J. Pinto (20 min) Prof. LIU, L. Y. (20 min) Prof. S. Crewell (20 min) Prof. K. Schneider (20 min) *Chair: Prof. LIN, Z. H.*
16:00 – 16:20	Coffee Break	
16:20 – 18:00	**Item 3: Energy Technology** Keywords: Coal technology in Germany; Carbon capture and storage; Renewable energy (wind, solar, biomass)	Prof. WANG, J. Y. (20 min) Dr. D. Keller (20 min) Dr. F. M. Baumann (20 min) Prof. YANG, C. H. (20 min) *Chair: Prof. ZHANG, Y. H.*
Evening	Conference Dinner beginning at 19:00	
29 April		
9:00 – 10:00	**Key Note:** Energy Use and Production, China's perspective **Key Note:** Air Quality and Climate Change	Prof. YAN, L. G. (30 min) Prof. A. Wahner (30 min) *Chair: Prof. P. Speth*
10:00 – 10:30	Coffee Break	
10:30 – 12:10	**Item 4: Air Quality and Climate Change** Key Words: Air pollution modelling, monitoring, atmospheric chemical processes; atmospheric boundary layer processes; link between climate impact, climate disaster and climate change.	Dr. A. Strunk (20 min) Prof. HU, M. (20 min) Prof. S. Emeis (20 min) Prof. SONG, Y. (20 min) *Chair: SHI, P. J.*
12:10 –	**Lunch**	

13:30		
13:30 – 15:10	**Item 5: Energy and Climate Strategy** Key words: China's strategy to meet future needs; Germany's strategy and experience; Energy mix; Legislation	Dr. D. Lindenberger (20 min) Dr. WEN, G. (20 min) Dr. D. Fischer (20 min) Dr. M. Tuerk (20 min) *Chair: Prof. M. Bettzüge*
15:10 – 15:30	Coffee Break	
15:30 – 16:30	**Item 6: Cooperation** Key words: Research, development,	*Prof. A. Wahner, Prof. WANG, H. J., Prof. ZHANG, Y. H., Dr. M.H.*
16:30-16:40	**Closing**	*Prof. JIANG, Z. H., Prof. P. Speth*
Evening	Dinner, Social activities beginning at 20:00	
30 April		
	Visiting energy facilities and research institutes	*Prof. Y. Shao, Dr. T. Sperling*
8:30 8:30 – 9:30 9:30 – 11:30 11:30-12:30 12:30-13:00 13:00-16:00 16:00-17:00 20:00	Departure from Hotel "Holiday Inn" Bus to Grevenbroich; Visit wind energy systems, including lecture Lunch Bus to RWE; Visit a lignite-fired power plant with optimized plant engineering (BoA) at Niederaußem, including lecture; Return to Hotel "Holiday Inn" Dinner at brew-house at historic site	

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