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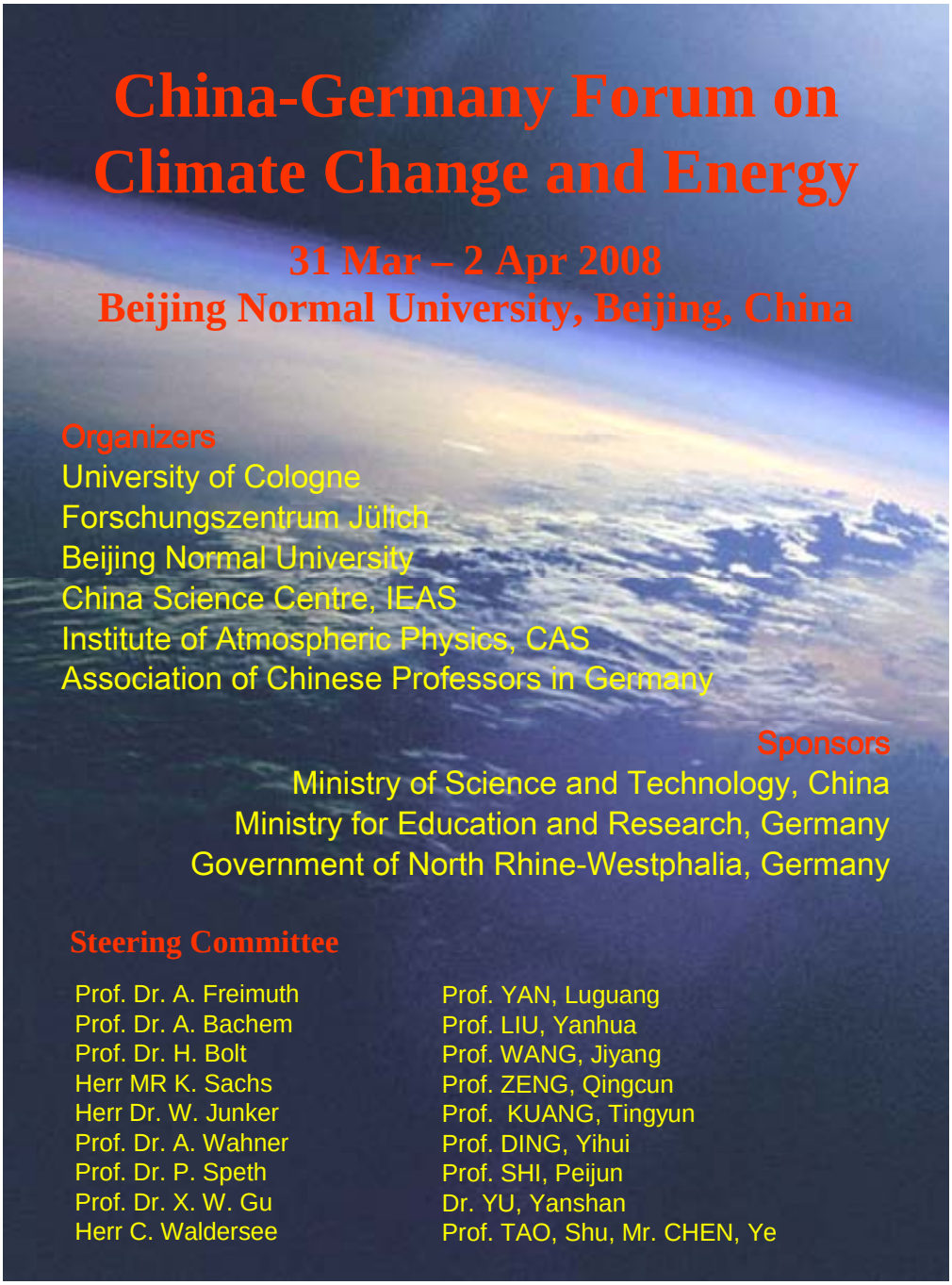

Compiled by
Y. SHAO, A. WAHNER, G. B. PENG, L. Y. LIU and Z. H. LIN
22 May 2008
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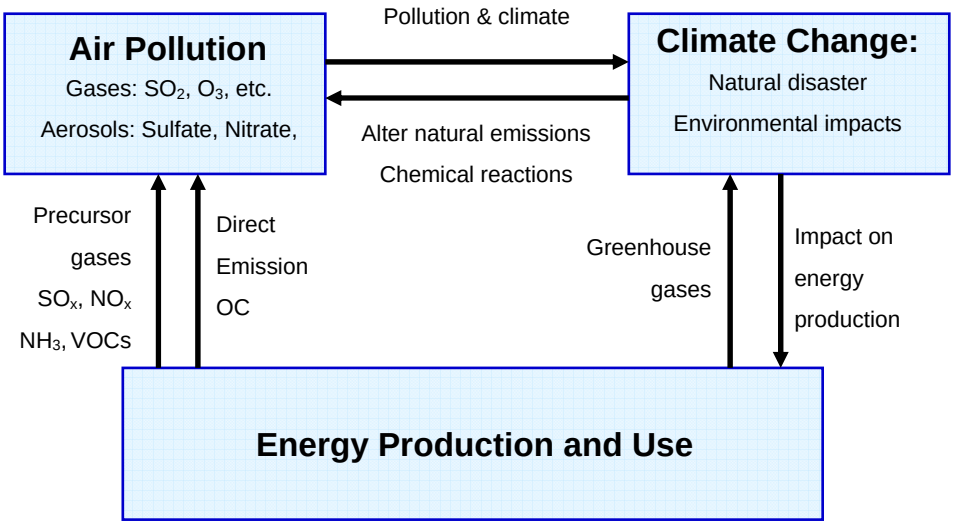
Summary and Proposal

The China-Germany Forum on Climate Change and Energy took place between 31.03 and 02.04.2008 in Beijing, with the participation of more than 50 German and Chinese scientists, government officials and industry representatives. Professor LIU Yanhua, Vice Minister of the Ministry of Science and Technology of China, and Mr Werner H. Lauk, Minister and Head of the Economic and Commercial Section of the German Embassy, attended the forum and contributed with seminal speeches. The forum highlighted the great potential for collaboration between the two countries, and the participants agreed to put forward a proposal of a joint research and development program to the Chinese and German government with a focus on climate change and energy.

Proposal: The core objective of the proposal is to implement the high-tech strategy for climate protection. To produce tangible results, the joint program is designed to tightly integrate the three pillars of climate change, air pollution and energy use. The inter-relationship between these pillars is illustrated in the following diagram.



The aims of the joint program are

1. To demonstrate the feasibility of the high-tech strategy for climate protection in China by evaluation of its impacts on the reduction of air pollutants and greenhouse gas emissions;
2. To organise pilot projects in China using exportable German technology to demonstrate the effectiveness of the strategy, these include
    i. A wind-energy pilot study in Gansu Province
    ii. A bio-fuel pilot study in Shangdong Province
    iii. A low-energy housing pilot study in Shanghai
3. To develop the capacity for modelling climate disasters and the capacity for monitoring air pollution and greenhouse gas emission.

Benefits: The challenges facing China associated with climate change and energy supply are worldwide second to none. The rapid social and economic evolution over the past thirty years has been accompanied by a greater need for energy, increased emission of greenhouse gases and deterioration of air, water and soil quality due to pollution. As documented in the "Chinese National Response Strategy for Climate Change", China has set highest priority on

- Reduction of greenhouse gas emission
- Environment protection
- Renewable energy technology and energy efficiency.

China will benefit from the joint program by

- Contribution to the development of sound strategies for greenhouse gas emission reduction and air pollution mitigation
- Increased knowledge of renewable energy technology and energy efficiency
- Enhanced capacity to respond to climate disasters

Germany has been playing a leading role internationally in climate change policy development and is one of the most advanced countries in renewable energy technology. According to the policy document of the German Federal Ministry for Education and Research "High-tech Strategies for Climate Protection", the main objectives of the German government in this context are

- To reduce greenhouse gas emission
- To increase energy efficiency
- To increase contingent of renewable energy

The German strategy combines climate protection with scientific innovation, creation of jobs and the assurance of enduring prosperity for the next generations. These objectives should be pursued both nationally and internationally, particularly in developing countries.

The joint program will contribute significantly to achieving the above listed objectives. The pilot projects will serve as a show case of Germany's support to China's effort to achieve a more sustainable balance between economic development and environmental protection. This is a process which will provide the tremendous business opportunities for Germany's renewable and clean energy sector. The benefits to Germany include

- Contribution to achieving Germany's objectives for climate protection through reduction of greenhouse gas emission.
- Creation of business opportunities for Germany's energy sector and environmental science and technology sector in China. The export growth in these sectors will enable Germany to maintain its advantage as a major exporter to China during the next decades.

Appendix

I. Background

Climate change and energy are two of the greatest issues of our time. They are also the key areas for future collaborations between China and Germany. Both China and Germany are developing strategies to respond to climate change, to reduce greenhouse gas emission and to promote the use of clean energy. In these processes, there are major political and scientific challenges as well as commercial opportunities. The purpose of the forum is to initiate a closer and long-term collaboration between China and Germany in the areas of climate change and renewable energy.

II. Objectives

- To exchange views on climate change and renewable energy and to explore the possibilities for joint research on carbon cycle
- To identify China's specific needs for renewable energy technology
- To explore possibilities of teaching & training programs in Germany
- To explore the possibilities of pilot renewable energy projects in China with the involvement of Chinese and German industries

III. Organizers

Germany: University of Cologne
Forschungszentrum Jülich GmbH
Association of Chinese Professors in Germany
China: Beijing Normal University
China Science Centre, International Eurasian Academy of Sciences
Institute of Atmospheric Physics, Chinese Academy of Sciences

IV. Sponsors

Germany: Government of North Rhine-Westphalia
Federal Ministry of Education and Research
China: Ministry of Science & Technology
Ministry of Finance
Originno Technology Ltd.

V. Hosts

Beijing Normal University (BNU)

State Key Laboratory of Earth Surface Processes and Resource Ecology, BNU

Key Laboratory of Environment Change and Natural Disaster, BNU, MOE

Academy of Disaster Reduction and Emergency Management, BNU, MOCA/MOE

Academy of Global Change and Earth System Science, BNU

VI. Program

31 March 2008, Yingdong Conference Hall		
08:30–09:00	**Opening**	
Chair: Y. Shao, University of Cologne Fanghua Hao, Director International Exchange & Cooperation, Beijing Normal University Werner Lauk, Minister, Head of Economic & Commercial Section, German Embassy Xuedu Lu, Deputy Director General, Office of Global Environmental Affairs, MOST Luguang Yan, Academician, Chinese Academy of Science H. Bolt, Vorstandsmitglied, Forschungszentrum Jülich GmbH		
09:00-09:15	**Break (Group Photo)**	
09:15–11:30	**Item 1: Climate Strategy**	
Chair: Y. Shao **China:** H.J.Wang, H.Liao **Germany:** P. Speth, J. Pinto, A. Wahner, K. Schneider		**Key Words:** Manifestation of climate change in China and Europe; Strategic response to climate change, Chinese and German perspectives; Link between energy use, technology and climate change
09:15-09:45	P. Speth *et al*.	Climate Change - Projections for Germany
09:45-10:05	Discussion	
10:05-10:25	H.J.Wang	Research on Climate Change at Institute of Atmospheric Physics
10:25-10:45	Discussion	
10:45-11:05	H. Liao	Connections between Energy Use, Air Quality & Climate Change
11:05-11:30	Discussion	
11:30–13:00	Lunch	8th Floor, Jingshi Hotel, BNU
13:00–15:00	**Item 2: Energy Strategy**	
Chair: E. Dinjus **China:** L.G. Yan, H. Chen **Germany:** X.W. Gu, R. Schwarze, D. Fischer, K. Maßmeyer, D. Lindenberger		**Key works:** China's strategy to meet future needs; Germany's strategy and experience; Energy mix; Legislation
13:00-13:30	L.G.Yan	Study on Energy Sustainable Development in China for the First Half of 21st Century
13:30-13:45	Discussion	
13:45-14:15	X.W. Gu, R. Schwarze *et al*.	Climate Policy Scenarios 2020 and Beyond
14:15-14:30	Discussion	
14:30-14:50	H. Chen	China CDM Fund - An Innovative Financial Mechanism for Addressing Climate Change
14:50-15:10	Discussion	
15:00–15:30	Coffee Break	
15:30–17:30	**Item 3: Renewable Energy Technology**	
Chair: T.Y. Kuang **China:** J.Y. Wang, Z.H. Pang		**Key words:** New energy technology developments in China; New

Germany: Y.J. Ding, E. Dinjus, H.G. Beyer, T. Sperling, B. Hermansen		energy technology developments in Germany; Areas where demand and supply; What are the channels
15:30-16:00	Ding, Sperling, Beyer, Dinjus, Hermanen	Renewable Energy and Energy efficient buildings in Germany
16:00-16:15	Discussion	
16:15-16:45	J.Y. Wang, Z.H. Pang	Geothermal Energy Development in China
16:45-17:00	C.H. Yang	Photosynthesis and Solar Energy Vitalization
17:00-17:30	F. Huang	Microalgae: a Green & Renewable Source of Bio-diesel & H2
18:00-20:00	Banquet	2nd Floor, Jingshi Hotel, BNU

1 April 2008

08:00–10:00	**Item 4: Government and Business Perspectives**	
Chair: C. Waldersee **China:** Y.S. Yu, H.X. Zhuang, L.Y.Liu **Germany:** D. Fischer, C. Waldersee, M. Obliego		**Key words:** Expectations of both governments; Expectations of both industries; Role of scientists
08:00-08:20	Y.S. Yu	Potential for Reducing GHG Emissions in Chinese Power Sector
08:20-08:30	Discussion	
08:30-09:00	D. Fischer *et al.*	Research for Sustainability as a Challenge for Science Policies
09:00-09:15	Discussion	
09:15-09:30	H.X.Zhuang	Yumen Million Kilowatt-Class Wind Energy Industry, Research and Education Demonstration Base
09:30-09:45	L.Y.Liu	Blown Sand Hazards and Control in China
09:45-10:00	Discussion	
10:00–10:15	Coffee break	
10:15–12:15	**Item 5: Climate Disaster and Air Pollution**	
Chair: K. Schneider **China:** Y.H. Ding, D.Y.Gong **Germany:** A. Wahner, K. Schneider, J Pinto, P. Speth, Y. Shao, T. Sperling		**Key words:** Climate disaster; Air pollution; Warning system development; Global models
10:15-10:45	A. Wahner *et al.*	Climate Change and Air Pollution
10:45-11:05	Discussion	
11:05-11:20	D.Y.Gong	Weakly cycle in atmosphere: polluted weather over China?
11:20-11:35	Discussion	
12:15–14:00	Lunch	8th Floor, Jingshi Hotel, BNU
14:00–15:30	**Item 6: Cooperation**	
Chair: A.Wahner, LGYan **China:** L.G. Yan, Z.H. Lin, G.B. Peng, L.Y. Liu *et al.* **Germany:** H. Bolt, K. Schneider, H. He, X.D.		**Key words:** Areas of collaboration; Channels for collaboration; Action plan

Han, M.G. Zhao, A. Krawisch *et al.*		
14:00-14:10	Y. Shao	Review
14:10-14:20	H. Bolt	
14:20-14:30	H. He	HGF Perspective
14:30-14:40	Z.H.Lin	
14:40-14:50	X. D. Han	Fraunhofer-Gesellschaft
14:50-15:00	K. Schneider	
15:00-15:10	L.Y. Liu	
15:10-16:00	Discussion	
Closing: K. Schneider, G. B. Peng		
18:00-20:00	**Reception by German Embassy**	Welcome speech by Dr M Hack

VII. News Reports

The forum has attracted much attention from the Chinese news media. Xinhuan and other news agencies reported on the forum, as listed below.

China View (新华网)

http://news.xinhuanet.com/newscenter/2008-04/02/content_7905647.htm

China Climate Change Info-Net (中国气候变化信息网)

http://www.ccchina.gov.cn/cn/Public_Right.asp?class=3&ScrollAction=3

http://www.ccep.org.cn/ (中华环保世纪行)

http://www.ccep.org.cn/news/detail_81552r.html

China Meteorological Administration (中国气象局)

http://www.ss.gov.cn/ssmo/qxxw/2008040545986.shtml

China Meteorological Newspaper (新气象，中国气象报社)

http://www.zgqxb.com.cn/xqx/xwzx/hyxw/2008_4_3/47327.shtml

China Economy Net (中国经济网，经济日报社)

http://www.ce.cn/xwzx/gnsz/gdxw/200804/02/t20080402_15042797.shtml

People Net (人民网)

http://www.022net.com/2008/4-2/505835122541510.html

China Science and Technology Daily (中国科报网，科技日报)

http://www.stdaily.com/gb/misc/2008-04/06/content_794492.htm

中德学者共同探讨气候变化对策与可再生能源应用前景

2008 年 04 月 02 日 16:02:11 来源：新华网

新华网北京 4 月 2 日电（记者邱红杰）中国和德国气候和能源领域的专家学者近日相聚北京师范大学,共同探讨全球气候变化的对策与可再生能源的应用前景。气候变化和可再生能源是目前国际学术界的两大研究热点，也是中德两国开展学术交流和技术合作的两个重要领域。欧亚科学院中国科学中心的彭公炳院士说，中国政府近几年高度重视气候问题，在相关国际活动中充分展示了一个负责任的发展中国家风范。科隆大学的斯佩特教授说，德国在致力推动转变经济增长方式，为应对气候变化承担责任。在这样的背景下,中德两国的相关学术交流也日益频繁。面对不断发生的全球气候灾害和气候变暖对世界经济社会发展带来严峻威胁，与会学者们提出，要加强气候灾害预警体系的建设，不断提升应对气候灾害的能力。与气候相关的能源问题是学者讨论的热点。两国学者在交流了新能源技术的不同发展现状后认为，虽然减少温室气体的排放给经济发展造成压力，但通过调整能源结构，开发应用生物能、太阳能等新能源技术，可以有效减缓这种压力，并可在长远时期获得显著利益。中德学者还交流了在碳循环领域的合作方式，中国对可再生能源技术的特殊需求，中国建立可再生能源试点项目的可行性，以及在德国开展教育和训练工程的可行性。北京师范大学的史培军副校长说，此次论坛，主要为中德气候变化与能源政策、技术和研究等方面提供相互交流的平台，并促进中德两国在这两个领域密切而长期的合作。论坛由欧亚科学院中国科学中心、中科院大气物理所、北京师范大学、科隆大学、尤利希研究中心发起。来自科隆大学、尤利希研究中心、波鸿-鲁尔大学、马格德堡-施腾达尔应用科技大学、中科院、欧亚科学院、北京大学、香港中文大学、北京师范大学的学者参加了论坛。

2007 年 5 月 15 日，冰山的影子倒映在格陵兰岛沿岸的水面上。据测算，格陵兰岛的冰盖约为 260 万立方千米，目前正在以每年 100 至 150 立方千米的速度消融。联合国环境规划署在 6 月 4 日呼吁各国联手采取切实行动，应对全球变暖问题。

Part 1: Introduction

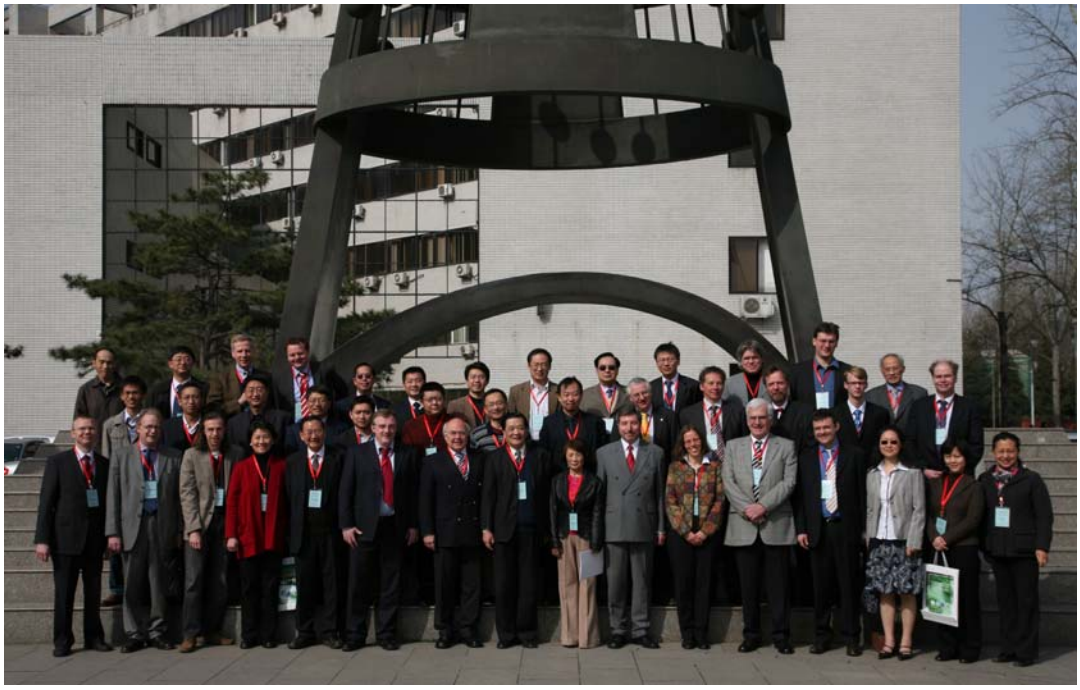


Figure 1: More than 50 German and Chinese scientists, government officials and industry representatives attended the China – Germany Forum on Climate Change and Energy, which took place in Beijing Normal University between 31.03 – 02.04.2008. ---***---

Figure 2: Professor HAO Fanghua, Director, Office of International Exchange and Cooperation, Beijing Normal University, gave the welcome speech on behalf of Beijing Normal University at the opening ceremony. The transcript of her speech is as follows.

Distinguished experts, distinguished leaders, colleagues, ladies and gentlemen:

I'm glad that we are here today to hold the "China-Germany Joint Forum on Climate Change and Energy". Jointly organized by the Juelich Research Center and University of Cologne, Germany, the China Science Center of International Eurasian Academy of Sciences, Institute of Atmospheric Physics, Chinese Academy of Sciences, and Beijing Normal University, China, this forum is now open. On behalf of Beijing Normal University, I'd like to express our warmest welcome and appreciation to all the participating experts and colleagues.

Climate change and renewable energy are two of the greatest issues of our time, especially for China with rapid social economic progress and large population. These two issues are also the key areas for future collaborations between China and Germany, which were identified by the Chinese and German governments during the visit of Chancellor Merkel to China in 2007. Today, both China and Germany are developing strategies to respond to climate change, to control greenhouse gas emission and to promote the use of clean energy. So it's of great significance to initiate a closer and long-term collaboration between China and Germany in the areas of climate change and renewable energy.

Beijing Normal University was founded in 1902. Now, it has 1840 teachers, including 637 professors and 807 associate professors, and 19,520 students, including 8520 undergraduate students, 8990 master and doctor students, and 2010 foreign students. Four research organizations, namely the State Key Laboratory of Earth Surface Processes and Resources Ecology, the Academy of Disaster Reduction and Emergency Management, the Key Laboratory of Environmental Change and Natural Disaster of Ministry of Education, and the Academy of Global Change and Earth System Science, have many outstanding scientific leaders and solid scientific research foundations in global change. I believe that this forum will absolutely facilitate the further cooperation in global change and energy fields between China and Germany.

Finally, I would like to express my warmest thanks to all the experts and colleagues attending this forum, and sincerely wish the workshop a great success. ---***---

Figure 3: Mr. Werner H. Lauk, Minister and Head of the Economic and Commercial Section, German Embassy, attended the opening ceremony and addressed the forum. The following is the transcript of his speech.

Distinguished Prof. Zhong, distinguished academicians, Ladies and Gentlemen:

I take great pleasure in attending this bilateral forum on “Climate Change and Energy” and addressing you at this important conference.

China and Germany share the common view that the challenges related to climate change and energy demand dearly need on the one hand worldwide efforts with the aim to reduce greenhouse gases, and on the other hand that governments have to provide the framework conducive for the development of sustainable economic activities. The time necessary to reach those sustainable efforts to this end is running out fast, so the global community has to join hands, take action and - especially - concrete measures. The German Federal Chancellor, Dr. Angela Merkel, has addressed climate and energy policy issues not only during her chair of the EU-Council presidency in the first half of 2007 but also during her leadership of the G8 group, when meeting in Heiligendamm in June last year with the leadership of the five outreach-partners, including China.

So, China is already part of this important process in view to more sustainable development in economic and social affairs including most pressing environmental and energy issues on a global scale.

But this is by far not sufficient, a global approach – based on bilateral cooperation - is clearly needed. Research and technology have to contribute in order to prepare political decisions for sound development in this direction.

We all need to use our natural environment in all aspects of life. But, as we have to admit, very often mankind does not make use of its natural environment in a sustainable way. But yet the world needs more sustainability; this becomes obvious for us in the contradictory population and lifestyle trends in poorer and richer parts of our common globe. In unstable, underdeveloped crises regions, the thrive for sustainability can hardly compete with basic daily needs for survival, and there is no framework for planning and long-term implementation of such objectives. These problems are certainly part of phenomena like unorganised and thus unauthorised international migration, organised crime and in extreme through international terrorism. Research and technology have to play a vital role in finding keys to come closer to a sustainable and thus healthier path of development for mankind.

Ladies and Gentlemen, China faces climate change related environmental problems at large and energy challenges – and so do we in Germany and Europe as well, as the consequences of climate change and energy demand effects do not stop at national borders.

These negative effects have already seriously hampered the sustainable economic and social development as well as the use of natural resources and environment in China and elsewhere, and thus have resulted in serious constraints for further sound development of economy and society. Both China and German have set a research agenda which expresses the need for further improvement and enhancement of technologies as well as of economy and society in a sustainable way.

The German Government and the German Embassy in Beijing take great pleasure in observing the joint undertaking of both sides for closer bilateral collaboration in order to strengthen research efforts and capabilities and to contribute to the further development of new technologies.

The systematic preparation for joint research activities will certainly help to identify thematic fields, research institutions, scientists and industries that are willing and able to participate actively in the envisaged programmes. And what is sometimes even more important: Each side will address the appropriate scientific organisations and / or funding agencies in order to cater for the programmes, and prioritise these programmes within the framework of the Sino-German bilateral science and technology agreements.

On behalf of the Federal German Government and the German Embassy, I wish you all success for your endeavours. I am convinced that fruitful cooperation between China and Germany, between government agencies, research institutions, research personnel and industries will lead to a better understanding and contribute to a brighter future not only for our two peoples but also for mankind and our common environment.

Thank you very much for your attention.

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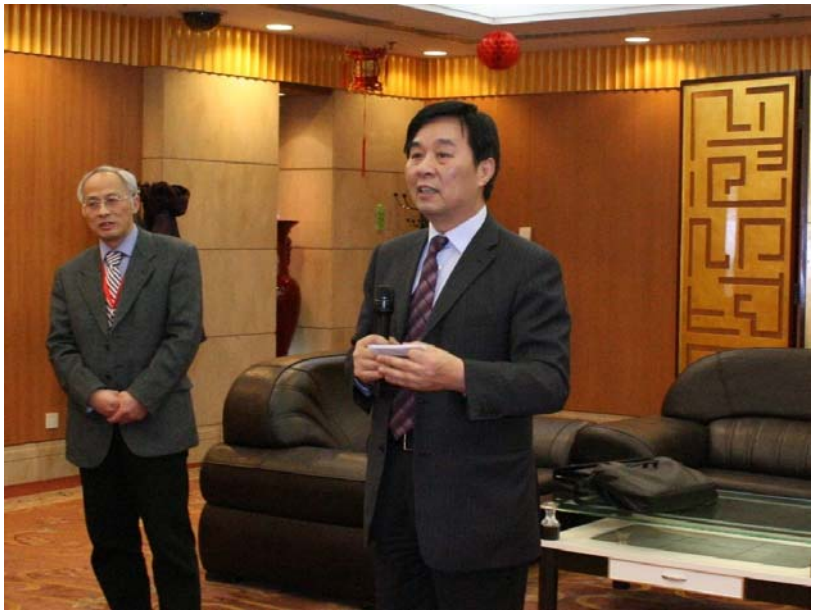


Figure 4: Prof. LIU Yanhua (right), Vice Minister of the Ministry of Science and Technology of China, who is also an Academician of IEAS, attended the evening banquet hosted by Beijing Normal University. Vice Minister Liu said that climate change and energy supply are posing serious challenges to China and the Chinese government is developing strategies to address these issues. He strongly supports the forum and believes that the forum will achieve results which will have far reaching implications to China–Germany collaborations. He said he eagerly awaits the forum outcomes and he will make his best effort to turn these outcomes into actions.

Vice Minister Liu also revealed one of his most recently major concerns, namely, inflation. He encouraged the participants to study the reasons and mechanisms of the current world-wide inflation and souring food prices. He asked the participants to suggest combat measures.

Prof. SHI Peijun Shi (Center, right photo), Vice President of the Beijing Normal University, Academician of IEAS, attended the evening banquet. Prof. Shi extended his warmest welcome to all participants and expressed his gratitude to them for their contribution to the forum. He said that China with such a large population is facing major challenges of climate change and energy supply. He believes that the forum provides an excellent platform for exchanging ideas and for exploring the possibilities for collaborations. He strongly supports the forum and believes that the forum will be a great success. ---***---

Figure 5: Prof. YAN Luguang (Academician of CAS and Academician of IEAS, 2nd right), Vice Chairman of CAS Committee for Renewable Energy, discusses with Professor Peter Speth (left) and makes a point at the forum.

Academician Yan gave a key note speech on "Energy Sustainable Development in China for the First Half of the 21st Century". He discussed

- General situation and main features of energy development in China;
- Proposals for establishment of the energy sustainable development system; and
- Future strategic suggestions.

He said China needs to take urgent action in the following areas:

- promote energy structure change to reduce reliance on coal and increase the use of renewable and nuclear energy
- establish a large-scale national renewable energy program
- establish a national advanced nuclear energy system program
- set higher priority for enhancing energy use efficiency
- strengthen the effort to reduce CO_2 emission and solve the climate change problem
- guarantee oil supply
- promote growth of clean and energy-saving technologies
- restructure the energy technology research and development system
- create a national energy management body
- conduct organized and continuous energy strategy study. ---***---

Figure 6: Prof. Dr. Harald Bolt, Member of the Board of Directors for Energy and Environment of the Forschungszentrum Jülich GmbH (Jülich Research Centre, FZJ) gave a talk at the forum, entitled “Finding Tomorrow Today”. FZJ with an annual budget of €380M and 4300 staff members is one of the largest research centers in Europe. FZJ has an outstanding record and reputation for excellent fundamental and applied research. One of the recent highlights at FZJ is the 2007 Nobel Prize (Physics) award to Prof. Dr. Dr. Peter Grünberg. Prof. Bolt said that Energy and Environment, together with Information Technology and Health, is now one of the corner stones of FZJ.

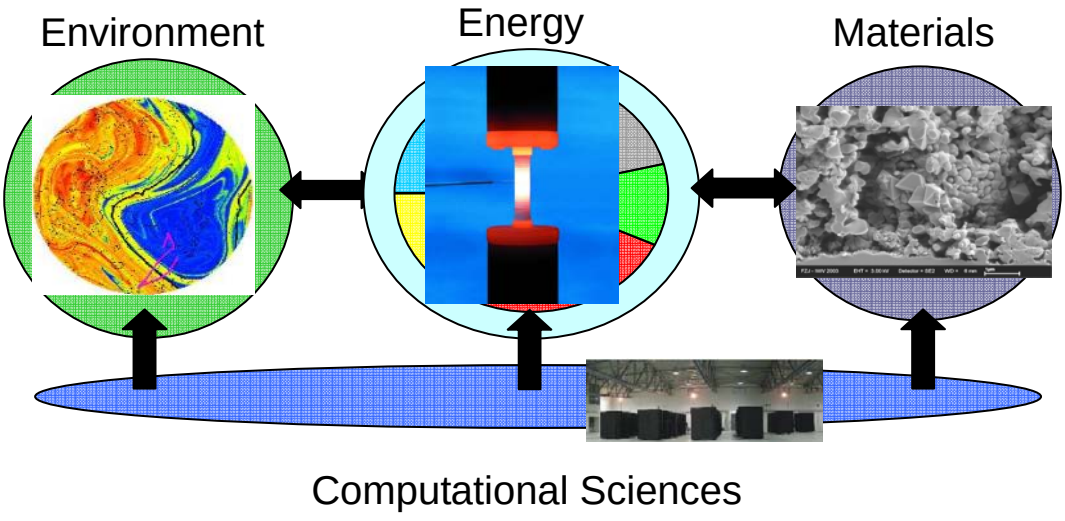


Figure 7: Energy and Environment, Information Technology and Health are the corner stones of research at FZJ. ---***---

Part 2: Climate Change

Figure 8: Dr LV Xuedu, Deputy Director General, Office of Global Environmental Affairs of MOST speaks at the forum.

In his lecture, Dr. Lv explained the policy of the Chinese government to climate change. He said that climate change is a global issue but has profound impacts on China's ecosystems, economy and other sectors. The Chinese government takes climate and environment challenges very seriously. As a developing country, China needs to develop policies, policy-enforcement mechanisms and research institutions for climate and environmental protection. To this end, the Chinese government actively seeks international scientific and technological collaborations in the areas of climate change. For example, China and Germany have carried out the clean development mechanism (CDM) project to promote energy use efficiency. With respect to the Chinese and German collaborations, Dr Lv suggested that we should concentrate on the reduction of greenhouse gas emission. He suggested that we should first develop the mechanism for collaboration between the two countries, including short- and long-term strategies for technology transfer and we should aim to establish an entity to explore how the frameworks of bilateral cooperation can be used to facilitate the transfer of technology to achieve the common goal of reduction of greenhouse gas emission. ---***---

Figure 9: Dr. D. Lindenberger (front left), Mr. C. Waldersee (front right), Dr. J. Pinto (second row left) and Prof. Dr. P. Speth (second row right) at the forum.

Prof. Dr. Speth reported on climate change projections for Germany. He summarized the IPCC report and described the method being developed at the University of Cologne for studying the impact of climate change on regional scales. He showed a set of examples to illustrate how climate change affects water resources and natural disasters. Further, he pointed out the need for investigation on how energy use affects climate change and how climate change in turn affects the generation of renewable energy (e.g. wind energy and hydropower). The analysis of Speth and Pinto shows that due to climate change, the storm activity will intensify over Great Britain, the North Sea and Southern Scandinavia - with consequences for extreme wind events over northern and central Germany. Prof. Speth believes that the techniques being developed in the University of Cologne can be readily adapted for studies in China.

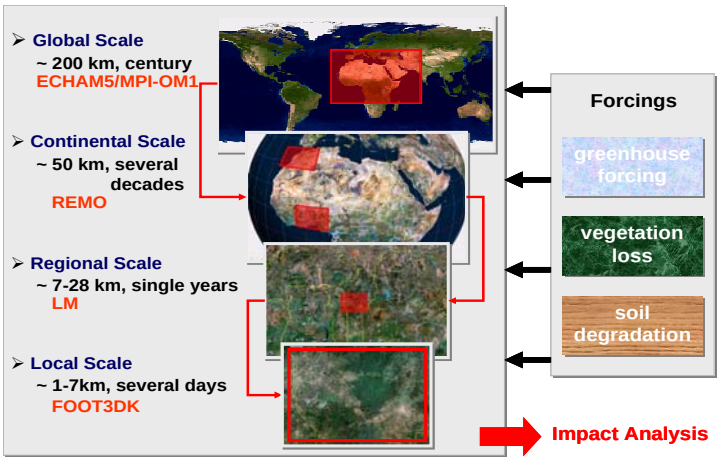


Figure 10: An example of model chain being developed at the University of Cologne for studies on climate change and climatic impacts. ---***---

Figure 11: Prof. LIN Zhaohui reports on climate research activities in China and the Chinese perspectives on climate change.

Prof. WANG Huijun, Director of the Institute for Atmospheric Physics (IAP, CAS), said that one of the recent research focuses of IAP is the development of an Earth System model for the projection of climate change and the assessment of climatic impacts. IAP frequently advises the Chinese government on climate policy development. Dr. LIAO Hong discussed the interactions between climate change, energy use and air pollution. Her analysis shows that north China has been in drought while the Changjiang valley region has experienced frequent floods. Her study has also revealed that Northern China, Changjiang Delta, Sichuan Basin and Pearl River Delta are four severely polluted regions (figure below) as represented by the column load of NOx averaged over 1996-2006.

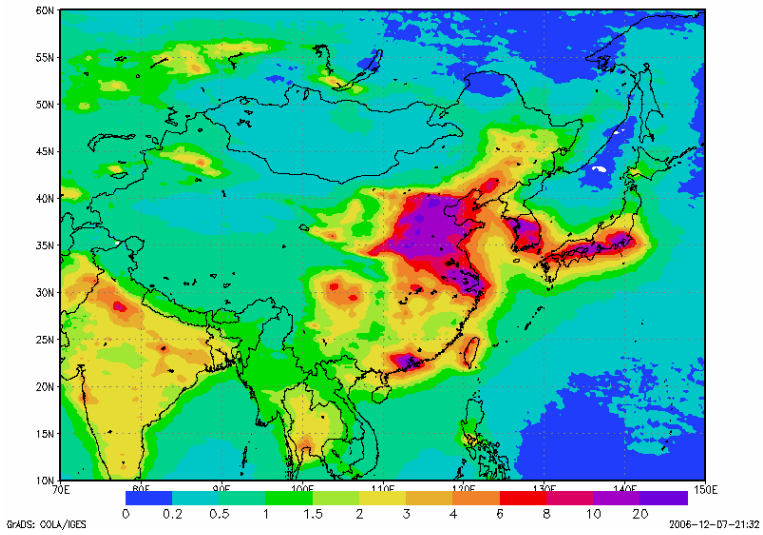


Figure 12: Column load of NOx averaged over 1996-2006 (10^{15} molecules cm^{-2}). ---***---

Figure 13: Prof. LIU Lianyou, Director of the Key Laboratory for Environmental Change and Natural Disaster, Ministry of Education, Beijing Normal University, is one of the forum organizers.

Prof. Liu is a specialist in natural disasters. He said that climate change is posing major challenges to water resources and land use sustainability in China. North China is particularly affected, where there are increased land degradation and dust storms. He said that a particularly important area for collaborative research should be the capacity development for prediction, assessment and response to natural and climate disasters.

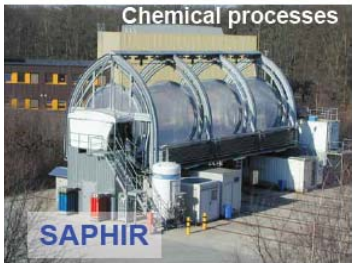
Figure 14: A photo showing the dead trees at the lower reaches of the Tarim River.

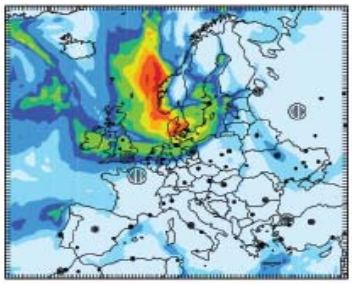
Prof. L. S. CHIU of Chinese University of Hong Kong (CUHK) shared his views with the participants on the effect of pollution on global and regional climate. He pointed out that while the impacts of greenhouse gases have been included in climate models in the 2007 IPCC report, those of air pollution on regional climate and the feedbacks to the global energy and water cycle have not been understood well enough to be included in the climate models. Potential exists for collaborations for the data analysis and model development to quantify the aerosol effects on the climate system and to examine their impacts on regional energy and water balances.

Prof. CHIU's expertise is in satellite remote sensing and data analysis. He has been associated with the Tropical Rainfall Measuring Mission (TRMM) and provided rainfall products to the WCRP Global Energy and Water Cycle Experiment (GEWEX) Global Precipitation Climatology Project (GPCP). His team is currently studying the impact of aerosol on cloud and precipitation processes using satellite data and model. ---***---

Prof. Dr. Andreas Wahner, Director of the Institute of Chemistry and Dynamics of the Geosphere (ICG-2), Forschungszentrum Jülich GmbH, discussed in depth the issues of climate change and air pollution. ICG-2 has been carrying out a comprehensive research program on the anthropogenic and biogenic emissions which influence to a large extend the chemical and physical states of the troposphere, the climate and air quality. The focus of this program has been on

- Long term observations of the composition of the changing atmosphere
- Photochemistry processes and emissions in the lower troposphere
- Multi-component aerosol systems and their physical and chemical properties
- Global and regional modelling of chemistry – climate interactions





Most sophisticated platforms for air chemistry research have been designed and put into practice by Jülich scientists, including the troposphere research aircraft (Halo), the boundary-layer monitoring balloon (Zeppelin), the chemical process chamber (Saphir) and the plant chamber. These platforms allow the collection of air chemistry measurements covering various atmospheric levels on a wide range of scales, which are then assimilated into global and regional air quality models for chemical forecasting and the investigations on global chemistry and climate interactions. In recent years, Prof. Wahner has been working closely with Prof. Y. H. Zhang and Prof. M. Hu from the Peking University and colleagues from the Sun Yat Sen University on the solutions to the severe air pollution problems in the Pearl River Delta, Changjiang Delta and Beijing-Tianjin areas.

Prof. Wahner discussed the inter-relationship between climate change, air pollution and energy consumption. He said that these interactions constitute a fundamental subject of study, which involves all major aspects of the society, covering not only natural environmental but also social economic problems. Prof. Wahner demonstrated, based on his own experience, that the collaborations between China and Germany can greatly benefit both countries. He said that Forschungszentrum Jülich is motivated to significantly contribute to further enhancing the collaborations between the two countries through joint research and development programs as well as training programs in the areas of climate change and energy, more specifically in

- Development and operation of long-term global observing systems
- Atmospheric processes, including the atmospheric self-cleaning capacity
- Air-quality and climate interactions
- Operational chemical forecasting on regional and global scales---***---

Part 3: Energy Technology and Energy Use Efficiency

Figure 15: Prof. WANG Jiyang, Academician of CAS (Institute of Geology and Geophysics) and Academician of IEAS, tells the participants how the geothermal energy technology is implemented in the National Grand Opera project.

Prof. Wang discussed the present status and future development of geothermal energy in China. He said China should greatly promote the use of renewable energy, including solar, bio, wind and geothermal energy. Low-medium temperature geothermal resources are widely distributed in China. At present, China is ranked No. 1 in the world in non-electrical utilization of geothermal energy, with an installed capacity and the annual energy output of 3,687 MWt and 12,605 MWh. Using the heat-pump technology, groundwater even with normal temperature can be used for space heating in winter, air conditioning in summer and supplying thermal water for domestic use all year round. He has been working closely with German colleagues on several major geothermal projects, including the National Grand Opera project, which has just been completed prior to the 2008 Olympics.

On 2.04.2008, the forum participants visited the Ever Source Science and Technology Development Ltd., a company specialized in geothermal energy applications. ---***---

Figure 16: Prof. KUANG Tingyun, an Academician of CAS (Institute of Botany) and Academician of IEAS, chairs the renewable energy session. Prof. Kuang's group has been actively developing bio fuel technology in China.

Prof. HUANG Fang from Kuang's group reported on the study on "Microalgae: a Green and Renewable Source of Biodiesel and Hydrogen". She said organisms capable of synthesizing raw material are better suitable for producing biomass for deriving biodiesel and are ideal for bio-system for H_2 production. She and her colleagues are working on the following problems: (1) Screening and developing a substantial number of algal stains suitable for large-scale and low-cost production of biodiesel; (2) Overcoming and minimizing the barrier of H_2 evolution under normal photosynthetic condition and (3) Developing and engineering algal stains capable of higher and sustainable hydrogen evolution.

Prof. YANG Chunhong, a graduate from the University of Mainz in 2002, is also working in the group of Academician Kuang. In her talk, she reported on "Artificial Photosynthesis and Solar Energy Usage". She said solar energy can offer unlimited renewable energy supply and we can learn a lot from plants by better understanding and utilizing the principle of photosynthesis, and then artificially create photosynthesis.
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Figure 17: Prof. Dr. Yongjian Ding, Director of the institute of Electrical Engineering, The Applied Science University of Magdeburg-Stendal, coordinated the German contribution to the energy-technology session.

Prof. Dr. habil. Beyer (solar energy), Prof. Dr. E. Dinjus (synthetic fuels), Dr. T. Sperling (wind energy) und Prof. Dr. Hermansen (energy-use efficiency) presented an overview of the innovative energy-technology developments and applications in Germany.

Prof. Ding explained that the teaching and research activities at the Institute of Electrical Engineering, The Applied Science University of Magdeburg-Stendal, cover the chain of electrical power generation and distribution as well as the operation of power networks on all voltage levels. Special expertise of the institute lies in the areas of decentralized generation, combined heat and power, biogas applications, wind energy and photovoltaic systems. District heating, shallow geothermal energy and solar energy are also subjects of research and teaching. The teaching programs of the University include a bachelor of electrical engineering and a master of engineering for renewable and rational energy supply for buildings. The active energy research program is supported by the European Union on photovoltaic and energy meteorology, supplemented by several other projects in cooperation with local partners. The institute already cooperates with Chinese universities in the field of bachelor and master education and is looking for more potential partners in China in the research field of renewable energy.

Prof. Hans-Georg Beyer gave an overview on the applications of active solar energy systems in Germany. He focused on solar thermal systems for supply of domestic hot water and heating and photovoltaic (PV) systems feeding electricity to the supply grid. Concerning solar thermal systems, about 9.000.000 m² of collector area are in operation with an annual energy delivery of about ~22.3 TWh. This is still a marginal contribution (<1%) to the coverage of Germany's total thermal load. However, a significant increase of this share is envisaged as new incentive schemes are being launched. Concerning the application of PV, the German market currently constitutes almost half of the world market. This is the result of an effective incentive scheme based on fixed feed in tariffs paid to the system operators - the tariff being coupled to cost reductions due to increase of production volume. It is envisaged that due to the constant growth of this market the costs of PV-generated electricity will be reduced to ~0.2-0.25 €/kWh till 2015.

Figure 18: Example for a grid connected PV-system at Magdeburg, installed 2007 on a historical school building. This system has a nominal power of 25 kW and an expected annual energy gain of ~22.000 kWh. This system is owned by a consortium of citizens. At the Applied Science University of Magdeburg-Stendal, research is carried out in both fields of solar heating systems and Photovoltaic systems. In the latter, projects on PV-components, PV-systems and solar energy meteorology are run in the framework of cooperation with European partners funded by the European Commission.

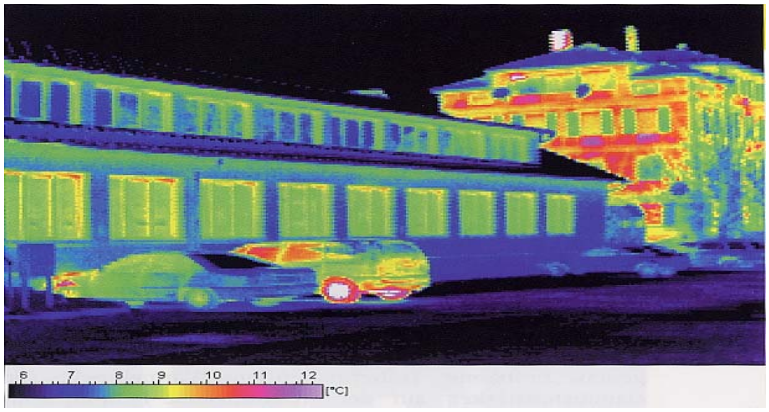

Figure 19: At the forum, Prof. Dr.-Ing. B. Hermansen discussed the problem of energy efficiency of buildings. This thermograph shows a comparison of energy losses (left: low energy house, right: high energy house). He said that in Germany, starting from 2008, every property owner will have to obtain an Energy ID-Card for their building. He explained the meaning of the Energy ID-Card and said that the energy-saving potential for Chinese office buildings and housing is tremendous. China would benefit greatly from implementing a similar Energy ID-Card system.

Figure 20: Prof. Dr. Eckhard Dinjus of Forschungszentrum Karlsruhe (FZK) delivers a speech on "Synthetic Fuels from Biomass: Concepts and Technologies".

Prof. Dinjus described the 2nd generation bio-fuel. He pointed out that

- Biomass is a renewable carbon source
- Biomass should be used for organic chemicals and fuel production instead of electrical power and heat generation
- Technologies have already been developed, but have to be made suitable for high capacities
- New structures of agricultural production are required

Prof. Dinjus discussed the option of using straws for bio-fuel generation. This technique, in contrast to growing crops for bio-fuel, is that it is both environment friendly and does not compete with agriculture for land. He said that both the science and technology of generating bio-fuel from agricultural residuals do exist now and should be put in practice. Prof. Dinjus has been working with Chinese colleagues on the applications of the technology in China. His work has attracted much attention from the Ministry of Science and Technology of China.
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Dr. Sperling has been acting as consulting meteorologist for wind energy, approved by the German Meteorological Society. Dr. Sperling became executive officer of the Environmental Forum at the University of Cologne. Since 2001, he has been assistant professor and chief of the renewable energy workgroup. In close collaboration with the energy industry, effective methods have been procured for the operational prognosis of wind power generation all over Gemany and Europe.

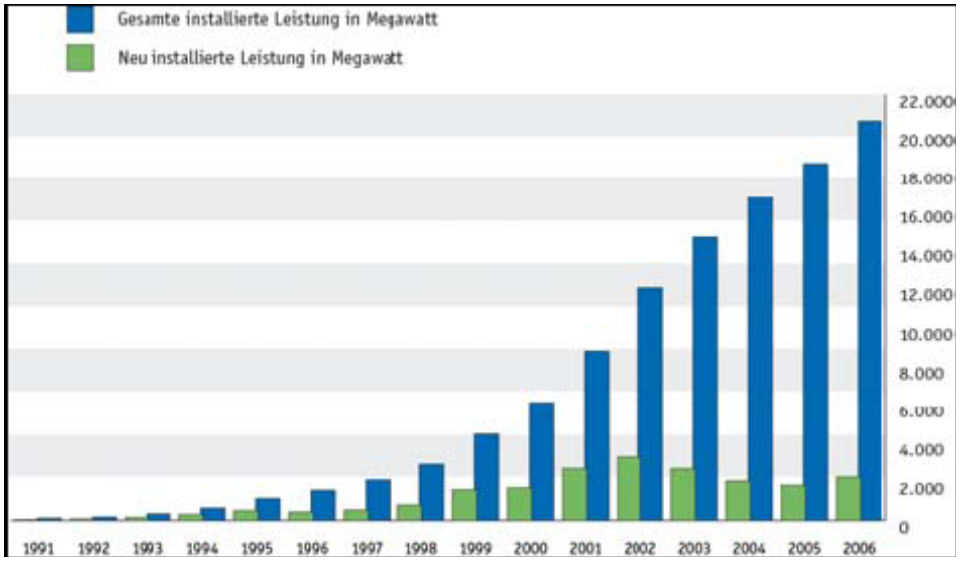

Figure 21: Expansion of installed wind power in Germany.

Dr. Sperling gave an overview of the development of wind energy industry in Germany. He pointed out methods for analyzing the resource potential of wind as well as the German standard for certified, bankable energy yield expertise for on and offshore wind farms. Germany is planning 12.000 MW offshore wind energy until 2020. For efficient power station management and grid integration, operational daily forecasts of wind power generation are of increasing interest. The presentation has been finished with a special investigation into the impact of renewable energies on energy prices at European Energy Stock Exchange (EEX), which decrease during periods of enhanced wind power generation.

Part 4: Policy and Industry

Figure 22: Present at the forum are leading energy-strategy and climate-policy researchers, including Prof. Dr. R. Schwarze (front 2nd right) and Prof. Dr. Xuewu Gu (standing).

Prof. Dr. Schwarze gave a detailed overview on Germany's recent integrated climate and energy strategy until 2030. He explained the policies and measures taken and how it relates to parallel moves by the European Union. He also deliberated about the costs and benefits of these programmes, showing that the large co-benefits from increased energy security outweigh the costs.

Prof. Dr. Gu, Director of the East Asian Politic Sciences, said that "with all respect to the EU for its sincere effort in helping China to effectively manage its huge energy and environment problems, it can be argued that the energy cooperation between EU and China also serves the interest of the EU in that it helps minimizing China's demand on outside energy sources and thus easing the pressure of the world energy market on the EU and to safeguard its own energy supply". ---***---

Figure 23: Dr. Doris Fischer of German Development Institute (Deutsches Institut für Entwicklungspolitik) presented a talk on sustainable development and a comparative study of the research infrastructures in Germany and China. An economist and sinologist by training, Dr. Fischer has taken part in and initiated a number of research projects on different aspects of China's economy since the 1990s. Since August 2007, Dr. Fischer is Senior Expert at German Development Institute and in charge of the research related to China within the project "Sustainable Solutions – Research for Sustainability" financed by the BMBF. Dr. Fischer is editor of the "Country report: China" published in 2007 by the German Federal Agency for Civic Education. At the forum, Dr. Fischer discussed

a range of issues related to sustainable development in China and Germany. She said that while the German and Chinese interpretations of sustainability are quite different, there is a common understanding between China and Germany in that energy and climate change are key ingredients of sustainable development and should be a focus of collaboration between the two countries. ---***---

Figure 24: Mr. Christoph Waldersee, Managing Director of the Asia Water Development Corporation Ltd., chairs the "Government and Business Perspectives" Session. Active in China since 1984 and based there now for almost 10 years, Mr. Waldersee has brought a broad sector and country based knowledge, experience and contacts in the public, environmental, financial and infrastructure sectors to China. Mr. Waldersee believes that China's need for better environment protection offers unprecedented business opportunities for German companies. In addition to technology and know-how for renewable energy production and energy efficiency, technologies for waste water management, solid waste treatment and air quality protection are in high demand. Using his Chinese language skills, Mr. Waldersee has been advising companies and central government institutions (such as the Ministry of Finance, the new China CDM Fund and NDRC, the National Development and Reform Commission) in the structuring of BOT/TOT finance for the Chinese water sector, energy plus energy efficiency projects for the industrial and infrastructure sector, related technology transfer and CDM projects, including relevant joint venture contracts. ---***---

Figure 25: Ms. Hong Tang, General Manager of BoCIT, discusses with the participants at the forum. Her professional experience within the construction and engineering area is mainly obtained through a wide range of projects in the area of building energy efficiency in China and Germany. Ms. Tang was General Manager of ROM Hamburg (Shanghai) in 1995 when ROM was the mechanical contractor for the project Jin Mao, the biggest intelligent building project according to international standards in China. Today, her main consulting work is focused on the areas relevant to building energy efficiency.

Ms. Tang pointed out that it is very important to improve the energy efficiency using new technology in addition to developing new energy forms. Currently, a total area of about 2 bn m^2 is built every year in China (about 50 times that in Germany) and the building energy consumption amounts to about 30 % of the total energy consumption. If we just look at how many single air conditioners with low energy efficiency and strong negative impact on the environment are used everywhere in China, we can appreciate much better how urgent the situation is to save energy. The cooperation between Germany and China in the area of building energy efficiency will generate huge business opportunities for the German industry. ---***---

Figure 26: Dr. ZHUANG Haixiong, managing director of Originno Technology Ltd, a company focusing on project-development of wind energy in China, proposed to establish a wind-energy industry, research and education base at Yumen, Gansun, China. Dr. Zhuang said that according to China's long and middle-term plan and "the 11th Five-Year Plan" on renewable energy, China will vigorously develop wind energy in the coming future. However, China is relatively weak in areas such as wind turbine design and manufacturing, wind resource assessment, wind farm design and management. There is also a critical shortage of skilled professionals in China to develop the wind-energy sector. In the proposed pilot project, a one million kW wind energy technology innovation and education base will be established, which includes a wind energy farm, a professional wind-energy-resource observation network, a wind-power equipment testing centre, a wind-energy research laboratory, a wind industry service centre and a training centre.

Gansu, a province in China's west, is rich in wind-energy resources due to its unique geographic location. However, it can be very cold in winter and quite dusty in spring. Dr. Zhuang has been working closely with the Gansu provincial government on strategic plans of harnessing wind energy in China's vast western area. He said it is important to learn from the German experience in wind energy development and he welcomes the opportunities of collaboration with German industries. ---***---

Figure 27: Dr. CHEN Huan (2nd left), Deputy Director General of the China CDM Fund, Ministry of Finance of China and Dr. WEN Gang (4th left) at the forum. Also pictured here are wind-energy experts Prof. Dr. K. Maßmeyer (1st left) and Dr. T. Sperling (3rd left).

Dr. Chen said that CDM is one of the flexible mechanisms under the Kyoto Protocol. It is a cooperation mechanism to help developed countries to fulfill their emission reduction commitment stipulated by the Kyoto Protocol. CDM also facilitates developing countries to receive some additional financial resources for sustainable development. China CDM is approved by the State Council of China in August 2006. In April 2007, the Fund entered into business operation.

The Fund is created as a policy-oriented and development served, public benefit, long-term, open-ended, non-profit and solely state-owned fund. The financial sources of fund includes revenues from CDM projects owned by the state, grants from international financial organizations, donations, earnings from the Fund's business operation and other incomes approved by the State Council. The Fund supports activities to address climate change, energy conservation, energy efficiency, renewable energy etc.

Dr. Chen further described the management of the fund and priority areas and aspects of international and domestic collaborations. He said the Fund will actively support for and involve in international climate change cooperation, to make contribution to national actions against climate change and common protection of global climate. ---***---

Part 5: Discussions

Figure 28: Prof. Dr. A. Wahner and Academician YAN Luguang jointly chair the discussion session. Participants focused their discussions on

- Areas of collaboration
- Channels for collaboration
- Action plan joint research: climate – air pollution – renewable energy

The participants discussed the following main issues:

(1) Joint Research on Climate Change

- Earth System Model with focus on carbon management
- Prediction of climate disaster
- Inter-relationship between energy use and climate change
- Renewable energy and desert research. It is believed that China's deserts have a large potential for solar energy and biofuel production.

(2) Possible Pilot Projects

- Energy production: wind energy, biomass
- Energy efficiency: Green city, energy saving in buildings, efficiency. For China, to adapt energy saving measures is urgent and has a long way to go, as the rapid increase in building construction will further accelerate in future
- A pilot Green House (Sky and Earth Building: 天地屋) combining German and Chinese technologies
- Technology transfer between Germany and China
- Biomass
- Coal burning technology

(3) Exchange of scientists and students; intensive programs for renewable energy applications

- Leading role of University of Cologne in coordinating collaboration with China
- University of Cologne offers the International Master of Environmental Science in English
- DFG supports currently the Mega City Project
- PhD programs

Figure 29: Prof. Dr. K. Schneider and Prof. Dr. R. Schwarze at the discussions. Prof. Schneider said University of Cologne offers an International Master of Environmental Sciences. Prof. Schwarze said it is important to explore the possibilities of funding through the China CDM.

(4) Funding opportunities

- Initial funding should be sought from the German and Chinese governments
- The initiative should be able to attract funding from funding organizations, such as China CDM
- The future projects of the program will be marketable, e.g. the sustainable urban development project. Such projects should be able to attract funds from funding bodies such as the World Bank, CDA (Citi Development for Asia) etc.

Figure 30: Prof. Dr. Maßmeyer, Prof. Dr. Ding and Prof. Dr. Beyer (from left) discuss how to forge a closer collaboration between China and Germany.

(5) Second Joint Forum

The 2nd China – Germany Forum on Climate Change and Energy will take place at University of Cologne in 2009.

(6) Joint China – Germany Research Centre for Climate Change and Energy

The possibility of a joint centre has been raised with Vice Minister Liu. The delegates believe that the establishment of the centre is important because it will allow the collaborations between the two countries to be both coordinated and long-term. The joint centre will provide young scientists and students with a unique platform to work together on the very important issues of climate change and energy.

Figure 31: Dr. Joaquim Pinto from the University of Cologne is a specialist in natural-disaster studies. Dr. Pinto said that China is a vast country prone to climate disasters (such as flood, snow storms, sand storms, high wind, frost etc.) and the German know-how and his own expertise can be readily applied to many areas in China. He said it is particularly interesting for him to collaborate with the Chinese colleagues on nature disaster assessment and mitigation. ---***---

Figure 32: Prof. PENG Gongbing, General Secretary and Academician of the China Science Centre, IEAS, makes concluding remarks at the forum.

Prof. Peng said that during the forum, serious questions have been asked and debated about. All participants agree that the challenges lying ahead, as well as the potential for collaboration, are tremendous. It is the responsibility of both China and Germany as two of the largest countries in the world to take joint actions to achieve the common goal of protecting the Earth environment. Climate has no national boundaries and our common goal of climate protection for the benefit of the entire humanity can only be achieved if we work together.

Prof. Peng hopes to see concrete collaborations between China and Germany in the following three areas:

- Carrying out joint research into climate, air pollution and energy to enhance our capacity for the prediction of climate disasters and the monitoring of environment changes and to provide a sound scientific basis for the development of strategies for climate protection;
- Promoting the transfer of technologies between the two countries, most notably the technologies for renewable energy, energy efficiency, carbon management and reduction of greenhouse gas emission; and
- Focusing our effort initially on producing tangible outcomes. To achieve this, we should first conduct pilot studies to demonstrate the feasibility of the high-tech strategy for climate protection. Of particular interest to China are projects for wind-energy generation, 2nd generation bio-fuel, carbon management and energy efficiency (e.g. low-energy office buildings and housing).

Prof. Peng concluded that collaboration between China and Germany on climate change and energy offers a win-win opportunity for both countries. This view is unanimously shared by all participants.

Part 6: Acknowledgements

Figure 33: Prof. SHAO Yaping, on behalf of the coordinators, including Prof. Andreas Wahner, Prof. PENG Gongbing, Prof. LIU Lianyou and Prof. LIN Zhaohui, thanks the participants for their contribution to the forum and the sponsors for their financial support.

In particular, we wish to thank Dr. M. Hack (First Counselor, Science and Technology, German Embassy in Beijing) and his colleague Dr. ZHANG Beiyu for their active engagement in supporting the forum and for organizing the evening reception at the German Embassy for the workshop participants.

We are most grateful to

- Prof. LIU Yanhua, Vice Minister of Ministry of Science & Technology of China
- Prof. SHI Peijun, Vice President of Beijing Normal University
- Prof. Dr. A. Freimuth, President of University of Cologne
- Prof. Dr. A. Bachem, Director General of Forschungszentrum Jülich

for their encouragement and endorsement of this forum.

We wish to thank Dr. XU Wei (Beijing Normal University) and his team for their tremendous effort in preparing the logistics for and ensuring the smooth running of the forum. We also wish to thank a number of colleagues who have helped with the preparation of the forum, including

- Dr. W. Junker (BMBF: Grundsatzfragen Nachhaltigkeit, Umweltrecht)
- MR K. Sachs (MIWFT NRW)
- Dr. F. Stiller (BMBF: Internationales Büro)
- Dr. M. Brockmann (MIWFT NRW)
- Dr. S. Bildhauer (AAA, University of Cologne)
- Dr. S. Preuschoff (AAA, University of Cologne)
- Dr. C. Brechter (Rektorat, University of Cologne)
- Dr. HE Hong (Helmholtz Association of German Research Centres)
- Dr. HAN Xiaoding (Fraunhofer Representative Office Beijing)
- Dr. A. Krawisch (Chinesisch-Deutsches Zentrum für Wissenschaftsförderung)
- Ms. WANG Lu (Representative, AiF)
- Ms. PAN Y. (China Science Centre, IEAS)

The introduction of Prof. HU Min to Peking University, the guide of Prof. YANG Chunhong to the Botanic Garden, the visit to Ever Source Sci. & Tech Development and the Quanjiude dinner hosted by Prof. LIU Lianyou have made the tour of 2 April 2008, organized for the German colleagues, most enjoyable.

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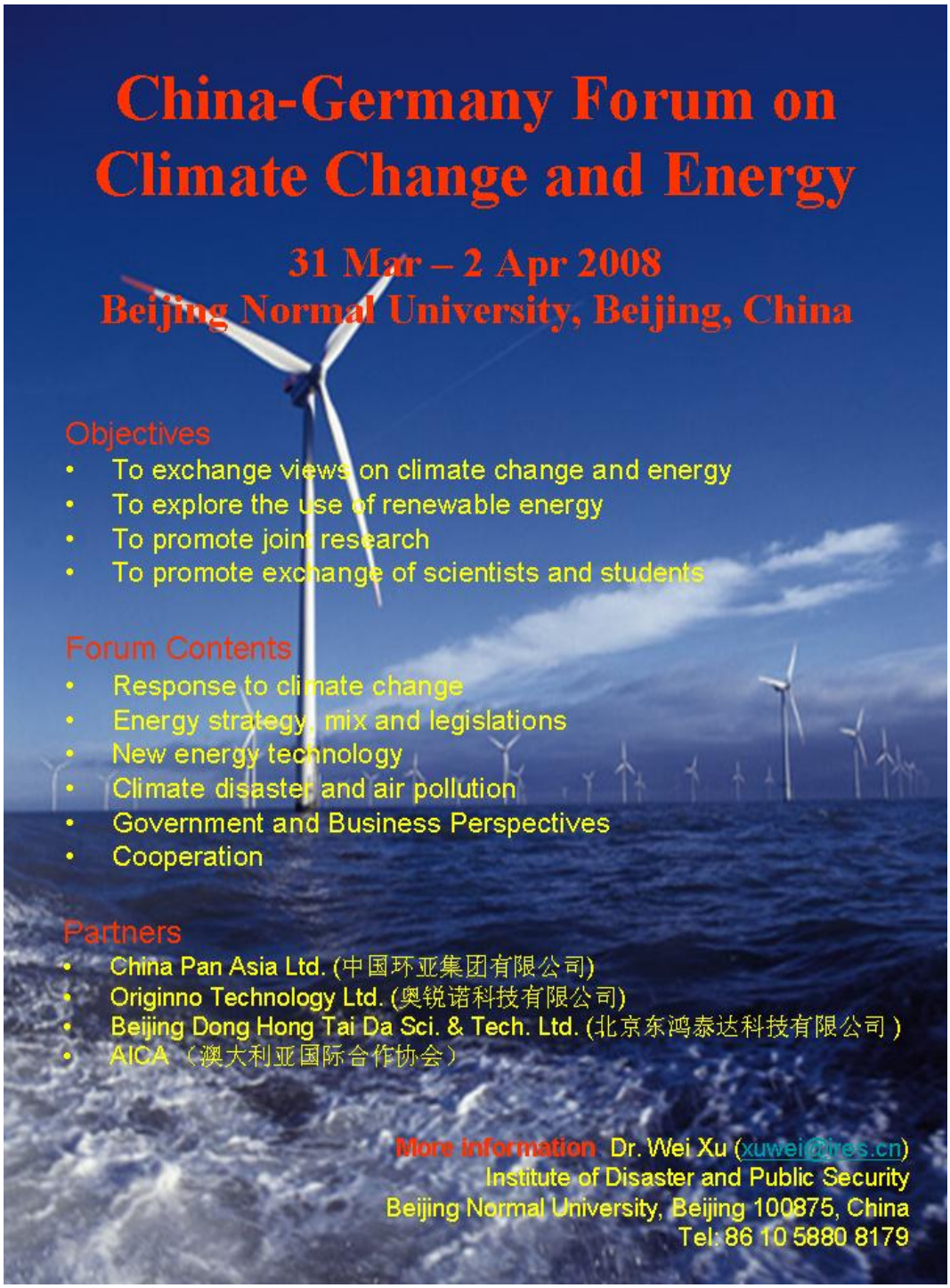
China-Germany Forum on Climate Change and Energy
31 Mar – 2 Apr 2008
Beijing Normal University, Beijing, China
Objectives
• To exchange views on climate change and energy
• To explore the use of renewable energy
• To promote joint research
• To promote exchange of scientists and students
Forum Contents
• Response to climate change
• Energy strategy, mix and legislations
• New energy technology
• Climate disaster and air pollution
• Government and Business Perspectives
• Cooperation
Partners
• China Pan Asia Ltd. (中国环亚集团有限公司)
• Originno Technology Ltd. (奥锐诺科技有限公司)
• Beijing Dong Hong Tai Da Sci. & Tech. Ltd. (北京东鸿泰达科技有限公司)
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