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Ad Hoc Group of Experts on Coal and Thermal Power

International Workshop on Clean Coal Combustion in Small
and Medium Sized Boilers in Central and Eastern Europe
Brasov, Romania, 4 – 6 September 2002

REPORT

I. WORKSHOP ORGANIZERS AND PURPOSE

1. The Workshop was jointly organized by the Institute of Power Studies and Design (ISPE) of Romania, the United Nations Economic Commission for Europe (UNECE), the World Coal Institute (WCI) and the World Energy Council (WEC) and in collaboration with the IEA Coal Research – the Clean Coal Centre (IEACCC).
2. Coal is the major source of energy for power and heat production in Central and Eastern Europe (CEE): 25% of primary energy needs in CEE are provided by coal; and 48% of power generation in CEE is based on coal.
3. Traditionally, this coal – which in CEE is predominantly low rank – has been utilized in households and small and medium capacity boilers in the region. This sector, also known as the industrial or non-power sector, refers to boilers below 50 MW_{th}. There are estimated to be some 100,000 to 150,000 of such boilers in CEE, consuming around 150 million tonnes of coal per annum, equivalent to one-third of the region's total coal consumption. However, the use of coal in this sector also poses a significant environmental and health hazard due to: (i) the boilers being in urgent need of rehabilitation/modernization or replacement, which will require significant investment; and, (ii) not always appropriate emission standards. European Union (EU) emission standards are, however, available for boilers above 50 MW and some EU countries also have standards for boilers below 50 MW.

4. For coal to maintain this important market in an environmentally-acceptable manner it was recognized that a critical assessment was urgently required to fully understand the challenges and barriers to be overcome, notably:

- (i) to understand the scale of the issue (including number of boilers under 50 MW, volume of coal supplies to residential and small consumer sector, and related emission levels);
- (ii) to identify the reasons underlying the neglect (including lack of finance, lack of emission standards, inappropriate combustion technologies, and competition from gas); and
- (iii) to draft recommendations to the key stakeholders, in particular the EU and CEE governments.

5. The main objectives of the Workshop were to: (a) provide a forum for the exchange of information and experience on past and current utilisation of coal in small and medium sized boilers in CEE, together with the future prospects for coal in this sector; (b) assess and understand the market for coal-fired small and medium sized boilers in CEE, including the demand for and utilisation of domestic coal, existing legislation and coal standards; (c) discuss and understand the competition in this market from other fuels; (d) assess the current status, adequacy and enforcement of emissions standards applied to small and medium sized coal-fired boilers in CEE; (e) understand the institutional and commercial barriers to financing of and investment in cleaner coal technologies for small and medium sized boilers in CEE; (f) initiate the creation of an international database for cleaner coal combustion technologies applicable for small and medium sized boilers, together with dissemination of information regarding “success stories” in this field; (g) formulate policy and technical recommendations for the future use of coal in small and medium sized boilers in CEE; and (h) ensure continued promotion of coal-fired small and medium sized boilers in the region through dedicated actions and relevant measures at both the national and international levels.

II. OFFICERS AND ATTENDANCE

6. Mr. Celestin Alexandrescu, Adviser to the Director General, ISPE served as Chairman of the Workshop. The Workshop was attended by around 50 experts from the following ECE member countries: Albania, Belgium, France, Germany, Italy, Poland, Romania, Russian Federation, Switzerland, United Kingdom and United States of America.

III. PROGRAMME

7. The programme comprised four working sessions and a closing round table discussion.

IV. OPENING SESSION

8. The Seminar was opened by Mr. Ioan Dan Gheorghiu, Chairman and CEO, ISPE. Additional opening addresses were provided by Mr. Ioan Ghise, Mayor of Brasov, who welcomed the participants and wished them a fruitful meeting and pleasant stay in Brasov, and also Mr Radu Zaharia, General Director, Foreign Trade Department, Government of Romania, who drew attention to the provisions of the Foreign Investment Law of Romania.

9. On behalf of the UNECE Executive Secretary and the Director of the Sustainable Energy Division, Ms. Charlotte Griffiths, Economic Affairs Officer, expressed appreciation to the Government of Romania and the Romanian host organizations and other sponsors for organizing this workshop, which represented a valuable contribution to the UNECE energy programme.

10. Mr Klaus Brendow, Head of Central-East European Energy Programme, WEC, also expressed his appreciation for the organization of this timely workshop and welcomed the opportunity for the WEC to be involved.

11. Mr Marian Dobrin, Deputy Head, Studies and International Programmes Department, ISPE, presented an overview of the Report “Clean Coal Combustion in Small and Medium Sized Boilers in Central and Eastern Europe” (ENERGY/GE.1/SEM.4/2), which had been prepared specifically as a background document for the workshop.

V. WORKING SESSIONS

Session 1. Technologies and Manufacturing

Chairman: Mr. Andrew Minchener, Associate Senior Consultant, IEACCC, United Kingdom

Scientific Secretary: Mr. Nistor Bujdei, Technology Project Manager, Process Department, ISPE Timisoara, Romania

12. The aim of this session was to consider issues including: trends in international and national research, development and deployment (R,D&D) of technologies for use in small and medium sized coal-fired boilers; adaptation of foreign experience to specific, but largely low-grade, coals; boiler types; automation; efficiency aspects; load variance; emissions; waste and waste heat recovery and utilisation; dual fuel-firing; quality assurance (ISO); and retrofitting.

13. The following expert papers were presented and discussed:

Mr. Mihai Picu, High Energy Intensity Processes Department Head, OVM - ICCPET S.A. Romania – “Modern System of Combustion with Low Emission to the Stack and Monitoring Possibilities”

Mrs. Carmencita Constantin, Studies & International Programs Department Head, Mr Marian Dobrin, Deputy Head, Ms. Veronica Petri, Power Studies Project Manager, ISPE, Romania (presented by Ms. Petri) – “Romanian Overview of Fluidised Bed Combustion Technology Development”

Mr. Nicolae Scarlat, Deputy Head, International Relations Department, OVM-ICCPET, Romania – “Fluidised Bed Combustion “

Mr. Dumitru Gârdan, Process Department Head, Mr. Laurentiu Maier, Technology Project Manager, Mr. Nistor Bujdei, Technology Project Manager, Mrs. Maria Gârdan, Technology Project Manager, ISPE Timisoara Romania (presented by Mr. Maier) – “Ecological and Economic Solutions for Removing and Dumping the Slag and Ash from Low Capacity Coal-Fired Boilers”

Mr. Alexsei Bychkov, Head of Department, RAO EES ROSSII, Russian Federation – “Repowering of Old Pulverised Coal Boiler: Demonstration Project of CFB Boiler at Nesvetay Thermal Power Plant”

Mr. Stephan Peper, Head of Process Optimization, ABB Utilities GmbH; Mr. Dirk Schmidt, Powitec Intelligent Technologies, Germany – “Intelligent flame analysis for an optimized combustion”

Mr. Mikhail Puchkov, Chief Specialist, Ministry for Industry, Science and Technologies, Russian Federation - "Production and Combustion of Coal-Water Fuel"

The following paper was also submitted by Mr. Christian Wirtgen, Representative Head, Coking, Briquetting and Thermal Waste Treatment Group, University of Aachen, Germany – “Thermal Refining of High Volatile Coal”. This paper will be included in the workshop proceedings.

Main Conclusions of Session 1

14. Participants identified and agreed that:

(a) There is a need for technology transfer from Western Europe of commercially available CCTs appropriate for the small and medium sized boiler market in CEE.

(b) It is critical that the introduction of low cost, fast payback methods for improving the energy efficiency and environmental performance of existing boilers in the small and medium sized boiler market is fully assessed and explored.

(c) New technology development appears to be largely focussed on the power sector rather than the industrial and non-power sector.

(d) Research and development (R&D) of new technologies applicable to the industrial sector includes fluidised bed combustion (FBC) and there is some cooperation with researchers in the EU. FBC is also suited to the low rank coals that predominate in CEE.

(e) Dissemination of research results and “success stories” is required to ensure decision makers and other interested stakeholders in CEE are fully informed of the status of both national and international technology developments applicable to the industrial sector.

(f) An understanding of the possible methods and sources of financial support for improved technology deployment is needed.

- (g) Further investigation of the obstacles facing the development of clean technology and equipment applicable to the industrial and non-power sector is required; and
- (h) Cooperation between R&D bodies and equipment suppliers/manufacturers is essential.

Session 2. Markets and Financing

Chairman: Mr. Virgil Musatescu, President, Romanian Association for Energy Policies, Romania

Scientific Secretary: Mrs. Carmencita Constantin, Head of Studies & International Programs
Department Head, ISPE, Romania

15. The aim of this session was to consider issues including: competition between coal, gas and district heating in the residential, small customer and industrial sectors; customer-specific marketing; product design (eg smokeless fuels) and retailing aspects; single and dual-use boilers; the appeal of distributed power based on indigenous coals; enhancing coal quality; financing, including the role of energy service companies (ESCOs); and licensing.

16. The following expert papers were presented and discussed:

Mr. Stefan Ragalie, Deputy General Director, National Institute for Financial and Monetary Research, Mr. Victor Vaida, General Director, Deva TPP, Romania – “Energy Prices and Inflation”

Mrs. Carmencita Constantin, Studies & International Programs Department Head, Ms. Lidia Mitroi, Power Studies Project Manager, Ms. Raluca Căndea, ISPE, Romania (presented by Mrs. Constantin) – “Internalisation of Externalities – Effects on Implementation of Environmental Technologies”

Mrs. Elena Dumitru, General Director, Regulatory, Authorisations, Environmental Approvals and Waste Management Division, Waters and Environmental Protection Ministry, Romania – “Environmental Policies in the Power Field – Achievements and Trends”

Mrs. Carmencita Constantin, Studies & International Programs Department Head, Ms. Veronica Petri, Power Studies Project Manager, Ms. Corina Boita ISPE, Romania (presented by Ms. Petri) – “Romanian Environmental Technology Market – Funding Opportunities”

Main Conclusions of Session 2

17. Participants identified and agreed that:

- (a) Financing is one of the most critical issues connected to the implementation of clean coal combustion technologies in the small and medium sized boiler sector in CEE. Technology transfer and foreign investment are essential for CEE countries.

(b) A clear economic environment involving reduction of high inflation, real prices, and a gradual reduction of subsidies can assist to realise effective and efficient allocation of resources.

(c) Access to the capital markets is hindered by many objective and subjective matters, including: lack of technology performance information for the banking community; a high risk perception for such projects; inertia for development and deployment of innovative technologies; lack of experience and lack of adequate financial instruments (e.g. specific funds), etc.

(d) There is a need for more information on the sources of financing, financing schemes and mechanisms that can be used in each country and it was agreed that a Directory of financing sources for investments in clean coal combustion projects would be useful to facilitate this.

(e) A specific fund dedicated to such projects was concluded to be an important tool. The participants agreed that the proposal of such a fund should be included in the final Agenda for Action; and

(f) There is a need for innovative financing tools based on internalization of externalities, Kyoto Protocol, flexible mechanisms (in particular Joint Implementation), Prototype Carbon Fund instruments, etc.

Session 3. Policies and Regulations

Chairman: Mr. Marek Sciazko, Director, Institute for Chemical Processing of Coal, Poland

Scientific Secretary: Mrs. Claudia Tomescu, Environment Project Manager, Power Plants
Technology Department, ISPE, Romania

18. The aim of this session was to consider issues including: the trends and composition of “low stack” emissions; energy and pollution abatement policies related to small and medium sized coal-fired boilers; existing and required regulatory approaches; effectiveness and enforcement of emission standards for small and medium sized boilers; measurement of emissions; and obstacles and barriers to implementation of appropriate policies and regulations.

19. The following expert papers were presented and discussed:

Mr. Marek Sciazko, Director, Institute for Chemical Processing of Coal, Poland – “Regional Programme for Low-Level Emission Abatement - Silesian Case Study”

Mr. Florin Popa, Coordinator of the Regional Centres activity- OSIM- Romania- “Clean Coal and Patent Policy in Romania”

Mr. Jeffrey Orrey, Coordinator of the Technology Transfer Component, U.S. Agency for International Development - “Ecolinks programme in the South Eastern European Countries”

Mr. Radu Stoenescu, Director, Power Generation & Environment Division, Mrs. Claudia Tomescu, Environment Project Manager, Power Plants Technology Department, ISPE, Romania (presented by Mrs. Tomescu) – “Legislative Regulations Regarding Environmental Protection in Romania”

Mrs. Anca Popescu, Power Transmission & Distribution Division Director, Mr. George Lavrov, Energy Systems Department Head, Mrs. Diana Costea, Energy Systems Project Manager, ISPE, Romania (presented by Mrs. Popescu) – “Use of Modern and Clean Coal Technologies for Reduction of Greenhouse Gas Emissions”

Mr. Ghiorghe Constantinescu, General Director, Mrs. Vasilica Daescu, Counsellor of Institute Board, The National Research Development Institute for Environmental Protection (ICIM), Romania (presented by Mrs. Daescu) – “Evaluation of the Environmental Components Impact caused by the Replacement of Crude Oil by Coal and/or Petroleum Coke in Romanian Cement Mills”

Main Conclusions of Session 3

20. Participants identified and agreed that:

(a) EU emission standards are available only for boilers above 50 MW. For boilers below 50 MW, national legislation already exists in some countries, but may not be comprehensive in its coverage and in most instances boilers of less than 1 MW are not covered. Hence, participants agreed that a concerted EU approach could result in harmonization of emission standards for boilers below 50 MW, but that specific legislation is left to national governments; and

(b) Participants noted with regret the existing lack of knowledge and information for CEE on the sources of and share of emissions released from boilers in the range 1 to 50 MW and below 1 MW and suggested that the development of a report providing such data would be helpful, but further noted that this would require significant effort and funding.

Session 4. Cooperation

Chairman: Mr. Klaus Brendow, Regional Coordinator – Central-East European Energy Programme, World Energy Council, Switzerland

Scientific Secretary: Ms. Veronica Petri, Power Studies Project Manager, Studies & International Programs Department, ISPE, Romania

21. The aim of this session was to consider issues relating to “cooperation”, including: international programmes and directives in the area of “cleaner coal” of relevance to the non-power market; international harmonization of emissions from small and medium sized boilers; the potential role of Joint Implementation under the Kyoto Protocol for this sector; experience with joint ventures; and licensing issues.

22. The following expert papers were presented and discussed:

Mr. Andrew Minchener, Associate Senior Consultant, IEACCC, United Kingdom – “The Role and Importance of Technology Transfer”

Ms. Christine Copley, Senior Manager, World Coal Institute, United Kingdom – “International Cooperation and Financing”

Mr. Gheorghe Tipei, General Director, Mr. Florica Baltaretu, Counsellor of Institute Board, IPROMIN, Mr. Octavian Todeasa, Director, National Pitcoal Company Petrosani, Romania (presented by Mrs. Baltaretu) – “Environmentally Friendly Production of Smokeless Fuel from Coal for Use by Domestic and Small Enterprises”

Ms. Habil Ioana Ionel, Professor, Department for Thermal Machine & Transportation, Faculty of Mechanical Engineering, “Politehnica” University of Timisoara, Romania – “Clean Combustion of Powdered Coal by Applying Dry Methods “

Mr. Nicolae Nicolescu, Department Head, Piping and District Heating System Department, Mr. Lazar Lupescu, Counsellor, Mrs. Constanta Dragan, Deputy Head, Mr. Constantin Hamzu, Piping and DHS Project Manager, ISPE, Romania (presented by Mr. Nicolescu) – “Efficient Use of Valea Jiului Coal in the Thermal Plants by Implementing High Technologies“

Main Conclusions of Session 4

23. Participants identified and agreed that:

(a) Participants noted and welcomed the success stories of cooperative research on CCTs involving Western and Eastern and Central Eastern European partners.

(b) The difficulties of translating the results of research projects into commercial operations were noted and it was agreed that this was primarily due to the lack of funding on the part of CEE countries and not due to a lack of adaptability of technologies. International funding is not geared or designed to assist the introduction and deployment of CCTs in this particular sector despite the significance of small and medium sized boilers in CEE, in particular with regard to efficiency and emissions.

(c) The European Commission should address R,D&D (research, development and deployment) of technologies applicable to the coal-fired small and medium sized boiler sector in CEE, bearing in mind the status of these economies as EU accession countries.

(d) In view of these difficulties of financing it was agreed that the UNECE should be requested to keep the issue of CCTs in small and medium sized boilers on the work agenda of the UNECE Committee on Sustainable Energy bearing in mind that cooperation on this issue has just begun to develop. Further the UNECE should organise a workshop/seminar in Geneva or elsewhere on “options and difficulties related to financing of CCTs in small and medium sized boilers in CEE”.

(e) A key issue to be addressed is that of appropriate and enforceable standards. If CEE governments were to elaborate standards (both on efficiency and emission levels), apply them and control their application then old, obsolete boilers would be forced out of the market and, hopefully, replaced by new improved boilers. An invitation needs to be addressed to CEE

governments to elaborate such standards for boilers between 1 and 50 MW at a national level; above 50 MW there are EU standards.

(f) Joint Implementation (JI), under the Kyoto Protocol, is an additional driver. However, in view of the difficulties in applying this mechanism to the small and medium sized boiler sector one solution might be to group or bundle similar projects under one financing or JI programme. There is a need to draw the attention of CEE governments to the beneficial effects that JI can have on improving the efficiency and emissions record of the 100,000 to 150,000 small and medium sized coal-fired boilers in the CEE region; and

(g) A further driver to facilitate the deployment of CCTs in the non-power sector is the regional and municipal authorities, which are directly affected by the emission of "local" pollutants. These authorities should be invited to address the deployment of CCTs in small and medium sized boilers of 1 MW and below via incentives and penalties.

VI. ROUND TABLE DISCUSSION

24. Participants in the closing Round Table discussion included: Mr. Klaus Brendow, Ms. Christine Copley, Mrs. Carmencita Constantin, Mr. Ioan Dan Gheorghiu, Ms. Charlotte Griffiths, Mr. Andrew Minchener and Mr. Marek Sciazko.

25. The closing Round Table discussion aimed to draw together the conclusions of all the workshop sessions in order to develop a final set of Conclusions and Agenda for Action for submission to key policy makers with a view to defining the future role of domestic coal in the non-power markets in Central and Eastern Europe.

VII. GENERAL CONCLUSIONS RESULTING FROM THE SEMINAR

26. The general conclusions arising from the workshop are summarised as follows:

(i) Coal is the world's most abundant and widely distributed fossil fuel resource, emphasised by the role coal has played in underpinning world economic and social progress. Coal is also cost competitive and safe to store. Given the projected strong growth in global energy demand (75% by 2020) and the importance of security of energy supply, coal will continue to be an essential part of the world's energy and industrial materials for the foreseeable future.

(ii) However, to use coal as a key primary energy source a number of environmental challenges need to be addressed. Implementation and deployment of clean coal technologies (CCTs) offers an opportunity for coal to be utilised in an environmental acceptable manner.

(iii) CCTs allow coal to be used in a more efficient and cost-effective manner, while enhancing environmental protection through reduced emissions of carbon dioxide and oxides of sulphur and nitrogen. CCTs can be applied at all stages of the coal-to-energy chain. The potential to implement new clean coal combustion technologies in the small and medium sized boiler sector in the countries

of CEE is of great relevance in view of the annual coal consumption of these boilers, which is over 30% of the total annual coal consumption in these countries.

(iv) Government measures are needed to implement emission standards that promote uptake and deployment of CCTs in the small and medium sized capacity sector in the region.

(v) Industry must be encouraged to enter into joint ventures and third party financing schemes and to recognise that improvements in the industrial boilers sector can be self-financing under such conditions.

(vi) Research/consulting and engineering companies should promote their consulting services in the area of CCTs for small and medium sized boilers. Energy Service Companies (ESCOs) could play an important role in this sector.

(vii) Coal producers need to more actively associate themselves with the small users market, in particular with reference to the needs for coal preparation as a means of contributing to local emissions control.

(viii) Regional and municipal authorities need to facilitate and support the recommendations outlined in items (v) and (vii).

(ix) The manufacturing industries of west European countries should use business development tools more forcefully in order to sell their products in CEE countries.

(x) Problems arising from upgrading small capacity plants and boilers usually relate to the limited financial capability of the plant owners, who are faced with the high costs of either replacing the existing boilers with new modern units or with rehabilitating the existing ones. However, as previously noted low cost, fast payback improvements can be very profitable if implemented.

(xi) In order to fund implementation of CCTs in small and medium sized boilers, which will result in reduced emissions of greenhouse gases, the potential for attracting financing via Joint Implementation under the Kyoto Protocol should be fully explored.

(xii) In Central and Eastern European countries, the implementation of clean coal combustion technologies requires Governments (especially regional and municipal authorities), consulting and engineering companies and industry to work together to produce and replicate success stories.

(xiii) Technology transfer and foreign investment are critical; and

(xiv) Removal of institutional and commercial barriers will facilitate early transfer and implementation of CCTs. Local companies, through technology transfer from the most advanced and experienced west European companies, could then implement the new CCTs domestically.

VIII. AGENDA FOR ACTION

27. In order to facilitate Clean Coal Combustion in Small and Medium Sized Boilers in CEE the following Agenda for Action was agreed upon by all participants at the workshop:

(a) **Identify Financial Solutions**

Financing is one of the most crucial issues and obstacles connected to the implementation of clean coal combustion technologies in the small and medium sized boiler sector in CEE. UNECE, through the Committee on Sustainable Energy, should be invited to address the issue of financing of CCTs for the small and medium sized boiler sector through the organisation of a workshop/seminar, in collaboration with other stakeholders – including WCI, WEC and IEACC – in order to identify appropriate financing sources or funds and build/develop adequate financing schemes.

(b) **Further Develop and Harmonize Emission Standards**

Emission standards for the coal-fired small and medium sized boiler market (i.e. less than 50 MW_{th}) should be further developed in CEE (and hence so promote cleaner coal combustion technologies) by seeking, through national government measures, to harmonise the legal framework with that of EU countries. In some countries, national legislation already exists, but may not be comprehensive in its coverage and in most instances boilers of less than 1 MW are not covered. Hence, there was a consensus that a concerted EU approach could result in harmonization for boilers below 50 MW, but that specific legislation is left to national governments.

(c) **Create Inventory of Coal-Fired Boilers in CEE**

Owing to the existing lack of knowledge and information a report identifying the sources of and share of emissions released from coal-fired boilers under 50 MW in CEE would be valuable. Such a report would facilitate the development of the necessary EU general guidelines and national legislation and policies. Funding options to undertake this activity need to be assessed.

(d) **Initiate Technology Transfer Programme**

Technology transfer programmes dedicated to clean coal combustion in small and medium sized boilers should be initiated, based on international programmes already in existence. This should include an approach to the European Commission to explore opportunities for funding and assistance, recognising the special conditions existing in CEE economies in view of their status as EU accession countries.

(e) **Disseminate Information**

In order to address the urgent need for dissemination to policy makers and other interested stakeholders of success stories highlighting the status of clean coal combustion technologies for the small and medium sized boiler sector, the creation of an international electronic database/clearing house should be explored.

IX. CLOSING SESSION

28. The Chairman expressed his satisfaction with the outcome of the Workshop and thanked all participants for their contributions and for the fruitful discussions. Votes of thanks and appreciation were also given by representatives of the UNECE, the World Coal Institute and the World Energy Council.