Prof Jürgen Hake

Prof Józef Dubiński

Dr Oliver Then

Mr Juho Lipponen

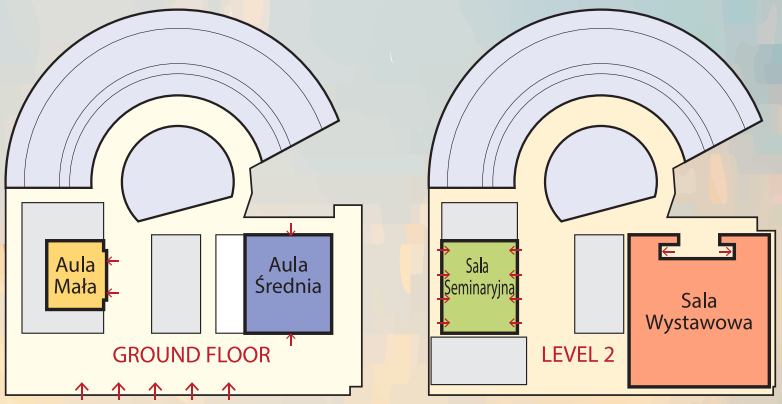
Mr Scott Smouse

THE SEVENTH INTERNATIONAL CONFERENCE ON CLEAN COAL TECHNOLOGIES

KRAKÓW CCT2015

17–21 MAY

PROGRAMME



AUDITORIUM MAXIMUM, JAGIELLONIAN UNIVERSITY

Sunday 17 May 2015

Registration: 18:00–20:00 - Foyer I **Reception:** 19:00–20:30 - Foyer

Organised by the IEA Clean Coal Centre and Główny Instytut Górnictwa (the Central Mining Institute of Poland) under the patronage of the Ministry of Economy

IEA CLEAN COAL CENTRE

GIG

MINISTRY OF ECONOMY

Location:	Aula Mała	Aula Średnia	Sala Seminaryjna
	Monday 18 May 2015		
08:30–10:00		**Welcome and Keynote session I** **Chair: Prof Jürgen Hake** Welcome address *Prof Jürgen Hake - Chair IEA Clean Coal Centre ExCo* Welcome address *Prof Józef Dubiński - GIG General Director* The perspective of coal in times of decarbonization in Europe – *Dr Oliver Then, VGB Powertech - Germany* CCS: building on early opportunities – *Juho Lipponen, Head of CCS unit, IEA - France*	
10:00–10:20	**Break**		
10:20–12:00	**Gasification I** **Chair: Dr Alberto Pettinau** Gasification of low rank coal – *Dr Christiaan van der Meijden, ECN - Netherlands* Performance assessment of fixed-bed up-draft gasification by steady state model – *Eng Vittorio Tola, University of Cagliari - Italy* Small-scale (<5MWe) catalytic fixed bed gasification for remote site power generation – *Dr Nikolai Kinaev, Strategic Energy Consulting - Australia* Studies on CO_2-enhanced gasification of coal in a circulating fluidized bed reactor – *Mr Grzegorz Tomaszewicz, Insitute for Chemical Processing of Coal - Poland* Effect of operation parameters on the performance of hot gas clean-up technology with a moving granular bed filter – *Dr Yau-Pin Chyou, Institute of Nuclear Energy Research - Taiwan*	**Carbon capture and storage** **Chair: Juho Lipponen** U.S. DOE's major carbon capture, utilization and geologic storage demonstration project portfolio – *Mr Thomas Sarkus, National Energy Technology Laboratory - USA* Application of life cycle assessment methodology in CCS studies – *Prof Jozef Pacyna, Norwegian Institute for Air Research (NILU) - Norway* Advanced CO_2 capture pilot plant at Tauron's coal-fired power plant in Jaworzno – *Adam Tatarczuk, Institute for Chemical Processing of Coal - Poland* Coal combustion with CO_2 capture in a 50KW chemical looping combustion unit – *Mr Raúl Pérez-Vega, Instituto de Carboquimica (CSIC) - Spain*	**SOx and particulate control** **Chair: Hellmuth Brüggemann** Dry desulfurization using MgO by-products: a sustainable alternative – *Mr Ricardo del Valle-Zermeño, University of Barcelona - Spain* Semi-dry desulphurisation for coal boilers – *Dr Igor Volchyn, Coal Energy Technology Institute - Ukraine* An integrated diffusion-reaction model for wet desulphurization with limestone sorbents: Absorption, reaction, leaching and precipitation – *Prof Raymond Everson, North-West University - South Africa* Particle charging and transport dependence on permittivity and fluid dynamics: A revised numerical model to evaluate ESP performance and design – *Dr David Branken, North-West University - South Africa*
12:00–13:20	**Lunch in Sala Wystawowa**		
13:20–15:00	**NOx control** **Chair: Dr Ian Barnes** ANCR© - the new flue gas cleaning technology – Case Studies – *Dipl Ing Andreas Anderl, MAL - Germany* Optimization of heat rate and emissions with advanced controls – *Jim Sutton, Alstom Power - USA* Combining OFA lances with SNCR technology – A promising approach to minimising NOx emission of lignite-fired power plants – *Dr Thomas Hilber, Alstom Boiler - Germany* SNCR Retrofit of a Lignite Power Plant to Meet the new EC NOx-Limit of 200mg/Nm^3 – *Mr Zoltan Teuber, ERC - Germany*	**Oxyfuel I - plant modelling** **Chair: Prof Jarosław Zuwała** Techno-economic optimization of first generation oxy-fired pulverized coal power plant – *Dr Hayato Hagi, EDF - France* Heat integration of an oxy-combustion power plant: minimization of the CO_2 capture process energy penalty – *Dr Sergio Espatolero, CIRCE - Spain* Structural integration of the oxy-fuel power system based on Exergy analysis: ASU and CPU cases – *Marcin Liszka, Silesian University of Technology - Poland* A heat integration study of a calcium looping CO_2 capture plant and a coal-fired power plant – *Mr Dawid Hanak, Cranfield University - UK*	**Boiler materials and slagging** **Chair: Dr Robert Romanosky** Improving flexibility of a coal power plant via optimization of thick-walled components – *Eng Malgorzata (Gosia) Stein-Brzozowska, Mitsubishi Hitachi Power Systems - Germany* Water wall coating protection – *Dr Michael Seitz, Alstom Power - USA* Investigation of iron-rich initial layer deposits at the inlet of the superheater level in a large pulverized fuel power plant – *Selahattin Babat, IFK Stuttgart - Germany* Analysis of slagging phenomena at Reftinskaya Power Plant – *Luca Ghiribelli, Enel - Italy* Sanicro25 - a heat resistant austenitic stainless steel for 700°C material temperature – *Urban Forsberg, AB Sandvik Materials Technology - Sweden*
15:00–15:30	**Break**		
15:30–16:50	**Post-combustion capture I** **Chair: Thomas Sarkus** Integrated capture of SO_2 and CO_2 in a post-combustion capture pilot plant - an amine-based case – *Dr Erik Meuleman, CSIRO - Australia* Modeling analysis of novel solvent regeneration through direct steam stripping – *Mr Jiahui Lu, EDF China - China* Experimental validation of split flow modification of an amine-based post-combustion CO_2 capture process – *Mr Marcin Stec, Institute for Chemical Processing of Coal - Poland* Equilibrium solubility of CO_2 in 2-amino-2-methyl-1-propanol solvent promoted by piperazine and monoethanolamine blend – *Mr Chikezie Ndubuisi Nwaoha, Chulalongkom University - Thailand*	**Power plant design and retrofit** **Chair: Dr Oliver Then** Analysis of coal power technology exports – *Mr Scott Smouse, National Energy Technology Laboratory - USA* Design concept and operation experience of recent hard coal-fired power boilers – *Hellmuth Brüggemann, Alstom Boiler - Germany* 910 MWe supercritical unit for Jaworzno III Power Plant in Poland – *Eng Krzysztof Janeczek, Rafako SA - Poland* Modeling analysis of installing a low temperature economizer in an existing 600 MWe coal-based power plant – *Mr Jiahui Lu, EDF China - China*	**Biomass and waste cofiring** **Chair: Ms Debo Adams** Cofiring characteristics of biomass in a coal firing combustion system – *Mr Taeyoung Chae, Korea Institute of Industrial Technology - Korea* Subcoal: an alternative for coal – *Mr Neville Roberts, Subcoal - Netherlands* On the emission issues during co-combustion of hard coal and biomass under pressurized conditions – *Janusz Lasek, Institute for Chemical Processing of Coal - Poland* The application of a modified distributed activation energy (DAE) based model to combustion and gasification of biomass-coal char blends – *Mrs Patience Mavhengere, University of the Witwatersrand - South Africa*
17:00–18:30	**Poster session with refreshments - Sala Wystawowa**		

Location:	Aula Mała	Aula Średnia	Sala Seminaryjna
	Tuesday 19 May 2015		
08:30–10:00	**Combustion behaviour** **Chair: Dr Andrew Minchener**	**Oxyfuel II - pilot plant** **Chair: Prof Wojciech Nowak**	**Biomass co-gasification** **Chair: Dr Michalis Agraniotis**
	Unusual combustion behaviour when burning four low grade South African coals: The impact of coal quality on the combustion and operational efficiency on one spreader stoker boiler – *Mr Rets'elisitsoe Taole, University of the Witwatersrand - South Africa*	Oxy-combustion flue gas purification in the CIUDEN compression and purification unit (CPU) – *Dr Jean-Pierre Planckaert, Air Liquide - France*	First results of experimental activities on the 5 MWth Sotacarbo gasification demonstrative plant – *Dr Paolo Deiana, ENEA - Italy*
	Structural evolution and fragmentation phenomena of coal particles in combustion systems – *Dr Osvalda Senneca, Istituto di Ricerche sulla Combustione, CNR - Italy*	Simulation of the sulfur retention in an oxy-fuel 20 MW CFB combustor – *Margarita de las Obras Loscertales, Instituto de Carboquimica (CSIC) - Spain*	Preparation of activated carbon and catalytic coal gasification using biomass ash – *Miss Boodsakorn Kongsomart, Gunma university - Japan*
	A Comparison of Fine Ash Emissions from Biomass and Coal Combustion – *Dr Feyza Kazanç, Ataturk University - Turkey*	Ignition behaviors of particles from different coal ranks in O_2/N_2 and O_2/H_2O atmospheres – *Dr Lei Cai, Huazhong University of Science and Technology - China*	Pyrolysis and combustion behaviors of coal and biomass by thermogravimetric analysis (TGA) – *Dr Alberto Pettinau, Sotacarbo - Italy*
	Co-firing of lignite with hard coal – *Mrs Halina Pawlak-Kruczek, Wroclaw University - Poland*	Oxy-fuel combustion using under bed fines injection in a 100 kWth fluidized bed – *Yinghai Wu, CanmetENERGY - Canada*	Thermochemical conversion of biowaste in the process of co-gasification with hard coal – *Dr Hab Adam Smoliński, Central Mining Institute (GIG) - Poland*
10:00–10:30	**Break**		
10:30–12:10	**Post-combustion capture II** **Chair: Prof Luis Romeo**	**Efficient use of lignite** **Chair: Dr Phil Gurney**	**Coal characterisation and beneficiation** **Chair: Dr Maria Holuszko**
	VPSA adsorption technology for CO_2 capture from power plant – *Dr Hab.Inż. Izabela Majchrzak-Kucęba, Czestochowa University of Technology - Poland*	Improving flexible operation in pulverized fuel boilers utilizing low rank coals – *Dr Michalis Agraniotis, Mitsubishi Hitachi Power Systems - Germany*	Effect of mild oxidation on the structure and properties of coals – *Dr Osvalda Senneca, Istituto di Ricerche sulla Combustione, CNR - Italy*
	Spherical activated carbons promoted with K for post-combustion capture – *Prof Colin Edward Snape, University of Nottingham - UK*	Introduction of a high efficiency lignite-fired power generation technology – getting water from lignite – *Dr Wenping Hu, Electric Power Planning and Engineering Institute - China*	Recovery of carbonaceous matter from three different tailings - Conventional flotation studies – *Prof Irineu Antônio Schadach de Brum, University of Rio Grande do Sul - Brazil*
	From laboratory to pilot scale experimental investigations of CO_2 capture from flue gas – *Dr Inż Dariusz Wawrzyńczak, Czestochowa University of Technology - Poland*	Prospects for the pre-drying technology implementation in partial load/low demand cases – *Mr Konstantinos Atsonios, Centre for Research & Technology Hellas - Greece*	Investigations of the ash fusibility for coal blending – *Dr Seuk Cheun Choi, Korea Insitute of Industrial Technology - Korea*
	Examination of reduction and oxidation reaction kinetics for Fe_2O_3, SiO_2 based ore – *Dr Ewelina Ksepko, Institute for Chemical Processing of Coal - Poland*	Optimisation of a vertically integrated surface lignite mine with a mine-mouth power plant - new approach and case study – *Leszek Jurdziak, Wrocław University of Technology - Poland*	The mode of occurrence of mercury in lignite deposits of Sindh, Pakistan – *Prof Dr Imdadullah Siddiqui, University of Sindh - Pakistan*
		Efficient and low emission combustion of pulverized lignite in utility boilers under various operating conditions – a comprehensive numerical study – *Dr Srdjan Belosevic, Institute of Nuclear Sciences - Serbia*	
12:10–13:30	**Lunch in Sala Wystawowa**		
13:30–15:10	**Chemical looping** **Chair: Dr Calin-Christian Cormos**	**Power plant optimisation** **Chair: Dr Adolf Aumüller**	**Underground coal gasification I** **Chair: Dr Krzysztof Kapusta**
	Hydrodynamic behavior of novel interconnected fluidized beds for chemical looping processes – *Dr Yau-Pin Chyou, Institute of Nuclear Energy Research - Taiwan*	Improving flexibility of coal fired power plants – *Eng Malgorzata (Gosia) Stein-Brzozowska, Mitsubishi Hitachi Power Systems - Germany*	Effective power generation from UCG gas – *Dr Piotr Adam Mocek, Central Mining Institute (GIG) - Poland*
	Thermochemistry of coal upon oxidation-desorption in innovative looping processes – *Dr Osvalda Senneca, Istituto di Ricerche sulla Combustione, CNR - Italy*	Challenges and opportunities in using high ash, low grade coals in modern power generating plant – *Prof Rosemary Falcon, University of the Witwatersrand - South Africa*	Groundwater monitoring during an underground coal gasification process – *Dr Johan van Dyk, African Carbon Energy - South Africa*
	CO_2 capture in coal combustion by chemical-looping with oxygen uncoupling (CLOU) – *Iñaki Adánez-Rubio, Instituto de Carboquimica (CSIC) - Spain*	Overall boiler performance assessment for supercritical coal-fired plant with Code Saturne – *Dr Jiesheng MIN, EDF China - China*	Underground coal gasification pilot trial in the operated mine KWK Wieczorek, Poland – *Prof Krzysztof Stańczyk, Central Mining Institute (GIG) - Poland*
	Investigations on kinetics of both reduction and oxidation reactions for Sinai manganese ore as a potential oxygen carrier for chemical looping – *Dr Ewelina Ksepko, Institute for Chemical Processing of Coal - Poland*	How online air & coal mass flow and UBC measurement systems contribute to higher boiler efficiency, lower emissions, and flexibility in lower rank coal utilization – *Xavier Dhubert, Promecon - Germany*	Effects of groundwater and rock deformation in controlling efficiency and extraction rate in underground coal gasification – *MS Blinderman, Ergo Exergy Technologies - Canada*
		Innovative diagnostic & control systems (FleCoS) for existing power plants – *Mr Henryk Kubiczek, EDF Poland - Poland*	Prospects of underground coal gasification for carbon capture and storage scenario – *Dr Alexey Belov, Far Eastern Federal University - Russia*
17:00–22:00	**Dinner at the Wieliczka Salt Mine**		

Location:	Aula Mała	Aula Średnia	Sala Seminaryjna
	Wednesday 20 May 2015		
09:00–10:00		**Keynote session II** **Chair: Dr Andrew Minchener** U.S. Department of Energy's CCT and CCS RD&D Activities - An Update – *Mr Scott Smouse, National Energy Technology Laboratory - USA* TAURON Group - Innovation as the way to the modern energy industry – *Dr Krzysztof Lampert, TAURON Polska Energia - Poland*	
10:00–10:20	**Break**		
10:20–12:00	**IGCC and precombustion capture** **Chair: Prof Giorgio Cau** An analysis of the performance of an IGCC plant with a PSA process integrated for CO_2 capture – *Luca Riboldi, Norwegian University of Science and Technology (NTNU) - Norway* Performance of hot gas desulfurizer and SEWGS process for pre-combustion CO_2 capture using real syngas from a coal gasifier – *Dr Ho Jung Ryu, Korea Institute of Energy Research - Korea* Increasing the flexibility of IGCC power plants – *Mr Chris Higman, Higman Consulting - Germany* Suitability of a bifunctional catalyst/sorbent material for sour SEWGS processes – *Dr Marta Marono, CIEMAT - Spain* Effect of amine blends on Pre-Combustion CO_2 capture – *Mrs Noraziah Muda, Tenaga Nasional Research - Malaysia*	**New technologies for high efficiency plant** **Chair: Dr Hubert Hoewener** Supercritical CO_2 cycles for coal-fired power plants – *Mounir Mecheri, EDF - France* Development and application of advanced sensors and controls for highly efficient power and energy systems – *Dr Robert Romanosky, National Energy Technology Laboratory - USA* On-line optimization in coal-fired power plants – *Mr Howard Rosenof, NeuCo - USA* Unconventional power cycles for HELE power generation from coal – *Dr Qian Zhu, IEA Clean Coal Centre - UK* Towards zero waste coal power plant – *Dr Tomasz Szczygielski, Warsaw University of Technology - Poland*	**Mercury control** **Chair: Prof Jozef Pacyna** Regenerable sorbents for mercury capture from coal combustion gas – *Prof Colin Edward Snape, University of Nottingham - UK* Mercury reemission control for wFGDs – *Mr John Meier, Nalco - USA* Effect of NO and O_2 on mercury capture efficiency of a regenerable sorbent under oxycoal combustion conditions – *Dr M Teresa Izquierdo, Instituto de Carboquimica (CSIC) - Spain* Ageing, deactivation and regeneration of SCR-deNOx-catalysts - effects on mercury oxidation and deNOx-activity – *Mr Tobias Schwaemmle, IFK Stuttgart - Germany*
12:00–13:20	**Lunch in Sala Wystawowa**		
13:20–15:00	**Gasification II** **Chair: Prof Raymond Everson** Modelling of a coal to SNG process for a German, Greek, and Polish Lignite – *Mrs Efthymia-Ioanna Koytsoumpa, National Technical University of Athens - Greece* Sulfur release behavior during entrained flow coal gasification – *Sarma Pisupati, Pennsylvania State University - USA* Modelling of char-CO_2 reaction kinetics and pore surface evolution under elevated pressure conditions – *Martyna Tomaszewicz, Institute for Chemical Processing of Coal - Poland* CFD investigation of the gasification behavior of four Australian coals in a 5MW pilot-scale reactor – *Dr Michele Vascellari, ZIK Virtuhcon, Freiberg University of Mining and Technology - Germany* Modeling and economic evaluation of carbon capture and storage technologies integrated into SNG plants – *Claudia Bassano, ENEA - Italy*	**Oxyfuel III** **Chair: Dr M Teresa Izquierdo** Oxy-fuel combustion integrated with a CO_2 processing unit – *Prof Wojciech Nowak, AGH University of Science and Technology - Poland* Corrosion of metal surfaces by trisulphates formation in oxy-co-combustion – *Dr M Carmen Mayoral, Instituto de Carboquimica (CSIC) - Spain* SO_3 and sulfates levels detected in co-firing of coal and biomass blends under oxy-firing conditions – *Dr Nelia Jurado, Cranfield University - UK* Dynamic modeling of oxy-combustion power plant – *Andrzej Sachajdak, Silesian University of Technology - Poland*	**Fluidised bed combustion** **Chair: Toby Lockwood** Utility CFB technology developments for flexibile large scale power production – *Mr Kalle Nuortimo, Foster Wheeler Energia Oy - Finland* Circulating fluidised bed boiler – A case study of performance issues and materials – *Dr Saravana Bavan Balakrishnan, Parsons Brinckerhoff - UK* Study on operation ranges in both air-mode and oxy-mode for a circulating fluidized bed boiler – *Dr Taehyun Kim, Hyundai Engineering and Construction - Korea* An investigation of defluidisation within bubbling fluidised bed combustors burning washed and unwashed lump coals – *Daniel Afilaka, University of Nottingham - UK* The effect of the densification process on brown coal's structure and its spontaneous combustion propensity – *Mr Mohammad Reza Parsa, Monash University - Australia*
15:00–15:30	**Break**		
15:30–16:50	**Coal conversion** **Chair: To be confirmed** Assessment of energy vectors polygeneration concepts based on solid fuel direct chemical looping systems – *Dr Eng Calin-Cristian Cormos, Babeș-Bolyai University - Romania* Techno-economic evaluation of coal-to-ammonia plant – *Mr Seunghyeon Yeon, Hyundai Engineering and Construction - Korea* New and efficient utilisation of Hungarian low rank coal – *Dr Andras Kallay, Methunol - Hungary* Co-liquefaction of coal with wastes – *Mr Cemil Koyunoğlu, Istanbul Technical University - Turkey*	**International outlooks for cleaner coal power - Chair: Scott Smouse** Upgrading the efficiency of the world's coal fleet to reduce CO_2 emissions – *Dr Ian Barnes, IEA Clean Coal Centre - UK* Perspectives of power to methanol technology in the power and process industries – *Mrs Efthymia Ioanna Koytsoumpa, Mitsubishi Hitachi Power Systems - Germany* An overview of lignite development activities in Australia – *Dr Phil Gurney, Brown Coal Innovation Australia - Australia* Application of Near-zero PM, SO_3 and NOx Emissions Technology for Coal-fired Power Plants – *Dr Xinglong Zhou, Shenhua Guohua - China*	**Underground coal gasification and coal bed methane - Chair: Prof Krzysztof Stańczyk** Sensitivity analysis of UCG operating parameters on the composition and quality of product gas – *Dr Piotr Adam Mocek, Central Mining Institute (GIG) - Poland* Techno-economics of coal bed methane production in the South Wales coal field – *Dr Vasilis Sarhosis, Cardiff University - UK* A full lifecycle UCG pilot carried out by Carbon Energy at Bloodwood Ck, Australia 2008-2015 – *Dr Cliff Mallett, Carbon Energy - Australia* Production of power and synthetic natural gas using underground coal gasification – *Mr Thomas Gibney, Linc Energy - Poland*
17:00–17:20		Closing address *Dr Andrew Minchener* CCT2017 *Dr Gianni Serra*	
	Thursday 21 May 2015		
09:00–17:00	**Visit to Łagisza power plant, coach departs Auditorium at 09:00**		