EDUCATION, SCIENCE AND TRAINING

SENATE LEGISLATION COMMITTEE - QUESTIONS ON NOTICE
2006-2007 ADDITIONAL ESTIMATES HEARING

Outcome: CSIRO
Output Group: CSIRO

DEST Question No. E945_07

Senator Milne asked on 14 February 2007, EWRE Hansard page 36.

Question:

Publications

Senator MILNE — Okay, but I asked specifically about research products—reports, analysis of those reports, the economics of your work, the liability in relation to it, the climate impacts and all that. Where is the material that you are producing? What have you produced and what are you going to produce in the next 12 months?

Dr Brockway—The CCSD program, the gasification program, is being published with CCSD reports. There have also been a significant number of conference papers and papers in refereed journals. I could give you a list of those; I do not have it with me, of course. The Centre for Low Emission Technology program, the gas separation program, has been established now for only two years, so it is at a relatively early stage, although there have been a number of conference papers et cetera presented on it. I would need to get the data on that.

Answer:

CSIRO has provided the following response.

Publications

Following is a list of CRC for Coal in Sustainable Development (CCSD) publications and reports to which the Division of Energy Technology has contributed from 2004 to 2007. Further publications and reports are expected over the remaining two years that CCSD will be in operation.

Also attached is a list of publications and reports from the Centre for Low Emissions Technology (cLET) since its inception to the current time. It should be noted that cLET has only been undertaking research for approximately two years so it is early in the reporting period. Further publications and reports are expected over the remaining life of cLET.

Publications and Reports for the Cooperative Research Centre for Coal in Sustainable Development (CCSD) by CSIRO Energy Technology
2004-2007

2004

Journal articles and conference presentations

1. Butcher, A.R.*, French, D.H., Cropp, A.L.F.R.*, Gottlieb, P.*, Wall, T.F.*, and Gupta, R.*. Advances in the automated measurement of coal and mineral matter by QEMSCAN. In: *Twenty-First Annual International Pittsburgh Coal Conference: Coal - Energy and the Environment: CD-ROM Proceedings,* Osaka, Japan, September 13-17, 2004. Pittsburgh, Pa.: Pittsburgh Coal Conference. 13 p.

2. Cham, S.T.*, Sahajwalla, V.*, and Sakurovs, R.J. The dissolution of cokes in molten iron. In: *Twenty-First Annual International Pittsburgh Coal Conference: Coal - Energy and the Environment: CD-ROM Proceedings,* Osaka, Japan, September 13-17, 2004. Pittsburgh, Pa.: Pittsburgh Coal Conference. 12 p.

3. Cham, S.T.*, Sahajwalla, V.*, Sakurovs, R.J., Sun, H.*, and Dubikova, M.*. Factors influencing carbon dissolution from cokes into liquid iron. *ISIJ International,* 44, (11): 1835-1841.

4. Harris, D.J., Roberts, D.G., and Henderson, D.G. Gasification behaviour of Australian coals at high temperature and pressure. In: *Twenty-First Annual International Pittsburgh Coal Conference: Coal - Energy and the Environment: CD-ROM Proceedings,* Osaka, Japan, September 13-17, 2004. Pittsburgh, Pa.: Pittsburgh Coal Conference. 18 p.

5. Hilding, T.*, Sahajwalla, V.*, Gupta, S.*, Bjorkman, B.*, Sakurovs, R.J., Grigore, M.*, and Saha-Chaudhury, N.*. Study of gasification reaction of cokes excavated from pilot blast furnace. *SCANMET II: 2nd International Conference on Process Development in Iron and Steelmaking,* Lulea, Sweden, 6-9 June 2004. p. 467-478.

6. Jankowski, J.*, Ward, C.R.*, French, D.H., and Groves, S.*. Leachability of heavy metals from selected Australian fly ashes and its implications for groundwater contamination. In: *Twenty-First Annual International Pittsburgh Coal Conference: Coal - Energy and the Environment: CD-ROM Proceedings,* Osaka, Japan, September 13-17, 2004. Pittsburgh, Pa.: Pittsburgh Coal Conference. 23 p.

7. Jankowski, J.*, Ward, C.R.*, French, D.H., and Groves, S.*. Trace element mobility from selected Australian fly ashes. In: *Twenty-First Annual International Pittsburgh Coal Conference: Coal - Energy and the Environment: CD-ROM Proceedings,* Osaka, Japan, September 13-17, 2004. Pittsburgh, Pa.: Pittsburgh Coal Conference. 16 p.

8. Kinaev, N.N., and Patterson, J.H. Viscous behaviour of Australian coal ash slags with high iron and low silica/alumina ration. In: *Twenty-First Annual International Pittsburgh Coal Conference: Coal - Energy and the Environment: CD-ROM Proceedings,* Osaka, Japan, September 13-17, 2004. Pittsburgh, Pa.: Pittsburgh Coal Conference. 15 p.

9. Nelson, P.F.*, Attalla, M.I., Halliburton, B.W., and Carras, J.N. Fine particle and trace element emissions from coal combustion. In: *13th International Conference on Coal Research,* Shanghai, China, 26-29 October 2004. International Committee for Coal Research in association with China National Coal Association. p. 669-

680.

10. Sakurovs, R.J., Sahajwalla, V.*, Cham, S.T.*, and Grigore, M.*. The impact of advancing BF technology on coke quality requirements. *2nd China International Coking Technology and Coke Market Congress 2004,* Beijing, China, June 22-23, 2004. Beijing: China Coking Congress. p. 192-197.

11. Ward, C.R.*, French, D.H., and Jankowski, J.*. Comparative evaluation of leachability test methods and element mobility for selected Australian fly ash samples. In: *Twenty-First Annual International Pittsburgh Coal Conference: Coal - Energy and the Environment: CD-ROM Proceedings,* Osaka, Japan, September 13-17, 2004. Pittsburgh, Pa.: Pittsburgh Coal Conference. 12 p.

12. Yu, J.*, Harris, D.J., Lucas, J.*, Roberts, D.G., Wu, H.*, and Wall, T.F.*. Effect of pressure on char formation during pyrolysis of pulverized coal. *Energy & Fuels,* 18, (5): 1346-1353.

Reports

1. Cottrell, A., Nunn, J.*, and Wibberley, L.J. *LCA of Western Australia's south west interconnected system for YEJ 2002*, ET/IR 931R. (CCSD Technology Assessment Report 50)

2. Day, S.J., and Riley, K.W. *Waste streams in black coal mining and coal-fired power generation. CCSD project 6.1*, ET/IR 610R. (CCSD Research Report 42)

3. Do, K.T., and Duffy, G.J. *Fact sheet on the IGCC coal value model*, ET/IR 634R.

4. Palfreyman, D., Nunn, J.*, and Wibberley, L.J. *Preliminary assessment of a process for post combustion capture of CO2*, ET/IR 939R. (CCSD Technology Assessment Report 43)

5. Patterson, J.H., and Do, K.T. *Survey of the suitability of export thermal coals for IGCC use*, ET/IR 667R. (CCSD Research Report 49)

6. Roberts, D.G., and Harris, D.J. *Project 3.1. Entrained-flow gasification. Task 2 Milestone Report: Bench-scale assessment of international coals for use in gasification*, ET/IR 685R. (Internal CCSD report)

7. Sakurovs R.J., and French, D.H. *Extended characterisation of world cokes*, ET/IR 679R. (CCSD Research Report 55)

8. Sakurovs R.J., Gawronski, E., and Burke, L.O. *Influence of coking conditions on the determination of the amount of reactive inertinite in coals. Report to the CRC for Coal in Sustainable Development Project 5.1.3*, ET/IR 722R.

9. Scaife, P., Urfer, A.*, Brown, P., Cottrell, A.J., Nunn, J.*, and Wibberley, L.J. *Western Australia energy system*, ET/IR 942R. (CCSD Technology Assessment Report 51)

2005

Journal articles and conference presentations

1. Grigore, M.*, Sakurovs, R.J., French, D.H., and Sahajwalla, V.*. Mineral matter in coke and its effect on gasification rate. *2005 International Conference on Coal*

Science and Technology, Okinawa, Japan, October 10-13, 2005. 9 p.

2. Hla, S.S., Harris, D.J., and Roberts, D.G. A coal conversion model for interpretation and application of gasification reactivity data. *2005 International Conference on Coal Science and Technology,* Okinawa, Japan, October 10-13, 2005. Ibaraki, Japan: National Institute of Advanced Industrial Science and Technology. 21 p.

3. Jankowski, J.*, Dubikova, M.*, Ward, C.R.*, and French, D.H. An application of hydrogeochemical modelling in understanding chemical reactions in fly ash-water interaction during batch leaching tests of acidic fly ashes. In: *Twenty-Second Annual International Pittsburgh Coal Conference: Coal - Energy, Environment and Sustainable Development: CD-ROM Proceedings,* Pittsburgh, Pa., 12-15 September 2005. Pittsburgh, Pa.: Pittsburgh Coal Conference. 22 p.

4. Jankowski, J.*, Dubikova, M.*, Ward, C.R.*, and French, D.H. Formation of ettringite in leaching solutions from alkaline fly ashes: Evaluation using hydrogeochemical modelling. In: *Twenty-Second Annual International Pittsburgh Coal Conference: Coal - Energy, Environment and Sustainable Development: CD-ROM Proceedings,* Pittsburgh, Pa., 12-15 September 2005. Pittsburgh, Pa.: Pittsburgh Coal Conference. 23 p.

5. Jankowski, J.*, Ward, C.R.*, and French, D.H. The heavy metal leaching behaviour of Australian fly ashes. In: *2005 World of Coal Ash (WOCA),* Lexington, Ky., April 11-15 2005. 25 p.

6. Liu, Y.*, Gupta, R.*, Sharma, A.*, Wall, T.F.*, Butcher, A.R.*, Miller, G.*, Gottlieb, P.*, and French, D.H. Mineral matter-organic matter association characterisation by QEMSCAN and applications in coal utilisation. *Fuel,* 84: 1259-1267.

7. Liu, Y.*, Gupta, R.*, Wall, T.F.*, Butcher, A.R.*, Gottlieb, P.*, and French, D.H. Mineral-mineral associations characterized by QEMSCAN. *2005 International Conference on Coal Science and Technology,* Okinawa, Japan, October 10-13, 2005. 8 p.

8. Morrison, A.L.*, Graham, P.W., and Nelson, P.F.*. Emission consequences of transformation of Australia's energy generation portfolio to 2050. In: *17th International Clean Air & Environment Conference,* Hobart, Tas., 3-6 May 2005. Hobart, Tas.: Convention Wise for the Clean Air Society of Australia and New Zealand. 5 p.

9. Morrison, A.L.*, Graham, P.W., and Nelson, P.F.*. Future ash availability - potential consequences of transformation of Australia's energy generation portfolio to 2050. In: *2005 World of Coal Ash (WOCA),* Lexington, Ky., April 11-15 2005. 13 p.

10. Park, D.-C., Day, S.J., and Nelson, P.F.*. Nitrogen release during reaction of coal char with O_2, CO_2, and H_2O. *Proceedings of the Combustion Institute,* 30: 2169-2175.

11. Reedman, L.J., Graham, P.W., and Coombes, P.*. Using a real options approach to model technology adoption under carbon price uncertainty: an application to the Australian electricity generation sector. In: *Proceedings of the Australian Conference of Economists, 2005,* University of Melbourne, September 26-28 2005. Parkville, Vic.: University of Melbourne. 16 p.

12. Ward, C.R.*, and French, D.H. Relation between coal and fly ash mineralogy, based on quantitative X-ray diffraction methods. In: *2005 World of Coal Ash (WOCA),* Lexington, Ky., April 11-15 2005. 14 p.

13. Wee, H.L.*, Wu. H.*, Zhang, D.*, and French, D.H. The effect of combustion conditions on mineral matter transformation and ash deposition in a utility boiler fired with a sub-bituminous coal. *Proceedings of the Combustion Institute,* 30: 2981-2989.

Reports

1. Brown, P., Cottrell, A.J., Searles, M., Wibberley, L.J., and Scaife, P. *LCA of the New South Wales electricity grid for YED 2003*, ET/IR 936R. (CCSD Technology Assessment Report 58)

2. Brown, P., Cottrell, A.J., Wibberley, L.J., and Scaife, P. *LCA of the Victorian electricity grid for YED 2003*, ET/IR 938R. (CCSD Technology Assessment Report 57)

3. Brown, P., Searles, M., Cottrell, A.J., and Scaife, P. *LCA of the Queensland electricity grid for YEJ 2004*, ET/IR 937R.

4. Dave, N.C., Do, K.T., and Duffy, G.J. *Assessment of the aqua ammonia process as an option for CO2 capture from coal-fired power plants*, ET/IR 837R. (CCSD Research Report 68)

5. Day, S.J., Nelson, P.F.*, and Park, D.C. *Gaseous nitrogen and sulphur emissions from coal gasification. Final industry report to CCSD Project 3.1, Task 5*, ET/IR 756R. (CCSD Research Report 59)

6. Dubikova, M.*, Jankowski, J.*, Ward, C.R.*, and French, D.H. *Application of hydrogeochemical modelling to evaluating chemical reactions and element mobility associated with the interaction of water and fly ash: research report*, ET/IR 954R.

7. Graham, P.W., Coombes, P.*, Beer, T., Bouma, W., and Vincent, D.*. *Options for electricity generation in Australia*, ET/IR 855R. (CCSD Technology Assessment Report 44)

8. Harris, D.J., and Roberts, D.G. *CCSD Project 3.1 Task 1 Milestone Fact sheet: Specification of gasification test procedure (version 1): Identification of test parameters and assessment tools*, ET/IR 948R. (CCSD Fact Sheet 8)

9. Hla, S.S., Harris, D.J., and Roberts, D.G. *Project 3.1. Entrained-flow gasification. Task 9 Milestone Report: Development of an interpretive gasification conversion model*, ET/IR 805R.

10. Hodge, E., Roberts, D.G., Harris, D.J., and Stubington, J.F.*. *Project 3.1. Entrained-flow gasification. Task 7 Milestone Report: Char gasification at high temperatures: progress report on literature review*, ET/IR 816R.

11. Kinaev, N.N. *Project 3.1. Entrained-flow gasification. Task 4 Milestone Report: A review of mineral matter issues in coal gasification*, ET/IR 793R. (CCSD Research Report 60)

12. Palfreyman, D., Cottrell, A.J., Scaife, P., and Wibberley, L.J. *Techno-economics of oxygen-fired pf power generation with CO2 capture*, ET/IR 945R.

13. Riley, K.W. *Legislation relevant to ash disposal: report on Task 6.1.7 to CCSD*, ET/IR 739R. (CCSD Technical Note 19)

14. Riley, K.W., Dale, L.S., Devir, G.*, Williams, A.*, and Holcombe, D.*. *Background information for website on trace elements in coal. Report on ACARP Project C12060*, ET/IR 787R. (CCSD Research Report 56)

15. Roberts, D.G., and Kinaev, N.N. *International travel report: Japan, September 9-19, 2004*, ET/IR 744R.

16. Roberts, D.G., and Tinney, J. *Reactivity measurements of an Indian coal char for pressurised fluidised bed gasification*, ET/IR 771R.

17. Roberts, D.G., Tinney, J., and Harris, D.J. *Project 3.1. Entrained-flow gasification. Task 2 Milestone Report: Char reactivity in gas mixtures: competition and inhibition*, ET/IR 797R. (Internal CCSD report)

18. Scaife, P., Brown, P., Cottrell, A.J., and Wibberley, L.J. *Country energy scenarios - India*, ET/IR 940R. (CCSD Technology Assessment Report 53)

19. Scaife, P., Brown, P., Cottrell, A.J., and Wibberley, L.J. *Japan energy scenarios 2004*, ET/IR 941R. (CCSD Technology Assessment Report 46)

20. Wibberley, L.J., Cottrell, A.J., Palfreyman, D., Scaife, P., and Brown, P. *Techno-economic assessment of power generation options for Australia*, ET/IR 934R. (CCSD Technology Assessment Report 52)

21. Wibberley, L.J., Cottrell, A.J., Scaife, P., and Brown, P. *Synergies with renewables: concentrating solar thermal*, ET/IR 943R. (CCSD Technology Assessment Report 56)

2006

Journal articles and conference presentations

1. Cham, S.T.*, Sakurovs, R.J., Sun, H.*, and Sahajwalla, V.* Influence of temperature on carbon dissolution of cokes in molten iron. *ISIJ International,* 46: 652-659.

2. Grigore, M.*, French, D.H., Sakurovs, R.J., Gupta, S.*, and Sahajwalla, V.* Effect of coke mineralogy on the gasification behavior and their implications for innovative blast furnace operations. *Proceedings of the First Australia-China-Japan Symposium on Iron and Steelmaking,* Shengyang, China, September 24-26, 2006. Shenyang, China: Liaoming Science and Technology Publication. p. 66-74.

3. Grigore, M.*, Sakurovs, R.J., French, D.H., and Sahajwalla, V.* Influence of mineral matter on coke reactivity with carbon dioxide. *ISIJ International,* 46: 503-512.

4. Grigore, M.*, Sakurovs, R.J., French, D.H., and Sahajwalla, V.* Influence of mineral matter on coke reactivity with carbon dioxide. *Metalurgia International,* 11: 5-21.

5. Grigore, M.*, Sakurovs, R.J., French, D.H., and Sahajwalla, V.* Mineral matter in coke and its effect on gasification. In: *Papers Presented at the Research Seminar, Ishii Symposium on Sustainable Ironmaking,* Sydney, N.S.W., 2 & 3 March 2006. Pullenvale, Qld.: Cooperative Research Centre for Coal in Sustainable Development. 12 p.

6. Gupta, S.*, Al-Omari, Y.*, Sahajwalla, V.*, and French, D.H. Influence of carbon structure and mineral association of coals on their combustion characteristics for pulverized coal injection (PCI) application. *Metallurgical and Materials Transactions B,* 37: 457-473.

7. Harris, D.J., Roberts, D.G., and Henderson, D.G. Gasification behaviour of Australian coals at high temperature and pressure. *Fuel,* 85: 134-142.

8. Hodge, E.M., Roberts, D.G., Harris, D.J., and Stubington, J.F.* The char-CO2 reaction at high temperatures and pressures. In: *Twenty-Third Annual International Pittsburgh Coal Conference: CD-ROM Proceedings,* Pittsburgh, Pa., September 25-28, 2006. Pittsburgh, Pa.: Pittsburgh Coal Conference. 14 p.

9. Jankowski, J.*, Ward, C.R.*, French, D.H., and Groves, S.* Mobility of trace elements from selected Australian fly ashes and its potential impact on aquatic ecosystems. *Fuel,* 85: 243-256.

10. Lovel, R., Vining, K., and Dell'Amico, M. Iron ore sintering with charcoal. In: *Papers Presented at the Research Seminar, Ishii Symposium on Sustainable Ironmaking,* Sydney, N.S.W., 2 & 3 March 2006. Pullenvale, Qld.: Cooperative Research Centre for Coal in Sustainable Development. 13 p.

11. Reedman, L.J., Graham, P.W., and Coombes, P.* Using a real options approach to model technology adoption under carbon price uncertainty: an application to the Australian electricity generation sector. *Economic Record,* 82, (Special issue): S64-S73.

12. Roberts, D.G., and Harris, D.J. A kinetic analysis of coal char gasification reactions at high pressures. *Energy & Fuels,* 20: 2314-2320.

13. Sakurovs, R.J. Current trends in coke quality. In: *Papers Presented at the Research Seminar, Ishii Symposium on Sustainable Ironmaking,* Sydney, N.S.W., 2 & 3 March 2006. Pullenvale, Qld.: Cooperative Research Centre for Coal in Sustainable Development. 13 p.

14. Ward, C.R.*, and French, D.H. Determination of glass content and estimation of glass composition in fly ash using quantitative X-ray diffractometry. *Fuel,* 2268-2277.

15. Ward, C.R.*, French, D.H., Heidrich, C.*, and Bowman, H.* Fly ash - waste or resource? In: *Proceedings of the Thirty Sixth Sydney Basin Symposium on "Advances in the Study of the Sydney Basin",* editors, Hutton, A.*, and Griffin, J.*, Wollongong, N.S.W., 27-29 November, 2006. Wollongong, N.S.W.: University of Wollongong. p. 125-132.

Reports

1. Brown, P., Cottrell, A.J., and Scaife, P. *LCA of Australian electricity grids for YED 2004*, ET/IR 935R.

2. French, D.H., Smitham, J.B., and Nelson, P.F.*. *A preliminary assessment of the physical and chemical variability of selected Australian fly ashes*, ET/IR 817R. (CCSD Research Report 65)

3. Halliburton, B.W., Carras, J.N., and Nelson, P.F.*. *Fine particle emissions from power stations*, ET/IR 711R. (CCSD Technology Assessment Report 55)

4. Harris, D.J., Roberts, D.G., Hodge, E.M., and Henderson, D.G. *Gasification behaviour of Australian coals at high temperatures*, ET/IR 873R. (CCSD Research Report 66)

5. Hodge, E. *23rd International Pittsburgh Coal Conference, 25th-28th September 2006, Pittsburgh, PA, USA*, ET/IR 908.

6. Kinaev, N.N. *Project 3.1. Entrained-flow gasification. Task 4 Milestone Report: Effect of potassium on viscous behaviour of Australian coal ash slags*, ET/IR 904R.

7. Reedman, L.J., Graham, P.W., Coombes, P.*, and Vincent, D.*. *Impact of carbon price uncertainty on investment in selected electricity generation options*, ET/IR 856R. (CCSD Technology Assessment Report 59)

8. Riley, K.W. *Benchmarking of fly ash: final report on Task 6.1.7 to CCSD*, ET/IR 818R. (CCSD Research Report 67)

9. Riley, K.W., Farrell, O.P., French, D.H., Ward, C.R.*, and Nelson, P.F.*. *Modes of occurrence of trace elements in Australian coals*, ET/IR 822R. (CCSD Research Report 64)

10. Roberts, D.G., Tinney, J., and Harris, D.J. *Project 3.1. Entrained-flow gasification. Task 2 Milestone Report: Char reactivity in gas mixtures: hydrogen inhibition of the steam-char reaction*, ET/IR 849R.

11. Sakurovs, R.J. *Fact sheet: Mineral matter transformations during coking*, ET/IR 950R. (CCSD Fact Sheet 9)

12. Ward, C.R.*, Dubikova, M.*, French, D.H., Jankowski, J.*, Li, Z.*, Groves, S.*, and Riley, K.W. *Mineralogy, geochemistry and leaching characteristics of long-stored fly ashes in relation to ash dam water and groundwater quality: a case study at Wallerawang, New South Wales*, ET/IR 953R.

13. Ward, C.R.*, French, D.H., Jankowski, J.*, Riley, K.W., and Li, Z.*. *Literature review: Use of coal ash in mine backfill and related applications*, ET/IR 932R. (CCSD Research Report 62)

14. Ward, C.R.*, French, D.H., Stephenson, L.G.*, Riley, K.W., and Li, Z.*. *Laboratory evaluation of ash, rock and water interactions for use in mine backfill evaluations: a preliminary study based on the Tarong Coal Mine and Power Station, Queensland*, ET/IR 952R. (CCSD Research Report 63)

2007

Journal articles and conference presentations

1. Grigore, M.*, Sakurovs, R.J., French, D.H., and Sahajwalla, V.*. Effect of carbonisation conditions on mineral matter in coke. *ISIJ International,* 47: 62-66.

2. Gupta, S.*, Dubikova, M.*, French, D.H., and Sahajwalla, V.*. Characterization of the origin and distribution of the minerals and phases in metallurgical cokes. *Energy & Fuels,* 21: 303-313.

Publications and Reports for the Centre for Low Emissions Technology (cLET) by CSIRO Energy Technology
2004-2007

2004

Reports

1. Duffy, G.J., Beltramini, J.*, Diniz da Costa, J.C.*, Dicks, A.*, Edwards, J.H., Ilyushechkin, A., Park, D.C., and Trimm, D.L.*. *Centre for Low Emission Technology scoping study report: syngas processing*, ET/IR 791R.

2. Harris, D.J., Su, S.*, and Gleeson, T.*. *Centre for Low Emission Technology scoping study report: gasification and core facility scoping studies*, ET/IR 868R.

3. Sharma, S.D., Su, S.*, Morpeth, L., Park, D.C., Dolan, M.D., and Feng, B.*. *Centre for Low Emission Technology scoping study report: syngas cleaning*, ET/IR 792R.

2005

Journal articles and conference presentations

1. Sharma, S.D., Dolan, M.D., Dell'Amico, M., Ilyushechkin, A., Kinaev, N.N., McLennan, K.G., Harris, D.J., and Thambimuthu, K.V. A critical review of syngas cleaning technologies - fundamental limitations and practical problems. In: *Advanced Gas Cleaning Technology: Proceedings of the 6th International Symposium on Gas Cleaning at High Temperatures,* editors Kanaoka, C., Makino, H., and Kamiya, H., Osaka, Japan, October 20-22, 2005. Tokyo: Jugei Shobo. p. 315-323.

Reports

1. da Costa, J.* , Smitham, J.B., Badwal, S.P.S., Beltramini, J., Chiefari, J., Dicks, A., Dave, N.C., Dolan, M.D., Donelson, R., Duke, M., Feng, B., Groth, A., Hill, A., Ilyushechkin, A., Jacobs, P., Lu, G.Q., McLennan, K.G., Macrossan, M., Morpeth, L., Nguyen, C., Pham, T., and Zhu, J. *Centre for Low Emission Technology gas separation scoping study: final report submitted by CSIRO & the University of Queensland*, ET/IR 790R.

2. Sharma, S.D. *A Report on 6th International Symposium and Exhibition on Gas Cleaning at High Temperatures, 20-22 October 2005, Osaka, Japan*, ET/IR 826R.

2006

Journal articles and conference presentations

1. Dolan, M.D., Dave, N.C., Ilyushechkin, A., Morpeth, L.D., and McLennan, K.G. Composition and operation of hydrogen-selective amorphous alloy membranes. *Journal of Membrane Science,* 285: 30-55.

2. Sharma, S.D., and Thambimuthu, K.V. cLET research aimed at lower emissions. *Queensland Government Mining Journal,* no.1222: 51-52.

Reports

1. Dave, N.C., Dolan, M.D., Ilyushechkin, A., McLennan, K.G., and Morpeth, L. *Thin film metal membranes (amorphous) for hydrogen separation.*, ET/IR 898R.

2. Park, D.C., Duffy, G.J., Edwards, J.H., Ilyushechkin, A., Morpeth, L., and Roberts, D.B. *Catalysts for water gas shift reaction with coal-derived syngases in fixed-bed and packed-bed membrane reactors; progress report*, ET/IR 896R.

3. Sharma, S.D., Dolan, M.D., Ilyushechkin, A., McLennan, K.G., Kinaev, N.N., Nguyen, T., and Park, D.C. *cLET Dry Gas Cleaning GC001. Thermodynamic identification of protectors, sorbents and guard bed materials for cLET dry gas cleaning process development. Annual report*, ET/IR 900R.

2007

Reports

1. Hla, S., Park, D.C., Duffy, G.J., Edwards, J.H., Morpeth, L., Nguyen, T., and Roberts, D.B. *Catalysts for water gas shift reaction with coal-derived syngases in fixed-bed and packed-bed membrane reactors; progress report, 1 July 2006-31 December 2006*, ET/IR 923R.

2. Park, D.C., Hla, S., Duffy, G.J., Edwards, J.H., Ilyushechkin, A., Morpeth, L., and Roberts, D.B. *Water gas shift reactions in high temperature membrane reactors: progress report, period 1 July 2006-31 December 2006*, ET/IR 924R.

* Denotes authors who are **not** CSIRO officers.