



**Trade &
Investment**
Resources & Energy

Report to NSW Parliament

Coal Innovation NSW Fund

**Income, Expenditure
&
Evaluation of Projects**

2013-2014

Coal Innovation NSW Fund

Income and Expenditure, and Evaluation of Projects Report 2013/2014

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Disclaimer

The information contained in this publication is based on knowledge and understanding at the time of writing (October 2014). However, because of advances in knowledge, users are reminded of the need to ensure that information on which they rely is up to date and to check the currency of the information with the appropriate officer of NSW Trade & Investment, or the user's independent advisor.

TRIM reference:

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Annual Report 2013-14

Coal Innovation NSW Fund

Outcomes Achieved to 30 June 2014

A. BACKGROUND

The Coal Innovation NSW Fund (the Fund) has been established and is governed under the *Coal Innovation Administration Act 2008 (Act)*.

Part 2, section 5 of the *Act* establishes the Purpose of the Fund, as follows:

- (a) *to provide funding for research into, and development of, low emissions coal technologies,*
- (b) *to provide funding to demonstrate low emissions coal technologies,*
- (c) *to provide funding to increase public awareness and acceptance of the importance of reducing greenhouse gas emissions through the use of low emissions coal technologies,*
and
- (d) *to provide funding for the commercialisation of low emissions coal technologies.*

Part 2, section 7 of the *Act*, details Payments out of the Fund, to include:

- (1) *There is payable from the Fund:*
 - (a) *payments approved by the Minister for the purposes of the Fund,*
 - (b) *administrative expenses incurred in relation to the Fund or CINSW, and*
 - (c) *payments directed or authorised to be paid from the Fund by or under this or any other Act or law.*
- (2) *Any money paid into the Fund on the condition that is to be used only for a specified purpose, including any proceeds of the investment of that money in the Fund, is only payable from the Fund for the specified purpose and a proportionate share of the administrative expenses payable from the Fund.*
- (3) *The Minister is to produce an Annual Report detailing fund allocations and the projects and other activities that received funding under this Act during the year.*
- (4) *The Annual Report is to include an evaluation of the effectiveness of each of the projects and other activities that received funding under this Act.*
- (5) *The Annual Report is to be tabled in each House of Parliament within 6 months after the end of the financial year to which it relates.*
- (6) *The Minister is to publish each Annual Report, so as to promote low emissions coal technologies to the NSW public.*

Part 3, section 10 of the *Act*, prescribes the Membership of CINSW, as follows:

- (1) CINSW is to consist of the following members appointed by the Minister:
 - (a) *an independent person appointed by the Minister to be the Chairperson of CINSW,*
 - (b) *2 persons, each of whom is employed in or by a government agency,*
 - (c) *2 persons who are nominated jointly by the Australian Coal Association and the Minerals Council to represent the New South Wales black coal industry,*
 - (d) *such other persons (up to a maximum of 4) as the Minister may appoint from time to time, being persons whom the Minister considers have qualifications or experience relevant to the functions of CINSW.*

Part 3, section 11 of the *Act* establishes Coal Innovation NSW (CINSW) and prescribes its functions.

- (1) *The functions of CINSW are as follows:*
 - (a) *to give advice and make recommendations to the Minister concerning the funding from the Fund of projects and other activities for the purposes of the Fund, including advice about priorities for funding and recommendations concerning applications for funding,*
 - (b) *to advise the Minister on policies to encourage the development and implementation of low emissions coal technologies,*

- (c) *to make recommendations to the Minister concerning opportunities for involvement by private and public sector entities in interstate, national and international research projects involving low emissions coal technologies,*
 - (d) *to advise the Minister on such other matters concerning low emissions coal technologies as the Minister may refer to the CINSW,*
 - (e) *such other functions with respect to low emissions coal technologies as the Minister may from time to time direct.*
- (2) *CINSW may give its advice and make its recommendations either at the request of the Minister or without any such request.*
- (3) *CINSW has such other functions as are conferred or imposed on it by or under this or any other Act.*

The current Coal Innovation NSW (CINSW) membership has either been appointed or reappointed for a term of two years, ending 31 December 2015.

The purpose of this report is to fulfil the requirements of the *Act's* Part 2, Sections 7(3) to 7(6) inclusive. That is to produce an Annual Report detailing Coal Innovation NSW's Fund allocations and to provide an evaluation of the effectiveness of each of the projects.

On 10th March 2014, the Auditor General wrote to the Minister and Department stating that the Coal Innovation NSW fund is 'controlled' by the Minister for Resources & Energy and as such should comply with section 45A(1A) of the *Public Finance and Audit Act 1983* (the PF&A Act). Therefore the Fund, to comply with the PF&A Act, must:

- prepare financial statements in accordance with S45E(1), (separately from Department Trade & Investment's statement as was included in the past)
- have the financial statements audited by the Audited General (s45F).

The audited accounts attached to this report have complied with the request of the Auditor General correspondence.

B. PAYMENTS RECEIVED

During the 2013/14 financial year the Fund received income from:

- Interest: with the separation of accounts from Tade & Investment, the Fund earned \$2,073,257 in interest payments, Interest is earned on daily bank balances at the monthly average NSW Treasury Corporation (TCorp) 11am unofficial cash rate, adjusted for a management fee to NSW Treasury.
- The CO₂ Storage Assessment Program Funding Agreement with the Commonwealth and ACALET Ltd. These funds along with NSW contributions are to be expended on the CO₂ Storage Assessment Program over the coming 12 months (see C5). The Commonwealth contributed its proportional share upfront, with ACALET paying quarterly in arrears on invoice.
- During Stage 1B of the CO₂ Storage Assessment Program, the Program undertook certain activities on behalf of the CSIRO and CO2CRC, repayment is listed below as other income.

The Fund received a repayment from the Delta CCS Demonstration Project due to:

- the project being effectively suspended awaiting the delivery of a suitable storage reservoir and
- The future sale of the Vales Point site, through the government's asset sale program. (see D3) Each funding partner received a proportional share of unspent research money paid in advance.

The tables below summarise the income received as follows:

description	value \$
Interest	2,073,257
The Commonwealth Government (Geoscience Australia)	7,200,000
Australian Coal Association Low Emission Technologies Ltd	7,690,011
Total	16,963,268

<i>Other income</i>	
CSIRO	190,454
Auscope (CO2CRC)	317,542
Delta CCS Project-Refund	31,476
	539,472

total income 2013/14	17,502,740
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C. EXPENDITURE

Coal Innovation NSW has dispersed funds received from the Climate Change Fund and other income sources listed above, across the key areas as set out as follows:

C1: Coal Innovation NSW (Advisory Council) & Technical Working Group costs

For the financial year ending 30 June 2014 the following funds have been expended in relation to the costs of Coal Innovation NSW meetings and sitting fees. (It is noted that the Technical Working Group did not meet during this period):

description	value \$
Total costs of Coal Innovation NSW (Council).	22,348

C2: Coal Innovation NSW Secretariat

Coal Innovation NSW Secretariat employs five staff:

- Director;
- 2 Senior Project Officers (Economist and Scientist);
- Project Officer (Finance);
- Geoscientist.

For the financial year ending 30 June 2014 the following funds have been expended against salaries and on costs:

description	value \$
Secretariat costs including salaries	613,140

C3: Delta Carbon Capture and Storage Project (Delta Electricity).

For the financial year ending 30 June 2014 the following funds have been expended in relation to the Delta CCS project:

description	value \$
Return of prepaid research allocation	- 31,476
Total CCS Delta Demonstration Project	- 31,476

C4: Research & Development (R&D) projects funded under Expressions of Interest process.

For the financial year ending 30 June 2014 the following funds have been expended in relation to the R&D projects:

Applicant	project description	value \$
UCC Energy P/L	Project cancelled at end of Stage 1	
Centennial Coal (Mandalong) P/L	Fugitive Emissions (ventilation)	-223,747
CSIRO	Capture Testing Solvents	81,954
CSIRO	Fugitive Emissions (open cut)	terminated
Uni of Newcastle	Chemical Looping – oxyfuel	127,883
Uni of Newcastle	Social Research/Public Awareness	-12,745
CSIRO	Novel Capture & Energy Efficiency	100,932
Uni of Newcastle	Direct Carbon Fuel Cell	82788
Total		716,232

Note: *the negative values in Centennial and Uni of Newcastle (Social Research) are effectively reversals of accruals from the previous year. These accruals were placed in the accounts with expectations of payments, however due to milestones not being met in the corresponding periods payments were not made. These negative figures are balancing figures and not repayments.*

C5: NSW CO₂ Storage Assessment Program

For the financial year ending 30 June 2014 the following funds have been expended in relation to the NSW Data Acquisition & Drilling Program:

description	value \$
Total State Wide Storage Assessment project	18,755,492

Note: The CO₂ Storage Assessment Program is a \$54.3 million jointly funded agreement. Currently the Darling Basin drilling program has a \$20.2 million budget and will receive income from the funding partners along with CINSW Funds.

C6: Membership of CO2CRC

For the financial year ending 30 June 2014 the following funds have been expended and accrued in relation to membership of CO2CRC

description	value \$
Membership of CO2CRC	250,000
Conference Fees	20,000
Total	270,000

Note: the \$20,000 Conference fee was an approved sponsorship fee for the National CCS Week Conference held in Sydney 1 to 2 September 2014.

C7: Legal and Audit Fees

description	value \$
Legal Fees-Funding Agreement GreenMag	5,283
Audit Fees for FY 2008-2013 & FY 2013-14	56,250
Total	61,533

D. EVALUATION

Evaluation of the effectiveness of each of the projects & other activities that received funding under the Act.

D1 Coal Innovation NSW (CINSW)

The *Coal Innovation Administration Act 2008 (Act)*, which amendments were assented on 22 August 2011, requires the formation of Coal Innovation NSW (CINSW). As prescribed in Part 3, section 10 of the *Act*, CINSW is to comprise a Chair, and up to eight members appointed by the Minister, Coal Innovation NSW now consists of two appointed members from government and two from industry to represent the NSW black coal industry, and up to four additional members and an independent person as Chairperson appointed by the Minister.

As at 1 July 2013 the membership of CINSW was (and had been the same since the inaugural meeting):

- Dr Neil Shepherd, Chair
- Prof Mary O’Kane, NSW Chief Scientist
- Mr Brad Mullard, ED, Mineral Resources, Department Trade and Investment
- Dr Nikki Williams, Chief Executive, Australian Coal Association
- Mr Michael Buffier, Chairman NSW Minerals Council
- Prof Michael Dureau, Deputy Chairman, Warren Centre for Advanced Engineering
- Prof Jim Galvin, Mining Engineer Consultant and Academic
- Prof Dianne Wiley, Program Manager (CO₂Capture) CO2CRC and Professor UNSW

On the 29 November 2013 the Minister made 1 new appointment as a result of the resignation of Dr Nikki Williams

- Mr David Moulton, Chairman NSW Minerals Council and CEO Centennial Coal, for a period of two years, term ending 30 December 2015;
- and reappointed the following members for a period of two years, with their terms ending 30 December 2015:

- Dr Neil Shepherd, Chair
- Prof Mary O’Kane, NSW Chief Scientist
- Mr Brad Mullard, ED, Mineral Resources, Department Trade and Investment
- Mr Michael Buffier, Group Executive, Glencore
- Prof Michael Dureau, Deputy Chairman, Warren Centre for Advanced Engineering
- Prof Jim Galvin, Mining Engineer Consultant and Academic
- Prof Dianne Wiley, Program Manager (CO₂Capture) CO2CRC and Professor UNSW

CINSW held three meetings in the 2012/13 financial year:

- 31 July 2013,
- 3 December 2013
- 26 March 2014.

Several sub committees were held to discuss progress of R&D projects and the development of a future ‘*low emissions coal strategy*’.

Of the \$ 22,348 expenditure, \$20,000 was paid to the Chair as his remuneration. The remaining costs were meeting costs including room hire and refreshments.

Evaluation:

The 6th meeting of CINSW, held 31 July 2013, continued to review the progress of R&D projects being funded under the CINSW Fund and received a detailed presentation from Prof Donne on his Direct Carbon Fuel Cell project. CINSW also reviewed the development of the risk register and risk management plans for the Darling Basin drilling program and received latest update on the engagement of contractors. The Council received report backs on the CINSW Fund's successful review by Treasury, the Commonwealth's development of a National CCS Roadmap and the awarding to NSW of the 2014 National Conference during CCS Week. Finally, Council also reviewed the upgrade of CINSW's website.

At the 7th meeting of CINSW, held 3 December 2013, Dr Shi Su presented the latest findings on his Capture Technology research along with reports from the Secretariat as to the progress on all R&D projects. CINSW began detailed discussions on 'Future Investment in R&D for CINSW Fund' and formed a sub committee, chaired by NSW Chief Scientist and Engineer to progress the development of a draft policy paper. Finally Council received a detailed report on the commencement of the Darling Basin drilling program, including finalisation of contracts, budgets and site safety management plans.

At the 8th meeting of CINSW, held 26 March 2014, CINSW finalised their 'Code of Conduct' in accordance with Government and Public Sector Commissioner's guidelines and after receiving internal Department legal advice. CINSW received a detailed report from Aztech Well Constructions, project managers, Darling Basin drilling program, as to the current status of drilling and forward planning. CINSW continued discussions on the development of a future low emissions coal technology options policy with assistance from a presentation by Mick Buffier on international perspectives of current and predictive coal production and low emissions coal technology research initiatives.

All three meetings were productive with constant monitoring of R&D projects and drilling programs and the efficient use of CINSW Funds. Their concentrated work has centred on two dominant themes:

1. Darling Basin drilling program and the establishment of systems and processes to deliver a successful outcome,
2. the understanding of current research into low emissions technologies in Australia (and internationally) and the future role for NSW in this field so as to maximise the return for investment by the fund.

It should also be acknowledged that CINSW has put in place a 'best practice' Code of Conduct, internally developed and endorsed at the December 2013 meeting and duly signed by all members. This Code covers topics such as:

- Personal and Professional behaviour
- Communication and official information
- Fraudulent and corrupt behaviour
- Conflicts of interest
- Gifts
- Use of public resources
- Record keeping and use of information

D2 Coal Innovation NSW Secretariat – Salary costs.

Coal Innovation NSW Secretariat employs five staff:

- Program Director,
- 2 Senior Project Officers (Scientist and Economist),
- Project (finance) Officer
- Geoscientist

Evaluation:

Employment at the Secretariat has again been stable, although there was a change in Project (finance) Officer. This has allowed the Unit to maximise its efforts in utilising the staff's skills. Significant tasks for the financial year have centred on:

- managing existing projects, including working with researchers in development of final R&D reports
- finalising of contracts for Principal contractor and sub contractors for Darling Basin, establishing financial systems to manage payments and reporting processes,
- finalising site safety management plans, obtaining peer reviews and site implementation audits,
- engaging Darling Basin community including local government and town meetings for the two drilling sites
- the project management of Darling Basin drilling program consumed significant time and resources of the Secretariat
- finalising data collection and commence modelling of Stage 1B (Darling Basin) of the NSW CO₂ Storage Assessment Program
- involvement within policy debate at a National level; and
- upgrade of website.

D3 Delta Carbon Capture and Storage Demonstration Project.

In August 2009, the then Minister, approved \$9.43 million from the NSW Clean Coal Fund for Stage 1 of the Delta Carbon Capture and Storage (CCS) project, being the 'Development and Approvals' phase.

The total for Stage 1 of the project is \$28.3 million. Two thirds of the funding was to be provided from the Commonwealth and ACA Low Emissions Technologies Limited (ACALET) in equal shares, pending conditions of the Funding Agreement being met.

Stage 1 of the Delta CCS project was essentially an approvals and planning stage, the development of a storage site for CO₂ and the Front End Engineering and Design (FEED) stage. Stage 1 was aiming to pioneer in NSW:

- community engagement on a CCS project
- gaining exploration permits for CO₂ storage
- establishment of storage leases
- planning and environmental approvals for CCS

Stage 2 was to demonstrate the integrated process:

- validate Post Combustion Capture Technology on NSW coals
- verify geological storage techniques

NSW had committed \$40 million to Stage 2 of the project, 'Construction and Operation', along with similar commitments from the Commonwealth and ACALET. NSW's commitment has been allocated within the existing Coal Innovation NSW Fund budget.

Evaluation:

As advised in last years report, the project had been effectively placed on hold, minimising spending, while awaiting the outcomes of the Darling Basin drilling program. In saying that, the project was ready to commence, at pace, once a prospective storage site had been delivered.

However, on the 22 May 2014, the Commonwealth Department of Industry wrote to NSW Department advising them that the Commonwealth "*has decided to reduce funding for the National Low Emissions Coal Initiative in the 2014/15 Budget.*" This resulted in Commonwealth funds for the Delta Project no longer being available. On 11 July 2014, a meeting of the Funding Partners Steering Committee terminated the Project in accordance with the Funding Agreement's terms. At that meeting the Commonwealth stated "*the decision to withdraw Commonwealth funding was not a reflection on the management of the project but was made in the context of budget pressures which resulted in the government reducing funding across a number of government programs.*"

As part of the Steering Committee's resolution to terminate the Project, Delta is required to produce a Final Report within 90 days as outlined in Item 3 of Schedule 5 to the Funding Agreement. That report shall include the following:

- the Project title;
- the name of the Recipient and all subcontractors;
- the amount of funds paid under the Agreement;
- a statement of the Funds and Recipient Contributions received and spent;
- the amount (if any) remaining in the account;
- a description and analysis of the progress of the Project; and
- copies of any published reports, promotional material, media publicity, pamphlets or other documentation relevant to the Project.

Copies of these reports will be valuable contributions to the theoretical understanding of issues of the supply chain within NSW for CCS. Studies will include transport options, preliminary environmental studies and community engagement strategies.

Coal Innovation NSW is currently developing advice for the Minister including an analysis of the termination of the Delta project, future strategy options and budget allocations that will continue to prepare NSW for low emissions coal technologies. This will form part of the 2014/15 report.

D4 Research Projects

A “Call for Expressions of Interest under the NSW Clean Coal Fund” closed on 4 December 2009, and 29 applications were received and assessed. In May 2010, the then Minister approved 10 successful projects as follows:

APPLICANT	BRIEF PROJECT DESCRIPTION	FUNDING, UP TO (\$)	DURATION
UCC ENERGY P/L	UCC BURNING EFFICIENCY		CLOSED
CENTENNIAL COAL (MANDALONG)	FUGITIVE EMISSIONS (VENTILATION)	2,200,000	2 YRS
CSIRO	CAPTURE TESTING SOLVENTS	1,300,000	3 YRS
CSIRO	FUGITIVE EMISSIONS (OPEN CUT)		CLOSED
UNI OF NEWCASTLE	CHEMICAL LOOPING – OXYFUEL	886,618	3 YRS
UNI OF NEWCASTLE	SOCIAL RESEARCH/ PUBLIC AWARENESS	618,930	2 YRS
CSIRO	NOVEL CAPTURE & ENERGY EFFICIENCY	613,711	1.5 YRS
UNI OF NEWCASTLE	DIRECT CARBON FUEL CELL	608,719	5.5 YRS
UNI OF NEWCASTLE & GREENMAG	MINERAL CARBONATION.	3,040,000	4 YRS
OURSUN P/L #	COMBINED BRAYTON RANKINE CYCLE		CLOSED
TOTAL		\$ 9,267,978	

A detailed evaluation of each project follows.

D4.1 Project: UCC Fired Diesel Engines in the generation of electricity Grantee: UCC Energy Pty. Ltd

Project closed.
See report 2012/13 for details

D4.2 Project: Fugitive emissions abatement from ventilation air Grantee: Centennial (Coal) Mandalong Pty Ltd

Centennial Mandalong P/L has received initial grant funding to trial an exciting new technology termed a VAM-RAB (Ventilation Air Methane Regenerative After Burner) that has potential to mitigate fugitive methane emissions escaping from underground coal mines. These emissions are notoriously difficult to abate because this naturally-occurring gas becomes diluted by the large volumes of ventilation air that is flushed through the mine during standard mining operations. As methane typically constitutes less than 1% of the ventilation air expelled from the mine, the gas concentration is too low to burn-off (often referred to as flaring) or process for electricity generation.

The VAM-RAB system overcomes this problem by directing the ventilation air through what is essentially a large industrial oven where it is heated up to approximately 1000° C. By using this oxidation technique almost all of the methane (> 99%) is converted to carbon dioxide and water. A key feature of the technology is the ability to be self-sustaining without the need for additional energy to maintain the temperature in the combustion chamber. This is accomplished by preventing the heat from migrating out of the chamber via a periodic change in direction of the flow of the ventilation air through the system; hence the title ‘Regenerative After Burner’.

Evaluation:

This project commenced the commissioning of the VAM-RAB prototype unit. This involved the installation of the burners to provide sufficient heat up energy from the supplied drainage gas for hot commissioning the unit, and a re-design of the snorkel installation to overcome air-flow issues and comply with the safety requirements of an industrial operating mine site. This has allowed the project to conduct a number of short-term heat-ups of the VAM-RAB and some processing of simulated Ventilation Air Methane (VAM). Testing has revealed several necessary minor modifications and redesigns before the project can begin the experimental phase.

The availability of gas to supply both the VAM-RAB and operational requirements of the mine has been an ongoing issue. As the Mine carries out a longwall move, the gas plant is turned off to redirect all gas to underground inertisation. Delays in scheduling and access to gas have occurred due to delays from repairs and the operational needs of the Mine. The hot commissioning issues are considered minor and are expected to be readily resolved by early 2014-15, which will allow the experimental phase of the project to commence.

D4.3 Project: Further development of post combustion capture Grantee: CSIRO Energy Technology

CSIRO Energy Technology has received initial grant funding to support a research and development program dedicated to the chemical capture of CO₂ emitted in the flue gas from NSW coal-fired power stations. The program is specifically tailored to focus on NSW black coals and the power stations which they fuel and aims to optimise and improve the aqueous ammonia absorbent process under real working conditions (i.e. operating on an existing power station). This innovative project continues to be the only current research and development pilot program on liquid-based absorbent Post Combustion Capture technologies suitable for NSW power stations. The results also have applicability across the Australian black coal electricity generation sector.

The pilot-scale CO₂ capture plant used in the research was located at Delta Electricity's Munmorah Power Station on the Central Coast, north of Sydney. The Coal Innovation NSW Fund is assisting the upgrade and move of the pilot plant from Munmorah to Delta Electricity's Vales Point Power Station so that this critical research program can continue.

Evaluation:

The focus during this period was on commissioning the refurbished pilot-scale CO₂ capture plant and addressing the issues identified from the initial stages of commissioning. This project has been valuable to the CSIRO in that a number of maintenance issues were identified during commissioning and a number of modifications made that has resulted in an improved test rig in line with the project objectives. The commissioning process identified issues and faults that may have been overlooked during previous project phases. As a quality control step before operations it helped to identify issues affecting the safe operational performance of the plant.

The pilot plant has been commissioned and has been modified in preparation for an integrated solar thermal trial which aims to realise the benefits of utilising renewable energy for regeneration of capture solvents to lessen the impact on the power station. A final report including life cycle assessment will be assessed and included in the 2014/15 annual report.

**D4.4 Project: Reducing Fugitive Emissions -Enhanced Drainage techniques
Grantee: The CSIRO Centre for Environment, Social and Economic Research**

Project closed December 2012 and unspent moneys returned
See 2012/13 report for full details

**D4.5 Project: A Novel Chemical Looping Based Air Separation Technology
Grantee: The University of Newcastle Priority Research Centre for Energy**

The University of Newcastle Priority Research Centre for Energy has received grant funding to undertake research into a novel way of producing pure oxygen for use in the efficient burning of coal to generate electricity. The technology relies on the principles of 'chemical looping' and uses the cyclic interaction of a metallic compound (called a metallic oxide carrier) with air as a means of separating out the oxygen. The proposed technology promises to be a cost effective method of mitigating one of the major barriers to the adoption of carbon capture technologies such as oxy-firing as conventional air separation is notoriously expensive. The specific power requirements of the Chemical Looping Air Separation (CLAS) system is about 26% of that of the most advanced cryogenic air separation unit. This equates to a corresponding oxygen production cost of 0.64 vs 2.4 cents/m³ and greenhouse gas emissions of 72 vs 270 gCO₂-e/m³ oxygen produced.

In addition to greatly reducing the greenhouse gas emissions from air separation processes, the CLAS technology could accelerate the commercial-scale deployment of low emissions electricity generation utilising cost effective highly-advanced coal technologies currently being developed such as Oxy-Fuel Combustion. With support from the Coal Innovation NSW Fund, a three-year program will be pursued to get this innovative air separation technology commercially ready.

Evaluation:

In this period this project finalised its laboratory experiments, analytical modelling and pilot-scale studies including desktop scoping retrofit-ability studies and life cycle assessment analysis.

Overall, the research team made solid progress during the year and successfully completed all laboratory and analytical work within agreed time and budget. The project sought to better understand the basic chemistry of the use of metal oxides for air separation and to determine the optimum oxide(s) and carrier and the preferred conditions for operation of a loop based technology. The most suitable metal oxide species for CLAS based applications was selected and tested. The team also developed a spray drying technique as a cost effective method for mass production of oxygen carriers to be used in the pilot-scale and large-scale investigations

associated with the project. The fundamental science underpinning the oxygen decoupling phenomenon stage was determined through theoretical, mathematical modelling and numerical simulations. The behaviour of fluid and particle flow in an integrated CLAS system geometry was studied through a perspex (cold-flow) model of the 10 kW_{th} unit and also a cold-flow model of a 500 kW_{th} unit. This has helped with establishing scale-up rules. A detailed techno-economic assessment of the NSW fleet of coal-fired power plants for oxy-fuel conversion using the CLAS system provides promising results for economic viability. A life cycle assessment study also found the CLAS to achieve better performance than current methods for oxygen air separation.

A final report was submitted and its review will be reported on in more detail in the next 2014/15 Annual report.

D4.6 Project: Managing Project Risk: The Role of Public Awareness **Grantee: University of Newcastle**

The University of Newcastle's Research Institute for Social Inclusion and Well-being has received grant funding to use an innovative approach to understand the network of relations between industry, society and government that impact on public acceptance of low emission coal technologies.

Using a contemporary methodology of the Actor-Network Theory (ANT) which can explain how technology and people interact over time, the research aims to identify and implement those contemporary public awareness methods, beyond traditional consultation and public relations, to increase the public awareness and positive social attitudes to support the adoption and applications of low emission coal technologies.

This project undertook research in regional and metropolitan areas, and studied varying technological applications to develop a set of recommendations and strategies for government, society and industry to increase public awareness and acceptance for low emissions coal technologies.

Evaluation:

The project has met its research objectives, to address the organisational dynamics within the low emissions coal technologies and other related industries, and the question of how and why publics form around issues related to them. The report and its findings has had preliminary acceptance with the government working towards its release.

D4.7 Project: Site Trials of Novel CO₂ Capture Technology **Grantee: CSIRO Coal Technology**

CSIRO Coal Technology has received initial grant funding to investigate the ability of a novel, patented technology to physically separate out CO₂ emitted from NSW coal-fired power stations. The technology uses Honeycomb Monolithic Carbon Fibre Composite adsorbents which are a type of nano-structured adsorbent material. The

technology enables dry CO₂ capture at room temperature and atmospheric pressure and in dusty environments with low pressure drop, reducing the operational and maintenance cost of the post-combustion capture process. In addition, the heat in the flue gas can be utilised in the process thereby further reducing the electricity requirements of capturing CO₂. Thus this technology promises to play a key role in the cost effective and environmentally responsible generation of electricity in the future.

Through the support provided by the Coal Innovation NSW Fund, an adsorption test unit has been installed at Delta Electricity's Vales Point power stations on the Central Coast, north of Sydney. The effect of real flue gas on the operation and performance of the test unit will be tested and CO₂ capture process demonstrated. Information on the commercial application of the technology will also be generated from the field trial.

Evaluation:

The Project was successfully completed within budget in 2014-15 and the final report is currently being reviewed by CINSW. This project successfully performed over 200 adsorption and regeneration tests on real flue gas from the power station over this period. The experimental results showed that the CO₂ adsorption efficiency of the solid sorbents was found to be consistently over 98%, which meant that most of the CO₂ in the flue gas was captured during the adsorption process. The captured CO₂ on the solid sorbents needed to be released by a desorption process and its CO₂ desorption efficiency was found to be between 90-95%.

The tests demonstrated that the CO₂ capture performance of the solid adsorbents was maintained and proven to be very stable towards flue gas containing nitrogen oxide (NO_x) and sulphur oxide (SO_x). Moreover, the carbon composite solid adsorbents had very high removal performance of SO_x and NO_x from flue gas. As an additional outcome the solid adsorbents were found to be a better and efficient pre-treatment system to remove both SO_x and NO_x compared to other processes such as a caustic scrubber that mainly removes sulfur dioxide (SO₂).

A preliminary life cycle assessment study was carried out on a base case study of a 350 MW power plant. It found that the flue gas waste heat was not sufficient to achieve the regeneration duty for processing the entire flue gas generated. Further extra auxiliary heat would be required however this would diminish the overall efficiency of the solid adsorbents. Nonetheless, the site trials were a world first in demonstrating such solid sorbents on real flue gas. The solid sorbents remained stable with real flue gas without any noticeable impact of SO_x and NO_x on their CO₂ adsorption performance. The important experimental data and site operational experience obtained at the power station form a good base for further development of this carbon composite adsorbent CO₂ capture technology for fossil fuel fired power stations.

D4.8 Project: Development and Optimisation of the Direct Carbon Fuel Cell Grantee: University of Newcastle's Discipline of Chemistry

The University of Newcastle's Discipline of Chemistry has received grant funding to research and develop a Direct Carbon Fuel Cell (DCFC). This technology is yet to be

commercialised but is widely promoted as being the 'holy grail' of coal-fuelled electricity generation as it has the capacity to generate electricity with much higher thermal efficiencies (~70-80%) than engines and turbines (~35-55%). The higher efficiencies equate to substantial reductions in greenhouse gas emissions as less fuel is used per unit of electricity generated. In addition, the fuel cell emissions are almost entirely pure CO₂ which is therefore ready for sequestration without the need to firstly separate out other gases such as nitrogen which are present in the flue gases emitted from power plants.

In a DCFC, electricity is generated directly from coal through the chemical oxidation of coal which has been ground and purified of ash and other contaminants. This differs substantially to the way electricity is traditionally generated – coal is burnt to boil water to make steam to turn a turbine, to turn a generator, to produce electricity. In essence, a fuel cell can be compared to an electrochemical battery. They differ in that a battery stores electrical energy chemically whilst a fuel cell relies on the external supply of a fuel (in this case coal) which must be continually replenished.

Like many fuel cell types, DCFCs are susceptible to cell degradation from contaminants originating from the fuel source. An important aspect of the experimental work is to understand the different structural aspects of coal to understand its performance in the DCFC. The overall objective of this project is to obtain proof of concept for the technology and progress towards commercialisation of the DCFC through further development and optimisation of bench-scale and then pilot-scale systems.

Evaluation:

This project made steady progress on all milestone tasks during this period, and rectified prior delays to get the program back on track as planned. Several initial technical issues were readily overcome by what is apparently a highly capable research team, that facilitated the demonstration and testing of the DCFC bench scale cell. A working hypothesis has been developed to explain electrochemical activity on various carbon electrode surfaces. Extensive data analysis and further experimentation has also added to the body of knowledge developed to this point with a clear path forward.

Refinement of techniques in several different areas has also led to an increase in overall project advancement. These include the expansion of experimental techniques in characterising coal and carbon samples, and streamlining electrode fabrication procedures to produce replicable and useful anodes with low fail rate, making finalisation of several future milestones possible.

Movement towards commissioning of the next step in the project, the pilot scale DCFC, has also gathered momentum. The proof of concept testing for key parameters of pilot scale design was successful, along with design of testing apparatus for optimization of pilot scale finalised allowing key parts to be manufactured and ordered. Three journal articles have also been submitted for publication. The next year will see the complete construction of the pilot scale DCFC and its testing.

D4.9 Project: Permanent Large Scale CO₂ Storage by Mineral Carbonation Grantee: Mineral Carbonation International

The GreenMag Group and University of Newcastle Priority Research Centre for Energy was awarded grant funding, contingent on the receipt of matching Commonwealth and industry funding, to develop and optimise a promising method of storing carbon dioxide gas emitted from NSW coal-fired power stations. GreenMag and the University of Newcastle formed Mineral Carbonation International Pty Ltd (MCI) with a commitment from Orica to match funding as the industry partner. This joint venture will undertake further research into mineral carbonation technology and establish a CO₂ mineral carbonation pilot plant at the University of Newcastle. The project aims to transform captured CO₂ emissions into forms of carbonate rock that will be trialled as new green building materials for the construction industry.

The Mineral Carbonation process takes advantage of a natural process whereby CO₂ is captured in mineral deposits resulting in it being stored in rocks. A key advantage of this process is that the CO₂ is permanently stored in the rocks. It would only re-enter the atmosphere if the rocks were subjected to extremely high temperatures.

The Project is intended to take existing known processes for mineral carbonation from bench scale to demonstration plant scale and to conduct complementary R&D activities which each could reduce the overall cost of mineral carbonation that could eventually operate at industrial scale. The major goal for the Project is to reduce the cost of existing mineral carbonation processes from the current \$70 per tonne of CO₂ sequestered to \$40 per tonne (with potential for further reduction) and to demonstrate that the process involved can be scaled up from the laboratory to this pilot scale and beyond.

The MCI project extends over a four-year period and encompasses three main strands including: 1) pilot plant construction and operation, 2) intensive research and development, and 3) program governance, communication and commercialisation. The project was officially launched 23 August 2013 by Minister for Mineral Resources at the Newcastle Institute of Energy and Resources, University of Newcastle (NIER).

Evaluation:

The Funding Agreement for the MCI project was signed on Thursday 27 June 2013. The effective commencement period of the project was 3rd quarter 2013. Although the project description, outcomes and overall budget remain essentially unchanged, this project, as a result of the Scientific Advisory Group meeting in March 2014, has undergone a significantly improved restructure. By unanimous agreement of the Steering Committee the project has widened its scope to allow for testing of alternative pathways and for the construction of two 'reactors' instead of the original single. This will both provide flexibility and efficiency. Steps within the research process that are not considered fundamental to the outcome have been 'outsourced' for cost savings, allowing for extra research initiatives.

The project's first 12 months remains on milestone targets and within budget. The next period will see finalising the design of the reactors and tendering for construction commence. Collaborative Agreements are near finalised with Columbia University (USA) and Sydney University. Both these collaborative research initiatives will significantly increase the capacity of the project.

**D4.10 Project: A Simple Heat Engine for Sustainable Coal Generation
Grantee: ourSUN Pty Ltd – application WITHDRAWN December 2010.**

Application withdrawn December 2010.

D5 NSW CO₂ Storage Assessment Program

The drilling program is being developed in 3 stages as follows:

- Stage 1A – Sydney Basin (4 wells)
- Stage 1B – Darling Basin (4 wells)
- Stage 2 – to be determined based on results from Stage 1 and further desktop analysis.

Funding Agreements between NSW Trade & Investment, the Commonwealth Department of Resources, Energy and Tourism (DRET) and industry, Australian Coal Association Low Emissions Technologies Limited (ACALET) were signed and announced on 4 June 2012. This announcement also advised of commencement of Stage 1B of the program.

The total budget for the NSW CO₂ Storage Assessment Program is estimated at \$54.3 million, with all 3 funding partners contributing equally.

Evaluation:

Having commenced in 2008, the Program is expected to run until the end of 2015. Program status is as follows:

- Stage 1A – Sydney Basin data acquisition and assessment (completed)
- Stage 1B – Darling Basin data acquisition and assessment (in progress)
- Stage 2 – further data acquisition (to be defined based on Stage 1 outcomes)

The table below displays updated financial contributions, expenditure and remaining commitments under the Funding Agreement:

	Stage 1A Contributions	expended during Stage 1A	Stage 1B contributions	expended during Stage 1B	remaining Stage 2	totals
Commonwealth	\$ 2,500,000		\$ 7,200,000	\$ 9,700,000	\$ 8,400,000	\$18,100,000
ACALET	\$ 300,000		\$ 8,000,000	\$ 8,300,000	\$ 8,400,000	\$16,700,000
CINSW Fund	\$ 7,550,000	\$ 7,550,000	\$ 2,200,000	\$ 2,200,000	\$ 8,350,000	\$18,100,000
			<i>note 1</i>	<i>note 2</i>	<i>note 3</i>	

note 1: ACALET reduced its contribution to Stage 1B by \$1,400,000 (effectively its contribution to the 20% contingency fund)

note 2: There is a small surplus of approx \$660,000 from Stage 1B which will be rolled over to Stage 2 to commence the planning operations, but for this exercise it has been assumed to have been expended.

note 3: The Commonwealth has notified that due to budgetary cuts that Stage 2 funding will not be available and ACALET has advised that Stage 2 funding is not automatic and will have to be approved by an ACALET Board meeting.

Arising from the advice given in note 3 (above) CINSW has been in discussions with the Commonwealth and ACALET to remain in the drilling program based on the successful results obtained from the Mena Murtee site in the Darling Basin. These discussions are on-going and may depend on the final results of Stage 1B.

The work in 2013/14 focussed on the planning and the drilling within the Darling Basin (Stage 1B of the CO₂ Storage Assessment Program). The data acquisition program in the Darling Basin consisted of the drilling of two stratigraphic wells to a planned depth of 2,400m, to acquire core and to complete significant downhole testing. There was no injection or storage of CO₂ gases.

There were three broad aims for the Stage 1B (Darling Basin) drilling campaign:

- Gather information on the geothermal potential of the area in collaboration with the CSIRO
- to assess the carbon dioxide (CO₂) storage potential for the sites.
- general geological data for the region.

Work Program

On 19 March 2013, NSW Department of Trade & Investment was granted two exploration licences, EL8065 and EL8066, under the *Mining Act 1992*. The Department, assisted by NSW Public Works (for procurement of service providers), awarded the Principal Contract to Aztech Well Construction (Aztech).

Drilling was conducted using a petroleum rig under contract to Enerdrill Pty Ltd, capable of drilling to the depths required and expected hardness of rock. The drilling program was based on scant offset well data and the coring program was based on modelled seismic data and developed to capture a representative sample of rocks from within the well. Both holes were stratigraphically and geophysically logged with several sections in each to be cored. A side wall coring program was conducted in each hole to compliment the geophysical data gathered. All retrieved core is now stored in the W.B. Clark Centre, Londonderry. Details of each well are below.

The locations of the two sites with the exploration licences are illustrated in Figure 1.

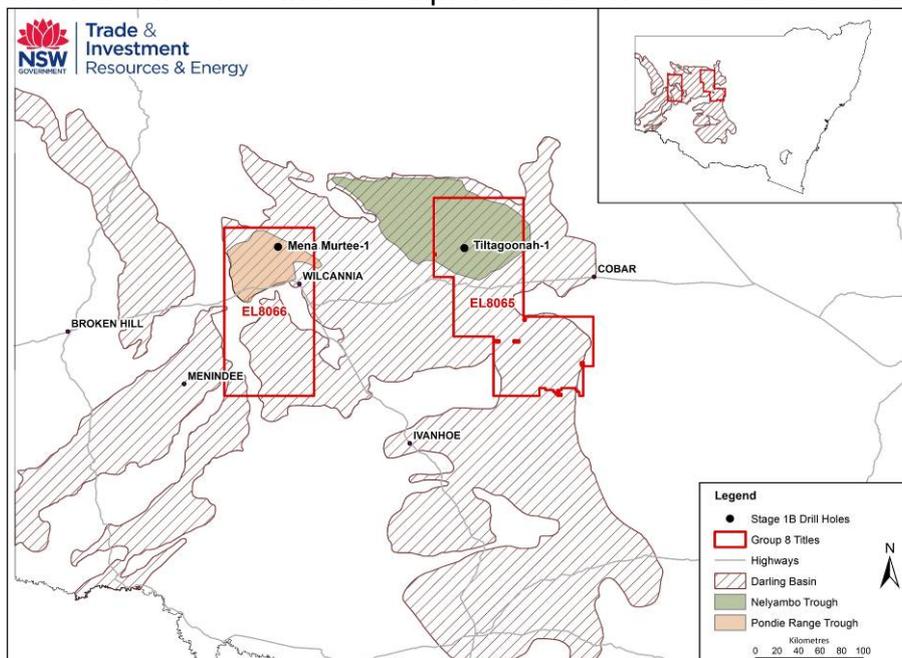


Figure 1: Location of the Stage 1B wells, Darling Basin.

Tiltagoonah 1

Tiltagoonah 1 was the first borehole to be drilled and was located in the Nelyambo Trough, within the Darling Basin. Site location was determined from the previous

geological work, proximity to the gas pipeline corridor, modelling of seismic lines undertaken by Departmental geologists and positive landholder sentiment.

Drilling commenced on the 21st of February 2014 and reached total depth (TD) of 1,434m on the 19th of March 2014. The TD was reached after 26 days of drilling through unexpectedly hard and dense rocks. The excessively hard and dense nature of the rocks resulted in extreme wear on drilling bits and a total of 11 drill bits were used in the 8½” section of the hole. The decision to call TD at 1,434m, rather than the proposed TD of 2,400m, was taken to maintain the project within budget and time constraints. The coring system was unable to effectively deal with the unexpected rock properties which reduced coring and drilling rates and ultimately the TD and core retrieved.

A full suite of geophysical logs was run in the hole to gather information on porosity, permeability, density, rock type and seal propensity.

A total of 27m of core was cut at Tiltagoonah 1 from depths between 675.5m – 1288.9m, a heavy reduction from the proposed 800m. This reduction was necessary due to the coring system inadequacies, coupled with the extreme conditions encountered down hole. A Side Wall Coring (SWC) Program was developed to sample sections of interest not covered by cored sections. 15 SWC samples were planned with 100% recovery being achieved.

Based on seismic modelling a potential sandstone reservoir was predicted to occur at several depth intervals. Core was retrieved from these intervals and samples selected for further laboratory analysis to measure the porosity and permeability. The visual porosity in core and drill cutting (chip) samples was poor (nil), with this observation confirmed by lab results.

The apparent lack of a potential reservoir suitable for storing CO₂ led to a decision that no further analysis work would be undertaken at this site. Unfortunately this has potentially ruled out the Nelyambo Trough as a region for further exploration, but was not unexpected following the conditions encountered down hole.

The question of a seal (that is an impermeable layer above a likely reservoir) has always been one that was being investigated as part of this program. Drilling confirmed rocks suitable as a seal from approximately 125m to 580m, and downhole testing (Extended Leak Off Test) and laboratory testing (Mercury Injection Capillary Pressure, Thin Section Microscopy, Scanning Electron Microscopy, X-ray Diffraction results) confirmed its suitability. The lack of a reservoir makes this point mute.



Figure 2 aerial shot of Tiltagoonah 1, camp site left side of main road

Mena Murtee 1

Mena Murtee 1 was the second hole drilled and was located in the Pondie Range Trough, within the Darling Basin. Selection of the Pondie Range Trough was based on previous studies conducted by Blevin et al¹ and Hill et al². Site location was determined from the previous work, proximity to the gas pipeline corridor, modelling of seismic lines undertaken by Departmental geologists and positive landholder sentiment.

Mena Murtee 1 is only the second well to be drilled in the Pondie Range Trough and the first in the depocentre. Drilling commenced on the 4th of April 2014 and reached total depth (TD) of 2,270m on the 2nd of May 2014. TD was reached after 30 days of drilling. The rocks encountered at Mena Murtee 1 were much easier to drill than at Tiltagoonah 1, resulting in drilling being ahead of schedule for most of the hole. Hard rocks were encountered towards the bottom of the hole with drilling rates dropping. The decision to call TD 130m short of the proposed TD was made to maintain the project within time and budget constraints. The average overall daily drilling rate was 75.6m / day.

The reduction in the abrasiveness of the rocks and the switch to conventional coring resulted in improvements in drill bit usage; three drilling bits and one core head were used in the 8½” section at Mena Murtee 1.

A full suite of geophysical logs was run in the hole to gather information on porosity, permeability, density, rock type and seal propensity.

A total of 86.5m of core was retrieved from Mena Murtee 1 from depths between 1598 – 2039m. A total of 64 samples was selected which were subjected to a range of testing and petrographic analysis.

¹ Blevin J, Pryer, J., Henley, P. and Cathro, D., 2007, Darling Basin Reservoir Prediction Study and GIS, Project Code: MR706, Confidential Report to NSW-DPI, Eraring Energy, Macquarie Generation & Delta Electricity by FrOG Tech Pty Ltd.

² Hill, M. B. L., Hyland, K. A., and Tutt-Branco, A. D. 2008. Regional Stratigraphic Drilling Program: Potential Geosequestration reservoirs in the Sydney-Gunnedah Basin. Unpublished Report, NSW Department of Primary Industries.

Initial porosity and permeability rates are promising with preliminary interpretations of wireline logs and core data indicating prospective CO₂ storage reservoirs. Further analysis is required before definitive results will be known. The CO₂CRC is currently completing 4 different research papers based on extensive analysis and modelling:

- Geological Storage System Characterisation
- Injection & Plume Migration Modelling
- Geomechanical Evaluation
- Geochemical Analysis & Modelling

These results and all data collected during the drilling program will be publically available and provide a resource for the state, industry and academia.

Collaborative Work Program

A collaborative work program was developed between the Department and CSIRO, for Geothermal exploration and with the CO₂CRC on the Darling Basin as a potential CO₂ storage site.

The CSIRO collaborative work program is designed to measure the thermal properties of the basin and its sediments and is important in several contexts:

- as an important input in predicting the behaviour of CO₂ interactions with formation water and the formation itself;
- to better define the geothermal potential of the Darling Basin and underlying basement;
- for thermochronological studies of the basins evolution, which in turn is important for understanding the hydrocarbon potential of the basin.

Research and modelling was designed in collaboration with the CO₂CRC to use the new and existing data to better understand the evolution of the Darling Basin and specifically, how tested and modelled parameters will affect storage potential. Four work packages (WP) were developed:

- Geological Storage System Characterisation – designed to characterise the geological system of prospective storage sites.
- Injection and Plume Migration Modelling – designed to assess CO₂ preliminary injectivity, storage efficiency and capacity in the Pondie Range and Nelyambo troughs through (semi-) analytical, and 2D numerical simulations.
- Geomechanical Evaluation – designed to provide an estimate of the in situ stress field in the vicinity of the new wells.
- Geochemical Analysis and Modelling – designed to provide information on the formation water composition, predict mineral trapping capacity and changes to porosity under CO₂ storage conditions over time.

HSE

Extensive risk management planning and site safety management plans were developed in accordance with the *Work Health and Safety Act 2011* and *Mine Health & Safety Act 2004*. The Coal Innovation Secretariat took a lead role in the development and overseeing of these plans. An independent peer review was conducted of the Rig for compliance and safety and the plans for conformity. As a final check, the implementation of all the safety plans was independently audited on site. A comment by the independent auditor on his visit to site on 13 March 2014, noted “*On the basis of the gap analysis completed prior to the site visit contained in the report of 5 March 2014 (SWMS Gap Analysis 5Feb14.pdf) and the findings of the site audit identified above, it is the opinion of the Lead Auditor that the Enerdrill HSE management*

system in theory and practice meets the letter and intent of the legislation with regard to the content and implementation of a safe system of work.”

Aztech employed an HSE officer on site, as did the Rig contractor. As a result of this rigorous process to achieve the highest standard of compliance for site and environmental safety, the sites had an exemplary record, with over 47,000 man hours worked and no lost time injuries and no environmental incidents recorded.

Community engagement

Two landholder agreements have been negotiated for the drilling sites. Relationships with landholders and neighbours have been outstanding. Local media coverage has been positive via both print and radio.

The community engagement strategy involved Local Government and community meetings. These meetings included: Cobar Shire Council meetings, 28 June 2012 and 14 November 2013 and a Cobar Community meeting on 14 November 2013. Central Darling Shire Council meeting was held on 15 October 2013.

All meetings have received positive responses. General comments at the Councils and community meetings were accepting of the research drilling program and asked constructive questions of possible outcomes the future may bring.

A commitment given in the program environmental approval was the remediation of any damage to local roads and this has been fulfilled with repairs to local gravel roads. The tendering process, conducted by NSW Public Works, was able to award work to the Shire Councils for civil work to establish and rehabilitate the sites and for road remediation work.

Conclusion

Stage 1B in the Darling Basin achieved its aims and objectives with Mena Murtee 1 showing potential as a CO₂ storage site. Whilst the Tiltagoonah 1 site proved unsuitable for storage a great number of learnings were acquired that will assist in enhancing the outcomes of further exploration undertaken as part of the NSW CO₂ Storage Assessment Program; the greater Darling Basin area remains the focus for Stage 2 exploration. Concomitantly, an enhanced understanding of the geology of the basin has been gained, and a large volume of subsurface data and drill core (114.39 m) were acquired. These data and cores are now available for continued assessment and study by government agencies, academia and industry involved in Carbon Capture and Storage and mineral/petroleum exploration activities.

The funding, income and expenditure for Stage 1B of the program is currently being audited for reporting to the Funders Steering Committee meeting in November. However, preliminary balance sheets show that, the \$20.2 million budget, expenditure has come in marginally (approximately 3%) under budget.

Final reports are being finalised to be presented to the Steering Committee meeting in November 2014 as a milestone achievement.

D6 Membership of CO2CRC

“The Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC) is one of the world's leading collaborative research organisations focused on carbon dioxide capture and geological sequestration (geosequestration, carbon dioxide capture and storage, carbon capture and storage, or CCS). CO2CRC is a joint venture comprising participants from Australian and global industry, universities and other research bodies from Australia and New Zealand, and Australian Commonwealth, State and international government agencies. Its resources come from the Federal Government Cooperative Research Centres Program, other Federal and State Government programs, CO2CRC participants, and wider industry”.³

Evaluation:

NSW has had a long-standing commitment of membership to the CO2CRC with a fee structure of \$250,000 per year. Membership is current until June 2015. Future membership beyond June 2015 remains under review.

Membership of this world leading research organisation has been and will be of further benefit to NSW as it commences and develops its carbon capture and storage research and demonstration programs. The Coal Innovation NSW Secretariat Scientific Officer and Geoscientist attended the annual CO2CRC Research Symposium and exchanged valuable information on NSW programs.

A significant return on membership is being gained now that NSW has commenced drilling, testing and modelling in the Darling Basin with services and advice being provided by CO2CRC experts. During the year, an agreement between the Secretariat and the CO2CRC was reached on the scope of a collaborative work program. Four separate work packages have been developed focussing on a comprehensive analysis and geological modelling of data acquired from the Darling Basin drilling program. This work includes analysis of the potential reservoir for:

- Geological Storage System Characterisation
- Injection & Plume Migration Modelling
- Geomechanical Evaluation
- Geochemical Analysis & Modelling

The analyses and modelling will be undertaken by the CO2CRC and its affiliated research institutes (CSIRO, Geoscience Australia, University of Adelaide, and University of Melbourne).

The value of this work is in excess of \$479,000 from CO2CRC or over \$959,000 including CO2CRC's research partner's in-kind contributions under the CO2CRC collaborative research agreement.

The evaluation of the return on membership based on services provided for that membership fee has been enormous. It has allowed the drilling budget (D.5) to concentrate expenditure on the gathering of data and minimise expenditure on modelling with the knowledge that this CO2CRC research was forthcoming. Without this value, and if we would have had to go to the market for commercial modelling, it could be expected to have to expend 150 to 200% of the total in-kind payment, and as stated above this has come in-kind due to our membership.

³ <http://www.co2crc.com.au/about/>

E. CONCLUSION

Expenditure for financial year 2013/14:

Coal Innovation NSW (Advisory Council) costs	22,348
Secretariat costs including salaries	613,140
R&D projects grants	716,232
CO ₂ Storage Assessment Program	18,755,492
Legal fees	5,283
CO2CRC membership	270,000
Audit Fees	56,250
GRAND TOTAL	20,438,745

Overall Financial Balance:

Opening balance as at 1 Jul 2013 (Credit)	see note	89,309,862
Interest Payment		2,073,257
Income from Commonwealth & ACALET		14,890,011
Income from CSIRO & Auscope		507,996
Delta CCS Project (refund)		31,476
Total		106,812,602
 Less expenditure		 20,438,745
 TOTAL as at 30 June 2014 (credit)		 \$ 86,373,858

Note: the previous Report to Parliament had a closing balance of \$84,144,744, however you will note that this year the financial statement attached has an opening balance of \$89,309,862 which is an increase of \$5,165,118 due to back calculations for interest payments.

COAL INNOVATION NSW FUND

STATEMENT IN ACCORDANCE WITH SECTION 45F OF THE PUBLIC FINANCE AND AUDIT ACT 1983

Pursuant to section 45F of the *Public Finance and Audit Act 1983*, I state that:

- a) the accompanying financial statements have been prepared in accordance with applicable Australian Accounting Standards (which include Australian Accounting Interpretations), the provisions of the *Public Finance and Audit Act 1983*, the applicable clauses of the *Public Finance and Audit Regulation 2010*, and the Financial Reporting Directions published in the Financial Reporting Code for NSW General Government Sector Entities or issued by the Treasurer;
- b) the accompanying financial statements exhibit a true and fair view of the financial position and the financial performance of the Coal Innovation NSW Fund for the year ended 30 June 2014;
- c) at the date of signing I am not aware of any circumstances that would render the financial statements misleading or inaccurate.


MARK I PATERSON, AO
SECRETARY

Date: 12/12/14

Coal Innovation NSW Fund

Financial Statements

30 June 2014

Beginning of the Financial Statements

STATEMENT OF COMPREHENSIVE INCOME FOR THE YEAR ENDED 30 JUNE 2014

	Notes	2014 \$000	2013 \$000
Expenses excluding losses			
Operating expenses			
Personnel services	2a	587	652
Other operating expenses	2b	19,135	1,082
Grants and subsidies	2c	716	1,779
Total expenses excluding losses		20,438	3,513
Revenue			
Grants and Contributions	3a	14,890	34,300
Interest	3b	2,073	1,759
Other Revenue	3c	538	76
Total Revenue		17,501	36,135
Net Result		(2,937)	32,622
TOTAL COMPREHENSIVE INCOME		(2,937)	32,622

The accompanying notes form part of these financial statements.

STATEMENT OF FINANCIAL POSITION AS AT 30 JUNE 2014

	Notes	2014 \$000	2013 \$000
ASSETS			
Current Assets			
Cash and cash equivalents	4	74,381	-
Receivables	5	12,898	89,557
Total Current Assets		87,279	89,557
Total Assets		87,279	89,557
LIABILITIES			
Current Liabilities			
Payables	6	906	247
Total Current Liabilities		906	247
Total Liabilities		906	247
Net Assets		86,373	89,310
EQUITY			
Accumulated funds		86,373	89,310
Total Equity		86,373	89,310

The accompanying notes form part of these financial statements.

STATEMENT OF CHANGES IN EQUITY FOR THE YEAR ENDED 30 JUNE 2014

	Accumulated Funds \$'000	Total Equity \$'000
Balance at 1 July 2013	89,310	89,310
Net result for the year	(2,937)	(2,937)
Balance at 30 June 2014	<u>86,373</u>	<u>86,373</u>
Balance at 1 July 2012	56,688	56,688
Net result for the year	32,622	32,622
Balance at 30 June 2013	<u>89,310</u>	<u>89,310</u>

STATEMENT OF CASH FLOWS FOR THE YEAR ENDED 30 JUNE 2014

	Notes	2014 \$000	2013 \$000
CASH FLOWS FROM OPERATING ACTIVITIES			
Payments			
Personnel services		-	-
Grants and subsidies		-	-
Other		-	-
Total Payments		<u>-</u>	<u>-</u>
Receipts			
Grants and Contributions		-	-
Receipt from DTIRIS*		74,381	-
Other		-	-
Total Receipts		<u>74,381</u>	<u>-</u>
NET CASH FLOWS FROM OPERATING ACTIVITIES	9	<u>74,381</u>	<u>-</u>
NET INCREASE/(DECREASE) IN CASH			
Opening cash and cash equivalents		74,381	-
CLOSING CASH AND CASH EQUIVALENTS		<u>74,381</u>	<u>-</u>

The accompanying notes form part of these financial statements.

*Coal Innovation NSW Fund did not have a separate bank account prior to 30 June 2014.

Notes to and forming part of the financial statements

1. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

(a) Reporting entity

Coal Innovation NSW Fund (the Fund) is a NSW Government entity. Coal Innovation NSW Fund is a not-for-profit entity (as profit is not its principal objective) and the Fund does not have a cash generating unit. The reporting entity is consolidated as part of the NSW Total State Sector Accounts.

The Fund has been established and is governed under the *Coal Innovation Administration Act 2008* (Act). Part 2, section 5 of the Act establishes the purpose of the Fund as follows:

- To provide funding for research into, and development of low emissions coal technologies
- To provide funding to demonstrate low emissions coal technologies
- To provide funding to increase public awareness and acceptance of the importance of reducing greenhouse gas emissions through the use of low emissions coal technologies and
- To provide funding for the commercialisation of low emissions coal technologies

These financial statements for the year ended 30 June 2014 have been authorised for issue by the Secretary on 2014.

(b) Basis of preparation

The Fund's financial statements are general purpose financial statements which have been prepared on an accrual basis in accordance with:

- applicable Australian Accounting Standards (which include Australian Accounting Interpretations)
- the requirements of the *Public Finance and Audit Act 1983* and Regulation 2010 and
- the Financial Reporting Directions published in the Financial Reporting Code for NSW General Government Sector Entities or issued by the Treasurer.

Judgements, key report assumptions and estimations management has made are disclosed in the relevant notes to the financial statements.

All amounts are rounded to the nearest one thousand dollars and are expressed in Australian currency.

(c) Research and Development expenses

The Fund engages contractors to conduct work for site preparation, drilling, engineering, project management and other research activities. This activity is classified as in research phase for the project and no expenses have been capitalised. An asset will not be recognised until clear and quantifiable future benefit is established. However there is acknowledgement that any grant is from the Coal Innovation NSW Fund and any future economic benefits (assets) arising out of it would belong to NSW government or the research partner.

(d) Statement of compliance

The financial statements and notes comply with Australian Accounting Standards, which include Australian Accounting Interpretations.

(e) Insurance

The Fund's insurance activities are conducted through the NSW Treasury Managed Fund Scheme of self-insurance for Government entities. The expense (premium) is determined by the Fund Manager based on past claim experience.

(f) Accounting for the Goods and Services Tax (GST)

Income, expenses and assets are recognised net of the amount of GST, except that:

- the amount of GST incurred by the Fund as a purchaser that is not recoverable from the Australian Taxation Office is recognised as part of the cost of acquisition of an asset or as part of an item of expense and
- receivables and payables are stated with the amount of GST included.

Cash flows are included in the Statement of Cash Flows on a gross basis. However, the GST components of cash flows arising from investing and financing activities which are recoverable from, or payable to, the Australian Tax Office are classified as operating cash flows.

(g) Income recognition

Income is measured at the fair value of the consideration or contribution received or receivable.

(i) Grants and contributions

Grants and contributions include industry donations, grants from Commonwealth and New South Wales government. They are generally recognised as income when the Fund obtains control over the assets comprising the grants and contributions. Control over grants and contributions are normally obtained upon the receipt of cash.

However, some Revenue is recognised when the Fund issues invoices in relation to Partnership agreements where work is completed and grants are based on actual expenses incurred in the previous quarter. The invoices are issued after the Steering Committee accepts the financial report and actual expenses for the quarter.

1. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (continued)

(ii) Investment Revenue

Interest revenue is recognised using the effective interest method as set out in AASB 139 *Financial Instruments: Recognition and Measurement*.

(h) Assets

(i) Loans and receivables

Loans and receivables are non-derivative financial assets with fixed or determinable payments that are not quoted in an active market. These financial assets are recognised initially at fair value, usually based on the transaction cost or face value. Subsequent measurement is at amortised cost using the effective interest method, less an allowance for any impairment of receivables. Any changes are recognised in the net result for the year when impaired, derecognised or through the amortisation process.

(ii) Impairment of financial assets

All financial assets, except those measured at fair value through profit and loss, are subject to an annual review for impairment. An allowance for impairment is established when there is objective evidence that the entity will not be able to collect all amounts due.

For financial assets carried at amortised cost, the amount of the allowance is the difference between the asset's carrying amount and the present value of estimated future cash flows, discounted at the effective interest rate. The amount of the impairment loss is recognised in the net result for the year.

Any reversals of impairment losses are reversed through the net result for the year, where there is objective evidence. Reversals of impairment losses of financial assets carried at amortised cost cannot result in a carrying amount that exceeds what the carrying amount would have been had there not been an impairment loss.

(iii) De-recognition of financial assets and financial liabilities

A financial asset is derecognised when the contractual rights to the cash flows from the financial assets expire; or if Fund transfers the financial asset:

- where substantially all the risks and rewards have been transferred; or
- where Fund has not transferred substantially all the risks and rewards, if the entity has not retained control

Where the Fund has neither transferred nor retained substantially all the risks and rewards or transferred control, the asset is recognised to the extent of the entity's continuing involvement in the asset.

A financial liability is derecognised when the obligation specified in the contract is discharged or cancelled or expires.

(i) Liabilities

(i) Payables

These amounts represent liabilities for goods and services provided to Fund and other amounts. Payables are recognised initially at fair value, usually based on the transaction cost or face value. Subsequent measurement is at amortised cost using the effective interest method. Short-term payables with no stated interest rate are measured at the original invoice amount where the effect of discounting is immaterial.

(ii) Other Provisions

Other provisions exist when NSW The Fund has a present legal or constructive obligation as a result of a past event; it is probable that an outflow of resources will be required to settle the obligation; and a reliable estimate can be made of the obligation.

Any provision for restructuring is recognised only when an agency has a detailed formal plan and the agency has raised a valid expectation in those affected by the restructuring that it will carry out the restructuring by starting to implement the plan or announcing its main features to those affected.

If the effect of the time value of money is material, provisions are discounted at an appropriate percentage, which is a pre-tax rate that reflects the current market assessments of the time value of money and the risks specific to the liability. None with a material effect of the time value of money presently exist.

(iii) Personnel services arrangement

The Fund does not have any employees and receives administrative, secretarial support and operational assistance from Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS). The Fund has an arrangement with DTIRIS to reimburse them for personnel services expenses.

(j) Equity and reserves

(i) Accumulated Funds

The category accumulated funds included all current and prior period retained funds.

(k) Comparative information

Except when an Australian Accounting Standard permits or requires otherwise, comparative information is disclosed in respect of the previous period for all amounts reported in the financial statements.

1. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (continued)

(I) New Australian Accounting Standards issued but not effective

Australian Accounting Standards and Interpretations that have recently been issued or amended but are not yet effective have not been adopted for the financial reporting period ended 30 June 2014. These are listed as follows:

- AASB 9, AASB 2010-7 and AASB 2012-6 regarding financial instruments
- AASB 127 Separate Financial Statements
- AASB 1031 Materiality
- AASB 1055 and AASB 2013-1 regarding budgetary reporting
- AASB 2012-3 regarding offsetting financial assets and financial liabilities
- AASB 2013-5 regarding accounting for Investment Entities
- AASB 2013-8 regarding Australian Implementation Guidance for Not-for-Profit Entities – Control and Structured Entities
- AASB 2013-9 regarding the Conceptual Framework, Materiality and Financial Instruments (Parts B and C).

The Fund will consider the impact of these standards during the 2015 Financial Year.

2. EXPENSES EXCLUDING LOSSES

	2014 \$000	2013 \$000
(a) Personnel services		
Salaries and wages (including recreation leave)	512	504
Superannuation – defined benefit plans	-	-
Superannuation – defined contribution plans	45	37
Long service leave	-	10
Payroll tax and fringe benefits tax	30	10
Redundancy payments	-	91
	587	652
(b) Other operating expenses include the following:		
Auditor's remuneration – audit of financial reports	56	-
Operating lease rental expense – minimum lease payments	1	-
Insurance	55	-
*Maintenance	-	4
Advertising and promotion	1	27
Consultants	23	130
Telecommunication	1	1
Training and education	2	13
Travel	47	35
Membership	250	251
Legal other	26	97
Other contractors (Refer note 1(c))	18,198	482
Motor Vehicle expenses	428	-
Other operating	47	42
	19,135	1,082
Maintenance Reconciliation		
*Maintenance expense – contracted labour and other (non-employee related), as above	-	4
Total maintenance expenses included in Note 2(b)	-	4
(c) Grants and subsidies		
Research and Development projects	716	1,779
	716	1,779

3. REVENUES

	2014 \$000	2013 \$000
(a) Grants and Contributions		
Grants – Industry/Private Bodies	7,690	300
Grants – Commonwealth Government	7,200	2,500
Grants – NSW Government	-	31,500
	14,890	34,300
(b) Interest Revenue		
Interest receivable from DTIRIS	2,073	1,759
	2,073	1,759
(c) Other Revenue		
Miscellaneous Revenue	538	76
	538	76

4. CURRENT ASSETS – CASH AND CASH EQUIVALENTS

	2014 \$000	2013 \$000
Cash at bank and on hand	74,381	-
	74,381	-

For the purpose of the Statement of Cash Flows, cash and cash equivalents include cash at bank

Cash and cash equivalent assets recognised in the Statement of Financial Position are reconciled at the end of the financial year to the Statement of Cash Flows as follows:

Cash and cash equivalents (per Statement of Financial Position)	74,381	-
Closing cash and cash equivalents (per Statement of Cash Flows)	74,381	-

Refer Note 10 for details regarding credit risk, liquidity risk and market risk arising from financial instruments.

5. CURRENT / NON-CURRENT ASSETS-RECEIVABLES

	2014 \$000	2013 \$000
CURRENT		
Grants and Contributions	5,099	-
Other	556	-
GST Receivable	5	-
Receivable from DTIRIS	7,238	89,557
	12,898	89,557

The Fund did not have a bank account until late June 2014. DTIRIS paid all the fund's expenses and banked its grants received from the date the Fund was established in 2008. At 30 June 2013 DTIRIS owed the fund \$89million (net revenue received less expenses). The Fund does not have any debtors, creditors, GST payable, provisions etc and does not employ staff.

In June 2014, a bank account was established for the Fund. DTIRIS paid the Fund all amounts owed which included 30 June 2013 receivable balance and net current year transactions. At 30 June 2014 an amount of \$343,000 was owed by the Fund to DTIRIS representing end of June expenses yet to be reimbursed (included in Note 6, Creditors).

6. CURRENT LIABILITIES - PAYABLES

	2014 \$000	2013 \$000
CURRENT		
Creditors	394	247
GST Payable	512	-
	906	247

Details regarding credit risk, liquidity risk and market risk, including a maturity analysis of the above payables are disclosed in Note 10.

7. COMMITMENTS FOR EXPENDITURE

	2014		
	Under 1 year \$000	1-5 years \$000	Total \$000
Forward years commitments for Research and Development projects			
Centennial Coal	336	-	336
CSIRO (Shi Su)	19	-	19
CSIRO (Feron)	90	-	90
Uni of Newcastle/GreenMag	1,142	1,587	2,729
Uni of Newcastle (Donne)	173	46	219
Uni of Newcastle (Moghtadery)	10	-	10
Uni of Newcastle (Webb)	14	-	14
Total	1,784	1,633	3,417

The above forward years commitment are including GST (\$310,683.23)

	2013		
	Under 1 year \$000	1-5 years \$000	Total \$000
Forward years commitments for Research and Development projects			
Centennial Coal	430	-	430
CSIRO (Shi Su)	130	-	130
CSIRO (Feron)	180	-	180
Uni of Newcastle/GreenMag	615	2,729	3,344
Uni of Newcastle (Donne)	154	157	311
Uni of Newcastle (Moghtadery)	151	-	151
Uni of Newcastle (Webb)	14	-	14
Total	1,674	2,886	4,560

The above forward years commitment are including GST (\$414,548.00)

8. CONTINGENT LIABILITIES

The Fund is unaware of the existence of any contingent liabilities or contingent assets as at balance date (2013: \$Nil)

9. RECONCILIATION OF CASH FLOWS FROM OPERATING ACTIVITIES TO NET RESULT

	2014 \$000	2013 \$000
Net cash used on operating activities	74,381	-
Increase / (Decrease) in receivables	(76,659)	-
Decrease / (Increase) in payables	(659)	-
Net result	(2,937)	-

10. FINANCIAL INSTRUMENTS

The Fund's principal financial instruments are outlined below. These financial instruments arise directly from the Fund's operations or are required to finance the Fund's operations. The Fund does not enter into or trade financial instruments, including derivative financial instruments, for speculative purposes.

The Fund's main risks arising from financial instruments are outlined below, together with the Fund's objectives, policies and processes for measuring and managing risk. Further quantitative and qualitative disclosures are included throughout these financial statements.

The Secretary has overall responsibility for the establishment and oversight of risk management and reviews and agrees policies for managing each of these risks. Risk management policies are established to identify and analyse the risks faced by the Fund, to set risk limits and controls and to monitor risks.

(a) Financial instrument categories

Financial Assets	Note	Category	Carrying Amount 2014 \$'000	Carrying Amount 2013 \$'000
Class:				
Cash and cash equivalents	4	N/A	74,381	-
Receivables ¹	5	Loans and receivables (at amortised cost)	12,893	89,557
			87,274	89,557
Financial Liabilities				
Financial Liabilities	Note	Category	Carrying Amount 2014 \$'000	Carrying Amount 2013 \$'000
Class:				
Payables ²	6	Financial liabilities measured at amortised cost	394	247
			394	247

Notes

1. Excludes statutory receivables and prepayments (i.e. not within scope of AASB 7).
2. Excludes statutory payables and unearned revenue (i.e. not within scope of AASB 7).

(b) Credit Risk

Credit risk arises when there is the possibility of the Fund's debtors defaulting on their contractual obligations, resulting in a financial loss to the Fund. The maximum exposure to credit risk is generally represented by the carrying amount of the financial assets (net of any allowance for impairment).

Credit risk arises from the financial assets of Fund, including cash and receivables. No collateral is held by the Fund. The Fund has not granted any financial guarantees.

Credit risk associated with fund's financial assets, other than receivables, is managed through the selection of counterparties and establishment of minimum credit rating standards.

Cash

Cash comprises cash on hand and bank balances within the NSW Treasury Banking System. Interest is earned on daily bank balances at the monthly average NSW Treasury Corporation (TCorp) 11am unofficial cash rate, adjusted for a management fee to NSW Treasury.

Receivables – trade debtors

As at 30 June 2014, the Fund had debtors of \$5million which represent accrued grants income (refer note 1(g)(i)). There are no trade debtors as at 30 June 2013.

Authority Deposits

The Fund has no funds placed on deposit with TCorp.

(c) Liquidity risk

Liquidity risk is the risk that the fund will be unable to meet its payment obligations when they fall due. The Fund continuously manages risk through monitoring future cash flows and maturities planning to ensure adequate holding of high quality liquid assets.

During the current year and prior year, no assets have been pledged as collateral. The Fund's exposure to liquidity risk is deemed insignificant based on prior periods' data and current assessment of risk.

The liabilities are recognised for amounts due to be paid in the future for goods or services received, whether or not invoiced. Amounts owing to suppliers (which are unsecured) are settled in accordance with the policy set out in NSW TC 11/12. For small business suppliers, where terms are not specified, payment is made not later than 30 days from date of receipt of a correctly rendered invoice. For other suppliers, if trade terms are not specified, payment is made no later than the end of the month following the month in which an invoice or a statement is received. For small business suppliers, where payment is not made within the specified time period, simple interest must be paid automatically unless an existing contract specifies otherwise. For payments to other suppliers, the Secretary may automatically pay the supplier simple interest.

The table below summarises the maturity profile of NSW Trade & Investment's financial liabilities, together with the interest rate exposure.

Maturity analysis and interest rate exposure of financial liabilities

	Weighted Average Effective Int. Rate	Nominal Amount ¹ \$'000	Interest Rate Exposure			Maturity Dates		
			Fixed Int. Rate \$'000	Variable Int. Rate \$'000	Non-interest bearing \$'000	< 1 yr	1 – 5 yrs	> 5 yrs
2014								
Payables	0.0%	394	-	-	394	394	-	-
		394	-	-	394	394	-	-
2013								
Payables	0.0%	247	-	-	247	247	-	-
		247	-	-	247	247	-	-

(d) Market risk

Market risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market prices. The Fund has no exposure to foreign currency risk and does not enter into commodity contracts.

The effect on profit and equity due to a reasonably possible change in risk variable is outlined in the information below, for interest rate risk and other price risk. A reasonably possible change in risk variable has been determined after taking into account the economic environment in which the Fund operates and the time frame for the assessment (i.e. until the end of the next annual reporting period). The sensitivity analysis is based on risk exposure in existence at the Statement of Financial Position date. The analysis assumes that all other variables remain constant.

Interest rate risk

Exposure to interest rate risk arises primarily through the Fund's cash at bank. A reasonably possible change of + / - 1% is used, consistent with current trends in interest rates. The basis will be reviewed annually and amended where there is a structural change in the level of interest rate volatility. The Fund's exposure to interest rate risk is set out below.

	Carrying Amount \$'000	Result \$'000	Equity \$'000	Result \$'000	Equity \$'000
2014			-1%		+1%
Financial assets					
Cash and cash equivalents	74,381	(744)	(744)	744	744
Receivables	12,893	-	-	-	-
Financial liabilities					
Payables	394	-	-	-	-
2013					
Financial assets					
Receivables	89,557	-	-	-	-
Financial liabilities					
Payables	247	-	-	-	-

Other price risk – TCorp Hour Glass Investment facilities

The Fund holds no units in Hour-Glass investment trusts.

(e) Fair value measurement

Financial instruments are generally recognized at cost. The amortized cost of financial instruments recognized in the statement of financial position approximates the fair value, because of the short term nature of the financial instruments.

11. EVENTS AFTER REPORTING DATE

There are no events subsequent to the balance date which affect the financial information disclosed in these financial statements.

End of the financial statements.