COAL MINE METHANE PROJECT OPPORTUNITY

First Safe Direct Coupling of a Commercial-Scale RTO to a Working Coal Mine

Centennial Coal Company Limited

Mandalong, NSW, Australia

OVERVIEW OF COAL MINE METHANE PROJECT:

Centennial Coal's Mandalong Mine is located between Sydney and Newcastle in NSW, Australia. This commercial scale project aims to safely directly couple to a mine ventilation fan to capture 98% of the fan flow between 100 m^3/s to 150 m^3/s. This project is at concept phase with a feasibility study underway.

Funding is contemplated from Centennial Coal Company, the Australian Government's Coal Mining Abatement Technology Support Package (CMATSP) and industry funding.

Centennial Coal and Corky's propose to engage with the mining industry, its regulators and relevant stakeholders to develop a design assurance process utilising established aerospace industry practices for complex design processes. Subsequent to a successful design assurance process, a commercial scale 'hard connection' (safe connection duct) and RTO will be designed, installed and demonstrated at Mandalong Mine. The major aims from this project are to add no safety risk and provide no back pressure to the underground coal mine, manage the variable flow of methane released from one ventilation fan and to significantly drive down delivery cost for subsequent projects.

ESTIMATED ANNUAL EMISSION REDUCTIONS: 360,500 $MTCO_2E$

PROJECT DETAILS

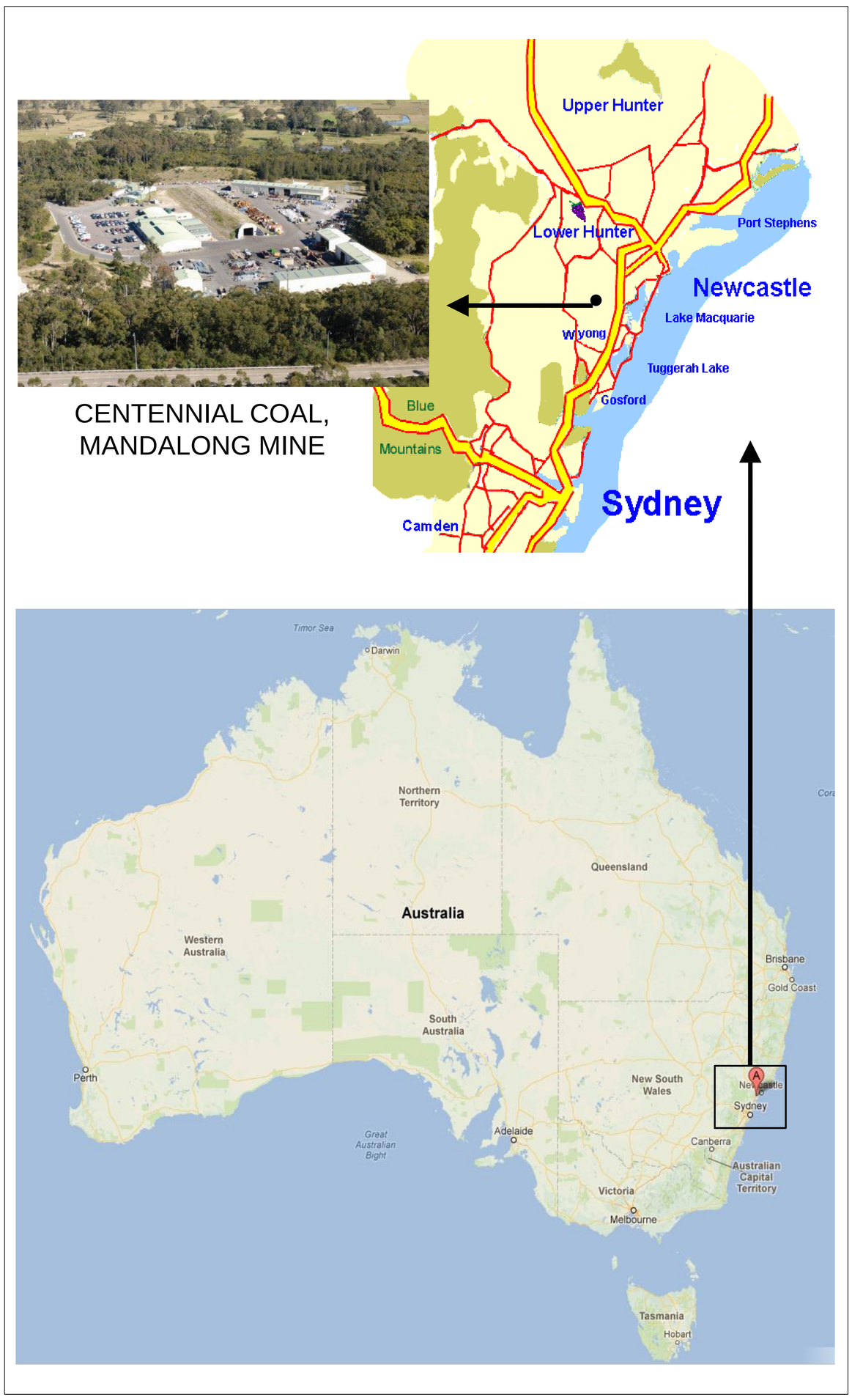
- Name of Project: **COMMERCIAL SCALE 'RTO' WITH FIRST SAFE DIRECT CONNECTION TO A WORKING COAL MINE**
- Name of Mine: **CENTENNIAL COAL, MANDALONG MINE**
- Type of Ownership: **PRIVATE**
- Type(s) of assessments performed: **FEASIBILITY**
  - When performed: **CURRENTLY UNDERWAY**
  - By whom: **CORKY'S SUSTAINABLE ENERGY**

MINE INFORMATION

- Mine owner: **CENTENNIAL COAL**
- Percent ownership: **100%**
- Parent company: **BANPU PUBLIC COMPANY LIMITED**
- Status and type of mine: **ACTIVE UNDERGROUND**
- Mining Method: **LONGWALL**
- Service Life of Mine: **25 YEARS REMAINING (SUBJECT TO FURTHER APPROVAL)**

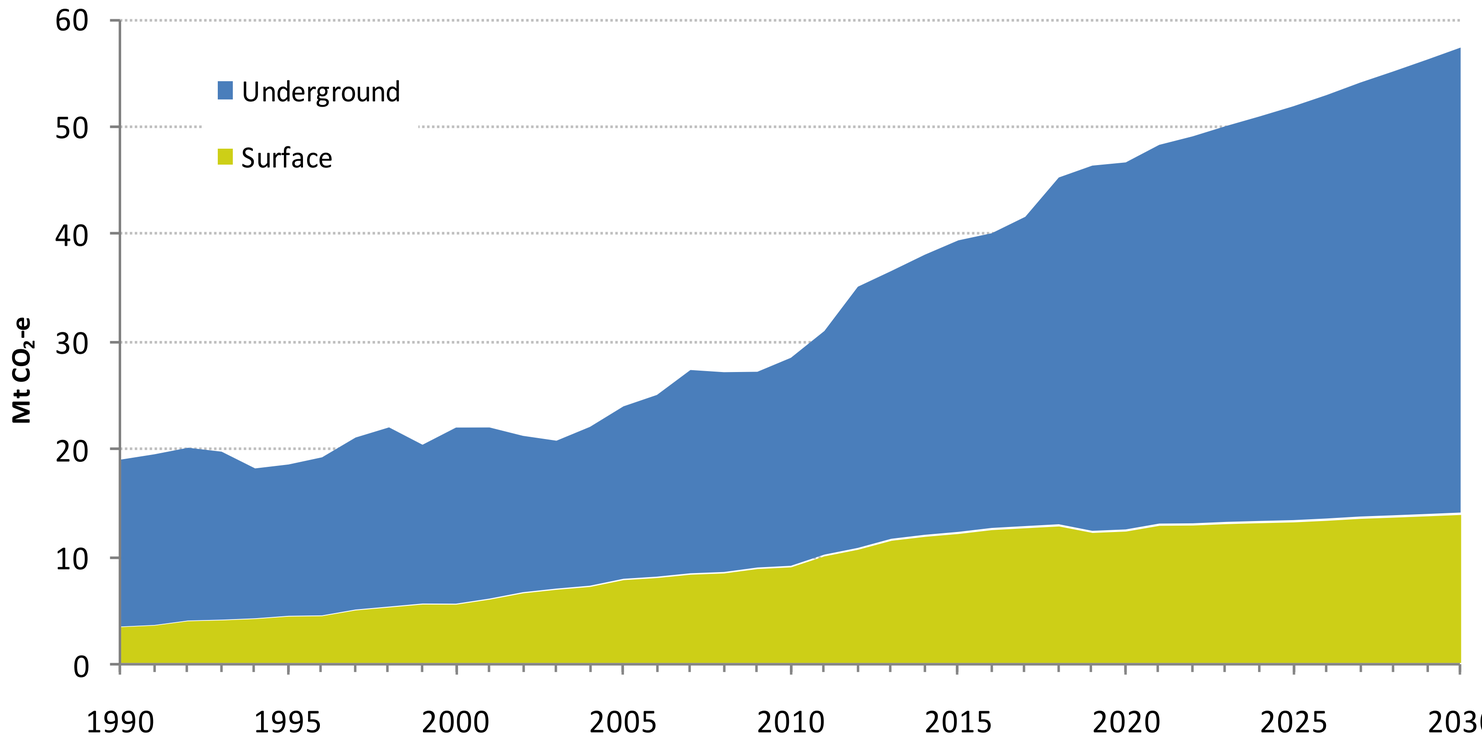
PROJECT FINANCES

- Assumptions :
  - **Australian carbon tax liability of $23 AUD/$MTCO_2E$**
  - **For 125 m^3/s (450,000 m^3/h) of VAM processing:**
    - **VAM average of 0.6% CH_4 concentration by volume**
    - **Global Warming Potential (GWP) of CH_4 of 25**
    - **98% abatement**
    - **AUD to USD exchange rate of 1.05 on 14th Jan 2013**
    - **Estimate of ROM Coal Mined and CMM Emissions for Mandalong Mine**
- Estimated revenue: **US$ 8.7 M pa**
- Projected capital costs: **US$ 32.7 M (over 5 years)**
- Projected operation and maintenance (O&M) costs for fully implemented project: **US$ 0.26 M pa**
- Estimated Return on Investment (ROI): **3.7 YEARS (25%)**



HISTORICAL AND PROJECTED MINE DATA

PAST AND PROJECTED AUSTRALIAN COAL MINING METHANE EMISSIONS



Source: DCCEE. (2010). Fugitive emission projections. Canberra, ACT: Department of Climate Change and Energy Efficiency.

GREENHOUSE GAS EMISSION REDUCTION

METHANE EXPECTED TO BE ABATED AT MANDALONG MINE (COMMERCIAL SCALE UNIT ONLY)

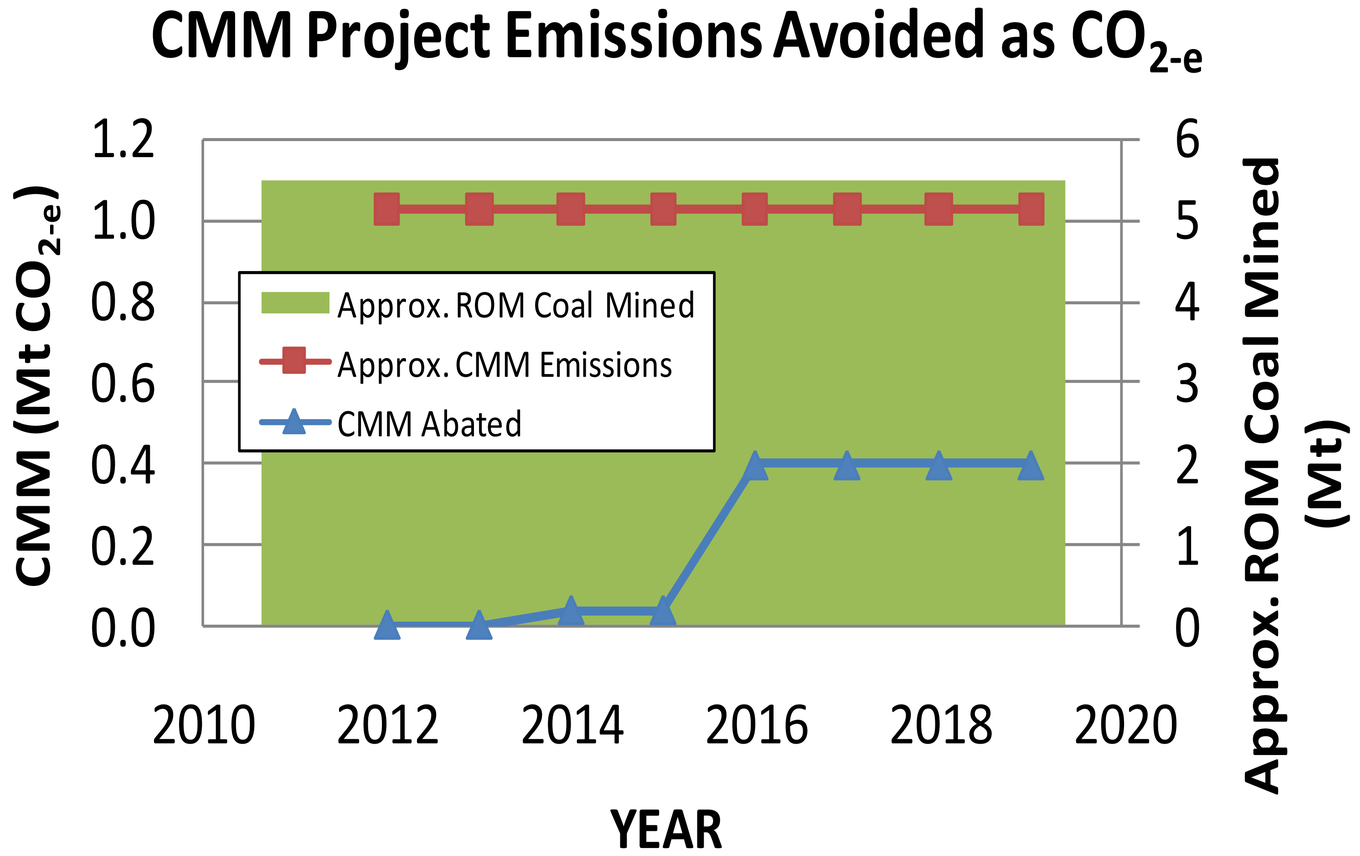
YEAR	2013	2014	2015	2016	2017	2018	2019
Average Estimate of CH_4 in Ventilation Air, concentration by volume (%)	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Total CH_4 captured and abated (Mm^3/year)	**Planning**	**Off site exhibition**	**Constructio n**	**23.12**	**23.12**	**23.12**	**23.12**
Total CH_4 captured and abated (metric t/year $CO_{2\text{-}e}$)	0	0	0	360,500	360,500	360,500	360,500
Net benefits – reduction in Australian Carbon Tax Liability ($M US/year)	0	0	0	8.75	8.75	8.75	8.75

GREENHOUSE GAS EMISSION REDUCTION CHART

TOTAL METHANE EMISSIONS (IN CO_2 EQUIVALENT) ABATED AT CENTENNIAL COAL'S MANDALONG MINE (WITH DEMONSTRATION AND COMMERCIAL SCALE RTO).

PROJECTED TO ABATE APPROX. 38% CMM EMISSIONS BY 2016.

CMM Project Emissions Avoided as $CO_{2\text{-}e}$



MARKET ANALYSIS / DEMAND ANALYSIS

The new carbon tax in Australia has lead to a growing demand for methane abatement systems. However, the major barriers are legitimate concern about mine safety and operability and the absence of regulator approved standards. This project aims to quantify and demonstrate the design of the functional and safety systems in such a way that standards can be written. There after the cost to deliver RTO technology will be reduced.

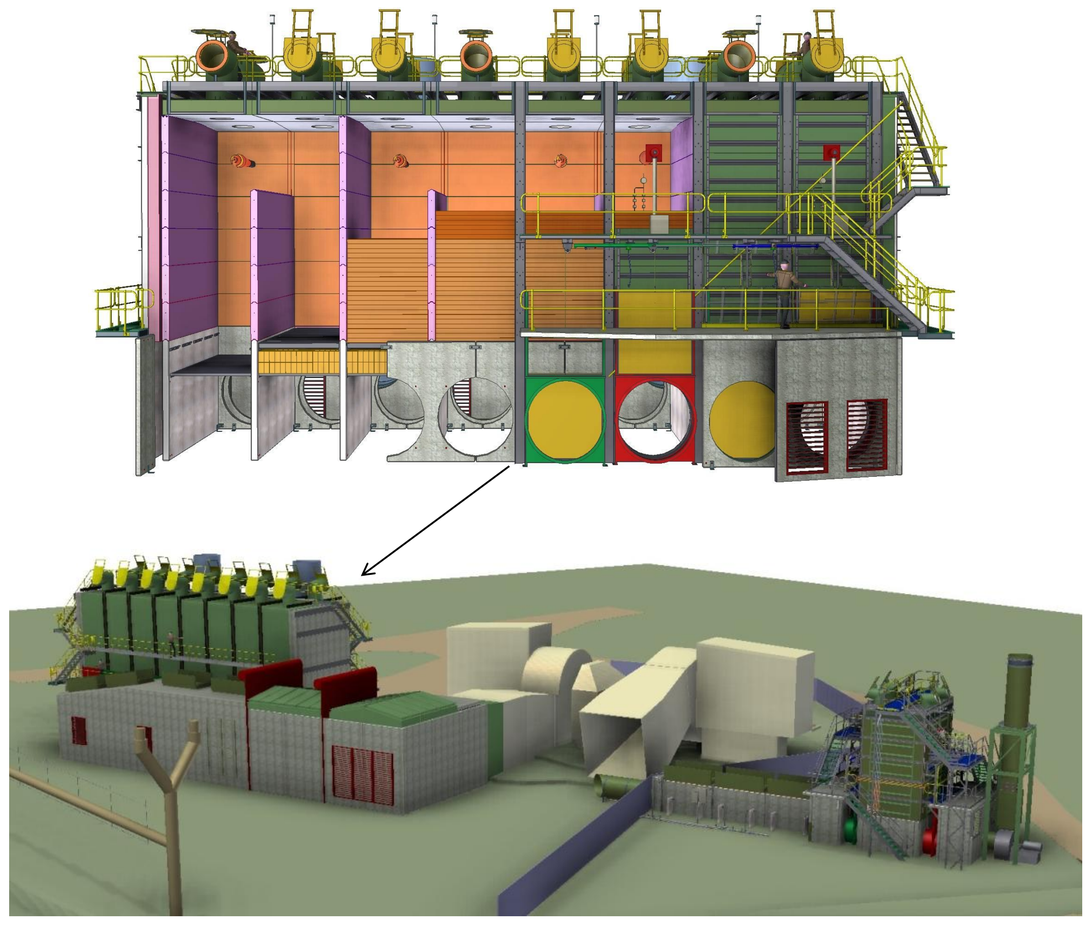
With global warming increasing, it is becoming a poignant issue to act now to ensure the coal mining industry becomes more environmentally and economically sustainable. After acceptance of the safety analysis in the exhibition phase of the project, VAM RAB technology's modular design will be available internationally.

TYPE(S) OF ASSISTANCE SOUGHT

Technical design, construction and experimentation are being completed through Corky's Sustainable Energy. The construction and testing compliances will be verified via third party reviews.

PROPOSED TECHNOLOGIES

SCHEMATICS OF THE EXISTING DEMONSTRATION PLANT AT CENTENNIAL COAL MINE AND THE PROPOSED COMMERCIAL SCALE UNIT.



SECTION CUT-OUT OF THE COMMERCIAL SCALE 'FOUR PACK' VAM RAB

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