



Market Research Report – Executive Summary

Clean Coal Technologies

July 2012

Kevin M. Closson
Senior Analyst

Nerac
1 Technology Dr.
Tolland, CT 06084
Phone: (860) 872-7000
www.nerac.com

Contents

Introduction.....	3
Study background.....	3
Study goals and objectives	3
Intended audience.....	3
Scope and format	4
Methodology and sources.....	4
Executive summary	5
About the author	8
About Nerac.....	8
Terms and Conditions	9

Introduction

Study background

The largest fraction of the world's electricity is generated by burning coal. Coal is plentiful, has a high energy value, is easily transportable and storable, and provides dispatchable energy. Coal also produces many pollutants harmful to the environment and human health when burned, requires huge quantities of water to process, and is the largest source of anthropogenic CO₂ emissions on the planet.

It is this last fact that is driving interest in what are called “clean coal technologies.” It is widely acknowledged by observers both pro- and anti-coal that without addressing CO₂ emissions from coal-fired power plants, any significant reduction in greenhouse gas emissions overall is not possible.

“Clean coal technologies” can encompass different technologies depending on how the term is defined. In this report, clean coal technologies are defined as those technologies applied to coal-fired electricity generating systems which reduce the environmental externalities associated with that generation. That is, clean coal technology is any technology which reduces emissions of harmful pollutants or reduces required inputs (i.e. improves efficiency of the system).

Study goals and objectives

The goal of this report is to provide readers with analysis of the market for clean coal technologies worldwide. Specifically, this is accomplished by:

- Outlining the coal industry
- Providing an overview of the key clean coal technologies available today
- Analyzing the intellectual property landscape for clean coal technologies
- Estimating the size of the market for clean coal technologies
- Profiling key companies within the clean coal industry
- Profiling key clean coal projects

It should be recognized that this report and its analysis is a snapshot of the industry in a moment in time. Clean coal technologies are evolving at a high rate of speed, as are clean coal markets. Moreover, the global energy situation is constantly in flux. Thus, the contents and analysis presented in this report reflect the situation as it exists at the time of publication.

Intended audience

This report is intended primarily for an audience not already deeply familiar with the technologies profiled herein. It is designed for use by those readers with a need to understand what technologies are involved, where the clean coal market is headed and what companies are involved in it. This audience includes executives of companies involved in or seeking to become involved in the clean coal market, entrepreneurs, investors, venture capitalists and others who might be affected by the direction of clean coal technologies in the next four years. The report and its analysis also should be of interest to members of the coal and power generation industries more broadly.

Scope and format

This report addresses the global market for clean coal technologies. The report covers combustion technologies (gasification, fluidized bed, supercritical/ultra-supercritical and oxy-fuel combustion); post combustion emissions reduction technologies (filters, electrostatic precipitators, scrubbers and catalytic reduction systems); and carbon capture (both pre- and post-combustion), transport, sequestration and monitoring.

The report contains the following major components:

- Executive summary
- Coal power fundamentals
- Clean coal technology descriptions and applications
- Intellectual property analysis
- Global clean coal technology markets, 2009-2015
- Factors affecting the clean coal technology market
- Key company profiles
- Key clean coal project profiles

Methodology and sources

A combination of primary and secondary sources was used to develop the content of this report. Primary sources included interviews with suppliers of clean coal technologies and industry observers. Secondary sources included industry and trade literature, trade association content, company literature and financial filings, technical journals and various intellectual property resources.

The market analysis developed for this report reflects a combination of methods typically used for such tasks. Both demand-side and supply-side models were built. Methodologies used within these analyses include trend line projection, regression analysis, input-output analysis, figures from industry and government sources and estimates of future demand from credible industry sources.

The intellectual property data for this report was developed using a number of search strategies. These included key words, forward/backward citations, international and US patent classes, assignees and inventors. The results of the data collected through these strategies were then analyzed for important trends in the clean coal technologies market.

Executive summary

Clean coal technologies are those technologies which reduce the environmental impact of coal-fired electricity generation through reduction in emissions and/or improved efficiency. There are three broad categories of clean coal technologies:

- Combustion technologies, which are concerned with how coal is thermodynamically converted into electricity
- Post-combustion technologies, which involve the on-site mitigation of harmful emissions produced as a result of coal combustion
- Carbon capture and sequestration (CCS) technologies, which are designed to reduce the amount of CO₂ emitted as a result of coal combustion

Nerac estimates the global market for clean coal technologies to be approximately \$28.2 billion in 2011 and slightly over \$30 billion in 2012. We project this market to grow to about \$40.9 billion worldwide by 2015. This represents a CAGR of 9.7% over the period 2011 to 2015.

SUMMARY TABLE

GLOBAL CLEAN COAL TECHNOLOGY MARKET, THROUGH 2015 (US\$ Billions)

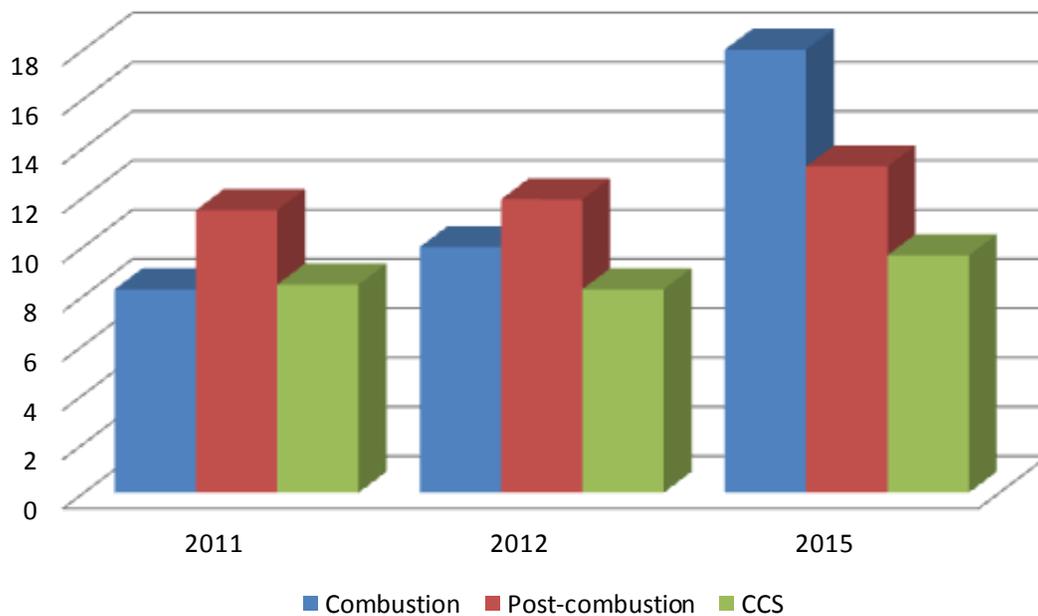
Technology	2011	2012 (Projected)	2015 (Projected)	CAGR 2011-2015
Combustion	8.26	9.97	17.99	21.5%
Post-combustion	11.47	11.91	13.25	3.7%
Carbon capture and sequestration	8.45	8.26	9.64	3.4%
Total	28.18	30.15	40.87	9.7%

Source: Nerac

Within the total market, Nerac projects the strongest growth will come from combustion technologies, which will grow from \$8.26 billion to 17.99 billion in 2015 (a CAGR of 21.5% over the period). Post-combustion and CCS technologies will grow more modestly, at a CAGR of 3.7% and 3.4%, respectively. We believe this reflects the fact that many of the combustion technologies improve plant efficiency irrespective of their effect on overall emissions. Thus, end users consider these technologies of value regardless of the requirements for emissions abatement.

SUMMARY FIGURE

**GLOBAL CLEAN COAL TECHNOLOGY MARKET, THROUGH 2015
(US\$ Billions)**



Source: Nerac

Within the broader clean coal market, the greatest growth in the market for **CCS technologies** will come from Asia and North America. Nerac forecasts the Asian market to grow from approximately \$620 million in 2011 to some \$1 billion by 2015 (a CAGR of 14%), driven largely by the rapid expansion of the Asian coal-fired electricity generation fleet. Meanwhile, North America will remain the largest market for clean coal technologies by far, growing at 4.4% per annum (average) from \$5.2 billion in 2011 to \$6.5 billion in 2015. Meanwhile, growth in Australasia will be flat and the European market for clean coal will actually contract over the period.

SUMMARY TABLE

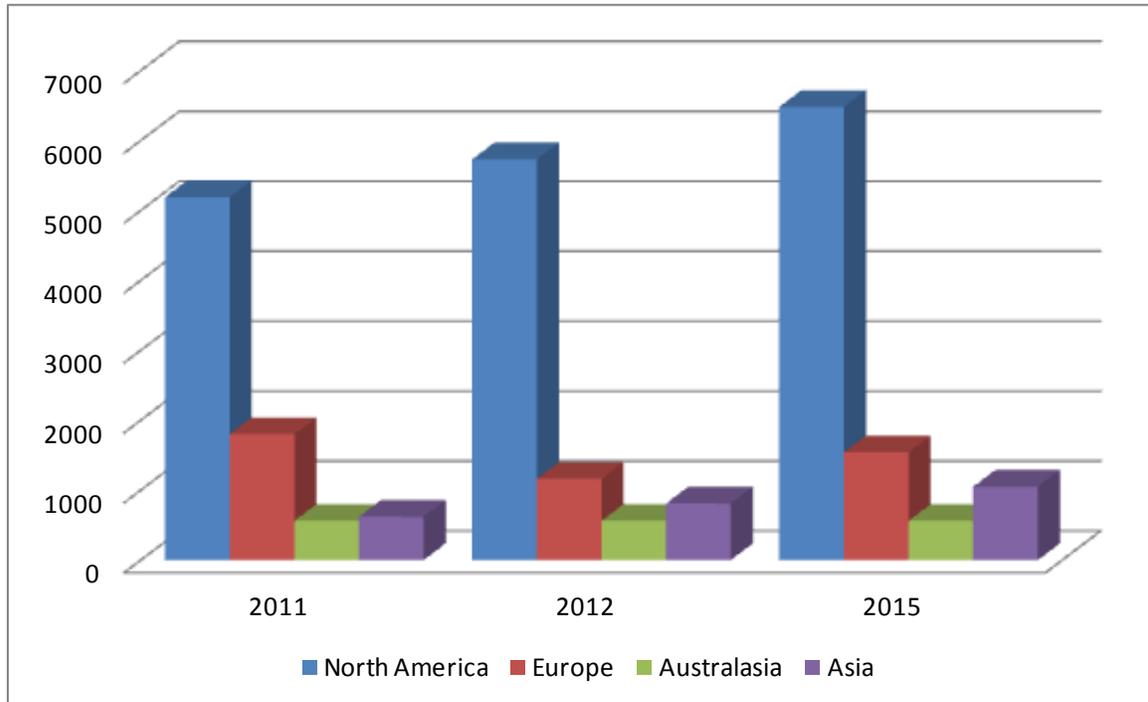
CARBON CAPTURE AND SEQUESTRATION TECHNOLOGY MARKET BY GEOGRAPHIC REGION, THROUGH 2015 (US\$ Millions)

	2011	2012 (Projected)	2015 (Projected)	CAGR 2011-2015
North America	5,190	5,730	6,480	4.4%
Europe	1,800	1,160	1,540	-3.8%
Australia	560	560	560	0.0%
Asia	620	810	1,050	14.0%
Total	8,450	8,260	9,640	3.4%

Source: Nerac

SUMMARY FIGURE

CARBON CAPTURE AND SEQUESTRATION TECHNOLOGY MARKET BY GEOGRAPHIC REGION, THROUGH 2015 (US\$ Millions)



About the author

Kevin M. Closson, the author of this report, is a senior analyst with Nerac. He consults with senior executives in a number of industries including energy, manufacturing, aerospace and automotive. He helps clients understand technologies and markets better through collaborative consulting engagements customized to each client’s needs. These include competitive intelligence analysis, technology analysis, market analysis and intellectual property analysis.

Kevin has an MBA and both Master’s and Bachelor’s degrees in Mechanical Engineering. He can be reached at kclosson@nerac.com or (860) 872-7000.

About Nerac

Nerac Inc. (www.nerac.com) is a global research and advisory firm for companies developing innovative products and technologies. Nerac provides expert insights that equip clients with the knowledge to develop or refine a technology, explore market growth opportunities, evaluate intellectual property strategies and respond to regulatory changes. Nerac has approximately 1,200 clients worldwide and a long, successful consulting history in a wide range of industries

with a strong focus in the areas of energy, food, pharmaceutical, medical device, engineering and specialty chemicals.

If you would like to learn more about how Nerac can assist your company, please visit www.nerac.com or call (860) 872-7000.

Terms and Conditions

All content contained in this market research report is owned by Nerac, Inc. This content of this market research report is based on an independent analysis of publicly available information and may contain professional opinions of the author. No opinion expressed in this report constitutes legal, managerial or financial advice, and Nerac, Inc. shall not be held responsible for any losses or liabilities resulting from reliance on any of the content of this report.