

Article

The Role of Clean Coal Technologies in the Development of Renewable Energy Sources

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Abstract: The article presents research on the synergistic impact of clean coal technologies and renewable energy sources on the energy mix in Poland. The main causes of problems that inhibit the development of renewable energy sources and ways to eliminate them are presented. A factor that may undermine the development of renewable energy potential is access to critical raw materials such as rare earth elements. Clean coal technologies will make it possible to survive the transition period for coal-based energy mixes. The CCT solution described in this article will enable the acquisition of rare earth elements necessary for the development of renewable energy sources. The ability to meet the demand for REEs based on elements recovered from fly ash is examined. For this purpose, an analysis of wind electricity production capacities was carried out and a forecast until 2030 was created. A program was written using machine learning and the Gompertz sigmoid model. Based on the forecast, the level of demand for REEs was determined and compared with the supply obtained from fly ash. The authors propose an alternative source of REEs and analyze the relationship between demand and supply of this source.

Keywords: coal demand; clean coal technologies; machine learning; renewable energy



Citation: Rybak, A.; Rybak, A.; Joostberens, J. The Role of Clean Coal Technologies in the Development of Renewable Energy Sources. *Energies* **2024**, *17*, 2892. <https://doi.org/10.3390/en17122892>

Academic Editor: Manoj Khundhwal

Received: 11 May 2024

Revised: 10 June 2024

Accepted: 11 June 2024

Published: 13 June 2024



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1. Introduction

Poland's energy security has so far been based on coal. From 1985 to 2018, the contribution of coal to electricity production in Poland was not lower than 130 TWh per year. In 2019, this share dropped for the first time in 35 years to 120 TWh. The reason for this state of affairs is certainly the European Union's climate policy and Poland's Energy Policy. These documents assume the so-called decarbonization of the energy sector. This means that the EU will achieve carbon neutrality by 2050. Coal is to be replaced by renewable energy sources in this process. These provisions are included in the European Green Deal, as well as in the RED (Renewable Energy Directive) [1]. Implementing decarbonization in Poland will require a special amount of work and investment due to the specific nature of the country's energy mix. Figure 1 presents primary energy consumption in Poland in 2022. It should be noted that coal plays the dominant role. This is mainly due to Poland's favorable geographical location in terms of access to coal resources.

This has naturally shaped the energy system, and easy access to coal fuel influenced decisions to build subsequent coal-fired power plants. Figure 2 presents the structure of energy carriers used in the electricity production process. Once again, coal is of key importance, in this case with a share of over 70%. At the same time, attention should be paid to the share of renewable energy sources (RESs). In both cases it is small, 9% in the case of demand for primary energy and 19% in the case of electricity production. Despite the RES share level in 2022, it should be mentioned that this share is growing very dynamically every year, and in 2007 it was close to zero [3].

Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper

**Great Britain. Department of Trade
and Industry**



Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper:

Clean Coal Technologies Great Britain. Department of Trade and Industry,1994 This document sets out the rationale for the DTI s R D programme on clean coal technologies and describes the collaborative work under way in the present programme and that planned for the next few years The document also describes the main targets established for the programme and the management structure put in place to ensure both value for money and that full advantage is taken of overseas collaboration

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Cleaner Coal Technologies Great Britain. Department of Trade and Industry,1999

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international contexts **Hmso Monthly Catalogue** Stationery Office, The,1994-12 **Energy Abstracts for Policy Analysis** ,1987 *International Conference on Coal, the Environment and Development: Technologies to Reduce Greenhouse Gas Emissions* International Energy Agency,1992 *Carbon Capture and Storage in the United Kingdom* Marc Hudson,2024-03-27 This book is a concise but comprehensive guide to the history present and possible futures of carbon capture and storage policy and action in the United Kingdom UK There have been multiple failed starts promises and last chances for carbon capture and storage CCS in Europe North America China and Australia but thus far it has repeatedly collided with the political and economic realities that the technology is too expensive and complicated to gain and keep policymakers support However in the UK that might be changing with explicit government support for CCS to help decarbonise industry Set within the broader context of global interest in CCS this book first outlines the technologies involved in the types of capture technology transport options and storage options in the UK It then briefly introduces an overarching policy analysis framework John Kingdon s multiple streams approach and uses it to give an account of the long history of CCS interest and efforts in three chapters covering the 1970s to 2002 2003 to 2015 and 2016 to the present day Marc Hudson focusses on the various arguments made for the introduction of CCS and the slowly shifting coalitions of actors who make those arguments while contrasting these with the perspectives of those opposed to CCS This book will be of great interest to students scholars and policymakers researching and working in the field as well as the related areas of energy policy energy transitions and climate change *Energy Research Abstracts* ,1993 **Keeping the Lights on** Great Britain: Parliament: House of Commons: Environmental Audit Committee,2006-04-16 Keeping the lights On Nuclear renewables and climate change sixth report of session 2005 06 Vol 3 Written Evidence Chemical Engineering Progress ,2008 **Acid Precipitation** ,1993-07 **Whitaker's Books in Print** ,1998 **HMSO Annual Catalogue** Great Britain. Her Majesty's Stationery Office,1986 **Survey of Current Affairs** ,1999 *Coal Abstracts* ,1993 **Science, Technology and Industry Outlook 1996** Organisation for Economic Co-operation and Development,1996 Energy Sources and Policy Israel Berkovitch,1996 This guide provides a summary of the key energy policy issues including the safety of long term environmental effects of different energy sources costs estimated reserves of non renewable energy sources new and experimental sources and energy conversion A bibliography is included *British National Bibliography for Report Literature* ,2002

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Table of Contents Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper

1. Understanding the eBook Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - The Rise of Digital Reading Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - Advantages of eBooks Over Traditional Books
2. Identifying Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - User-Friendly Interface
4. Exploring eBook Recommendations from Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - Personalized Recommendations
 - Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper User Reviews and Ratings
 - Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper and Bestseller Lists
5. Accessing Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper Free and Paid eBooks
 - Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper Public Domain eBooks

- Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper eBook Subscription Services
- Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper Budget-Friendly Options
- 6. Navigating Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper eBook Formats
 - ePub, PDF, MOBI, and More
 - Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper Compatibility with Devices
 - Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - Highlighting and Note-Taking Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - Interactive Elements Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
- 8. Staying Engaged with Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
- 9. Balancing eBooks and Physical Books Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - Setting Reading Goals Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - Fact-Checking eBook Content of Clean Coal Technologies A Strategy For The Coal R Dprogramme Energy Paper
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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