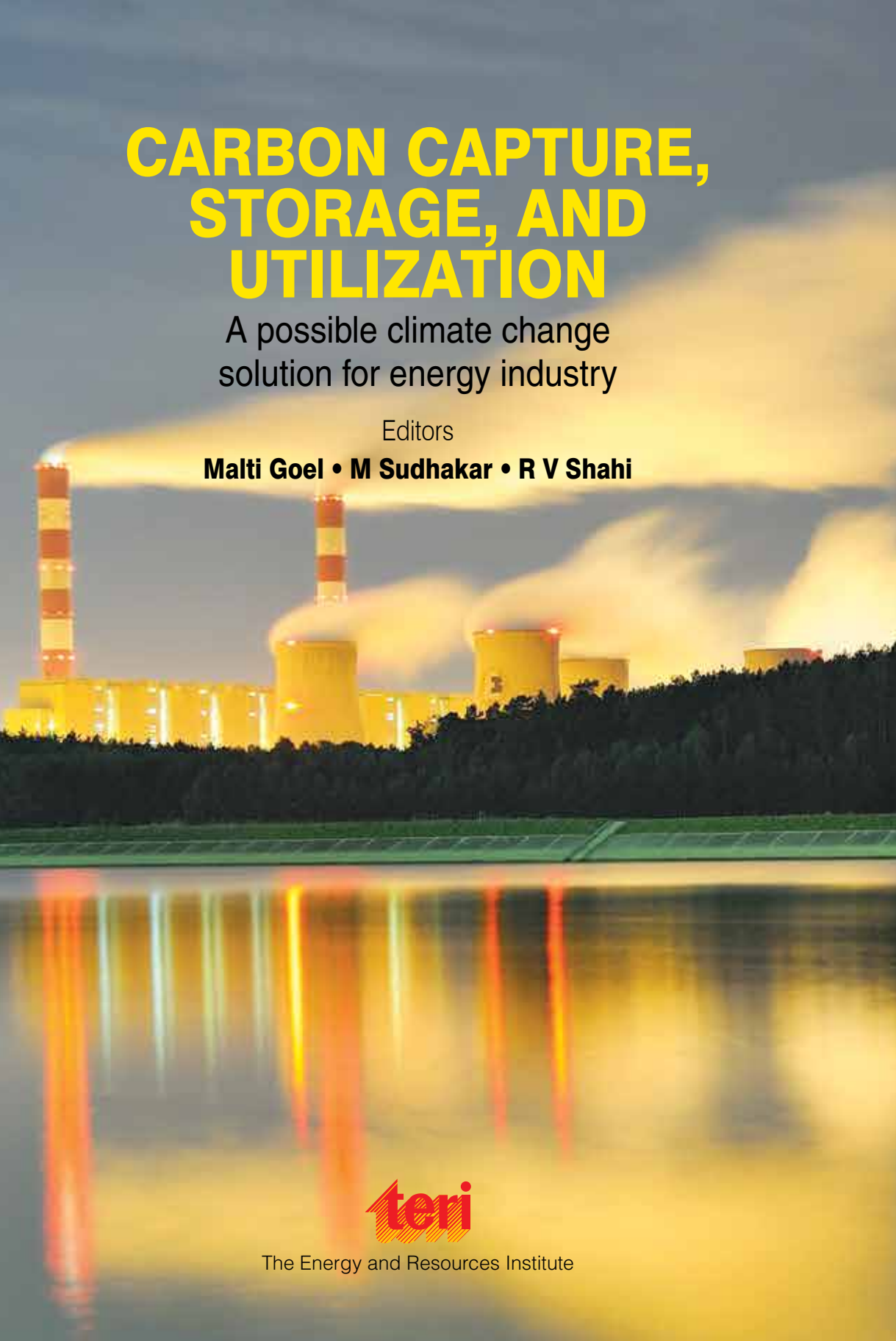
CARBON CAPTURE, STORAGE, AND UTILIZATION

A possible climate change solution for energy industry

Editors

Malti Goel • M Sudhakar • R V Shahi



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The Energy and Resources Institute

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ISBN 978-81-7993-568-2

Suggested citation
Goel, Malti, M Sudhakar, and R V Shahi. 2015. *Carbon Capture, Storage, and Utilization: a possible climate change solution for energy industry.* New Delhi: TERI

Published by
The Energy and Resources Institute (TERI)
TERI Press
Darbari Seth Block
IHC Complex, Lodhi Road
New Delhi – 110 003
India

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Printed in India

Foreword

Carbon Capture and Storage (CCS) has emerged as one among the three key energy technology options to mitigate climate change. The other two are: energy efficiency improvement and increasing use of renewable energy sources.

Introduced in 1990s, the CCS technology is seen as an option to address problems of climate change, and has also added a new dimension to scientific research in addressing one of the most contentious issues of the 21st century. The other two technology options are already being pursued in a mission mode under National Action Plan on Climate Change. CCS being a late entrant to the scene, has attracted the attention of both researchers and policy makers.

The research in carbon sequestration took shape in the Department of Science and Technology under its Inter-sectoral programmes. I am happy that this book on Carbon Capture, Storage, and Utilization (CCSU) edited by Malti Goel, M. Sudhakar, and R. V. Shahi is a unique text about the options for CO_2 fixation. A large number of research frontiers have been covered in the book. The need of the hour is for the Industry and Government Departments to pool their resources to address CCSU-related issues. The policy paper of Shri R. V. Shahi, Ex-Secretary Power, in this context is of immense value.

We need to take steps to tackle climate change arising from economic growth. Energy is the engine for economic growth. The question is, could CCS become a turning point in the future in the energy sector and what we can do in this emerging field? The book discusses potential of an innovative energy technology CCSU towards a sustainable energy future. Various techniques of CO_2 recovery from power plants by physical, chemical, and biological means as well as challenges and prospects in biomimetic carbon sequestration are addressed in this book. It showcases Indian research perspectives to the world and that makes it a significant

contribution. It is sincerely hoped that this book will be a valuable guide for policy makers and serve as a reference book also.

Harsh Gupta
Member, Atomic Energy Regulatory Board
President, International Union of Geodesy and Geophysics
President, Geological Society of India

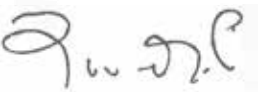
Message

I have long association with Coal India Ltd., a company which produces so much of coal. We are the third largest coal producer and the Coal India is the single largest coal producing company in the world. I personally believe that by producing coal, their responsibility does not cease. Something beyond that must be pursued for reducing its carbon footprints. On the research and development (R&D) activities for carbon sequestration, Coal India's contribution till today is almost negligible. I think that one of the cash-rich companies like Coal India with around 42,000 crores cash liquidity has a role to play and should invest in R&D and technology development.

I fully agree with Dr. Kasturirangan, Former Member, Planning Commission, that we would need to find implementable solutions for carbon capture and storage (CCS) through continuous R&D activity and in this area capacity building is important. In this context, contribution of Dr. Malti Goel, Former Adviser and Scientist 'G' in the Department of Science & Technology, who conceived and spearheaded the research under National Programme on CO_2 Sequestration, is very much appreciated. I think institutions like Indian School of Mines, Banaras Hindu University and other mining institutions and universities should pay serious attention to it. There is a need to give thrust to R&D and also special courses have to be conducted. At present about 600 million tonnes of coal is consumed and it would soon become 1.0 billion tonnes and then 1.6 billion tonnes. Once you capture carbon dioxide, the variant is how to store it. That is going to be a real challenge. I would suggest that to sequester CO_2 inside the mine need to be given a push. While industries like NTPC, ONGC and Reliance are coming forward to invest in R&D, I am sure that Coal India will also involve themselves in these activities.

Recently, Hon'ble Minister of State with Independent Charge for Power, Coal and New & Renewable Energy, Government of India Shri Piyush Goyal has said that top priority is to be given to R&D projects in Energy sector. I feel extremely happy that an edited volume of the lecture notes of capacity building workshop on carbon capture and storage:

earth processes organized by Climate Change Research Institute is being published as *Carbon Capture, Storage and Utilization* by TERI Press. This book certainly would form a noteworthy resource for future researchers as well as compose an educational material on the subject.



M. P. Narayanan
Former CMD, Coal India Ltd

Acknowledgement

India is the third largest coal producer and coal consumer country, accounted for about 8% of the world coal consumption in 2012. The climate change concerns arising from coal combustion and increasing accumulation of greenhouse gases have given rise to the need for development of clean energy technologies; and CO_2 sequestration is one of them. This book, *Carbon Capture, Storage, and Utilization: a possible climate change solution for energy industry*, is about CO_2 Sequestration technology.

In this endeavour our whole hearted thanks are to Hon'ble Dr Kasturirangan, Member, Planning Commission; and to Vice Chancellor, Jawaharlal Nehru University for his blessings and encouragement; and to Prof. H. K. Gupta, Member, National Disaster Management Authority, who has been extremely gracious in giving his valuable time, advice and guidance.

We are indebted to Dr Shalaish Nayak, Secretary, Ministry of Earth Sciences for the valuable guidance, support and interactive discussions; and to Prof. A. K. Ghoshal, IIT Guwahati and Prof. T. Satyanarana, Delhi University South Campus for their active involvement and unstinted cooperation.

We feel obliged to Dr M. P. Narayanan Ex-CMD, Coal India Ltd and Shri D. K. Aggrawal, Executive Director, National Thermal Power Corporation for giving industry perspectives and recommendations about taking up pilot projects.

The Climate Change Research Institute in association with the Ministry of Earth Sciences and other stakeholders organized the workshop on Carbon Capture and Storage: Earth Processes at India International Centre (IIC) during 15–19 January 2013. This publication contains a compilation of lectures delivered in the workshop and also those which were proposed but could not be delivered, to widely disseminate the knowledge on the subject.

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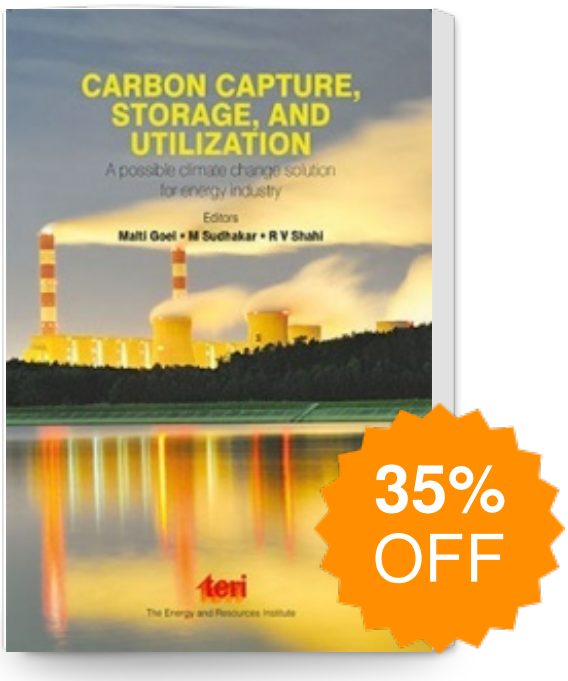

Publisher : TERI Press ISBN : 9788179935682 Author : Malti Goel