AS ISO 27919.1:2019

Australian STANDARD

Carbon dioxide capture

Part 1: Performance evaluation methods for post-combustion CO2 capture integrated with a power plant

STANDARDS Australia

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Australian Energy Council
Australian National Low Emissions Coal Research and Development
CSIRO
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Department of Premier and Cabinet (SA)
Engineers Australia
Geoscience Australia
NSW Department of Planning and Environment
Petroleum Exploration Society of Australia (Victorian Branch)
University of Melbourne

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Part 1: Performance evaluation methods for post-combustion CO2 capture integrated with a power plant

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Preface

This Standard was prepared by the Standards Australia Committee EE-002, Carbon dioxide capture, transportation, and geological storage.

The objective of this Standard is to specify methods for measuring, evaluating and reporting the performance of post-combustion CO_2 capture (PCC) integrated with a power plant, and which separates CO_2 from the power plant flue gas in preparation for subsequent transportation and geological storage. In particular, it provides a common methodology to calculate specific key performance indicators for the PCC plant, requiring the definition of the boundaries of a typical system and the measurements needed to determine the KPIs.

This document covers thermal power plants burning carbonaceous fuels, such as coal, oil, natural gas and biomass-derived fuels, which are producing CO_2 from boilers or gas turbines, and are integrated with CO_2 capture.

The PCC technologies covered by this document are those based on chemical absorption using reactive liquids, such as aqueous amine solutions, potassium carbonate solutions, and aqueous ammonia. Other PCC concepts based on different principles (e.g. adsorption, membranes, cryogenic) are not covered. The PCC plant can be installed for treatment of the full volume of flue gas from the power plant or a fraction of the total (i.e. a slip stream). Captured CO_2 is processed in a compression or liquefaction step as determined by the conditions for transportation and storage.

This Standard is identical with, and has been reproduced from, ISO 27919-1:2018, *Carbon dioxide capture — Part 1: Performance evaluation methods for post-combustion CO_2 capture integrated with a power plant.*

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Contents

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. www.iso.org/patents

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This document was prepared by Technical Committee ISO/TC 265, *Carbon dioxide capture, transportation and geological storage*.

A list of all the parts in the ISO 27919 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

It is very important to reduce atmospheric carbon dioxide (CO_2) emissions in order to meet climate change mitigation targets. Inclusion of carbon dioxide capture and storage (CCS) among the variety of available emission reduction approaches enhances the probability of meeting these targets at the lowest cost to the global economy. CCS captures CO_2 from industrial and energy-related sources and stores it underground in geological formations. It can capture emissions from carbonaceous fuel-based combustion processes, including power generation, and is the only technology capable of dealing directly with emissions from several industrial sectors, such as cement manufacture and fertilizer production.

This document is the first in a series of standards for CO_2 capture. It is limited to evaluation of key performance indicators (KPIs) for post-combustion CO_2 capture (PCC) from a power plant using a liquid-based chemical absorption process. New or revised standards focused on other capture technologies and approaches will be developed at a later date.

PCC is applicable to all combustion-based thermal power plants. A simplified block diagram illustrating the PCC is shown in Figure 1.

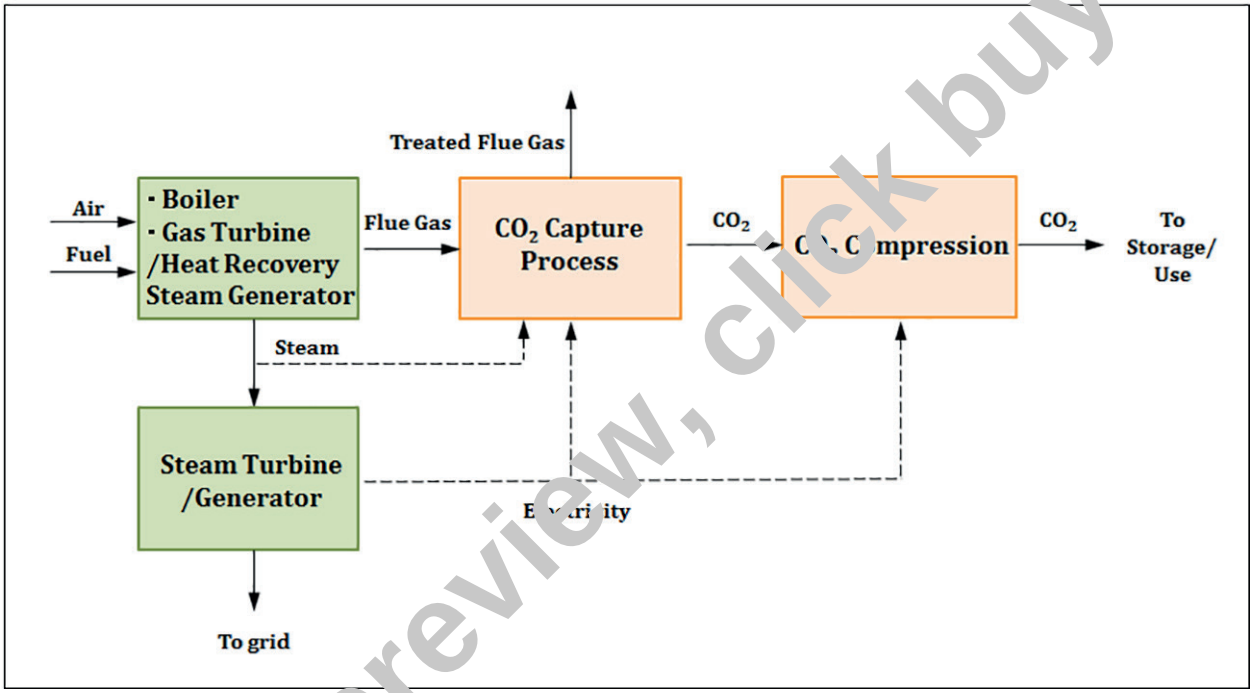

Figure 1 — Simplified block diagram for PCC

In a typical power generation facility, carbonaceous fuel (e.g. coal, oil, gas, biomass) is combusted with air in a boiler to raise steam that drives a turbine/generator to produce power. In a gas turbine combined cycle system, the combustion occurs in the gas turbine to drive power generation, and steam generated through a heat recovery steam generator (HRSG) contributes to additional power generation. Flue gas from the boiler or gas turbine consists mostly of N_2, CO_2, H_2O and O_2 with smaller amounts of other compounds depending on the fuel used. The CO_2 capture process is located downstream of conventional pollutant controls. Chemical absorption-based PCC usually requires the extraction of steam from the power plant's steam cycle or, depending on the absorption liquid/process employed, the use of lower grade heat sources for absorption liquid regeneration.

The intended readership for this document includes power plant owners and operators, project developers, technology developers and vendors, regulators, and other stakeholders. The document will provide several benefits, as outlined in the clauses below. In brief, it provides a common basis to estimate, measure, evaluate and report on the performance of a PCC plant integrated with a power plant. It can help various stakeholders to identify potential efficiency improvements among different

plant components. It can help to guide the selection of measurement methodologies, and serve as a resource in development of regulations. Finally, it provides the basis for future standards development.

Australian Standard®

Carbon dioxide capture

Part 1: Performance evaluation methods for post-combustion CO2 capture integrated with a power plant

1 Scope

This document specifies methods for measuring, evaluating and reporting the performance of post-combustion CO_2 capture (PCC) integrated with a power plant, and which separates CO_2 from the power plant flue gas in preparation for subsequent transportation and geological storage. In particular, it provides a common methodology to calculate specific key performance indicators for the PCC plant, requiring the definition of the boundaries of a typical system and the measurements needed to determine the KPIs.

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The KPIs considered in this document are the following:

a) Specific thermal energy consumption (STEC);

b) Specific electrical energy consumption (SEEC);

c) Specific equivalent electrical energy consumption (SEEC);

d) Specific reduction in CO_2 emissions (SRCE);

e) Specific absorbent consumption (SAC) and specific chemical consumption (SCC).

The calculations are based on measurements at the boundaries of the considered system, particularly of energy and utilities consumption. The integrated system includes the definition of interfaces between the PCC plant and the power plant.

This document includes the following items:

— The system boundary which defines the boundaries of the PCC plant and identifies which streams of energy and mass are crossing these boundaries to help power plant operators identify the key streams that are applicable for their particular case.

— Basic PCC plant performance which defines the parameters that describe the basic performance of the PCC plant.

— Definition of utilities and consumption calculation which lists the utility measurements required and provides guidance on how to convert utility measurements into the values required for the KPIs.

— Guiding principles - Basis for PCC plant performance assessment which describes all guidelines to prepare, set-up and conduct the tests.

— Instruments and measurement methods which lists the standards available for the relevant measurements and considerations to take into account when applying measurement methods to PCC plants.