Table of Contents

CHAPTER 1

AIM & OBJECTIVE

Project Title

Discussion and analysis of possible solutions of carbon capture and storage to reduce emission in heavy industries.

Project aim and objectives

The aim of this report is to look for possible solutions to prevent the release of carbon dioxide from heavy industry with the intent of mitigating the effects of climate change. We defined following objectives to actives our aim.

- Review of growth of carbon dioxide in the environment and major factors responsible for it. Effects of the growth of the carbon dioxide and possible solutions.
- Investigation of carbon dioxide emissions from heavy industries and identification of the process involving the carbon dioxide emission.
- Methods of carbon capture, utilization, and sequestration (CCUS) for heavy industries.
- Conceptual CCUS plant design for heavy industry
- Comparative analysis of the CCUS methods used in heavy industries.

Project structure

Carbon capture, utilization, and sequestration (CCUS) is the method involved with capturing carbon dioxide and putting away it so it is not discharged into the environment. We are discussing about the methods used in the heavy industries for CCUS. Hence initial part of our work focuses on the review of growth of carbon dioxide in the environment and major factors responsible for it. In initial part of the work, we will perform an investigation of carbon dioxide emissions from heavy industries and identification of the process involving the carbon dioxide emission. In later part we will focus on the methods of carbon capture, utilization, and sequestration (CCUS) for heavy industries and applicability of the CCUS process in different heavy industries and its effectiveness. Finally we will complete our work with comparative analysis of the CCUS methods used in heavy industries.

CHAPTER 2

WORK PROCEDURE

Initial part

- Review of growth of carbon dioxide in the environment and major factors responsible for it. Effects of the growth of the carbon dioxide and possible solutions.
- Investigation of carbon dioxide emissions from heavy industries and identification of the process involving the carbon dioxide emission.

Analysis method

This section examines carbon emissions across heavy industries in an attempt to develop a rapid and suboptimal update of the techniques for calculating and analysing greenhouse gas emissions from heavy businesses. The major contributor in air pollution is heavy industry, which emits massive volumes of carbon dioxide into the environment. Methods for assessing and evaluating the carbon emissions of heavy industries are still being developed, which is crucial in the control of greenhouses gases that contribute to global warming. However, there are some differences in the definitions and methodologies employed in prior research to quantify the carbon emissions of heavy industries.

This section examines the commonalities between the technologies for measuring carbon dioxide emissions and the analysis used to assess them. This section also will discuss the benefits and drawbacks of each research project. The current research adds to the identification of acceptable methodologies for measuring carbon dioxide emissions by heavy industries and raises awareness of environmental concerns by doing so. The deployment of the most appropriate framework is believed to aid in the reduction of carbon dioxide emissions by heavy industries.

This assemblage of data gathered from an intensive survey of the writing from electronic sources, including diaries, books, reports distributed by a global association and articles. The articles were found in the Science Direct, Elsevier, e-Journal Portal and Google Scholar data sets and Google data set through a web search tool using six watchwords: ozone-depleting

substances; carbon dioxide emissions; carbon dioxide emissions from heavy industries; carbon dioxide emissions through Geographical Information System (GIS) application; Sustainable Development Goals (SDGs); sustainable strategy.

Tragically, the different techniques for working out carbon dioxide emissions from heavy industry have led to confusion or down to earth applications. This audit will made a significant commitment to dealing with this issue by laying out the wellsprings of carbon dioxide emissions. All things considered, it has identified the significant components of the techniques used to make immediate and roundabout estimations of carbon dioxide emissions. To that end, this study will introduce the diff erent criteria used to gauge carbon dioxide emissions from heavy industry, including the strategies for industry scale, fuel utilization, and industry type and air-quality instrument estimation.

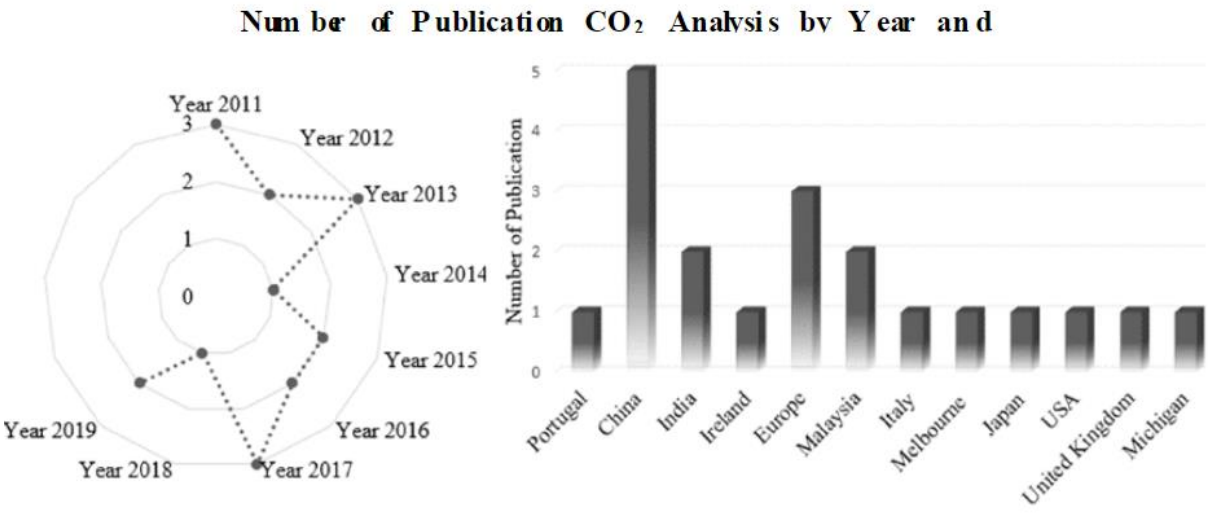


Figure 1 Number of research paper published on carbon dioxide analysis [1]

The examination will be performed in light of seven indicators: accuracy, classification, cost of hardware, work and preparation, activity and support, the sort of data required the technique for acquiring information, the kind of result and time perception. In view of the comparison, we can reason that air-quality instrument estimation is the best strategy to observe carbon dioxide emissions because of its short perception period and constant information, and furthermore in light of the fact that it provides information about other ozone-depleting substances. Be that as it may, every technique has its specialization and the appropriate strategy relies upon the point of the examination.

Considering everything, past examinations have done diff erent investigations to explore carbon dioxide emissions. The strategy for examination utilized in each study is subject to the sort of information accessible and the degree of the study.

Main part of the work

- Methods of carbon capture, utilization, and sequestration (CCUS) for heavy industries.
- Conceptual CCUS plant design for heavy industry

Analysis method

The activities, known as CCUS, are one of a handful of the manners in which weighty businesses that rely upon petroleum derivatives for energy can decrease their effect on the climate. The IEA, which exhorts significant economies, says it's "basically incomprehensible" for the world to meet focuses for diminishing ozone harming substances without that innovation, since enterprises from steel creators to solidify industrial facilities have not many choices to produce the hotness they need to work or stay away from emanations from specific cycles.

CCUS is a strategy for catching carbon dioxide from smokestacks and different producers and afterward infusing it underground or to use in different items. However, the innovation is restrictively costly at this moment, with no privately owned business ready to take on an interest in a significant venture without government support, a carbon cost or some type of pay for the outflows set aside.

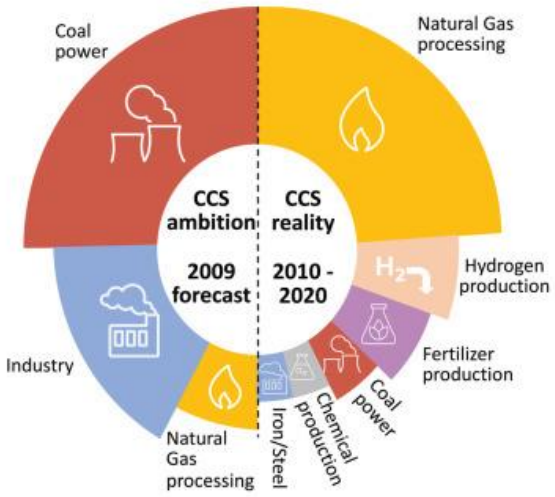


Figure 2 Ambition v/s reality of CCUS project

A precise audit of the writing has been completed on four of the biggest modern areas (the iron and steel industry, the concrete business, the oil refining industry and the mash and paper industry), as well as chosen high-virtue wellsprings of CARBON DIOXIDE from different enterprises to survey the relevance of various CCUS advances.

Costing information have been accumulated, and for the concrete, iron and steel and refining ventures, these information are utilized in a model to project costs per ton of CARBON DIOXIDE kept away from throughout the time-frame stretching out from first arrangement until 2050. A responsiveness examination was done on the model to survey which factors greatestly affected the general expense of wide-scale CCUS organization for future better focusing of cost decrease measures. The elements found to have the best generally sway were the underlying expense of CCUS toward the beginning of arrangement and the beginning date at which huge scope organization is begun, while a more slow introductory sending rate after the beginning date additionally prompts essentially inflated costs.

Writing fulfilling these rules was then audited, examined utilizing a standard survey, and focused on as indicated by measures displayed in the valuable data. Synopsis sections on each inspected paper were composed as a feature of the survey in view of the paper's substance concerning modern CCUS innovation, expenses and strategy. A full rundown of the papers evaluated, and a short synopsis with respect to the pertinence of each to this review, is remembered for the strengthening data.

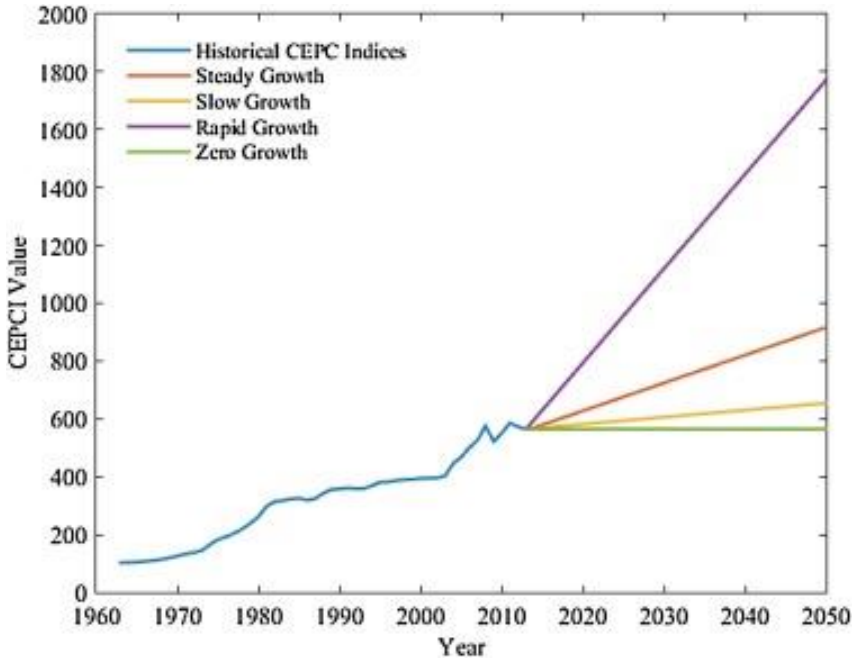


Figure 3 future forecasting [Image credit:2]

Where vital, 'dim writing' from significant industry and environment bodies, for example, the International Energy Agency and the Intergovernmental Panel on Climate Change has been utilized to give extra costing information to praise information from the scholarly writing. Albeit the data from these reports is once in a while less definite than that found in the scholastic writing, the meager condition of cost information from the deliberate survey implied that adding these assets was valuable to show agreement and approve a few suspicions made.

While being aware of the way that carbon dioxide catch relies upon different factors like quality and wellspring of discharges, restrictions/difficulties of the innovation chose, status of the plant (new plant or an old plant), nearby framework (power, utilities), and waste age and so forth. It is prescribed to lead a predictable specialized assessment of carbon dioxide catch innovations focussing on outflow reduction and energy execution for retrofit in the concrete business. To pick the best accessible innovation for a particular plant, explicit specialized and monetary assessments should be performed. Notwithstanding techno-financial assessment, plant-explicit assessment of more reasonable properties, for example, accessible space, limit in neighbourhood power network and choices for steam supply ought to likewise be thought of.

The CARBON DIOXIDE catch process depends on a regenerative assimilation desorption cycle. The vent gas enters the immediate contact cooler and is chilled off in direct contact

with cooling water to around 40-50°C. Along these lines, the vent gas is moved to the safeguard where it streams upwards, in counter current with the MEA dissolvable, the carbon dioxide ties synthetically with the dissolvable in an exothermic response. Downstream of the safeguard, the CARBON DIOXIDE- lean pipe gas enters a water washer to eliminate MEA fume and drops.

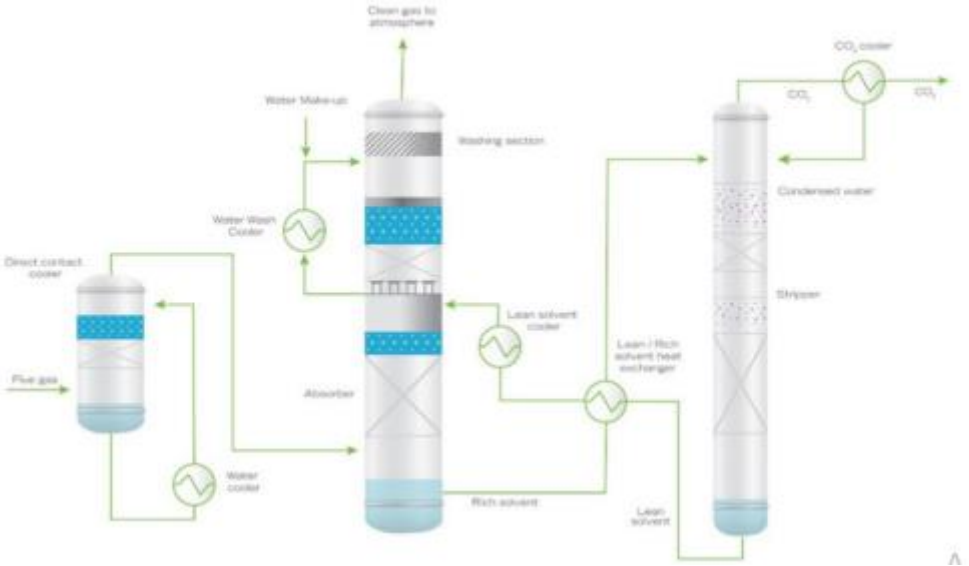


Figure 4 A typical CCUS plant based on adsorption/ desorption [3]

The treated gas is then, at that point, transmitted to the environment. The rich dissolvable containing artificially bound CARBON DIOXIDE is siphoned to the highest point of a stripper through lean/rich cross hotness exchanger in which the rich dissolvable is warmed to a temperature near the stripper temperature (110-120 °C) and the lean dissolvable is cooled. The dissolvable is "recovered" in the stripper by warming it up to temperature of 110-130 °C at a strain somewhat higher than climatic. Heat is provided to the dissolvable by the reboiler that is normally warmed with low tension steam.

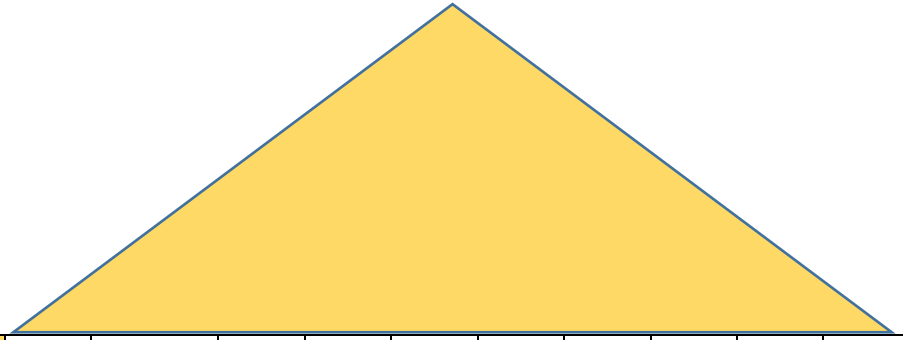
The CARBON DIOXIDE leaving the highest point of the stripper is then cooled and gone through a separator where the dense water is gathered and gotten back to the stripper. The CARBON DIOXIDE leaving the separator is then shipped off the use unit with a sponsor fan, in the wake of going through a dehumidification unit to arrive at a CARBON DIOXIDE immaculateness above almost 100%.

CHAPTER 3

EXPECTED OUTCOME OF THE WORK

House of Quality

The QFD analysis perform to discuss the expected outcome of the work.



Minimize or Maximize														
House Of Quality	**Technical Specifications**													
	Location	Capacity	Applicability	Efficiency	Interchangeability	Power consumption	Operation cost	Manufacturing cost	Maintenance	Reuse of carbon				

														Competitive Assessment			
	Requirements	**Importance**	1	2	3	4	5	6	7	8	9	10	1	2	3	4
1	Proper capturing of carbon dioxide	5	15	20	10	5	15	10	5	15	20	10				
2	Storage of Carbon dioxide	5	9	12	15	15	9	18	12	15	12	9				
3	Easy transportation of the carbon dioxide	5	12	12	12	9	9	15	15	15	15	15				
4	Net carbon emission to environment is zero	4	6	15	15	18	15	15	9	9	9	9				
5	Applicability of the CCUS system in different industries	3	9	9	9	9	9	9	9	9	9	9				
6	Good safety standards	4	15	12	12	9	15	9	12	15	15	15				
			66	70	81	89	56	45	76	45	77	65				

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Reference

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2. Leeson, D., Mac Dowell, N., Shah, N., Petit, C. and Fennell, P.S. (2017). A Techno-economic analysis and systematic review of carbon capture and storage (CCS) applied to the iron and steel, cement, oil refining and pulp and paper industries, as well as other high purity sources. International Journal of Greenhouse Gas Control, 61, pp.71–84.

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