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Il Life Cycle Thinking a supporto delle strategie di mitigazione e adattamento ai cambiamenti climatici

Carbon Capture and Storage – A Review of Life Cycle Assessment of the Transportation and Storage Phases

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INTRODUCTION

The Life Cycle Assessment (LCA) methodology is employed many times to assess Carbon Capture and Storage (CCS) feasibility. This paper has the aim to analyze some recent LCA studies of CCS, not necessarily related to power plants, with a focus on the transport and storage phases.

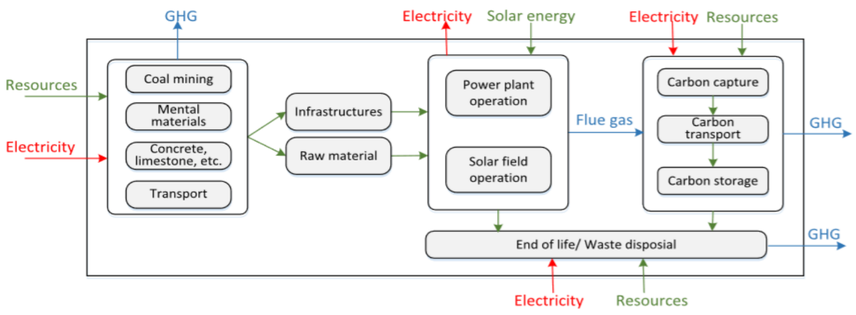
METHODOLOGY

The study was carried out by identifying existing scientific publications on LCA studies of CCS including the environmental impacts associated with the transportation and storage phase. To this end, the Scopus engine was used with the following research query: ALL (ccs AND carbon AND capture AND storage AND lca). Only the years 2017, 2018 and 2019 were selected to give state of the art on where is the scientific community when it comes to this topic. In the end, 7 articles were considered.

RESULTS

1) System boundary

- Similar, even though written in different ways;
- Only two out of seven also adopt the end of life/waste disposal.



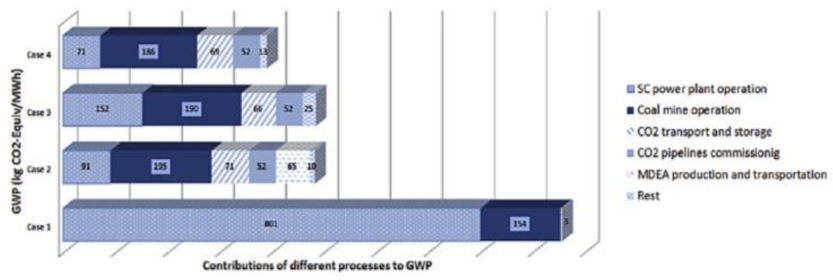
Source: Wang et al., 2019

2) How the transport and storage are characterized in the system

	Functional unit	Transport	Observation	Storage	Observation	Characterisation method
Oreggioni et al. (2017)	1 kWhe	pipeline	a natural gas transport network	off-shore	natural gas production wells	ReCiPe 1.08
Wang et al. (2017)	1 kWh of electricity generated by power plants	pipeline	200 km	saline aquifer	1500 m	GWP factors from the IPCC Fifth Assessment Report mid-point method
Petrescu et al. (2017)	1 MWh of net power produced	pipeline	800 km - hypothetical	off-shore	2000 m	CML 2001 method
Fozer et al. (2017)	Generation of 1 MWhe in a coal-fueled power plant	pipeline	100 km	geological	–	IPCC 2007/ Eco-indicator 99/ IMPACT 2002 +/EPS 2000
Wang et al. (2019)	1 kWh of electricity generation	pipeline	200 km	saline aquifer	1500 m	IPCC Fifth Assessment Report GWP100 method
Aldaco et al. (2019)	A coal combustion plant of 500 MW capacity to supply energy to the grid	pipeline	CO_2 is transported in a supercritical state 5 km onshore and 95 km to an offshore aquifer	off-shore aquifer	–	time-dependent characterization factors for calculating overall life-cycle impacts
Chisalita et al. (2019)	1 metric ton of Hot Rolled Coil (HRC)	pipeline	800 km	off-shore	2000 m	CML 2001 method

3) How the results are presented

- Graphs or images are presented with a breakdown of the parts. However, in some cases the storage and transport are together.



Source: Petrescu et al., 2017

4) Energy-related

- Five out of seven were associated with the energy sector (this can be from coal power plants to the use of CCS with solar energy).

CONCLUSIONS

In the LCA of CCS technologies, there is usually a broader focus on the capture method rather than in the transportation and storage part. However, when thinking about improving the transportation and storage technologies, it is important to have studies that have in their spectra the environmental burdens of these phases. Better yet if even with case scenarios with different lengths of pipelines and types of transportations and storage. This could be done by considering different countries for instance.

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