PilotSTRATEGY

WP4 -Deliverable 4.10

Socioeconomic impact of CCUS pilot implementation. Methodology and application to Ebro Basin.

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1. Document History

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AUTHORISATION	Name	Signature	Date
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2. Executive summary

The main goal of D4.10 is to evaluate the socioeconomic benefits of CCS deployment in the region of the Ebro Basin in Spain. Departing from the scenarios presented in D4.9 (Canteli *et al.*, 2025) in this document we estimate the value added and employment creation that would arise if the investments proposed do take place.

This report explains the methodology used: the Multi-Regional Input-Output (MRIO) analysis that allows us to include both direct and indirect impacts that take place in the so-called global value chains. Hence, we present results regarding direct and indirect value added and employment creation globally, identifying where (in which countries and sectors) these impacts are expected to be generated.

The results show that the implementation of CCS projects in the Ebro Basin demonstrates significant socioeconomic benefits, primarily through value-added generation and employment creation. The study reveals that approximately 9,300 full time equivalent jobs (FTE) can be created under the Minimum Investment Scenario, with 78% of these jobs retained within Spain. The investments, totalling around €360 million (2022 prices), are distributed mainly across capture (64%), storage (32%), and transportation (4%) stages. The Input-Output analysis indicates that most of the value-added impacts originate in Spain, followed by contributions from the European Union and the rest of the world. The sectors benefiting the most include Research and Development, Other business activities, Construction, and Manufacturing of machinery and equipment. The use of the MRIO model highlights the interconnectedness of global value chains, emphasising the role of international trade and sectoral linkages in enhancing regional economic growth.

The calculated abatement cost of €84 per tonne of CO_2 places the Ebro Basin CCS deployment within a competitive range compared to other carbon reduction measures. Despite the relatively high costs, the employment creation potential is substantial, offering a promising outlook for regional economic development.

However, it is essential to acknowledge the methodological limitations. Consequently, while the findings provide valuable insights into the economic implications of CCS deployment, they should be interpreted with caution.

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3. Introduction

The objective of the WP4 is to provide and analyse available information of the optimum development concept applicable to the proposed pilots of the Paris Basin (FR), the Lusitanian Basin (PT), and the Ebro Basin (ES) to go ahead with the decision of whether these pilots are viable technically and commercially, considering social and environmental demands, and in the existing European and local regulatory frame. This task is fed with inputs from other work packages, therefore there is a retrofitting process that may push modifications from the first approaches to the more updated final options.

This report shows the socioeconomic benefits of CCS deployment in the Ebro Basin in Spain. Departing from the selected presented in D4.9 (Canteli *et al.*, 2025), in this document we estimate the value added and employment creation that would arise if the investments proposed do take place.

In this deliverable, we contribute to shed light onto the role of CCS technologies on economic growth and job creation in Spain and in Europe, by evaluating the socioeconomic effects (value added and employment) regarding the required investments to enable carbon capture, transport and storage in the Ebro Basin. We are consistent with data provided in D4.9 for the Minimum Investment scenario, assuming both their outputs and scenarios as our inputs to perform the input-output analysis. As Minimum Investment Scenario is only focus on storage stage, it was completed by capture and transport stages, providing additional (new) jobs and value-added creation, based on the industries that "retrofit" to include capture modules. Hence, we can consider new impacts when compared with the absence of CCS.

Section 4 covers the methods and data used for the estimations of value added and employment creation. Results are presented in sections 5. This research concludes in Section 6 with final comments and policy remarks.

4. Methods and data

The investments needed to implement CCS technologies will affect the economy of the region contributing to value added generation and gross domestic product (GDP) growth as well as creating opportunities for employment. The Input-Output (IO) methodology is a tool that gathers information in a systematic way about the productive relations between the different sectors in any given country or regional economy. An IO table contains the inputs provided from each sector to the rest of the economy sectors. Using this information, it is possible to describe the interdependencies between production sectors and countries. Extensions of the methodology exist to simultaneously assess direct and indirect effects on some socioeconomic indicators, in particular job creation. Production processes increasingly fragment across borders, and this fundamentally alters the nature of international trade with deep consequences for the location of production as well as its impacts. Therefore, the proposed approach is to use a multiregional IO (MRIO) modelling that analyses the consequences of this fragmentation in a comprehensive way identifying the sectors and regions that will be most stimulated by the investments needed to implement CCS technologies. We simulate how an exogenous increase on final demand, driven by the CCS investments, boosts economic growth and employment, capturing total effects (direct and indirect) including Global Value Chains phenomenon.

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We thus can identify the country and sector-origin of the impacts assessed. The basis of the MRIO modelling will be EXIOBASE, a global, detailed Multi-regional Environmentally Extended Supply and Use / Input Output (MR EE SUT/IOT) database[1]. The methodological principle a well as required data are summarized in Figure.4.1.

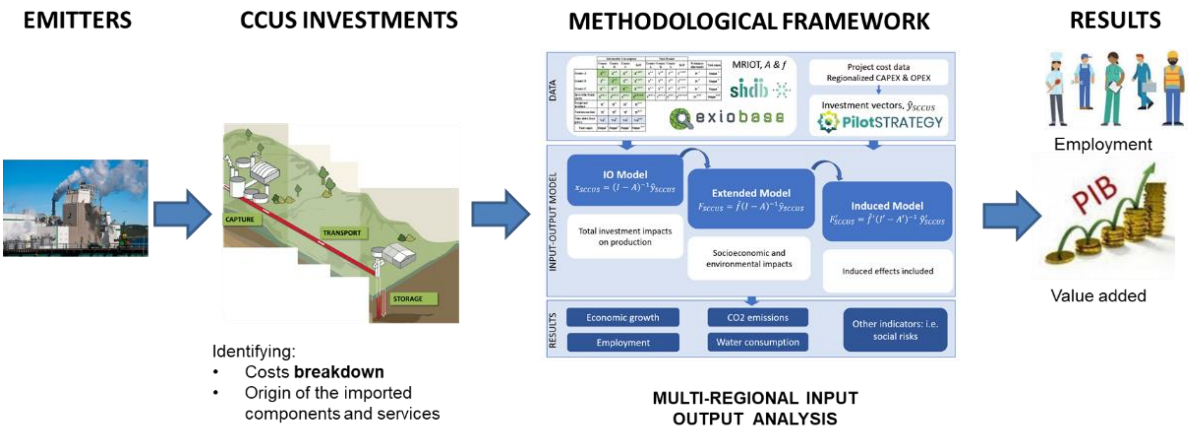

Figure.4.1. Methodological approach and required data

This analysis uses the data on costs collected in Deliverable D4.9 (Canteli *et al.,* 2025) to construct the technology costs vectors. Afterwards, using the MRIO modelling framework, the effects on direct and indirect value-added generation and job creation are assessed, locating the sectors and countries where these effects are more relevant. This analysis is performed for Ebro basin region (Table 4.1).

Table 4.1 Parameters included in the analysis

Socioeconomic assessment	
Regions	Ebro Basin (ES)
Year	2050
Stages	Capture, Transportation and Storage
Impacts	Domestic, European, Rest of the world
Effects	Direct and Total
Indicators	Value added (M.EUR), Employment (1000p)

4.1 MRIO model

We use a MRIO model to quantify the impacts of carbon capture, transportation, and storage investments. This model captures the intersectoral linkages (sales and purchases of intermediates) between sectors and countries, including international trade (Miller and Blair, 2009). The fundamental equation (1) shows how production is boosted by an exogenous final demand through the multiplier:

$$x = (I - A)^{-1} y \qquad (1)$$

[1] https://www.exiobase.eu/

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Where x is the total production of goods and services, $(I - A)^{-1}$ is the inverse of Leontief (1986), that considers all the direct and indirect requirements per unit of output needed to satisfy the final demand y. Instead of considering the final demand, we depart from specific cost data in Deliverable 4.9 (CCS-related components and services required for the capture, transport and storage stages) to adapt CCS investments on a MRIO basis format. Hence, we can use the Leontief's inverse to quantify the total effects, both direct and indirect, that CCS deployment would have for the region considered. Since our goal is to perform an assessment focused on value added and employment creation, the model has been extended (EMRIO) as seen below:

$$F = f^{\wedge}(I - A)^{-1}\mathbf{y}^{\wedge}{}_{CCS} = P\mathbf{y}_{CCS} \quad (2)$$

Where F provides the total effects of the socioeconomic indicator considered (value added or employment), $f^{\wedge}$ is the socioeconomic diagonalised impact factor, and $y^{\wedge}{}_{CCS}$ are the diagonalised investments, for each CCS stage. Direct impacts include the purchase of the components needed as initial investments to satisfy the demand for carbon capture equipment, transportation, and storage (*i.e.*, direct employment in the supply of equipment, the installation and construction services), as well as the in-plant effects (*i.e.*, operation and maintenance labour). Indirect effects refer to the intermediate inputs that, round by round of the production supply chain, were needed to provide the final components (Jenniches, 2018). When pre-multiplied by the Leontief inverse, P becomes the impact factor multiplier, capturing the direct and indirect impacts embodied in the supply chains (Banacloche*, et al.*, 2022a).

Some impacts are not related to the components and services, but those related to the use of factors of production required in-plant such as labour. These direct requirements are exogenously added to the impact calculation.

4.2 Data sources

4.2.1 Extended Multiregional Input-output Table

EXIOBASE3 is the chosen IO database in the present research. This MRIO database considers 49 regions (27 EU countries plus 17 major economies and 5 aggregated rest of the world regions) and 163 industries, covering the period 1995–2022. A description of EXIOBASE3 can be found in (Stadler *et al.*, 2018) and the database itself is available free of charge in Zenodo[2]. The extensive sectorial disaggregation of EXIOBASE makes this database the most suitable for the research to our understanding.

We use the latest year available (2022) and aggregate the whole set to 3 regions: the selected region (Ebro Basin/Spain), the European Union, and rest of the world. Two socioeconomic indicators have been chosen (see Table 4.1): value added and employment. Value added corresponds to the overall factor payments' (labour and capital, land, net taxes on production, and remaining net operating surplus) in the country of origin.

One limitation of this methodology is that MRIO tables take into account countries, not regions. Therefore, we have to assume that the productive interlinkages of the Ebro Basin are similar to those of Spain. That is, regional sectors involved behave the same as the national ones, requiring the same

[2] https://zenodo.org/records/5589597

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inputs per unit of output (both domestic and imported). In other words, the distinctions between intraregional and interregional linkages are not captured. Only in-plant indicators are closer to the effects that would occur in the selected region. On the contrary, impacts in global value chains (direct and indirect) are subjugated to the similarities that each region shares with its respective country. Hence, results must be understood as approximations.

4.2.2 Specific cost data

The deliverable D4.9. (Canteli *et al.*, 2025) describes the selected scenario, based on limited initial investment and optimised operating costs, which is here evaluated. This Minimum Investment scenario includes a pre-commercial phase (pilot scale, with 0.03 Mt/year during 2 years) and a commercial phase (first year ramp up from 0.03 MtCO_2/year and 0.5 MtCO_2/year thereafter). Permit-granting procedure, geology and geophysics activities, exploration well design and drill, repurposing the exploration well to be an injector, and design and construction of injection facilities are included. An MMV plan during storage operativity and final abandonment when maximum capacity is reached (23 Mtonnes estimated capacity and 35 years in operation) are considered. To complete the full CCS chain for socioeconomic evaluation, a source 100 km away with maximum CO_2 stream of 0.5 Mt/year and a pipeline construction connecting this source with Lopín storage site are considered. This scenario has been completed with an extra injector well in the year 20 (10 years after first one) and a monitoring well as part of a refined MMV plan.

Specific cost data depart from data collected in Deliverable D4.9 for the Minimum Investment Scenario. We look for the overall CAPEX and OPEX to be installed. A detailed disaggregation of costs has been performed and is provided in a separate excel file (zenodo link: 10.5281/zenodo.14960671). Here, both CAPEX and OPEX of every stage are discounted to bring the cash flows to present values (2022 reference year). Only the inflation rate remains necessary to adapt current prices to MRIO table prices (2022 reference year). With respect to the OPEX, we calculate the FIXOM (Fix operational and maintenance cost) and VAROM (variable operational and maintenance cost) separately (see Table 4.2). Since the other stages do not make this differentiation, we maintain the OPEX without further disaggregation.

In the present document, we cover the entire carbon capture and storage process (value chains included). We present the following calculations:

- **In-plant impacts:** direct impacts related to compensation of employees (value added, considered as induced effects in the sector allocation), and number of jobs. For the later, we calculated the number of employees in each stage directly employed in the storage site. In the case of the capture stage, we take the average salary provided by INE for the industrial sector in Spain[3] and the compensation of employees to calculate the number of employees. These impacts are located in the host country and are mostly related to the functioning and maintenance of the technology.
- **Global value chain (GVC) impacts**: both direct and indirect impacts related to the fragmentation of production in successive rounds of production until the goods and services required to deploy CCS technologies are completed (final goods). They happen inside the host

3 https://ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736045053&menu=resultados&idp=1254735976596

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country, as well as in Europe and the rest of the world, and depend on the industrial linkages among countries and sectors.

4.2.3 CCS investments modelling

For the adaptation of specific cost data into the MRIO investments, the next arrangements have been performed. The first one is to bring the data from D4.9 to the MRIO table reference year (2022). The inflation rate is obtained from INE[4] using the update of rents with the general CPI (Consumer Price Index base 2021 system). Table 4.2 and Figure 4.2 below show the aggregated input data.

Table 4.2 Input data for the MRIO analysis (Discounted costs expressed EURO 2022)

		Labour costs	Total INV / O&M	FTE direct
CAPTURE				
CAPEX	**Equipment**		28,849,702 €	
	Facilities		75,148,903 €	
	Other		32,814,551 €	
OPEX	FIXOM	37,473,357 €	31,631,704 €	2,648
	VAROM		24,893,754 €	
TOTAL CAPTURE		**37,473,357 €**	**193,338,615 €**	**2,648**
TRANSPORT				
CAPEX			9,577,916 €	
OPEX			4,480,876 €	
TOTAL TRANSPORT			**14,058,791 €**	
STORAGE				
Pre-commercial stage	**Permitting**	**377,359 €**	**136,604 €**	3
	Characterisation & Appraisal (Exploration G&G)	559,064 €	2,759,385 €	7
	Design and contracting	684,959 €	250,523 €	6
	Construction	1,096,504 €	8,503,672 €	26
	Testing and injection	1,261,877 €	7,495,211 €	25
Total pre-commercial		**3,979,763 €**	**19,145,395 €**	**67**
Commercial stage	**Permitting**	89,554 €	200,032 €	3
	Design and contracting	504,894 €	211,172 €	6
	Construction	13,622,763 €	44,071,159 €	180
	Injection	12,825,085 €	14,327,236 €	210
	MMV	536,724 €	2,924,844 €	110
	Plug and abandon	19,047 €	2,642,061 €	2
Total commercial		**27,598,067 €**	**64,376,504 €**	**510**
TOTAL STORAGE		**17,723,728 €**	**83,521,899 €**	**577**
TOTAL CCS		**55,197,085 €**	**290,919,305 €**	**3225**

[4] https://www.ine.es/calcula/calcula.do

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Most of the costs are due to the capture activities (66%), followed by the storage activities (29%) and the transport activities.

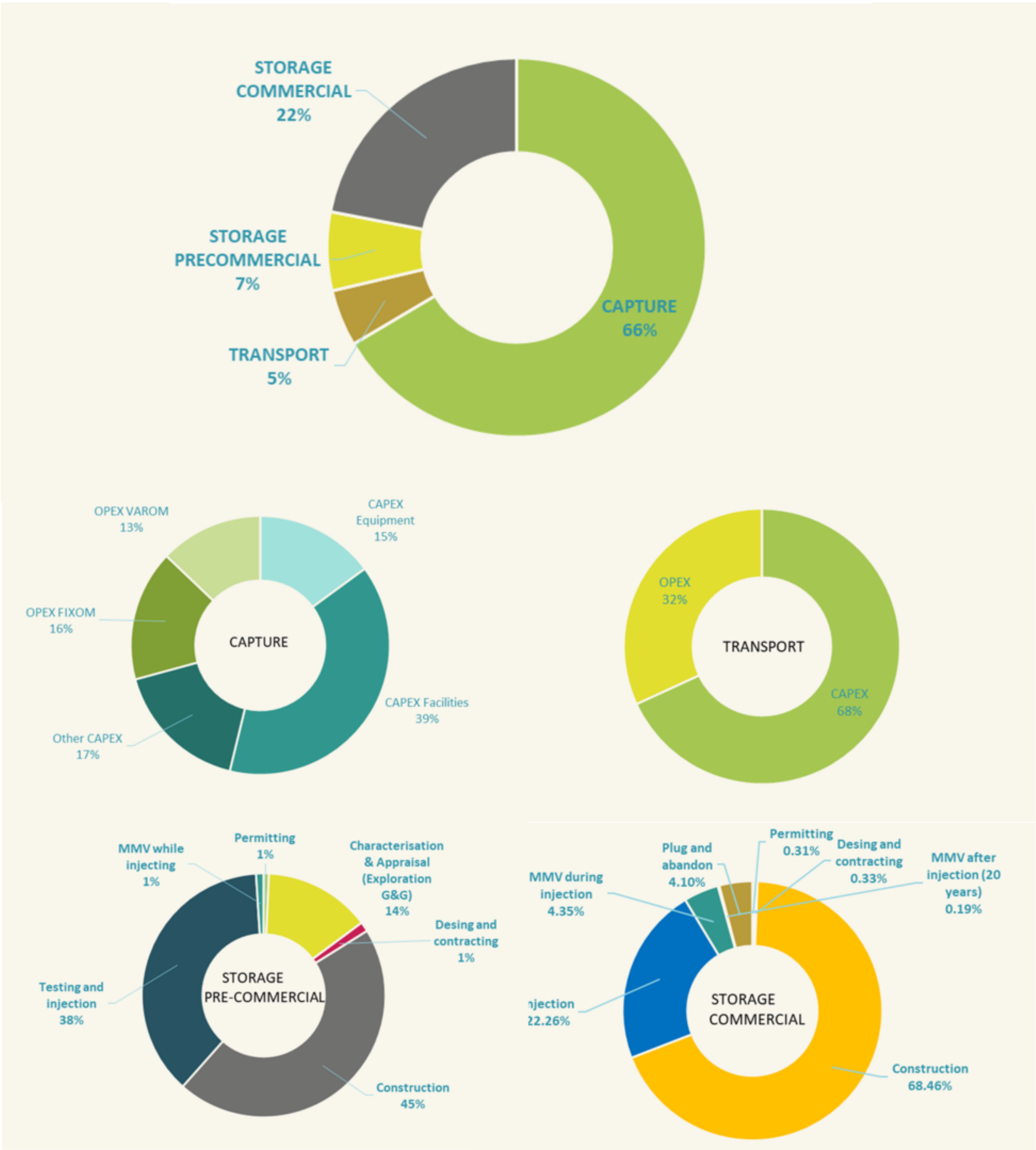

Figure 4.2. Cost input data for the MRIO analysis (without compensation of employees)

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The next step consists in creating an investment vector that decomposes the costs into the components and services required to deploy the technology. Finally, disaggregated data on components has to be allocated in the sector basis format of the MRIO table.

In the case of capture activities, we have followed the assumptions validated in the Strategy CCUS project[5] regarding both costs and sector allocation (Banacloche *et al*., 2022b) with the only exception of the electricity input to the capture installation that has been allocated to the sector *Production of electricity by biomass and waste* instead of *Production of electricity by coal.* Regarding the country allocation of the capture stage inputs required, we have considered that the region is autonomous in supplying the capture technology (the main components and equipment, installation, operation, and maintenance) and that it has the potential to meet the needs of carbon capture deployment.

In the case of transport activities, it has been considered that CO_2 is transported in gaseous form via new pipelines and no liquefaction or compression costs are required. Transport distance has been considered to be 100 km. The CAPEX is made up of the cost of the pipelines (72%) as well as the cost of trenching (17%) and sensor installation (11%). OPEX costs are estimated to be 3% of CAPEX annually.

The storage costs are divided into two phases: the pre-commercial phase, which lasts 8 years, and the commercial phase, which lasts 35 years and is followed by a 20-year after-closure monitoring period. A detailed breakdown of the costs for both phases, as well as the sectoral and country allocation of each expenditure, has been prepared. It is presented in the Excel file attached to this deliverable (Zenodo link: 10.5281/zenodo.14960672).

Once that both sector and country allocations have been designed, the investment vector is ready to be used in the MRIO model as explained in Section 4.1 and is shown in Table 4.3 below.

Table 4.3: Investment cost vector for the MRIO analysis

SECTOR	REGION	COSTS (M.EURO 2022)			
		CAPTURE	TRANSPORT	STORAGE PRE-COMMERCIAL	STORAGE COMMERCIAL
Real estate activities (70)	ES			0.34	0.89
Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods (52)	ES			0.03	0.06
Other business activities (74)	ES			3.29	48.75
Hotels and restaurants (55)	ES			0.04	
Construction (45)	ES	29.01	1.60	1.58	1.06
Quarrying of sand and clay	ES			0.16	0.16
Post and telecommunications (64)	ES			0.08	0.08
Extraction, liquefaction, and regasification of other petroleum and gaseous materials	ES				0.54
Extraction of crude petroleum and services related to crude oil extraction, excluding surveying	ES			0.16	0.16
Manufacture of basic iron and steel and of ferro-alloys and first products thereof	ES		6.92	0.56	0.91
Other land transport	ES			1.46	0.13
Manufacture of medical, precision and optical instruments, watches and clocks (33)	ES				0.01
Distribution and trade of electricity	ES				0.96

[5] https://strategyccus.brgm.fr/

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Landfill of waste: Inert/metal/hazardous	ES			0.07	
Chemicals nec	ES			5.09	
Research and development (73)	ES			0.03	
Extraction, liquefaction, and regasification of other petroleum and gaseous materials	ES			0.53	
Insurance and pension funding, except compulsory social security (66)	ES	22.40			
Manufacture of fabricated metal products, except machinery and equipment (28)	ES	21.11			
Research and development (73)	ES	27.37			
Education (80)	ES	5.57			
Chemicals nec	ES	5.29			
Steam and hot water supply	ES	0.08			
Production of electricity by biomass and waste	ES	11.42			
Production of electricity by gas	ES	9.73			
Manufacture of machinery and equipment n.e.c. (29)	ES	48.59			
Manufacture of office machinery and computers (30)	ES	1.78			
Manufacture of electrical machinery and apparatus n.e.c. (31)	ES	10.98			
Transport via pipelines	ES		4.48		
Other business activities (74)	FR			2.45	2.03
Extraction, liquefaction, and regasification of other petroleum and gaseous materials	FR			0.20	0.21
Extraction of crude petroleum and services related to crude oil extraction, excluding surveying	FR			1.77	1.34
Research and development (73)	FR			0.48	
Other land transport	FR			0.08	
Extraction of natural gas and services related to natural gas extraction, excluding surveying	FR		1.06	0.00	
Other business activities (74)	DEU			0.41	0.63
Extraction, liquefaction, and regasification of other petroleum and gaseous materials	DEU			0.20	
Extraction of crude petroleum and services related to crude oil extraction, excluding surveying	ITA			1.22	1.48
Manufacture of machinery and equipment n.e.c. (29)	NL				4.78
Extraction of crude petroleum and services related to crude oil extraction, excluding surveying	US			0.20	0.21
		193.34	**14.06**	**20.45**	**64.38**

We have also taken into account the so-called induced effects, *i.e.* the spill-over effects that arise from the spending of labour income by households after the deduction of savings. These induced effects are generated by workers' spending and would provide an additional stimulus to the economy. To calculate these effects, we have considered the direct labour costs in each stage (capture and storage since there is no direct labour in the transport stage). Then we have estimated the Marginal Propensity to Consume deducting the % savings that is estimated in a 14.2 % of the gross revenue according to the Banco de España (Banco de España, 2024). This amount is allocated to the different sectors of the economy using the distribution of household expenditure calculated by INE using the Household Budget Survey (HBS) (INE, 2024).

The cost vector considered for induced effects is shown in Table 4.4 below.

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Table 4.4 Induced effects cost vector for the MRIO analysis

SECTOR	REGION	COSTS (M.EURO 2022)			
		CAPTURE	TRANSPORT	STORAGE PRE-COMMERCIAL	STORAGE COMMERCIAL
Processing of Food products nec	ES	6.16		0.65	4.28
Manufacture of beverages	ES	1.24		0.13	0.86
Manufacture of wearing apparel; dressing and dyeing of fur (18)	ES	1.27		0.13	0.88
Distribution and trade of electricity	ES	0.96		0.10	0.67
Collection, purification and distribution of water (41)	ES	0.96		0.10	0.67
Retail sale of automotive fuel	ES	0.96		0.10	0.67
Real estate activities (70)	ES	0.96		0.10	0.67
Manufacture of furniture; manufacturing n.e.c. (36)	ES	1.72		0.18	1.19
Health and social work (85)	ES	1.86		0.20	1.29
Other land transport	ES	4.62		0.49	3.21
Post and telecommunications (64)	ES	1.08		0.11	0.75
Recreational, cultural and sporting activities (92)	ES	2.76		0.29	1.92
Education (80)	ES	0.60		0.06	0.42
Hotels and restaurants (55)	ES	4.48		0.48	3.11
Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods (52)	ES	1.25		0.13	0.87
Insurance and pension funding, except compulsory social security (66)	ES	1.25		0.13	0.87
	ES	**32.15**		**3.41**	**22.34**

5. Results

5.1 Cumulative investments and value-added creation

The proposed scenario would have a **cumulative investment of approximately 360 M.EUR** (in 2022 prices), in order to install and operate CCS technologies. Capture is the most important stage, accounting for 64% of the overall deployment (around 230 M.EUR), followed by storage (32%) and transportation (4%). The in-plant labour payments (compensation of employees), mainly at the O&M stage, range from 19% of the total figures. The remaining is related to the components and services required to deploy the technology, coming from inside and outside Spain.

In value added terms, all along this global value chains process, from 76% to 96% of the initial investment is estimated to have its origin in Europe, depending on the stage (see Figure 5.1). On average, **93% of the value generated in the intermediates that the region needs would come from inside the European Union**.

The main sectors in terms of value added come from Spain and are those related to *Other business activities* (mainly from storage activities)*, and Construction, Manufacturing of machinery and equipment, Research and development, and Manufacture of fabricated metal products* (mainly from capture activities). From Europe, intermediate activities that generate most value added are *Other*

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business activities, Manufacture of machinery and equipment, Extraction of crude petroleum and services related to crude oil extraction, Wholesale trade and commission trade, Manufacture of fabricated metal products, except machinery and equipment and Other land transport, all of them mainly from storage activities. From the rest of the world, intermediate activities that generate most value include *Extraction of crude petroleum and services related to crude oil extraction, Other business activities, Wholesale trade and commission trade, Chemicals, Financial intermediation, Manufacture of basic iron and steel, and Extraction of natural gas and services related to natural gas extraction,* all of them mainly from storage activities.

Figure 5.1 below summarizes the breakdown of socioeconomic impacts related to the CCS deployment in the Ebro Basin under the Minimum Investment Scenario.

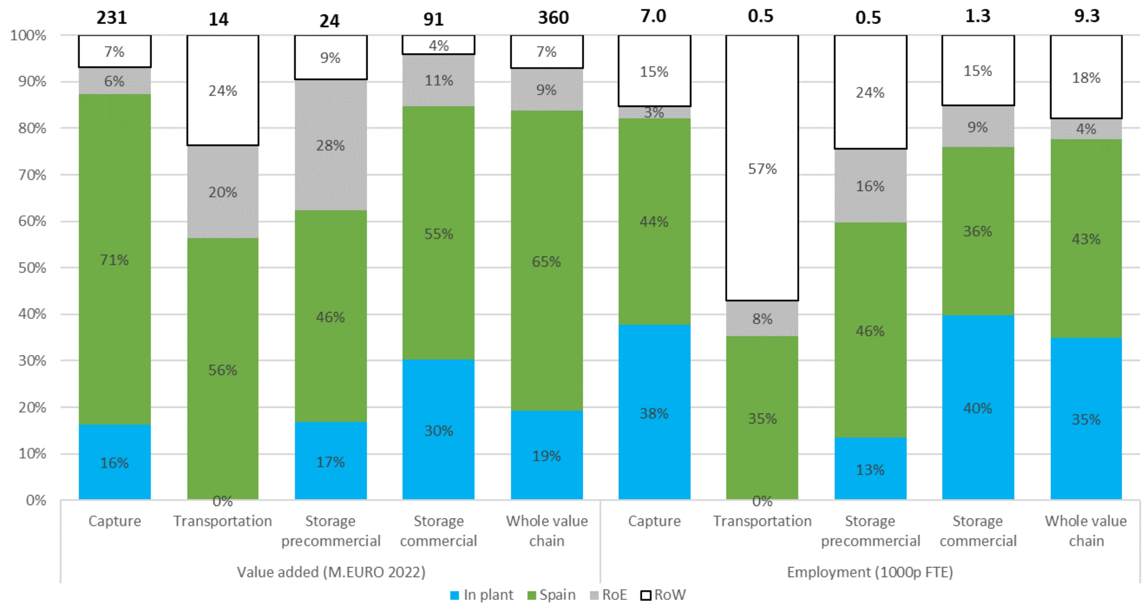

Figure 5.1: Socioeconomic impacts of CCS deployment in the Ebro Basin

5.2 Employment creation

Employment creation can be understood as net employment since jobs created neither displace nor destroy any current job. According to our results, **approximately 9,250 jobs would be created under the Minimum Investment Scenario**, which means around **140 FTE jobs annually** (understood as long-term employment), retaining **109 in Spain (78%)**. **Each M.EUR invested in CCS technologies is likely to generate around 20 FTE jobs inside Spain and 26 FTE jobs globally**.

In-plant employment located in the host country (related to long-term jobs) accounts for 35% of the overall job creation (ranging from 13 to 40% approximately, depending on the stage). The remaining employment creation is related to the intermediate goods and services required for deploying the technology. Zooming into these figures, on average, 66% of the employment in this global value chains phenomenon is originated in Spain, and 7% in the European Union, meaning that the remaining 27% is being created when supplying intermediates outside the EU. **Capture is the most job-intensive stage, accounting for 76% of the overall employment creation, followed by storage (19%) and transportation (5%).**

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Overall, employment in Spain comes from *Research and development, Construction, Wholesale trade and commission trade, except of motor vehicles and motorcycles, Manufacture of machinery and equipment and Chemicals* (from capture activities), and *Other business activities* from storage activities. Some activities arise with the requirement of intermediates while others are rather related to the initial investments. The European Union has a more modest role here: the main sectors responsible for employment creation are related to *Other business activities, Retail trade, Wholesale trade and commission trade, Manufacture of fabricated metal products, except machinery and equipment, Manufacture of machinery and equipment, Other land transport and Research and development*. The rest of the world creates employment in *Mining activities, Wholesale trade, Retail trade, Other land transport, Other business activities, Manufacture of machinery and equipment, Manufacture of fabricated metal products, Manufacture of electrical machinery and apparatus, Manufacture of basic iron and steel and of ferro-alloys, Manufacture of rubber and plastic products and supporting and auxiliary transport activities*.

Looking at the indicators in global value chains it can be seen that **the deployment of CCS technologies in Spain relies more on foreign employment (22%) than on foreign value added (16%).** Around 84% of value added would be sourced in Spain (in-plant included), considering that the host country is capable of supplying many of the goods and services required. The remaining 9% and 7% of the initial investment are estimated to originate from Europe and the rest of the world, respectively. That is, 16% of the value generated from the intermediates that Spain needs comes from outside the country. Figures regarding foreign employment are higher, especially at the transport stage (see Figure 5.2), where jobs created outside Europe are higher as the transportation stage is the most dependent on foreign jobs.

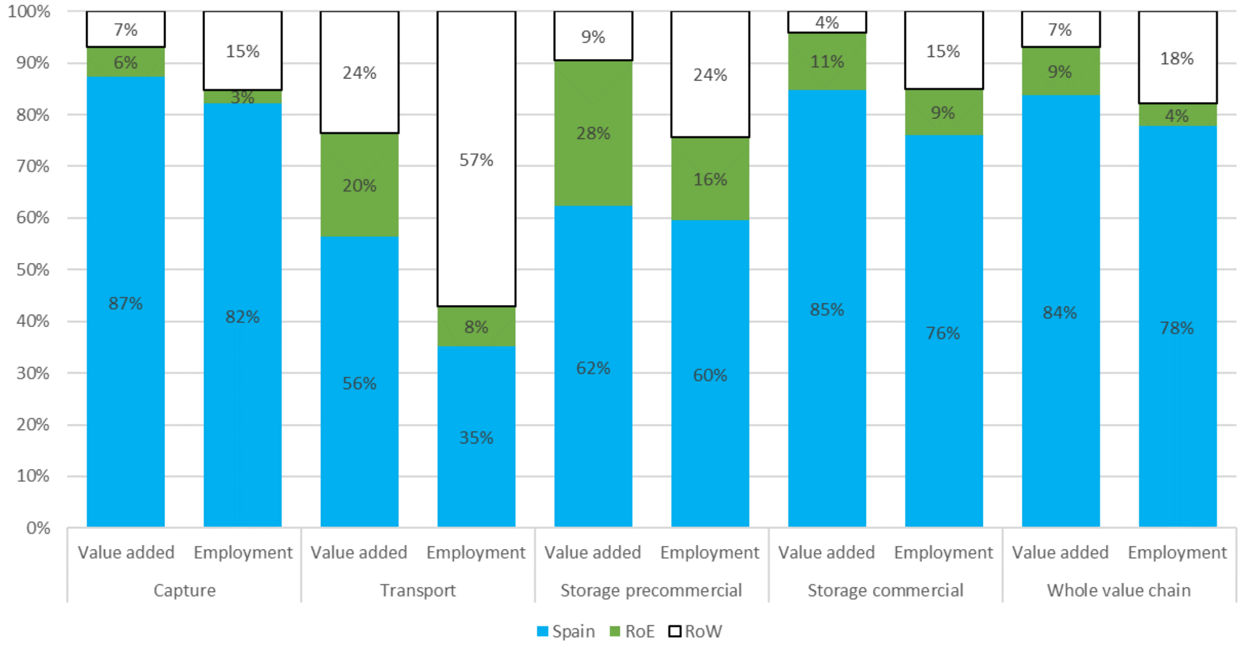

Figure 5.2: Impacts of CCS deployment in the Ebro Basin in global value chains.

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5.3 Abatement costs

Abatement costs are the cost associated with reducing greenhouse gas (GHG) emissions by 1 tonne of carbon dioxide (CO_2) equivalent. This is calculated considering the lifetime cost of deploying the technology (discounted to the present based on a discount rate of 5%) divided by the cumulative CO_2 emissions stored over the technology lifetime (also discounted to the present using the same discount rate).

During the precommercial phase and first year ramp-up 100,000 t of CO_2 are stored, and after that, 0.5 MtCO_2 /yr thereafter to reach 23 Mtonnes. A total discounted amount of 4.32 Mt CO_2 has been calculated. Considering a total discounted investment of 361 M.EURO, the resulting abatement costs are estimated in **84 Euro/t CO2**.

Figure 5.3 below shows the CO_2 abatement costs of other carbon reduction measures. CCS technologies still have high abatement costs in comparison with other options that could even have negative abatement costs such as energy efficiency measures. The calculated abatement costs for the Ebro basin installations proposed in Pilot Strategy are in the range of other measures and below the reported abatement costs of coal CCUS.

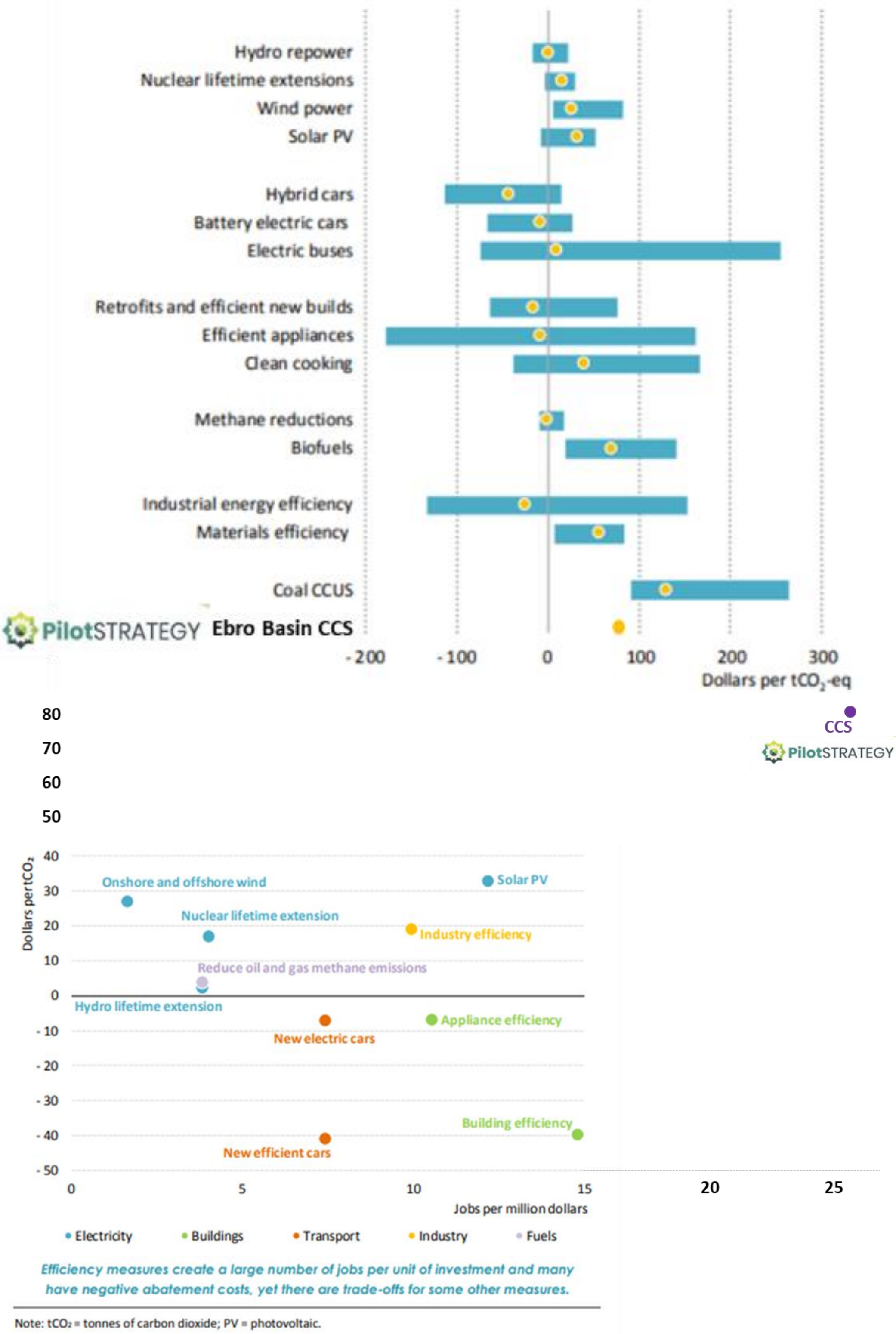

Figure 5.3. Abatement costs and job creation potential of CCS technologies proposed in Pilot Strategy in comparison with other low carbon measures. Source: IEA 2020.

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5.4 Summary of results

Table 5.1 summarizes data explained in this deliverable. These results are an acceptable guidance to understand the underlying effects of economic growth and employment creation when deploying CCS technologies in the Ebro basin, but have to be considered with caution due to limitations of the methodology and uncertainties in the input data.

Table 5.1 : Results of the calculated indicators for the Ebro Basin Minimum Investment Scenario

		Value added (M.EURO 2022)					Employment (1000p FTE)				
	Region	**Capture**	**Transportation**	**Storage precommercial**	**Storage commercial**	**Whole value chain**	**Capture**	**Transportation**	**Storage precommercial**	**Storage commercial**	**Whole value chain**
In plant	Spain	37.47	0.00	3.98	27.60	69.05	2.65	0.00	0.07	0.51	3.22
In value chain	Spain	164.00	7.93	10.81	49.74	232.48	3.11	0.17	0.23	0.46	3.97
	RoE	13.56	2.81	6.67	10.21	33.24	0.18	0.04	0.08	0.11	0.41
	RoW	15.78	3.32	2.24	3.68	25.03	1.07	0.27	0.12	0.19	1.65
		231	**14**	**24**	**91**	**360**	**7.0**	**0.5**	**0.5**	**1.3**	**9.3**
FTE/M.EURO	Total						30	33	21	14	26
	Spain						25	12	12	11	20
	RoE						0.8	2.6	3.3	1.3	1.1
	RoW						4.6	19.0	5.1	2.1	4.6
Abatement costs	84	Euro (2022) / tCO_2									

FTE generated in each region per million euro invested is shown in Table 5.1 above. Total FTE generated is calculated in around 26 FTE/M.EUR, from which around 20 FTE/M.EUR is generated in Spain, 1.1 FTE/M.EUR in the rest of Europe and 4.6 FTE/M.EUR in the rest of the world. FTE per million euro invested in CCS is broadly aligned with results from other cases. For example, employment in the sector of renewables is estimated around 45 FTE/M.EUR in Mexico (Banacloche *et al.,* 2020). For the same country, carbon capture technology creates almost 50 FTE/M.EUR domestically, and 54 to 57 in total (Banacloche *et al.*, 2022a). Since the methodology used is the same, higher values correspond to higher employment intensities in the countries and sectors involved.

Another work by SINTEF accounts for 33 FTE/M.EUR domestically speaking (in Norway) and 88 in total: higher figures, but in the same order of magnitude (Størset, *et al.*, 2018). Wind, solar and biomass create 10 FTE/M.EUR according to (Garrett-Peltier, 2010). In the UK, 18 FTE/M.EUR could be created considering a 25-years lifetime of the investments of CCS (Turner *et al.*, 2020). These

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examples, although depart from the IO approach, use other databases and/or complementary methodology.

Figure 5.3 provides an overall assessment of the job creation potential of different carbon abatement measures together with their respective abatement costs including the results of these parameters for the Ebro Basin CCS installations proposed in Pilot Strategy. While abatements costs are still high in comparison with other measures, the potential to boost employment is very high for the proposed CCS installations.

6. Conclusions

The socioeconomic assessment of CCS deployment in the Ebro Basin demonstrates that the technology offers significant benefits in terms of value-added generation and employment creation. Using a Multi-Regional Input-Output (MRIO) analysis, this study highlights the direct and indirect economic impacts of investments in carbon capture, transport, and storage.

The analysis estimates that approximately 9,300 FTE jobs can be created under the Minimum Investment Scenario, with the majority (78%) retained within Spain. This employment boost is particularly pronounced in sectors such as Research and Development, Construction, Manufacturing of machinery and equipment, and Other business activities. Additionally, the cumulative investment of approximately €360 million (2022 prices) generates notable value-added impacts, predominantly within Spain, followed by contributions from the European Union and other regions.

The MRIO approach underscores the interconnectedness of global value chains, illustrating how international trade and sectoral linkages amplify the socioeconomic benefits of CCS investments. Notably, the capture stage accounts for the largest share of both costs and employment creation, while storage and transportation also contribute significantly.

The calculated abatement cost of €84 per tonne of CO_2 places the Ebro Basin CCS deployment within a competitive range compared to other carbon reduction measures. Despite the relatively high costs, the employment creation potential is substantial, offering a promising outlook for regional economic development.

However, it is essential to acknowledge the methodological limitations, particularly the assumption that the Ebro Basin's productive interlinkages mirror those of Spain as a whole. Consequently, while the findings provide valuable insights into the economic implications of CCS deployment, they should be interpreted with caution.

In conclusion, CCS deployment in the Ebro Basin presents a viable pathway to foster economic growth and job creation, contributing to Spain's and Europe's broader climate and energy objectives.

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