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Is There a Future for Carbon Capture and Storage in Poland?

A Socio-political Analysis

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The climate is changing, the average temperature on Earth is rising, the EU is concerned and Poland is developing. Despite the fact that the country is trying to make up economically for lost time under Communism, it still has to comply with a demanding EU climate policy. The task is not easy, particularly keeping in mind how heavily coal-dependent the Polish economy is. Consequently, Carbon Capture and Storage (CSS) appears to be a perfect solution. However, the closer the technology is examined, the more its charm fades away.
This paper analyzes CCS technology in terms of the likelihood of its application in Poland. After placing CCS in the European context, examining attitudes held by Polish stakeholders, reviewing the Polish public debate, and scrutinizing Polish society's beliefs about the technology, the paper concludes that chances for CCS implementation in Poland are virtually nonexistent.

Read the interview of the author.

MICHAL DRABIK

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EDITOR'S NOTE

Cover picture © Belle Mellor.

I. Introduction

The author would like to thank Professor Giacomo Luciani for his guidance and advice, as well as Paula Mendez Keil for her editing assistance and support.

1 The Earth is facing a climate challenge: the average temperature of the planet is rising. In an effort to prevent the, potentially dreadful, consequences of such an increase, governments have undertaken various initiatives aimed at limiting the increase in temperature to no more than 2 degrees Celsius relative to pre-industrial levels. In order to achieve that goal, CO_2 and other greenhouse gases (GHG) emissions must be significantly reduced.

2 However, the task is not easy. It requires large investments and worldwide cooperation. A variety of different measures must be undertaken since no single solution is efficient enough to sufficiently mitigate the amount of CO_2 discharged into the atmosphere. What complicates things even further is the fact that the demand for fossil fuels, especially in developing countries, is still on the rise (GCI, 2013, 1).

3 There are many ways to reduce GHG emissions. Carbon Capture and Storage (CCS) is one of them (Bradbury, Greenberg and Wade 2011, 4). It is an appealing one because it allows one to reconcile the rising demand for fossil fuels with the need to reduce CO_2 emissions (EC 2013, 3-4). In other words, it helps lowering emissions without "annihilating" air-polluting industries.

4 That last feature of CCS is of utmost importance keeping in mind that 40 per cent of the world's energy-related CO_2 emissions are attributed to fossil fuel-driven electricity generation (GCI 2013, 1), while another 25 per cent comes from equally vital branches of the economy, such as "iron and steel production, cement making, natural gas processing and petroleum refining." Since there are very few alternatives for cutting emissions from the above-mentioned sectors (SBC Energy Institute 2013, 3), CCS, with its potential for reducing emissions from large-scale point sources without jeopardizing their future, appears to be a truly worthwhile option (GCI 2013, 1).

5 However, appealing as it may seem, CCS is actually facing many difficulties, which, at present, effectively obstruct its commercial application. First of all, CCS is not only a very expensive technology, but it also reduces the efficiency of the plants that utilize it. Secondly, due to the fact that it relies on, and thus prolongs the use of, fossil fuels, it is not perceived as being unambiguously "eco-friendly." Thirdly, not being "a simple, single

technology, but a novel combination of techniques and different industry practices [...] [CCS] lack[s] any iconic visual elements," such as, for instance, "friendly windmills or benign solar panels" which would help to "sell" it to the public (Prangnell 2013, 2). Therefore, in the current state of affairs, once the technology is introduced to people, they tend to focus on the risks it carries and additional costs it entails. Consequently, with all of the above taken into consideration together, the future of CCS appears far from bright. In fact, having lost its initial politician-driven momentum for development,[1] "CCS is now at a crossroads" (EC 2013, 22).

6 Indeed, the current data concerning CCS "achievements" is by no means impressive. Despite relatively large (around $1.5 billion in 2011) investments in research and development (R&D), and the fact that CCS technologies have already been proven technically feasible and ready for application, there are only a few large-scale projects worldwide. These capture and store a mere 23MtCO2 per year. That is roughly equivalent to avoiding emissions of only 3.8GW of coal-based electricity (SBC Energy Institute 2013, 2).

7 In other words, CCS projects have been progressing much more slowly than is required to mitigate climate change. "With [...] a forecasted 52MtCO2/year in operation by 2017, the IEA's recommended pathway towards decarbonization appears out of reach" (SBC Energy Institute 2013, 2).

8 CCS' failure to develop as fast as expected comes, to a large extent, from its reputation of being a dangerous gamble (Rochon 2008, 5). Having serious concerns about its actual feasibility, costs, safety, and the liability that its application may potentially entail, neither are state decision-makers keen to bear political responsibility for promoting it, nor are prospective investors willing to take the risk of financing it.

9 In such difficult circumstances, Poland, as well as other European countries, has to make a decision soon on whether or not to adopt CCS technology. It is not to suggest that the burden of fighting against climate change is borne to some disproportionate extent by European states. It is, rather, to point to the fact that since the European Union (EU) adopted the so-called CCS Directive, European governments must, within a limited time frame, take a stance on CCS.

10 Member States are not obliged to use this technology in particular. Austria, for instance, has already decided to prohibit underground storage of CO_2 on its territory (UfU; SiteChar 2012, 4). Yet, if countries choose to opt for CCS, they have to follow certain precise guidelines. Besides, rejecting CCS is by no means a safe choice. On the contrary, in the long run, it can actually prove to be quite problematic.

11 As the EU is strongly committed to achieving certain climate-protection goals, each Member State has particular emission-limits it must meet. Furthermore, those limits are becoming progressively stricter with time. Therefore, at the end of the day, the decision to not utilize CCS technology may leave a state with a dreadful choice between closing its most polluting industrial plants and paying significant financial fines for not complying with EU environmental policy standards.

12 Due to the fact that Poland is a coal-based economy, with hard coal and lignite accounting for nearly 95% of its energy output,[2] the former choice is by no means a viable option. Poland does, and in any foreseeable future will, depend on coal. And yet, the above statement notwithstanding, CCS still encounters great difficulties in Poland.

13 Nowadays, neither politicians have any interest in advocating its implementation, nor do people consent to host CO_2 storage sites in the vicinity of their homes. While adoption of CCS technology in Poland may prove to be necessary in the future, major stakeholders, such as the government or potential project developers, are focusing on short-term benefits, thus giving them priority over long-term goals.

14 Consequently, this paper focuses on the socio-political dimension of the issue in question, and takes a stance that chances for prompt large-scale application of CCS technology in Poland are very low. To put it more resolutely, I argue that with anything short of an EU imposed obligation to do so, Poland will not adopt CCS on a commercial scale in any foreseeable future.

15 In the second part of the paper I present the methods that I used to analyze the issue. The third part explores the subject of CCS in the European Union. The fourth part discuses the likelihood of wide-scale implementation of CCS in Poland. Lastly, the fifth part summarizes the paper and presents concluding remarks.

NOTES

1. World Nuclear Association, "'Clean Coal' Technologies, Carbon Capture & Sequestration," http://www.world-nuclear.org/info/inf83.html (accessed 20 November 2014).

2. ZeroCO_2.No, "Poland," http://www.zeroco2.no/projects/countries/poland (accessed 20 November 2014).

II. Methodology

Literature review

1 To thoroughly explore the issue that constitutes the subject of this paper I utilized three basic techniques. First of all, in order to familiarize myself with the technology in general, and the socio-political dimension of its implementation in particular, I resorted to reviewing the specialist literature and statistical data concerning CCS.

Process tracing

2 Secondly, for the purpose of establishing who the stakeholders are in the Polish context, what stances they adopt, and what factors determine their positions, I looked through the various available sources of information, which directly or indirectly provide data on the matters in question. Consequently, to trace the process of CCS' development in Poland, I studied official documents of the Polish government; publications issued by non-governmental organizations (NGOs), energy companies, and scientific institutions; resolutions and communications of the relevant local governments in Poland; Polish national and local newspapers; Polish and international websites related to CCS; informational brochures, promotional folders, and leaflets issued by stakeholders; as well as reports of international organizations specializing in energy and environmental issues.

Survey

3 Finally, for the purpose of obtaining data directly from the stakeholders themselves, I prepared a survey[3] which I sent to over one hundred recipients including Polish politicians, political parties, ministries of economy and of the environment, NGOs, labor unions from coal and energy industries, scientists, educational and research institutions, energy companies and local governments (of *voivodeships*, counties and boroughs) in Poland.

4 I selected the recipients on the basis of their knowledge of CCS or their involvement in the process of CCS implementation in Poland. Selected politicians were either the main

political figures in Poland that have a say in most matters in the country, or members of various parliamentary commissions dealing with environmental or energy issues. Political parties included only those that currently have their representatives in the Parliament as it is only these that actually participate in the decision-making process in the country. Selected NGOs were singled out on the basis of their involvement with the issue in question, either through publications or active participation in public consultations concerning CCS projects in Poland. Scientists were chosen on the basis of their area of expertise or affiliation. Educational and research institutions included only those which specialize in coal, mining, energy, geology or air pollution issues. Selected energy companies were the main electricity producers in the country, all utilizing coal-fired power plants. Finally, local governments that I approached were all from the localities were CCS projects were at some point either being developed or have been planned for development in the future.

5 Unfortunately, due to the very limited number of responses (16), the results obtained through my survey are not statistically significant. Nevertheless, they still provide an interesting insight into particular stakeholders' attitudes and factors by which those attitudes are determined

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3. Survey questionnaire is available from the author upon request michal.drabik@graduateinstitute.ch.

III. The Current Situation and the Future of CCS in the EU

1 In the short-term, until 2020, the EU committed itself to the so-called "3x20%" objectives which aim at "reducing greenhouse gases emission by 20% of 1990 levels, reducing energy consumption by 20% of the projected 2020 levels and increasing the share of renewable sources of energy to 20% of total energy generation" (PEP 2009, 4). With regards to long-term objectives, the Union has adopted specific legislation based on which it committed itself to reduce greenhouse gas emissions by at least 80% by 2050 as compared to 1990 levels (Corless et al. 2011, 6).

2 Since "fossil fuels are likely to continue to be used in Europe's power generation as well as in industrial processes for decades to come [...] the 2050 target can only be achieved if the emissions from fossil fuel combustion are eliminated from the system" (EC 2013, 11). According to the European Commission's estimates, intended emissions' reductions may be achieved only through coordinated efforts directed at energy efficiency improvements, greater use of renewable energy sources, further development of nuclear power, and expansion of CCS technologies (Hinc 2010, 10).

3 CCS is thus a crucial tool of the undertaken decarbonization of the EU's economy. As envisioned by two major documents published by the Commission – the "Energy roadmap 2050"[4] and the "Roadmap for moving to a low-carbon economy in 2050"[5] – it is expected to play a significant role in the future EU energy mix. Yet, for such predictions to materialize, it has to be proven, first, that CCS "can be used as a large scale technology that can be commercially viable to allow for large scale deployment" (EC 2013, 16). As of today, CCS still falls short of those expectations.

4 In 2007 the European Council made a decision to support up to 12 large-scale CCS demonstration projects by 2015. Shortly after, the European Commission undertook an effort to create a relevant legal framework, ultimately leading to the adoption of the so-called CCS Directive.[6] The Directive regulates issues of capturing, transporting and storing CO_2 within Member States (EC 2013, 18).[7]

5 In addition, two funding instruments, the European Energy Programme for Recovery (EEPR)[8] and the New Entrants Reserve 300 (NER300),[9] have been set up with the expectation of providing around €9 billion – the amount sufficient to ensure the

construction of several CCS demonstration plants across the EU (EC 2013, 16). However, due to the, much lower than expected, level of carbon prices, the funds actually available proved to be much smaller. As the ongoing crisis caused a radical slowdown of the European economy, industrial production decreased, simultaneously reducing the emissions. Yet, since allowances were issued in quantities corresponding to the anticipated industrial output of a "healthy" EU economy, they turned out to be too numerous, and as such drove the market price of carbon significantly down.[10]

6 "The shrinkage of the pot of [NER300] funds mean[s] that projects successful in the competition [for the program's financing] [...] receive less support than initially anticipated, placing an additional burden on co-founders such as host states and sponsor companies" (Pearson and Whiriskey 2013, 3). As a result, with the current economic situation and with the carbon price being around €5, neither states nor companies have any real incentive to invest in CCS.

7 From the perspective of private operators, the money potentially saved on allowances owing to CCS-based reduction of a plant's emissions, is unable to cover large additional expenses provoked by the technology itself. For governments, in turn, large investments in CCS appear to be unnecessary due to the fact that states, being currently in a recession, have had their economies shrunk and thus manage to meet their emissions targets even without the discussed technology (EC 2013, 17).[11]

8 Consequently, despite the original goal of NER300 "to fund 8 CCS demonstration projects of commercial size together with 34 innovative renewable energy projects" (EC 2013, 17). in the first phase of the program, no CCS project was actually awarded funds because hosting states were unable or unwilling to support them (Pearson and Whiriskey 2013, 2).

9 Thus the first phase of NER300 was a plain failure. It neither reduced the costs and risks of CCS technology, nor did it remove "key barriers to the deployment of CCS, through the development of sufficient storage capacity, transport infrastructure and relevant industrial know-how." Furthermore, "[t]he absence of full-scale integrated CCS demonstrations will have significant long term repercussions on the development of CCS in Europe, retarding the development of indigenous CCS service providers, jeopardising the timeline for commercial deployment and subsequently reducing the technologies' ability to contribute to CO_2 emissions reductions" (Pearson and Whiriskey 2013, 6).

10 Therefore, "[n]otwithstanding its critical role [in meeting the EU's emission goals], CCS has now reached a tipping point in the EU." Its fate depends on the price of carbon (Pearson and Whiriskey 2013, 1-3). This price, being determined by the market principle of supply and demand (Corless et al. 2011, 6-7), peaked at €30/t of CO_2 in 2008, decreasing since then over threefold and reaching, at the end of 2012, a mere €8.49/t of CO_2 (GCI 2012, 7) – a level far below what is necessary for the commercial viability of CCS. What is even worse, though, is that the price of 10-year CO_2 futures remains low as well, giving little hope for any dramatic increase of the price of carbon in the near future (Pearson and Whiriskey 2013, 3).

11 To conclude, as much as the EU refuses to give up on CCS, the technology appears to be facing ever increasing difficulties. Most importantly, neither Member States nor energy companies are keen on putting their own money into CCS projects. While the Union is still capable of keeping CCS "alive" for at least some time, either by somehow incentivizing states to test it or by subsidizing demonstration projects to a greater extent than is done currently, it is unlikely to persuade its members to apply the technology on a

wide scale. In order to achieve the latter goal, the EU would have to mandate the use of CCS. Yet, as neither the authorities nor the societies of Member States have much enthusiasm for the technology, it is very unlikely that European governments would let any such law pass.

NOTES

4. EC (European Commission). 2012a. *Energy roadmap 2050*. COM(2011) 885 final. DOI:10.2833/10759. http://ec.europa.eu/energy/publications/doc/2012_energy_roadmap_2050_en.pdf (accessed 20 November 2014).

5. EC (European Commission). 2011. *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions; A Roadmap for moving to a competitive low carbon economy in 2050*. COM(2011) 112 final. http://eur-lex.europa.eu/resource.html?uri=cellar:5db26ecc-ba4e-4de2-ae08-dba649109d18.0002.03/DOC_1&format=PDF (accessed 20 November 2014).

6. CCS Directive. 2009. *Directive of the European Parliament and of the Council of 23 April 2009, on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/200.* 2009/31/EC. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0031&from=EN (accessed 20 November 2014).

7. According to CCS Directive's provisions, each Member State has full discretion over the decision of whether or not to allow the application of CCS technology in its territory (GCI (Global CCS Institute). 2012. *EOR/CCS 360-Degree Legal Review,* 8. http://decarboni.se/sites/default/files/publications/84561/eor-ccs-360-degree-legal-review.pdf - accessed 20 November 2014). However, once a decision is made in favor of CCS, domestic regulations must conform to specific rules prescribed by the Directive. Although the deadline for the transposition of the Directive into national laws expired in June 2011, by October 2012 only ten Member States (namely Spain, Lithuania, Slovakia, Malta, the Netherlands, Denmark, Italy, France, Portugal, and Romania) had actually completed the transposition process (GCI 2012, 8). In addition, as of today, one Member State "has [still] not notified any transposition measures of the Directive to the Commission" (EC 2013, 18). Furthermore, there are also several others, such as e.g. Austria (UfU; SiteChar 2012, 4), which decided to ban or restrict storage of CO2 in their territories (EC 2013, 18).

8. The EEPR is a "€4bn. programme [that] was set up in 2009 to co-finance projects (59 so far), designed to make energy supplies more reliable and help reduce greenhouse emissions, while simultaneously boosting Europe's economic recovery" (European Commission, "European Energy Programme for Recovery," http://ec.europa.eu/energy/eepr/ - accessed 20 November 2014). By the end of 2010, almost 97% of the available funds for energy projects were already utilized, with around €1 billion being allocated to CCS ventures (GCI 2012, 12).

9. The NER300, is a subsidy scheme "financed by the sale of 300 million emission allowances from the New Entrants Reserve (NER) under the ETS Directive" (GCI 2012, p. 13). It "was introduced to finance CCS commercial scale demonstrations, together with innovative renewables energy projects" (EC 2013, 16). With the assumption that the carbon prices will oscillate at around €15/t, NER was estimated to provide around €4.5 billion for research and development (European

Commission, “Strategic Energy Technologies Information System,” http://setis.ec.europa.eu/newsroom-items-folder/carbon-capture-and-storage-crossroads - accessed 20 November 2014).

10. McGrath, M. “Green energy on the back foot after carbon trading blow,” BBC. 2013. http://www.bbc.co.uk/news/science-environment-22183232 (accessed 20 November 2014).

11. See also European Commission, “Strategic Energy Technologies Information System,” http://setis.ec.europa.eu/newsroom-items-folder/carbon-capture-and-storage-crossroads (accessed 20 November 2014).

IV. CCS in Poland

1. Status of Coal in Poland

1 The Polish economy is highly carbon intensive. While coal is utilized not only for the purpose of power generation, but also in a number of other branches of industry, the energy sector depends on its use most heavily (Heiskanen et al. 2008, 178-179). Solid fuel – of which hard coal constitutes 83% – accounts for 54% of Poland's energy consumption mix and is responsible for nearly 87% of its electricity generation (EC 2012, 125).

2 For Poland, which does not have at its disposal either nuclear power or sizeable amounts of renewables, domestically extracted coal is an important strategic asset. Since Polish coal-deposits are large,[12] promising abundant supplies for years to come, coal is an important pillar of Poland's energy security (Brunstig et al. 2011, 20).[13] In the words of the Polish Minister of Environment, Mr. Korolec, all environmental concerns notwithstanding, and despite the fact that "the government aims to reduce the power sector's dependence on coal by increasing energy efficiency, introducing nuclear power and boosting natural gas and renewable energy, [...] fossil fuels will remain in the predictable future."[14] Indeed, the recently prepared Polish long-term energy strategy calls for a "rational and efficient management of Poland's coal deposits and continued use of coal as the principal fuel for the energy industry" (Hinc 2010, 11). In addition, due to the fact that "mining and [the] subsequent use of coal has a long historical tradition in Poland," not only the government but also the Polish people tend to perceive this resource "as an important part of the nation's wealth, heritage, and independence" (Corless et al. 2011, 10).

3 However, Poland's enormously intensive use of coal in electricity generation "is not only a legacy of the past, but also a conscious choice of consecutive Polish governments" (Brunstig et al. 2011, 20). For instance, quite recently the Polish Prime Minister, Donald Tusk, announced that one of the main goals of his government's energy policy is to encourage greater use of coal in the power generation sector not only in Poland but also in the EU. In order to achieve that goal, the Tusk administration will make efforts to decrease the burdens imposed by the EU environmental policy on energy producers relying on coal.[15]

2. Polish Energy Sector

4 Poland's generating capacity is ageing (EC 2012, 125). While great progress in the energy sector has been achieved since 1989, there is still a lot of room for improvement. Since 2004, when Poland joined the EU, an additional impulse for change has continuously flowed from the Union "resulting in several new aspects of organisation and development of this sector" (Heiskanen et al. 2008, 178-179). Nevertheless, although energy intensity is now on a much lower level than it was 20 years ago, it is still twice as high as that of the European Union taken as a whole (Olejarnik and Argiri 2010, 3).[16] "With its 10 tons of CO2 per capita in 2007, Poland is exactly at the level of the EU average, but given its lower income level, the Polish economy comes out as among the least emissions-efficient" (WB 2011, 8-9).

5 "[T]he Polish power sector emit[s] 1.12 tonnes CO2eq[17] per MWh of electricity produced, compared to 0.45 tonnes CO2eq/Mwh in EU27 and 0.39 tonnes CO2eq/Mwh in EU15" (Corless et al. 2011, 10). Such high emissions are a consequence of the low energy efficiency of the sector, which relies on a very old coal-fired generating fleet. A great majority of Polish power plants will require replacement in a few years. While the age of 37% of them is between 20 to 30 years, more than 40% are already over 30 years old. Consequently, "[t]he transformation of the Polish energy sector is a must" (Hinc 2010, 11, 25), for "[a]ny delays in investment decisions may lead to blackouts in the near future" (Corless et al. 2011, 11).

6 Since the Polish energy sector is currently on the verge of a profound modernization, Poland has a unique opportunity for large-scale application of CCS technologies (Olejarnik and Argiri 2010, 3-4). Given the facts that, i) building new CCS equipped plants is easier, cheaper and ultimately more efficient than retrofitting old ones,[18] ii) Poland urgently needs new energy installations, and iii) the country has to conform to the EU's environmental ambitions, the time for CCS implementation in Poland appears to be optimal.

7 In addition, because a majority of Polish power generation facilities are obsolete, their one-to-one replacement with new plants equipped with CCS technology will not decrease the overall productivity of the sector. While old Polish installations rarely work at an efficiency level higher than 36%, modern facilities tend to achieve an efficiency of up to 46%. Therefore, despite the fact that the addition of CCS always reduces the efficiency of any given plant by around 10%, the overall electricity production of future CCS-equipped installations in Poland will still be around 25-30% higher than the current output of facilities that they will replace.[19]

8 The problem, however, lies in costs. "According to energy experts, multibillion Euro investments will be required to renew the exhausted [Polish] power sector and guarantee uninterrupted supplies of electric energy" (Corless et al. 2011, 11). For instance, the IEA predicts that in the period 2010-2030, total investments in the Polish energy sector will amount to approximately €195 billion or 1.3% of the GDP on an annual basis.[20] Following the Agency's estimates, over two-thirds of that amount will be allocated to building 92 GW of new capacity, while the remaining part will be used to cover power distribution and transmission needs (Olejarnik and Argiri 2010, 4).

9 Adding CCS expenses on top of such, already enormous, costs may prove, especially in situations where the country struggles with economic austerity, simply impossible.

Besides, with the current, very low, price of carbon, it seems quite difficult to justify CCS spending in economic terms. In times when all state expenditures are being cut to a minimum, investments in technologies, which in themselves are not necessary for energy generation, are likely to appear frivolous not only to politicians but also to economists, accountants and the general public.

10 Hostility towards additional spending is likely to come from all possible sides due to the fact that it is not yet known how the overall costs of CCS will be distributed among the society. On the one hand, investment in the technology may, for example, help to preserve some existing jobs, or even lead to the creation of new ones ((UfU; SiteChar 2012, 5). On the other hand, by increasing the price of coal-based energy, CCS can render such energy uncompetitive, thus leading to the fall of the Polish coal industry.[21] In such a case thousands of jobs would be lost. Furthermore, Polish society is likely to oppose CCS for yet another reason. In a country in which "electricity prices [...] are among the highest in Europe when compared to average household income" (Corless et al. 2011, 10), the prospect of even higher energy bills is hardly appealing to anybody except energy providers.

11 The people, however, are also far from being enthusiastic about CCS itself. In Poland, over 60% of the market is controlled by only 3 companies: "Polska Grupa Energetyczna SA (PGE) ha[s] a 36.5% market share, TAURON Polska Energia SA (TAURON) 15.1% and Electricité de France (EDF) 10.2%" (EC 2012, 126). Consequently, as the competition is quite tight, all the companies are closely watching one another's market behaviors. Since CCS "first movers" will have to incur significant extra expenses resulting from necessary investments in scaling up the technology, such a step is not likely to win the favor of shareholders (ZEP 2008, 3). Currently, the potential risks of "betting" on CCS, which is expensive and has never been tested on a commercial-scale, simply appear to be too high. As a result, none of the competitors are likely to turn to the technology unless compelled by law.

3. The Future of Energy in Poland

12 Apart from working on the implementation of the CCS Directive, the Polish government has also been undertaking a number of other initiatives which indicate its interest in CCS technology. For instance, in October 2009, Poland joined the Carbon Sequestration Leadership Forum (CSLF), an international organization focused on fighting climate change and promoting CCS.[22] Moreover, on November 10, 2009, the Polish Council of Ministers adopted a document called "Polish National Energy Policy until 2030" (PEP),[23] which, among other things, defines Polish plans concerning the use of CCS technology in the future.

13 According to PEP assumptions, within the time framework of the document, domestic coal deposits will continue to be the backbone of Poland's energy supply. In the words of the document itself, "[s]tate energy policy assumes using coal as the main fuel for the power industry in order to ensure an adequate level of energy security of the country" (PEP 2009, 9).

14 The dominant role of coal, as envisioned by PEP, is unquestionable. In 2030, the end date of the forecasted period, natural gas generation is projected to account for less than 10% of Poland's electricity supply, while nuclear power plants, the first of which is planned to

become operational shortly after 2020,[24] are anticipated to produce no more than 18% of the nation's electricity (Corless et al. 2011, 32). Since PEP predicts that the share of renewables in energy generation in 2030 will fluctuate around 15%, the remaining 57% will still be coming from CO_2 intensive energy sources such as hard coal and lignite.

15 At the same time, while maintaining Poland's strong commitment to coal in the energy generation sector, PEP recognizes the need for a reduction in GHG emissions. Owing to the greater anticipated use of renewables and improvements in energy efficiency, CO_2 emissions will, according to PEP forecast, decline from approximately 332 million tons in 2006 to approximately 280 million tons in 2020. Yet, after that date, as the Polish economy will continue to develop, these figures are estimated to gradually rise again.

16 Despite that fact, apart from demonstration projects, "[t]he energy policy does not envisage [...] broader use of clean coal technologies [in Poland]" (Hinc 2010, 13). Nevertheless, being aware of the necessity to mitigate the environmental impact of the power industry, PEP assumes Poland's "[a]ctive participation in implementing the initiative of the European Commission to build large-scale demonstration facilities for carbon capture and storage (CCS) technologies," as well as the "[i]ntensif[ication][of] research and development on the CCS technology" (PEP 2009, 22). Important as they may be, such declarations are, however, quite far from being an endorsement of a broad application of CCS in the country.

4. Emissions in Poland

17 The large-scale adoption of some emission-mitigating technology is necessary if Poland plans to keep up with EU environmental goals. "If [having in mind the characteristics of the Polish power generation sector] we realize that the combustion of 1 kg coal leads to more than 2 kg of CO_2, then the scale of the problem [facing the country] becomes quite obvious" (UfU; SiteChar 2012, 4-5).

18 On the one hand, being heavily coal-dependent, Poland often restrains the environmental ambitions of the Union.[25] On the other hand, however, the country has ratified the EU's 3x20% target (see above) and committed itself to the Union's long-term goal of reducing emissions by 80% by 2050.[26]

19 As a result, if Poland does not adopt either CCS or some other clean-coal technology, Polish coal-fired power generation facilities will inevitably exceed the agreed upon emission limits, thus exposing themselves to fines that will quite probably render them uncompetitive in the market. Indeed, the "EU climate and environment policy [...] [is] likely [to] make unabated electricity generation from coal plants uneconomic" (Corless et al. 2011, 12). As penalty costs will be reflected in higher electricity prices, Polish recipients may find it cheaper to buy "cleaner" energy from abroad.[27] Since such a situation would carry severe social and energy security consequences for the country, Poland would certainly prefer to avoid such a scenario.

20 Regardless, however, of the threat of harsh ramifications of non-compliance with EU emission targets, the task of achieving its abatement goals will not be easy to accomplish for Poland. This is because meeting obligations ensuing from the above-mentioned emission-cut commitments will require thorough and a very costly modernization of the whole Polish power-generation sector.

21 Since "the [exact] combination of technologies chosen or new investments [in that sector] will depend not only on capital costs, operational savings, and emissions abatement potential, but also [on] energy security, domestic sourcing, and a raft of other issues" (WB 2011, 18), Poland's turn towards CCS technology is by no means certain. As a matter of fact, however, neither is it certain that the country will actually manage to meet its emission goals, nor can one be sure that the goals in question will be upheld by the EU.

4.1. CCS' Potential in Reducing Emissions in Poland

22 The potential for reducing Polish emissions is huge. McKinsey & Company, taking 2005 levels as a reference point, estimates that by 2030 abatement per year can reach up to 236 MtCO2e (McKinsey&Company 2009, 12).[28] Furthermore, the company assesses that around 15% of that number can be achieved through the application of CCS technology (Hinc 2010a, 25). Putting it in absolute terms, by 2030 CCS can contribute to an overall annual reduction of approximately 36 MtCO2e.[29] "[O]ver a half of th[at] [...] potential (20 MtCO2e) is related to equipping coal power plants with CCS, [and] [t]he remaining 16 Mt could be achieved in industrial sectors" (McKinsey&Company 2009, 16).

23 Yet, capitalizing on such huge (overall) emission-reduction potential would require an enormous effort from the whole country. The full reduction forecasted by McKinsey & Company can only be achieved through well-designed, concerted and targeted actions undertaken by the government, businesses, and consumers (McKinsey&Company 2009, 13).

24 A clear indicator of the bulk of work that awaits Poland is the fact that in order to obtain the maximum estimated emission reductions out of 236 MtCO2e per year, low-carbon energy sources, which currently amount to around 10%,[30] would have to rise by 2030 to over 50% of the country's total electricity supply. "Another way to illustrate the challenge is to look at GDP emissions intensity [...]; [t]o achieve the total identified technical potential by 2030, Poland would have to decrease its GDP emissions intensity by almost 70% against current levels, and by over 40% against the B[usiness]-A[s]-U[sual] scenario level" (McKinsey&Company 2009, 13).

25 In addition, while CCS' contribution to the overall emission abatement of approximately 15% is relatively low, utilization of the technology is forecasted to be quite costly for the Polish economy. According to the World Bank (WB), after 2020 utilizing CCS would cost the country as much as a 0.5% reduction in GDP per year. As compared to other mitigation options – such as transition to low-emission energy supplies, fuel efficiency measures, or energy efficiency measures – CCS is the least effective in reducing CO2 emissions and, at the same time, is the second most expensive in terms of affecting growth (WB 2011, 14).[31]

26 As CCS is still being tested, there are many uncertainties concerning its application. In the discussed analysis, McKinsey & Company assumes, for instance, that in 2030 there will be a storage capacity of approximately 30-40 Mt/year in Poland. At the same time the company also acknowledges that development of CCS at a faster than predicted pace may, by 2030, solve many problems related to CO_2 storage and transportation currently being faced. This may result in a much greater storage capacity of the country[32] and also in its increased abatement potential (up to ~74 Mt) (McKinsey&Company 2009, 16).

5. CCS-Related Projects in Poland

27 In order to assess the potential geological storage capacity of the country and to test CCS in practice, a wide variety of CCS-supporting programs have been realized in Poland since the mid-1990s.[33] "Polish experience in CCS originates from CO_2 and H_2S storage in a gas field related to a small scale industrial project in Borzecin since 1995" (Corless et al. 2011, 25). Since then, a large number of scientific, governmental as well as industrial institutions have been involved in researching, developing and promoting CCS technology (MS 2008, 8).

28 Furthermore, until very recently, Poland was also hosting two CCS demonstration projects in Bełchatów and in Kędzierzyn. The latter installation was intended to be a first-in-the-world "Zero-Emission Power and Chemical Complex" integrating IGCC[34] generation technology with CCS (Brunstig et al. 2011, 20). "The 308 MW project was planned to use IGCC generation technology to produce electricity from synthesis gas made from hard coal and biomass through the process of coal gasification, and pre-combustion capture technology to capture 2.5 million tonnes of CO_2 per year" (Corless et al. 2011, 18). Unfortunately, in March 2011, the project developer, a Polish company called ZAK S.A.,[35] decided to abandon the initiative due to financial reasons (Brunstig et al. 2011, 20).

29 The undertaking in Bełchatów, being located in the largest lignite-fired power generating facility in Europe, was the most ambitious CCS demonstration project in Poland (Brunstig et al. 2011, 20). It aimed to apply post-combustion CO_2 capture technology to parts of the new 858 MW block of the Bełchatów power plant (Reiner, Hauke and Kong 2012, 49). "The capture unit [...] [was designed to] use an amine process known as 'advanced amine' to capture approximately 25% of the CO_2 emissions – about 2.1 million tonnes of CO_2 annually – from the new generation unit with a 90% capture efficiency" (Corless et al. 2011, 18).

30 In October 2009, the European Commission allocated €180 million to the Bełchatów demonstration project under the European Economic Recovery Program (Brunstig et al. 2011, 20). Later, however, as the project did not receive an additional €340 million, sought under the NER300 funding scheme, it encountered a significant financing gap (EC 2013, 28).

31 According to the project developer – the biggest Polish energy company, PGE[36] – without financial support under NER300 the project was not economically feasible.[37] Following the company's calculations, with the current price of carbon being below €10/t, the benefits accrued from lower emissions would not be able to cover the costs of capture and storage – estimated at €60/t for the project.[38]

32 Moreover, while, according to Polish deputy Minister of Economy, the government would, in general, be willing to compensate private developers for utilizing CCS technology, given the current situation of a significant economic slowdown it simply does not have sufficient funds to do so.[39] Although PGE accepted such argumentation, it was nevertheless convinced that the government was, on the whole, not active enough in supporting the uptake of CCS in Poland (Breukers et al. 2011, 65-66).

33 For all the above mentioned reasons, as well as the fact that Poland has still neither transposed the CCS Directive nor adopted legislation necessary for building the CO_2 transport corridor, PGE began terminating the venture in March 2013 (EC 2013, 28). In

addition, what also significantly contributed to the developer's decision was a serious difficulty in finding a location for a CO_2 storage site, deriving from strong public opposition to the project in all local communities initially considered suitable for that purpose.

6. Competition to CCS Technology in Poland

34 The government's budget for CCS is not limited only due to the financial crisis. Another important reason is that other large-scale investments in the energy sector are simply given priority over CCS.

35 First of all, in August 2009, the Polish government published a roadmap with the aim of commissioning the first Polish nuclear power plant in 2021 (Olejarnik and Argiri 2010, 4). While this date has, by now, been officially acknowledged as being overly optimistic, the government is, nevertheless, determined to proceed with the project. As the Prime Minister recently[40] declared, Poland has by no means abandoned its nuclear aspirations. To the contrary, he revealed that the country is actually aiming at building not one but two atomic power plants, with a capacity of 3 GW each. In accordance with the Prime Minister's statement, the first of the plants is currently scheduled to become operational by 2024.[41]

36 In terms of necessary funding, the government-issued "Polish Nuclear Energy Program" (PNEP)[42] estimates the cost of the discussed venture at €3-3.5 billion/GW (PNEP 2010, 63). According to the majority of independent experts, however, that calculation is highly understated. As data obtained from international energy companies and rating agencies suggest, the current cost of building a nuclear power plant ranges between €4.5-5.4 billion/GW.[43]

37 In accordance with these findings, Prof. Andrzej Strupczewski of the Atomic Energy Institute "PolAtom," postulates that, given present Polish realities, the discussed cost will amount to €4.68 billion/GW, i.e. almost €1.5 billion/GW higher than the governmental prognosis.[44] Since PGE, a state-run energy company responsible for developing a nuclear energy project in Poland, agrees with such estimates, €4.68 billion/GW appears to be a credible prediction of what the actual cost of building a nuclear power plant in Poland will be. Consequently, multiplying that value by 6GW, constituting the planned capacity, adds up to over €28 billion of necessary investments.

38 Nowadays, another thing that efficiently draws the Polish government's attention away from CCS is shale gas. "The recent discovery of significant unconventional gas deposits in Poland could prove a game changer [...] for Poland [...] by helping to satisfy rising demand, reducing import dependency and slowing the growth in CO_2 emissions by encouraging fuel switching from coal to gas" (Olejarnik and Argiri 2010, 4). Keeping in mind all the potential benefits of shale gas extraction and its wide-scale utilization in Poland, it is only natural that the government focuses on this issue rather than on CCS.

39 However, despite the fact that several firms are already exploring the prospects of shale gas in Poland, it is much too early to draw any conclusions concerning its future in the country. The "barriers and obstacles that will first need to be overcome include the geological characteristics of the resources yet to be appraised, limitations on physical access to the resource base, the ability to comply with environmental and fiscal

regulations, access to water and the proximity to existing pipeline infrastructure" (Olejarnik and Argiri 2010, 4).

40 In addition, while forecasted benefits from potential commercial-scale shale gas extraction in Poland are very appealing, the outlays necessary for making it possible are equally stunning. The president of the Energy Studies Institute,[45] Andrzej Sikora, estimates that the overall cost of the first preparatory stage of the project itself will add up to almost €140 billion.[46] Putting that into perspective, he points to the fact that the amount needed for the development of the Wejherowo concession alone (€7-9 billion[47]) roughly equals the cost of building a 2-3GW nuclear power plant.[48]

41 Nevertheless, despite all the costs and uncertainties, shale gas is, at present, still much further above CCS on Poland's list of priorities. Paradoxically, if Polish hopes pinned on its extraction and large-scale use ever materialize, CCS may once again regain its lost attractiveness. This is because shale gas, like all fossil gases, can "contain significant amounts of CO_2 that is [sic] 'ready' for capture."[49] Yet, keeping in mind how doubtful and distant such a perspective currently is, any discussion about that issue is currently purely speculative.

7. Socio-political Conditions of CCS Implementation in Poland

7.1. Potential Stakeholders

42 Implementation of CCS in Poland depends on winning the hearts and minds of stakeholders and the general public. For the purpose of this paper, the former are understood as either those who have a professional interest in CO_2 capture and storage or those whose lives will be affected by CCS technology to a greater than average extent. Stakeholders in Poland can be divided into 4 broad groups: public authorities, industry, research, and the civil sector.

43 The first group is comprised of: the Ministry of the Environment, which is responsible for coordinating the legislative work on the CCS Directive; the Ministry of Economy, which runs the "Polish Clean Coal Technology Program;" and Polish political parties as well as individual politicians involved in CCS legislation and decision-making process.

44 The second group encompasses energy companies actively involved in CCS-related projects in Poland. The most prominent among them are: PGE (Polish Energy Group[50]), operator of the Bełchatów power plant; ZAK (Nitrogen Plant Kędzierzyn[51]), operator of the Kędzierzyn plant; and TAURON Polska Energia, the second largest Polish energy company seriously involved in CCS research and pilot projects.

45 The third group includes scientific and research institutions, as well as so-called individual experts exploring CCS technology for professional purposes. This group consists of: the Polish National Geological Institute (PIG),[52] a CO_2 storage research institution and a potential future CO_2 storage oversight body; the Clean Coal Technologies Center,[53] a research facility operating under the auspices of the Central Mining Institute;[54] the Institute for Chemical Processing of Coal, a CO_2 capture research body;[55] the Mineral and Energy Economy Research Institute,[56] a part of the Polish Academy of Science[57] which is involved in researching CCS technology; and the Oil and Gas Institute,[58] a transport and storage research organization.

46 The last group embraces: i) Non-Governmental Organizations taking part, whether directly or indirectly, in either pro or anti-CCS campaigns in Poland, such as: DemosEuropa, WWF, Greenpeace, Bellona Polska, Sobieski Foundation, Center for International Relations,[59] Polish Wind Energy Association, [60] and the Center for Sustainable Development;[61] as well as ii) inhabitants and local authorities representing communities in which CCS installations were/are planned or being developed.[62]

47 Besides stakeholders, however, CCS also has to win the approval of Polish society as a whole. "The public [...] play[s] a major role in the decision-making process about the construction of CO_2 injection, storage and transport infrastructure" (Hinc 2010a, 29). The importance of gaining favor with the people was clearly visible recently in Germany (Jänschwalde) and the Netherlands (Barendrecht) where outright public opposition forced developers, Vattenfall and Shell respectively, to back down on their CCS projects (Prangnell 2013, 2). Those two cases showed that, at the end of the day, even huge and influential companies are actually powerless when faced with strong and well-organized social opposition.

7.2. General Attitude to CCS in Poland

7.2.1. Public Authorities

48 Since "[t]heir support for the technology at large and for specific projects at regional or local level is critical to success, whilst opposition can prove to be very problematic," "[p]oliticians at all levels are [extremely] influential stakeholders in the CCS debate" (Wolff, Chrysostomidis and Perumalpillai 2012, vii). By being responsible for passing laws and designing policies, it is they who set the terms under which CCS will operate. Through their support for, or opposition to, the technology they can, respectively, facilitate or hinder its progress.

49 In Poland, on a governmental level, policy concerning CCS seems to be "directed by the economic reality of coal dependency on the one side, and the importance of international relations on the other."[63] Therefore, CCS, being perceived as a way of making use of coal "environmentally acceptable," was, from the very beginning, approached with interest by the Polish government.

50 Since it was offering emission-reduction without the necessity of renouncing coal-based energy, it appeared to be a perfect solution for the coal-dependent country. It was hoped that CCS would allow Poland to meet ecological goals set by the EU relatively painlessly and, at the same time, defer the fall of the Polish coal-mining industry, thus saving thousands of jobs in the sector. Furthermore, by preserving the dominant position of coal in the Polish energy mix, CCS was deemed to provide Poland with energy security for many years to come.[64]

51 It is not surprising then that, at first glance, the attitude of Polish state authorities to CCS is quite positive. The government undertakes efforts to implement the CCS Directive, participates in international CCS-supporting organizations,[65] and provides patronage for numerous CCS-related projects across the country. Moreover, in its official long-term energy strategy,[66] it pledges Poland's involvement in implementing the EU initiative to develop large-scale CCS demonstration facilities and intensification of research on the technology (PEP 2009, 22).

52 Consequently, CCS appears to be one of the technologies that the government takes under serious consideration in the context of Poland's emission-reduction obligations. It is by no means treated as the overall or even primary solution to the problem of CO_2 emissions, but it seems to be viewed as a potential abatement option.

53 Although it has always been underlined that "[t]he current research phase [...] has to be completed, before a broader debate and a possible commercial scale introduction could take place,"[67] up until quite recently, government representatives talked about CCS with a large dose of enthusiasm, usually presenting it in a very positive light.[68] CCS projects were typically portrayed as an opportunity for communities wherever these projects were about to be placed. They tended to be described as safe innovatory undertakings stimulating development and providing local people and authorities with new employment opportunities, wealth and access to high technologies.[69]

54 Nevertheless, that rhetoric has changed recently. While CCS still stands as a worthwhile technology in governmental documents, politicians from the governing coalition are much more reticent in expressing their admiration and support for it. On the contrary, at present, the dominant attitude is quite negative and seriously questions the raison d'être of CCS in Poland.

55 In February, Minister of the Environment, Marcin Korolec, plainly stated that "despite the fact that the EU perceives CCS as a technology of the future, it has no chance to come into being on a commercial scale, due to its excessive costs."[70] "Under the current regulations," he continued, "companies will never decide to utilize CCS unless the state gives them a guarantee that it will cover their future losses resulting from thereof." In his view, "no state is ready to accept such responsibility."[71]

56 His deputy, Tomasz Tomczykiewicz, agrees and confirms that "even though the state should recompense companies for losses they suffer from utilizing CCS, in the current situation it simply does not have budgetary funds to do so."[72] Besides, he adds that "the technology, de facto, does not arouse anybody's enthusiasm anymore – while the citizens oppose underground CO_2 injections, the energy industry is concerned with increased costs of energy production and decreased plants' efficiency."[73]

57 In a broader context, Minister Korolec believes that the "EU should abandon its very costly climate policy which directly translates into high energy prices."[74] He wholeheartedly opposes the Union's dominant paradigm that climate policy and energy have to be expensive.[75] Pointing across the Ocean, Korolec underlines that "the United States, due to the shale gas revolution, is today able to have both cheap energy and CO_2 emission reduction [which are] twice as high as in Europe."[76] Therefore, he warns, "having in mind a possibility of establishing a free trade zone between the EU and US, the American way of thinking about energy must not be disregarded, or otherwise the remains of the EU heavy industry would be scared away, causing another economic catastrophe in Europe."[77]

58 The Minister of Economy, Janusz Piechociński, also criticizes EU climate policy, and thus indirectly voices his opposition to CCS. In his view, climate concerns must not slow down the economy.[78] Consequently, he recently proclaimed that "there would be no consent of the Polish government to make a transition to a low-emission economy if it is to hinder the country's development."[79] Moreover, his declaration that "GHG emissions reduction at the expense of the economy's competitiveness is out of the question,"[80] suggests that

Piechociński will not favor an expensive and efficiency decreasing technology such as CCS.

59 Like Minister Korolec, Piechociński also calls for abandoning the EU climate policy. He is convinced that the Union should postpone setting any emission goals until such time that some form of worldwide agreement on the issue is worked out. In his opinion, "it is possible that at some point it will become justified to increase EU climate ambitions, so far, however, Europe should wait and see whether the rest of the World is actually willing to follow that path."[81]

60 Waldemar Pawlak, Piechociński's predecessor who occupied his ministerial post for five years beginning in 2007, was also quite skeptical about CCS in general and the prospects for its broad application in Poland in particular. He was concerned about Poland's insufficient CO_2 storage capacity and, most of all, about the technology's high costs. He viewed CCS as being unprofitable and advocated using CO_2 for the production of liquid fuels instead of storing it underground.[82]

61 The general attitude of discouragement and skepticism about CCS that currently prevails among the politicians of the governing coalition was conveyed well by a recent statement made by the undersecretary of state in the Ministry of the Environment, Beata Jaczewska. During one of the March 2012 sessions of the Polish parliament, in Sejm (lower house of parliament), she expressed her serious doubt over whether anybody in Europe still actually believes in CCS.[83] Since such a sense of resignation is very common, even amongst those in the government who used to be the most fervent supporters of the technology, it appears that the current state leadership has already written off CCS.

62 A potential change of government, however, is also unlikely to turn the scales in CCS' favor. "[W]hen looking at other parts of the political spectrum, CCS is not held in a high regard."[84] At present, none of the serious political parties in Poland unambiguously support the technology. Two Members of Parliament representing the biggest opposition party, "Law and Justice"[85] (PiS), who answered my survey, were very critical of CCS. Neither of them was in favor of wide-scale application of the technology in Poland. They both underlined its high costs and the fact that it translates into very high energy prices. Besides this, one of them additionally supported his negative stance by stating that Poland's geological conditions are unfavorable for CO_2 storage and that, by now, the technology has lost its appeal even in the EU.

63 The above-mentioned respondents differ on the issue of the consequences that CCS may have for the Polish coal industry. One of them believed that the technology, if actually ever adopted, will spur its development. The other, in turn, was strongly convinced that application of CCS in Poland (in his view possible only if imposed by EU) will simply annihilate said industry. In a comment accompanying the survey, the latter politician also expressed satisfaction over the fact that CCS is slowly becoming history not only in Poland but also within the EU. This being said, he followed with a remark: "Woe betide us if I'm wrong."[86]

64 Furthermore, besides substantive criticism of the technology, PiS also has a number of less legitimate objections to CCS. While none of the absurd charges mentioned below directly concerns CCS technology as such, they are brought to the reader's attention in order to reveal the quality of the political discourse in Poland, as well as the emotions surrounding the debates on CCS in the country.

65 For instance, Member of Parliament, Piotr Cybulski, made an accusation against the government by claiming that, on the pretext of amending the Mining and Geological Law, which is a key regulatory document concerning CO_2 transport and storage in Poland, it is actually trying to quietly appropriate the natural resources of the country which rightfully belong to the entire nation. The government's action, according to Cybulski, is not only in blatant violation of the Polish Constitution, but also aims at giving access to the resources in question to some undefined persons or forces.[87] With regard to CCS projects, in turn, Cybulski stretches the truth with equal ease, pointing to the fact that the new Mining and Geological Law will oblige local leaders to assist energy companies in organizing forced re-locations, if such become necessary for the development of the project (Breukers et al. 2011, 100).[88]

66 A heightened level of emotions, in most cases negative, is not only characteristic of politicians from PiS. A completed survey sent to me by a politician from the second biggest opposition party, "Palikot's Movement"[89] (RP), shows not only the respondent's strong dislike for CCS, but also his annoyance at the fact that the technology is still even being discussed.[90]

67 To the detriment of CCS, the research conducted for the purpose of this paper suggests that even those Polish politicians who currently do not occupy any public posts are, in their majority, also against the technology. The criticism of CCS comes equally, from both, the left as well as the right side of the political spectrum. Janusz Steinhoff, ex-minister of economy in Jerzy Buzek's right wing administration, argues, for instance, that the Polish coal-based energy sector cannot be based on CCS technology, for the latter is simply not yet applicable on a commercial-scale.[91]

68 Herbert Leopold Gabryś, once an undersecretary of state in the Ministry of Industry and Trade in the left wing post-Communist government, argues in turn that "regardless of the costs, it is necessary to demonstrate how pointless, under the present conditions, the application of CO_2 capture, transport and storage installation is in economic terms."[92] In his view "nobody in Europe has a larger interest in exposing that fact than the Polish economy."[93]

69 Interestingly, even the green party, Zieloni 2004, does not perceive CCS as a priority.[94] From its perspective, the technology loses in the competition with renewable energy sources and energy efficiency measures. As party co-chair Dariusz Szwed observes, the fact that CCS decreases plants' efficiency "goes against the goal of an overall upgrade to more energy saving systems."[95] Instead of investing in CCS, he advises, instead, to "replace ageing plants and structures, and to expand cogeneration, combined heating and power."[96] When asked to put all those solutions in order of preference, he puts CCS in the last place. "Further down the list is only nuclear power."[97]

7.2.2. Non-Governmental Organizations

70 NGOs have been active participants in the debate about CCS in Poland. They issued, for instance, a significant number of publications dealing with the technology. Many of them are of a purely informational nature, focusing on an honest presentation of the subject rather than on arguing for or against it.[98] Others, however, have taken a particular stance. While some of them do it openly, blatantly forwarding their arguments, others only timidly suggest which option they actually lean towards, approaching the issue in quite a cautious and reserved manner.

71 The Center for International Relation (CSM),[99] an independent think tank focusing on international relations, adopts the latter strategy. In its publications about CCS, which are in fact rather sparse, the Center only seems to inform the reader about CCS, thus avoiding any aggressive attempts of orienting him/her in any direction. It observes that familiarizing Polish people with low-carbon technologies is necessary for having them make an informed choice. Consequently, CSM calls for a broad involvement of the government, relevant industries, scientists and NGOs in the process of educating and cooperating with Polish society for the purpose of establishing whether and how CCS technology can be implemented in Poland (Szerzysko 2010).

72 At the end of the day, however, CSM is not only informing people, but actually does have a choice of preference which it conveys in a subtle way. Its true colors are shown through such rare but very unambiguous statements like, for instance, the one which calls CCS a "huge chance for the Polish energy sector" (Szerzysko 2010).[100]

73 Bellona Polska, a branch of the international ecological organization based in Norway, adopts a similar strategy. It aims at providing the audience with possibly the most complete data about the technology. While it generally presents the subject impartially, it is, nevertheless, not free from some pro-CCS comments. Bellona underlines that CCS "offers the potential to radically reduce CO_2 emissions," and as such "plays an important role as a transition technology." In addition, the organization raises a questionable pro-CCS argument stating that the technology "will help CO_2-intensive economies to comply with climate regulations while *maintaining competitiveness*" (Corless et al. 2011, 6. Emphasis MD).

74 In general, however, Bellona does not attempt to idealize CCS. It appears to be positively attuned towards the technology, yet at the same time conscious of its limitations. The conclusion that "only full use of all available measures – such as switching to renewable energy sources, enhancing energy efficiency, curbing emissions from agriculture and forestry, as well as deploying CCS – will solve the energy and climate challenge," proves that the organization believes in CCS, but also soberly assesses its abilities (Corless et al. 2011, 6).

75 Foundation ClientEarth, while also quite cautious in the language it uses while debating on CCS, has recently expressed its support for the technology by initiating legal action against the Polish government, accusing it of blocking progress of the EU climate policy and not meeting the deadlines for implementing already existing regulations. A complaint to the European Commission was made after a decision of the Polish administrative court, ruling that the investor planning to expand one of the existing coal-fired power plants was not obliged to obtain CCS-ready expertise, due to the fact that the CCS Directive imposing such a duty has not yet been implemented in Polish law.[101]

76 Pointing to the fact that the EU-prescribed time limit for transposition of the Directive to the domestic legal systems of Member States expired a long time ago, ClientEarth decided to seek "justice" through the Commission. In general, the foundation backs the use of the technology, since it believes that without CCS Poland will not be able to meet its long-term emission-reduction goals.[102]

77 In contrast to the above three organizations, demosEUROPA, an EU-oriented think tank based in Warsaw, is by no means reserved in expressing its enthusiasm about CCS. Its publications not only contain a large number of very positive opinions about the technology, but also stress the necessity of its application in Poland.

78 For instance, the report "How to Efficiently Implement CCS in Poland," states that "[d]ue to the fact that more than 90 per cent of electricity in Poland is produced from coal, Poland *will have to use* Carbon Capture and Storage in order to reduce CO_2 emissions until such time when Poland will be able to produce most of its electricity from renewable energy sources" (Hinc 2010a, 25. Emphasis MD). In addition, the publication's author is convinced that "[w]ithout the CCS technology, Poland will not be able to fulfill its obligations to reduce greenhouse gases emissions under the EU's energy and climate package," and therefore in her view "it is *necessary* that the CCS technology becomes reality in Poland *as quickly as possible*" (Hinc 2010a, 5, 25. Emphasis MD).

79 The quoted report also warns that a failure of CCS in Poland "may prove to be very risky in terms of [...] [the country's] energy security and dependence on external energy supplies." As a result, it declares that "it is *extremely important* (not only in the context of Poland's own interest, but also globally) to make an effort and establish Carbon Capture and Storage as *one of the most important Polish flagship projects*" (Hinc 2010a, 32. Emphasis MD).

80 However, apart from foretelling the dreadful consequences awaiting the country in case of its failure to implement the technology, the report also offers an alternative scenario presenting a safe and wealthy Poland, drawing its strength and security from the use of and expertise in CCS. It announces that "Poland has an incredible chance to become a leader of the technology which will be one of the most important elements of the transformation [towards low emissions]." As such, the country "can strengthen its position in a newly shaped global order and thus have more influence on the life of future generations, i.e. increase the living standards of the Polish, European and world-wide community" (Hinc 2010a, 32. Emphasis MD).

81 While other publications of demosEuropa are equally biased towards CCS, their author Agata Hinc, has recently admitted that "as for now, whether in Poland or in Europe, CCS technology is uneconomic, especially as compared to other CO_2 emission reduction solutions."[103] It appears that even the strongest advocate of CCS has abandoned it, being helpless in the face of a brute economic reality. Although Hinc once again repeated that, in her opinion, "CCS is one of the most, if not the most, effective method of emission reductions,"[104] she also acknowledged that "it will not be economically viable until implemented on a commercial-scale."[105]

82 The economic argument is one of the most common objections to CCS. As presented above, even those who see the many positives of the technology are still unable to ignore its costs. Like Hinc, Tomasz Chmal, an energy expert working for the conservative think tank "Sobieski Foundation,"[106] also praises CCS for making coal power more acceptable. At the same time, however, he is also seriously concerned about the fact that such power, once "treated" with CCS, will become much more expensive. Consequently, he does not cheer for CCS. "[I]t is [...] a matter of pure economy," he says, "[t] he main selling point of coal power is the price - and CCS would bring prices up."[107]

83 Another flaw of the technology, often spotted by those skeptical about it, is CCS' dubious environmental value. The Polish Wind Energy Association (PSEW)[108] observes that CCS not only prolongs and increases exploitation of fossil fuels but also constitutes the antithesis of energy efficiency improvement efforts. Consequently, PSEW is strongly convinced that the technology cannot be an alternative to renewable energy. In the organization's view, an effective energy sector with a large share of renewables does not need CCS.[109]

84 Greenpeace goes even further by naming the so-called “clean coal” a “pure lie.” As for CCS itself, the organization criticizes the technology for the fact that it reduces a plant’s efficiency and warns that underground CO_2 storage involves considerable risks. Greenpeace cautions that leakage of even a small percentage of stored CO_2 will be enough to undermine the efforts to prevent further climate change.[110]

85 According to Greenpeace, the “future development [of CCS] has been widely promoted by the coal industry as a justification for the construction of new coal-fired power plants” (Rochon 2008, 5). With regard to that issue, the coordinator of the organization’s climate-energy campaign, Magdalena Zowsik, said that “claiming that new coal-fired power plants should be built because CCS will solve the problem of emissions in the future is as irrational as is intentionally picking up a disease in the hope that medicine will at some point find a cure for it.”[111]

86 Besides, in the organization’s opinion, “[p]roviding the substantial levels of support needed to get CCS off the ground comes at the expense of real solutions” (Rochon 2008, 7). In order to stop climate change, political leaders should, according to Greenpeace, give priority to investments in energy efficiency measures and already tested technologies based on renewables, rather than succumb to illusory promises of CCS technology, which nowadays is still at a nascent stage.[112] Pointing precisely to the fact that "the technology is [yet] largely unproven,” the organization warns that it “will not be ready in time to save the climate” (Rochon 2008, 5).

87 As a result, being strongly against CCS, Greenpeace has taken action and through its Polish website encourages other organizations to sign a (downloadable) petition against the use of the technology in Poland. According to the information contained in the petition itself, it has been originally backed by the following six organizations:[113] Foundation Wild Poland,[114] Foundation Eco-Union,[115] Greenpeace Poland,[116] Association Green Masovia,[117] Zieloni 2004, and the Social Movement We-Citizens of Poznań.[118]

88 While the Center for Sustainable Development (CZR)[119] did not sign the petition, it is a very strong and vocal opponent of utilizing CCS in Poland. It attends meetings and conferences about the technology and actively participates in public consultations concerning its use in particular communities. It also organizes on its own initiative informative sessions about CCS with inhabitants of localities selected for CCS projects (Breukers et al. 2011, 66). During such gatherings, it always loudly and fiercely criticizes the technology, using at times arguments of rather dubious substantive value.[120]

89 The Center argues that CCS’ conformity with the EU 3x20% package is illusory because reducing CO_2 emissions through the use of the technology actually increases the production of CO_2 instead of decreasing it. CZR points to the fact that since CCS lowers plants’ efficiency, more fuel needs to be extracted and burned to produce the same amount of energy; hence the overall production of CO_2 rises.[121]

90 In addition, the Center underscores that, given the fact that EU funds are covering only a fraction of the costs of CCS projects, the burden of financing the investments will be placed on the consumers at the end of the day. CZR estimates that by using CCS, the price of electricity in Poland will rise by about 30%.[122]

91 Furthermore, the organization is not convinced that CO_2 storage is safe. “The fact that fumes injected into saline formations will have the ability to expand from 2.8 m^3 to 1,000 m^3,” the Center warns, “can be compared to storing one anti-tank mine per second over 40 years with the hope that they will never explode.” [123]

92 CZR is also disgruntled by the fact that underground storage of CO_2 in Poland will, in its view, prevent any other use of the lands selected for CCS projects. The Center asserts that those grounds will be qualified as "mining fields," and thus will be deprived of any chance for development, as either farming or forestry will no longer be an option. Besides this, the organization (without good reason) cautions local inhabitants that CCS projects in their neighborhoods may subject them to potential forced relocations.[124]

93 Moreover, the Center claims that contrary to what the Polish National Geological Institute maintains, the areas presently considered for CO_2 storage contain multiple natural resources such as, for instance, drinking water, natural gas, salt deposits and geothermal resources, which will not be available to use once storage projects are carried out. It also suggests, sensing a possible conspiracy, that PIG disseminates such false information purposefully.[125]

94 In general, CZR does not have much confidence in state institutions and authorities. It is concerned about who the actual beneficiary of CCS projects in Poland will be. It claims (without providing any evidence) that funds from the EU are to be given to project developers and that the latter, according to the proposed amendments to the Mining Law, will also become owners of all natural resources occurring in lands encompassed by their concessions. Consequently, the Center fears that all those alleged resources are going to be given to foreign companies.[126]

95 CZR concludes that "having in mind availability of renewable sources of energy in Poland and the possibility of utilizing technologies causing neither increase in energy prices nor serious threat to the environment, CCS in Poland should be abandoned and greater support should be given to solutions objectively better in social, economic, and environmental terms." The Center itself strongly advocates for wind power.[127]

96 To sum up, the majority of NGOs in Poland do not have a good opinion about CCS. With some notable exceptions, they speak about it either disapprovingly or with outright aversion. In addition, it also appears that some of the organizations that initially favored the technology have become disillusioned with it over time. As a result, presently, CCS is very unlikely to obtain any meaningful support from the Polish civil society sector.

7.2.3. Scientists and Experts in the Field

97 Opinions about CCS among scientists and energy experts in Poland are divided. Nevertheless, it seems that the majority of them are against, rather than for, the application of the technology in the country. Yet, despite the fact that this group is probably the most competent to speak about the subject, they have not been very vocal participants in the public debate about CCS in Poland.

98 Dr. Adam Wójcicki from the Polish National Geological Institute is one of those few who publicly support CCS. He explains his stance by pointing out that for the next 20-30 years Polish energy production will, without a doubt, still be based on coal. Therefore, in his view, CCS application in Poland is indispensable, especially given that other options, such as renewable or nuclear power, do not guarantee meeting the short-term emission-reduction goals set by the EU.

99 As the task of meeting those goals will be very challenging for Poland, Wójcicki believes that none of the available technologies, including CCS, should be put aside.[128] Resignation from CCS, he warns, can in effect translate into large fines that the country may have to pay for its excessive emissions of CO_2 in the future. That, in turn, will impact the cost of

domestically produced energy and thus also the competitiveness of Polish plants, potentially forcing Poland to buy energy from abroad.[129]

100 Other outspoken experts, however, are much less enthusiastic about CCS. Professor of Warsaw Technical University, Krzysztof Żmijewski, for instance, like Dr. Wójcicki, also points to the economic dimension of the technology, yet he draws very different conclusions. In his opinion, since the technology doubles the cost of energy production, its application will put into question the very survival of the Polish industry.[130]

101 In general, Zmijewski discerns the paradox of the situation wherein the debate on CCS goes hand in hand with putting pressure on increasing energy efficiency.[131] Besides, he also points to the insufficiency of CCS for Poland's needs. In his view, neither the discussed technology nor nuclear power will allow the country to meet its reduction goals by the 2020 deadline.[132]

102 While Professor Marek Jarosiński, from the Polish National Geological Institute, does not completely reject CCS, he considers it to be "a worst-case strategy."[133] At first, he admits that from the perspective of his field, CCS does not encounter any significant obstacles because "the geological conditions of [CO2] storage [in Poland] are good enough." Soon after, however, he underlines that the real problem with the technology lies elsewhere. In accordance with Professor Żmijewski and many other scientists, experts and politicians, Jarosiński believes that CCS' true Achilles' heel is the economy.[134]

103 Dr. Andrzej Kassenberg, from the Institute for Eco-development,[135] agrees with Professor Jarosiński that the economic dimension of CCS is very problematic. He supports his position by pointing to significant CCS-spurred increases in both investment and operational costs. Interestingly, however, unlike Professor Jarośiński, Kassenberg also doubts whether CO2 storage capacity in Poland is sufficient and environmentally safe.[136]

104 Moreover, that is not where his criticism ends. He also expresses his discontent with the fact that CCS lowers plants' efficiency and thus increases the overall production of CO_2. In addition, since he observes that storage facilities are often far from power-generation units, the transport of CO_2, in his view, presents a serious problem as well.[137]

105 Being generally very skeptical about CCS, Kassenberg regrets that the technology has attracted greater support than renewables have in Poland. He is disappointed, for instance, that the state decided to run two rather than just one demonstration project.[138] According to Kassenberg, the financial means devoted to the second project would be much better utilized if spent on the development of renewable energy in the country.[139]

106 Dr. Bolesław Jankowski, the vice president of the consultancy company Energ-Sys, points in turn to the fact that the use of CCS in the energy sector only makes sense under the assumption that CO_2 is a true cause of climate change. Such a supposition is, however, in Jankowski's view, ever more queried in recent times, especially in the face of the eruption of the so-called "Climategate."[140] Consequently, calling the legitimacy of the current climate policy into question, Jankowski believes that Poland should follow the lead of Australia and suspend its emission-reduction efforts, thus preventing a potential waste of huge amounts of money.[141]

107 Professor Tomasz Żylicz does not doubt that CO_2 contributes to climate change, yet he is also certain that CCS is not a proper solution for preventing it. He is surprised that such an absurdly expensive technology managed to get so much attention from state officers and businessmen alike. In his opinion, CCS does not deserve any interest as it is

completely inefficient at reducing emissions and therefore has nothing to do with combating climate change.[142]

108 Żylicz also attacks people's conviction about CCS. Recalling basic knowledge of chemistry, he calculates that fumes resulting from burning coal are not only much more voluminous but also 3.67 times heavier that the original resource. While it is possible to liquefy them, he continues, they would still remain almost 4 times as heavy as the coal from which they originate. Based on those results, Żylicz argues that contrary to popular belief, CO_2 can neither be easily transported by pipelines or trains, nor injected into mining pits.[143]

109 Żylicz also warns against taking for granted that the, currently high, price of CCS will fall in the future. In his view, such hopes are not based on any rational grounds. While he admits that it happens at times that technologies become cheaper as they mature, he simultaneously underlines that such a relationship is by no means certain or even common.[144]

110 Therefore, according to Żylicz, nothing except either a very high price of carbon or a large-scale program of government subsidies can make CCS economically viable. Yet, while the former is possible in his opinion, it could only happen through an administrative decision that is quite unlikely to be made. At the same time, with the latter being extremely expensive, in the long run it is unfeasible not only for Poland, but even for much richer states.[145]

111 Finally, it is worth mentioning Professor Kozłowski from Cracow University of Technology who, despite not being very active in the Polish debate on CCS, nevertheless managed to make his voice heard. The statement he made was quite remarkable, and unambiguously conveyed his attitude towards the technology. Kozłowski, quoted by the Polish conservative daily "Nasz Dziennik", noted that "developing CO_2 underground sequestration in Poland equals turning Poland into the trash-dump of Europe" (Breukers et al. 2011, 100).

112 Generally speaking, a majority of experts and scientists, who publicly discuss CCS in Poland, believe that the application of such an expensive and untested[146] technology to the coal-dependent Polish energy sector would be, at best, a very considerable challenge, or at worst, a fatal blow to the sector.[147] Yet, judging only from the results of the survey that I carried out among randomly selected Polish scientists, whose area of expertise relates to CCS, the attitude towards the technology appears to be much more evenly split. Due to the very low turnout, however, the results I obtained cannot be treated as being representative.

113 Out of the 6 responses that I received, 3 participants were positive about CCS and its wide-scale implementation in Poland, 1 was quite neutral, and the remaining 2 were skeptical about it. Interestingly, however, all six of them believed that, in the long-term perspective, coal should remain the primary source of energy in Poland.[148]

114 The most commonly mentioned reasons against the implementation of CCS in Poland included the "technology's costs" (4 responses), the "lack of public acceptance" (3 responses), "legal obstacles," and "geological difficulties" (2 responses each). The other, singularly occurring, answers to that question also included: "lack of necessary specialists," "limited interest in the subject of the energy and mining sectors," and "the increased need for fuel resulting from decreased efficiency of power plants."

115 As arguments in favor of CCS' implementation in Poland, the respondents most frequently listed "the necessity of reducing CO_2 emissions" (3 times) and "the large share

of coal in the Polish energy balance" (2 times). Effectively, since both of those answers refer to the very same problem, at the end of the day 5 out of 6 respondents perceived CCS as a useful means of fighting climate change and a potential way of meeting EU environmental goals.[149]

116 Two respondents believed that a wide-scale application of CCS in Poland will be possible in 10 years. While one participant was more optimistic, seeing such a possibility getting realized in 5 to 10 years, one was much more cautious opting for a 20 year horizon. Two respondents did not want to speculate on that issue.

117 With regard to CCS' potential impact on the Polish coal industry, three respondents believed that it would be rather positive. Among the remaining participants, answers varied significantly, ranging from: "in the close future it would have no impact" to "it will lead to its gradual liquidation" to "everything depends on circumstances determined by the political reality."

118 Finally, four respondents took a stance that investments in CCS-related R&D would improve the innovation of the Polish economy. Those who shared that opinion pointed to such potential benefits of developing the technology as, for instance, "the introduction of new techniques of carbon capture and storage," "the creation of new enterprises" and "the promotion of Polish coal abroad."

119 In conclusion, the results of the survey may suggest that the opinion of the Polish academia about CCS is not as one-sided as it appears to be in the media. It is possible that, for some reasons, the opponents of the technology are simply much more vocal than those who support it. Yet, as the number of responses to the survey was very low, any such conclusion is by no means scientifically justifiable and must be classified as pure speculation. What is certain though is the fact that among the publicly voiced experts' opinions about CCS the overwhelming majority is negative.

7.2.4. Energy Companies

120 The results of a 2012 annual survey conducted by PricewaterhouseCoopers (PwC) show that presidents and CEOs of big energy companies from around the world[150] believe that 35% of the energy coming from coal and 21% of energy produced from gas will be generated by plants equipped with CCS by 2030. While respondents admit that the technology has had a difficult start and has been encountering many difficulties ever since, yet they continue to have some faith in it. Keeping in mind that nowadays ever more people and institutions are convinced that the time of CCS has passed, the results of the survey are quite surprising.[151]

121 Interestingly, the two largest Polish energy companies have recently revealed very different attitudes towards the technology. PGE, the biggest energy company in the country, has just abandoned the EU-supported demonstration project in Bełchatów.[152] PGE's vice-president, Wojciech Ostrowski, plainly stated that the technology is not economically viable and therefore the company, like basically everybody else in the world, has decided to give up on large-scale CCS projects.[153]

122 No more than a week after PGE revealed its negative attitude towards CCS, TAURON Polska Energia, the second largest Polish energy company, announced that it will begin scientific research on CO_2 capturing and that its pilot mobile installation will become operational within a month from the date of the statement's release.[154] On April 25th the

installation was actually set in motion in the Łaziska power plant where it currently functions as a part of a 200 MW conventional block.[155]

123 As for the answers received in response to my survey, they were very scarce. Quite expectedly, energy companies were unwilling to reveal their business strategies concerning CCS. Only one of them, ZE PAK,[156] decided to contact me, without, however, providing any useful information.

124 The survey returned was unanswered and the attached message was very vague. The director of one of the company's departments informed me shortly thereafter that the technology has not yet reached the requisite level of commercial viability and therefore no decision concerning its utilization can be presently made. He also instructed me that speculative statements can be made by private individuals under their own names, but cannot be expected from public companies.

125 Consequently, it is difficult to make any strong predictions about the future behavior of Polish energy companies with regard to their interest in CCS. However, it appears that at least some of them may continue to devote their time and money to the research and development of the technology on a relatively small scale. At the same time, however, having in mind the large costs and uncertainties of investing in scaling up the technology, it is highly unlikely that any Polish energy company will try to apply CCS on a commercial-scale in the foreseeable future.

7.2.5. Local Communities

126 For the purpose of this paper, people living or working in the vicinity of CCS projects are also considered stakeholders. It is because their lives and interests are much more likely to be affected by the technology than the lives and interests of the rest of the population.

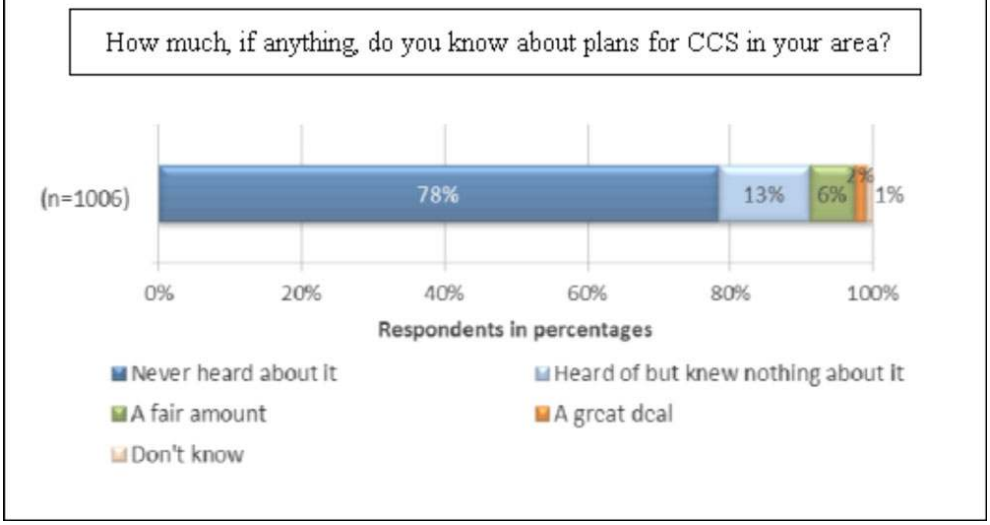
127 Installations may have multiple effects on local people depending on the capacity in which those people act. Every person can have either one or many "identities," each of which can be affected in a different way. For instance, people may have certain interests as neighbors of the installations, and other interests as landowners; some as potential subcontractors for the projects, and others as employees of the facilities; some as local businesspersons, and others as members of the local authorities (Heiskanen et al. 2008, 191).

128 In any case, the stakes are much higher for local people than for those who live further away. Consequently, opinions about CCS technology in general, and its application in specific places in Poland in particular, are to be discussed separately for the former (local communities i.e. stakeholders) and for the latter group (the general public).

129 Operating within the framework of the SiteChar project,[157] the Independent Institute for Environmental Issues, UfU, conducted a research project aimed at exploring attitudes towards CCS among the local population living in the vicinity of the proposed CO_2 storage sites in Załęcze and Żuchlów. The recently publicized results of the project revealed a number of interesting issues.

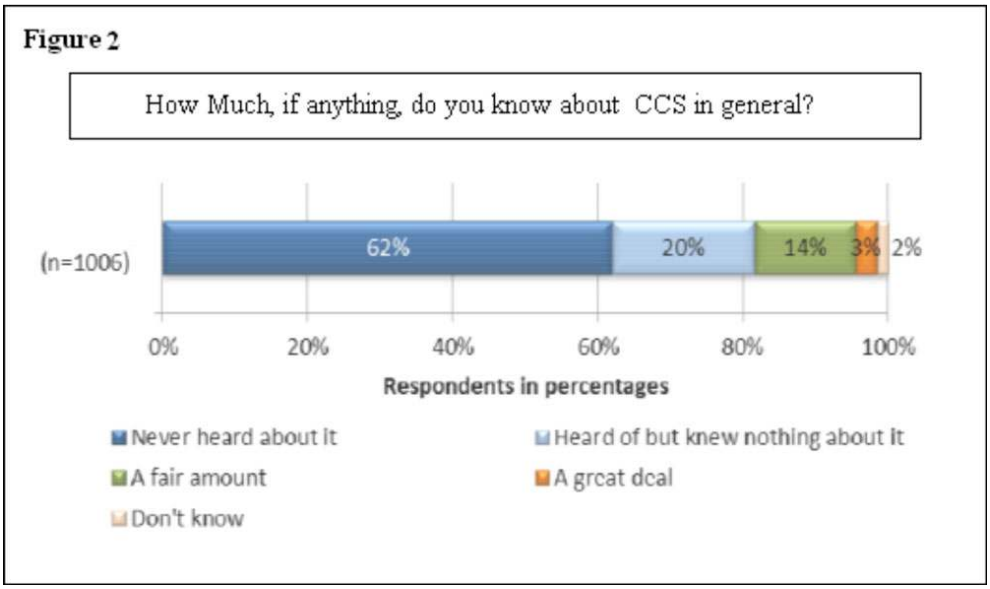
130 First of all, it was observed that the great majority of respondents have virtually no knowledge about both CCS in general, and the plans for its implementation in their neighborhood in particular. Over 80% of the local population questioned by UfU[158] had either never heard about the technology or heard about it but had no knowledge of it. Similarly, almost nobody (less than 10% of respondents) was, in any meaningful way, aware of local plans for CCS (Kaiser 2012, 20). (See Figures 1 & 2.)

Figure 1



Source: (Kaiser 2012, 20)

Figure 2

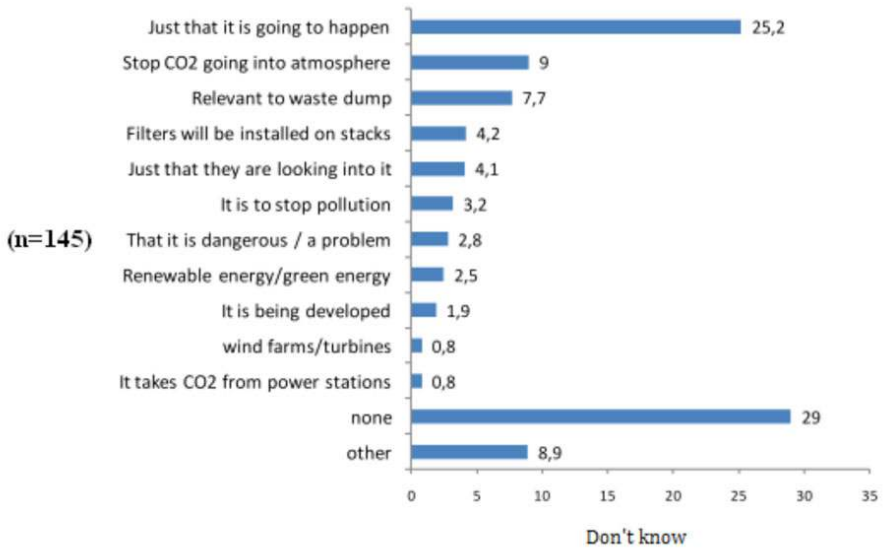


Source: (Kaiser 2012, 20)

131 In addition, as another SiteChar survey indicated, it has to be assumed that at least some of the respondents claiming to have knowledge of local CCS plans are actually likely to be mistaken. In this study, a certain number of people, having declared their awareness of local CCS developments, associated the technology with things that are by no means related to it. Several supposedly informed individuals maintained, for instance, that CCS has something to do with waste dump (8%), while some others linked it with wind farms and wind turbines (1%) (Brunstig et al. 2011, 50). (See Figure 3.)

Figure 3

What people say they have heard about local CCS plans if they have heard about the plans?



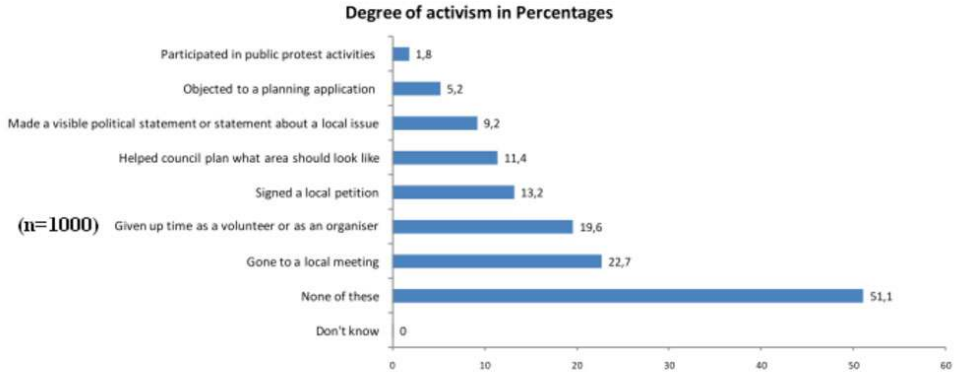
Source: (Brunstig et al. 2011, 51)

132 In general, the conclusions drawn from both studies are very similar. Similarly, like the UfU survey, the second SiteChar study also observed people's low awareness of local CCS plans. According to its findings, only around 15% of respondents (145 out of 1,000) have ever heard about them.

133 Sadly, the latter study also revealed that the majority of respondents do not undertake much effort to educate themselves about local plans or activities. 23% of respondents[159] reported that over the last 12 months they participated in a local meeting, 13% declared signing a local petition, and 11% recalled consulting their council about local plans. At the same time "[o]ver half of the respondents have not taken part in one of the local activities." In general, people participating in the survey tended to base their knowledge about local issues on information provided by local newspapers, district or community websites, flyers and other local media (Brunstig et al. 2011, 26-27, 54). (See Figure 4.)

Figure 4

Activities undertaken by respondents in their local area in the last 12 months

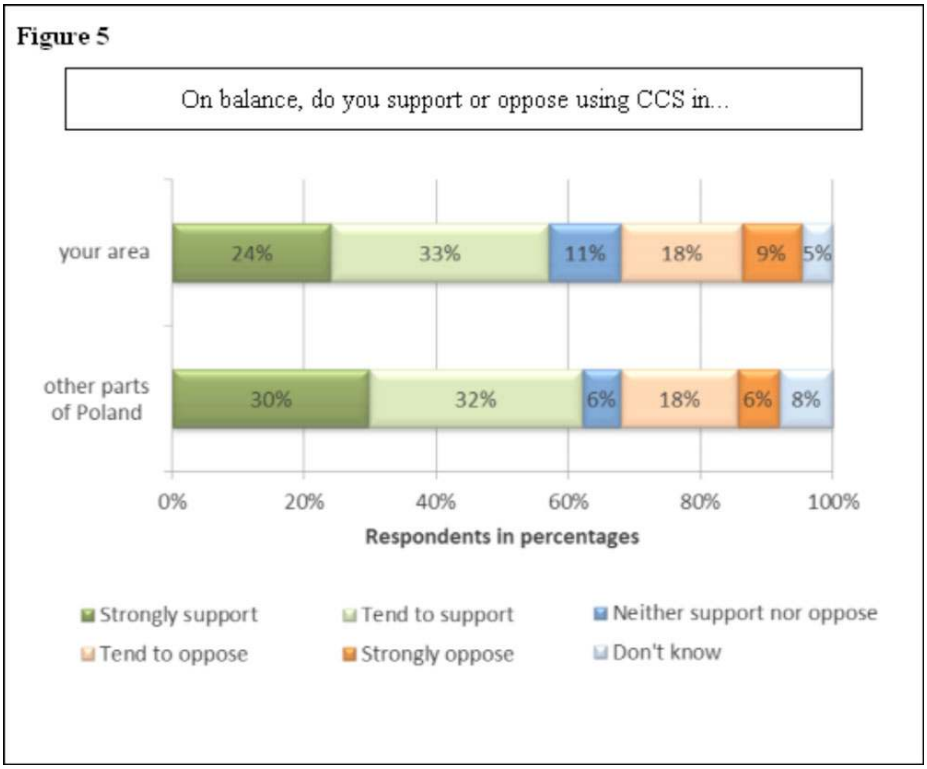


Source: (Brunstig et al. 2011, 55)

134 On the one hand, taking into account people's lack of CCS knowledge, the second SiteChar study's finding that most interviewees "were not able to debate advantages or disadvantages [of the technology] and did not want to commit to either a positive or negative position toward [it]" (Brunstig et al. 2011, 28), is hardly surprising. On the other hand, however, UfU did not signal encountering any such difficulties, and successfully obtained answers to all the questions including those about people's attitude towards CCS. Indeed, the UfU study revealed that 57% of participants supported using CCS in their local areas, and only 9% of them strongly opposed it (Kaiser 2012, 24). (See Figure 5.)

Figure 5

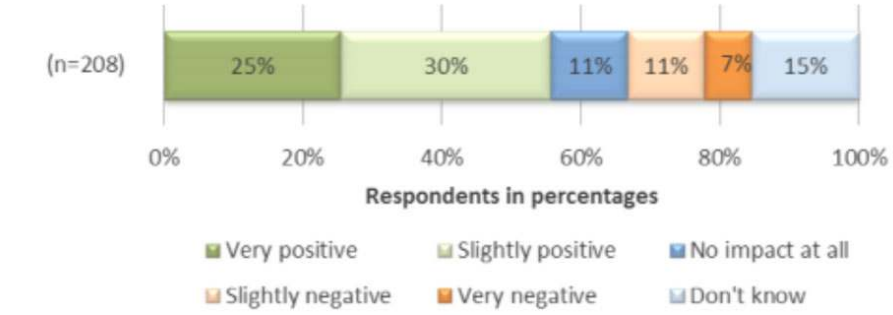
On balance, do you support or oppose using CCS in...



Source: (Kaiser 2012, 24)

135 Moreover, 77% of UfU respondents[160] found local CCS plans personally important. In addition, as much as 55%[161] thought that those plans would have a positive impact on their local area, as compared to only 18% who expected negative (11%) or very negative (7%) consequences (Kaiser 2012, 21-22). (See Figure 6.)

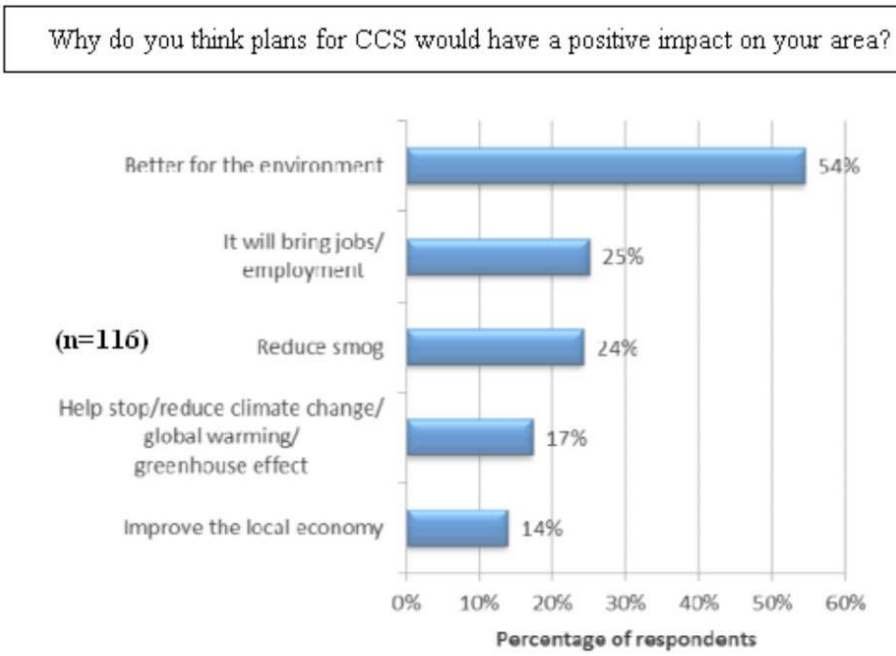
Figure 6



Source: (Kaiser 2012, 21)

136 The majority (54%) of those expecting positive effects believed that CCS would be beneficial for the environment. 25% of them hoped for new employment opportunities in the area, and 14% anticipated improvements in the local economy. (Kaiser 2012, 21-22). (See Figure 7.)

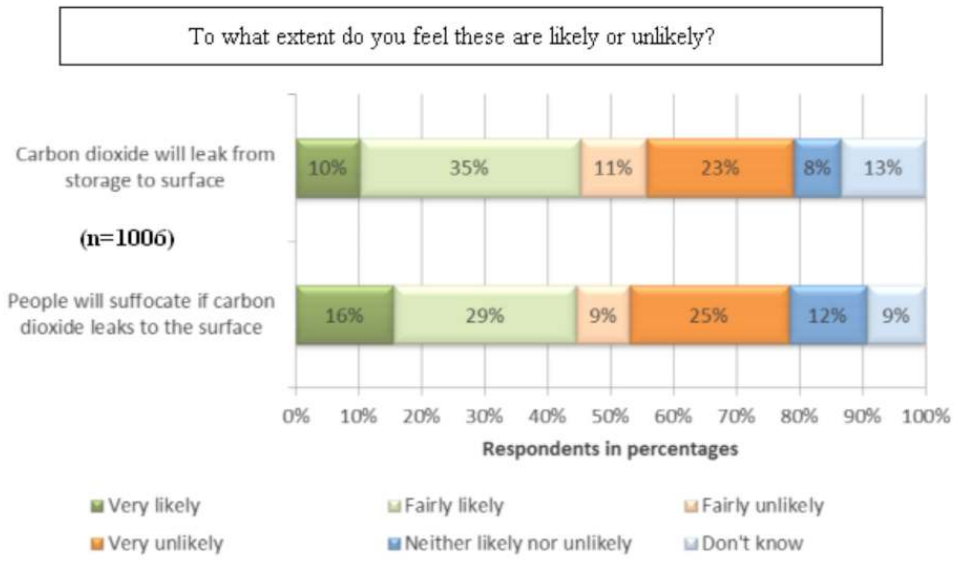
Figure 7



Source: (Kaiser 2012, 13)

137 Simultaneously, however, almost one half (45%) of respondents[162] believed that it is likely that CO_2 will leak from the storage site. In addition, the exact same number was of the opinion that in case of such a dreadful occurrence people will suffocate. Conversely, 34% of respondents found both, the leakage and the fact that people will suffocate if it actually occurs, unlikely (Kaiser 2012, 15, 23). (See Figure 8)

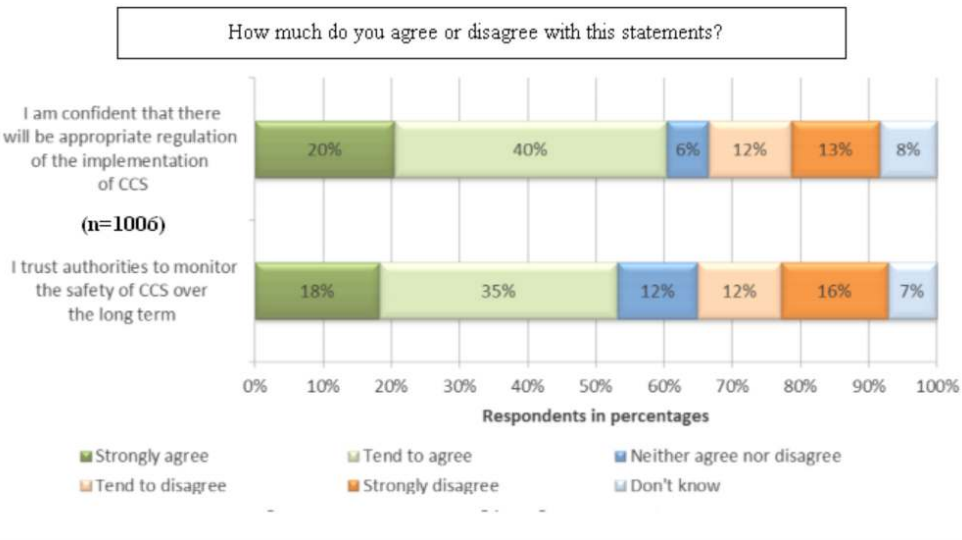
Figure 8



Source: (Kaiser 2012, 15)

138 The above results notwithstanding, 53% of respondents trusted authorities to properly monitor the safety of CCS over the long term. At the same time, the proportion of those who had the opposite opinion was only 24%. In addition, respondents were also convinced that implementation of CCS in Poland will be regulated in an appropriate way. While such a view was held by 60%, only one out of four (25%) disagreed (Kaiser 2012, 27). (See Figure 9.)

Figure 9

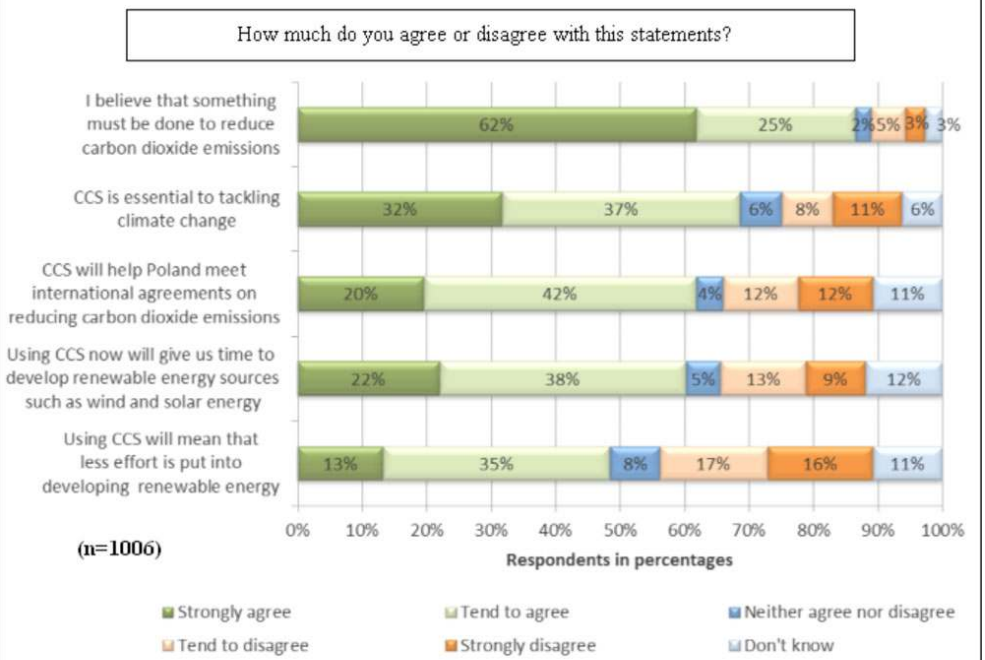


Source: (Kaiser 2012, 27)

139 In general, judging from the above results, it appears that people living in close proximity to the planned CO_2 storage sites in Poland are either quite positive or neutral about CCS.

140 With regards to less locally focused issues, 87% of respondents agreed that it is necessary to address the problem of CO_2 emissions. Moreover, 69% of them found CCS to be an essential tool for tackling climate change. Interestingly, only 19% of respondents disagreed with the latter statement. 60% of respondents believed that CCS will give Poland extra time to develop renewable sources of energy (Kaiser, 2012, 12, 25) (See Figure 10).

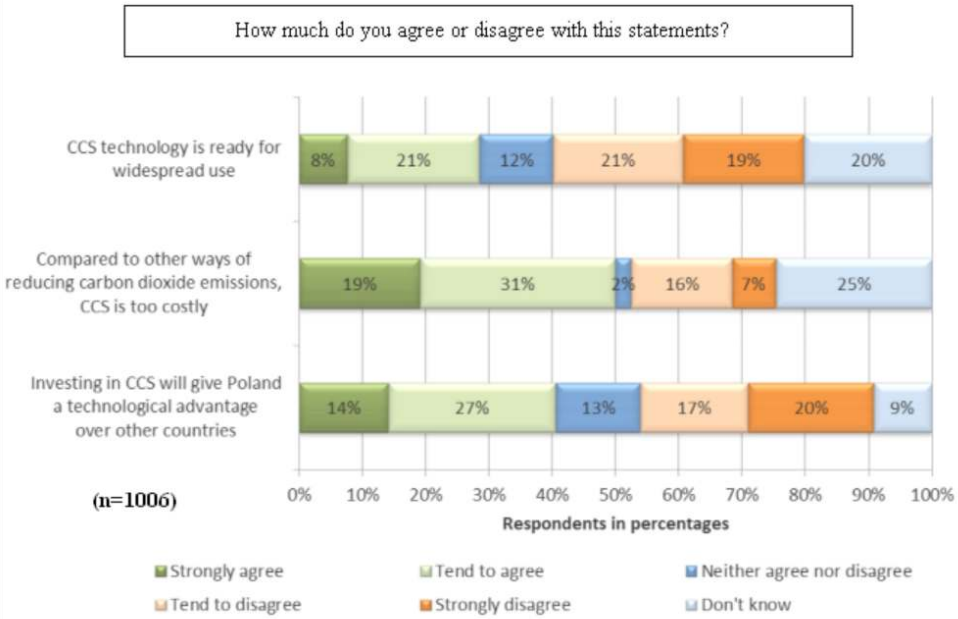
Figure 10



Source: (Kaiser 2012, 25)

141 At the same time, as much as 48% were concerned that the technology will draw attention away from renewable. Half of the respondents identified the technology as being too costly in comparison with other available ways of reducing CO_2 emissions. 23% of respondents found such a statement unjustified and almost the same number (25%) had no opinion about the issue. Furthermore, while 29% of respondents took the stance that CCS is already suitable for widespread use, 40% disagreed (Kaiser, 2012, 25, 26) (See Figure 11).

Figure 11



Source: (Kaiser 2012, 26)

142 In terms of the benefits which Poland can reap from implementing the technology, 62% of respondents pointed to the fact that CCS will help the country meet its international obligations of reducing emissions. In addition, 41% also believed that the technology will give Poland a technological advantage over other countries. Yet, while opposition to the former statement was relatively low (24%), as much as 37% of respondents challenged the latter view (Kaiser, 2012, 12, 26) (See Figures 10 & 11).

143 However, the actual real life experience contradicts those results. In virtually all communities in Poland where CO_2 was planned to be stored, people expressed a strong opposition to the project by either voicing their discontent through local authorities or organizing themselves against the venture.

144 In Pabianice, for instance, in response to the drilling undertaken in nearby Jadwinin, people formed the "Civil Committee Against Storing CO_2"[163] and filed a petition against the project to the Prime Minister and the Minister of the Environment.[164] In addition, "[l]etters were sent to the President of Poland [...] asking if Pabianice could be withdrawn as a location for underground storage, referring to the perceived risks of contamination of the underground geothermal waters, explosion, carbon leakage or contamination of soil with mercury" (Breukers et al. 2011, 66).

145 Besides, out of 179 contracts that the drilling company Geofizyka Toruń concluded with local inhabitants to secure access to their properties, 31 were unilaterally dissolved once people realized what they really agreed to. While the company threatened them with financial fines of about €2 million each,[165] local residents requested termination of the contracts on the basis of misinformation. Moreover, some of them "openly broke their contracts by refusing to allow the company's staff access to their land" (Breukers et al. 2011, 65).

146 Following a very strong public opposition, local authorities from the areas adjacent to the project, lodged an official protest against the venture.[166] While "ten borough leaders from the area around Pabianice signed a petition to the Minister of the Environment against CO_2 storage [in the region]," many "community councils adopted [...] resolution[s] stating that the company should stop its activities in the area, and openly denied the validity of the permit for geological research" (Breukers et al. 2011, 65-66). Despite large EU funds available for the investment,[167] in light of strong public opposition to the project, geological research in the area of Pabianice has been called off (Breukers et al. 2011, 67).

147 A considerable degree of uneasiness about CCS, and the general opposition to implementing the technology in given areas, was also visible in the correspondence received in response to the survey which I sent to the local authorities of communities selected for hosting CCS projects. The council of the borough of Dalików, for instance, informed me that it expressed a resolute protest against storing CO_2 within the borders of the borough. It explained that its opposition was based on multiple grounds.

148 First of all, the council wished to protect the interests of the borough and preserve its chances for future development. Secondly, it sought to protect the environment and the natural resources of the borough. Finally, due to the fact that the underground storage of CO_2 has never been unambiguously proven to be safe, the council also took under consideration broadly understood security matters.

149 In addition, authorities of the county of Poddębice, to which the borough of Dalików belongs, communicated to me that the county is rich in geothermal resources. As such, the development of that region is to be based on the exploitation of said resource rather than on CCS. In general, the authorities of the county announced that they are firmly against the technology.

150 The authorities of the Bedlno borough notified me, in turn, that they did not oppose geological research work there, yet they were quick to underline that this does not mean that the actual storage of CO_2 would be accepted. As, in accordance with what I was told, the residents of the borough are very concerned about the potential negative consequences[168] of such a venture, the chances of obtaining their consent for locating a storage site in the borough would actually be rather low.

151 The other responses that I obtained tended to be very short and rather superficial. Authorities of the county of Rawicz drily stated that their strategic planning documents do not anticipate the future underground storage of CO_2 within the borders of the county. The authorities of the borough of Rawicz responded that, since no CCS projects are currently being developed within their jurisdiction, they do not undertake to comment on the issue. Similarly, the authorities of the borough of Łask were also unwilling to take any stance on either CCS or its local application, pointing to the fact that all relevant works that have ever been performed in the borough were exclusively for research purposes. Finally, authorities of the Moszczennica borough informed me that, due to the fact that their borough was intended to host not a storage site but merely a pipeline and because the whole venture was abandoned in the very early stage, their knowledge about the project was limited and approach to it was neutral.

152 To sum up, it appears that residents of local areas in which CCS projects were planned to be located have much more favorable views about the technology in theory than in practice. While many of them declare their support for CCS installations in their localities and even expect certain benefits deriving from such ventures, they also strongly oppose

any such undertakings once they are about to materialize. It seems therefore that people wish to appear much more tolerant of CCS projects near their homes than they actually are. Consequently, in the context of a potential wide scale implementation of the technology in Poland, massive protests by inhabitants of neighborhoods adjacent to CO_2 storage sites seem to be unavoidable.

7.2.6. General Public

7.2.6.1. Foreword

153 Public opinion of CCS is a crucial factor. People's acceptance or rejection of the technology will determine its future (Desbarats et al. 2010, 4). Yet, the problem is that in order to have an opinion on CCS people have to know about it first. Unfortunately, in the great majority of cases they do not (Heiskanen et al. 2008, 66).

154 "The lack of knowledge about CCS in the general public could be due to the fact that there is relatively little information on CCS that is designed for the public" (Wolff, Chrysostomidis and Perumalpillai 2012, v). In other words, CCS, being a difficult "concept," requires careful explanation, which is lacking at present. As a result, much of what people are being told about the technology by developers and governments, once particular projects are about to start, has to be taken on face value. Yet, people do not easily trust either politicians or big business;[169] nor do they feel at ease with unknown and potentially risky undertakings in their neighborhoods. It is, therefore, hardly surprising that virtually all CCS projects are being met with, at best, public suspicion (Prangnell 2013, 2). "While levels of general awareness on CCS are still low, public opposition is growing in areas in which CCS projects are underway" (Desbarats et al. 2010, 4).

7.2.6.2. Climate Change Awareness in Poland

155 "Unlike other alternative energy options such as wind or solar power, CCS only really makes sense as a technology if we accept the contribution CO_2 makes to global warming" (Reiner, Hauke and Kong 2012, 20). Discerning such a causal relationship requires, however, certain basic knowledge of climate change. As a result, considering "CCS as part of a portfolio of options is likely to depend [not only] on the awareness and perceptions of CCS [...] [but also] upon the perceived urgency and challenge of addressing climate change more broadly" (Anderson et al. 2007, 13). In other words, as several studies of public attitude towards CCS indicate, there are "two contextual conditions for CCS acceptance: climate change should be recognized as a problem, and significant CO_2 reduction as the only solution" (Coninck 2006, 33).

156 In that context, the assessment of the chances which CCS has to win the support of Polish people is quite difficult. It is because the picture of Polish society that emerges from Eurobarometer's survey[170] on CCS in Poland is not clear. On the one hand, only 36% of citizens considered themselves familiar with the causes of climate change, while almost twice as many (61%) admitted that their knowledge about the subject is either not sufficient or non-existent. Similarly, people felt they were not informed (60%) rather than informed (37%) about the consequences of climate change. Finally, 64% of Poles confessed to not knowing enough about ways in which climate change can be fought against, and merely 32% were of the opposite opinion (Eurobarometer 2011, 136-138). (See Figure 12.)

Figure 12

Personally, do you think that you are well informed or not about...

(Figures in percentages) (n=1000)

The different causes of climate change?

	Very well informed	Fairly well informed	Not very well informed	Not at all informed	DK (Don't know)	Total 'Informed'	Total 'Not informed'
PL	3	33	45	16	3	36	61

The different consequences of climate change?

	Very well informed	Fairly well informed	Not very well informed	Not at all informed	DK (Don't know)	Total 'Informed'	Total 'Not informed'
PL	3	34	43	17	3	37	60

Ways in which we can fight climate change?

	Very well informed	Fairly well informed	Not very well informed	Not at all informed	DK (Don't know)	Total 'Informed'	Total 'Not informed'
PL	3	29	46	18	4	32	64

Source: (Eurobarometer 2011, 136-138)

157 On the other hand, however, as much as 75% of Poles correctly identified CO_2 as carbon dioxide. An equally high percent of respondents (75%) was also right to characterize CO_2 as being unhealthy. Only when questioned about the biggest global source of CO_2 were Poles often mistaken, placing industry[171] ahead of electricity and heat generation.[172] In contrast, however, when asked about CO_2's impact on climate change, 84% of Poles answered accurately again, stating that it is high (Eurobarometer 2011, 14, 147, 150-151). (See Figures 13 and 13A.)

Figure 13

(Figures in percentages) (n=1000)

What do you think CO2 is? (OPEN QUESTION)

	Carbon monoxide	Carbon dioxide	Greenhouse gas	A gas	A chemical	Water	Carbon
PL	8	75	1	2	1	0	0

Ozone	Methane	Something to do with climate change but you don't know what	Other	DK (Don't know)
0	0	2	1	10

Which of the following statements do you think apply to carbon dioxide (CO2)? (MULTIPLE ANSWERS POSSIBLE) %

	It is flammable	It is safe to breathe	It is unhealthy	It is harmless	It is explosive	It is a water pollutant
PL	8	5	75	7	11	11

Other (SPONTANEOUS)	DK (Don't know)	Only positive statements	Only negative statements
1	8	6	78

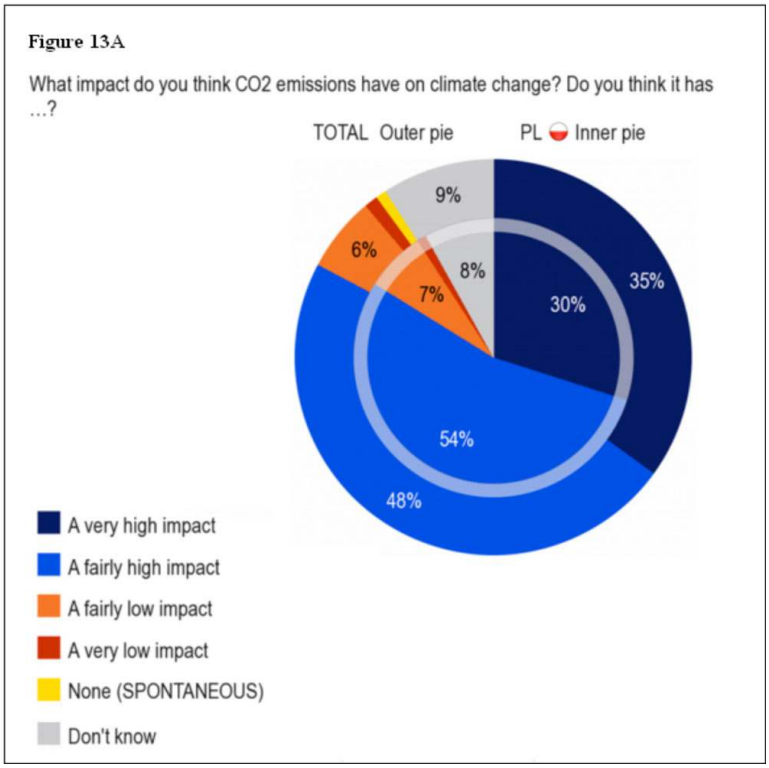
In your opinion, which of the following produces the most carbon dioxide (CO2) globally? %

	Power plants that burn fossil fuels	Agriculture	Factories	Passenger or freight transport	Heating our homes	DK (Don't know)
PL	30	3	35	14	10	8

What impact do you think CO2 emissions have on climate change? Do you think it has ...? %

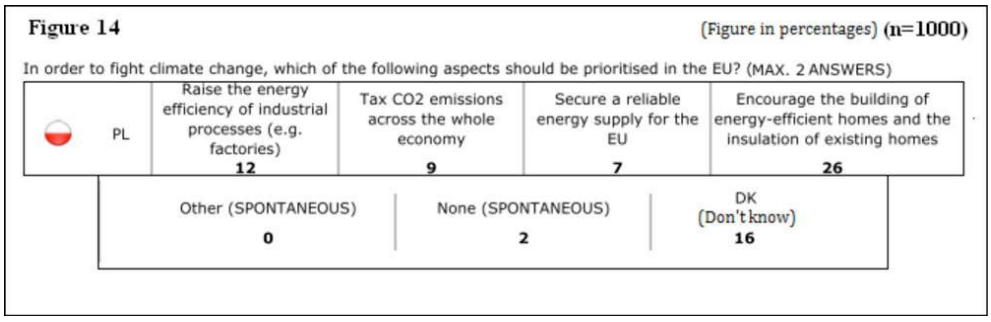
	A very high impact	A fairly high impact	A fairly low impact	A very low impact	None (SPONTA-NEOUS)	DK (Don't know)	Total 'High impact'	Total 'Low impact'
PL	30	54	7	1	0	8	84	8

Source: (Eurobarometer 2011, 144, 147, 150-151)



Source: (Eurobarometer 2011a, 1)

158 When asked about measures that the EU should undertake to fight climate change, 32% of respondents answered that it should reduce CO_2 emissions from electricity generation, and 9% suggested taxing CO_2 emissions across the whole economy.[173] Interestingly, the former answer was also the most common one, beating the second most popular response, "encourage the building of energy-efficient homes and the insulation of existing homes," by 6 percentage points (Eurobarometer 2011, 142). (See Figure 14.)



Source: (Eurobarometer 2011, 141)

159 Moreover, 42% of Poles confirmed hearing about "clean coal." In addition, 59% of the population agreed that "the storage of CO_2 will help to combat climate change."[174] While 29% of people did not feel competent to take a stance on that statement, only 19% opposed it (Eurobarometer 2011, 159, 181). (See Figure 15.)

Figure 15 (Figures in percentages) (n=1000)

Please tell me whether you totally agree, tend to agree, tend to disagree or totally disagree with each of the following statements.

The storage of CO2 will help to combat climate change

	Totally agree	Tend to agree	Tend to disagree	Totally disagree	DK (Don't know)	Total 'Agree'	Total 'Disagree'
PL	14	45	9	3	29	59	12

In the context of energy production, which, if any, of the following have you heard of? (MULTIPLE ANSWERS POSSIBLE)

	Nuclear fusion	Combined heat and power (cogeneration)	Hydrogen energy (H2) and fuel cells	Biogas	Geothermal energy	Ocean energy (tidal/ wave/ marine currents)
PL	31	7	21	49	42	21

	Algae biofuels	Solar photovoltaic energy	Nuclear fission	Clean Coal	Ground source heat pumps	None (SPONTA-NEOUS)	DK (Don't know)
	24	28	25	42	28	10	10

Source: (Eurobarometer 2011, 158, 181)

160 Quite surprisingly, only 50% of respondents were aware that over half of the electricity produced in Poland comes from coal. The rest either did not know what to answer or opted for a smaller share. When asked about the attitude towards coal as a source of energy in the country, 68% of participants favored it and only 26% were against it (Eurobarometer 2011, 152, 164). Although in comparison to other sources of energy, the score in favor of coal was the second worst,[175] yet coal was still perceived positively by over two-thirds of the society. (See Figure 16.)

Figure 16 (Figures in percentages) (n=1000)

According to you, what proportion of total electricity produced in (OUR COUNTRY) currently comes from coal?

	0%.	Between 1 and 10%	Between 11 and 20%	Between 21 and 30%	Between 31 and 50%	More than 50%	DK (Don't know)
PL	0	2	4	8	14	50	22

To what extent are you in favour of or opposed to the use of the following sources of energy in (OUR COUNTRY)?

	Strongly in favour	Fairly in favour	Fairly opposed	Strongly opposed	DK (Don't know)	Total 'In favour'	Total 'Opposed'
PL	16	52	22	4	6	68	26

Source: (Eurobarometer 2011, 152, 160)

161 To conclude, while Polish people do not consider themselves well informed about the causes and consequences of climate change, and claim not to know how to fight against it, they seem quite aware of CO_2 and its contribution to the greenhouse effect. They recognize the necessity of reducing CO_2 emissions and are familiar with "clean coal" technologies. Most importantly, however, Poles perceive CO_2 storage as a useful means of combating climate change and are positively attuned towards coal as an energy source. Consequently, especially keeping in mind the last two findings, CCS should presumably be well received by the Polish general public. Yet, that is not exactly the case.[176]

7.2.6.3. Awareness of CCS in Poland

162 Poles cannot be positive about CCS because, as Eurobarometer's data shows, they are basically not aware of it. Only 7% of respondents heard about the technology and

maintained that they know what it is. 11% admitted to having heard about it, but were not aware of what it really is, and as much as 77% confessed to never having heard of CCS (Eurobarometer 2011, 156). (See Figures 17 and 17A.)

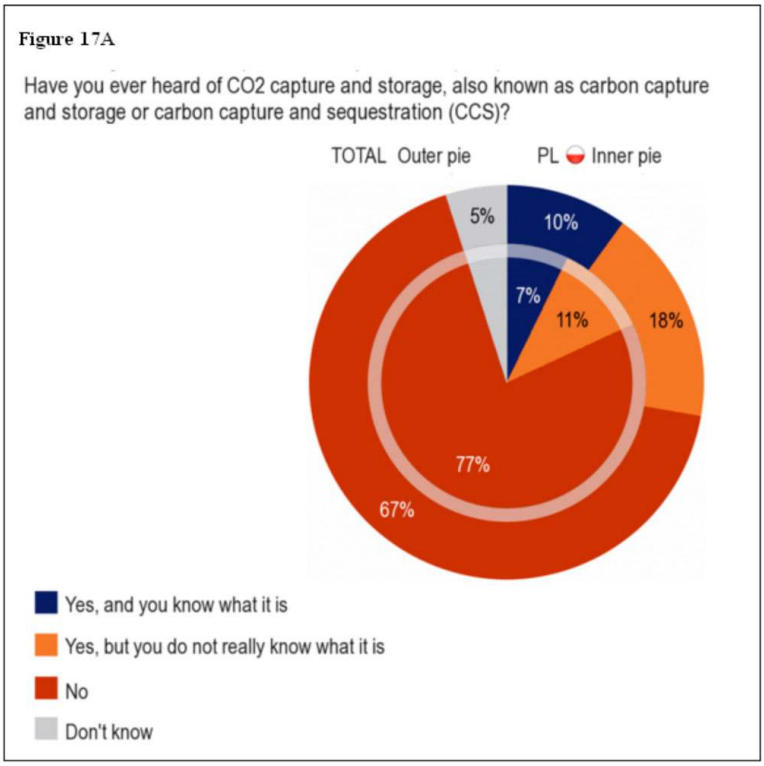
Figure 17 (Figures in percentages) (n=1000)

Have you ever heard of CO2 capture and storage, also known as carbon capture and storage or carbon capture and sequestration (CCS)?

	Yes, and you know what it is	Yes, but you do not really know what it is	No	DK (Don't know)	Total 'Yes'
PL	7	11	77	5	18

Source Source: (Eurobarometer 2011, 156)

Figure 17A



Source: (Eurobarometer 2011a, 1)

163 The awareness about CCS projects in the country is even lower. According to Eurobarometer, a stunning 90% of society has never heard about any such ventures, as compared to only 8% who maintain that they have at least some knowledge about them (Eurobarometer 2011, 157). (See Figure 18.)

Figure 18 (Figure in percentages) (n=1000)

Have you ever heard of (CCS PROJECT)?

	Yes	No	DK (Don't know)
PL	8	90	2

Source: (Eurobarometer 2011, 157)

164 Since Eurobarometer conducted its survey in 12 EU Member States, it was able to discern certain similarities and differences between them. Interestingly, it observed that, only in

Poland, Spain and Germany, the proportion of people who have heard about CCS projects was much higher in the regions where those projects were located than in the other regions of those countries (Eurobarometer 2011, 77).

165 The same conclusion can be drawn by comparing Eurobarometer's findings with the results of another survey on CCS in Poland conducted by NearCO2. Since, in the latter study, contrary to the Eurobarometer survey which was nationally representative, "respondents were intentionally selected so that half of them came from the region in the vicinity of one of the [...] CCS projects" (Reiner, Hauke and Kong 2012, 57), the measured level of people's awareness of the technology was much higher.[177]

166 Yet, even among such "non-representative" and "better-than-average informed" groups of people, such as those questioned by NearCO2, as many as 29% of those who claimed to know "quite a bit" about CCS responded negatively to the statement that the technology is supposed to deal with global warming and climate change (Reiner, Hauke and Kong 2012, 180). In this context, the obtained result of 58% of people (supposedly) aware of CCS is much less impressive.

167 Similarly, in the Eurobarometer study certain answers, besides of course those in which respondents directly admit to not knowing about CCS, also clearly suggest that people have a vague idea of what CCS really is. For instance, 37% of Polish respondents agreed with the plainly incorrect statement that "carbon capture and storage would ensure lower and more stable energy prices." Only 23% of participants disagreed and as many as 40% of them simply did not know how to answer the question (Eurobarometer 2011, 184). (See Figure 19.)

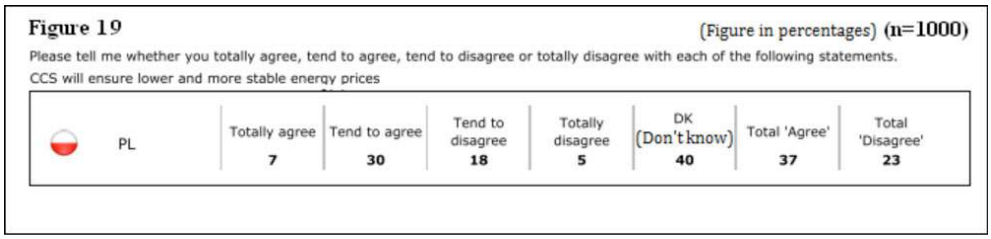


Figure 19 (Figure in percentages) (n=1000)

Please tell me whether you totally agree, tend to agree, tend to disagree or totally disagree with each of the following statements.

CCS will ensure lower and more stable energy prices

	Totally agree	Tend to agree	Tend to disagree	Totally disagree	DK (Don't know)	Total 'Agree'	Total 'Disagree'
PL	7	30	18	5	40	37	23

Source: (Eurobarometer 2011, 184)

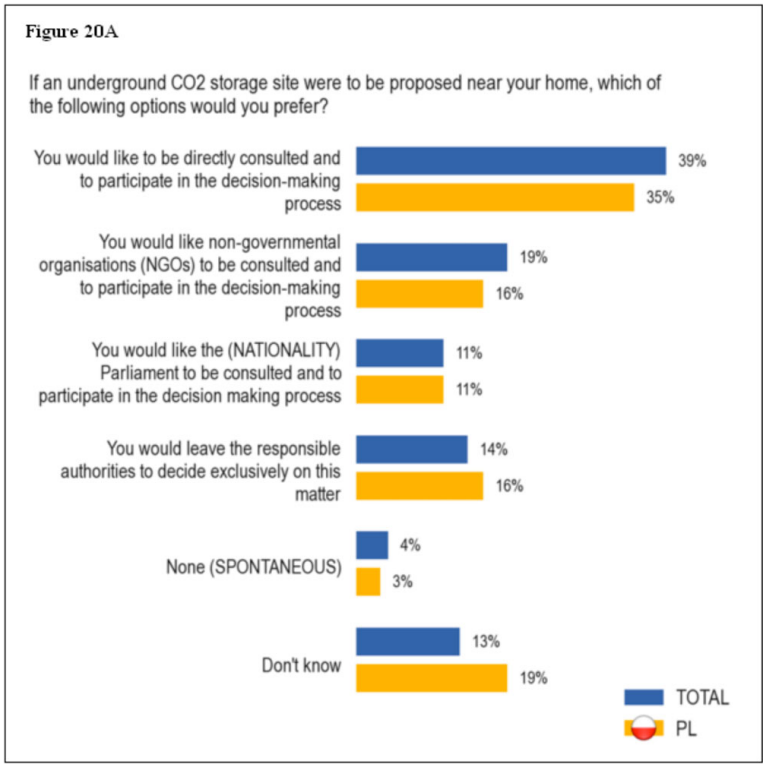
168 Nevertheless, despite having insufficient knowledge, as many as 35% of Poles would like to be directly consulted and participate in the decision-making process if an underground CO_2 storage site was to be proposed near their homes. At the same time, the majority of them do virtually nothing to educate themselves about CCS, thus remaining completely incapable of making any informed decisions with regards to the matter.[178] For 19% of citizens, however, complete ignorance does not constitute a problem because they do not even know whether they would like to participate in the decision-making process concerning CCS projects in their own neighborhood or not (Eurobarometer 2011, 176). (See Figures 20 and 20A.)

Figure 20 (Figure in percentages) (n=1000)

If an underground CO2 storage site were to be proposed near your home, which of the following options would you prefer?

	You would like to be directly consulted and to participate in the decision-making process	You would like non-governmental organisations (NGOs) to be consulted and to participate in the decision-making process	You would like the (NATIONALITY) Parliament to be consulted and to participate in the decision making	You would leave the responsible authorities to decide exclusively on this matter	None (SPONTA-NEOUS)	DK (Don't know)
PL	35	16	11	16	3	19

Source: (Eurobarometer 2011, 176)



Source: (Eurobarometer 2011a, 2)

169 To sum up, Polish people's awareness of CCS, in general, and CCS projects in Poland, in particular, is very scant. Even if some Poles consider themselves informed about the technology, in reality they are most often not. There are still many misconceptions about CCS among Polish people as well as many false hopes[179] that will never materialize. In general, in terms of Poles' knowledge of CCS, there is a lot of room for improvement.

7.2.6.4. CCS Communication in Poland

170 Regardless of whether it is due to people's lack of knowledge, or despite it, the EU requires Member States to communicate with their citizens about CCS projects undertaken in their territories. Article 26 of the CCS Directive states that "Member States shall make available to the public environmental information relating to the geological storage of CO_2 in accordance with the applicable Community legislation" (CCS Directive 2009, art 26).

171 Additionally, the Environment Impact Assessment Directive[180] and the Industrial Emissions Directive[181] "set out applicable information-sharing and stakeholder

engagement requirements." As IEA observes, in its 2012 CCS Legal and Regulatory Review, while "[t]he former requires any request for development consent, as well as relevant information to be available so that stakeholders are afforded the possibility of expressing an opinion before consent is granted," the latter "requires member states to ensure early and effective opportunities for stakeholder participation in relevant permitting procedures, and disclosure of specified information to the public" (IEA 2012, 16).

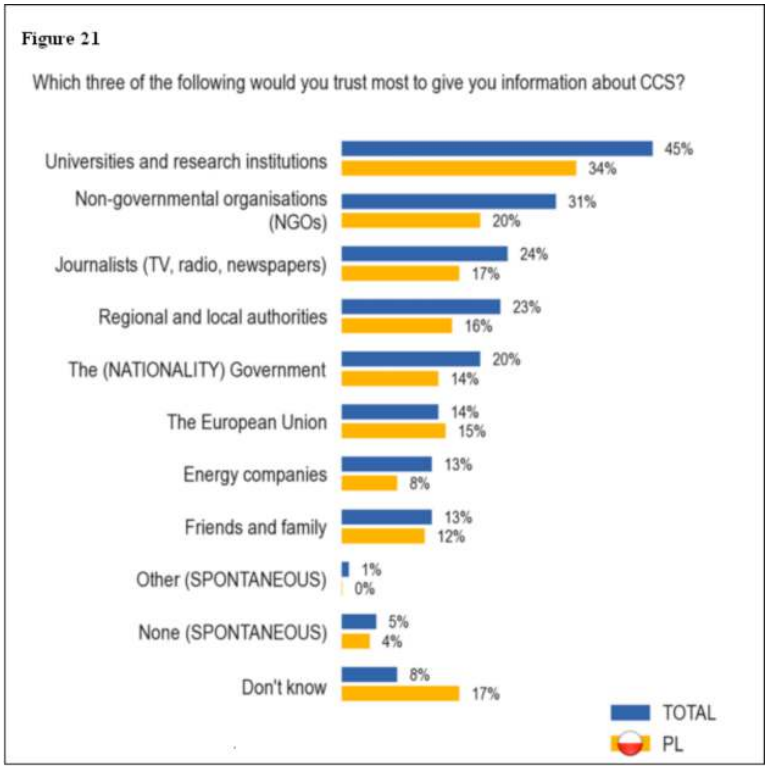
172 Legal requirements notwithstanding, communicating with the public is simply in governments' and project developers' best interest. Through interaction, people can be familiarized with the technology, educated about its consequences, and reassured about its safety. Since some studies indicate that "public acceptability of CCS increases as a greater understanding is developed" (Logan et al. 2007, 3), the value of effective communication with people can hardly be overestimated.[182]

7.2.6.4.1 Trust

173 As certain researches have revealed, "the identity of the messenger is as important as the message itself" (Anderson et al. 2007, 13). It determines, to a large extent, whether people perceive given information as being valid or not. "With complex technologies and high stakes, when people are not able to assess all information on its validity, they need to rely on the trust they have in the source" (Breukers et al. 2011, 16).

174 In general, people tend to place their trust in those who do not appear to have any vested interests in a given issue (Anderson et al. 2007, 13). Therefore information about CCS coming from either the government or project developers is not likely to be well received. Furthermore, some recent findings indicate that "information which is devised by stakeholders with diverging stakes is considered 'better information' compared to information provided by a single stakeholder" (Breukers et al. 2011, 16). Finally, it was also observed that people tend to have more trust in those sources of information whose values they share (Prangnell 2013, 7).

175 In practice, while given a list of different sources of information about CCS and asked to select three that are most trustworthy, Polish people most frequently pointed to universities and research institutions (34%), NGOs (20%), and journalists (17%). Energy companies were mentioned by only 8% of respondents, while the government by 14% (Eurobarometer 2011, 177). (See Figure 21.)



Source: (Eurobarometer 2011a, 4)

176 The survey by NearCO2, which encompasses answers from not only the general public but also stakeholders,[183] approached that issue differently. Instead of asking respondents to select the three most trustworthy sources of information, NearCO2 asked respondents about their opinion about each of them. The results revealed that "university scientists/ scientific publications" were found trustworthy by 73% of participants, interactive websites by 67%, NGOs by 53%, the European Union by 50%, local media by 38%, national media by 37%, local governments by 35%, national government by 33%, and the developers and energy companies by only 24% of respondents (Reiner, Hauke and Kong 2012, 66).

177 Regardless of some differences between the two above-presented surveys, they both clearly indicate that Polish people do not perceive either the government or energy companies as constituting trustworthy sources of information about CCS. That observation is of significant importance, especially in light of fact that, up until recently, those two actors were attuned positively towards the technology and were attempting to "sell" it to the public. In such a context, it is hardly surprising that CCS, lacking any other strong supporters in the country, has not managed to win the hearts and minds of the Polish people.

7.2.6.4.2 Sources of information about CCS in Poland

178 As Eurobarometer did not ask people which source they use most frequently to obtain information about CCS, all the data that is referred to in this section comes from the NearCO2 study. Therefore, it is important to remember that said study includes responses of not only the general public but also of people who live in close proximity to CCS projects, which for the purpose of this paper are categorized as stakeholders.[184] Consequently, since respondents residing nearby the proposed CO_2 storage sites are, for

instance, much more likely to search for information about CCS in the local media than the rest of the population would, the presented results are not likely to be nationally representative. However, it is probably safe to say that they convey the general trends characteristic of the whole country reasonably well.

179 Judging from the discussed results, Polish people's confidence in a certain source of information and the popularity of that source among them, do not necessarily go hand in hand. While Poles mostly trust science and research institutions,[185] they have an equal, if not greater, tendency to look for information about CCS on the internet.

180 As many as 78% of respondents answered that interactive websites are a source of information they would *likely* use in order to learn about the technology. 59% of respondents declared their willingness to turn to scientific publications or university scientists. 51% of Polish people stated they would follow national media. Regional media scored only 3 percentage points lower than their national counterpart (48%). Conversely, while local government is a likely source of information for 45% of people, the national one was mentioned as a potential source of information about CCS by only 35% of respondents. NGOs scored 44% and 42% for national/international and local organizations respectively. The European Union was selected by 42% of respondents, and only 27% of participants considered turning directly to the project developers and energy companies for relevant information (Reiner, Hauke and Kong 2012, 63). (See Figure 22.)

Figure 22

Public respondents' likely source of information regarding CCS in Poland

National/international NGOs	44%
Local NGOs/community groups, residents' associations etc.	42%
Friends, neighbours, family	36%
National media	51%
Local/regional media	48%
National government	35%
Local/regional government	45%
Interactive websites	78%
University scientists/scientific publications	59%
The developers, energy companies etc.	27%
European Union	42%

(n=535)

Source: (Reiner, Hauke and Kong 2012, 63)

7.2.6.4.3 Forms of communication in Poland

181 People's choice, from among the different sources of information, depends to a large extent on the availability of said sources. On the one hand, those who, for instance, do not have an internet connection at home can still go and search the web from other places. On the other hand, however, those who would like to participate in a scientific

conference on CCS or in a local informational meeting about the proposed CCS project cannot do so if such events are not being organized. Similarly, people are unable to go and ask energy companies' representatives about their CCS plans and undertakings if the opportunity to do so is not offered to them.

182 In Poland the last problem does not exist, as energy companies are truly active in attempting to reach, inform and win over the people. It is actually safe to say that "entrepreneurs planning to develop CCS demonstration projects play the main role in communication with the public" (IEA 2012, 52).

183 From the very beginning of the Bełchatów project, for instance, PGE tried to familiarize people with both the undertaking itself and with CCS technology in general. It produced brochures and leaflets dedicated to the subject, posted relevant data on its website and organized a number of meetings in the form of either scientific conferences or consultative sessions in the vicinity of the chosen storage site (Reiner, Hauke and Kong 2012, 50).[186] The above-mentioned sessions were designed to facilitate dialogue with local people and tended to offer them an opportunity to meet with upper echelon company representatives, Members of Parliament, representatives of the Ministry of Economy, independent scientific experts, as well as local and regional authorities.[187]

184 Apart from PGE, authorities and politicians from communities neighboring the Bełchatów project also took initiatives to organize meetings with local residents (Reiner, Hauke and Kong 2012, 51). In addition, having a less localized focus, the national government "has undertaken a series of seminars, meetings and conferences for a broad range of stakeholders to provide [general] information about CCS" (IEA 2012, 11-12).

185 Furthermore, issues of public acceptance were also encompassed by the scope of the MoE's "National Program Assessment of Formations and Structures for Safe CO_2 Geological Storage" project. Consequently, within the framework of the MoE's project, "several seminars, meetings and conferences for public, local authorities, schools and media [were organized], to inform about CCS technologies, answer questions and clarify doubts about the safety of CO_2 storage processes" (IEA 2012, 52).

186 NGOs also engaged with the CCS debate in a proactive way. Not only have they been voicing their opinions about the technology but they have also been issuing documents concerning CCS and organizing events aimed at informing the public about the consequences of its use. For instance, in 2012, a civic conference, under the auspices of the SiteChar project, was organized to familiarize the inhabitants of Bełchatów-surrounding communities with CCS.[188] Furthermore, the Polish Confederation of Private Employers, "Lewiatan," prepared a report about the effectiveness of CCS as a means of fighting climate change, which was intended to spark a debate about the prospects of developing the technology in the country.[189] Similarly, Bellona Polska published a CCS road map for Poland, titled "Insuring Energy Independence," in which it approaches the issue of large-scale implementation of the technology in Poland very thoroughly (Corless et al. 2011, 22). DemosEUROPA, in turn, not only released a number of publications treating the subject of CCS in the country, but also organized a symposium wholly devoted to discussing the matter.[190]

187 Interestingly, even the private business sector demonstrated a certain degree of activity in the discussed field. The web portal "Elektroonline.pl" and a consulting company "SC Consulting" organized, for example, a conference on "implementing CCS technology in an enterprise."[191] Furthermore, some educational and scientific institutions also assumed a

fraction of responsibility for informing the public about the technology by offering a number of freely available lectures, symposia and debates about CCS. The 2010 open house of CCS at the Polish National Geological Institute constitutes a model example of such events.[192]

7.2.6.4.4 Media in Poland

188 In the modern world the media plays an extremely important role regardless of the context. CCS is not an exception. As previously discussed, as many as 78% of Poles selected "internet" as a likely source of information about CCS. In addition, 51% and 48% of respondents declared that they would turn to national and local media outlets, respectively, in order to educate themselves about the technology.

189 Consequently, the way the media portrays the technology is likely to have a strong influence on people's perception of it. "[H]ow the media uses language, chooses to stress one set of concerns over another, and chooses sources of information characterizing CCS, are important in shaping public attitudes" (Logan et al. 2007, 3). It is especially true, keeping in mind that the public's own knowledge of CCS is very limited.

190 Since CCS application carries certain risks, the media's portrayal of the technology can either attenuate or amplify these. As observed in numerous researches, the media has "a significant impact on how the public conversation about public risk issues is shaped" (Reiner, Hauke and Kong 2012, 20). Yet, to date, "little interest in the issue [of CCS] has been exhibited by the mass media in most countries" (Wolff, Chrysostomidis and Perumalpillai 2012, v), including Poland. Even a few years back, when the technology was in its heyday, CCS was still not attracting much journalistic attention. In addition, there are also no good reasons to expect any spectacular change in the attitude of the Polish media towards the technology in the near future.

191 As a part of the SiteChar project, the two most opinion-forming national dailies in Poland, Gazeta Wyborcza and Rzeczpospolita, were analyzed in terms of their coverage of CCS. Only 148 articles referring to the technology were found, and, based on more in-depth verification, 87 of them were selected for further analysis (Brunstig et al. 2011, 31).

192 It was established that most articles on CCS were written in 2008 and 2009. In 2008, subjects related to climate change, such as CCS, were especially popular in Poland for two reasons: the recent adoption of the EU Climate and Energy Package, and the upcoming UN Climate Change Conference in Poznań. In 2009, in turn, CCS managed to catch the attention of the Polish media mostly due to planned CCS demonstration projects in Bełchatów and Kędzierzyn-Koźle (Brunstig et al. 2011, 31).

193 The 87 selected articles contained 127 separate speaker statements given in 4 different contexts: news, reports, comments or interviews. 49 (39%) of those statements originated from the press, 28 (22%) came from representatives of the political system, 22 (17%) from representatives of the industry, 21 (16.5%) from the education and research sector and 7 (5.5%) from the civil society sector (Brunstig et al. 2011, 33).

194 Almost one half of the statements (59 out of 127, or 47%) expressed unambiguous consent to CCS. An additional 7 (6%) gave conditional consent, "meaning that CCS would be approved only if certain conditions are fulfilled, such as reduction of costs, investigation of positive or negative impacts on the environment or the adoption of a legal basis for the use of the CCS technology." 17 (13%) statements expressed outright objection to the

technology, 31 (24%) of them did not adopt an unambiguous position and 13 (10%) were indifferent (Brunstig et al. 2011, 33-34).

195 The largest number of consenting statements came from representatives of the political system (21), industry (16), the education and research sector (11), and the press (11). Consent was expressed by as many as 75% of the statements originating from the political system. In the industry sector, the proportion of consent was 73%, in the education and research sector 52%, and in the press a mere 22% (Brunstig et al. 2011, 35).

196 Interestingly, all 7 (100%) statements made by representatives of civil society were against the technology. In contrast, none of the statements (0%) made by the industry representatives objected to CCS. As for other sectors, CCS was rejected by 6 (29%) statements coming from educational and research representatives, 2 (7%) statements originating from the political sector, and in 2 (4%) statements made by individuals from the press (Brunstig et al. 2011, 35).

197 The articles were also analyzed for particular arguments indicating approval or rejection of CCS technology. 298 different arguments were counted. Representatives of the press made 103 of them (35%), members of the political system made 67 (22%), those of the education and research sector made 64 (21%), while industry provided 41 (14%), and civil society offered only 23 (8%) of the arguments (Brunstig et al. 2011, 37).

198 172 (58%) of the arguments were positive, and 126 (42%) of them were negative. Not surprisingly, after clustering them into 8 different topic fields, it was observed that most arguments came from the fields of economy/profitability (72, or 24%), climate protection (52, or 17%) and safety/risks (51, or 17%). Only 13% (39) of the arguments referred to CCS' feasibility, and a mere 10% (31) pointed to the technology's significance for Poland (Brunstig et al. 2011, 35, 37).

199 The statement that CCS is a climate friendly technology was the single most frequently raised argument (49 times, i.e. 16%), followed by the reflection that it is very costly (28, i.e. 9%). 20 statements (7%) argued that, thanks to CCS, coal can be used cleanly, and 14 (5%) pointed to the fact that the technology prolongs the use of the latter (Brunstig et al. 2011, 37).

200 Arguments from the economic/profitability (72) and climate protection (52) categories were raised most frequently by the press,[193] whose representatives made 40% (i.e. 29) and 48% (i.e. 25) of said arguments respectively. Arguments from the safety/risk field, in turn, were put forward most often by members of the civil society group, who voiced almost one-third (29% i.e. 15) of the total number of questions in that field (51) (Brunstig et al. 2011, 37).[194]

201 Looking at what arguments were made most often by particular stakeholder groups, it is apparent that representatives of the press most often raised arguments concerning the "economy/profitability" field (28% of all arguments raised by that group).[195] Among representatives of the political sector, the most common were arguments related to the use of fossil resources (21%).[196] Members of the education and research sector most frequently resorted to arguments concerning CCS' technology and its feasibility (23%).[197] More than one out of three arguments (37%) raised by representatives of the industry referred to matters concerning the economy and CCS' profitability.[198] Finally, while arguments originating from people belonging to the civil society group were generally sparse (23), over half of them (65%) were related to CCS's safety and the potential risks which that technology entails (Brunstig et al. 2011, 37).[199]

202 To conclude, information about CCS in the two most important Polish daily newspapers has a slight but visible bias towards the technology. The ratio of positive arguments to negative ones is 3:2, and the majority of speakers favor the technology. While as many as 34% were either undecided or indifferent to CCS, only 13% of the analyzed articles raised strong objections against it. The biggest support for the technology came from the political system and industry actors. At the same time, all representatives from the civil society sector rejected CCS.

203 Yet, civil society actors' criticism of the technology was unable to turn the scales against CCS. It is because there was a clear prejudice against opinions voiced by the civil society group. Representatives of the industry and the political system were able to raise, respectively, two and three times more arguments than civil society speakers. As a result, statements of the latter were simply "outshouted" and thus had no meaningful weight in the debate.

204 This being said, it is necessary to point to two facts. First of all, as the SiteChar project report containing the above data was issued in October 2011, it does not include recent 'developments' in the field in question. Although I do not possess any statistical data, the impression I gathered while collecting material for this paper, was that the great majority of current publications, whether electronic or printed, was attuned negatively toward CCS. As discussed in the previous sections, the technology is presently losing support from virtually every group of Polish stakeholders, and the media reflects this reality quite accurately.

205 Secondly, the SiteChar project data is based on two serious, nationwide daily newspapers with a joint circulation of around 400,000 copies.[200] While, for Polish conditions, it is a significant number, it is nothing in comparison to the number of pages available on-line. According to SiteChar's project calculations, by mid-2011, Gazeta Wyborcza and Rzeczpospolita published 127 articles related to CCS, which presented almost 300 different arguments for or against the technology. In comparison, the Google search for the phrase "sekwestracja dwutlenku węgla," which means "carbon dioxide sequestration" in Polish, gave 25,000 results[201] – over 83 times more than the number of arguments presented in the two newspapers together.

206 While it is true that many of those pages may not be completely relevant, it must also be remembered that an internet search can be made for a different phrase and/or in a different language. For instance, the number of websites found when searching for the phrase "CCS+CO2," with results limited to pages in Polish, was 4,410,000. Yet, with the search phrase changed to "carbon capture" and settings altered to display pages in English, the amount of websites found totaled 23,300,000.

207 The above observations matter because opinions from the civil society sector appear to be much better "heard" on-line than on paper. In addition, judging from the experience of my own research, the opinions of civil society representatives in electronic form are very rarely more positive than those encountered by SiteChar in the two Polish dailies. Consequently, keeping in mind that the majority of Poles acquire information about CCS from the internet,[202] it comes as no surprise that they are cautious about the technology and unwilling to have CO_2 storage sites in proximity to their homes.[203]

208 In conclusion, the debate about CCS in Poland takes place on different plains and is characterized by the employment of different methods. While for an average citizen it

may not be very noticeable, all those who wish to participate in it will manage to find both a way and a forum to voice their opinion.

7.2.6.5. The attitude of the Polish general public towards CCS

209 The actual stance that the Polish public adopts on CCS and on its implementation in the country was recently measured by Eurobarometer as well as by NearCO2. Before turning to those results, however, it is useful to pay some attention to Create Acceptance's (CA) 2008 report about factors influencing societal acceptance of new energy technologies. The CA report gives an interesting insight into Polish people's general attitude towards nature, technology and innovations.

210 As revealed by a number of different surveys referred to in the CA study, Poles are not especially open to novelty. Only 31% of them expressed willingness to try innovative products. Furthermore, over one half (51%) of the respondents believed that "[o]ne should not start a business if there is a risk of failure." With regard to technology and nature, in turn, Polish society was almost unanimous (91%) that "science and technology will improve the quality of life of future generations," and as many as 70% of its members found it justifiable to "exploit nature for the sake of human well-being" (Heiskanen et al. 2008, 198, 200-201).

211 Judging from the above numbers, CCS should not raise significant environmental doubts among Polish people. Yet, being new, unfamiliar and untested, it appears likely to be treated with reservation and a considerable degree of suspicion.

212 However, the results of the NearCO2 survey[204] testify to the contrary. Literally none of the participants (0%) displayed a 'very unfavorable' attitude towards the technology. Moreover, only 2% and 4% of respondents had, respectively, 'unfavorable' or 'somehow unfavorable' attitudes towards it. While 12% of Poles were neutral, the rest of them, i.e. 78%, were to a greater or lesser extent attuned positively towards CCS (Reiner, Hauke and Kong 2012, 72).

213 In addition, since half of the NearCO2 survey respondents were selected from communities neighboring a CCS project,[205] the organization was also able to examine participants' attitudes towards the particular CCS venture in their proximity. As it turned out, people's attitudes towards the local CCS project were almost exactly as positive as they were towards the technology in general. None of the respondents expressed a 'very unfavorable' attitude towards the nearby CCS undertaking, and only 2% and 4% of them displayed 'unfavorable' or 'somehow unfavorable' attitudes towards it, respectively. 18% of participants were neutral and as many as 72% of them stated having, to a varying degree, a positive disposition towards the local CCS installation (Reiner, Hauke and Kong 2012, 72).

214 With regards to a more detailed approach to CCS, going beyond mere acceptance or rejection of the technology, the results of the Eurobarometer survey provide a great deal of insightful information. To begin with, 59% of Poles agreed that "[t]he storage of CO_2 will help to combat climate change." In addition, 49% of them believed that the technology will be an effective means of doing so. Since, in both cases, a large proportion of the respondents did not know which answer to choose (29% and 36% respectively), the number of those who actually disagreed with the above mentioned statements was relatively low (12% and 15% respectively) (Eurobarometer 2011, 80, 181). (See Figures 15 and 23.)

Figure 15 (Figures in percentages) (n=1000)

Please tell me whether you totally agree, tend to agree, tend to disagree or totally disagree with each of the following statements.

The storage of CO2 will help to combat climate change

	Totally agree	Tend to agree	Tend to disagree	Totally disagree	DK (Don't know)	Total 'Agree'	Total 'Disagree'
PL	14	45	9	3	29	59	12

In the context of energy production, which, if any, of the following have you heard of? (MULTIPLE ANSWERS POSSIBLE)

	Nuclear fusion	Combined heat and power (cogeneration)	Hydrogen energy (H2) and fuel cells	Biogas	Geothermal energy	Ocean energy (tidal/ wave/ marine currents)
PL	31	7	21	49	42	21

	Algae biofuels	Solar photovoltaic energy	Nuclear fission	Clean Coal	Ground source heat pumps	None (SPONTA-NEOUS)	DK (Don't know)
	24	28	25	42	28	10	10

Source: (Eurobarometer 2011, 158, 181)

Figure 23 (Figure in percentages) (n=1000)

In your opinion, taking into account all you know about CCS or Carbon capture and storage, could you tell me whether you think it could be effective or not to fight climate change?

	Very effective	Fairly effective	Not very effective	Not at all effective	DK (Don't know)	Total 'Effective'	Total 'Not effective'
PL	6	43	13	2	36	49	15

Source: (Eurobarometer, 2011, 167)

215 Furthermore, besides just finding the technology to be environmentally friendly, the majority of Poles (65%) are actually willing to make CCS installations compulsory for all newly built coal-fired power plants. While, according to Eurobarometer's findings, 27% of Polish society is not sure what to think about such an idea, only 8% of it is attuned against it (Eurobarometer 2011, 185). (See Figure 24.)

Figure 24 (Figure in percentages) (n=1000)

Please tell me whether you totally agree, tend to agree, tend to disagree or totally disagree with each of the following statements.

Capturing and storing CO2 should be compulsory when building a new coal-fired power plant

	Totally agree	Tend to agree	Tend to disagree	Totally disagree	DK (Don't know)	Total 'Agree'	Total 'Disagree'
PL	26	39	6	2	27	65	8

Source: (Eurobarometer, 2011, 185)

216 People's enthusiasm diminishes, however, when a CCS installation is suggested to be located in their region. Only 33% of respondents believe that such a step would be

beneficial for the region and 27% hold the opposite opinion. The largest number of people (40%) simply confesses to not knowing (Eurobarometer 2011, 168). (See Figure 25.)

Figure 25 (Figure in percentages) (n=1000)

If CCS or carbon capture and storage technology was used in your region, do you think that you would benefit from it or not?

	Would benefit	Would not benefit	DK (Don't know)
PL	33	27	40

Source: (Eurobarometer, 2011, 168)

217 Over one half (55%) of the respondents who think that CCS project would be profitable for their home region expect improvement in the quality of air. 25% derive their positive attitude from the hope that a local CCS project would provide greater employment opportunities. 24% count on lower electricity prices, 21% expect a reduction in water pollution, and 13% simply think that it would be good for the local economy (Eurobarometer 2011, 169). (See Figure 26.)

Figure 26 (Figure in percentages) (n=1000)

Why do you think that you would benefit from the use of CCS technology in your region? (MAX. 2 ANSWERS)

	It would reduce the water pollution in your local area	The price of electricity would be lower	It would create jobs	It would improve the quality of the air	It would be good for local economy	Other (SPONTANEOUS)	DK (Don't know)
PL	21	24	25	55	13	0	4

Source: (Eurobarometer, 2011, 169)

218 Those who displayed a negative attitude towards hosting a project in their region feared, in turn, that a CCS installation would increase the risk of air pollution (25%). 23% of them were afraid that it would cause an increase in electricity prices. 20% worried that the project would have a negative impact on the environment. 19% were concerned about the possibility of water pollution and 11% was of the opinion that it would be bad for the local economy (Eurobarometer 2011, 170-171). (See Figure 27.)

Figure 27 (Figure in percentages) (n=1000)

Why do you think you would not benefit from the use of CCS technology in your region? (MAX. 2 ANSWERS)

	The price of electricity would increase	Fossil fuels use will fall considerably in the coming years	It would not have a positive impact on the environment	It would be bad for the local economy
PL	23	11	20	11

There would be a risk of water pollution	There would be a risk of air pollution	Other (SPONTANEOUS)	DK (Don't know)
19	25	3	14

Source: (Eurobarometer, 2011, 170)

219 These results clearly demonstrate that Poles simply do not know what to expect from CCS. Oddly, their hopes are virtually identical to their fears. Yet, in the context of the,

already discussed, lack of awareness of CCS among Polish people, such results come as no surprise.

220 The initial confidence reposed in CCS is diminished even further when people are put in the hypothetical situation of having a CCS project in their immediate neighborhood. 18% of them admitted that if a CCS installation was to be located within a 5 km range from their homes, they would be very concerned. 38% of respondents proclaimed that they would be fairly concerned, and only 24% declared that they were not worried about that (Eurobarometer 2011, 170-171). (See Figure 28.)

Figure 28 (Figure in percentages) (n=1000)

If a deep underground storage site for CO2 were to be located within 5km of your home, do you think that you would be...?

	Very concerned	Fairly concerned	Not very concerned	Not at all concerned	DK (Don't know)	Total 'Worried'	Total 'Not worried'
PL	18	38	19	5	20	56	24

Source: (Eurobarometer, 2011, 172)

221 The most common sources of people's anxiety were: "the possibility of the installation's negative effects on the environment and health" (56% of respondents stated having this concern); "possible leaks from the site while in operation" (48%); "safety concerns related to the transport of CO_2 to the storage site" (29%); "the risk of a terrorist attack"; and a "possible drop in local property prices" (12% each). In addition, 6% of respondents who stated their concern were unable to specify its specific grounds (Eurobarometer 2011, 173-174). (See Figure 29.)

Figure 29 (Figure in percentages) (n=1000)

Why would you be worried? (MULTIPLE ANSWERS POSSIBLE)

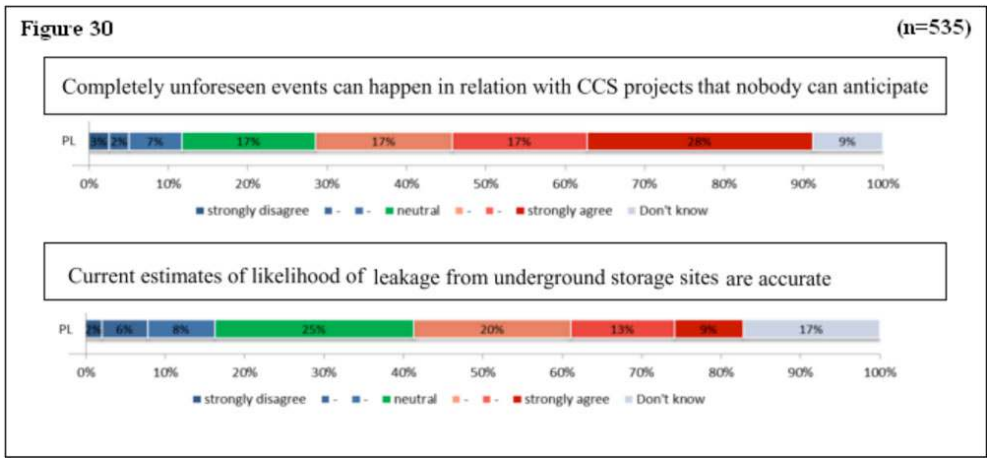
	The transport of CO2 to the storage site might not be safe	The risk of leaks while the site is in operation	The risk of terrorist attack	The possible negative effects on the environment and health	A possible drop in local property prices	Other (SPONTANEOUS)	None (SPONTANEOUS)	DK (Don't know)
PL	29	48	12	56	12	1	1	6

Source: (Eurobarometer, 2011, 173)

222 As for the risk of leakage, which ranked as the second most commonly mentioned source of people's anxiety, NearCO2's survey results indicate an interesting finding. Although Polish people declare that, with regard to information about CCS, they place most of their confidence in universities and research institutions,[206] not even half of them (42%) believe in the accuracy of scientific estimates concerning the likelihood of a leak (Reiner, Hauke and Kong 2012, 90). (See Annex I, Figure 30.)

223 Poles are definitely not convinced by assurances that the technology, especially its storage component, is safe. 62% of NearCO2's respondents admitted to having a fear that some "completely unforeseen events can happen in relation to CCS projects that nobody can anticipate." While another 26% were either neutral or did not have an opinion about

the issue, only 12% of people did not have such a concern (Reiner, Hauke and Kong 2012, 90). (See Figure 30.)



Source: (Reiner, Hauke and Kong 2012, 90)

224 In general, it appears that the more abstract it is, the more Polish society likes CCS. Theoretically, Poles do not have many objections against the technology. They do not know much about it, but they, nevertheless, find it environmentally friendly and therefore useful. Yet, the more real CCS becomes, being proposed either in their region or, God forbid, in their immediate neighborhood, the more uneasy, reserved and cautious Polish people immediately become.

225 Consequently, putting those observations in a broader context, implementation of the technology in Poland does not appear to be an easy task. While most Polish people, not being directly affected by CCS, are likely to remain indifferent to the technology, a small group of people whose neighborhoods will be selected to host storage sites will almost certainly arduously oppose such ventures.

226 While that minority, having much more at stake, will most likely organize themselves vehemently against CCS, the majority, typically not even paying attention to such "remote" issues, will remain passive, leaving all the relevant decisions in the hands of the government. The government, in turn, facing a well-organized and vocal opposition from the 'affected' minority, will most likely yield to its pressure, as it already did once before in the case of a proposed storage site for the Bełchatów demonstration project.

7.2.6.6. Public's Attitude towards Alternative Solutions

7.2.6.6.1 Nuclear Energy

227 As compared to its rather reserved approach to CCS, the attitude of the Polish public towards nuclear energy and shale gas extraction appears to be more positive, particularly at the local level. As for the idea of developing nuclear technology in Poland, the society is almost evenly split. While in 2009 and 2010 the scales were tipping in favor of such projects, the situation has reversed following the 2011 Fukushima tragedy (CBOS 2011, 2).

228 In the survey conducted by the Public Opinion Research Center (CBOS) in the aftermath of that event, 58% of Poles declared that their confidence in nuclear energy had diminished. Furthermore, 69% of the society was convinced that even the most modern technology does not guarantee safety of nuclear installations. Finally, as many as one-third of the respondents (32%) expressed their fear that a Fukushima-type disaster may happen in

Poland if state authorities continue to pursue the plan of developing nuclear technology in the country (CBOS 2011, 8, 10).

229 Yet, 18 months after the above-mentioned catastrophe, public sentiments have changed again. The large-scale information campaign initiated by the government only half a year earlier[207] has apparently begun to produce results. At the end of 2012 the idea of constructing a nuclear-power station in Poland was once again supported by over a half of the population (56%).[208]

230 Interestingly, in the region that is among the most likely locations for a future nuclear power station, the public support for that project is actually higher than in other parts of the country. As indicated by recent data, 59% of the inhabitants of Pomorskie voivodeship support the general idea of constructing a nuclear power plant in Poland, and as many as 57% of them are also in favor of locating such installations in the proximity of their houses. Moreover, in certain local communities, such as in Gniewino for example, the level of public approval for hosting nuclear installations reaches above 70%.[209] While inhabitants of other likely locations (such as, for instance, Zachodniopomorskie voivodeship) are often much less enthusiastic about having nuclear power stations in their neighborhoods,[210] the examples presented above clearly indicate that people's reluctance to living in the vicinity of nuclear technology is not as universal as their aversion to CO_2 storage sites.

231 Indeed, Poles appear to be much more at ease with the nuclear installations than with CCS. Such a situation is, to some extent, explainable by the fact that the former technology, being older and more widespread than the latter, is much more present in people's minds. As demonstrated by certain studies, "people are most concerned with unfamiliar technologies" (Logan et al. 2007, 3). In other words, they fear the unknown. If something is new and incomprehensible, it tends to be perceived as potentially dangerous (Reisch and Reiner 2010, 2). At the end of the day, nobody wishes to be a "guinea pig" for an unexplored undertaking (Brunstig et al. 2011, 29). While there are multiple examples of well-functioning and safe nuclear reactors all around the globe nowadays, there are still no operational commercial-scale CCS projects that could testify to that technology's harmlessness and utility.

232 Finally, nuclear technology also has one additional advantage over CCS; unlike the latter, it is not being commonly linked with a price rise of an energy unit. Indeed, due to the fact that it is currently still impossible to accurately estimate a future price of nuclear-based energy in Poland,[211] the whole public attention given to nuclear technology appears to be captured by its safety and security dimension.

7.2.6.6.2 Shale Gas

233 As for shale gas, only a miniscule percentage of Polish society (4%) oppose the projects of its extraction. While a considerable group of people does not have a clear opinion on the subject (23%), it is nevertheless safe to say that the great majority of Poles (73%) are positively attuned to the idea of exploiting Polish non-conventional gas deposits (CBOS 2011a, 1). Such extensive public enthusiasm results from a coincidence of three basic factors.

234 First of all, according to 80% of the people surveyed by CBOS, shale gas extraction would allow Poland to diminish its dependency on foreign gas suppliers and thus would contribute to the country's energy security (CBOS 2011a, 3). Keeping in mind the difficult

history between Poland and Russia and the fact that the latter, being the main provider of gas to Poland, continues to use its natural resources as political leverage over its neighbors, it is quite easy to understand Polish people's eagerness for shale gas extraction.

235 Secondly, 67 % of Poles are of the opinion that costs associated with the exploitation of non-conventional gas deposits would not be higher than the current costs of imports from foreign suppliers (CBOS 2011a, 3). In fact, according to certain experts, the former costs would actually be even lower than the latter by about $100 per each 1,000 m^3.[212] Yet, since all such calculations depend on a multiplicity of hardly foreseeable factors,[213] they are largely approximate and have to be approached with caution.

236 Finally, what also contributes to the positive attitude of Polish people towards shale gas exploitation is the fact that the society does not perceive this activity as being particularly dangerous. While almost half the participants of the, 2011, CBOS survey were unable to take a clear stance on this particular issue, over 40% of the participants believed that such an activity would not be harmful either to the natural environment or to human health. At the same time, merely one out of six respondents expressed the opposite opinion. In addition, only 21% of Poles stated their opposition to locating drilling sites in the proximity of their houses (CBOS 2011a, 2-3).

7.2.6.6.3 Summary

237 In sum, CCS is in a rather unprivileged position vis-à-vis shale gas and nuclear technology: it is less known than the latter; unlike the former it does not directly contribute to Polish energy security; it is expensive in terms of energy prices; and its storage sites give people more anxiety than shale gas drillings. Most of all, however, it has difficulties in proving to the people its superiority over the very technology that it is supposed to improve. Indeed, what CCS really has to compete with is neither nuclear energy nor shale gas; it is, instead, the fossil fuel-combustion technology which is free from CCS installations. As the latter is more familiar to people, more efficient, cheaper and does not need any potentially dangerous storage sites, it is not surprising that CCS has a hard time winning people's hearts and minds. Consequently, being unable to win its primary "battle," as of today CCS does not constitute any serious alternative to the two other solutions discussed in this section.

NOTES

12. The anticipated economic resources of hard coal in Poland, as of 31 December 2011, totaled 48.541 million tons. Total production of hard coal mounted to 67.637 thousand tons. (Jureczka, J., A. Zdanowski, A. Ihnatowicz, W. Krieger, S. Wilk. 2011. Węgiel kamienny. In *Bilans perspektywicznych zasobów kopalin Polski wg stanu na 31 XII 2009* ,. Wołkowicz, S., T. Smakowski and S. Speczik (eds.), 51-63.Warsaw: PIG-PIB).

Economic resources of brown coal (lignite) in Poland, as of 31 December 2011, amounted to 1,287.03 million tones. In 2011, production of brown coal in Poland amounted to 62,889 thousand

tons. (Polish Geological Institute – National Research Institute, "Mineral Resources of Poland: Energy Raw Materials - Brown Coal," http://geoportal.pgi.gov.pl/surowce/energetyczne/wegiel_brunatny - accessed 20 November 2014)
Such values are, according to IEA 2010, sufficient to satisfy Polish demand for hard coal and lignite for 200 and 300 years respectively (Chronmyklimat.pl, "Rozwój technologiczny warunkiem rentowności CCS," 2010. http://www.chronmyklimat.pl/wiadomosci/energetyka/rozwoj_technologiczny_warunkiem_rentownosci_ccs - accessed 20 November 2014).

13. See also PEP 2009.

14. Easton, A. "Poland's dependence on coal," BBC. 2012. http://www.bbc.co.uk/news/world-radio-and-tv-17813431 (internal quotation omitted; accessed 20 November 2014).

15. Gramwzielone.pl, "Premier: atom i węgiel kluczowe dla polskiego miksu energetycznego," 2013. http://gramwzielone.pl/trendy/6035/premier-atom-i-wegiel-kluczowe-dla-polskiego-miksu-energetycznego (accessed 20 November 2014).

16. See also WB (World Bank). 2011. *Transition To A Low-Emissions Economy In Poland*. Poverty Reduction and Economic Management Unit, Europe and Central Asia Region, 8-9; PEP 2009, 6.

17. "CO_2 equivalents (CO_2e [or CO_2eq]) is a unit used to express the warming potential of all greenhouse gases (e.g. methane) in terms of that of CO_2. For example each gram of methane has the warming effect of 23 grams of CO_2, 1g methane = 23g CO_2eq" (Corless et al. 2011, 6).

18. "The additional capital costs of CCS in retrofits are assumed to be 20% higher than those for new builds" (Corless et al. 2011, 38).

19. *Ciepiela, D., "J. Piekacz, Vattenfall: potrzeba 100 mld dolarów na CCS." wnp.pl. 2010* http://energetyka.wnp.pl/j-piekacz-vattenfall-potrzeba-100-mld-dolarow-na-ccs,98377_1_0_0.html *(accessed 20 November 2014).*

20. In the Reference Scenario

21. Nowadays, on the verge of the creation of a free-trade zone between the EU and the US (where prices of energy resources are much lower than in Europe), such a scenario is more possible than ever.

22. Chronmyklimat.pl, "Rozwój technologiczny warunkiem rentowności CCS," 2010. http://www.chronmyklimat.pl/wiadomosci/energetyka/rozwoj_technologiczny_warunkiem_rentownosci_ccs (accessed 20 November 2014).

23. PEP (Polish Energy Policy until 2030). 2009. Ministry of Economy. http://www.mg.gov.pl/files/upload/8134/Polityka%20energetyczna%20ost_en.pdf (accessed 20 November 2014).

24. This date is already known to be overly optimistic.

25. Only recently the country blocked the suggested increase of the level of GHG emissions' reductions by 2020 from 20% to 25%, pointing to the huge costs (over €1 billion) which such a step would impose on it. Subsequently, in 2012 Poland vetoed the proposed guidelines on achieving 80% emissions reduction by 2050, arguing that the solutions offered therein would harm the Polish economy by increasing energy prices threefold after 2020, and causing an annual fall of 5 to 11% in the country's GDP by 2030 (Easton, A. "Poland's dependence on coal," BBC. 2012. http://www.bbc.co.uk/news/world-radio-and-tv-17813431 - accessed 20 November 2014).

26. Easton, A. "Poland's dependence on coal," BBC. 2012. http://www.bbc.co.uk/news/world-radio-and-tv-17813431 (accessed 20 November 2014).

27. Elektroonline.pl, "Podziemne składowanie CO_2 może uchronić Polskę przed karami," 2011. http://www.elektroonline.pl/news/4043,Podziemne-skladowanie-CO2-moze-uchronic-Polske-przed-karami (accessed 20 November 2014).

28. Mt – Megaton; CO2e – see *supra* note 17).

29. As compared to the 2005 level

30. According to Eurostat, in 2010 the share of renewables in Poland was 9.4%. (Eurostat, "The contribution of renewable energy up to 12.4% of energy consumption in the EU27 in 2010." 2012.

http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/8-18062012-AP/EN/8-18062012-AP-EN.PDF - accessed 20 November 2014). Besides, in 2010 there was no nuclear power.

31. "The switch to low-emissions energy supply provides about 40 percent of abatement by 2030 and also imposes the largest cost on GDP (of about one percent each year). Fuel efficiency measures, on the other hand, while contributing towards 30% of overall abatement, begin to enhance GDP significantly by 2025 and provide a net boost to overall growth. Energy efficiency measures are most important in the early years, contributing towards 20% of mitigation by 2015, while costing over one percent in GDP losses in 2015 but switching to mildly growth-enhancing status by 2025."

32. Any current data concerning Poland's geological storage capacity is by no means conclusive. On the contrary, at present, all findings in this regard are quite imprecise and subject to further revision. While Poland is believed to have an enormous overall storage capacity of around 92 Gt, (Hinc 2010a, 26) that capacity is not only approximate but also remains largely uncharacterized (Corless et al. 2011, 25).

33. From the long list of initiatives undertaken in Poland since then, it is worth mentioning the, 2004 EU-founded, RECOPOL (Reduction of CO_2 emission by means of CO_2 storage in coal seams in the Silesian coal basin of Poland) project that "investigated the technical and economic feasibility of storing CO_2 permanently in subsurface coal seams [in the Silesian coal basin]." In addition, there is its 2006-2008 follow-up, MOVECBM (Monitoring and verification of CO_2 storage and enhanced coal bed methane recovery in Poland), which applied a comprehensive monitoring program at the RECOPOL site (Corless et al. 2011, 19). "[T]he results achieved under the RECOPOL and MOVECBM projects have shown that the storage of CO_2 in deep deposits of coal is doable and – what is more important – safe, as monitoring has not shown any alarming or dangerous changes in the concentration of CO_2" (Hinc 2010a, 26). In addition, in 2004-2006, the CASTOR project was conducted under the auspices of the "EU Sixth Framework Program," with the aim of estimating the CO_2 storage capacity of about 70 geological structures across the country (MS (Ministerstwo Środowiska). 2008. *Działania Ministerstwa Środowiska w Celu Rozpoznania Struktur Geologicznych dla Podziemnego Składowania Dwutlenku Węgla.* Warsaw, 9. https://www.mos.gov.pl/g2/big/2009_08/e83e155d4a74ba448ff66d41002bcebf.pdf - accessed 20 November 2014). Two years after the project's conclusion, the Ministry of the Environment initiated yet another program with a self-explanatory name "Assessment of formations and structures for safe CO_2 geological storage including monitoring plans" (Brunstig et al. 2011, 20-21). Besides, "[s]everal R&D projects have looked at underground coal gasification (UCG), coal bed methane extraction (CBM) and the possibility of injecting and storing CO_2 in support of these processes" (Corless et al. 2011, 19).

34. Integrated Gasification Combined Cycle.

35. Nitrogen Plant Kędzierzyn (Zakłady Azotowe Kędzierzyn).

36. Polish Energy Group (Polska Grupa Energetyczna).

37. Kowalczyk, A., "CCSu w Bełchatowie nie będzie," Rynek Infrastruktury. 2013. http://www.rynekinfrastruktury.pl/wiadomosci/ccsu-w-belchatowie-nie-bedzie-20093.html (accessed 20 November 2014).

38. Chronmyklimat.pl, "Eksperci: CCS znacząco podnosi koszt energii elektrycznej i zagraża polskiej energetyce," 2012. http://www.chronmyklimat.pl/wiadomosci/energetyka/eksperci-ccs-znaczaco-podnosi-koszt-energii-elektrycznej-i-zagraza-polskiej-energetyce (accessed 20 November 2014).

39. Elektroonline.pl, "Polska nie ma pieniędzy na instalacje CCS," 2012. http://www.elektroonline.pl/news/5620,Polska-nie-ma-pieniedzy-na-instalacje-CCS (accessed 20 November 2014).

40. In March 2013.

41. Gramwzielone.pl, "Premier: atom i węgiel kluczowe dla polskiego miksu energetycznego," 2013. http://gramwzielone.pl/trendy/6035/premier-atom-i-wegiel-kluczowe-dla-polskiego-miksu-energetycznego (accessed 20 November 2014).

42. PNEP (Program Polskiej Energetyki Jądrowej). 2010. Ministerstwo Gospodarki. http://bip.mg.gov.pl/files/upload/12331/20101216_PEJ_KRM_wer_2.pdf (accessed 20 November 2014).

43. Kierunekenergetyka.pl, "Program polskiej energetyki jądrowej," 2010. http://www.energetyka.e-bmp.pl/program-polskiej-energetyki-jadrowej,3138,art.html (accessed 20 November 2014).

44. Elektrownia-jadrowa.pl, "'1000 MW elektrowni jądrowej w Polsce będzie kosztować około 4,7 mld euro,' Dariusz Ciepiela, wnp.pl ," http://elektrownia-jadrowa.pl/1000-MW-elektrowni-jadrowej-w-Polsce-bedzie-kosztowac-okolo-4-7-mld-euro-Dariusz-Ciepiela-wnp-pl.html (accessed 20 November 2014).

45. Instytutu Studiów Energetycznych.

46. In original: 600 bn. PLN.

47. In original: 30-40 bn. PLN.

48. Onet.pl, "Prezes ISE: koszty poszukiwania gazu łupkowego wielokrotnie przewyższą koszt budowy elektrowni jądrowej," 2013.
http://biznes.onet.pl/prezes-ise-koszty-poszukiwania-gazu-lupkowego-wiel,18490,5501322,news-detal (accessed 20 November 2014). (In original: 600 bn. PLN.)

49. Global CCS Institute, "The future is now, Poland." 2011. http://www.globalccsinstitute.com/insights/authors/marek/2011/08/22/future-now-poland (accessed 20 November 2014).

50. Polska Grupa Energetyczna.

51. Zakłady Azotowe Kędzierzyn.

52. Państwowy Instytut Geologiczny.

53. Centrum Czystych Technologii Węglowych.

54. Główny Instytut Górnictwa.

55. Instytut Chemicznej Przeróbki Węgla.

56. Instytut Gospodarki Surowcami Mineralnymi i Energią.

57. Polska Akademia Nauk.

58. Instytut Nafty i Gazu.

59. Centrum Stosunków Międzynarodowych.

60. Polskie Stowarzyszenie Energetyki Wiatrowej.

61. Centrum Zrównoważonego Rozwoju.

62. Boroughs (Gminy) (first level of local government): Bedlno, Bielawy, Bojanowo, Budziszewice, Czarnocin, Dalików, Dobroń, Grabica, Kleszczów, Krzyżanów, Lutomiersk, Łęczyca, Łowicz, Moszczenica, Pabianice, Parzęczew, Rawicz, Rzgów, Tuszyn,Wodzierady, Zgierz, and Counties (Powiaty): (second level of local government): Bełchatowski, Kutnowski, Łaski, Łęczycki Łowicki, Łódźki Wschodni, Pabianicki, Piotrkowski, Poddębicki, Rawicki, Tomaszowski, Zgierski,

63. ZeroCO_2.No, "Poland," http://www.zeroco2.no/projects/countries/poland (accessed 20 November 2014).

64. *Id.*

65. Such as, for instance, Carbon Sequestration Leadership Forum (CSLF) (see Part IV, Section 3: The Future of Energy in Poland).

66. PEP 2009.

67. ZeroCO_2.No, "Poland," http://www.zeroco2.no/projects/countries/poland (accessed 20 November 2014).

68. See, for instance, the statement on CCS by Jerzy Buzek (ex-prime minister of Poland and a member of European Parliament): "Not developing and introducing technologies in which Poland may become a leader would be a shame for our country." "Instead of ruining our finances and

industry, we better spend €10 billion on coal technologies and make a great technological leap forward." "We have a unique opportunity to transform burdens imposed on us by the EU Climate Package into a source of our strength, energy security and wealth. We can develop our capabilities and build clean technologies in Poland as well as in the World." (In original: "Bez wprowadzenia i rozwijania technologii, w których Polska może być liderem, to będzie kompromitacja naszego kraju" "Zamiast się zarzynać finansowo, zarzynać przemysł, wydajmy 10 mld (euro) na technologie węglowe i dokonajmy skoku technologicznego." "Przed nami niepowtarzalna okazja, aby obciążenia nałożone przez negocjowany w UE pakiet klimatyczno-energetyczny stały się źródłem naszej siły, gwarancją bezpieczeństwa i przyszłych dochodów. Możemy rozwinąć nasze możliwości i budować czyste technologie w Polsce i na świecie.") (Majda W., "Czy SekwastracjaCO2 może się opłacać," Mojeopinie.pl. 2010. http://www.mojeopinie.pl/czy_sekwestracja_co2_moze_sie_oplacac,3,1268387135 – accessed 20 November 2014); See also "CCS is heralded as a promise for the future, and that Polish expertise in the field could produce "a Polish Nokia", as Henryk Jezierski, a deputy environment minister and Poland's chief geologist, put it." (Stille, G., "The politics and policy of carbon capture and storage," http://archive-se.com/page/2239792/2013-06-05/http://www.ccs-politics.se/poland.html - accessed 20 November 2014).

69. See, for instance, the statement by the director of Geology and Geological Concessions in the Ministry of Environment, Mr. Przybicin, during the "open days of CCS" in the National Geological Institute (Państwowy Instytut Geologiczny, "Dzień CCS w Państwowym Instytucie Geologicznym." 2010. http://www.pgi.gov.pl/pl/instytut-geologiczny-aktualnosci-informacje/2376-dzien-ccs-w-panstwowym-instytucie-geologicznym.html - accessed 20 November 2014).

70. NetTg.pl, "Technologia ccs nie ma szans na zaistnienie i..." 2013. http://www.nettg.pl/news/108332/technologia-ccs-nie-ma-szans-na-zaistnienie-i (accessed 20 November 2014). (In original: [T]echnologia CCS, wskazywana przez Komisję Europejską jako przyszłościowa w walce z emisją CO2, nie ma szans zaistnieć w skali przemysłowej. Jest ona bowiem zbyt droga.)

71. Id. (In original: [O]becne przepisy są tak skonstruowane, że prezesi firm nie zdecydują się na zastosowanie CCS, jeżeli państwo nie zagwarantuje im pokrycia przyszłych strat. Na taką sytuację żadne państwo nie jest w stanie się zgodzić.)

72. Newseria.pl, "Min. Tomczykiewicz przyznaje ze nie ma pieniedzy na eksperymenty z CO_2." 2012. http://www.biznes.newseria.pl/news/min_tomczykiewicz,p1115909964 (accessed 20 November 2014). (In original: "Państwo polskie powinno zrekompensować przedsiębiorcy straty wynikające z użycia technologii CCS. Jednak w sytuacji kryzysu gospodarczego nie widać w budżecie takich możliwości.")

73. *Id.* (In original: "Ta technologia de facto nie budzi entuzjazmu u nikogo – ani u obywateli, bo nie zgadzają się na zatłaczanie CO_2 pod ziemię, ani w energetyce, ponieważ zwiększa znacząco koszty produkcji energii i zmniejsza sprawność elektrowni.")

74. NetTg.pl, "Technologia ccs nie ma szans na zaistnienie i..." 2013. http://www.nettg.pl/news/108332/technologia-ccs-nie-ma-szans-na-zaistnienie-i (accessed 20 November 2014).) (In original; Unia Europejska powinna odejść od kosztownej polityki klimatycznej i wynikającej z tego drogiej energii).

75. *Id.*(In original: Fundamentalnie nie zgadzam się z paradygmatem, który króluje w Unii, że polityka klimatyczna i energia muszą być drogie).

76. *Id.* (In original: Stany Zjednoczone wychodzą z założenia, że energia powinna być tania i "dzisiaj, dzięki rewolucji łupkowej, osiągają tanią energię i realne redukcje CO2, dwukrotnie wyższe od europejskich.")

77. *Id.* (In original: "Mając realną perspektywę połączenia UE i USA w strefie wolnego handlu, nie możemy abstrahować od ich sposobu myślenia na temat energetyki i polityki klimatycznej.

Inaczej wyprosimy resztkę przemysłu ciężkiego z UE i spowodujemy katastrofę gospodarczą w Europie.")

78. *Wnp.pl, "Piechociński: "klimat" nie może spowalniać gospodarki." 2013.* http://energetyka.wnp.pl/piechocinski-klimat-nie-moze-spowalniac-gospodarki,195685_1_0_0.html (accessed 20 November 2014). (In original: klimat nie może spowalniać gospodarki)

79. *Id.* (In original: "Naszym zdaniem transformacja niskoemisyjna nie może odbywać się kosztem rozwoju gospodarczego.")

80. *Id.* (In original: redukcja m.in. emisji gazów cieplarnianych nie będzie się odbywać kosztem konkurencyjności gospodarki.)

81. *Id.* (In original: "Czas na zwiększenie unijnych ambicji klimatycznych może kiedyś przyjdzie, ale jednak musimy zobaczyć, czy kraje pozaunijne są gotowe podążać naszą drogą.")

82. Chronmyklimat.pl, "Rozwój technologiczny warunkiem rentowności CCS," 2010. http://www.chronmyklimat.pl/wiadomosci/energetyka/rozwoj_technologiczny_warunkiem_rentownosci_ccs (accessed 20 November 2014). (In original: CCS jest nierentowny, dlatego należy skupić się na badaniach nad technologiami oraz wyciąganiu wniosków z projektów pilotażowych.); Baca-Pogorzelska, K., "Brak wychwytywania i magazynowania dwutlenku węgla będzie kompromitacją Polski." Rp.pl. 2008. http://ekonomia.rp.pl/artykul/230344.html (accessed 20 November 2014). (In orginal: Wademar Pawlak odniósł się do CCS dość sceptycznie. Powiedział, że nie mamy możliwości do składowania dużych ilości CO_2, dlatego lepiej pomyśleć o innych wykorzystaniach gazu: m.in. produkcji paliw płynnych.)

83. Chronmyklimat.pl, "CCS – przyszłość czy przeszłość?" 2012. http://www.chronmyklimat.pl/projekty/dofinansowania-i-dotacje/wiadomosci/136/ccs-przyszlosc-czy-przeszlosc (accessed 20 November 2014). (In original: "Nie wiem, czy jest ktoś w Europie, kto jeszcze wierzy w CCS...")

84. Stille, G., "The politics and policy of carbon capture and storage," http://archive-se.com/page/2239792/2013-06-05/http://www.ccs-politics.se/poland.html (accessed 20 November 2014).

85. In Polish: "Prawo i Sprawiedliwość"

86. In original: "Gdybym się jednak mylił, to biada nam."

87. Dakowski, M., "Rząd gorączkuje się z tłoczeniem CO_2," Strona Mirosława Dakowskiego. 2010. http://dakowski.pl/index.php?option=com_content&task=view&id=1731&Itemid=53 (accessed 20 November 2014). (In original: W ocenie Piotra Cybulskiego, posła PiS pracującego w sejmowej podkomisji nadzwyczajnej do rozpatrzenia rządowego projektu ustawy Prawo geologiczne i górnicze, projektodawca dąży do obejścia Konstytucji RP i chce kuchennymi drzwiami wejść w zasoby naturalne, które przynależą do całego narodu, i udostępnić je bliżej nieokreślonym podmiotom.)

88. See also Dakowski, M., "Rząd gorączkuje się z tłoczeniem CO_2," Strona Mirosława Dakowskiego. 2010. http://dakowski.pl/index.php?option=com_content&task=view&id=1731&Itemid=53 (accessed 20 November 2014). (In original: Jak zauważył poseł, w kolejnych wprowadzanych regulacjach rola samorządów jest ograniczana, a zmieniane prawo górnicze wpisuje się w ten nurt. W efekcie lokalne władze będą musiały zgadzać się na wszelkiego typu inwestycje. Jak przypomniał, podobny zapis został przyjęty w ustawie o gospodarce nieruchomościami. W przypadku realizowania inwestycji wymagających wysiedleń, starostowie zostali zobligowani do pomocy inwestorowi.)

89. Ruch Palikota.

90. In response to the question whether CCS should be utilized in Poland on a large scale, he responded tritely: "no" (in original; "Nie"). When asked about the main obstacles to the large-scale application of the technology in Poland, he replied: "science and people's intelligence," (in original: "Nauka i inteligencja ludzi") what in my view is supposed to mean that Polish people are too smart to be taken in by what he believes are false promises of CCS. In response to the query

about the key arguments for CCS use in Poland, he enlisted two: “lack of basic chemical and biological knowledge and ecological fanaticism” (in original: “Brak elementarnej wiedzy chemicznej i biologicznej, fanatyzm ekologiczny”). Especially the latter statement clearly suggests that the respondent does not have a high regard for those who advocate for the technology. Finally when probed about CCS-related legislative actions being currently undertaken in Poland, he remarked with undisguised despise that he hopes that nobody will ever waste time on it anymore (in original: “Mam nadzieję, że nikt nie będzie marnował na to czasu ”).

91. Chronmyklimat.pl, “CCS – przyszłość czy przeszłość?” 2012. http://www.chronmyklimat.pl/projekty/dofinansowania-i-dotacje/wiadomosci/136/ccs-przyszlosc-czy-przeszlosc (accessed 20 November 2014). (In original: Janusz Steinhoff od wielu lat powtarza, że polskiej energetyki węglowej nie można opierać o technologie CCS, które nie funkcjonują jeszcze na skalę przemysłową.)

92. Elektroonline.pl, “Garbyś: technologia CCS bezsensowna w kategoriach gospodarczych.” 2011. http://www.elektroonline.pl/news/3484,Gabrys.pl-technologia-CCS-bezsensowna-w-kategoriach-gospodarczych (accessed 20 November 2014). (In original: “powinniśmy nie bacząc na koszty spróbować pokazać jak bezsensowne jest wykonanie w kategoriach gospodarczych dzisiaj instalacji wychwytywania, transportu i magazynowania CO_2.”)

93. *Id.* (In original: “Nikt w Europie nie jest tym tak zainteresowany jak polska gospodarka.”)

94. Stille, G., “The politics and policy of carbon capture and storage,” http://archive-se.com/page/2239792/2013-06-05/http://www.ccs-politics.se/poland.html (accessed 20 November 2014).

95. *Id.*

96. *Id.*

97. *Id.*

98. See, for instance, on-line publications by the Polish Confederation of Private Employers “Lewiatan”, available at http://konfederacjalewiatan.pl/opinie/klimat_i_ochrona_srodowiska/czyste_technologie_weglowe (accessed 31 July 2013).

99. Centrum Stosunków Międzynarodowych.

100. In original: Technologie CCS "są ogromną szansą dla przyszłości polskiej energetyki.”

101. Chronmyklimat.pl, “Skarga przeciwko rządowi polskiemu w sprawie rozbudowy elektrowni w Opolu i wdrożenia Dyrektywy CCS.” 2013. http://www.chronmyklimat.pl/wiadomosci/energetyka/skarga-przeciwko-rzadowi-polskiemu-w-sprawie-rozbudowy-elektrowni-w-opolu-i-wdrozenia-dyrektywy-ccs (accessed 20 November 2014).

102. Bruksela.lodzkie.pl, “Bruksela zmierza ku nowym ‘śmiałym’ celom ccs do 2014 roku.” http://www.bruksela.lodzkie.pl/polecamy/srodowisko/item/380-bruksela-zmierza-ku-nowym-smialym-celom-ccs-do-2014-roku (accessed 20 November 2014).

103. *Id.* (In original: “Na chwilę obecną, w Polsce jak i w Europie, technologia CCS nie jest opłacalna, a już na pewno na tle innych rozwiązań ograniczenia emisji CO_2.”)

104. *Id.* (In original: “Technologia CCS jest jedną z najbardziej skutecznych technologii ograniczania emisji, jeśli nie najskuteczniejszą.”)

105. *Id.* (In original: “CCS nie będzie rentowna dopóki nie dojdzie do komercjalizacji tej technologii.”)

106. Fundacja Sobieskiego.

107. Stille, G., “The politics and policy of carbon capture and storage,” http://archive-se.com/page/2239792/2013-06-05/http://www.ccs-politics.se/poland.html (accessed 20 November 2014).

108. Polskie Stowarzyszenie Energetyki Wiatrowej.

109. Elektroonline.pl, “PSEW: Efektywna energetyka z dużym udziałem OZE nie potrzebuje CCS.” 2011. http://www.elektroonline.pl/news/3561,PSEW-Efektywna-energetyka-z-duzym-udzialem-OZE-nie-potrzebuje-CCS (accessed 20 November 2014).

110. Greenpeace, "Wyłapywanie CO2 nie uratuje klimatu." 2008. http://www.greenpeace.org/poland/pl/wydarzenia/swiat/wylapywanie-co2/ (accessed 20 November 2014).
111. *Id.* (In original: "Twierdzenie, że należy budować nowe elektrownie węglowe, bo CCS rozwiąże kiedyś problem emisji CO2 ma tyle samo wspólnego ze zdrowym rozsądkiem, co świadome zarażenie się chorobą w nadziei, że pewnego dnia medycyna znajdzie na nią jakieś lekarstwo.")
112. *Id.*
113. *Id.*
114. Fundacja Dzika Polska.
115. Fundacja Eko-Unia.
116. Greenpeace Polska.
117. Stowarzyszenie Zielone Mazowsze.
118. Porozumienie Społeczne My-Poznaniacy.
119. Centrum Zrównoważonego Rozwoju.
120. Centrum Zrównowazonego Rozwoju, "Zagrożenia z CCS." http://www.czr.org.pl/zagrozenia_z_css.pdf (accessed 31 July 2013).
121. *Id.*
122. *Id.*
123. *Id.*
124. *Id.*
125. *Id.*
126. *Id.*
127. *Id.*
128. E-czytelnia abrys.pl, "Technologie CCS w Polsce – szansa, konieczność czy zagrożenie?" http://www.e-czytelnia.abrys.pl/?mod=tekst&id=10920 (accessed 31 July 2013).
129. Elektroonline.pl, "Podziemne składowanie CO_2 może uchronić Polskę przed karami," 2011. http://www.elektroonline.pl/news/4043,Podziemne-skladowanie-CO2-moze-uchronic-Polske-przed-karami (accessed 20 November 2014).
130. Chronmyklimat.pl, "Eksperci: CCS znacząco podnosi koszt energii elektrycznej i zagraża polskiej energetyce," 2012. http://www.chronmyklimat.pl/wiadomosci/energetyka/eksperci-ccs-znaczaco-podnosi-koszt-energii-elektrycznej-i-zagraza-polskiej-energetyce (accessed 20 November 2014).
131. *Id.*
132. Baca-Pogorzelska, K., "Brak wychwytywania i magazynowania dwutlenku węgla będzie kompromitacją Polski." Rp.pl. 2008. http://ekonomia.rp.pl/artykul/230344.html (accessed 20 November 2014).
133. Stille, G., "The politics and policy of carbon capture and storage," http://archive-se.com/page/2239792/2013-06-05/http://www.ccs-politics.se/poland.html (accessed 20 November 2014).
134. *Id.*
135. Instytut na rzecz Ekorozwoju.
136. E-czytelnia abrys.pl, "Technologie CCS w Polsce – szansa, konieczność czy zagrożenie?" http://www.e-czytelnia.abrys.pl/?mod=tekst&id=10920 (accessed 31 July 2013).
137. *Id.*
138. See Part IV, Section 5: CCS-related Projects in Poland.
139. E-czytelnia abrys.pl, "Technologie CCS w Polsce – szansa, konieczność czy zagrożenie?" http://www.e-czytelnia.abrys.pl/?mod=tekst&id=10920 (accessed 31 July 2013).
140. "Climategate" refers to the leakage of e-mail correspondences from servers of the University of East Anglia's Climatic Research Unit. According to Newsweek "Climategate, as its "gate" suffix suggests, has attained mythical status. For skeptics, the 1,000 or so e-mails and documents hacked last year from the Climactic Research Unit of the University of East Anglia

(UEA), in England, establish that global warming is a scientific conspiracy. [However] [t]here is no such proof." (Somaiya, R., "Third Inquiry Clears 'Climategate' Scientists of Serious Wrongdoing." Newsweek. 2010. http://www.thedailybeast.com/newsweek/2010/07/07/third-enquiry-clears-climategate-scientists-of-serious-wrongdoing.html - accessed 20 November 2014).

141. E-czytelnia abrys.pl, "Technologie CCS w Polsce – szansa, konieczność czy zagrożenie?" http://www.e-czytelnia.abrys.pl/?mod=tekst&id=10920 (accessed 31 July 2013).

142. Żylicz, T., "Debata na temat system CCS," Chronmyklimat.pl. 2010. http://www.chronmyklimat.pl/energetyka/czyste-technologie-weglowe/9827-debatanatematsystemuccs (accessed 20 November 2014).

143. *Id.*

144. *Id.*

145. *Id.*

146. Specifically, it has not been tested on a large scale.

147. Chronmyklimat.pl, "Eksperci: CCS znacząco podnosi koszt energii elektrycznej i zagraża polskiej energetyce," 2012. http://www.chronmyklimat.pl/wiadomosci/energetyka/eksperci-ccs-znaczaco-podnosi-koszt-energii-elektrycznej-i-zagraza-polskiej-energetyce (accessed 20 November 2014).

148. Four respondents decided to briefly elaborate on this last issue. Two of them made their positive responses conditional on failure of the shale gas venture in Poland. (In case of shale gas success, both of those respondents would rather see Poland's energy sector based on that resource.) One respondent underlined that coal, while remaining in its dominant position, should be gradually supplanted by renewable sources of energy. Finally, one participant supplemented his answer with a clarification that by 'long-term perspective' he implies a time-period spanning the next 20-30 years.

149. One of them added, however, that any successful future developments of technologies less risky than CCS should give them priority over the latter.

150. The survey provides opinion of 72 presidents and CEOs of big energy companies from 43 countries around the world.

151. Chronmyklimat.pl, "CCS – przyszłość czy przeszłość?" 2012. http://www.chronmyklimat.pl/projekty/dofinansowania-i-dotacje/wiadomosci/136/ccs-przyszlosc-czy-przeszlosc (accessed 20 November 2014).

152. See Part IV, Section 5: CCS-related Projects in Poland.

153. Kowalczyk, A., "CCSu w Bełchatowie nie będzie," Rynek Infrastruktury. 2013. http://www.rynekinfrastruktury.pl/wiadomosci/ccsu-w-belchatowie-nie-bedzie-20093.html (accessed 20 November 2014).

154. Elektroonline.pl, "Tauron pionierem CCs w Polsce." 2013. http://www.elektroonline.pl/news/6177,Tauron-pionierem-CCS-w-Polsce (accessed 20 November 2014).

155. NetTg.pl, "Łaziska: pierwsza w Polsce instalacja CCS." 2013. http://www.nettg.pl/news/109990/laziska-pierwsza-w-polsce-instalacja-ccs-galeria (accessed 20 November 2014). The installation, the first of that type in Poland, was a result of cooperation between TAURON and the Institute for Chemical Processing of Coal (Instytut Chemicznej Przeróbki Węgla). It cost over €2 million (in original: 9 m. PLN) and was financed by the TAURON Group. It was designed to serve research purposes and therefore captured CO2 is not utilized for either storage or any other industrial process but is simply released out of the chimney (*Id.*). In the next phase of the project, the installation is planned to be transported to the Jaworzno III power plant where it is intended to be applied to fumes generated by a Circulating Fluidized Bed (CFB) boiler (Elektroonline.pl, "Tauron pionierem CCs w Polsce." 2013. http://www.elektroonline.pl/news/6177,Tauron-pionierem-CCS-w-Polsce - accessed 20 November 2014).

156. Zespół Elektrowni "Pątnów, Adamów, Konin" (Power Plants Group "Pątnów, Adamów, Konin") – a group of 3 power plants located in vicinity of Konin, which together produce 2,512 MW, i.e. 8.5% of the overall Polish Energy output (2,512 MW).
157. SiteChar is a European research project about CO_2 storage. It brings together sixteen partners from research, industry and the consultancy sector from ten EU countries. SiteChar started in January 2011 and will last for 3 years. Central to the Sitechar project's purpose is examining the technical, economic and societal requirements for a company to be allowed to store CO_2 underground. (SiteChar, "What is SiteChar?" http://www.sitechar-co2.eu/Sections.aspx?section=558.558.566.567 (accessed 20 November 2014).
158. Here, n = 1006.
159. Here n = 1000.
160. Here n = 208.
161. Here n = 208.
162. Here n = 1006.
163. Komitet Obywatelski Przeciwko Magazynowaniu CO2.
164. Bereszyński, M., "Pabianice: Komitet Obywatelski Przeciwko Magazynowaniu CO2," Dziennik Łódzki. 2010. http://www.dzienniklodzki.pl/artykul/249131,pabianice-komitet-obywatelski-przeciwko-magazynowaniu-co2,id,t.html?cookie=1 (accessed 20 November 2014).
165. *Id.* (In original: 10 m. PLN).
166. *Id.*
167. *Id.*
168. Especially leakage of CO_2.
169. See also below, Part IV, Section 7.2.6.4.1: Trust.
170. n = 1000.
171. "Factories" comprised 35% of answers.
172. "Power plants that burn fossil fuels" constituted 30% of answers.
173. A maximum of 2 answers were possible.
174. 14% of Poles agreed with that totally and 45% "tended to agree."
175. Being ahead only of nuclear power (44% in favor, 44% against).
176. See below, Part IV, Section 7.2.6.5: The attitude of the Polish general public towards CCS.
177. While, according to Eurobarometer only 18% of Poles have ever heard of CCS, as much as 58% of the NearCO2 respondents stated that they know about it at least a little bit (Reiner, Hauke and Kong 2012, 56). However, due to the fact that NearCO2 surveyed not only the general public but also people who, in this paper, are considered to be stakeholders, the Eurobarmeter data is a better source of information for the purpose of this section as regards Polish society at large.
178. See below, Part IV, Section 7.2.6.4.2: Sources of Information about CCS in Poland.
179. Such as, for instance, that about lower energy prices.
180. EIA (Environment Impact Assessment) Directive. 1985. *Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment*. European Council. 85/337/EEC. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31985L0337&qid=1416568800523&from=EN (accessed 20 November 2014); Article 31 of the CCS Directive amends the EIA Directive to include capture and transport of CO2 streams for the purposes of geological storage and storage sites. (See IEA (International Energy Agency). 2012. *Carbon Capture and Storage; Legal and Regulatory Review, Legal and Regulatory Review*. Edition 3, 16. http://www.iea.org/publications/freepublications/publication/CCS_Review_3rdedition_FINAL.pdf - accessed 20 November 2014).
181. IE (Industrial Emissions) Directive. 2010. *Directive of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)*. European Council and European Parliament . 2010/75/EU. http://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/2394177/LexUriServ_1.pdf (accessed 20 November 2014).

182. Without effective communication, the public will remain ignorant about CCS. Not having sufficient knowledge of the technology, the public is likely to exaggerate the risks that CCS poses (Brunstig et al. 2011, 30). Being fearful of the technology, the public will adopt a negative attitude towards it. With the public being against the technology, "stakeholder groups—particularly the industry—will not contribute to the implementation and use of CCS, for they will consider it too risky" (Klaas van, A, Q. van Voorst tot Voorst, M. P. Hekkert, R. E. H. M. Smits. 2007. Societal acceptance of carbon capture and storage technologies. *Energy Policy* 35, 4372-4373). Similarly, without having people on its side, CCS will also become politically unacceptable (Wolff, Chrysostomidis and Perumalpillai 2012, v).

183. NearCO2's respondents were intentionally selected so that half of them came from a region in the vicinity of one of the EERP funded CCS projects. (Reiner, Hauke and Kong 2012, 57)

184. See *supra* note 183.

185. See above, Part IV, Section 7.2.6.4.1: Trust.

186. See aso PGE (Polska Grupa Energetyczna), "Projekt CCS – Konsultacje społeczne." 2010. http://www.pgegiek.pl/index.php/2010/08/27/projekt-ccs-konsultacje-spoleczne/ (accessed 20 November 2014); Wnp.pl, "PGE rozpoczęła konsultacje ws. budowy CCS." 2012. http://energetyka.wnp.pl/pge-rozpoczela-konsultacje-ws-budowy-ccs,171623_1_0_0.html (accessed 20 November 2014).

187. Wnp.pl, "PGE rozpoczęła konsultacje ws. budowy CCS." 2012. http://energetyka.wnp.pl/pge-rozpoczela-konsultacje-ws-budowy-ccs,171623_1_0_0.html (accessed 20 November 2014).

188. SiteChar, "Konferencja obywatelska." 2012. http://www.sitechar-co2.eu/Sections.aspx?section=590.608.609 (accessed 20 November 2014).

189. Lewiatan, "Czyste technologie węglowe oraz technologie wychwytywania i składowania CO2 (CCS)." http://pkpplewiatan.pl/opinie/klimat_i_ochrona_srodowiska/czyste_technologie_weglowe (accessed 31 July 2013). The Report is available at http://konfederacjalewiatan.pl/upload/File/2009_05/RAPORT CCS.pdf (accessed 20 November 2014).

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191. Elektroonline.pl, "Wdrożenie technologii CCS w przedsiębiorstwie." 2010. http://www.elektroonline.pl/news/2666,Wdrozenie-technologii-CCS-w-przedsiebiorstwie (accessed 20 November 2014).

192. Państwowy Instytut Geologiczny, "Dzień CCS w Państwowym Instytucie Geologicznym." 2010. http://www.pgi.gov.pl/pl/instytut-geologiczny-aktualnosci-informacje/2376-dzien-ccs-w-panstwowym-instytucie-geologicznym.html (accessed 20 November 2014).

193. 21% (15) of the arguments concerning the economic/profitability field were made by representatives of the industry sector, 18% (13) by people from the education and research sector, 14% (10) by politicians, and 7% (5) by representatives of civil society; with regard to arguments from the climate protection field (52), in turn, 23% (12) of them were made by the representatives of the political sector, 15% (8) by people from the education and research sector, 13% (7) by the representatives of the industry sector, and 0% (0) by representatives of civil society (Brunstig et al. 2011, 37).

194. 23% (12) of those arguments were made by representatives of the education and research sector, 20% (10) by politicians, 16% (8) by representatives of the press, and 12% (6) by the representatives of the industry (Brunstig et al. 2011, 37).

195. It was followed by the comments referring to climate protection (24%) and the use of fossil resources (17%) (Brunstig et al. 2011, 31).

196. It was followed by arguments belonging to the fields of "climate protection" (18%) and "CCS' significance for Poland" (16%) (Brunstig et al. 2011, 37).

197. Only a little less frequently were they raising arguments about the economy and profitability of CCS (20%) and about the safety and risk issues associated with its use (19%) (Brunstig et al. 2011, 37).

198. The next two arguments most commonly raised by that group belong to the fields of climate protection and the use of fossil resources (17% each) (Brunstig et al. 2011, 37).

199. Apart from that, the only other issue which seemed to be of any interest to that group was the economy and CCS' profitability (22%). The other matters were virtually ignored. (Brunstig et al. 2011, 37).

200. Wikipedia, "Gazeta Wyborcza; Nakład i sprzedaż." http://pl.wikipedia.org/wiki/Gazeta_Wyborcza#Nak.C5.82ad_i_sprzeda.C5.BC (accessed 20 November 2014); Wikipedia, "Rzeczpospolita (gazeta)." http://pl.wikipedia.org/wiki/Rzeczpospolita_(gazeta) (accessed 20 November 2014).

201. As of July 5, 2013.

202. See Part IV, Section 7.2.6.4.2: Sources of information about CCS in Poland.

203. See Part IV, Section 7.2.6.5: The attitude of the Polish general public towards CCS.

204. See comment about the survey, *supra* note 183.

205. See *supra* note 183.

206. See Part IV, Section 7.2.6.4.1: Trust.

207. The campaign started in April 2012 and is called: "Poznaj Atom. Porozmawiajmy o Polsce z energią," see http://www.poznajatom.pl/ (accessed 20 November 2014)

208. Ministerstwo Gospodarki, "MG: Polacy przekonują się do atomu." 2012. http://www.mg.gov.pl/node/17416 (accessed 20 November 2014).

209. *Ciepiela, D., " Wysokie poparcie dla elektrowni jądrowej w woj. Pomorskim." Wnp.pl. 2013.* http://energetyka.wnp.pl/wysokie-poparcie-dla-elektrowni-jadrowej-w-woj-pomorskim,208471_1_0_0.html (accessed 20 November 2014).

210. In Zachodniopomorskie voivodeship, the number of people supporting the idea of constructing a nuclear power plant in the vicinity of their houses is only 21% (see Ciepiela, D., " Wysokie poparcie dla elektrowni jądrowej w woj. Pomorskim." Wnp.pl. 2013. http://energetyka.wnp.pl/wysokie-poparcie-dla-elektrowni-jadrowej-w-woj-pomorskim,208471_1_0_0.html - accessed 20 November 2014).

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212. See, for instance, wPolityce.pl "Polski gaz łupkowy byłby tańszy niż paliwo z Rosji. Ale opłacalność wydobycia wciąż stoi pod znakiem zapytania." 2013. http://wpolityce.pl/polityka/166044-polski-gaz-lupkowy-bylby-tanszy-niz-paliwo-z-rosji-ale-oplacalnosc-wydobycia-wciaz-stoi-pod-znakiem-zapytania (accessed 20 November 2014).

213. Such as, for example, the price of gas on World's markets, the actual costs of shale gas extraction in Poland, the degree of future liberalization of the Polish gas market, etc.

V. Conclusion

1 In conclusion, the climate is changing, the average temperature on Earth is rising, the EU is concerned and Poland is developing. Despite the fact that the country is trying to make up economically for lost time under Communism, as a member of the EU, it still has to comply with a demanding European climate policy. Therefore, the country is obliged to gradually suppress its emissions. The task is not easy, especially keeping in mind how coal-dependent and energy intensive the Polish economy is. Given that abandoning coal as an energy source is not a viable option, Poland has no other choice but to find a way to make coal "cleaner."

2 At first glance, CCS, with its potential for lowering CO_2 emissions without jeopardizing the future of coal-fired power plants, appears to be a perfect solution. Yet, the closer it is examined, the more its charm fades away. First of all, CCS installations are expensive to build and operate. Secondly, the technology reduces the efficiency of plants in which it is installed. Thirdly, it diverts attention from renewables. Fourthly, its storage component poses potential dangers to people and the environment alike. Finally, CCS raises the price of electricity.

3 The first argument worries governments and private investors; the second one discourages energy companies; the third one upsets environmentalists; the fourth one alienates people living nearby CO_2 storage sites; and the last one simply disheartens the whole society. As a result, there is nobody left to support the technology. While the above description overly simplifies the issue, it conveys the current state of affairs quite well. Consequently, it appears that under these circumstances, any attempt to implement CCS on a commercial-scale in Poland is doomed to failure.

4 This paper analyzed the technology in terms of the likelihood of its application in Poland. After placing CCS in the European context, examining the attitudes Polish stakeholders have towards the technology, reviewing the public debate on CCS in the country, and scrutinizing Polish society's hopes, fears and beliefs concerning CCS, the paper concludes that, as of today, the chances for CCS implementation in Poland are virtually null.

5 A lack of complete certainty comes from the fact that there is always a chance that the EU will, at some point, render the use of the technology mandatory. Short of such an imposition, however, the large-scale implementation of CCS in Poland will simply not happen.

6 The "risk" of the above-mentioned "intervention" from Brussels is rather low. Even in the EU CCS is not as popular as it used to be, for there are many factors that stand against it: it has been developing slower than was forecasted, its costs have still not declined, its supporting programs and initiatives have been underperforming or failing, Member States have not been keen to invest in it, and the price of carbon remains low. Consequently, conditions for CCS development in the EU are, euphemistically speaking, rather adverse.

7 While the Union is capable of keeping CCS "alive" for the time being, it does not have any persuasive arguments to convince its members to apply the technology on a large-scale. It is also unlikely to force them to do so. At the end of the day, the final say within the Union is always with the states, and CCS has not been friends with most of them for a long while now.

8 Likewise, in Poland as well the technology suffers a general lack of support. Politicians are much more concerned with combating the crisis rather than climate change at present. As a result, they give priority to the economy and put environmental matters on the backburner in anticipation of better times in the future.

9 NGOs seem to follow the same path. Even those that had previously favored the technology, ultimately turned against it, being unable to ignore its costs.

10 Experts and research institutions, while occasionally infatuated with CCS's promises, are generally far from being enthusiastic about it. On the contrary, they tend to perceive the technology as an interesting subject to explore rather than as a viable abatement solution, ready for implementation in the country.

11 Energy companies, while to some extent still open to testing and trying CCS on a small scale, are unwilling to commit resources to its commercial development. Since the "first movers" will have to pay a lot for something that will be available to others at a substantially lower price later, each company has good reason to wait.

12 People, in turn, do not wish to wait. As soon as a storage site is announced to be planned in a given neighborhood, its inhabitants immediately and fiercely oppose it. Notwithstanding the fact that they claim to be friendly towards the technology, they will not rest until the project is relocated elsewhere.

13 If discussed in abstract, CCS is not rejected by Poles. Although they do not know much about it, they perceive it as environmentally friendly and potentially useful. Yet, the closer the technology comes to realization, the more their acceptance evolves into rejection.

14 Furthermore, such a situation is unlikely to change, as Polish people do not make much effort to educate themselves about the technology. While the public debate about CCS in Poland may not be spectacular from the perspective of the outside observer, it is certainly instructive, multi-layered, relatively unbiased and definitely available for anybody who wishes to participate in it. However, most Polish people do not have such a wish.

15 In fact, a great majority of lay people who do participate in the debate only do so in response to CCS' direct encroachment on their lives. Since most people are not being directly affected by CCS and are completely indifferent to it, the relatively small group of loud protesters becomes the *de facto* voice of the whole public. Consequently, confronted by the negative opinion of "the people," the government, being ever more cautious itself and reserved towards the technology, happily yields to their demands. Once the project is

terminated no one dwells on it, since it is extrapolated that no one in Poland really wants CCS based on the trends discussed in this paper.

16 The only problem which remains is how the country will meet its emission goals without CCS. This, however, is a subject for further research. To shed some light on that issue, I can only add that, according to my best knowledge, no one in Poland has an answer to that question yet. Besides, having in mind the growing opposition to the climate policy in the EU, I would be very careful in treating it as something set in stone.

17 Two decades ago, the 42nd President of the United States, Bill Clinton, exclaimed these famous lines: "it's the economy stupid!" Twenty years have gone by and the US still remains faithful to that principle. Since the EU is at the verge of establishing a free-trade zone with the US, it has to keep that fact in mind. Under the current circumstances, the idea of subordinating environmental ambitions to market mechanisms may prove worthwhile once again.

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