Journal of Energy Research and Environmental Technology (JERET)
Print ISSN: 2394-1561; Online ISSN: 2394-157X; Volume 2, Number 5; April-June, 2015; pp. 356-361
© Krishi Sanskriti Publications
http://www.krishisanskriti.org/jeret.html

Carbon Capture & Sequestration: A Review

Amita Tayal[1], Dipti Nirwani[2] and Shagufta Jabin[3]

[1]*DepartmentDepartment of applied Science and Humanities Applied Science Humanitie Rawal Institute of Technology and Management; Faridabad; India*
[2]*Department M.Tech(NSIT);N. Delhi India*
[3]*Department of applied Science and Humanities Lingayas University; Faridabad, India*
E-mail: [1]tayalamita2014@gmail.com

Abstract—*Carbon Capture is the process by which carbon dioxide (CO2) is isolated from other gases That are produced as a result of fossil fuel combustion or other industrial processes. According to the National Energy Technology Laboratory, up to 95% of CO2 gas Generated in these ways can be prevented from entering the atmosphere. After CO2 is captured, it must be compressed and Transported to a storage site. Carbon Sequestration refers to the underground storage of captured CO2 in specific geological formations. CO2 is injected under such high pressure during sequestration that it becomes liquid [16]The International Energy Agency (IEA) has estimated that the world energy demand will increase with more than 50% by 2030 and fossil fuel will contribute to more than 80% of the world energy consumption by 2030. Therefore, the world faces the climate change challenge and global concern of reducing GHG emissions (especially carbon dioxide - CO2) that result mainly from the combustion of fossil fuels (Coal, natural gas and oil). However, Carbon Capture and Storage (the capture of CO2 from industrial installations, its transport to a storage site and its injection to suitable underground geological formation for permanent storage) has emerged as a potential measure and a bridging technology to help mitigate the effect of climate change due to the release of CO2. Despite the emergence of CCS as a potential bridging technology for mitigating climate change, it has continued to face a lot of commercial, financial, social and legal challenges that have affected its deployment and development. [16]*

Keywords*: Sequestration, mitigate*

1. INTRODUCTION

Carbon capture refers to the separation and capture of CO2 from emissions point sources or the atmosphere and the recovery of a concentrated stream of that CO2 that can be feasibly stored (sequestered) or converted in such a way as to mitigate its impact as a greenhouse gas. For all practical purposes, it entails the capture of CO2 from stationary sources, such as fossil fuel-fired power plants and industrial facilities. Research efforts are focused on systems for capturing CO2 from coal-fired power plants because they are the largest stationary sources of CO2. Although current R&D emphasizes CO2 capture in coal-fired power plants, the carbon capture technologies to be developed will apply to natural gas-fired power plants and industrial CO2 sources as well. [1]CO2 capture has been happening for many years in the petroleum, chemical, and power industries, for a variety of reasons relevant to those industrial processes. However, in those cases, only a small portion of the CO2 produced is captured. Capturing all, or even just three-fourths, of the CO2 in a typical power plant with current technology would require equipment many orders of magnitude larger-a very expensive and highly energy-intensive option. In addition, without feasible, cost-effective ways to transport and store.

2. STEPS INVOLVED IN CCS

CCS, is broken into 2 parts: Part 1 - Capturing the carbon dioxide and Part 2 - Storage of carbon dioxide.

Part 1: Capturing the Carbon Dioxide

There are several methods of capturing carbon dioxide. These methods can either be human induced or it can happen naturally.

1. Pre-combustion

Carbon dioxide is captured from a gas mixture produced by partial oxidation of natural gas or biomass. As the mixture contains predominantly hydrogen and carbon dioxide, physical absorption is used to capture the carbon dioxide.

2. Post-combustion Capture

Carbon dioxide is captured at low pressure and low carbon dioxide content from fuel gas by separation from nitrogen and oxygen gas. This is achieved through the use of chemical absorption by monoethanolamine.

3. Oxyfuel combustion

For this process, oxygen is separated and is then used to burn fossil fuels. A part of the Fuel gas, which consists mainly of carbon dioxide and water is recycled to the combustion chamber to enhance the carbon dioxide concentration for subsequent removal.

4. Direct Capture from the atmosphere

This method can be achieved by building "carbon scrubbers" or towers that can capture carbon dioxide from the atmosphere.

5. Biological Capture CCS may seem to be a new technology to us but in fact it has been occurring naturally throughout history. The ocean has the natural ability to absorb atmospheric carbon dioxide. According to a report by RSC(Royal Society of Chemistry), about 90 gigatonnes of carbon are exchanged between the ocean and the atmosphere each year with a net uptake by the ocean of 2.2 gigatonnes. It is because of this ability and also with the increase in carbon dioxide emission that is causing ocean acidification. [1]

Part 2: Storage of Carbon Dioxide

After being captured, the carbon dioxide can be either stored undergound (geological sequestration) or in the ocean (ocean sequestration).

3. GEOLOGICAL SEQUESTRATION

1. Oil fields and Aquifier Storage

The carbon dioxide that is captured can be stored in depleted or depleting oil and gas fields, deep saline aquifers and unmineable coal seams. The benefits of pumping carbon dioxide in existing oil fields is that it actually improves oil yield and the carbon dioxide is stored in the fields. This greatly help in the development of enhanced oil recovery (EOR) projects. Storing carbon dioxide in saline aquifiers is also possible as deep saline aquifiers has the potential to store huge quantities of carbon dioxide. One example of carbon storage in saline aquifiers is at the Sleipner West field in the Norwegian North Sea . It is operated by Statoil.[1]

2. Carbon dioxide Sinks

Carbon dioxide sink is actually a European project where they aim to store carbon dioxide in subterranean rocks. Recently, Germany has inaugurate Europe’s first underground carbon dioxide storage site. 60,000 tonnes of carbon dioxide will be pumped into the porous, salt- water filled rocks at depths of more than 600m over the next 2 years.[1]

4. OCEAN SEQUESTRATION:

1. Use of marine phytoplankton

Marine phytoplankton assimilate carbon from seawater and when they die, they carry the carbon with them to the deep ocean .However ,phytoplankton growth is limited by the lack of the nutrient iron. Thus if iron were to be introduced into the ocean to promote the growth of these phytoplankton, it could help in the absorption of carbon dioxide. But these method has many downsides. Firstly, very little of the carbon dioxide is taken in by the phytoplankton makes it to the deep ocean. Instead, as the phytoplankton decays ,it releases the carbon back into the water. Secondly, if the growth of these phytoplankton were to be left unattended, it could cause the region of the ocean to become a dead zone because as the phytoplankton dies and decomposes, it actually requires oxygen. Algae and bacteria in the ocean have a great impact on the equilibrium between the drawdown and release of carbon dioxide (CO2) from the atmosphere and therefore on the global climate. [10] Studies have shown that bacteria in laboratory experiments produce DOM that can be stable for over a year. For their study, the researchers placed bacteria from the sea in artificial sea water, in order to ensure that the water was DOM-free at the beginning of the experiment. The bacteria were fed using known carbon sources. [11]

" The DOM measured in the incubations was produced by the bacteria," explained Lechtenfeld. After four weeks the DOM produced by bacteria was analyzed using high-resolution chemical methods (nuclear magnetic resonance spectroscopy and ultra high-resolution mass spectrometry) and compared with the DOM found naturally in sea water. "Our study reveals that bacteria rapidly produced complex DOM that was similar in it's chemical composition to natural DOM. The results were surprising and indicate that bacterial metabolites are a source of the persistent molecules in the ocean," said Dr Ronald Benner from the University of South Carolina.

The origin of persistent DOM: "It seems very clear that bacteria are a major driver in keeping a fraction of the atmospheric carbon dioxide in the ocean for long periods of time," said Dr Norbert Hertkorn of the Helmholtz Centre Munich. "Although the percentage of persistent substances in our experiment was apparently very low, their stability suggests that they may accumulate in the ocean. This is how bacteria efficiently contribute to carbon storage in the ocean and play an important and so far underestimated role for climate."[11]

2. Direct Injection into the Deep Ocean

By injecting carbon dioxide into the ocean at a depth of 3000m, the carbon dioxide can be kept away from being in contact with the atmosphere for 200 years. At ocean levels between 800 and 3000m a stream of liquid carbon dioxide is less dense than seawater and tends to rise to the surface, slowly mixing and dissolving with the surrounding water. At below 3000m liquid carbon dioxide reacts with the seawater to form clathrate, a solid ice-like substance that is denser than the surrounding water.[1]

Transport

The captured CO2 is compressed into a liquid-like state for efficient transport via pipelines, tanks, or by ships. The most cost effective method of transportation of CO2 is via pressurised pipelines. The pipelines must meet the required construction design and maintenance standard as well as health and safety requirements. The technologies used in pipeline transportation are the same as those used for transporting oil, natural gas and other fluid around the world.[17]

Storage

At the storage site, the compressed CO2 is injected into suitable geological underground formations which includes depleted oil and gas reservoirs, deep saline formations (either onshore or offshore), unmineable coal beds, use of CO2 in enhanced oil recovery, use of CO2 in enhanced gas recovery, and use of CO2 in enhanced coal bed methane recovery.[18] The storage sites for the CO2 are injected several kilometres under the earth's surface at sufficiently high pressure and depth (more than 800 metres to ensure that it becomes and remains a super critical fluid. CO2 in supercritical fluid will allow the CO2 to occupy less space than ordinary gases or liquid.[19]Immediately CO2 is injected into the geological formations, various physical/geochemical trapping mechanisms called cap rock would operate to prevent the CO2 from escaping out of the reservoir or migrating to the surface.[20]

5. CO2 UTILISATION

Utilisation of CO2 has been proposed as a possible alternative or complement to geologic storage of CO2 that could enhance an economic value for captured CO2. Many uses of CO2 are known, although most of them remain at a small scale. Between 80 Mt and 120 Mt of CO2 are sold commercially each year for a wide variety of applications (Global CCS Institute, 2011; IPCC, 2005). These include use as chemical solvents, for decaffeination of coffee, carbonation of soft drinks and manufacture of fertiliser. Some of these applications, such as refrigerants and solvents, demand small quantities of much less than 1 MtCO2 per year (MtCO2/yr) while the beverage industry utilises 8 Mt/yr. The largest single use is for enhanced oil recovery (EOR) which consumes upwards of 60 MtCO2/ yr, mostly from natural sources . Other emerging uses, such as plastics production or enhanced algae cultivation for chemicals and fuels, are still small scale or require years of development ahead before they reach technical maturity.Chemical uses of CO2, which is a relatively abundant source of carbon, remain limited despite carbon being the basis for most of our goods and fuels. This is because CO2 is unreactive and usually requires large amounts of energy to break its chemical bonds. This is the same property that makes it an inert and safe gas to trap underground. The main challenge is scale. Given today's uses for CO2, the future potential of CO2 demand is immaterial when compared to the total potential of CO2 supply from large point sources (Global CCS Institute, 2011). Mineral carbonation and CO2 concrete curing have the potential to provide long-term storage in building materials. However, the mass of calcium carbonate that would result if the captured CO2 in the 2DS were used for carbonation would equate to nearly double the total projected world demand for cement between today and 2050.

Another challenge is what happens to the CO_2 when it is used. In most existing commercial uses the CO_2 is not permanently isolated from the atmosphere and does not assist climate change mitigation. Carbon used in urea fertilisers returns to the atmosphere during a plant's lifecycle and fuels manufactured from CO_2 release the carbon when combusted. On the other hand, uses of CO_2 that can verify that the CO_2 is isolated from the atmosphere, such as bauxite residue carbonation in the aluminium industry and monitored EOR operations, can be classified as CCS.[15]

6. COMBINING CCS WITH BIOMASS ENERGY SOURCES

Bioenergy with carbon capture and storage (BECCS) is an emissions reduction technology offering permanent net removal of CO2 from the atmosphere. BECCS works by using biomass that has removed atmospheric carbon during its growth cycle, and then permanently storing underground the CO2 emissions that result from its combustion or fermentation. A decrease in the amount of CO2 in the atmosphere results from the combination of the benefits of biomass use with the benefits of CCS, with the ultimate aim of storing more CO2 from biomass use than that emitted from fossil fuel use.[15]

BECCS has significant potential, it is important to ensure that the biomass is produced sustainably, as this will significantly impact the level of emissions reduction that can be achieved, and will hence define "how negative" the resulting emissions can be (IEAGHG, 2011c). BECCS can be applied to a wide range of biomass conversion processes and may also be attractive from a relative cost perspective. Applications range from capturing CO2 from biomass co-firing and biomass-fired power plants, to biofuel production processes. To date, however, BECCS has not been fully recognised or realised. Incentive policies to support it need to be based on an assessment of the net impact on emissions that the technology can achieve. The IEA (2011c) recommends that, to the greatest extent possible, all carbon impacts of BECCS be fully reflected in carbon reporting and accounting systems under the UNFCCC and Kyoto Protocol. A solid understanding of the life-cycle emissions savings that BECCS could achieve will be an essential prerequisite for well-calibrated BECCS support. BECCS merits a specific set of incentives that reflects the negative life-cycle emissions that BECCS can achieve compared to emissions reductions of other CCS applications.[15]

Advantages OF CCS : First, it could work within the existing system – so the powerplant sites and wires, which make and transport electricity, can be reused. That saves decades of planning wrangles, and low carbon electricity can be delivered at a similar .Second, CCS could take away 35% of Scottish CO2 emissions, and provide low carbon electricity routinely by 2025. That enables development of electric cars and electric house heating to remove still more carbon emissions.

Third, the power output is flexible, so that as renewables grow to dominate output, CCS fossil fuel is still available to be turned up rapidly on the calm or cold days and weeks when it is needed. Fourth, CCS can reduce CO2 in the atmosphere. If 10% or more biomass, formed from atmospheric carbon, is co-combusted and the CO2 captured, that is a net reduction. Fifth, Scotland has 50% of the offshore storage capacity in Europe.[13]

CCS could be one of the most effective measures for fighting climate change at the same time as ensuring energy security. Currently over 60 percent of carbon dioxide emissions come from 8,000 large-scale stationary sources, such as coal- and gas-fired power plants and industrial sites — all of which could be subjected to CCS.

Moreover, when you take into account some of the downsides of renewable energy, CCS could be crucial to ensure energy security and supply for the U.S.. Mills points out that it is very unlikely that renewable will dominate energy supply in time to tackle climate change and that the maintenance of the electricity grid is almost impossible using only alternative energy sources as wind and solar power. In short, coal- and gas-powered generating stations can be run everywhere, independent of whether there is sun or wind available locally, and with regular supply, unlike the peaks and troughs of wind and solar.

7. DISADVANTAGES

Big grants are needed to get the first plant running. Second, the energy used in capturing CO2 is 25-30% of the fuel. Historically, spectacular improvements occurred with both sulphur oxide (acid rain) and nitrogen oxide capture at power plants. Both of these were "impossible" initially, but are now cheap and routine. Capturing carbon oxides will work too. Third, maybe the stored carbon will leak? Well there are natural accumulations of CO2 beneath the North Sea which have been stored, along with oil or gas, for 55 million years. Pointing at the danger of leakages from carbon storage, one critique referred to the disaster at Lake Nyos in the African country of Cameroon back in 1986 where 1,700 people and 3,500 livestock died as volcanic activity suddenly released pockets of carbon dioxide from the depth of the lake. Who wouldn't fear such scenarios — being asphyxiated within seconds?

CCS encourages extraction of coal, oil and gas. These fuels are convenient and cheap, and will be extracted and burned anyway. Better, then, to tax emissions, which discourages fossil use, while also providing clean electricity from renewables and CCS, so that citizens have something good to change towards.[13]

[14] Carbon capture and storage (CCS) has been widely heard about, widely demonized but also widely misunderstood. President Barack Obama has incorporated it as one of the main actions by the U.S. in the fight against climate change. Research in the field has been immense, though many questions are still open.

In the case of the Nyos disaster, carbon dioxide naturally accumulated 700 feet below the surface of the lake in unusually high concentrations. In the case of CCS, however, carbon dioxide is stored a thousand times deeper, far away from any populated areas and not necessarily in such high concentrations. Also, before injecting the climate-threatening gas, extended geological surveys ensure the safety of the project as much as possible. And, even if an accident would happen, how severe is the impact of such an accident compared to the long-term impacts of climate change including a possible rise of the sea-water level of up to 23 inches by the year 2100, threatening the lives of 100 million U.S. citizens who live within 3 feet of mean sea level and many more globally?

The costs and efforts for the industry and taxpayers might be out of scale compared to the possible gains. For instance, the most adequate carbon storage sites are not evenly scattered across the globe and the U.S., which means carbon dioxide would have to be transported for long distances to storage sites. sites.

Vaclav Smil, an energy expert at the University of Manitoba, Canada, points out that to capture just a fifth of the current carbon dioxide emissions, the world "would have to create an entirely new worldwide absorption-gathering-compression-transportation-storage industry whose annual throughput would have to be about 70 percent larger than the annual volume now handled by the global crude oil industry."

And according to MIT's Carbon Capture and Sequestration Technologies program, there are currently only six projects under way, of which five are still in the planning phase; Even though carbon dioxide leakages won't necessarily happen, if they happen, who would be responsible? The state? The industry (even after carbon-dioxide has been stored for hundreds of years)? On another note, as we would have to take the common responsibility for any accident.

Environmental Issues: storage of carbon dioxide in the deep sea may lead to the pH of the seawater to decrease and become acidic.

Social Issues: Some consider carbon dioxide to be an industrial waste and thus dumping it in the ocean is similar to contributing to water pollution. The setback of CCS is that it requires energy and with this we need to use more fossil fuel. The intergovernmental panel on climate Change (IPCC) estimates that the cost of CCS technology would increase the energy needs of power plants by 10-40% and increase the cost of energy from plants by 30-60%. One solution would be to use renewable energy to provide for the energy required. Because of the global impact of this issue, it cannot be addressed by any one nation or by special-interest sector. It must be addressed at an international and intergovernmental level. But first, we need to promote public awareness so as to let the public understand and accept CCS as a safe and technologically sound option for carbon dioxide abatement.[21]

whether CCS could be a viable technological option for significantly reducing future CO2 emissions in India

The most crucial precondition that must be met is a reliable storage capacity assessment based on site-specific geological data since only rough figures concerning the theoretical capacity exist at present. [22]Our projection of different trends of coal-based power plant capacities up to 2050 ranges between 13 and 111 Gt of CO2 that may be captured from coal-fired power plants to be built by 2050. If very optimistic assumptions about the country's CO2 storage potential are applied, 75 Gt of CO2 could theoretically be stored as a result of matching these sources with suitable sinks. If a cautious approach is taken by considering the country's effective storage potential, only a fraction may potentially be sequestered. In practice, this potential will decrease further with the impact of technical, legal, economic and social acceptance factors. Further constraints may be the delayed commercial availability of CCS in India, a significant barrier to achieving the economic viability of CCS, an expected net maximum reduction rate of the power plant's greenhouse gas emissions of 71–74%, an increase of most other environmental and social impacts, and a lack of governmental, industrial or societal CCS advocates.[22]

Several preconditions need to be fulfilled if CCS is to play a future role in reducing CO2 emissions in India, the most crucial one being to determine reliable storage capacity figures. In order to overcome these barriers, the industrialised world would need to make a stronger commitment in terms of CCS technology demonstration, cooperation and transfer to emerging economies like India. The integrated assessment might also be extended by a comparison with other low-carbon technology options to draw fully valid conclusions on the most suitable solution for a sustainable future energy supply in India.[22]

8. CONCLUSION

CCS could be a core part of a viable synergy between fossil fuel and alternative energy sources. This would prop up the U.S. energy network and allow it to exploit its comparative and growing cost advantage in fossil fuels in a sustainable and secure way, even with the possibility of guaranteeing U.S. energy independence in the long term. Choosing CCS does not have to mean that renewable energy sources have to be excluded, something that the mainstream, according to Mills, often overlooks.

Finally, it should not be forgotten that CCS methods are anyhow already in use in a process called enhanced oil recovery (EOR), which increases the amount of oil recovered in a field by 25 percent. Battelle, a nonprofits research and development organization has just announced the beginning of a large-scale carbon dioxide injection in the oil fields of Michigan's Northern Reef Trend. Other industrial-scale storage projects like this are already in operation, such as the Weyburn EOR project in Canada, the InSalah project in Algeria and the Sleipner project in Norway's North Sea. There is an urgent need to tackle climate change and we need "all the tools in the box" to do so; we cannot tackle climate change effectively without CCS. Measures to reduce greenhouse gas emissions, including more electric cars, will mean we need more electricity; and CCS is an unavoidable option if we are to ensure that we can meet this electricity demand with an acceptable carbon footprint.[14]To meet UK climate change targets, need is to decarbonise the power sector by the 2030s, and the heavy industry sector beyond that. this cannot be done without CCS. Several preconditions need to be fulfilled if CCS is to play a future role in reducing CO2 emissions in India, the most crucial one being to determine reliable storage capacity figures. In order to overcome these barriers, the industrialised world would need to make a stronger commitment in terms of CCS technology demonstration, cooperation and transfer to emerging economies like India.

Seven key actions for the next seven years

The next seven years are critical to the accelerated development of CCS, which is necessary to achieve low-carbon stabilisation goals (*i.e.* limiting long-term global average temperature increase to 2 °C). The seven key actions below are necessary up to 2020 to lay the foundation for scaled-up CCS deployment. [15]They require serious dedication by governments and industry, but are realistic and cover all three elements of the CCS process.

1. Introduce financial support mechanisms for demonstration and early deployment of CCS to drive private financing of projects.
2. Implement policies that encourage storage exploration, characterisation and development for CCS projects.
3. Develop national laws and regulations as well as provisions for multilateral finance that effectively require new-build, base-load, fossil-fuel power generation capacity to be CCS-ready.
4. Prove capture systems at pilot scale in industrial applications where CO2 capture has not yet been demonstrated.
5. Significantly increase efforts to improve understanding among the public and stakeholders of CCS technology and the importance of its deployment.
6. Reduce the cost of electricity from power plants equipped with capture through continued technology development and use of highest possible efficiency power generation cycles.
7. Encourage efficient development of CO2 transport infrastructure by anticipating locations of future demand centres and future volumes of CO2.[15]

Actions and milestones after 2030: CCS goes main stream

In 2050 CCS is routinely used to reduce CO2 emissions from fossil fuel power plants and all suitable industrial applications.[15]

All new coal-fired power plants, one out of two gas-fired power plants, and one out of five biomass-fired power plants are equipped with CCS; by 2050, a total of over 950 GW of power generation capacity is equipped with capture. Between 25% and 40% of all production of steel, cement and chemicals are equipped with CCS globally.

The total global storage rate exceeds 7 gigatonnes of carbon dioxide per year (GtCO2/yr); CO2 storage is a well-developed industry exceeding the size of gas and oil industry in 2013; by 2050, around 120 GtCO2 have been stored in geological storage sites around the world, and the exploration and storage industry has projects in development to meet a market demand of 10 GtCO2/yr.

Policy conditions are such that CCS projects are commercial under technology-neutral climate change policies worldwide in all sectors.[15]

The period after 2030 involves the continuation and consolidation of actions in progress in 2030, leading to a significant ramp-up of the CCS industry. It is assumed that governments and industry will conduct regular evaluation of the status and deployment of CCS technologies and design follow-up policies, R&D, financing and other actions accordingly.

REFERENCES

[1] Northwestern University Climate Change Symposium 2010
[2] http://www.netl.doe.gov/technologies/carbon_seq/FAQs/carboncapture.html#how.
[3] http://alternativeenergy.procon.org/view.answers.php?questionID=001401&print=true
[4] http://alternativeenergy.procon.org/view.answers.php?questionID=001401&print =true
[5] http://www.buzzle.com/articles/what---is---carbon---capture---and---storage .html
[6] Article from http://www.buzzle.com/articles/what-is-carbon-capture-and-storage.htm
[7] http://www.geos.ed.ac.uk/sccs/storage/storageSites.html
[8] http://network.carboncapturejournal.com/video/2018151:Video:4342
[9] http://www.futuregenalliance.org/about.stm
[10] Scientific blogging By News Staff | April 1st 2015 10:00 AM11.http://dx.doi.org/10.1038/ncomms7711
[11] Oliver J. Lechtenfeld, Norbert Hertkorn, Yuan Shen, Matthias Witt&Ronald Benner (2015): Marine sequestration of carbon in bacterial metabolites. Nature Communications 6:6711
[12] This is an article from issue 58 of What on Earth magazine.
[13] Capturing and storing carbon: Is it worth it? By Stefanie Heerwig
[14] International Energy Agency 9 rue de la Fédération 75739 Paris Cedex 15, Francewww.iea.org Technology Roadmap Carbon capture and storage - 2013 edition.
[15] Ayeni Oladotun; CLIMATE CHANGE MITIGATION: CARBON CAPTURE AND STORAGE (CCS) TO THE RESCUE; WHAT KEY ELEMENTS?
[16] IPCC, Ibid.
[17] IPCC, Ibid.
[18] Addison, J., Bowman, J., and Watchman, P. Q., Supra note 15, at p. 287-289.
[19] Addison, J., Bowman, J., and Watchman, P. Q., Supra note 15, at p. 288.
[20] http://www.buzzle.com/articles/what-is-carbon-capture-and-storage.html
[21] Peter Viebahn, , Daniel Vallentin, Samuel Höller Prospects of carbon capture and storage (CCS) in India’s power sector – An integrated assessment Peter Viebahn, , Daniel Vallentin, Samuel Höller Available online 25 December 2013Applied Energy Volume 117, 15 March 2014, Pages 62–75