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# Carbon Capture SCAM (CCS)

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How a False Climate Solution Bolsters Big Oil

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# GREENPEACE

Greenpeace is an independent campaigning organization that acts to expose global environmental problems and achieve solutions that are essential to a green and peaceful future.

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# Executive Summary

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Human-caused, global climate disruption demands we quickly phase-out the burning of fossil fuels as an energy source.<sup>1</sup> The Greenpeace Energy [R]evolution analysis (E[R]), as well as many others, demonstrates there is a pathway to a renewable energy economy in time to stop the worst impacts of global warming.<sup>2</sup> Many politicians and industry leaders, however, refuse to let go of the combustion economy, and waste valuable time and resources on false solutions.

The CCS myth posits that the economy could continue to burn fossil fuels without the harmful effect of global warming. Burning fossil fuels for electricity is the number one source of anthropogenic carbon dioxide, the most predominant greenhouse gas and most problematic climate pollutant over the long term.<sup>1</sup> Burning coal is the number one source of CO<sub>2</sub> from the electricity sector.<sup>3</sup> The proposed carbon rule from the US Environmental Protection Agency (EPA) regarding future power plants would affect only new coal plants.<sup>4</sup>

***The EPA rule abandons the ‘S’ in CCS. No longer must the CO<sub>2</sub> be sequestered from the atmosphere. Instead, the EPA carbon rule would be a protocol for how carbon capture must be used to increase supply of oil. EPA must rethink this rule before it is finalized.*** The facade of the proposed EPA rule should not be surprising given the history of how carbon capture technology has developed. It will be disappointing if President Obama’s environmental agency validates this expensive political distraction. Here are four reasons why EPA will be right to ditch support for carbon capture.

- Even data from the federal government, a proponent of CCS, shows CCS would be the costliest way to reduce CO<sub>2</sub> pollution caused by electricity production.
- Increasing oil extraction is the real goal of developing CO<sub>2</sub> capture. Capturing carbon means more, not less, climate pollution in the atmosphere.
- CO<sub>2</sub> leakage is a worsening gamble. And people, not polluters, bear the risk.
- CCS threatens to make the overall environmental impact of using fossil fuels worse.

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<sup>1</sup> Methane, 86 to 105 times more warming than CO<sub>2</sub> as a greenhouse gas, is a greater problem in the short term. <http://www.greenpeace.org/usa/en/campaigns/global-warming-and-energy/science/Natural-Gas-and-Global-Warming>



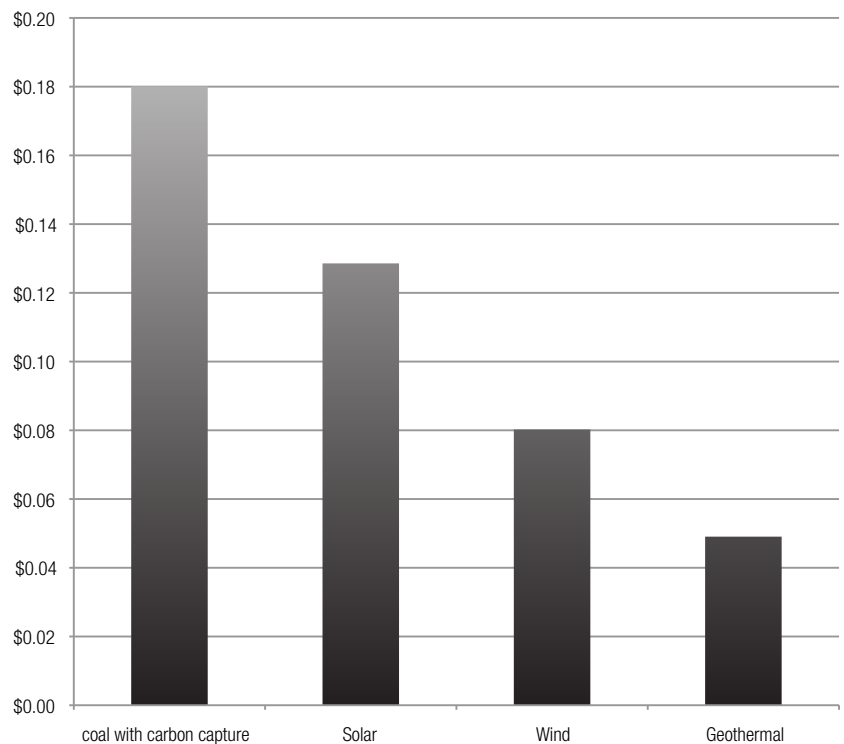
# Executive Summary

## 1. CCS Is A Distraction That Cannot Save The Climate

CCS proponents claim that carbon capture-enabled coal plants would provide “the greatest reductions in future US electric sector CO2 emissions” and highlight the urgency with which CCS must be applied in order to achieve these benefits.<sup>5</sup> The International Energy Agency (IEA) is right to increasingly focus on renewable energy over fossil fuels, a dynamic reinforced as solar and wind development soars and communities work energetically to divest from coal, oil and gas.<sup>6</sup> In 2009, IEA published its first “technology roadmap” for developing CCS quickly enough to avoid the worst impacts of climate change. Even if IEA’s ambitious CCS roadmap succeeds, it will not be much help.

Ultimately, the most damning aspect of CCS for policymakers may be its cost. Cost estimates from the US Energy Information Administration, part of Department of Energy which has invested billions of dollars in CCS, show that CCS is the most expensive method of avoiding additional CO2 emissions. We compared the cost of avoiding a kilogram of CO2 emissions per unit of electricity (kilowatt hour). See Appendix I for an explanation of the methodology. Being overly fair to CCS, we show that CCS would cost almost 40% more per kilogram of avoided CO2 compared with solar PV, 125% more than wind, and 260% more than geothermal.

**Figure 3:** Relative Costs of Avoided CO2 (per kilogram, per kWh)



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# Executive Summary

## 2. Capturing Carbon Will Increase Climate Pollution

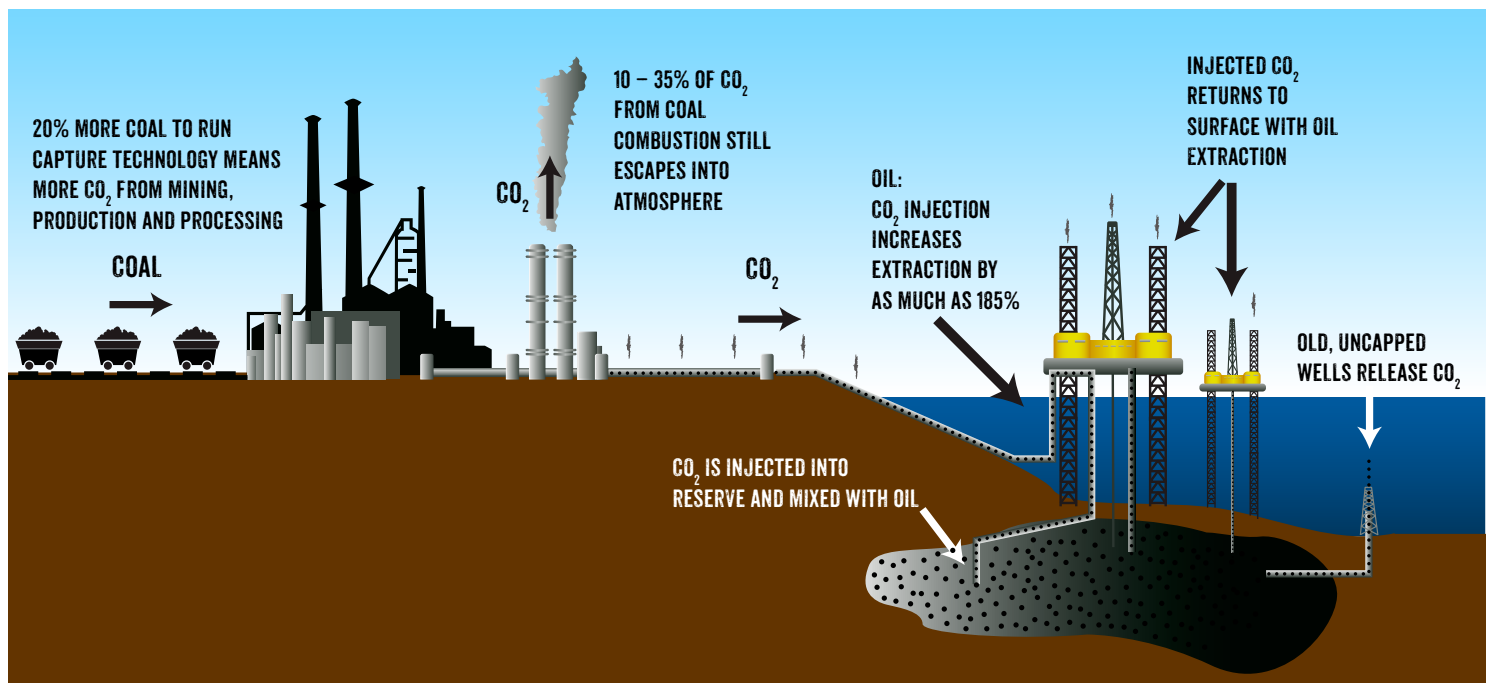
Australia, the second largest exporter of coal after Indonesia, announced in 2009 a new initiative called the Global CCS Institute to promote CCS development world-wide.<sup>7</sup> The Institute says the business case for carbon capture rests on the ‘twin pillars’ of public support and market opportunity.<sup>8</sup> The exorbitant cost of CCS and political difficulty in generating enough taxpayer support has made proponents turn more and more to market opportunity.

CCS proponents do not bother to hide that the major selling point behind carbon capture is its role in ‘enhanced oil recovery’ (EOR). Responsible for 6% of U.S. oil production today, up from virtually nothing in the 1980s, industry claims to have been doing it for more than three decades. So-called CO<sub>2</sub>-EOR

works by pumping CO<sub>2</sub> underground to force out oil that otherwise could not be extracted.<sup>9</sup> Some claim that without CO<sub>2</sub> injection 65% of the oil would be left underground.<sup>10</sup> There is no reason to believe industry practices are geared toward anything but maximizing oil supply.

There are few independent, peer-reviewed studies of lifecycle greenhouse gas emissions from CO<sub>2</sub>-EOR projects. However, one independent study of 5 projects and revealed that—between mining coal, capturing carbon from the coal plant, utilizing the carbon for EOR, and burning the produced oil—the EOR can result in a net *increase* in carbon emissions.<sup>11</sup>

**Figure 5: CO<sub>2</sub> Capture = More Coal, More Oil, More CO<sub>2</sub>**



# Executive Summary

## 3. Sequestration Is A Bad Bet; People – Not Polluters – Bear The Risk

In order for CCS to deliver a lasting benefit to the climate, the vast majority of sequestered CO<sub>2</sub> must remain underground permanently. Geological formations proposed are sub-seabed and saline aquifers. The IEA says that depleted oil and gas reservoirs would be the most likely candidates for initial storage operations because of both their geology and proximity to industrial development.

The multiple bore holes and wells drilled in them to find and extract oil and gas further increase the risk of leakage. The IEA also has admitted that, “[t]he long-term storage integrity of oil fields that have been exploited with multiple wells has yet to receive serious scientific investigation.”<sup>12</sup> Ongoing extraction industry activities, such as fracking, also jeopardize long term sequestration. When it comes prospects for CO<sub>2</sub> sequestration not thwarted by the extraction industry itself, a recent MIT study seriously undermines previously held assumptions about the chemistry of CO<sub>2</sub> integration with geology underground. This study indicates that the majority of injected CO<sub>2</sub> could uncontrollably make its way back to the surface.<sup>13</sup>

The fossil fuel industry has long advocated shifting long term responsibility and liability for CO<sub>2</sub> sequestration and monitoring to the public, as they have also done for virtually any type of liability for their public health impacts. They have largely succeeded both in the US and abroad.

## 4. Carbon Capture Is Bad For The Environment

At best, CCS could mitigate some of the carbon pollution associated with burning coal, but it would do nothing to address a long list of environmental and public health harms associated with coal use in the power sector. CCS would exacerbate many of these harms not just because it would support continued use of coal but because carbon capture requires significantly more coal to provide the same amount of electricity.

Using coal for electricity requires mining, washing and processing, transporting, burning, as well as disposing of ash – in stark contrast with relying on the wind and sun for energy. CCS would magnify coal’s environmental footprint, including the increased use of freshwater and more pollution of the air and water. This would be in addition to the already hundreds of billions of dollars in annual costs to health and the economy, costs currently covered by taxpayers and electricity ratepayers.



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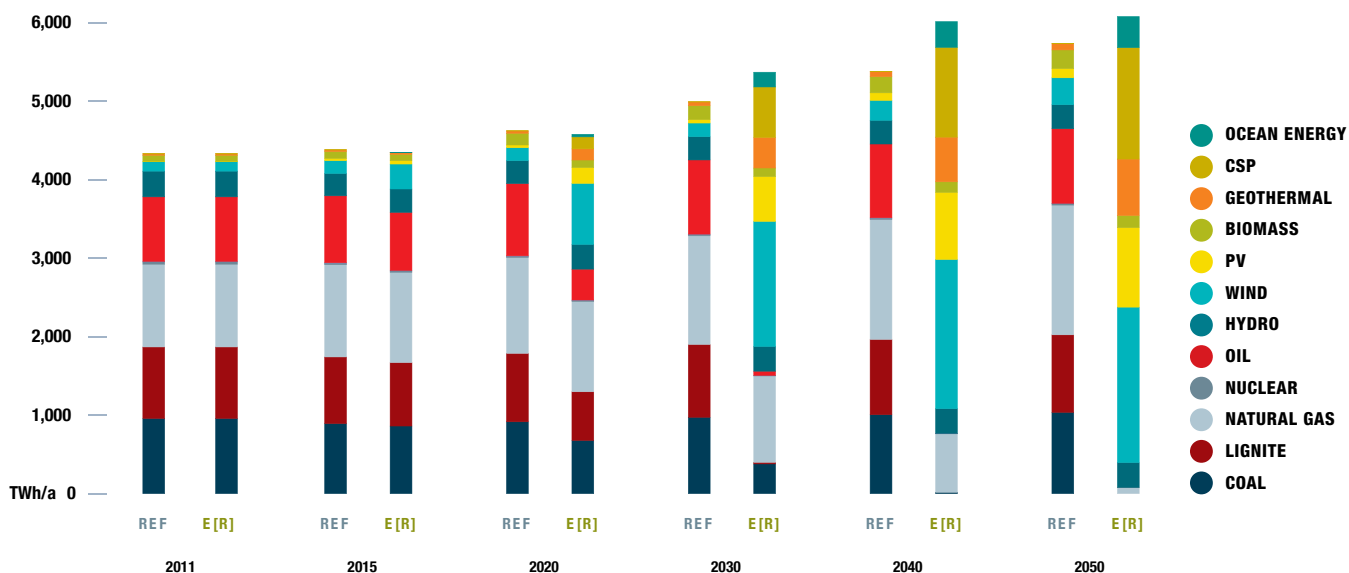
# Conclusion

This report shows how even the most ambitious plans for CCS also would not help avert the worst impacts of climate change. Its proponents in the federal government are also working with information that shows it would be the most expensive way to avoid CO2 pollution in the power sector. The Obama administration seems partly driven by faith in a technology that was supposed to sequester pollution from the atmosphere. However, the administration view also appears to be that fossil fuel projects never contribute to climate change. Every federal agency has an excuse for why its okay to support new coal, oil and gas supply projects.

Supporters of carbon capture for oil extraction claim that oil produced with CO2 injection is going to get produced somewhere else anyway, and therefore would actually be 'green' oil because it keeps CO2 from a coal plant from entering the atmosphere. Is this "clean coal" for "green oil"? This sounds confusing because it makes no sense for many reasons, one being that injected CO2 comes back up the well with the oil. EPA's proposed carbon rule ascribes to this logic, by promoting oil production with CO2 injection without accounting for any of the CO2 injected, nor created by burning the oil later.

EPA must rethink its proposed rule and come up with a final policy that acknowledges fossil fuel-fired power plants, not to mention fossil fuel extraction, are a poor investment. The future is in solar and wind are, as the Greenpeace Energy [R]evolution analysis has predicted more accurately than most.<sup>14</sup> There is no viable solution for both supporting the use of fossil fuels and the climate simultaneously.

**Figure 1:** Electricity Generation Structure – Comparing Greenpeace E[R] Scenario with Energy Information Administration Scenario





# Endnotes

- <sup>1</sup> "Quick-Change Planet: Do Global Climate Tipping Points Exist?" by Dave Levitan. Scientific American. 25 March 2013. Accessed 3 March 2015. <http://www.scientificamerican.com/article/do-global-tipping-points-exist/>
- <sup>2</sup> "Energy Revolution 2014: A Sustainable USA Energy Outlook," 12 May 2014. <http://www.greenpeace.org/usa/en/media-center/reports/energy-revolution-2014/>; "Renewables 2014: Global Status Report," REN21. Accessed 3 March 2015. [http://www.ren21.net/Portals/0/documents/Resources/GSR/2014/GSR2014\\_full%20report\\_low%20res.pdf](http://www.ren21.net/Portals/0/documents/Resources/GSR/2014/GSR2014_full%20report_low%20res.pdf); Berger, John. "Pathways to 100 Percent Renewable Energy," 30 April 2013. Accessed 3 March 2015. <http://www.renewableenergyworld.com/rea/news/article/2013/04/pathways-to-100-percent-renewable-energy>
- <sup>3</sup> "Carbon Capture and Sequestration: A Primer," Congressional Research Service. 16 July 2013. Accessed 3 March 2015. <http://www.fas.org/sgp/crs/misc/R42532.pdf>
- <sup>4</sup> "In Depth: The Debate Over the EPA's New Carbon Capture Climate Scheme," by Mike Ludwig, Truthout, 26 September 2013. Accessed 3 March 2015. <http://www.truth-out.org/news/item/19063-in-depth-the-debate-over-the-epas-new-carbon-capture-climate-scheme>
- <sup>5</sup> From Testimony given in Senate hearing, 22 March 2007. Accessed 5 March 2015. [http://www.energy.senate.gov/public/index.cfm/files/serve?File\\_id=291abc96-0cf4-428f-8dba-71551689e11d](http://www.energy.senate.gov/public/index.cfm/files/serve?File_id=291abc96-0cf4-428f-8dba-71551689e11d)
- <sup>6</sup> <http://gofossilfree.org/wrap-up/>
- <sup>7</sup> World Coal Association. Accessed 6 March 2015. <http://www.worldcoal.org/resources/coal-statistics/>
- <sup>8</sup> "The Global Status of CCS: 2014," Global CCS Institute. 5 November 2014. p. 35. Accessed 6 March 2015. <http://www.globalccsinstitute.com/publications/global-status-ccs-2014>
- <sup>9</sup> "Carbon Dioxide Enhanced Oil Recovery: Industrial CO2 Supply Crucial for EOR," by Michael L. Godec. American Oil and Gas Reporter. February 2014. Accessed 6 March 2015. <http://www.aogr.com/magazine/editors-choice/industrial-co2-supply-crucial-for-eor>; "EOR as Sequestration-Geoscience Perspective," by Susan D. Hovorka. white paper for Symposium on Role of EOR in Accelerating Deployment of CCS. Accessed 6 March 2015. <https://mitei.mit.edu/system/files/hovorka.pdf>
- <sup>10</sup> C12 Energy. Accessed 6 March 2015. <http://www.c12energy.com/#/eor-basics/c1vff>
- <sup>11</sup> Jaramillo, et al. "Life Cycle Inventory of CO2 in an Enhanced Oil Recovery System," Environmental Science and Technology. 43(21). 30 September 2009. Accessed 6 March 2015. <http://pubs.acs.org/doi/abs/10.1021/es902006h>
- <sup>12</sup> "A Policy Strategy for Carbon Capture," IEA. January 2012. Accessed 6 March 2015. [http://www.iea.org/publications/freepublications/publication/policy\\_strategy\\_for\\_ccs.pdf](http://www.iea.org/publications/freepublications/publication/policy_strategy_for_ccs.pdf)
- <sup>13</sup> "MIT Study Challenges Feasibility of Carbon Capture and Storage," MIT New Office. Accessed 10 March 2015. <http://www.pennenergy.com/articles/pennenergy/2015/01/mit-study-challenges-feasibility-of-carbon-capture-and-storage.html>
- <sup>14</sup> "Guess Who Most Accurately Predicted the Explosion of Clean Energy Markets," by Brian Merchant. 24 March 2015. Accessed 27 March 2015. <http://motherboard.vice.com/read/guess-who-accurately-predicted-the-explosion-of-the-clean-energy-market>

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