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SPECIAL EDITION

# *Sequestration News*

*As was mentioned in the previous issue of Sequestration News, it may be very challenging to enact comprehensive climate change legislation in the days remaining for the 111th Congress, but an enhanced energy bill could provide some impetus for CCS. The House passed climate legislation, H.R. 2454, in June 2009. Senators Kerry and Lieberman released a draft climate bill on May 12, 2010. Also, Senators Lugar and Graham have introduced an energy bill that includes transportation, efficiency, and power sector provisions. Since portions of these bills could be used in near-term energy legislation, and all are likely to contribute to climate legislation in 2011, it would be useful to compare and to contrast their various provisions related to accelerating deployment of CCS. In this context, the USCSC invited Doug Carter who has been closely following these bills to provide the USCSC members with a short comparative analysis of their CCS incentives. His analysis is the subject of this issue of Sequestration News.*

## *A Comparison of Legislative Approaches to Promote Carbon Capture & Storage*

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### *Summary*

There is broad support for the views that aggressive greenhouse gas (GHG) reduction goals cannot be affordably met with current technologies, and that the public sector should foster accelerated development of key technologies. The basic argument for technology incentives is that, by paying a little more now via subsidies, improved technologies will be developed which will enable more aggressive goals to be met at much lower costs in the long run. Moreover, CCS is generally recognized as one of those key technologies, if not the key technology. As a result, various climate change mitigation bills have proposed financial and regulatory incentives to promote development of CCS, and other low carbon technologies.

This paper identifies a range of regulatory and financial incentives relevant to accelerated deployment of CCS technology. It then reviews three recent legislative proposals which provide one or more of those incentives.

### *Types of incentives*

CCS incentives can be structured as carrots or sticks: financial subsidies or regulatory requirements. Regulatory requirements can take the form of:

- A limitation on overall emissions
- A performance standard for a particular technology, like power generation, which cannot be met absent CCS technology
- A "clean energy" or "low-carbon" standard, similar to a renewable electricity standard
- Measures to address non-financial barriers to CCS, such as pore space ownership, and long-term stewardship of storage sites.

Financial incentives can take the form of:

- Government grants for CCS, such as those provided by the DOE Clean Coal Power Initiative demonstration program
- Loan Guarantees, such as those provided by Title XVII of the Energy Policy Act of 2005
- Tax credits provided through the IRS for specific technologies
- CCS subsidy funds whose revenues derive from fees placed on sales of fossil energy-based electricity
- "Bonus allowances" whose revenues derive from allocation of GHG compliance allowances

### *Recent legislative proposals*

Both H.R. 2454, passed by the House in June 2009, and the draft climate bill released by Senators Kerry and Lieberman on May 12, 2010, are comprehensive climate change mitigation bills which contain incentives for CCS technology. The regulatory incentives include performance standards for new coal and petroleum coke-fired power plants (and for existing coal and petroleum coke-fired power plants in the Kerry-Lieberman bill); and significant financial incentives in the form of a special fund for CCS projects, and large allocations of "bonus allowances" to CCS projects. However, neither bill makes much progress in addressing non-financial barriers to CCS.

S. 3464, introduced by Senator Lugar on June 9, 2010, is not a comprehensive climate change mitigation bill, but it does include a "diverse energy" electricity standard which would require greater use of low-carbon technologies, such as renewable energy, nuclear energy, and CCS. Under this technology deployment approach, a direct subsidy is not employed. Rather, the requirement for (typically more costly) low-carbon technologies internalizes the additional cost of low-carbon technologies in the price consumers pay for electricity.

### *Unresolved issues*

Neither H.R. 2454 nor the Kerry-Lieberman bill provide details regarding how their CCS financial incentives would be implemented at a project level, so it is unclear if the amount of the subsidies, which appear adequate overall, will be adequate at a project level. Additionally, none of these three bills resolves outstanding non-financial barriers to CCS technology, although two call for studies and reports which could lead to legislation in the future.

S. 3464 mandates low-carbon technologies in general, but it does not ensure that a broad portfolio of emerging technologies, including CCS, will be deployed. Set-asides, or "carve-outs" for specific classes of low-carbon technologies could provide such a portfolio, if added to the general construct of the bill.

## *Introduction*

This paper begins with a brief review why various stakeholders in the climate debate have proposed incentives to foster the development and deployment of carbon capture and storage (CCS) technologies for fossil energy power systems and other emitters of carbon dioxide ($CO_2$). It then describes several types of incentives which have been considered in recent legislation, followed by a review of CCS incentives offered in three recent legislative proposals. The paper closes with a review of key unresolved policy issues related to CCS incentives.

This paper does not repeat the work of other publications which describe CCS technology and its state of development, cost and performance. CCS, for purposes of this paper, is meant to include the overall system of separation and capture of $CO_2$ from other gases, transport by pipeline to an appropriate site, injection of the $CO_2$ deep below the surface of the earth and monitoring to ensure that it is permanently contained.

## *Reasons for government incentives*

In general, a government incentive for an activity warrants consideration if the activity provides a substantial public good, and would not occur without the incentive. The broad argument for CSS incentives is that they will foster development of an affordable technology necessary for achievement of long-range climate goals, and that absent the incentives, the technology would at best be significantly delayed, and at worst never be deployed on a large scale.

The need for technology incentives to meet climate change mitigation goals was articulated by the National Commission on Energy Policy in 2004.[1] NCEP concluded that "only improved technologies can provide cost-effective answers" to the nation's energy challenges and that the current pace of energy-technology innovation was inadequate to meet those challenges. NCEP specifically recommended "early-deployment incentives for clean-coal technologies," as well as deployment incentives for a more efficient transportation sector, nuclear power, and renewable energy technology. The funding for these incentives would derive "from the sale of a small portion of emission allowances under the proposed tradable-permits system for greenhouse gases," a revolutionary concept in 2004.

An international perspective on the need for CCS was offered by former UK Prime Minister Tony Blair, who stated, "The vast majority of new power stations in China and India will be coal-fired. Not 'may be coal-fired'; will be. So developing carbon capture and storage technology is not optional, it is literally of the essence."[2] In 2009, the U.S. consumed 19.8 quadrillion Btu's of coal, and coal use had declined for the two previous years; China consumed 61.0 quadrillion Btu's of coal, an increase of 9 quadrillion Btu's over coal use in 2007.[3] The value of CCS technology has been estimated as quite large by the International Energy Agency. The IEA projected the marginal cost of attaining aggressive global goals for GHG mitigation in 2050 to be 97% greater in the absence of CCS technologies, leading to an incremental cost increase of $1.3 trillion per year.[4]

### *Types of incentives – carrots and sticks*

Incentives to promote technology can take the form of financial rewards (carrots) or regulatory imperatives (sticks). Both types of incentives have been included in recent legislative bills to address energy and climate change goals.

The most obvious regulatory incentive for CCS contained in GHG mitigation bills is the "cap," or limitation on emissions of GHGs (creating a so-called "price signal"). Limiting allowable emissions creates a dollar penalty for emitting GHGs, and hence a dollar reward for not emitting GHGs. Under H.R. 2454 and the Kerry-Lieberman bill, EPA projects that cost at about $16/tonne $CO_2$ in 2012 or 2013, rising to about $100/tonne in 2050. Assuming a unit commencing operation in 2020 and operating for 30 years, the average allowance price would be about $50/tonne $CO_2$, in 2005 dollars.

Out of a general concern that the price placed on emissions would not be large enough to prevent the use of coal without CCS, several climate bills have included a regulatory incentive in the form of performance standards for coal fired power plants. In other words, in addition to

[1] Ending the Energy Stalemate – A Bipartisan Strategy to Meet America's Energy Strategies, The National Commission on Energy Policy, December 2004.
[2] Breaking the Climate Deadlock – A Global Deal for Our Low-Carbon Future, Tony Blair and The Climate Group, June 2008.
[3] BP Statistical Review of World Energy, British Petroleum, June 2010.
[4] Energy Technology Perspectives, International Energy Agency, Table 2.5, 2008.

complying with the GHG emission cap, owners of new power plants would also have to meet a rule specifying a maximum rate of emissions per kilowatt-hour (kWh) of power generated, or a minimal %-reduction in uncontrolled emissions. Since there are no "low carbon" coals, and available efficiency options provide only modest reductions in $CO_2$ emissions, a performance standard requiring a substantial (e.g., over 50%) reduction in $CO_2$ emissions effectively requires the use of CCS. To date, performance standards in the U.S. have been designed only for coal fired power plants, although in Europe there have been calls for CCS on natural gas fueled power plants by the IEA, Alstom Power, and at least one climate advocacy group.[5] Additionally, given the current state of CCS technology, performance standard requirements have postponed the effective date of such standards until a specified amount of CCS capacity has been deployed, effectively demonstrating the practicality of the technology. Most performance standard requirements have focused on new coal-based power systems, but the recent Kerry-Lieberman bill would require EPA to set performance standards for existing coal units as well, although the bill would prohibit performance standards of any type for oil or gas-fired power plants.

A third type of regulatory incentive has been employed by a number of state and local government agencies, and included in legislative proposals for national legislation, to promote renewable energy technologies. These "renewable electricity standards" mandate that a certain percentage of electricity generation be provided by technologies meeting the definition of renewable energy in the requirement. A recent bill introduced by Senators Lugar and Graham[6] broadened this concept to include other low-carbon technologies such as nuclear power and fossil energy based systems with CCS (the Lugar bill is discussed in more detail below). One feature common to these bills is that they are broadly aimed at either the entire family of renewable technologies, or at the larger family of low-carbon technologies, but not at specific technologies within those groups. As a result, they would tend to encourage the lowest cost complying technology, and not a broad spectrum of technologies. This would be consistent with goals of minimizing cost, while reducing GHG emissions, but inconsistent with a goal to foster early deployment of emerging technologies which typically are more costly initially. In order to achieve the latter goal, it would be necessary either to provide the more costly options with additional financial incentives (exceeding any financial incentives for the lower-cost options), or to specify a minimum share of the standard be met by specific technologies (i.e., specify "carve outs").

An example of the "carve out" approach can be developed by applying results of analysis of the recent Kerry-Lieberman draft bill to the Lugar bill. EPA's analysis of Kerry-Lieberman concludes that, of the incremental low carbon electricity resulting from the bill by 2050, 43% will be nuclear, 32% will be renewable based power, and 25% will be from coal units with CCS. S. 3464 (the Lugar bill) does not include a cap on GHG emissions, but it requires a progressively increasing amount of low-carbon power generation over time, pursuant to a "diverse energy standard" (e.g., 20% in 2020; 50% in 2050). If half of this DES requirement were allocated to

[5] Op. Cit., Energy Technology Perspectives; Op. Cit., Breaking the Climate Deadlock; The Climate Change Committee, Meeting Carbon Budgets, http://www.theccc.org.uk/reports .
[6] S.3464, introduced June 9, 2010.

specific categories of low-carbon technologies along the lines of electricity generation shares predicted under the Kerry-Lieberman bill, then by 2050 utilities would deploy a minimum of approximately 46 GW of renewables, 37 GW of nuclear power, and 22 GW of CCS. A comparable amount of additional low-carbon capacity would be deployed overall, but not directed by technology class. Note that the Lugar approach includes interstate trading of DES "credits," so the distribution of these technologies would be expected to vary considerably by region and electric utility, with each locality pursuing the technologies that worked best locally.

An additional form of regulatory incentive is one that addresses a regulatory barrier to a technology, sometimes categorized as "legal framework" issues. One frequently cited barrier to CCS is the issue of long-term stewardship of $CO_2$ storage sites. A storage site must prevent emission of $CO_2$ into the atmosphere for hundreds or thousands of years to be of benefit in mitigating climate change. The IPCC has stated that "appropriately selected and managed geological reservoirs" will "very likely" retain over 99% of injected $CO_2$ for over 100 years, and "likely" retain that fraction for over 1000 years.[7] Given that corporations, and often countries, do not last for such periods of time, the question of who will manage these sites in the decades and centuries after injection has ceased becomes highly relevant. The most practical solution to this problem appears to be a mechanism by which the injecting party is fully responsible for the site during injection and for a period of time afterwards, and a separate entity (a government agency, or a private entity servicing a number of storage sites via a pooled stewardship arrangement) assumes long term monitoring, maintenance, and potential damage liabilities. Funds for this extended stewardship program would be provided by entities which initially captured and injected the $CO_2$. Creating such a stewardship mechanism would undoubtedly require legislation, and crafting a measure that avoids issues of moral hazard and financial inequities is non-trivial. However, without such a measure, $CO_2$ storage in deep saline formations may be impractical in the U.S.[8] Additional legal framework issues include rules for injecting $CO_2$, and establishment of property rights for geologic "pore space" (the space in geologic formations where $CO_2$ is stored). Incentives which remove regulatory barriers might be thought of as "un-sticks."

A discussion of regulatory incentives should also address regulatory measures that might serve as disincentives to a technology. An example of this would be legislation that effectively requires CCS for coal power systems, but not for natural gas power systems. Uncontrolled natural gas systems have roughly half the $CO_2$ emissions per kilowatt-hour of power generation of uncontrolled coal-fired power plants. However, it is generally acknowledged that a 50% reduction in emissions will not be sufficient to meet an overall goal of 83% reduction in 2005 emissions (in the year 2050), as specified in recent legislation. Providing a "no-control" option for natural gas systems may be a low cost approach for modest reductions in near-term GHG emissions, but if the uncontrolled gas option is more economically attractive than coal systems with CCS (including financial incentives), then early deployment of CCS technology is unlikely to

[7] Carbon Dioxide Capture and Storage, IPCC, 2005. The report defined "very likely" to mean a probability between 90 and 99%, and "likely" to mean a probability between 66 and 90%.

[8] The stewardship issue may be less critical in other nations where much of the $CO_2$ storage is likely to be beneath the seabed. There, the risk of release may exist, but risk of damage to drinking water supplies or to health and safety are largely absent.

occur, and technology development could freeze for decades. Another example of a potential regulatory disincentive for CCS would be the regulations that will prescribe how $CO_2$ will be stored, and how stored $CO_2$ will be credited against obligations to submit allowances for $CO_2$ emissions. These regulations do not currently exist, so criticism may be tantamount to "crying wolf." Nevertheless, it would be easy for regulators, acting in an abundance of caution, to develop rules which would stifle this emerging technology.

A variety of voluntary financial incentives have been suggested to foster both demonstration and early deployment of CCS technology. For example, technology demonstration has been encouraged by funding provided in DOE's "Clean Coal Power Initiative" program, and related programs.[9] Additional financial incentives for a limited set of advanced coal and CCS technologies have been provided via tax provisions.[10] These include:

- Section 48A – Which originally provided an investment tax credit for advanced coal-based generation technologies (cumulative credits totaling $1.3 billion), but has been modified to require at least 65% of $CO_2$ emissions to be captured via CCS (cumulative additional credits totaling $1.25 billion).
- Section 48B – Which provides similar investment tax credits for industrial gasification projects. This provision originally provided a total of $350 million in credits. That amount was augmented by $250 million (cumulative) for projects which captured at least 75% of $CO_2$ emissions via CCS.
- Section 48C – Which provides a total of $2.3 billion in investment tax credits for equipment used to manufacture certain renewable energy and CCS equipment.
- Section 45Q – Which provides a tax credit of either $10 per tonne or $20 per tonne for storage of $CO_2$. The lesser amount is for $CO_2$ stored in an enhanced oil recovery (EOR) or enhanced gas recovery (EGR) project. The credits are limited to 75 million tonnes of $CO_2$ (cumulative, for all projects).
- Loan guarantees – Such as those provided under Title XVII of the Energy Policy Act of 2005. Loan guarantees provide both assurance of financing for higher risk technologies, and lower financing costs.

Since the NCEP report cited above, most comprehensive climate change mitigation bills have included provisions which would provide substantial financial incentives to the early deployment of CCS.[11] Note that, unlike the voluntary tax incentives and appropriation-backed

[9] See U.S. Department of Energy Carbon Sequestration Initiatives, DOE presentation to USEA, June 24, 2010, for an overview of DOE's activities. http://www.usea.org/Programs/CCSBriefings/documents/CarbonSequestrationInitiatives_USEA_June_24_2010.pdf . For greater detail, see http://www.netl.doe.gov/technologies/carbon_seq/refshelf/project%20portfolio/2009/index.html

[10] All of the following are codified under US Code Title 26, Subtitle A, Chapter 1, Subchapter A, Part IV, Subpart E, except for §45Q, which is under Subpart D.

[11] For example: S. 280 and S. 1766 (2007); S. 2191 (2008); S.1733 and H.R. 2454 (2009). Copies of these bills and summaries can be found at the Library of Congress' excellent website for legislation: http://thomas.loc.gov/. The recent draft bill by Senators Kerry and Lieberman, although not introduced, can be found at:

RD&D funding cited above, none of these climate bills has been enacted into law, so their funding remains hypothetical. Two types of financial incentives for CCS have emerged as the dominant mechanisms for assistance. The first has acquired the moniker of a "lines charge" because it would acquire its incentive funds from a levy placed on ongoing sale of electricity from fossil fuel based power generation (delivered via transmission lines). Under this incentive approach, money would be collected from a fee per kilowatt-hour of generation, varying by the carbon intensity of generation (less for natural gas, more for coal). The fee would be collected for a period of 10 years and deposited each year into a special fund. CCS projects would apply for support from the fund and successful applicants would be awarded support. Different versions of this concept would operate somewhat differently. Collected revenue would be $1 billion per year or $2 billion per year, depending on the bill, and distribute a total of $10 billion or $20 billion overall. None of the proposals to date has specified exactly how much support a given project would receive, but EPA has estimated that the $20 billion approach in the Kelly-Lieberman bill would support 12 GW of CCS-equipped capacity.

The other type of dominant financial incentive is also named for its method of acquiring revenue: "Bonus allowances." In this incentive system, a portion of allowances distributed by EPA under a cap and trade (C&T) GHG mitigation program would be provided to entities implementing qualifying CCS projects. For example, the recent Kerry-Lieberman draft bill would direct between 0.8% and 10% of allowances issued between 2017 and 2034 (the amount varying by year) to CCS projects. Selected projects would receive assistance for 10 years. Funds would be awarded at a congressionally specified level for a portion of the awards (e.g., 20 GW), and the system would then convert to an alternative design prescribed by EPA rulemaking (either a "reverse auction" or an alternative design if the reverse auction approach did not work out). If fully exploited, the total amount of incentives is large: The Kerry-Lieberman bill provides nearly 5 billion allowances, with a value of over $150 billion at EPA's projected prices for allowances. As much as 72 GW of CCS capacity could receive support, although the amount allocated per project is undefined beyond the initial 20 GW of support. The approach to setting the value of incentives for this second phase of CCS incentives, directed by both H.R. 2454 and the Kerry-Lieberman draft bill, is to use "reverse auctions." In a reverse auction, potential bonus allowance recipients would "bid" how little subsidy they would be willing to accept, and the lowest bids would "win." Reverse auctions are used in about 5% of private sector purchases[12], and are generally applied to commodity products that are non-strategic[13] (not essential to the purchaser's success). Unfortunately, CCS has not yet reached "commodity" status, and the reductions projected for CCS are highly strategic to the success of global GHG mitigation.[14] Both of the above bills direct EPA to devise an alternative plan if the reverse auction proved impractical.

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http://kerry.senate.gov/work/issues/issue/?id=7f6b4d4a-da4a-409e-a5e7-15567cc9e95c. EPA analysis of most of these bills can be found at: http://www.epa.gov/climatechange/economics/economicanalyses.html .

[12] The Role of Reverse Auctions in Strategic Sourcing, Beall, et. al., CAPS Research, 2003.

[13] Aerospace parts suppliers' reaction to online reverse auctions, Emiliani et. al., Rensselaer Polytechnic Institute, published in "Supply Chan Management: An International Journal", Vol9, No.2, 2004.

[14] See, for example, Energy Technologies Perspectives – 2010, International Energy Agency, 2010, "*Decarbonising the power sector, the second-largest source of emissions reductions, is crucial and must involve dramatically*

### *Comparison of recent legislative proposals*

The most recent proposals for comprehensive economy-wide legislation to reduce US GHG emissions are H.R. 2454, passed by the House of Representatives in June 2009, and "The American Power Act," more often cited as the Kerry-Lieberman bill, which was distributed by the Senators on May 12,[15] but which has not been formally introduced as a bill. Key CCS incentive provisions of these bills are presented in Table 1. The table demonstrates that the two legislative proposals have much in common, although there are some important differences. The legislative proposals are quite detailed regarding most of the provisions summarized in Table 1, and the reader is directed to the actual legislative language to appreciate those details.

S. 3464, the Lugar bill, is not a comprehensive climate change bill. It relates primarily to improving fuel efficiency in the transportation sector, and energy efficiency in buildings, industry, and appliances. The bill includes no financial incentive mechanism for CCS. However, Title III includes provisions to promote "Diverse Domestic Power" and, as described above, would require a certain percentage of electricity generation (increasing over time) to come from low-carbon emission sources. These low-carbon systems include coal-based power generators with at least 65% carbon reduction (before 2030), and any fossil energy based power system which reduces carbon emissions by 80%. Hence, instead of drawing from a "lines charge," or providing "free" allowances based on an economy-wide C&T system, the Lugar bill would work like a renewable energy standard, and pay for the increased cost of low carbon technologies by requiring their use and generating the needed funds internal to the price of electricity.

### *Unresolved issues*

The goal of an incentive mechanism is to help launch an emerging technology which provides significant public benefits, and which either would not become commercial without the incentive, or would encounter significant delay in deployment. Incentives should not be permanent subsidies. Reasonable tests of an incentive, or set of incentives are:

- Does it provide sufficient overall funding?
- Does it provide sufficient funding at a project level?
- Does it overcome non-financial barriers to the technology?

Both H.R. 2454 and the Kerry-Lieberman draft bill would appear to provide sufficient overall funding, via a combination of lines charge-based subsidies and bonus allowance subsidies. If

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*increasing the shares of renewables and nuclear power, and adding carbon capture and storage (CCS) to generation from fossil fuels.*"

[15] The legislative text and supporting materials were posted at: http://kerry.senate.gov/americanpoweract/intro.cfm .

fully exploited, they could provide resources of over $180 billion for CCS. However, the amount of subsidy applied at a project level is left largely undefined in these bills. The fact that bill authors felt that performance standards for coal are necessary to deploy CCS, even though significant financial incentives are included in the bills, suggests that those authors are not confident that the incentives will be sufficient at a project level. Moreover, most of the implementation issues and legal framework issues are also unresolved in these bills. Finally, the divergent treatment of coal and natural gas is counter-productive to CCS development.

S. 3464 takes a purely regulatory approach to promoting clean technology deployment. However, like a C&T approach without financial incentives, the bill would likely result in dominance by technologies which are currently the lowest cost and lowest risk, and not promote development of a portfolio of low-carbon options. This could be addressed by designating portions of the total requirement for low-carbon options to specific technology categories like renewables, nuclear, and CCS. And like the two comprehensive bills, S. 3464 does not address legal framework barriers to CCS.

**Table 1. Comparison of legislation**

| Provision | H.R. 2454 | Kerry-Lieberman |
|---|---|---|
| Early deployment project subsidies | §114. $10 billion fund created via a fee paid per kWh on electricity sales from coal, oil, and gas fired power plants. Fund is used to support CCS projects. Amount paid per project is not specified. | §1412 – 1420. $20 billion fund created via a fee per kWh on C/O/G electricity sales. As with H.R. 2454, the fund is used to support CCS projects and the funding per project is not specified. A stated goal is to foster at least 10 GW of CCS-equipped capacity. |
| Commercial deployment subsidies | §115. Approximately $200 billion in "Bonus allowances" are to be awarded to up to 72 GW of qualifying power plant and industrial applications of CCS technology. Phase 1 recipients (6 GW) are awarded $50-90 per tonne of $CO_2$ stored for 10 years. The remaining 66 GW will be awarded via a reverse action process or an alternative approach if the reverse auction proves ineffective. EPA will design the system and conduct the competitions for bonus allowances. Industrial projects can receive up to 15% of the total allowances. | §1431. Approximately $160 billion in Bonus allowances are awarded in two Phases and there are two tranches in Phase 1. Ph.1/Tr.1 provides $50-96 per tonne CO2 avoided for 10 GW of power plants. Ph.1/Tr.2 provides $50-85 per tonne $CO_2$ avoided for another 10 GW of systems, which can include industrial CCS projects. Phase 2 provides up to an additional 52 GW of CCS capacity, of which 15% can be industrial projects, using a reverse auction approach (or alternative). All incentives are for the first 10 years of operation of the CCS system. |
| Performance standards, new units | §116. Provides that any coal or petroleum coke-based electric generating unit initially permitted between 2009 and 2020 must achieve a 50% reduction in $CO_2$ emissions. Initial compliance is required by a date 4 years after a minimal amount of CCS-equipped systems have operated successfully (4 GW of nameplate capacity, of which at least 3 GW are electric generating units, and at least 2 units exceeding 250 MW capacity are operating without EOR/EGR based storage. However, in no event may the initial compliance date be later than 1/1/2025. For coal or petroleum coke units initially permitted after 2020, they must reduce $CO_2$ emissions by at least 65% upon startup.<br><br>§331 prohibits similar standards for natural gas-based power systems. | §1441. Similarly requires 50% $CO_2$ reduction for coal or petroleum coke fueled power plants initially permitted 2009 – 2020. However the initial compliance date is 4 years after 10 GW of US CCS capacity has operated, including at least 3 units with non-EOR/EGR storage, but no later than 1/1/2020. Coal or petroleum coke units initially permitted after 2020 must reduce emissions by at least 65% upon startup.<br><br>EPA can tighten the standards, by rulemaking.<br><br>§2302 prohibits similar standards for natural gas-based power systems. |

| Provision | H.R. 2454 | Kerry-Lieberman |
|---|---|---|
| Performance standards, existing units | §331 prohibits performance standards for any type of existing power plant. | §2302 requires EPA to set performance standards under CAA §111(d) for existing coal and petroleum coke-fired power plants, and prohibits such standards for natural gas power plants. |
| Clean energy standard | Contains no provision requiring a portion of generation from CCS-equipped systems. | Contains no provision requiring a portion of generation from CCS-equipped systems. |
| Legal framework issues (injection rules, pore space property rights, long term stewardship of storage site) | No specific requirements. Some provisions (e.g., §111, §112, §113) call for studies and reports to Congress, or for EPA to develop injection rules. | No specific requirements. Some provisions (e.g., §1402, §1432) call for EPA studies and reports to Congress. |