ENVIRONMENTAL DEFENSE
finding the ways that work

Attachment 1: Description of Emissions Reduction Measure Form

Please fill out one form for each emission reduction measure. See instructions on attachment 2.

Title: Inclusion in a multi-sector cap-and-trade program on the basis of stationary source combustion emissions. Include reductions of fugitive methane emissions in a system of emissions offsets.

Type of Measure (check all that apply):

☐ Direct regulation
☐ Monetary Incentive
☐ Voluntary
☐ Other Describe:
☑ Market-based compliance:
☐ Non-monetary incentive
☐ Alternative Compliance Mechanism

Responsible Agency: California Air Resources Board; California Department of Conservation, Division of Oil and Gas

Sector:

☐ Transportation
☐ Other Industrial
☐ Agriculture
☐ Sequestration
☐ Electricity Generation
☐ Refineries
☐ Cement
☑ Other Describe: Oil and natural gas extraction

2020 Baseline Emissions assumed (MMT CO2 eq):

1990 fugitive emissions = 0.915
1990 combustion emissions = 10.696
1990 total emissions = 11.611

2004 fugitive emissions = 0.773
2004 combustion emissions = 14.736
2004 total emissions = 15.509

2020 emissions (From Climate Action Team report 2006) = 19.73 MMTCO2 eq

Percent reduction in 2020:

See below

Cost effectiveness ($/metric ton CO2E) in 2020:

See below

Description:

Environmental Defense believes that combustion emission reductions from oil and gas exploration and extraction sources should be achieved by inclusion in a multi-sector cap-and-trade program. Although CO2 emissions from this sector most likely fall within the group of general stationary combustion sources, we discuss it here separately since there are many details specific to oil and gas exploration. Under a multi-sector cap-and-trade program, CARB would set a total allowable limit on emissions from all sectors that are within the cap. Regulated entities would then be required to submit allowances equal to their emissions during each compliance period. Therefore, since the overall cap would be less than the current aggregate emissions, individual plants would be required to either reduce on-site emissions, purchase reductions from other capped facilities, or purchase qualified offsets.

Emissions from the extraction of oil and gas in the state of California occur from combustion sources or from fugitive non-combusted emissions. Combustion emissions are by far the majority of emissions and are generated as fossil fuels (natural gas, oil and coal) are burned to generate steam and power or by flaring waste gas. Fugitive emissions have been reported to be about 7% of the total emissions from this sector and arise because of failures in seals and packing around valves, pumps and compressors. Additional losses can occur from storage tanks if vented to the atmosphere.

In 2007, the California Market Advisory committee recommended that combustion sources emitting greater than 10,000 metric tons of CO2 be within a market based emissions reduction system. For the California oil and gas sector, this would likely include a substantial number (if not all) of California's over 250 oil and gas producing fields. This recommendation pertained only to combustion emissions from these facilities since the MAC report stated that fugitive emission sources should not be covered under the cap-and-trade program. The report reasoned that difficulty in ensuring the completeness and accuracy of emission estimates prevented inclusion in the market system. Rather, for fugitives, the MAC recommended that CARB should consider requiring sources to take measures to capture fugitive emissions, as well as urged CARB to explore the potential for developing monitoring and reporting protocols that would allow efforts to reduce fugitive emissions from certain sources to qualify for offset credits.

Emission reduction calculations and assumptions:

Calculating the overall emissions reductions (cap): The emissions reductions required under a multi-sector cap-and-trade program are determined by the extent to which the cap is below the actual level of emissions in covered sectors. One of the best aspects of a cap is that it is a limit on the total allowable emissions from sources covered in the cap. Other regulatory

approaches, such as performance-based standards, may limit emissions associated with a given activity, but do not limit the amount of activity and thus do not put a limit on total emissions. Furthermore, by observing allowance prices in the marketplace, the real costs of economy wide emissions mitigation can be observed and used to inform future adjustments to the cap. Similarly, the real costs of ratcheting the cap downward can be observed via changes in allowance prices.

We recommend a stringent multi-sector cap that is derived from an aggregation of sector-specific emissions reductions goals. CARB should also consider factors such as the size of the overall cap-and-trade market, the percentage of statewide greenhouse gas emissions that are under the cap, and the availability of offsets and linkages to beyond California in setting the cap. Ultimately, of course, the reductions required under the multi-sector cap-and-trade program, combined with reductions achieved through other measures, must equal or exceed the amount of reductions needed to reduce statewide greenhouse gas emissions to 1990 levels by 2020.

Estimating sector-specific emissions reductions: Several factors affect the calculation of an emissions reductions estimate for each sector. First, the number of emitting entities within each sector and cost curves for potential emissions reductions from that sector will help determine emissions reduction potential. Also, the contribution each sector makes to the overall California emissions inventory and cap-and-trade market is relevant. In addition, any sector-specific estimates rely, in part, on the historic emissions data for that sector. Further, the impact of other regulations applicable to each sector, along with cost and competitiveness factors unique to each sector, must also be assessed.

Cost effectiveness calculation and assumptions:

Economy wide cost effectiveness: There is a difference between a cost-effectiveness metric calculated as the costs per unit of emissions reduced and the idea of a program that is achieving reductions goals as least cost. Cap-and-trade policy ensures the latter. A cap-and-trade program creates incentives for emissions sources to find the least-cost options to achieve emission reductions. In a multi-sector cap-and-trade program, emissions sources have the option of pursuing on-site reduction strategies, purchasing emission allowances from other entities in any other sector under the cap that have been able to beat their own targets, or purchasing qualified offsets from entities not within the cap. This means that trading within and between sectors allows for market participants to seek out and implement the most cost-effective reductions strategies. The cost of emissions reductions achieved under a cap-and-trade program will be lower than the cost of those same emissions reductions achieved through an alternative policy instrument.

The total cost to society of meeting an emissions reduction goal is equal to the emissions mitigation costs incurred by the regulated entities plus the regulatory costs of administering and enforcing the program. Cap-and-trade programs typically involve lower regulatory costs than traditional command-and-control programs for at least two good reasons. First, there is no need for regulators to conduct detailed and time-consuming assessments and rulemakings about

specific control technologies, such as establishing Best Available Control Technology measures. Second, the regulated entities have a financial incentive to demonstrate compliance because they can sell unused emissions credits.

Individual site and measure cost effectiveness: A major benefit of trading is that no *a priori* calculation of cost effectiveness by CARB will be needed because market participants will be incentivized to do this calculation internally for their unique reductions options and to then compare their internal options with the market-clearing price for emissions allowances. While the cost effectiveness of specific emission reduction strategies can be calculated as the cost of implementation divided by the amount of reductions achieved, with trading it is not clear that a specific reduction strategy will be used. This "flexible compliance strategy" makes moot the need to determine in advance which abatement methods will be best for individual facilities. Also, a cap-and-trade program eliminates the need for government agencies to estimate which strategies will be used at the facility level because the cap-and-trade program allows individual facilities (who are the ones best positioned to have that information) to weigh their options and then act in a manner that is in their best economic interest.

***Creating sector-specific cost curves*:** To determine how trading might evolve and to forecast allowance prices, we are actively researching sector-specific cost curves and will provide this information when complete.

In order to determine what the costs to facilities will be using marginal abatement curves, it is important to understand the relative differences on potential for emissions between the facilities in each sector. One way to achieve this is through the use of benchmark emissions criteria. These benchmarks establish facility level indexes on emissions by using industry wide data. However, as explained below, benchmark criteria have not been developed for any industry.

Implementation barriers and ways to overcome them:

Variable facility characteristics create a challenge to creating marginal cost curves: It is useful to have facility-level knowledge of the marginal costs of emissions abatement. This information can be an important tool for determining emission reduction potential and likely trades between facilities (and sectors). Facility and sector-specific marginal abatement cost curves are also useful for forecasting the economy-wide costs of meeting a reductions goal.

One way to compare facilities to create the range of marginal costs curves is to use benchmark emissions criteria. These benchmarks identify the fundamental differences between facilities (e.g. API gravity of pumped material, geological structure, depth of oil pumped, etc) that make some more emissive than others (on a lbs CO2 / bbl oil pumped).

Lack of industry data: Lack of data on ability to implement energy efficiency, fuel switching, and methane emissions reduction projects at oil and gas extraction sites should not be seen as a barrier to implementation. Under a multi-sector cap-and-trade system, CARB does not choose technology winners or the mitigation strategies at the facility (or for a sector).

Rather, the market system allows facilities to determine the most cost effective manner to make reductions and rewards them for beating the standard. Further, under an offsets program, facilities are rewarded for the emissions reductions they can achieve beyond that required under mandatory regulations. This incentive to innovate and go beyond the regulatory mandate is one of the most attractive advantages of cap-and-trade policy over other mechanisms.

Although specific strategies to reduce emissions from stationary combustion sources are well known, the extent to which these strategies can be implemented in the state of California is not. Further, although an entire suite of methane emissions reduction projects has been developed through the EPA Natural Gas Star program, the extent of voluntary participation within California is not known. Estimates however project that approximately 30 % of industry members have or are currently participating in this program. Reasons for this lack of data are the large degree of small entity private ownership throughout the state, the lack of reporting standards for this type of information, and the varying age of the states gas wells.

As with the general stationary source category, the methods to reduce combustion emissions from oil and gas extraction sites primarily fall into three categories. First, facilities can implement energy efficiency measures to reduce wasted energy, thereby requiring less fuel to produce the same amount of output. Second, facilities can turn to less GHG intensive methods of heating such as using waste heat from other processes, if available, or by upgrading facilities to cogeneration and/or integrated combined cycle systems, if cost effective. Third, facilities can implement demand reduction measures that lead to less overall energy demand, thus reducing the need for fuel combustion. This third measure however may also reduce crude production which is at variance with the facilities intended purpose, and thus not very likely.

No protocol for fugitive emissions reduction measurement: Although the MAC recommended inclusion of methane emission reductions in an offset program, the tools required to allow such inclusion are yet not in existence. In such a program, emission offsets must be supported by a measurement methodology to make sure reductions are real, quantifiable, additional, and verifiable. This method must not only provide specific guidance to facilities to measure emissions that are escaping, but must also enable facilities to calculate differences between pre- and post-project emissions.

To overcome this lack in emissions measurement methodology, CARB must develop and adopt a protocol that can be uniformly applied to the states oil and gas extraction systems. The development of this protocol must involve stakeholder companies as well as the public.

Tools not yet available to allow the point of regulation to be crude and gas processing plants: Inclusion of the oil and gas sector in a multi-sector cap-and-trade program may best be achieved by regulating at crude and gas processing facilities (refineries and gas plants) for the pre-gate (extraction, production and transportation) emissions of the product they import. This point of regulation would reduce the number of regulated entities and would place the responsibility of holding and surrendering emissions allowances on larger, more economically robust companies. Further, this point of regulation could allow California to track and account for emissions

associated with the extraction and transport of raw fuels imported into California, thus reducing emissions leakage from imports of raw materials via pipeline and tanker. Specifically, refineries would have to account for the emissions associated with the extraction, transport and pre-gate processing of the raw material they import.

Lifecycle emissions reporting and tracking requirements associated with a California Low Carbon Fuel Standard (LCFS) will inevitably overlap with a multi-sector cap-and-trade program that includes refineries and gas plants. By requiring refiners and gas plants to account for the pre-gate emissions of products they import, CARB will generate a necessary data for implementation of the LCFS and for inclusion of pre-gate emissions in a multi-sector cap-and-trade system.

In order to establish processing facilities (refineries and gas plants) as the point of regulation for the oil and gas extraction sector in a multi-sector cap-and-trade (and in an LCFS), the processing plant would need to have information on the pre-gate emissions associated with the product they import. Currently however, no such uniform GHG emissions accounting, tracking, and reporting system is in place. Therefore, importers and refiners of raw products are likely to be unaware of the extraction or transportation emissions associated with the products they take in. CARB can overcome this barrier by developing reporting regulations for the oil and gas sector that require in-state extraction sites and importers of fuel to report all pre-gate emissions of the products they sell. In-state extractors would already be required to report their emissions under the reporting protocol, so this would not be a new requirement. Importers would have to determine the process used to extract and transport the raw material they receive, and likely an emissions estimator would be required. Refiners would therefore able to track pre-gate emissions of the products they import. This system would allow pre-gate emissions in the oil and gas sector to be included in the multi-sector cap-and-trade.

There is no system for incentivizing better use of cogen or waste heat capture use: Heavy oil accounts for two thirds of California's oil production and extraction of heavy oil from a well generally requires injection of heated and pressurized steam into it to increase formation productivity. Steam generation is primarily done on-site through cogeneration plants that simultaneously create electricity which is used to lift and pump the crude. Another option is the use of package boilers whose sole purpose of to produce steam without the generation of electricity. Also, some production facilities use steam manufactured off-site in their wells (e.g. waste heat from nearby facilities), it is not standard practice.

Although the use of cogeneration offers perhaps the most efficient use of natural gas combustion, and may be industry standard, there exists no current system to maximize or incentivize its use other that created by reduced fuel costs for operators. To overcome this lack of incentives, CARB should develop tools that reward companies for making on-site emissions reductions associated with decreased fuel combustion or on-site electricity use reduction. Further, CARB could develop a program that connects stationary sources with excess waste heat to oil extraction wells that need heat. Although such a program would probably link large industrial plants to

nearby extraction sources, it would probably require a funding mechanism to make the transportation and use of heat economically feasible.

There is no system for incentivizing enhanced oil recovery: Although the use of heat and steam in enhanced oil recovery is known to trap some CO2 below ground, there is no method to measure, reward, or incentivize the CO2 reductions. To overcome this lack of incentives, CARB could develop an accounting mechanism with default emissions rates that allowed facilities to generate emission reduction credits. Such a program would need to be coordinated with the California Department of Conservation in order to develop accurate accounting methodologies and permitting regimes to measure rates of injection and amounts of CO2 sequestered with an emptied reservoir. One issue however is that CO2 injection requires creation of a miscible oil phase to enhance recovery which is almost impossible with heavy oils due to excessive gas cycling. Therefore, this process may be limited to light oil applications.

Potential impacts on criteria pollutants

As discussed above, the extraction of oil and gas generally entails the combustion of a fossil fuel source. When burning natural gas and fuel oil, emissions of NOx and CO will result. For older plants, the emission rate is expected to be higher due to permit grandfathering and a higher incidence of flaring. When burning coal, emissions of NOx, CO, and various hazardous air pollutants may also occur.

Implementing GHG reduction technology at oil and gas facilities will serve to reduce criteria pollutants by generally reducing the amount of fossil fuels combusted on site. Where electrification is used, the emissions of criteria pollutants will be shifted to the power plant supplying the power, though the overall emissions rate is lower. And, where energy efficiency is used to decrease wasted heat steam, fewer overall emissions will occur because of an overall reduced amount of fuel needed.

Name: Timothy O'Connor
Organization: Environmental Defense
Phone / email: (916) 492 – 4680, toconnor@environmentaldefense.org