

## Supplemental Explanation of Performance-Based Measure Approach

### ***Performance-Based Measure Approach for Determining whether GHG Emission Increases are Significant:***

For sources with maximum stationary source project emissions over a 10,000 MTCO<sub>2</sub>e/yr “screening threshold”, a significance threshold would be established based on a percent reduction below a “best practices emissions” (BPE) level. The BPE level would be computed based on project data and the application of efficiency benchmarks. The benchmarks to be applied in this option have already been developed by CARB and incorporated into the Cap and Trade regulation. The percent reduction would be applied on top of the BPE level and would be consistent with AB 32 Scoping Plan goals.

There are two categories of established benchmarks in the Cap and Trade regulation: 1) product-based (tons CO<sub>2</sub>e per unit of product produced), and 2) energy use-based (tons CO<sub>2</sub>e per unit of energy consumed). These benchmarks are measures of GHG emissions efficiencies, and are considered performance standards. Product-based benchmarks are specific to various industries, but do not exist for all industries. Product-based benchmarks will be used when available. For industrial sectors with no established product-based benchmark, energy use benchmarks will be used to determine BPE.

Actual project emissions would be reported yearly and compared to the significance threshold on an annual basis. If reported actual metric ton/year CO<sub>2</sub>e exceed the significance threshold, then mitigation would be required for that year down to the significance threshold. Under this option, allowances purchased under Cap and Trade would apply towards mitigation.

### ***Benchmarks:***

Cap and Trade greenhouse gas (GHG) benchmarks are metrics that enable the comparison of GHG performance across similar industrial facilities. The definition in the Cap and Trade Regulation is as follows:

“Emissions Efficiency Benchmark” or “GHG emissions efficiency benchmark” means a performance standard used to evaluate GHG emissions efficiency between and amongst similar facilities or operations in the same industrial sector.

### ***Industrial Sector Product-Based Benchmarks:***

The methodology for establishing benchmarks can be found in the CARB document ***Development of Product Benchmarks for Allowance Allocation***<sup>1</sup>, and product benchmarks are incorporated into Section 95891 (Table 9-1) of the Cap and Trade regulation. These benchmarks were developed based on data reported by Cap and Trade subject facilities for years 2008-2010, as required by the Mandatory Reporting regulation (MRR); and 2011 was selected to formally establish the benchmarks. Each industrial sector’s production weighted average emissions intensity was determined for this historical base period, and the benchmark was set at 90 percent of this level per unit product. The benchmark is a function of the quantity of GHGs released per unit of industrial product output. The units for these

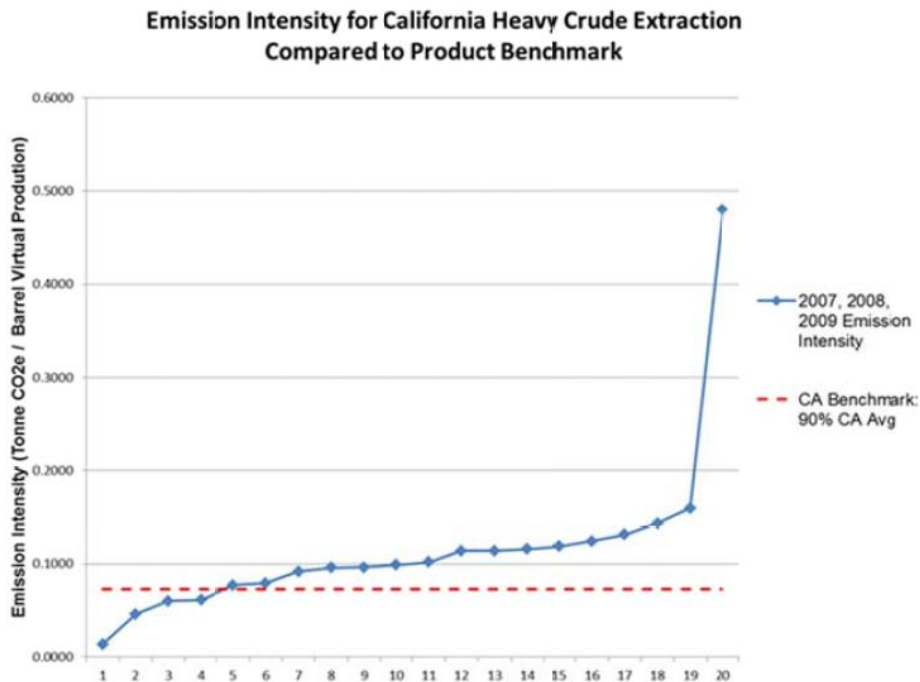
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benchmarks are given as metric tons CO<sub>2</sub>e per unit of production. Some benchmarks may be updated in the regulation over time, but CARB has indicated that the possibility is small.

An example is given below for the CARB derivation of the product benchmark for heavy crude oil extraction. The red dashed line is drawn at 90% of the average level of the emissions efficiency for the entities in this industrial sector (sample size of 20) subject to Cap and Trade. The product-based benchmark units for this sector are given in units of *metric tons CO<sub>2</sub>e/barrels of oil produced*.

**Figure 2. Benchmarking Heavy Crude Oil Extraction**



Benchmarks for Crude Petroleum and Natural Gas Extraction activities are codified in Table 9-1 of the Cap and Trade Regulation, and are given below. “Allowances” have the units of metric tons CO<sub>2</sub>e.

NAICS Sector Definition	NAICS code	Activity (a)	Benchmark (B <sub>a</sub> )	Benchmark Units
Crude Petroleum and Natural Gas Extraction	211111	Thermal EOR Crude Oil Extraction	0.0811	Allowances / Barrel of Oil Eqv. Produced Using Thermal EOR
		Non Thermal Crude Oil Extraction	0.0076	Allowances / Barrel of Non Thermal Crude Oil Eqv.
		Natural Gas Processing ≥ 25 MMscf/day	0.0220	Allowances / Barrel of Gas Processed Eqv.

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### **Energy-Based Benchmarks:**

Stationary combustion of fuel is the only source of GHG emissions for the majority of facilities that will be evaluated under this approach. Some of these facilities have boilers that produce steam as a heat carrier; others have direct process heaters or engines that use heat directly without producing steam. The energy-use methodology is composed of two components:

- Total thermal energy from combustion (fuel-choice) benchmark: 0.0537 CO<sub>2</sub>e/MMBTU
- Steam consumption (heat-carrier) benchmark: 0.06244 CO<sub>2</sub>e/MMBTU steam

The fuel-choice benchmark value is based on using natural gas, and the heat-carrier benchmark is based on a natural gas-fired boiler that is 85% thermally efficient.

### **Application of benchmarks and percent reduction factor in performance-based measure approach for GHG significance determination:**

BPE levels are determined in accordance with the following procedure. Product-based benchmarks are always used for industry sectors with an established product benchmark. Energy benchmarks will be used only in the case when no product benchmark has been established under Cap and Trade.

A) Product-based formulation:

$$\text{MT CO}_2\text{e/year (BPE)} = \text{Product benchmark} * \text{annual output}$$

B) Energy-based:

$$\text{MT CO}_2\text{e/year (BPE)} = \{(\text{MMBtu of steam} * 0.06244 \text{ CO}_2\text{e/MMBTU steam}) + (\text{MMBtu fuel combustion} * 0.0537 \text{ CO}_2\text{e/MMBTU})\}$$

If there was no steam produced/consumed then the first term of the equation would be zero, and BPE would be computed based on fuel combusted on site. The fuel combustion term excludes energy used to generate electricity for sale offsite and energy used to generate steam.

### **Examples of Application:**

#### **Example 1: Thermal Enhanced Oil Recovery (Steam Generator) Oil Extraction Project**

*Significance Threshold 15.3% below BPE*

YEAR	PRODUCTION (BBL/S/YR)	BENCHMARK (CO <sub>2</sub> E/BBL)	BPE (CO <sub>2</sub> E)	SIGNIFICANCE THRESHOLD (CO <sub>2</sub> E)	REPORTED ACTUALS (CO <sub>2</sub> E)	MITIGATION REQUIRED (CO <sub>2</sub> E)
<b>2016</b>	200,000	0.0811	16,220	13,738	22,000	8,262
<b>2020</b>	250,000	0.0811	20,275	17,173	23,000	5,827
<b>2030</b>	175,000	0.0811	14,193	12,021	20,000	7,979

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*Significance Threshold 35% below BPE*

YEAR	PRODUCTION (BBLs/YR)	BENCHMARK (CO2E/BBL)	BPE (CO2E)	SIGNIFICANCE THRESHOLD (CO2E)	REPORTED ACTUALS (CO2E)	MITIGATION REQUIRED (CO2E)
2016	200,000	0.0811	16,220	10,543	22,000	11,457
2020	250,000	0.0811	20,275	13,178	23,000	9,822
2030	175,000	0.0811	14,193	9,225	20,000	10,775

**Example 2: New 2,500 HP Internal Combustion Engine (ICE), PTE= 12,191 CO2e/year, no steam**

*Significance Threshold 15.3% below BPE*

YEAR	HEAT INPUT (MMBTU/YR)	BENCHMARK (CO2E/MMBTU)	BPE (CO2E)	SIGNIFICANCE THRESHOLD (CO2E)	REPORTED ACTUALS (CO2E)	MITIGATION REQUIRED (CO2E)
2016	200,000	0.0537	10,740	9,096	12,000	2,903
2020	190,000	0.0537	10,203	8,642	11,000	2,358
2030	150,000	0.0537	8,055	6,823	7,500	677

*Significance Threshold 35% below BPE*

YEAR	HEAT INPUT (MMBTU/YR)	BENCHMARK (CO2E/MMBTU)	BPE (CO2E)	SIGNIFICANCE THRESHOLD (CO2E)	REPORTED ACTUALS (CO2E)	MITIGATION REQUIRED (CO2E)
2016	200,000	0.0537	10,740	6,805	12,000	5,195
2020	190,000	0.0537	10,203	6,631	11,000	4,369
2030	150,000	0.0537	8,055	5,235	7,500	2,265

Where for example 1, BPE (CO2e) = Production (BBLs) \* Benchmark (CO2e/BBL)

Where for example 2, BPE (CO2e) = Heat Input (MMBtu/year) \* Benchmark (CO2e/MMbtu)

Where, Significance Threshold (CO2e) = BPE (CO2e) \* (1-0.153) or BPE (CO2e) \* (1-0.35)

Where, Mitigation Required (CO2e) = Reported Actual Emissions (CO2e) – Significance Threshold (CO2e)

<sup>1</sup> California Air Resources Board. July 2011. Cap-and-Trade Regulation. *Appendix B: Development of Product Benchmarks for Allowance Allocation.* <http://www.arb.ca.gov/regact/2010/capandtrade10/candtappb.pdf>