

Attachment 1: Description of Emission Reduction Measure Form

Please fill out one form for each emission reduction measure. See instructions in Attachment 2.

Title: Simplified Combined Cycle technology

Type of Measure (check all that apply):

- | | |
|---|--|
| <input type="checkbox"/> Direct Regulation | <input type="checkbox"/> Market-Based Compliance |
| <input type="checkbox"/> Monetary Incentive | <input type="checkbox"/> Non-Monetary Incentive |
| <input checked="" type="checkbox"/> Voluntary | <input checked="" type="checkbox"/> Alternative Compliance Mechanism |
| <input type="checkbox"/> Other Describe: | |

Responsible Agency: California Energy Commission

Sector:

- | | |
|---|--|
| <input type="checkbox"/> Transportation | <input checked="" type="checkbox"/> Electricity Generation |
| <input type="checkbox"/> Other Industrial | <input type="checkbox"/> Refineries |
| <input type="checkbox"/> Agriculture | <input type="checkbox"/> Cement |
| <input type="checkbox"/> Sequestration | <input type="checkbox"/> Other Describe: |

2020 Baseline Emissions Assumed (MMT CO₂E): There are currently about 200 simple cycle power plants operating in California, split almost equally between peaking and cogeneration facilities. These represent a little over 10,000 MW of generating capacity. Assuming a 2% per year increase, by 2020 there will be 12,500 MW of simple cycle plants. If the average capacity factor is assumed to be 10% for peaking plants and 80% for cogeneration plants, then the number of MWhrs of electricity produced by these plants will be 55,250,000 MWh. These plants have heat rates of about 11,000 Btu/kWh and therefore will burn about 600,000,000 MBtu of gas per year. Since natural gas will emit 117 lbs of CO₂ for every MBtu consumed, the total CO₂ emitted from simple cycle power plants in 2020 will be about 70 Billion lbs per year.

Percent Reduction in 2020: About 20%

Cost-Effectiveness (\$/metric ton CO₂E) in 2020: This reduction in CO₂ is essentially free because the one time investment in the SCC technology package will be recovered through the combination of increasing the plant's generating capacity and reducing the cost of natural gas.

Description: The Simplified Combined Cycle (SCC) is a technology package that increases the capacity and efficiency of existing simple cycle (peaking) power plants. After installing the SCC package, plant capacity increases by about 30% and the plant's

heat rate drops between 20% and 30%, depending upon the design of the combustion turbine. Besides adding needed generating capacity (at already permitted facilities) to meet California's growing demand, the plant makes more efficient use of natural gas, a serious issue associated with peaking plants according to the California Energy Commission. Because less natural gas is burned for the same amount of power generated, there is a one-to-one reduction in the amount of GHGs emitted from the simple cycle plant. For example, once the SCC is installed on a GE LM6000 Combustion Turbine, both the amount of natural gas burned and the amount of GHGs emitted decline by about 20% for the same number of operating hours.

Emission Reduction Calculations and Assumptions: The amount of emission reductions (CO2) is directly proportional to the reduction in the power plant's heat rate. (Reducing the heat rate, of course, reduces the amount of natural gas burned for the same hours of operation.) The heat rate reduction possible is dependent upon the type of Combustion Turbine. For example, the heat rate reductions for several CTs designed by GE are:

CT Design	Heat rate w/o SCC	MW	Heat rate w/SCC	MW
LM2500 P	10,360	22	8,450	~ 26 to 30
LM2500 PH	10,360	22	8,500	~ 28 to 30
LM2500 PH	10,309	22.8	8,497	26.3
LM6000 PC Sprint	9,600	49	7,600	~ 65
7EA	11,250	75	8,200	~ 123
GE 6B	12,000	40	8,500	~ 55

We would be happy to meet with CARB to explain how the SCC reduces GHG emissions.

Cost-Effectiveness Calculation and Assumptions:

This reduction in CO2 will essentially be free because the one time investment in the SCC technology package will be recovered through the combination of increasing the plant's generating capacity and reducing the cost of natural gas costs. We have done many Net Present Value calculations (basically cost-benefit studies) for different combinations of combustion turbine designs (GE LM2500 or GE LM6000, for example) and owner (IOU or POU, for example.) We would be pleased to share these with CARB.

Implementation Barriers and Ways to Overcome Them: International Power Services Co. is in the beginning phases of commercializing the SCC technology and thus faces typical barriers to entry, including unfamiliarity with the technology and, of course, resistance to change.

Potential Impact on Criteria and Toxic Pollutants: The SCC technology actually reduces NOx levels emitted by combustion turbines to between 2.0 and 5.0 ppmvd (without the need of any other control technology such as SCR.)

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