Taiwan Semiconductor Manufacturing Company, Ltd.

Fluorinated Greenhouse Gas (F-GHGs) Emissions Reduction Declaration for Y2019

Taiwan Semiconductor Manufacturing Company, Ltd. (the "TSMC") has made following efforts to ensure the semiconductor manufacturing process in accordance with the Part A and B of IEEE Standard for Environmental and Social Responsibility Assessment of Computers and Displays (IEEE Std 1680.1TM-2018) Criterion 4.1.10.2 Optional - Reduce fluorinated greenhouse gas emissions from semiconductor production. The fluorinated greenhouse gas (F-GHG) emissions inventory has been reported and F-GHG emissions have been reduced for all TSMC's 300mm process semiconductor manufacturing facilities, which including Fab 12A, Fab 12B, Fab 14A, Fab 14B, Fab 15A, Fab 15B, Fab 18 and Advanced Backend Fab3 (the "Fabs in scope").

For Part A

TSMC develops a F-GHG emissions inventory by the method of the IPCC 2006 Tier 2b methodology, multiply the IPCC 2006 Tier 2b emissions by a factor of 1.13 to obtain adjusted IPCC 2006 Tier 2b emissions from etching and chamber cleaning processes with 100-year global warming potentials (GWPs) from the IPCC Fourth Assessment (IPCC AR4). In addition, TSMC annually commissions a third-party to perform a verification of greenhouse gas assertions, including emissions of fluorinated GHGs used in plasma etching/wafer cleaning, chamber cleaning processes and heat transfer fluid use, on the basis of ISO 14064-1: 2016, and publicly reports the result on our CSR report.

For Part B

Our abatement equipment is electrically heated, fuelled-combustion, plasma, and catalytic devices that are specifically designed to abate F-GHGs, are used within the manufacturer's specified process window and in accordance with specified maintenance schedules, and whose DREs have been measured and confirmed under actual process conditions, using a technically sound protocol, which accounts for known measurement errors including, for example, CF_4 by-product formation during C_2F_6 abatement as well as the effect of dilution, the use of oxygen or both in combustion abatement systems.

We calculate that F-GHG emissions based on the equation stated below and the reduction percentage we are adopted is >75% as the fluorinated heat transfer fluids (F-HTFs) are excluded from the reduction assessment.

$$\textbf{Percent of Total Reduction Emissions} = 100\% \times \left[1 - \left[\frac{\Sigma\, TE_{FAB}}{\Sigma\, BE_{FAB}}\right]\right]$$

where:

TE_{FAB} is the total emissions per fab in scope calculated using the methodology in Part A.

BE_{FAB} is the baseline emissions per fab calculated using the following equation.

BE_{FAB} equation per fab:

$$BE_{FAB} = 1.15 \times [(C_{EW} \times WF_{EW}) + (C_{CC} \times WF_{CC})]$$

where:

1.15 is the factor to account for fluorinated heat transfer fluid emissions (omit if excluding HTFs)

C_{EW} is the total consumption of all F-GHGs by all etching and wafer cleaning processes within the fab in reporting year.

WF_{EW} is the weighting factor for etching and wafer cleaning that is **5940**.

C_{CC} is the total consumption of all F-GHGs by all CVD chamber cleaning processes within the fab in reporting year.

WF_{CC} is the weighting factor for CVD chamber cleaning that is **8260**.

F-GHG Reduction Emissions Result for Y2019 to the Fabs in Scope

Fabs in Scope	Fab 12A	Fab 12B	Fab 14A	Fab 14B	Fab 15A	Fab 15B	Fab 18	Advanced Backend Fab 3
Percentage reduced = 1 - (TE_{FAB}/BE_{FAB})	**91.9%**	**97.1%**	**93.8%**	**95.9%**	**96.7%**	**95.5%**	**96.7%**	**90.6%**
TE_{FAB} ($MT\ CO_2e$)	101,366	16,843	139,950	96,438	77,762	131,845	6,382	2,718
BE_{FAB} ($MT\ CO_2e$)	1,255,337	579,810	2,241,763	2,380,852	2,383,877	2,956,904	192,870	29,054
C_{EW} (kg)	43,878	23,854	77,665	78,664	65,304	174,906	3,733	4,748
C_{CC} (kg)	120,424	53,041	215,549	231,669	241,643	232,199	20,666	103

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