

## Development of the Kingdom's Updated Grid Emission Factor 2021

The Designated National Authority (DNA) has developed the 2021 Grid Emission Factor (GEF) for the Kingdom's power plants connected to the grid. The GEF has been developed based on the data for a period of 2018-2020. The earlier GEF estimated for the year 2011 was based on 2008-2010 data.

GEF is a unified rate of CO<sub>2</sub> emissions per MWh emitted from the electricity system in Kingdom.

The estimated **GEF** for the years **2018**, **2019** and **2020** are presented in the table below along with the average **GEF** value for the year **2021**. The average GEF has been estimated to be **0.568 tCO<sub>2</sub>/MWh**.

Year	Annual Electricity Generation (MWh)	EF <sub>OM</sub> (tCO <sub>2</sub> /MWh)
Year 1 (2018)	401,776,955	0.557
Year 2 (2019)	403,075,833	0.568
Year 3 (2020)	397,791,587	0.559
Generation Weighted EF <sub>OM,y1-y3</sub> (tCO <sub>2</sub> /MWh)		0.568
<b>Simplified CM Method</b> EF <sub>grid,CMY</sub> = 1*EF <sub>OMy1-y3</sub> + 0*EF <sub>BM,y3</sub>		<b>0.568</b>

### Justifications for Lower GEF Value in 2021:

Comparison of the two GEF values that is GEF 2011 and GEF 2021 shows a difference of approximately 13% i.e. the GEF value for 2021 has been estimated to be 0.568 tCO<sub>2</sub>/MWh while it was 0.654 tCO<sub>2</sub>/MWh in 2011. The reason for this lower value of GEF in 2021 can be attributed to the following factors.

- **Upgrade of Technology:** The share of energy efficient combined Cycle technology in the older plants, i.e., plants commissioned before 2010, was around 6% whereas the share of combined Cycle technology after 2010 has increased to be more than 30%.
- **Addition of New Plants and Their Efficiencies:** There are around 26 new plants out of a total of 107 plants which started electricity generation after 2010. These plants generate around 51% of the total generated electricity in 2018-2020. The new plants are more efficient than the old plants.

The average plant efficiency computed for the new plants, i.e., plants commissioned after 2010, was found to be around 46% while for the older plants the average efficiency was around 34%.

- **Increased Share of Natural Gas in the Energy Mix:** Utilization of increased share of natural gas in the fuel mix of power plants has also played a positive role. The share of Natural Gas in the fuel mix in power plants in 2020 has increased to be around 55% compared to 45% at the time of previous GEF estimation in 2011.

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