CO2 Emission Charge

The CO2 Emission charge is revenue neutral for CPH and has the purpose to incentivize airlines to continuously improve their CO2 efficiency. It is based on a reward system, where airlines performing better than the average terms of CO2 emission in a calendar year will receive a reward.

The airlines will pay an additional charge called “CO2 Charge”, which is calculated as 10% of the take-off charge before any discounts, reductions, and exemptions. The charge is payable per take-off.

All aircrafts will be divided into two segments “Small” and “Large” based on the aircraft’s maximum take-off weight according to the aircraft’s noise certificate (MTOW) as illustrated in the table below. In cases where an aircraft has a flexible MTOW, the weight factor will be determined based on the highest certified MTOW, for which the aircraft is certified in its state of registration.

Aircraft segments	MTOW (kg)
Small	≤100.000
Large	>100.000

A separate pool for each aircraft segment will be made and is equal to the sum of the CO2 charges (see formula below).

Formulas for calculating CO2 reward pool (DKK)		
Aircraft segments	**Criteria**	**Formula for CO2 reward pool (DKK)**
Small	MTOW ≤100.000	$\sum_{i=1}^{n}(takeoff\ charge\ (before\ discounts\ etc.)_i * 10\%)\ ,where\ i = total\ LTO$
Large	MTOW >100.000	$\sum_{i=1}^{n}(takeoff\ charge\ (before\ discounts\ etc.)_i * 10\%)\ ,where\ i = total\ LTO$

The CO2 reward pools will be distributed back on an annual basis to the aircrafts performing better than the average in a calendar year in terms of CO2 emission within its segment.

The performance is measured based on the CO2 emission per LTO (on an engine basis), using a standard landing and take-off (LTO) cycle and is based on certified engine data in the LTO cycle accordance with International Civil Aviation Organizations (ICAO) Engine Emission Databank. The absolute amount of CO2 per engine is calculated based on the average measured fuel flow values for all LTO modes of the individual engine multiplied by the thermodynamic constant 3.16 (ICAO) to express the amount of CO2 emitted. The following standard ICAO LTO cycle times are applied without adjustments: Approach 4 min., Take-Off 0.7 min., Climb 2.2 min. and Taxi 26 min (see formula below).

If no information is available in ICAOs Aircraft Engine Emissions Databank regarding emissions and/or the type of engine and the airline does not provide such documented information, then emission must be calculated on the least favorable values for the relevant type of aircraft/engine.

Formula for calculating emission per LTO	
Engine	**Formula for emission per engine (Kg)**
Engine 1	$Engine\ fuel\ flow * LTO\ mode\ time * 60 * termodynamic\ constant$
Engine 2	$Engine\ fuel\ flow * LTO\ mode\ time * 60 * termodynamic\ constant$
Engine XX	$Engine\ fuel\ flow * LTO\ mode\ time * 60 * termodynamic\ constant$

The size of the reward is based on the aircraft's MTOW, its relative performance to the average and a reward factor ("Max reward" elaborated below).

Formula for calculating the reward per LTO	
Reward (DKK)	$(Avg.CO_2 - CO2\ per\ LTO) * \frac{Max\ reward}{Avg.CO_2} * MTOW$

"Max reward" is based on the size of the total reward pool and the average performance within the aircraft segment (the formula is shown below).

Formula for calculating the Maximum reward	
Max reward (DKK)	$\frac{CO_2\ reward\ pool * Avg.LTO\ CO_2}{\sum_{i=1}^{n}((Avg.LTO\ CO_2 - LTO_i\ CO_2) * MTOW_i)}$ $,where\ i = total\ number\ of\ LTOs\ performing\ better\ than\ average$

An average emission per LTO in a calendar year will be calculated for each aircraft segment and only include the LTO with the required engine data.

Performance measure (avg. emission per LTO)	
Avg. CO_2 per LTO CO_2 (kg CO_2 per tonnes MTOW)	$(Kg\ CO_2\ per\ tonne\ MTOW) = \frac{\sum_{i=1}^{n} LTO_i\ CO_2}{\sum_{i=1}^{n} MTOW_i}$ $,where\ i\ = total\ number\ of\ LTOs\ excl.LTOs\ with\ no\ engine/emission\ data\ available$

Illustrative example:

Assumptions			
Aircraft assumptions (EXAMPLE)			
MTOW		77.000	Kg
Engines		2 x 20CM096	
LTO cycle (fuel flow)	Take-off	0.96	Kg/sec
	Climb	0.78	Kg/sec
	Approach	0.26	Kg/sec
	Taxi	0.09	Kg/sec
SMALL SEGMENT DATA (EXAMPLE)			
MTOW, total		5,000,000	Tonnes
CO2, total		150,000,000	Kg
Avg. performance		30.00	Kg CO2 / tonnes MTOW
General assumptions (EXAMPLE)			
Emission charge		10%	of takeoff charges
Max reward (SMALL SEGMENT)		110.00	DKK per tonnes MTOW

Reward calculation for LTO							
		Take-off	Climb	Approach	Taxi	**Total**	*Calculation*
Fuel flow (20CM096)	Kg/sec	0.96	0.78	0.26	0.09		
Standard ICAO LTO Cycle	Sec	42	132	240	1,560		
Fuel used	Kg	40	103	62	142	**348**	*Sum of LTO cycle*
Thermodynamic constant	Kg fuel / Kg CO2					3.16	
CO2 emission	Kg CO2					**1,100**	*348 x 3.16*

Number of engines	[#]		**2**	
LTO, total emission	Kg CO2		**2,200**	*1,100 x 2*
MTOW	Tonnes		**77**	
Performance	**Kg CO2 / Tonnes MTOW**		**28.54** *(eligible for reward)*	*2,200 / 77*
Performance measure	Kg CO2 / Tonnes MTOW		30.00	
Relative performance	Kg CO2 / Tonnes MTOW		1.46	*30.00 – 28.54*
Reward	**DKK**		**413**	*1.46 x (110.69 / 33.85) x 77*
Emission charge paid	DKK		-386	*10% of takeoff*
Net reward	**DKK**		**27**	*413 - 472*

Any reward must be paid by CPH to the airline via credit note no later than the end of February in the following calendar year. However, amounts less than DKK 5,000 will for administrative reasons not be paid out and will not be carried through to the next 12 months period. Instead, the amount will be redistributed to other carriers who are eligible for payout.