



**Tables**

**Boeing 787-8 Emissions Analysis**

Boeing promotes the 787 are having substantially lower emissions than current generation airplanes (largely because of new technology engines, but also because of the airframe design). Piano-X calculates the emissions for selected aircraft. The following data is the Piano-X calculation for the 787.-  
Leeham.net.

{TOW 219539.kg./ OEW 114532.kg./ Fuel 81955.kg./ Payload 23052.kg.}

Range mode: fixed mach, step-up cruise

Climb schedule: 250./277.kcas/ mach 0.824 above 35678.feet

Cruise at Mach = 0.850 {FL 350 390 430}

ICA 35000.feet, 490.ktas, 291.kcas, CL=0.49, 50277.newtons/eng=MCR-16%  
FCA 43000.feet, 488.ktas, 242.kcas, CL=0.48, 35075.newtons/eng=MCR-14%

	Distance (n.miles)	Time (min.)	Fuelburn (kg.)	
Climb	167.	26.	4169.	{S.L to ICA}
Cruise	7360.	905.	69381.	{ICA to ICA}
Descent	126.	22.	216.	{ICA to S.L}
Trip total	7653.	953.	73766.	
Block total	=====	972.	75126.	

Emissions:	taxi,t/o	climb	cruise	descent	app,taxi	total
(kg.NOx)	13.7	65.3	779.7	0.5	1.7	860.9
(kg.HC)	0.07	0.24	8.07	0.31	0.14	8.83
(kg.CO)	2.2	3.0	196.0	7.5	3.6	212.3
(kg.CO2)	3526.	13175.	219244.	682.	769.	237398.

Manoeuvre allowances:

taxi-out	907. kg. {extra to t/o mass}	10.0 min.
takeoff	209. kg.	1.0 min.
approach	181. kg.	3.0 min.
taxi-in	62. kg. {taken from reserves}	5.0 min.

Reserves {at landing mass 145382.kg.}:

Diversion distance	200. n.miles
Diversion mach	0.540
Diversion altitude	21223. feet
Diversion fuel	2373. kg.
Holding time	30. minutes
Holding mach	0.284
Holding altitude	5000. feet
Holding fuel	1718. kg.
Contingency fuel	3708. kg. {5.% of mission fuel}
Total Reserve fuel	7799. kg.



**Boeing 787-8 Range Analysis**

Boeing has acknowledged the 787-8 is overweight (and continues with a weight reduction program), with published reports and industry information placing the over-weight at between 5,000 and 20,000 lbs. Published reports also place the GEnx and Rolls-Royce Trent engines at 1%-2% and 3%-4% over specific fuel consumption (SFC) targets, respectively. GE acknowledges the 1%-2% figure but Rolls has not. Without definitive data, Piano-X offers the ability to calculate range at various SFC and weight assumptions. Boeing's advertised range for the 787-8 is 7,650-8,200nm.-Leeham.Net.

The numbers below are range in NM:

Delta-SFC	Base	Delta-OEW				NM
		+5000 lb	+10000 lb	+15000 lb	+20000 lb	
Base	7653	7376	7100	6830	6562	NM
+1%	7571	7296	7023	6756	6490	NM
+2%	7490	7218	6948	6683	6420	NM
+3%	7411	7142	6874	6612	6352	NM
+4%	7333	7067	6801	6542	6284	NM

Block fuel burns (lb) over a distance of 6000 NM with payload of 50820 lb (242 pax):

Delta-SFC	Base	Delta-OEW (base = 252500 lb)				lb
		+5000 lb	+10000 lb	+15000 lb	+20000 lb	
Base	124600	126400	128250	130200	132000	lb
+1%	126100	127900	130000	131800	133600	
+2%	127600	129400	131500	133300	135100	
+3%	129100	131000	133100	134900	136700	
+4%	130600	132500	134600	136500	138300	

For comparison, Piano-X shows the original 7E7 (2004 spec) would have burned 120800 lbs of fuel for the same distance and payload. The A330-200 comes out at 152600 lbs for the same distance and payload, although that's not a truly fair metric since its standard payload is usually a bit higher.