EU drives airline CO2 regulation

Post Kyoto emission reduction framework negotiation in place; proposals to include aviation in the EU emissions trading scheme

Governments globally are moving towards negotiating a post Kyoto framework to tackle climate change. While there is now a global consensus that emission reduction must take place, and the G8 have agreed in principle that a 50% reduction in global emissions by 2050 should be the goal, there is disparity between nations on how this will be achieved. Proposals for a post Kyoto framework, which expires in 2012, need to be agreed at the conference of the parties in Copenhagen, in December 2009. The EU has long taken a leading stance in the task of achieving a low carbon economy with a goal of a 20% CO2 emission reduction by 2020 (on a 1990 base), or 30% if the international community signs up.

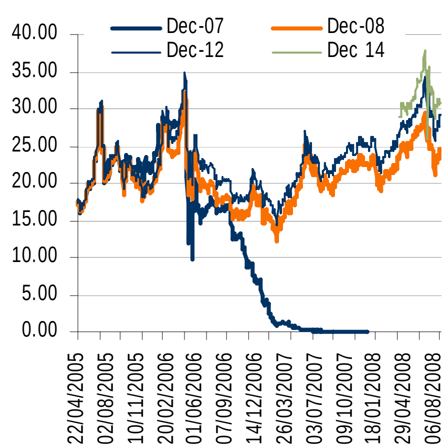
EU will not back down: emissions from aviation are increasing fast enough to offset reductions made in other industries

The EU has already made progress on the emission reduction goals through the emissions trading scheme, which has been regulating CO2 from companies in the heaviest polluting industries (power, oil and gas, cement) since 2005 under a cap and trade framework. However, in order to reach target emission reductions that countries are setting out, more needs to be done, and now aviation emissions are targeted. The aviation industry is a low emitting industry in a global context, responsible for just 2% of total emissions, but contributes around 8% to global GDP. However, according to the International Institute for Sustainable Development, airline emissions have grown 34% from 1990 – 2004, and the fears are that aviation emissions are offsetting the gains made from other industry.

Aviation is responsible for just 2% of global emissions

The EU is pressing ahead with plans to include airlines in its cap and trade emissions trading scheme and at the current time it appears unlikely that these proposals will be vetoed, despite high fuel prices and concerns from international airline organisations.

Chart 2: EUS Futures Contract



Source: European Climate Exchange

Discussions have been in place over the future regulation of emissions for more than a decade. Voluntary measures, emissions charges, and emissions trading have been considered, but ICAO (International Civil Aviation Organization) favours emissions trading. However, the acceptance of the importance of the industry to the world economy and the global nature of airline emissions makes establishing a comprehensive yet equitable regulatory system difficult.

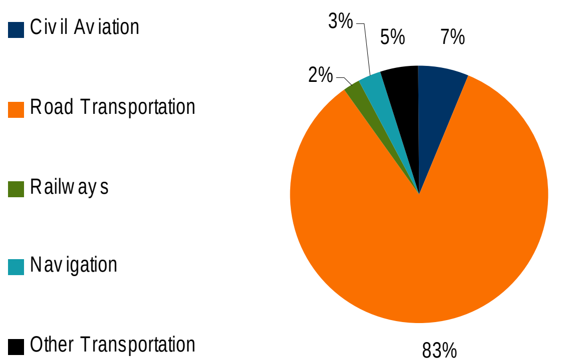
The EU has taken a leading stance in the global industry in our view by devising a credible regulatory framework for aviation according to the polluter pays principle. It has learnt from the problems of oversupply of allowances in Phase I (2005-2007; Phase II is 2008-2012) of the emissions trading scheme (ETS) which led to a collapse in the price of carbon (chart 1 overleaf), and has structured a framework of both free CO2 allowances and auctioning.

We think the tough stance taken by the EU on regulating all flights in and out of the EU is sensible for several reasons. Firstly, it reiterates the leadership role the EU has taken in getting to a low carbon economy and sets standards for other regions to follow, and invokes the behavioural change required to drive efficiencies in the airline industry. Unfortunately, however, the macro backdrop of high fuel costs hitting the industry could not have made the timing worse.

EU tough stance needed; but industry fundamentals could not be worse with $100+ oil; unsurprisingly industry lukewarm

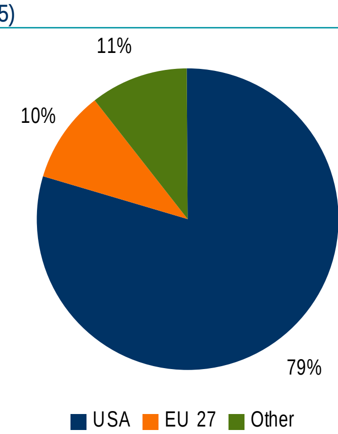
Most airlines acknowledge that a regulatory framework is sensible in order to enforce emission reduction, and agree that a cap and trade format is the most economically sensible, but want it to comprise a global agreement administered by ICAO. The argument is that airlines should not be singled out for emission reduction legislation now, against a backdrop of high fuel prices crippling the industry, and given the low contribution to global emissions. In addition, fuel efficiency gains are already significant and within transportation the contribution of aviation emissions is just 7% as shown in chart 2 below. Chart 3 shows the geographical split of aviation emissions.

Chart 3: Split of transport emissions (2005)



Source: http://unfcc.int Data is based on countries in Annex 1 to the Kyoto protocol

Chart 4: Geographical split of domestic (intra country) aviation emissions (2005)

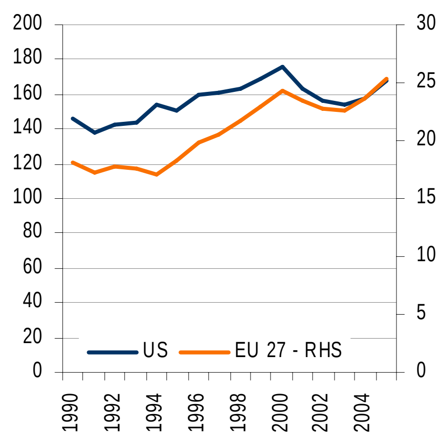


Source: http://unfcc.int Data is based on countries in Annex 1 to the Kyoto protocol

Aircraft - 70% more fuel efficient than 40 years ago, with more gains to come

In terms of fuel (and thus emission) efficiency, aircraft are now some 70% more efficient per passenger kilometre than 40 years ago. Most efficiency gains have come from engine improvements, but airframe design improvements have also been a contributing factor. In addition, according to an ICAO special emissions report, a further 20% improvement in fuel efficiency is projected by 2015 and a 40-50% improvement by 2050 (relative to aircraft produced in 1999). Since CO2 emissions are directly proportional to fuel burn (1 tonne of fuel is equivalent to 3.16 tonnes of CO2), if fuel consumption is optimised, emissions are reduced.

Chart 5: Domestic US & EU aviation emissions



Source: UNFCCC

Airline CO2; monitor, cap and trade

The dependence of the global economy on international transport, and countries' limited jurisdiction in controlling emissions from activities occurring outside their national borders makes a regulatory framework for aviation complex. In addition, there is no straightforward approach to calculating, monitoring, and reporting 'bunker' emissions.

Bunker emissions are emissions that come from 'bunker fuels' or fuels that are used outside the jurisdiction of national borders, and are therefore most commonly referred to in the aviation and maritime industries. The difficulty of attributing bunker emissions to a country is one reason why they are not included within Kyoto protocol country targets.

Addressing bunker fuels has moved up the priority scale for both the United Nations framework on climate change (UNFCCC) and the ICAO because of the expected speed of growth.

Long held general emission reduction targets from the EU, but until now no specific targets for aviation

The European emissions trading scheme (ETS) is a key framework to meet the emission reduction goals the EU has set out. Aviation is responsible for approximately 3% of EU emissions but growth has been increasing faster than the reductions in emissions from other areas. Flights departing from or arriving in the EU are now responsible for over half of all global aviation emissions. Indeed, if emissions from aviation carried on growing at historical rates, they would offset more than a quarter of the emissions Europe is required to make under the Kyoto protocol, which is one of the reasons why Europe is keen to pass the proposals for airline inclusion in the scheme.

December 2006: EU proposal for aviation to be included in the EU ETS;
2008: EU Parliament and Council reach compromise agreement

In 2006, the EU published the initial proposals for a directive to include aviation activities in the ETS, believing that it would be a better form of regulation from an environmental and economic point of view than taxes or charges. The European Parliament and Commission adopted the proposed directive in July. The European Council needs to endorse the directive, but this is widely regarded a formality which will take place in the Autumn.

Key proposals are as follows;

2012 start: ALL flights in and out of EU

- **From 2012**: ALL flights arriving in or departing from airports in the 27 EU member states[1] (i.e. including trans Atlantic) will be included in the emissions trading scheme

Regulator for aircraft operators

- **Aircraft operators will be regulated**, and each will be administered by a member state. Small aircraft and certain flights will be excluded. Airline operator emission allowances will be calculated on 2010 emission levels, before the scheme starts in 2012.

Monitoring and recording emissions down to airline operators

- **Airline operators will be responsible for monitoring and reporting emissions** and compliance with caps for domestic and international flights on a country by country basis. If an airline does not have an operating license from an EU country, the country with the highest amount of emissions from flights by that operator in 2006 will have to take supervision of the airline.

Total sector emissions cap based on 04-06 average

- **The sector benchmark emissions cap (from which future reductions will be measured) for the aviation sector as a whole would be 100% of 2004 – 2006** average annual emissions. In 2012 (first period) the number of allowances allocated to the sector as a whole will be 97% of the 2004-2006 cap. From 2013 (the second period, 2013 – 2020), the cap will be 95%.

Combination of free and auctioned emission allowances for airlines

- **85% of the allowances distributed to the operators will be free**, **15% will be auctioned**, and an EU ETS review will determine further auctioning at a later date. (Likely to get to 100% auctioning by 2020).

The EU wants the auctioning proceeds to be spent on climate change mitigation and adaptation measures and to promote research and development including in particular the aeronautic and air transport sector. They can also be spent to support low-emission means of transport and projects to avoid deforestation.

There is uncertainty over the exact figures that will be used for the 2004-2006 average for the industry benchmark emissions cap.

Timeframe set for a 2012 start

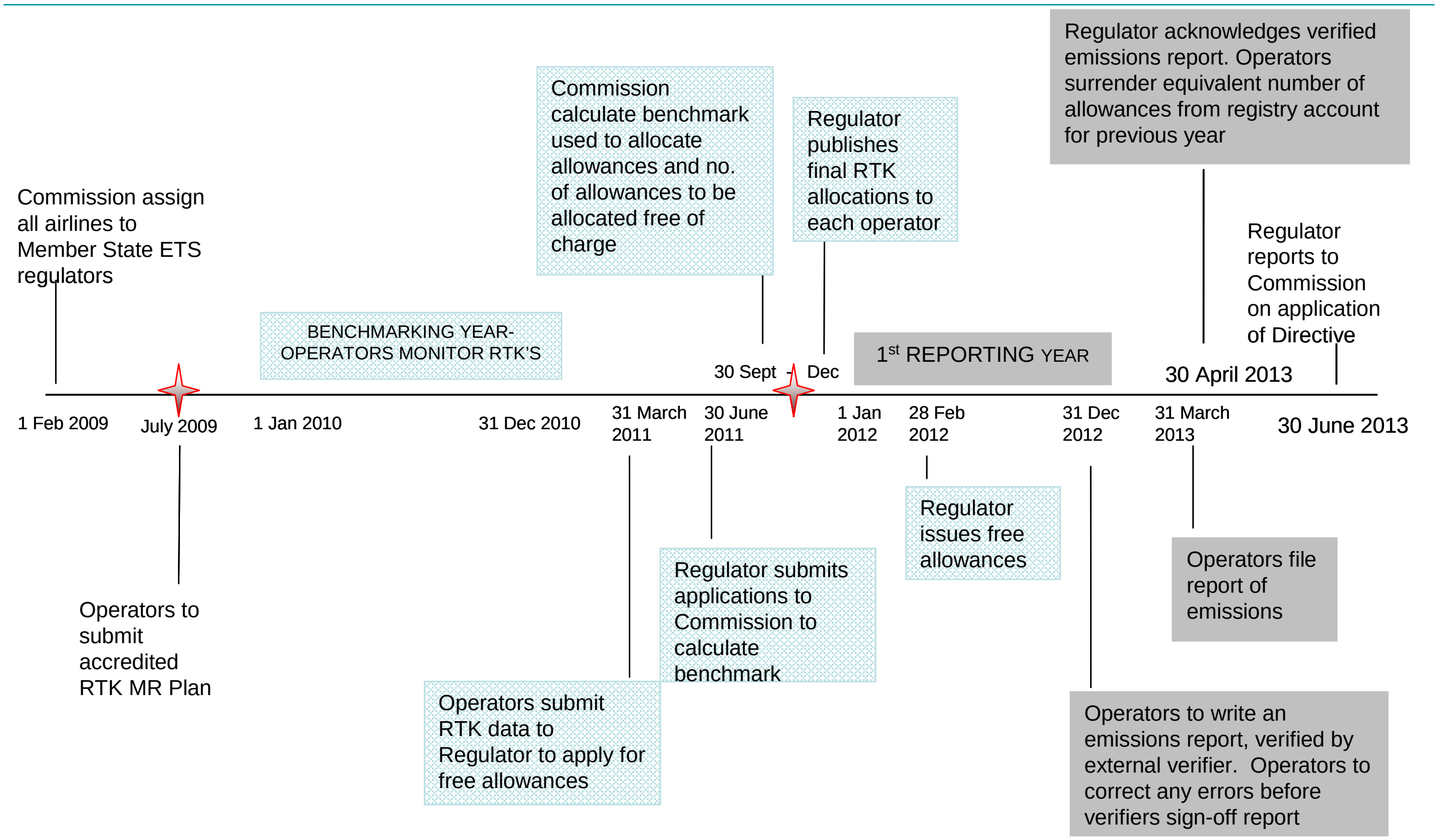
Feb 2009: EC assigns regulating authority to all airlines flying in to and out of

The process gets underway to make a 2012 start date in February next year, when the European Commission will assign a member state to regulate all airlines flying into or out of the EU. This will be determined by operators license, or, if the operator does not have a license originating from the EU, the country

[1] EU 27 member states are UK, France, Germany, Spain, Italy, Portugal, Belgium, Netherlands, Luxembourg, Ireland, Finland, Sweden, Denmark, Austria, Greece, Hungary, Romania, Bulgaria, Latvia, Lithuania, Estonia, Slovakia, Czech Republic, Poland

where it has most frequent activity (and therefore emissions). A summary of the time frame is in chart 7 below.

Chart 6: Timeline for a 2012 start



Source: Department for Transport

By July 2009 all operators will have to submit a plan for how to monitor and report emissions data based on RTK (revenue tonne kilometre) to the regulator. RTK is measured as sold capacity for passenger and cargo multiplied by distance flown. RTK's have been chosen as the benchmark measurement for airlines so that operators receive a share of the total amount of allowances in proportion to their share in total output.

2010 key year for operators

2010 is the benchmarking year for operators. During this year airlines will have to monitor RTK's carefully, since the data will be used by the European Commission in the calculation of free allowances. It is still not yet exactly clear how allowances will be determined but is expected to be as follows.

$$AA_n = AA_{tot} \times (RTK_n / RTK_{tot})$$

AA_n = aviation allowances allocated to airline n
AA_{TOT} = aviation allowances allocated to all aircraft operators
RTK_n = Verified RTK produced by airline n
RTK_{TOT} = Verified RTK produced by all aircraft operators

Airlines must submit RTK data for 2010 to the regulator for verification by March 2011. The regulator submits an application for allowances to the European

Commission by June 2011. The European Commission calculates the number of allowances it will give to each operator from the RTK data and the sector emissions cap (97% of 2004-2006 average emissions level, less a 3% special reserve of allowances reserved for distribution to new and fast growing operators).

When an operators allowance is decided, 85% will be allocated for free, and 15% will be auctioned. The operators will be given details of the allowance by December 2011.

End 2012 operators submit an externally verified emissions report

At the end of the first year (2012), operators will submit an emissions report which must be verified by an external verifier to demonstrate the balance of allowances. The operator will have to surrender allowances equivalent to the level given at the start of the year. If the operator is long it can sell the surplus to other operators.

Fictional example of how the scheme might work

A simple example of how the framework might work for two airline operators is given below. At the end of 2012 (the first year of trading) the actual allowance requirement for the two operators could be as follows.

Table 2: Example Allowance calculation comparison for 2 operators

	Operator 1	Operator 2
Position end 2011		
Total Industry allowance (based on 04-06 emission average)	150	150
Operator RTK submission for calendar year 2010	50	50
RTK for industry	500	500
Operator total allowance requirement: $AA_{tot} \times (RTK_n / RTK_{tot})$	15	15
Free allowances (85%)	13	13
Allowances to buy (either at auction or in market)	2	2
Position end 2012		
Operator actual RTK	70	40
Industry actual RTK	550	550
Actual Allowance required $AA_{tot} \times (RTK_n / RTK_{tot})$	19.1	10.9
Free Allowances (from above)	13	13
Allowances to buy / (sell)	6.1	(2.1)

Source: ML Research

On this basis operator 2 is long allowances and operator 2 is short.

Potential cost to the industry significant

Complex to forecast potential costs from RTK data, emissions forecasts used instead

The above example shows the complexities in estimating the potential cost to individual airlines of the scheme; particularly for non EU airlines flying into the EU (that do not disclose RTK for individual routes). Our approach to estimating a cost for the industry includes forecasting emissions for individual operators from 2012.

Analysis highly sensitive to key assumptions

In tables 3 and 4 we show the potential cost of ETS to airlines in 2012 (the first year) and in 2015 (this includes a lower cap -95% as per the regulatory framework). For our base forecasts we have taken 2006 emission levels, using publicly available data for the ML covered individual operators and 218mn tonnes for the sector as a whole. (Source: Frontier economics)

Our forecast emission analysis is highly sensitive to various key assumptions. We think it is also important to highlight that in intervening years (between now and 2012) there could be changes in the regulatory framework. At this stage we are making no changes to our earnings forecasts as a result of the regulatory proposals.

ML key assumptions:

- We assume 2.0% average annual passenger growth and emissions growth for the mainline carriers;
- We assume 12% average annual passenger growth for the low cost carriers (note this is slightly more conservative than company targets),
- We assume carbon emissions average growth c. 10.5% for the low cost carriers reflecting some efficiencies;
- We assume a lower cap (97% down to 95%) for our analysis in 2015 (as per latest regulatory framework, the cap moves to 95% in 2013);
- We assume carbon credit price (@ €30.0/tonne) =auctioning price and stays constant during the period (note the current carbon credit price is €25.25 while the 2012 contract is €30 -see chart 2 for the price of carbon);

Different operator strategies between now and 2012; will affect levels of emissions

Between now and 2012, airlines will pursue different strategies. This could involve overall expansionary capital investment and or a reduction in investment (for example, Iberia may decide to further reduce domestic capacity) or changes in the network. This will affect growth rates in the number of passengers and also in the level of emissions. On this basis, our analysis may need to be reviewed in subsequent years.

Table 3: Aviation and ETS - Level of emissions and potential cost to airlines in 2012

	2006 CO2 Emissions (mn)	2012 Forecast CO2 Emissions (mn)	With 97% Cap (mn)	85% Free Allowances (mn)	Allowances to Buy through auctioning (mn)	Cost of Auctioning, EURmn at EUR30/tonne	No. of Passengers (mn)	Cost per Passenger (EUR)
easyJet	3.0	5.7	2.6	2.2	3.5	104.1	65.6	1.59
Ryanair	3.8	6.8	3.6	3.0	3.8	112.0	74.9	1.50
AF-KLM	26.9	30.3	25.5	21.6	8.7	260.1	80.8	3.22
BA	17.6	19.9	16.4	14.0	5.9	176.8	40.6	4.35
Iberia	6.1	6.8	6.0	5.1	1.8	53.0	30.7	1.73
Lufthansa	21.9	24.7	20.7	17.6	7.1	211.7	71.0	2.98
Other	138.7	156.1	129.2	109.8	46.4	1390.6		
Total	218.0	250.2	203.9	173.3	76.9	2308.3		
						Average cost - low cost	Ryanair & easyJet	EUR 1.54
						Average cost - mainline	BA, Lufthansa, AF-KLM	EUR 3.52

Source: Company data, Frontier Economics, Merrill Lynch

In 2012, we estimate the potential cost to airlines could be over EUR 2.0bn. On a per passenger basis, we estimate an average cost for the low cost carriers of EUR 1.5 and an average cost for the mainline carriers at EUR 3.5.

In 2015, with a lower cap we estimate the potential cost to airlines could be approximately EUR 3.0bn. This includes Air France-KLM EUR 329mn, BA EUR 222mn and Lufthansa EUR268mn. On a per passenger basis, we estimate an average cost of the low cost carriers of EUR 1.8 and an average cost for the mainline carriers at EUR 4.2.

Table 4: Aviation and ETS - Level of emissions and potential cost to airlines in 2015

	2015 Forecast CO2 Emissions (mn	With 95% Cap (mn)	85% Free Allowances (mn)	Allowances to Buy through auctioning (mn)	Cost of Auctioning, EURmn at EUR30/tonne	No. of Passengers (mn)	Cost per Passenger (EUR)
easyJet	7.8	2.5	2.2	5.6	168.0	92.1	1.82
Ryanair	9.0	3.4	3.0	6.0	180.9	105.2	1.73
AF-KLM	32.2	24.9	21.2	11.0	329.2	85.7	3.84
BA	21.1	16.1	13.7	7.4	221.9	43.1	5.15
Iberia	7.3	6.2	5.0	2.3	68.7	32.5	2.11
Lufthansa	26.2	21.3	17.2	8.9	267.8	75.3	3.56
Other	165.7	133.2	107.5	58.2	1745.3		
Total	269.1	210.2	169.7	99.4	2981.7	434.0	
					Average cost - low cost	Ryanair & easyJet	EUR 4.18
					Average cost - mainline	BA, Lufthansa, AF-KLM	EUR 1.77

Source: Company data, Frontier Economics, Merrill Lynch

Cost sensitivity to various key drivers:

- **Change in rate of growth in emissions** - we estimate a 1.0% change in the level of emissions in 2015 would increase/decrease the costs of purchasing credits/auctioning by c.1.4% for the low cost carriers and by c.3% for the mainline carriers – this suggests to us that under the current proposals, there is an incentive for airlines to reduce the level of emissions;

- **Change in auctioning/carbon credit price** - we estimate a EUR 1.0 rise/fall in the carbon credit price/auctioning price in 2012 would increase/decrease the costs of purchasing credits/auctioning by c.3%;

- **Change in level of auctioning** - we estimate a 1% rise in the level of auctioning required to be purchased (currently 15%) in 2012 would increase costs by c.2.5%.

Airlines will try to offset ETS costs

1.6%E of total operating costs for mainline in 2012, c3.7%E for low cost

Using our current year forecasts for total operating costs as a base year, we estimate the cost of the scheme in 2012 could represent c.1.6% (for mainline carriers) and c.3.6% (for low cost carriers) of total costs. We expect airlines to look to offset these costs, for example through more efficient fleets (see OEM comments from page 12).

Table 5: European Airlines - costs of ETS

	Total operating costs, EURmn (2008/09E)	Cost of ETS EURmn (2012E)	% of total operating costs
easyJet	2901.0	104.4	3.6%
Ryanair	3024.7	112.9	3.7%
AF-KLM	24304.4	260.1	1.1%
BA	11485.4	181.1	1.5%
Iberia	5539.2	53.0	1.0%
Lufthansa	25276.3	211.7	0.8%
		Average - low cost	3.6%
		Average - mainline	1.6%

Source: Company data, Merrill Lynch

Cost pass through to consumers expected

Cost pass through highly likely

We expect airline operators to try to pass on as much as possible of the cost of emissions allowances to customers. In recent years, as fuel costs have increased, airlines have raised fuel surcharges. While low cost carriers do not explicitly introduce separate charges for fuel, underlying fares have risen during a similar period. Table 6 shows the latest fuel surcharges for the mainline carriers.

Table 6: Fuel surcharges summary

	Long-haul surcharge	Short-haul surcharge
Air France KLM	Less than 9hrs €131 per sector , over 9hrs €145 per sector	€21 per domestic flight & €35 per medium-haul flight
British Airways	Less than 9hrs £98 per sector , over 9hrs £133 per sector	£16 per sector
Lufthansa	€97 per flight	€27 per domestic & intra-Europe flight

Source: Company data, Merrill Lynch.

Fuel surcharges now represent a significant proportion of the overall ticket price. Despite this, until very recently, airlines successfully passed on these fuel surcharges to customers with no adverse effect on demand.

So far fuel surcharges passed on with no adverse effect on demand

As shown in our analysis above, we estimate an average 2015 emissions cost per passenger of EUR 1.8 for the low cost carriers and EUR 4.2 for mainline carriers (AF-KLM, BA and Lufthansa). This is low, compared to the current level of fuel surcharges, see table 4. We estimate the overall 2012 cost per passenger of ETS would represent between 1.4% and 3.1% of average current ticket prices – *on this basis, we would expect airlines to try to pass on this cost to customers*.

Table 7: Aviation and ETS as percentage of average ticket prices

	2012E No. of Passengers	2012E Cost per Passenger (EUR)	2008/09E Average ticket price (EUR)	As % of ticket price
easyJet	65.6	1.59	59.2	2.7%
Ryanair	74.9	1.50	41.5	3.6%
AF-KLM	80.8	3.22	234.7	1.4%
BA	40.6	4.35	241.3	1.8%
Iberia	30.7	1.73	129.0	1.3%
Lufthansa*	71.0	2.98	251.5	1.2%

Source: Company data, Merrill Lynch. Lufthansa excl. SWISS. Average ticket prices for low cost carriers are before ancillary revenues. Also worth noting ticket price definitions can vary. Our analysis includes EUR :GBP 1.26.

Cost of ETS per passenger – below the average increase in long-haul fuel surcharges

We estimate the average increase in long-haul fuel surcharges from BA since 2004 is approximately £4.75 per sector (EUR5.99). This is versus MLe cost of emissions allowances per passenger of EUR4.18 (see table 4).

Airlines’ revenue sensitivity

Table 8 shows our estimated overall price elasticity multipliers for individual carriers. We use these multipliers to estimate the overall impact on revenue for a 1% increase in price/yield.

For example, on the basis of our elasticity multiplier for easyJet, we estimate a 1% increase in price would reduce revenue by 0.5% (owing to the adverse effect on traffic from higher pricing). It is worth noting that our estimated cost per passenger from ETS in 2012 for easyJet is EUR1.6. This is equivalent to a 2.7% increase in its average ticket price (see table 7).

Table 8: Price elasticity of demand

	Elasticity Assumption	Revenue Impact for a 1% increase in price (local currency, millions)	% Change in Revenue
easyJet	1.31	-13.1	-0.5%
Ryanair	1.40	-11.5	-0.3%
AF-KLM	1.21	-52.0	-0.2%
BA	1.21	-24.0	-0.3%
Iberia	1.22	-8.0	-0.2%
Lufthansa	1.20	-34.0	-0.2%

Source: Merrill Lynch

We think low cost/fares airlines demand is more sensitive to price (despite their more efficient business model). This is due to alternative potential modes of transport within Europe and greater exposure to more price sensitive leisure customers. We expect costs to be passed on to passengers, see below.

The risk to our view on cost pass through is the economic backdrop in 2012. If the economy is worse than has previously been the case for surcharge pass on, demand could be more adversely affected than previously.

Carbon offset schemes are a useful cross-check

As a cross-check for our analysis, table 9 shows the carbon offset cost as shown on company booking websites. It can be seen that for easyJet the carbon offset cost for London to Milan is £1.16 which is close to our estimated ETS cost per passenger in 2012. In effect, if all costs are passed on, the ETS is a tool which forces consumer offsetting.

Table 9: Carbon offset cost as percentage of ticket price

	Total ticket price (£)	Fuel surcharge (£)	As % of underlying ticket price	Carbon offset cost (£)	As % of underlying ticket price
London - Milan (BA)	288	16	5.9%	2.26	0.8%
London - New York (BA)	574	98	20.6%	10.82	1.9%
London - Milan (easyJet)	109	-	-	1.16	1.1%

Source: Company data, Merrill Lynch.

Long-term reduction of CO2 emissions

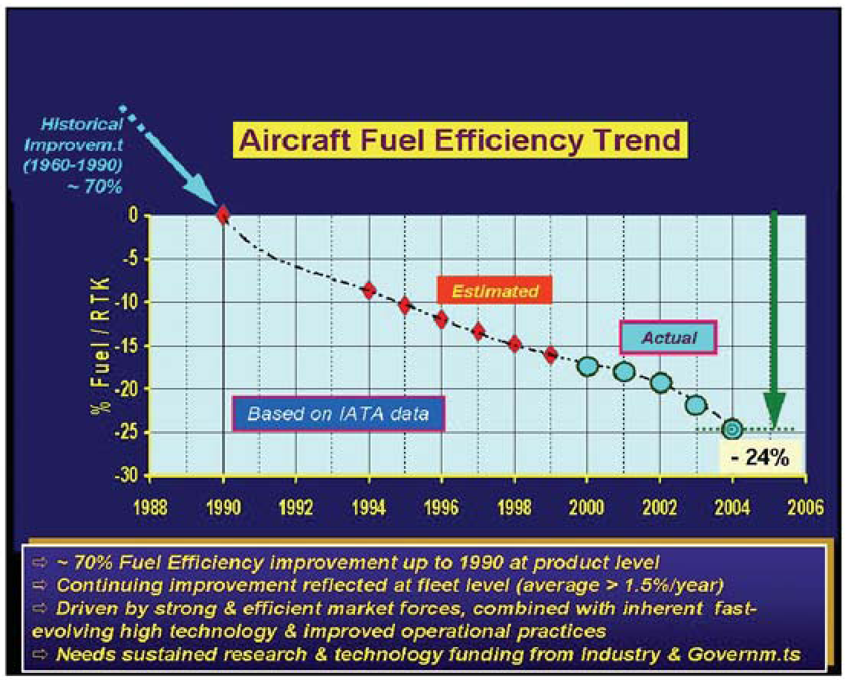
Fuel efficiency key driver of CO2 efficiency

The ultimate aim of the ETS is to reduce emissions from the aviation sector. A key driver of emissions reduction will come from fuel efficiency. This can be attributed to the original equipment manufacturers (OEMs – typically Airbus, owned by EADS or Boeing). Other airline strategies to reduce ETS costs include increasing the load factor, maximising fuel consumption per passenger per sector, more efficient route networks, and more pressure from the operators for air traffic management systems improvement.

Minimising fuel costs integral to airline business model; even more so with $100+ oil

The airlines' stimulus to replace existing equipment with new, more fuel efficient equipment comes down to the trade-off between new, and high, product costs and the fuel expense reduction (c.32% of an airline's total costs). Lowering fuel consumption, (and thus CO2 emissions) has always been a focus of the manufacturers, but ETS will reinforce this. Below we discuss the potential decisions that would be available for European airlines' fleet strategy.

Chart 7: Aircraft fuel efficiency



Source: IATA

European Fleet: incentive to renew equipment

The European existing aircraft fleet represents c.31.5% of world commercial aircraft fleet (above 14 seats including jets and turboprops) and 25% of the OEMs order backlog.[2]Table 9 shows the European fleet age profile, with the shaded aircrafts the oldest, per aircraft size. These are most likely to be replaced first.

Table 10: European fleet age profile

	Units	Av. age
Total EU operated fleet Jets	4,896	
Total EU fleet +110 seats	4,015	10.45
Long-haul fleet total	559	10.6
MD-11	52	12.65
B747	221	14.65
A340	163	7.72
B777	123	6.35
Medium haul twin aisle fleet total	379	13.4
DC-10	4	28.3
A300	65	22.9
A310	30	18.6
A330	137	6.0
B767	143	14.7
Single aisle fleet total	3,077	10.0
MD-80/90	260	18.5
B717	8	8.0
B737-Classics	623	16.5
B737NG	659	5.1
A320s (*)	1323	7.1
B757	204	14.7

(*): of which 110 A320s are the very ld ones 1988-1991
Source: Airclaims data base

The European operated fleet is relatively young (average age 10.45yrs) compared to the global fleet age (av.age 12yrs).

Generally, airlines can operate an aircraft for 30 years, but European skies have already implemented safety regulations, noise caps and fuel caps in the 1990s that forbid operations of very old aircraft types with original engines. In Europe, the replacement or enhancement of performance is likely to happen to aircraft approaching 15 years old and beyond.

However looking at each aircraft type in detail shows that the age range is wide: DC-10 and A300 are 20+ years old and the B737New Generation are the youngest at 5.1years old. Table 10 illustrates the various categories of aircraft and their “technology” generation. Each new generation tends to offer a minimum of 10-15% efficiency gains (fuel/ maintenance gains) compared to the older generation.

Table 11: Aircraft Generations

	Old Generation (pre-90s)	Newer Generation	Future Generation
Narrow-body/ Single-aisle			
	MD-80/90	B717	
	B737 Classics (200/300/400/500/600)	B737NG (700/800/900)	NGSA
		A319/320/321	NGSA
	B757-200	B757-300	
Wide-body/ Twin-aisle			
	A300		
	A310	A330	
	B767-200ER	B767-300ER	B787
	DC-10	A330/A340	B787, A350XWB
	MD11	B777	A350XWB
Large Wide-body			
	B747-200/300	B747-400	B747-8
			A380 (*)

Note (*): A380 entered service in 2008
NGSA: Next Generation Single Aisle, aircraft still to be defined both in terms of design and entry-into-service date
Source: ML estimates

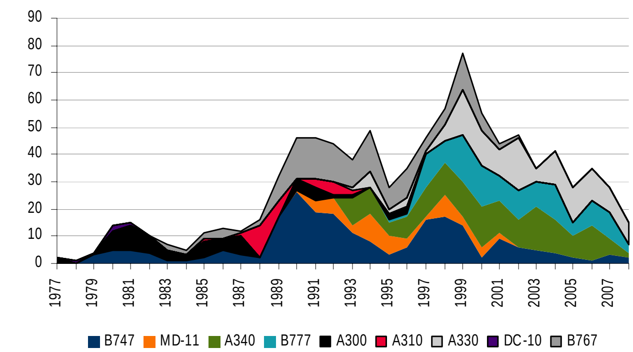
Wide body fleet profile

European WB fleet relatively old, more likelihood of aircraft replacement

The European wide body (WB) fleet is relatively old with average age of medium haul twin aisles at 13.4years and the long haul large twin aisles at 10.6 years. Aircraft delivery peaked in the late 80s-early 90s and then again in late 90s. The first peak is from old WB generation airplanes such as A310, DC-10, B767, B747 (Chart 8). Both the engines and the aircraft are from an older generation, so therefore operators are more likely to order new equipment which offers a significant fuel reduction opportunity. The need to replace the old twin-aisle (c.500 airplanes) verifies the success and the robust demand for A330/B787/ A350XB over the next decade.

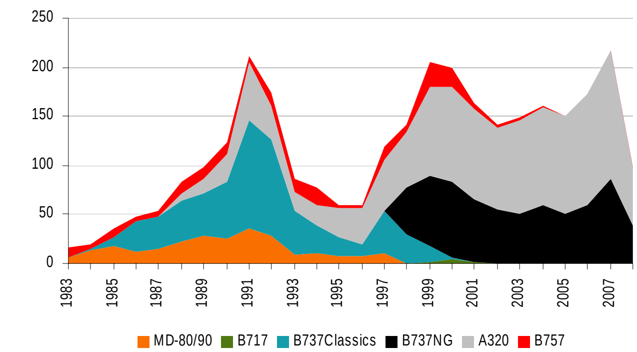
[2] Source ACAS database end of July 2008

Chart 8: European airlines WB fleet profile



Source: Airclaims

Chart 9: European airlines NB fleet profile



Source: Airclaims

Late 80's early 90's NB aircraft more likely to be replaced. Late 90's early 2000s NB aircraft more likely to see engine upgrades

Narrow Body Fleet Profile

European narrowbody (NB) fleet is younger than the widebody fleet. The NB fleet (75% of European total fleet) peaked in aircraft deliveries in late 80s-early 90s (Chart 9). This reflected by new environmental and noise standards. These 1,087 aircraft (MD80/90-B737Classics, gains than those currently produced. Most of the improvement could from the engine technology upgrade rather than the airframe (engine upgrade vs an all new aircraft).

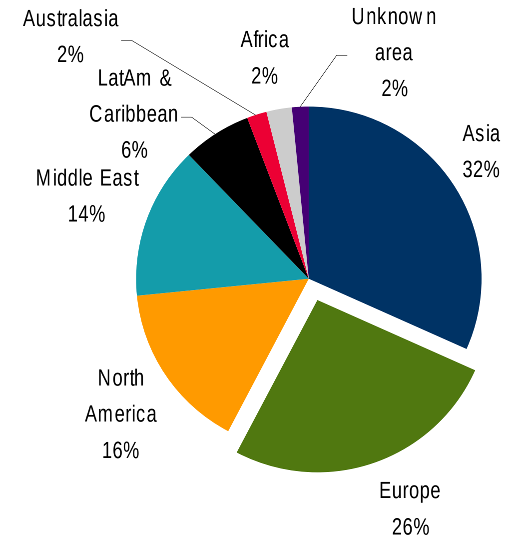
European airlines aircraft orders represent c. 20-25% of backlog of which 60-63% are NB orders c.1,080 aircraft

Orders so far from European Airlines

In total, European airlines have c.1,750 aircraft on order with Boeing and Airbus. European airlines (including Russia) represent c.19% of Boeing backlog of which 442 aircraft (c.63%) are orders for B737NG (with 87% to be delivered before the end of 2012). For Airbus, European airlines account for 26% of the total backlog of this, 638 are for A320s with 80% to be delivered by the end of 2012 (Chart 10 and 11). In total, European airlines have c.1,080 NB aircraft on order and 670 for WB. Most of the WB orders are for the replacement of old generation aircraft (674 orders vs 515 old gen airplanes in Europe) and for incremental growth.

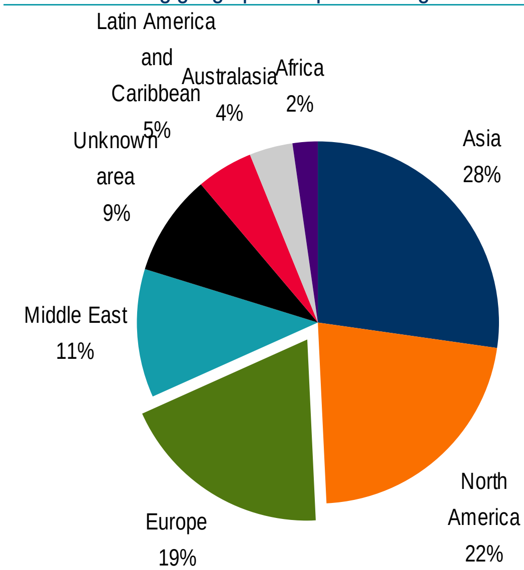
For NB orders, c.35-40% of the orders are from European LCC carriers which have relatively young fleets. As a result, their orders are for growth and expansion and not replacement. There is a potential need to replace c.1,090 old generation narrow body in Europe. However, we think only part of this will translate into new aircraft orders given the high cost of the equipment and the less attractive fuel efficiency gains...unless aircraft OEMs offer large discounts.

Chart 10: Backlog geographical split - Airbus



Source: Airclaims August 2008

Chart 11: Backlog geographical split - Boeing



Source: Airclaims August 2008

EU low cost carriers have young fleets so unlikely to see replacement orders from them

Table 11 shows aggregated fleet sizes and the average age across the European sector. It can clearly be seen that the average age of the low cost carriers fleets is much lower than the mainline carriers. Looking ahead, we would expect the mainline carriers average fleet age to fall as new aircraft are delivered over the next three to five years (particularly long-haul) and older aircraft are withdrawn/retired.

Table 12: European Airlines - Average fleet size and age

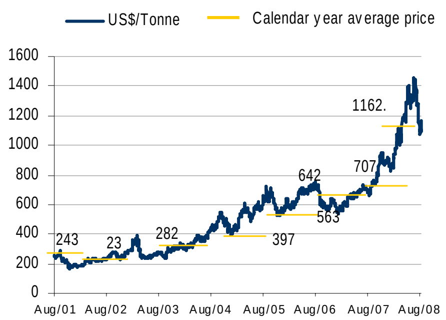
Airline	Number of aircraft in fleet	2007	
easyJet	137	2.7yrs	
Ryanair	163	2.5yrs	
AF-KLM	404 (incl. regional 622)	Long-haul 8-9yrs	Short-haul 10-11yrs
BA	245	Long-haul 11-12yrs	Short-haul 10yrs
Iberia	128	Long-haul 7 - 8yrs	Short-haul 6-7yrs, MD-88s (withdrawal)16yrs
Lufthansa	264 (incl. regional/other 513)		

Source: Company data, Merrill Lynch

Trade off; higher fleet costs & lower fuel costs

The airlines are constantly addressing the trade off between committing to newer technologies (aircraft or engines) with a 30 year life cycle, that come at a high price, and reducing fuel consumption (and thus costs and CO2). We estimate the cost of ETS for EU airlines in 2012 could be up to on average c.2.5% of their total costs (the range is 1% for mainline carriers and 3.6% for low cost carriers). This provides an additional incentive for airlines to invest in new equipment as lowering fuel emissions should lead to a reduction in the ETS costs.

Chart 12: Jet Fuel price ($/t)



Source: Datastream

Given the rise in the oil price (Chart 12) in recent years, it is airlines' interest to reduce its fuel costs in our view. We estimate the EU ETS scheme is another relatively small charge on top of the underlying fuel expense (c.32% of airline's total costs), but the ETS 2012 deadline could encourage airlines to replace old equipment sooner rather than later.

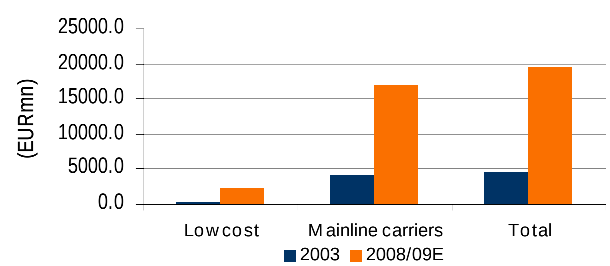
Historically, for the mainline carriers, fuel has been the second most important cost (after staff costs). However, our forecasts now suggest that for most of the airlines, fuel is the single most important cost. The exceptions this year are AF–KLM and Lufthansa. For the low cost carriers, fuel has been the single most important cost for some time. Fuel as a percentage of total costs (at $140 oil) is shown in table 12 below.

Table 13: European Airlines - Fuel as percentage of total costs

	2003	2008/09E
Ryanair	22.3%	48.7%
easyJet	14.2%	31.5%
BA	11.5%	34.1%
Iberia	12.5%	29.7%
Lufthansa	7.9%	22.4%
Air France - KLM	11.0%	24.3%
Average - low cost	18.2%	40.1%
Average - mainline carriers	10.7%	27.6%
Total - peer group average	13.2%	31.8%

Source: Company data, Merrill Lynch

Chart 13: European Airlines fuel costs (2003 vs. 2008/09E)



Source: Company data, Merrill Lynch

Wide body tradeoff: fuel savings large enough to offset cost of new aircraft

Clear incentive to replace old twin-aisles with new gen - fuel efficiency gains more than offset the cost of the new equipment

In recent press articles, Air France estimates that the B777-300ER is 20% more fuel efficient than the B747-400. Similarly, British Airways estimates 23% fuel gains. We make our own analysis based on publicly available data for US airlines twin-aisle operations (Airline Monitor August 2008, see Appendix 2). Our main conclusions are:

- In 2007 fuel represents c.58% of long haul flights direct operating costs. If fuel prices rise; this percentage could increase further

- The cost of buying a new generation long haul aircraft offering 20% efficiency gains (both in fuel and maintenance costs) against keeping the old generation WB with low ownership costs would be a "winning" trade for an airline given the significant savings generated by the new aircraft in fuel and maintenance expenses, despite costing twice as much. Typically we estimate that a new B777-300ER could cost $120mn and a B747-400 c.$75-80mn (as of recent sale and lease back announced by Global Knafaim Leasing for Air New Zealand B747-400). For WB older than the B747-400 such as B747-200/300, A310, the trade-off between fuel savings and fleet costs is even more encouraging.

- We estimate that a 1% saving in fuel saving cost is equivalent to a 5.5% increase in aircraft price/rentals.

Impact for OEMs: Strong and solid wide body growth ahead

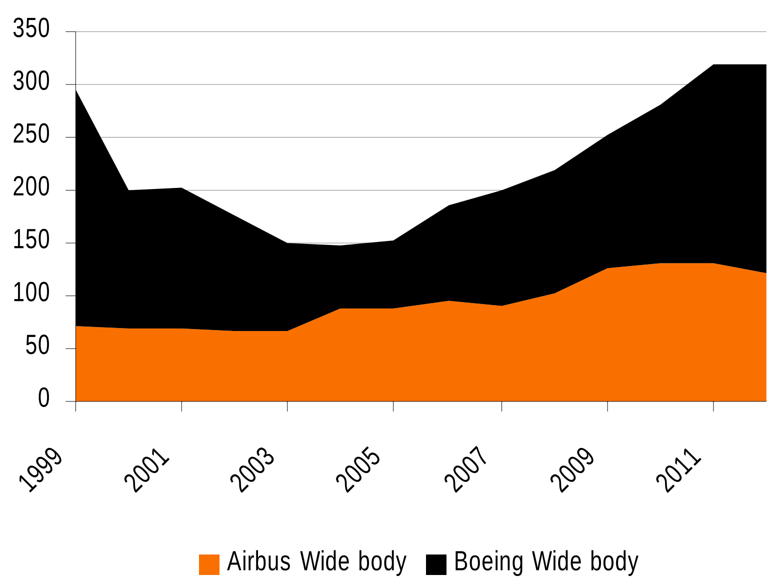
For EADS, WB share of revenues not enough before 2015 to counter downturn in other segments

Both Airbus and Boeing have strong demand for their WB (Chart 14 illustrates the production ramp up from 2007 onwards). Both OEMs are ramping up production on their current WB products (Airbus from 10 to 11 aircraft a month on the A330 product) and are working on future generation of WB (B787 and A350XWB). We think WB demand is likely to be resilient over the next 5-10 years as old generation WB are replaced, and potential available slots (before 2012-13) are very likely to be filled in. In addition for Airbus we would expect an improvement in pricing on A330 ordered today to be delivered beyond 2012. However, for Airbus we estimate that WB revenues still would only contribute to c.50-51% of total aircraft sales over 2009-2015E (against c. 48% historically) suggesting that the WB improvement would not be sufficient to counter discounted prices on NB (see next paragraph). As a comparison, Boeing has a larger proportion of sales from WB c.55-60% of civil aircraft sales.

Rolls-Royce better way among EU names to benefit from WB growth as early as 2010

Rolls-Royce (RR) manufacturers a significant amount of large engines - the Trent family of engines (all for Airbus and Boeing wide body aircraft) represent just c.25% of deliveries in unit terms, but up to c.45-50% of new engines and spare parts sales. The percentage of WB sales is ramping up overtime because of 1) the growth in new aircraft delivery in the WB segment and 2) RR increased market share in the large engine segment to the detriment of P&W – RR market share in WB is trending up from 30- 32% to 40-45%.

Chart 14: Wide body delivery forecast



Source: Merrill Lynch estimates

NB mixed gains but engines retrofits more likely

We also apply our trade off methodology (see Appendix 2) to assess the single aisle segment. The main conclusions are:

Fuel costs matter relatively "less" in NB operations compared to WB

- Fuel costs are less important for NB operations as a % of airline operating costs, hence the trade off between fuel gains vs new aircraft price is very different than the WB segment. We estimate that 1% saving in fuel saving cost is equivalent to a 3.7% increase in aircraft price/rents;

For mid 80's generation NB, aircraft replacement makes sense…but doesn't have to be a brand new one

- There is a clear incentive for airlines to replace their B737-300/MD80s aircraft with current generation airplanes. However airlines "trade-off" would work very well if they could just upgrade to early 90s second hand aircraft. There is no need for airlines to order brand new aircraft. The cost of the newly built aircraft could be too high to justify this decision...OEMs severely discount their products.

For 1990's generation NB, engine upgrades more likely

- For airlines operating NB of the 1990s generation we think that they are more likely to opt for engine upgrades rather than new aircraft renewals. The engines cost represents c.20-25% of aircraft costs. Spare parts kits price can vary depending on the upgrade level, but they are likely to much lower than a new engine price.

Impact for engine OEMS: increased demand for engine upgrades

CFM (engine JV between Safran/GE) and IAE (engine alliance between Rolls-Royce, P&W, MTU and Japanese suppliers) are likely to benefit further from increased orders in highly profitable modification engine kits. The European companies mostly likely to benefit from this are Safran (c.30% of group sales) and MTU (c.28.5% of group sales). For both names, NB engines represent a large part of their new engine deliveries (vs RR c.9% of total group sales).

Impact for aircraft OEMs: limited incremental demand for new NB

Current NB aircraft could alleviate airlines' fuel expense but risks for OEMs to provide large discounts

The future next generation of single aisle aircraft (NGSA), which would provide airlines with an even more fuel efficient product, is unlikely to be introduced before the middle of the next decade. Thus if Airbus/ Boeing were to provide attractive prices, we think airlines should be able to significantly reduce their fuel bill by moving from mid-80s aircraft to current enhanced generations.

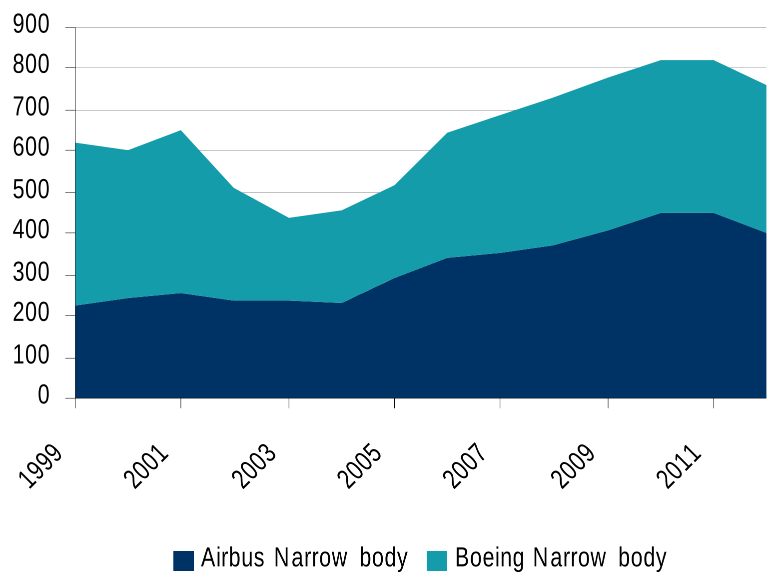
If discounts widen, OEMs would need to focus on reducing their cost base (moving NB lines to low cost countries) and on investing more in R&D to gain small percentages of fuel efficiency. To provide a c.40-50% discount to the list price we would expect the magnitude of cost savings required to be in the range of 20 – 25%. This would appear to be a very large number, however typically discounts from list price are in the range of 20-25%.

Airbus exposure to NB is higher than Boeing: single-aisles represent a 49.5% of total sales for Airbus in 2011E vs Boeing at 44% of total Boeing Commercial Airplanes sales. Airbus has maintained its plans to ramp up the NB production up from 36 to 40 aircraft / month by 2010.

For NB the 2010-2013 the market outlook is less solid given the pressure on medium traffic in Europe and US. There are currently c.3,077 single aisle aircraft in Europe, assuming c.1,080 retirements and c.2% growth pa over the next five years, the EU fleet size could be up to c.3,400 aircraft . Of these, there would be a need for max.1,500 new NB to replace all the old 1,090 NB (which is a very positive assumption as they could go for second hand aircraft as we said earlier) and c.400 airplanes to cope with the new traffic demand. Currently there are already 1,080 NB on order for Europe, the incremental upside is limited.

However, some of the LCC deferrals or cancellations could provide an opportunity for legacy carriers with old equipment to accelerate their fleet replacement (SAS and its affiliates, Air One, LOT, CSA, Air France) and reduce CO2 emissions.

Chart 15: Narrow body delivery forecast



Source: Merrill Lynch estimates

Even more attractive if US applies similar trading scheme

If the US were to implement a similar scheme to the EU in order to reduce aviation emissions, the upside to the aircraft and engine equipment manufacturers would be significantly larger. This could accelerate the replacement demand in North America. US fleet represent c.7,070 jet aircraft (50% more than EU fleet) and the average age of the fleet is 13yrs above world fleet average.

Load factors – the higher the better

Average European load factor 76.5%, LCC tend to be higher than this

Airlines with higher load factors will be the most efficient (greater number of passengers cover costs). Low cost carriers typically have higher levels of utilisation than mainline carriers (this reflects seat configuration and a one-class cabin). According to the Association of European Airlines (AEA), the average passenger load factor for 2006/07 was 76.5%. We estimate a passenger load factor for EasyJet of 83.8% (to September 2007) and 82.5% for Ryanair (to March 2007).

Table 14: European airlines load factors (2006/07)

	Passenger Load Factor	Overall Load Factor
easyJet	83.8%	NA
Ryanair (Mar y/end)	82.5%	NA
Average low cost	83.2%	
AF-KLM (Mar y/end)	81.4%	75.1%
BA (Mar y/end)	76.1%	65.5%
Iberia	81.6%	63.5%
Lufthansa	77.4%	73.4%
Average mainline	79.1%	69.4%

Source: Company data, STAR 2007, Merrill Lynch

Sizing-up capacity to counter low price elasticity

Airlines could adjust the aircraft interior (assuming all other costs remain fairly stable) to try to maximise the amount of seats flown per sector for a similar fuel consumption. This would give airlines the potential to spread the ETS cost over a greater number of passengers.

European LCC/ charters could increase aircraft size on sectors to maximise fuel costs/ seat. Shift from A319 to A320, B737-700 to B737-800

This could encourage a "sizing-up" trend in the NB segment. Air France CEO commented in the press in June 2008 that their plan is to "move the requirement (to replace A320/A321) from 120-200 seats to 150-250 seats and to get the right model covering this family. It is more about the costs." Adding 20 more seats on a plane will not increase the weight, and thus not impact the required fuel to fly the plane.

Speculation that operators already thinking of sizing up

Press reports have speculated on 15 August that easyJet has converted 25 of its existing A319 orders into A320s (the airline has not confirmed nor denied this). This should enhance easyJet competitiveness against Ryanair with B737-800s at 189 seats. The cost that needs to be offset is the additional cabin attendants (FAA requires one cabin attendant for every 50 seats). The economics are likely to favour the "sizing-up" option work given the relatively low cost and flexibility of LCC staff.

Impact for aircraft OEM's

Short-term, "sizing-up" could imply some shift within the European airlines NB orderbook as the A318/A319 could look much less attractive, similarly for the B737-700. Long term, an increase in the number of seats could determine the NSGA airframe design.

Other CO2 reduction measures include point to point and ATM

Point-to-point – lower emissions than hub & spoke

Some of the largest mainline European airlines operate networks based on a "hub and spoke" system, for example Air France-KLM. In these networks, passengers may typically take two flights to reach a destination, connecting through the hub. A direct "point-to-point" service will typically produce lower emissions than two flights via a hub. easyJet and Ryanair typically fly direct. It is also worth noting that BA, through its Heathrow hub, concentrates on point-to-point services.

Air traffic management – out of the operators hands

An ICAO commissioned special report estimates that a 2-6% saving could be made by increasing load factors, eliminating non essential weight, optimising speed and reducing taxi-ing at airports.

Air traffic management efficiency could cut fuel consumption between 8-18%

According to ICAO's CAEP (Committee on Aviation Environmental Protection) unit, air traffic management could reduce aviation fuel burn by between 8-18%, thereby contributing to the lowering of CO2 emissions. There are projects in place to improve air traffic management, namely the single European sky and the sesar projects. In addition, the EU supports the Atlantic Interoperability Initiative to Reduce emissions (AIRE) agreed between the EU and the US Federal Aviation Administration.

Alternative fuels to reduce dependence on fossil fuels

GTL blend could be ready next year

Airbus has completed its first flight with synthetic fuel using a gas-to-liquid (GTL) blend on the A380 RR engine and Boeing has tested biomass-to-liquid fuel. Qatar Airways aims to start using GTL blends in commercial service next year, which will accelerate OEMs effort.

Airbus is also working on biomass/ biosynthetic fuels which could bring a real step change in reducing the use of Jet-A fuel. The fuel has to be mixable with kerosene in order to simplify the roll out of the logistics chain. Production of hydrogenated vegetable oils is less energy intensive than biomas-to-liquid or coal-to-liquid blend and therefore have a lower overall carbon footprint.

OEMs target is to increase use of alternative fuels by 25% by 2025. Now biomass favoured to hydrogen fuels

OEMs will identify and test what could be the best fuel for aviation from now until 2011. The target is to increase the use of alternative (synthetic or biomass) fuel by 2025 by 25%. Airbus seems optimistic on the biomass as hydrogen cannot be mixed with fuel whereas biomass can. Biomass use would be carbon neutral as the biomass captures CO2 which would then be released during the flight. However this could be a long term process as ways to supply the quantity needed would require new investments and new infrastructure.

Carbon risk to be integrated into risk management

Under the scheme, airlines will have three options. cut emission through operational improvements, buy additional carbon allowances on the EU ETS or invest in CDM / JI projects under the Kyoto mechanism. It is unlikely that all of the carbon risk can be mitigated through operational efficiencies but airlines can use cost-effective market solutions:

- ETS and CER futures contracts
- Hedging and option strategies involving carbon and oil

Financial markets are starting to provide these financial services. For example ML Carbon Emissions can provide airlines with an *Emissions Compliance Solution*:

- Oil futures and derivatives products
- EU ETS spot and derivative trade strategies
- CER/ERU sourcing and risk intermediation
- Innovative hedging mechanisms involving carbon and oil
- Advisory services on carbon strategy and carbon inventory management through Merrill Lynch Green & Gold*SM*

Since airlines are used to hedging fuel costs we would expect them to manage their carbon risks appropriately.

Proposals unlikely to be derailed

ICAO has reservations on the scheme

There is little chance that the proposals will not be implemented since the European Parliament voted 640 in favour 30 against. Industry players and organisations have criticised the proposals however. In its 36th Assembly held last September, the ICAO stipulated that it was unacceptable that one contracting state impose emission trading system on other state's aircraft operator unless mutual agreement is reached between this states. The EU rejected this argument as according to the following provisions:

- Article 1 of international law states each state has complete and exclusive sovereignty over its airspace.
- Article 6 of international law states no international service may be operated over or into a territory of a Contracting State unless with the permission of the state.

- Article 11 of Chicago Convention states the regulation of contracting states regarding arriving at and departure from its territory should be applied to aircraft of all contracting states without discrimination.

Since EU ETS is a regulation of EU, it is justified that emissions from all fights arriving at and departing from EU, regardless of the country, should be regulated. In other words, an EU Member State would be entitled to refuse a non-EU air carrier access into its airspace, if the airline didn't comply with the regulation.

But EU goal is clear: low carbon economy status

Many also argue that high fuel costs will be so detrimental to the industry that industry players will be forced to leave, thus achieving reduced emissions. While the backdrop has changed significantly, and costs for the industry have increased since the proposals were put forward, we think that the EU has a clear goal on achieving a low carbon economy status and tackling emissions from aviation are a key part of achieving that goal.

Appendix 1 – Technology gains in engines & aircraft

The focus of the aviation industry has always been to improve its fuel efficiency and noise levels: over 1960-90s aircraft fuel efficiency has improved by 70% and perceived take-off noise level has been reduced by 20dB for jet-powered aircraft[3]

Engines: c.0.5-0.8% fuel efficiency gains per year

There are some general and simple rules for aircraft and engine efficiency:

1. Engine OEMs agree that with technologies insertion an engine can gain c.0.5-0.8% of fuel efficiency per year. Engine OEMs continue to offer fuel improvements through spare parts kits which tend to be standard on new engines productions, but can be retrofitted to older existing engines. Leap56 enhances CFM56-5/7 (2006-7 production) fuel efficiency by 1-2%, and similarly IAE with SelectOne improves V2500 efficiency by 1% (vs 2006-7 production).

Aircraft: c.3% efficiency gains over 10 years

2. Airbus estimates that over 10 years of product development both on the engines and airframe, an aircraft can improve its efficiency by 3% in total;
3. Airbus estimates that an A320 of 2007 is c.5% more fuel efficient than one produced in 1990;
4. Winglets (wings tips at the end of the wings) on aircraft can improve efficiency by c.3-4% on an airplane.

Chart 16: Six strands of Technological Progress

	Weight Reductions	Aerodynamic & Engine Performance Improvts.	Operations
1. Propulsion System	- Engine, Nacelle & Propulsion System • Advanced lightweight materials • Weight optimized Configuration	-Engine turbomachinery efficiency - Cycle optimized (intercooler, HBPR, UHBPR, geared turbofan, contra-fan) -"Intelligent"systems/more integrated engine -Innovative/active engine systems (heat management, cooling, power transmission,...) - Enhanced modelling capabilities (numerical) - low emissions combustor	- FADEC - Enhanced Controls & Sensors - Optimized Engine Operating Procedures
2. Materials	- Composites - Advanced light Alloys (Ti, Al-Li, Mg), Hybrid alloys (glare) - Innovative, smart materials	NOTE: *Information provided in this table is very general, non-exhaustive*	
3. Structure, Aero & Systems Design & Methods	- Aero-elasticity (load alleviation & control) - Structural optimization, integration & new concepts - Smart, morphing structures, nanotechnologies (future) - Wing, fuselage, empennage, landing gear, pylon innovative features	- Wing, HLD, HTP, Winglets, Fuselage - Engine/nacelle/pylon integration - Flow control - New unconventional configurations & concepts (future) - Multi-disciplinary design methods - Virtual Engineering	- Systems Modelling - Systems Simulation & Virtual Testing - Adaptive flight path to reduce emissions (future)
4. Manufact. Processes	- Welding processes (EBW, LBW, FSW) - Innovative structures & processes	- Welding Processes (drag reduction)	
5. Aircraft Systems	- Fly by Wire - Optimized, integrated & simpler electrical & mechanical systems, less components - IMA - Fuel transfer/load alleviation	- Advanced flight controls, more electronic systems: optimized control surface deflections, level & trajectory control	- Advanced Cockpit, Flight Management & Navigation - Optimized Energy & Electric Power managt (generation/distribution)
6. Operational Procedures	*Some procedures are linked with minimizing TOW*	*Some procedures optimize operations based on Aircraft aerodynamic characteristics*	- Optimized ground & flight, Maintenance procedures - ATM

Source: ICCAIA

[3] Source: ICAO Environmental Report 2007

Developments on the horizon

Aircraft OEMs future developments

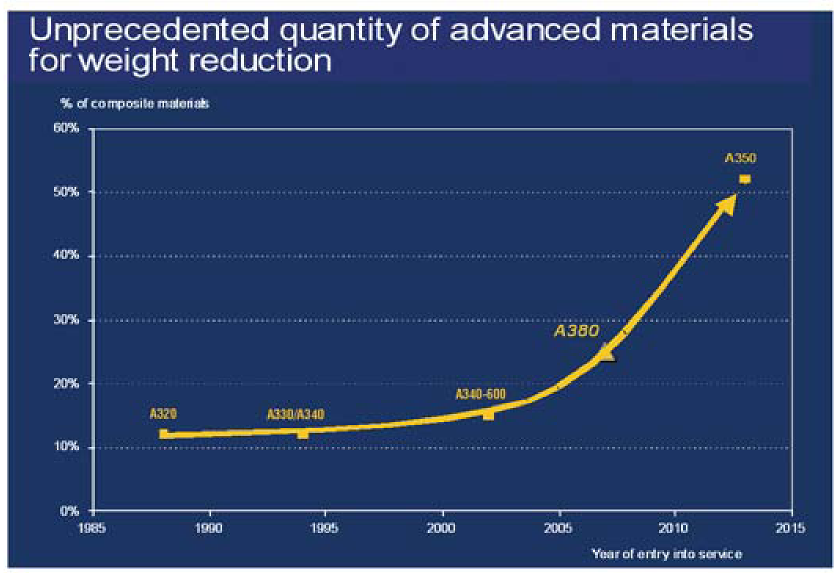
Airbus and Boeing are starting to discuss the replacement of the A320/B737 families - the Next Generation Single Aisle (NGSA) with an Entry-into-Service beyond 2015. Airlines are asking for 20% overall costs savings against the current aircraft in production with at least 20+% fuel savings. Industry agrees that this can only be achieved by a technological revolution in airframe and engines.

OEMs are working to meet the ACARE (Advisory Council for Aeronautical Research in Europe) targets by 2020 which impose 50% reduction (vs 2000 standards) in fuel consumption, 50% in noise and 80% in NOx emissions. These are very challenging and are likely to require some trade-offs from airlines and passengers (speed vs emissions, noise vs emissions).

Weight reduction of aircraft is a major item to decrease fuel consumption, as the aircraft would need less fuel "to fly itself". An area of focus is the use of new materials, like the increased use of composite materials (lighter than Aluminium). On B787/A350XWB composites are up to 50-55% of the plane vs 15% for the current generation wide body A330 (manufactured in mid-1990s).

Other areas explored are the increased use of hydrogen fuel cell systems to power smaller system of the aircraft for example for the APU, air conditioning and on-board electrics. This would reduce the total amount of Jet fuel currently required to power these systems even tough fuel-cells APU would be heavier and more expensive than more traditional designs.

Chart 17: Example of the trend in composites



Source: Airbus

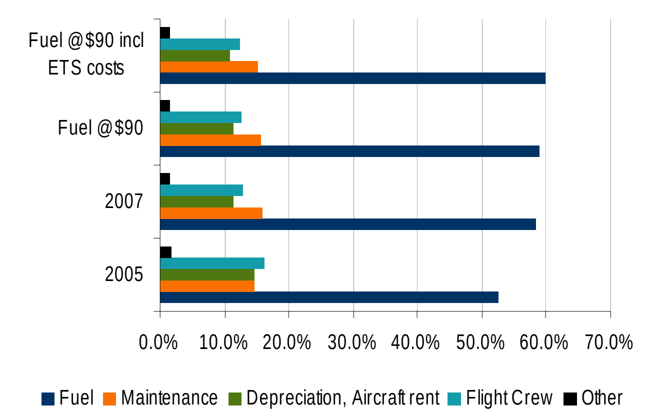
Appendix 2- Equipment & fuel cost trade off

Compiling The Airline Monitor Block Hour Operating costs data from 2005 to 2007 (the only publicly available data for compiled US airlines only), we can track the increase in fuel costs as a percentage of airlines direct operating costs (direct operating costs include flight crew, fuel expense, direct maintenance for engines and airframe, fleet depreciation, aircraft rent). The database splits out the cost of operations for long and short haul routes and also on a per aircraft type basis. As a general rule, DOCs tend to represent c.45-55% of an airline's total costs.

According to Airline Monitor Block data, in 2007 fuel costs represented c.58% of an airline's direct operating costs on twin aisle/ wide body operations and 50% for single-aisle/ narrow body segments. These numbers are up from 53% and 44% respectively in 2005. From 2005 to 2007, jet fuel prices increased 26%. The fleet costs (aircraft rental and depreciation) and flight crew decreased significantly as a proportion of DOC.

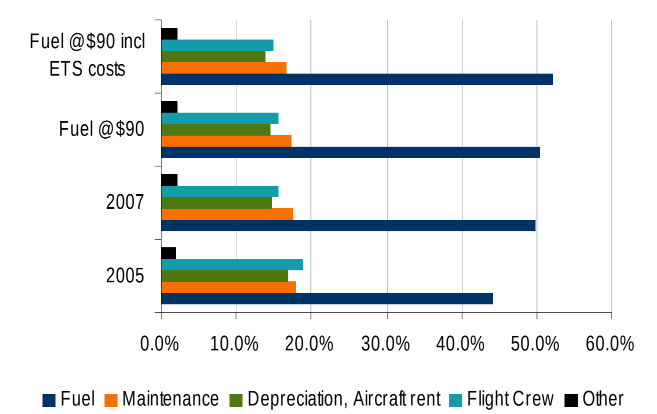
We have modelled fuel costs as a % of DOC using $90 bbl (ML long term oil price assumption) and assuming all non fuel related costs remain equal. We also simulate the case for European airlines that would additionally incur an ETS charge. For the ETS charge we estimated it to be between 0.5-3.5% of major European airlines total costs, and fuel represents c.32% of total costs, so we could derive ETS charges as a percentage of the fuel costs. Ultimately if an airline can reduce its fuel costs, its ETS charge should reduce, and potentially maybe become a benefit over the long term.

Chart 18: Twin-aisle DOC breakdown



Source: Airline Monitor

Chart 19: Single-Aisle DOC breakdown



Source: Airline Monitor

Charts 17 and 18 illustrate the fuel cost as a percentage of the DOC for single and twin-aisle operations. At $90bbl, for a twin-aisle fuel costs would account for 59% of DOC and 60% including the ETS costs. Fleet costs would represent only 11% of DOC. So fuel costs are 5.5x more significant than fleet costs. On a very similar approach for single-aisle, fuel costs are 3.7x more significant than fleet costs.

So a 1% change in fuel costs would be equivalent to a 5.5% change in fleet costs for twin-aisles and 3.7% for single-aisles. Given the relevance of fuel costs particularly on long-haul, we think the airlines would be more inclined to replace their old equipment for newer generation aircraft offering significant fuel and maintenance improvements despite the high price of the new aircraft.

Table 13 and 14 below illustrate how we model fuel and maintenance gains offsetting an increase in aircraft price for WB and NB.

For WB there is a clear incentive for an airline to replace its B747-400, currently valued at $75-80mn, to order a new generation WB like B777-300/ A350XWB/B787/A330. 20% savings both in fuel and maintenance costs justify that an airline would still be netted off (zero sum game scenario) if it was to value its B747 at $53mn and buy the new B777-300ER at an estimated $120m purchase price.

Table 15: Wide body/ twin-aisle: the trade off between aircraft equipment cost vs fuel/ maintenance gains

WB Aircraft type		ML estimated price paid	Implied Price $mn for a zero sum game	Fuel costs	Maintenance costs
B777-300ER	2012 Generation	$120mn	$120.0	Base	Base
B747-400	Old Gen	$75-80mn	$52.9	20%	12.5%

Note: we assume fuel at $90 and ETS costs to represent c.1.5% of total airlines costs and DOC as 55% of airlines' costs
Source: ML analysis

For NB, we looked at various scenarios depending on the aircraft or engine age. Similarly to the WB case, for airlines operating Mid 1980s aircraft the choice to upgrade to a 1990 generation aircraft seems reasonable. The old aircraft book value is probably higher than $2mn and our implied value would be close to zero in the “zero sum game” scenario i.e. fuel and maintenance costs contribute just enough to offset the cost of the new equipment.

For an airline operating a 1990 generation NB aircraft the option of buying a 2008 aircraft with improved engines doesn’t really seem attractive as implied price for a zero sum game scenario is well below the actual aircraft price. Looking just at the engine upgrade scenario for a 1990 aircraft, then the cost of the upgrade (between $1-4mn) and the expected fuel gains would offset each other. So this makes it much more interesting for airlines operating current generation aircraft.

Table 16: Narrow body/ single-aisle: the trade off between aircraft equipment cost vs fuel/ maintenance gains

NB Aircraft type	Aircraft Generation	Current estimated price	Implied Price $mn for a zero sum game	Fuel costs	Maintenance costs
A320/B737NG	2012 Generation -same engines	na	18.3	-10%	-13%
A320/B737NG	2008 Generation - improved engines	$25-35mn	16.7	-8%	-8%
A320	1990 Gen - only new engines upgrade	Engine upgrade range $1 to $4mn	$3mn	-5.0%	-5.0%
A320	1990 Generation	$12mn	12.0	Base	Base
B737Classics/MD80	Mid 1980s Generation	$2-5mn	0.13	20%	20%

Note: we assume fuel at $90 and ETS costs to represent c.1.5% of total airlines costs and DOC as 55% of airlines' costs
Source: ML analysis

Appendix 3 – ICAO Position

ICAO – in favour of trading but all talk no action

ICAO; in favour of emissions trading scheme
Assembly 36 – 18th – 28th September 2007

ICAO considers emissions trading to be the best way to tackle carbon reduction. This conclusion was reached in 2004, after a detailed consideration of voluntary actions, emissions charges and trading. In September 2007 the ICAO Assembly adopted a resolution with an emissions trading focus, but also stated that the EU scheme is unfair. Concerns over the attribution of bunker emissions remain an issue for ICAO member states however. The plan of action resulting from A36 includes the following elements:

Plan of action lacks real substance however

- The regular assessment of the impact of aviation on the environment and the continued development of tools for this purpose
- Vigorous development of policy options to limit or reduce the environmental impact of aircraft engine emissions
- Continued development and updating through CAEP (committee on aviation environmental protection), of standards and guidance for contracting states on the application of measures aimed at reducing or limiting the environmental impact of engine emissions.
- The formation of a new group on International aviation and climate change (GIACC) composed of senior govt officials representative of all ICAO regions. The group has to develop and recommend an aggressive programme of action on international aviation and climate change. The proposals are to be set out in 2009.

ICAO approach; cost effective solutions based on international consensus

The ICAO approach is to demonstrate a leadership role in all civil aviation matters related to the environment, with solutions that are cost effective based on international consensus. Consequently this requires the co-operation of all member states and the aviation industry, inevitably slowing down action.

More recently ICAO has tasked CAEP to prioritise and intensify all activities related to GHG, including quantification, more stringent NOx standards for aircraft engines, fuel burn goals and metrics, and operational measures to reduce global emissions and market based measures.

Analyst Certification

I, Zoe Knight, hereby certify that the views expressed in this research report accurately reflect my personal views about the subject securities and issuers. I also certify that no part of my compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

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Investment rating	Total return expectation (within 12-month period of date of initial rating)	Ratings dispersion guidelines for coverage cluster*
Buy	≥ 10%	≤ 70%
Neutral	≥ 0%	≤ 30%
Underperform	N/A	≥ 20%

* Ratings dispersions may vary from time to time where Merrill Lynch Research believes it better reflects the investment prospects of stocks in a Coverage Cluster.

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