

# **Economic Analysis of the European Union Emissions Trading Scheme and Composite Materials for Jet Engine Manufacturers**

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## **Overview**

In 2011-2012 the European Union's Emissions Trading Scheme will grow to include the aviation industry. The industry will incur great costs in purchasing additional carbon emissions. When combined with rising fuel prices, the industry will incur billions of dollars in increased expenses over the next two decades. The aviation industry must improve efficiency if it will be able to deal with these increasing costs. One of the most basic means to realize efficiency improvements is to reduce the weight of the aircraft. Recent composite material improvements have made possible such innovations as the Boeing 787 Dreamliner's composite shell and the GENx engine composite fan case among others. Due to enormous heat and stress conditions, however, little has been done to affect similar weight reduction in the core of the engine itself. The economic potential of using ceramic-carbon composite materials for blades and shrouds is examined, including an analysis of the investment potential that an engine manufacturer has to generate long-term cost savings for the airlines.

## **Methods**

Flight trends and patterns are analyzed for expected values throughout the coming decade. Fuel costs are extrapolated to show a baseline cost for the aviation industry during the same time period and added to predicted values for the emissions allocations. An formula is created for fuel usage based upon weight of the engine. Possible weight reductions are shown based on general expectations of ceramic matrix composites. These weight savings are converted to fuel savings and calculated again for the same ten year span.

## **Results**

Ceramic matrix composites in the core of an engine can reduce total engine weight by 10 to 15 percent. The total costs for the aviation industry just in the European Union will be approximately \$25 billion per year. These costs can be offset between \$3 and \$5 billion over ten years by introducing ceramic matrix composites to the core of the engine.

## **Conclusions**

Ceramic matrix composites are years away technology wise. However, research into these areas is critical for any jet engine manufacturer attempting to remain competitive in the market over the coming twenty years. The first manufacturer to market with these composite materials will have be a market favourite of customers for providing relief to incredible rising fuel costs.