

## The Mobile Air Conditioning (MAC) Initiative

### Solar control glazing to curb heat load & air-conditioning fuel consumption

As part of the EU strategy to reduce CO<sub>2</sub> emissions from light-duty vehicles, the European Commission has launched an initiative to decrease emissions generated by mobile air-conditioning systems (MAC) as of 2012. Through increased fuel consumption, MAC systems used in vehicles are a significant source of greenhouse gas (GHG) emissions. Glass for Europe supports the European Commission's approach to look for all possible means to minimise the environmental footprint of cars.

High-performance glazing technologies, in particular solar control glazing, which is already available today, can contribute to reducing the need to use air-conditioning or its load and subsequently offer an effective way to decrease CO<sub>2</sub> emissions generated from MAC systems. In Glass for Europe's view, **the Mobile Air Conditioning Initiative should already serve to promote energy-saving solutions such as solar control glass** in vehicles.

#### KEY FACTS AND FIGURES\*

- ▶ Air-conditioning use in vehicles can generate up to **20% extra fuel consumption**
- ▶ Reduced vehicle's cabin temperatures allow a reduction of the load on air-conditioning and **improvements to vehicle's overall fuel efficiency.**
- ▶ **High-performance solar control glazing solutions can reduce heat penetration in vehicles by over 25% and inside cabin temperatures by 7 or 8 °C.**
- ▶ **Emissions from vehicle air-conditioning are not yet accounted in official fuel consumption data and in the NDEC driving cycle. It should be in the future** to create a natural incentive for improvements.
- ▶ **The role of glazing in reducing needs for air-conditioning should be accounted for in test procedures.**

\* Sources are provided in the next pages.

## 1. The Mobile-Air-Conditioning (MAC) Initiative

The work initiated by the European Commission on mobile air-conditioning looks at ways to activate market mechanisms in a gradual way. It will serve in the first years to establish clear test procedures to quantify fuel efficiency of mobile air-conditioning systems and to oblige car manufacturers to publish the fuel consumption of MAC equipments. Targets of MAC-specific emissions would be established for manufacturers to achieve by a certain date to provide impetus for further green technology development.

As a result of this work, **fuel consumption generated by MAC could at last be taken into account in the overall fuel efficiency of vehicles.** This would allow benchmarking overall vehicle efficiency against the EU target of an average 120g CO<sub>2</sub>/km for new cars in 2012.



## 2. Reducing air-conditioning need

A considerable amount of solar heat penetrates the interior of vehicles when a car is exposed to solar radiation. For instance, without solar control glazing technology, solar radiation generates a greenhouse effect **heating up a vehicle's interiors to temperatures above 60°C** when the outside temperature is 27°C<sup>1</sup>.

Until now, the solution to reduce internal heat and to provide comfort to occupants has been to use air-conditioning, which results in an increase in fuel consumption and more CO<sub>2</sub> emissions. The individual fuel use for vehicle air conditioning depends on a variety of factors such as glazing surface, outside temperature, exposure to solar radiation, efficiency of the MAC unit, etc. and can therefore vary a lot. Studies nevertheless found that fuel use for air-conditioning is between 5 and 15% of the annual fuel use for a standard car<sup>2</sup>. Another study carried by the German Automobile Club ADAC demonstrates that for some popular European vehicles, air-conditioning use when temperatures are above 22°C **can generate up to 20% additional fuel consumption**<sup>3</sup>.

As indicated by the Commission's consultant TNO, real efficiency in MAC comes from a multitude of factors: technological choices within the units but also many other aspects such as glazing<sup>4</sup>. It is therefore **critical that highly effective solar control glazing should be employed to reduce heat load on vehicles**.

## 3. The role of solar control glazing in reducing CO<sub>2</sub> emissions from vehicles

**Solar control glazing** is a range of advanced glass products that provide not only good visibility and durability but also attenuate solar heat gain. Glazing with advanced solar control properties **substantially reduces heat build-up inside vehicles**<sup>5</sup> and therefore either reduces the need to air-condition the vehicle or helps considerably lower the load on the unit.

Studies have shown that reducing a standard vehicle's thermal load by 5% reduces energy consumption of the MAC unit by 10%. Considering that solar control glass can contribute to reducing inside cabin temperatures by more than 10%, **it has the potential to improve overall fuel consumption efficiency by 2% and up to 4% in some cases**<sup>6</sup>. Bearing in mind the thousands of new cars sold annually in the EU and overall CO<sub>2</sub> emissions generated by road transport, such an energy-saving potential should not be ignored.

Although solar control technologies are readily available to automotive manufacturers, most new cars are not yet equipped with these glass products to the detriment of passenger comfort and reduced CO<sub>2</sub> emissions. The main reason for this is simple: **today, air-conditioning use and related fuel**

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<sup>1</sup> In fact, temperature up to 65°C were found during real tests performed in the Paris region. Findings confirmed also in National Renewable Energy Laboratory, Dr. Robert Farrington – Stay Cool with Advanced Automotive Glazing – 2003.

<sup>2</sup> National Renewable Energy Laboratory, Dr. Robert Farrington – Stay Cool with Advanced Automotive Glazing – 2003.

<sup>3</sup> ADAC - Klimaanlagen auf dem Prüfstand – 2009. Tests have been carried on different vehicles categories and different driving conditions. It must be noted that test conditions are rather 'conservative'. It is assumed that passengers turn on the air conditioning to reach an inside temperature of 22°C whereas many users usually look for temperatures below that.

<sup>4</sup> Collection and evaluation of data and development of test procedures in support of legislation on mobile air conditioning (MAC) efficiency and gear shift indicators (GSI). Draft report: TNO 2010.

<sup>5</sup> The reduction in temperatures tested in a sedan car exposed to sun reached an average 7°C in the cabin, nearly 9°C at the driver seat and 14,6°C on the instrument panel surface. Source: National Renewable Energy Laboratory, Dr. Robert Farrington – An Overview of Vehicle Test and L's A/C Fuel Use Reduction Research – 2007.

<sup>6</sup> Sources : B. Taxis-Reischl & Fa. Behr - Energieverbrauch Klimaanlagen und Wege zur Verbrauchsreduzierung - 1997.



**consumption and CO<sub>2</sub> output, are not taken into account in vehicle's official fuel consumption data.** There is consequently no incentive for manufacturers to equip vehicles with solar control glass.

#### 4. What can policy-makers do?

The choice of glazing technology in a vehicle has an important influence on the demand for cooling and the vehicle's overall efficiency. For this reason, we believe that policy-makers should commit to concrete actions in the framework of an upcoming legislation on MAC efficiency. Glass for Europe calls in particular for the following policy options:

- ▶ **An ambitious CO<sub>2</sub> emission-reduction target for MAC systems** should be included in the upcoming regulation, to foster the greatest possible emission decrease using available and future technologies.
- ▶ The **test procedure** to calculate CO<sub>2</sub> emissions due to MAC systems should be unambiguous and provide a mechanism to take account of the solar load, which affects the need for cooling.
- ▶ **Glazing technology, surface area and inclination angle must be fully taken into account.** Since these parameters have an important impact on the heat load entering a vehicle, they need to be accounted for when assessing MAC performance.
- ▶ **A technology-neutral scale to quantify benefits of solar control glazing should be used.** The **approach suggested by** the Commission's consultants shows that it is feasible to apply accurate correction factors on fuel efficiency based on the 'total transmitted solar energy' through the glazing, the so called 'TTS scale'. With this tool, each technology is assessed in a fair manner and its **benefits reflected in the vehicle's MAC consumption**. A technology-neutral approach will also help strengthen competition and boost research and development in this field of technology.

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Through the MAC initiative, **market mechanisms can be activated to encourage the use of solar control glazing in light-duty vehicles.** It is policy makers' responsibility to make sure that the appropriate test procedures and targets are put in place so that automotive manufacturers are incentivised to equip their vehicles with these energy-efficient glazing solutions.

In the **wider context of the future revision of European Drive Cycles (NDEC)**, a holistic approach to all operating conditions should be reflected. Support for the most energy-efficient ways of heating vehicles in cold conditions, cooling in hot conditions, ice removal and condensation removal may also need to be envisaged.

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*Glass for Europe is the trade association for Europe's flat glass sector. Flat glass is the material that goes into a variety of end products, primarily in windows and facades for buildings, windscreens and windows for automotive and transport as well as solar energy equipment, furniture and appliances. Glass for Europe brings together multinational firms and thousands of SMEs across Europe, to represent the entire building glass value-chain. It is composed of flat glass manufacturers, AGC Glass Europe, Guardian, NSG-Group, Saint-Gobain Glass Industry and Siseçam-Trakya Cam, and works in association with national partners gathering thousands of building glass processors and transformers all over Europe.*

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