

Research Project: Towards Sustainable Automobility - Sustainable Automotive Technologies.

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Background:

The use of cars for personal transport is one of the key contributors to the environmental impact of consumer lifestyles in industrialised economies (as demonstrated by the *Environmental Impacts of Household Consumption* report developed by BRASS for Defra, or the *European Impact of Products* study led by BRASS Visiting Scholar Dr Arnold Tukker). Much of the automotive industry's focus on improving its sustainability performance has been through technical innovation to generate zero/low emission vehicles, alternative fuel sources and alternative transmission technologies. These technologies also pose a range of social science questions linked to infrastructure, consumer acceptance, regulatory drivers and business strategy which requires a range of stakeholder focused research that BRASS researchers have taken a lead in developing.

Aims & objectives: This project sought to understand the potential for the development of a more sustainable automotive industry and more sustainable personal mobility through the development and use of alternative vehicle technologies. Including in particular;

- To understand the role of, and drivers of, innovation in fuel and vehicle technology in transforming the automotive industry;
- To assess the feasibility and likely cost of technology based transformations in the sector including a move to a hydrogen economy and the wider adoption of bio-fuels.

About the Research: BRASS research concerning sustainable automotive technologies has focused on several different aspects particularly:

- Alternative fuels, and particularly bio-fuels and hydrogen power: In recent years the emphasis has been mainly on bio-fuels and BRASS' strong links with Brazil have been used to carry out fieldwork there. The work also links with the BRASS work on food and waste, particularly where food waste becomes a feedstock for bio-fuel production. This research has focused on the central role of the federal government as the main force driving the implementation of alternative locally produced ethanol and biodiesel. Earlier work focused on the potential for the use of fuel cell technologies and hydrogen power.
- Alternative vehicles, particularly electric vehicles and hybrid vehicles (such as the Toyota hybrid): In recent years BRASS Researchers have played a key role in the ENEVATE project, an EU Regional Development Fund supported network project of NW European electric vehicle experiments and EV research entities. This expertise has also provided the core socio-economic research expertise for Cardiff's new *Electric Vehicle Centre of Excellence*.
- CO₂ reduction in conventional vehicles: BRASS was commissioned by Greenpeace International to carry out a feasibility study into the extent to which it would be possible for the EU automotive sector to reduce average new car CO₂ emissions to a fleet average of 80 g/km by 2020. Innovative technologies, weight and size reduction and performance reduction for CO₂ reduction were considered, supported by an identification of the necessary legislative and policy measures required to achieve the more stringent target. A similar analysis was also conducted earlier on the potential to limit growth in CO₂ emissions linked to the growth in the Chinese car market.

Results and Outputs: The work on bio-fuels in Brazil provided evidence on the effectiveness of command-and-control measures and economic incentive instruments, and shows how lessons learned from earlier work in ethanol were taken into consideration in the design and implementation

of the biodiesel mandate, including social and environmental facets. It also emphasizes the uniqueness of producing sugarcane ethanol in the Brazilian context and how attempts to carry out similar fast growing bio-fuels programmes may not be possible in other parts of the world. The study of the small-scale producers bio-fuels programme in Brazil revealed some of the cultural and structural reasons why farmers' uptake of the programme was very low despite significant economic incentives.

The research into the potential for CO₂ reduction demonstrated that the European Commission and the automotive industry have tended to be overly conservative in their estimation of possible CO₂ emissions reductions, and unduly pessimistic in their estimates of the time that would be taken and costs involved in achieving larger reduction. The research also highlighted the need for a change in the regulatory regime to reflect energy use rather than CO₂ emissions per kilometre. Such a metric could be the use of kWh/km as a basic measure of efficiency and as a starting point for regulatory intervention. In turn, this study resulted in a project for the EU on the 'cost of regulation' in which it was demonstrated that inflation-adjusted prices to consumers did not rise over a 15 year period.

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Impacts achieved/potential for impact: A rating system (ERV) was developed jointly with consultants Clifford-Thames based on principles developed by BRASS and is available to the public via the Clifford-Thames website (www.clifford-thames.com) and has been adopted by a number of users. The work on the challenges faced engaging farmers with the Brazilian bio-fuels programme was published as a UN working paper. The work with electric vehicles and the EVCE has very direct links with a number of firms including Scottish and Southern Power, Citroen and GM who are all interested in developing a better understanding of the strategic implications of the development of electric vehicles. In 2012 BRASS Co-Hosted an Electric Vehicle Summit bringing together academics, industry partners and policy makers from various countries. BRASS researchers have provided advice and analysis to many businesses concerning innovation, strategy, and sustainable business, particularly linked to the automotive industry, including Shell, General Electric Advanced Materials, Akzo Nobel, Corus, Volvo, Toyota, Alcan, Alcoa, BT and TRL.