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What can eco-driving do for sustainable road transport? Perspectives from a city (Singapore) eco-driving programme

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ABSTRACT

Eco-driving with focus on driving style to save energy and enhance environmental quality can be applied to the private vehicle sector, reaping benefits that include fuel/energy savings of up to 16%. Eco-driving is the soft approach, not taken on the same level as vehicle technology advancement, in terms of lowering fuel consumption. In the Singapore's context, eco-driving is yet to be well-developed. Results presented were taken from a Singapore eco-driving programme that existed since 2011 with 116 participants. The data were obtained before eco-driving training and immediately after the training under instructor's supervision. There is evidence to support the contention that application of eco-driving tips in the driving style does not compromise journey speed, contrary to myths that eco-driving causes slower speeds. Results also showed that reduction of both fuel consumption and carbon emissions are achievable in excess of 10%. Hence, eco-driving training has the capability to reduce road transport energy and emissions without the need for vehicle renewal. In an urban setting such as Singapore, the promising results suggest the potential to reduce road transport carbon emissions by 12%, making it a worthy mitigation measure to be adopted at an extensive scale towards greater transport sustainability.

1. Introduction

1.1. What is eco-driving?

Eco-driving as a means towards energy saving and environmental sustainability has been around for years. Eco-driving generally refers to the practice of handling the vehicles in a manner that promotes fuel economy. It is not strictly defined, as it is also known by different terms in different countries. In United Kingdom, it is known as eco-driving or fuel-efficient driving. In United States, it is predominantly known as eco-driving though sometimes is also termed as sensible driving. In Australia, it is referred to as eco-driving or environmental driving. In Japan, it is known as eco-driving.

1.2. Overview of eco-driving activities

Automobile Association (AA) United Kingdom conducted an eco-driving experiment involving the participation of 50 AA employees for the private vehicle sector and 10% savings in weekly fuel consumption was achieved on the average, with the highest recorded savings being 33% (Automobile Association, 2011). Fuel-efficient driving entails smarter driving techniques which cut fuel costs, reduce wear and tear on the car, cut carbon emissions and reduce the risk of accidents (Energy Saving Trust, 2012).

Scott Gable claimed to routinely beat Environment Protection Agency estimates by 15% or 20% in every vehicle he drove by simply applying Thrifty-Drive eco-driving techniques (Gable & Gable, 2012). In United States, one can expect savings of 5% to 33% from sensible driving in replacement of aggressive driving and another 7% to 14% from observing speed limits as speeds above 50 mph (>80 km/h) are not as efficient (US Department of Energy, 2012a, 2012b). With maintenance and regular upkeep of vehicle, one can expect savings of 4% with a properly tuned engine and up to 3% for properly inflated tyres (US Department of Energy, 2012c).

For fleet vehicle operators, eco-driving brings about multiple benefits such as reduced fuel expenses and social responsibility wise of lower carbon emissions and air pollution for the community at large. Some Australian pilot programmes have suggested fuel savings in the order of 14% (Eco Station, 2012).

In Japan, eco-driving is defined as tenderly starting, less change of speed and early accelerator off in a study done to look into other vehicles' driving behaviour change when following an eco-driven

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Table 1
Europe's eco-driving results from 2001 onwards.

Country/organisation	Country-based activities	EcoWill activities
	Initiatives/results/details	
Austria	Eco-driving initiative to certify trainers and provide courses to drivers for car, trucks and tractors.Eco-driving compulsory for learner drivers' training.Trained more than 1700 bus drivers; resulted in 10.5% fuel savings after training and slightly higher average speeds.NIGGBus eco-driving resulted in 5% and 7% fuel savings for years 2000 and 2001.	May 2011—certified 12 Austrian master trainers and further trained 32 trainers, totalling 44 trainers for "level 1" and "level 2".
Belgium	2007: Tyre pressure check for car resulted in 62% having 0.5 bar below recommended pressure.2008: Tyre pressure check for car resulted in 35% having 0.5 bar below recommended pressure.2008: Trained 400 instructors and 200 examiners to pass on eco-driving to 60,000 student drivers.	None reported.
Croatia	2008: Eco-driving incorporated into curriculum in driving schools.	December 2011—more than 100 drivers trained.August 2011—34 trainers were certified for "level 2".
Czech Republic	2008: Certified 13 haulier companies that introduced effective measure to improve fuel economy.	September 2011—certified 14 trainers for "level 1" and 13 trainers for "level 2".
Finland	2008: Motiva trained 101 drivers; resulted in 14% fuel savings.	September 2011—certified 11 trainers, with another 30 more trainers by September 2012.
France	2008: RATP (stated-owned bus company) organised a competition between the bus lines for greatest fuel savings whereby 8 lines resulted in fuel savings of more than 2%.	None reported.
Germany	2007: Ford and German Road Safety Council (DVR) trained 765 drivers and resulted in 20.7% fuel savings; Ford's confidential data showed 10% fuel savings in the long run.Wasserwerke eco-driving resulted in more than 6% fuel savings and accident costs reduced by 25%.	December 2011—certified 36 trainers by June 2012 for "level 2".
Greece	2008: Training for car drivers, truck drivers and trolley bus drivers resulted in 15.9%, 14.7% and 25% fuel savings respectively after lessons.	November 2011—certified 12 trainers for both "level 1" and "level 2".
Hungary	Courses available to teach drivers about eco-driving.	September 2011—certified 23 trainers and organised 500 courses for licensed drivers.
Italy	Schools (Euromobility, etc.) available to teach drivers about eco-driving.	December 2011—certified 12 trainers for trainers and licensed drivers.
Lithuania	2010: EcoDrive Academy taught drivers about eco-driving.	October 2011—certified 36 trainers.
Poland	2008: LYRECO trained 100 employees for fleet vehicles, which aims to achieve fuel savings of 3–5% per annum.Trained 45 trainers to further pass on the training in driving schools.	November 2011—certified 12 trainers for "level 1" and "level 2".
Spain	Incorporation of eco-driving aspects into the driving curriculum.	June 2011—certified 13 trainers for "level 1" and "level 2", 24 more trainers to be certified by the third session.
Switzerland	2000: Swissenergy programme research showed 10% fuel savings in the long run after training.Canon eco-driving resulted in 6.1% fuel savings and 35% less accidents.Results from simulators training on eco-driving evaluation showed 17% savings on average.	None reported.
The Netherlands	1990–1998: Training for private and fleet vehicles resulted in up to 50% and 5–10% fuel savings in the short run and half of the reduction in the long run.	None reported.
The United Kingdom	2008: Ford and Energy Saving Trust trained 494 drivers and resulted in 22.5% fuel savings with slightly faster average speeds after eco-driving training.	July 2011—certified 12 trainers and another 25 more trainers for "level 1" and "level 2".

car (Ando & Nishihori, 2011). The effect on one eco-driving car is multiplied when practised on real roads. These basic indicators are in line with those in other parts of the world.

1.3. Eco-driving activities and success in Europe

In Europe, eco-driving programmes have been actively pursued and established since 2001, in countries other than the traditional eco-centric nations of Netherlands, Germany, Finland and Switzerland. Eco-driving has been implemented in driving schools, driving licence curricula, public transport fleets and commercial vehicle fleets. With strong support and active implementation in Europe, many eco-driving activities and effects are realised as summarised in Table 1 (EcoDriven Project, 2008; EcoDrive, 2012; EcoWill, 2012). EcoDriven (European Campaign On Improving Driving behaviour, Energy-efficiency and Traffic Safety) Project 2008 had the participation of 9 countries: Austria, Belgium, Czech Republic, Finland, France, Greece, The Netherlands, Poland and United Kingdom. Its achievement included reduction of 1 million tonne of CO_2 from 2006 till 2010 by informing drivers of eco-driving and its benefits. EcoWill activities focused on training the trainers for short duration in eco-driving, where "level 1" refers to learner drivers and "level 2" refers to licensed drivers.

Another study taken up by Ford, Germany showed favourable results. The key result suggested that some 25% savings in terms of resources (fuel) and emission reduction (CO_2) can be achieved when comparing Eco-Driving style with "normal-average" driving behaviour (Hennig, 2004).

1.4. Positive effects of eco-driving

Barkenbus (2010) mentioned that eco-driving can reduce fuel consumption by 10% on the average and over time, reducing carbon emissions from driving by a similar quantity. Hence, eco-driving, the most overlooked approach that can bring about sizeable carbon emissions reductions should be looked into and shaped into the norm for drivers.

Beside reductions in fuel consumption and carbon emissions, eco-driving brings along several environment benefits such as reduction of noise and air pollution. EcoDrive (2012) mentioned

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