Measure title: **Clean Fleet UMAS**

City: **Malmo** *Project:* **SMILE** *Measure number:* **5.8**

A Introduction

UMAS is the abbreviation for the University Hospital, Malmö General Hospital and the abbreviation will be used throughout this report. UMAS is one of the hospitals owned and operated by the regional health authority which is part of the regional authority called Region Skåne. All hospitals in Skåne are part of the regional health authority. Below when the term Region Skåne is used it refers to all of the regional authority and not just UMAS.

The long-term goal of this measure is that all hospital vehicles in Region Skåne will be clean vehicles. As a first step in this direction the plan within SMILE was to replace 30 hospital cars by the end of 2008 so that at least 50% of the UMAS vehicles would be clean vehicles by the end of SMILE.

Please note that during SMILE there was a reorganisation within the transport departments at the hospitals within Region Skåne and the transport department for the entire Region Skåne authority. This has ramifications for the ability to measure goal fulfilment and these ramifications are elaborated upon below.

A1 Objectives

While, as stated in the introduction above, the long-term goal has been to replace all Region Skåne vehicles, this measure only concerns the UMAS cars, not the car pool or fleet of the entire Region Skåne. The aim is that all the Region's vehicles will be clean vehicles in the future. The overall objective of this measure was to replace existing hospital cars at UMAS with clean vehicles according to the objectives schedule below:

- **Objective 1**:At least 30% of all cars purchased/ leased in 2006 will be clean vehicles
- **Objective 2:** At least 40% of all cars purchased/ leased in 2007 will be clean vehicles
- **Objective 3**: At least 50% of all cars purchased/ leased in 2008 will be clean vehicles

By using clean vehicles on a daily basis within a large organisation the positive experience of these vehicles will be more widely known.

Because of the reorganisation mentioned above and elaborated in section B4, deviations, it is no longer meaningful to follow and assess objective fulfilment for the three objectives above (these objectives were unchanged in the Detailed Measure Plan or DMP for the measure that the evaluator had access to.) **Instead, and keeping with the original intentions of this measure when planned, the objectives will be replaced as follows:**

- **Objective 4:** By the end of SMILE 50% or more of all vehicles leased and operated by UMAS for use by the hospital staff or for the UMAS transport department will be clean vehicles

A2 Description

This measure involves the use of clean vehicles. The transportation department and UMAS regularly retire existing vehicles. The measure has set out to implement a strategy to lease and use clean vehicles as the replacements. The various other health care and medical units/clinics within UMAS are also encompassed in the lease and use of clean vehicles. The original intention was that about 50% of the new vehicles would be gas vehicles (i.e. bi-fuel natural gas or biogas and petrol) and 50% ethanol vehicles (i.e. bi-fuel E85 and petrol).

B Measure implementation

B1 Innovative aspects

- **New organisational arrangements, regionally** – Using clean vehicles on a daily basis within a large organization will spread the positive experience of these vehicles more widely.

B2 Situation before SMILE

At the beginning of 2005, there were around 650 cars in Region Skåne's fleet for business trips by the staff, around 100 company cars and about 70 vehicles such as cars, vans, light and heavy lorries for transporting medical samples, goods, post etc. In total this amounts to just over 800 vehicles. Ambulance services are not run by Region Skåne but are instead outsourced.

At the start of SMILE the majority of these 800 or so vehicles were leased, normally for a period of three years. A third of the fleet, around 250 vehicles, is replaced every year.

UMAS has 65 vehicles. On average about a third of this fleet, just over 20, is replaced every year. The purchase price for clean vehicles is often higher and historically the residual value (resale price as used vehicle) lower than for equivalent conventional vehicles. UMAS' calculations of the additional cost for increasing the proportion of clean vehicles are based on estimates.

B3 Actual implementation of the measure

The measure was implemented as follows:

Stage 1: Vehicles leased *(Summer 2006 – January 2009)* – During this time existing vehicles were replaced at approximately the same rate that would have occurred without participation in SMILE. However, thanks to participation in SMILE the percentage of clean vehicles -- among the new vehicles that were leased – was increased.

Stage 2: Deviation (*September 2007-January 2009*) – Because of the reorganization and the removal of the transportation department vehicles, the scope of the measure changed.

How decisions were made about which vehicles would be procured. UMAS is part of Region Skåne. The regional government has a car procurement policy that places great emphasis on clean cars. As a part of Region Skåne, UMAS is supposed to follow this policy. However, in some cases there may be vehicle needs expressed by the various clinics and specific end-users where it is difficult or impossible to find clean vehicles that are available on the Swedish market and that can replace existing vehicles or the specifications. In theory the transportation department at UMAS should have been able to "suggest" clean

vehicles in relation to the specifications as expressed by the clinics and/or specific end-users. In practice this has not always been possible and - following the reorganization mentioned in stage 2 above - the ability for the transportation department to influence procurement decisions on the part of the clinics and specific end-users in the UMAS hospital has become severely restricted since, in terms of organisation, the transportation department is no longer a part of UMAS.

B4 Deviations from the original plan

The deviations from the original plan comprised:

- **Reduction in the number of vehicles** – At the time UMAS became part of SMILE there were about 65 vehicles in total that were part of the fleet of vehicles based at UMAS. These 65 vehicles included those used by the transportation department at UMAS as well as those used by the individual clinics.

In September 2007, because of reorganisation decisions taken within Region Skåne, a number of UMAS vehicles were moved from the local transport department at UMAS, to be a part of the total Region Skåne vehicle fleet and the Region Skåne transportation department. This meant that the goal of 30 vehicles being replaced with clean vehicles within SMILE at UMAS should be adjusted downward to approximately 23 vehicles since the remaining vehicles will now be mostly vehicles used by the clinics themselves that are part of the measure. At the time the measure leader wrote the first draft of the deviation text he believed also that of the 23 vehicles that are part of 5.8 about 20-40% of the vehicles would be gas vehicles (i.e. bi-fuel CNG/petrol) and 60-80% would be ethanol vehicles (i.e. bi-fuel E85/petrol).

B5 Inter-relationships with other measures

- Measure 5.1 involves a similar replacement of vehicles, but a much larger number, by the City of Malmö.
- Availability of CNG (either biogas or natural gas or a combination thereof called vehicle gas) as part of 5.2 will support this measure.
- Measure 11.8 is eco-driving training among UMAS employees. The goal of 11.8 is to reach the targets of number employees changed and to realise reduction of emissions for used vehicles because of the result of eco-driving. This means that there is some overlap between 5.8 and 11.8 in terms of emissions, fuel use, etc.

C Evaluation – methodology and results

C1 Measurement methodology

C1.1 Impacts and Indicators

Table 1: Table of Indicators

Nr.	Relates to GUARD Nr.	INDICATOR Name	Possible DESCRIPTION	DATA /UNITS
1	1	Operating Revenues	SEK	SEK
2	2	*Operating costs*	Cost difference in comparison with conventional vehicle, conventional fuel.	*SEK*
13	13	Awareness level of measure	*Degree to which the awareness of the policies/measures has changed*	*Index, qualitative, collected, survey*
14	14/19	*Attitudes level of measure*	Measure usage of scheme	Index, qualitative, collected, survey
?	?	*Objective Fulfilment*	The percentage of new vehicles that were clean.	Count the vehicles and calculate.

This measure has a certain overlap with 11.8, Eco-driving for UMAS employees. For this reason some indicators will be collected and described in both measure evaluations.

Detailed description of the indicator methodologies:

- **Indicator 1** (Revenues from the measure) – There are no revenues from this measure. There are reduced costs for fuel for the gas powered vehicles in this measure compared with more conventional light vehicles. Costs should of course be dealt with in indicator 2.
- **Indicator 2** (Measure costs) – The costs of the measure include the additional costs entailed in leasing clean vehicles. Data obtained from assistant to measure leader. This data describes the **differences** between alternative vehicles using clean fuel versus petrol fuelled vehicles in terms of operation.
- **Indicator 13** (Awareness) – A qualitative measure of awareness of the measure among UMAS staff.
- **Indicator 14** (Acceptance [Attitudes]) – A qualitative measure of attitudes among UMAS staff.
- **Indicator ?** (Degree of objective fulfilment) – The percentage of new vehicles that was clean.

C1.2 Establishing a baseline

The establishment of a baseline involved determining the number of vehicles prior to the start of SMILE and the expected rate and nature of vehicle replacement in the absence of the SMILE project. Allowing for the reorganisation of the UMAS felt this would be 50 petrol cars each covering 60,000 km per year.

C1.3 Building the business-as-usual scenario

It is not possible to know how many vehicles would have been obtained without the SMILE measure. Contacts with various people suggest that the number of clean vehicles would have been much lower and for the purposes of the evaluation we have assumed that all newly leased vehicles would have been petrol vehicles.

C2 Measure results

C2.1 Economy

The following figures are based on the assumption that a typical UMAS vehicle that could be procured as part of this measure is an average car, light truck or small van. Table 3 under section C2.5 shows which vehicles were procured. It is assumed that on average these vehicles run about 60 000 km/year. The overwhelming majority (18 out of 25 vehicles) that were obtained during SMILE were E85/petrol bi-fuel vehicles. The cost of using such vehicles on a yearly basis is about 3000 SEK more. This means that approximately 54 000 SEK more per year has been spent on maintenance of these bi-fuel vehicles. The procured vehicles replaced similar vehicles that were in use prior to the start of this measure.

Based on incomplete records of fuel consumption (the majority of but not all vehicles were included in this estimate) the E85/petrol vehicles used E85 about 75% of the time and petrol about 25% of the time during 2008. E85 is less expensive per litre at the pump but because of the lower energy content more E85 is required per driven kilometre than the case with petrol. As the price of petrol and E85 fluctuates there can be periods when it is less expensive to run the vehicle on petrol and other periods when it is less expensive to run on E85.

Because of the difficulties of accessing all costs and fuel consumption during all years of this measure, compounded by the reorganisation that took place during 2007, it is not possible to provide a cost differential because of this measure. Since costs for fuelling and running a bi-fuel E85/petrol vehicle are not greatly lower than running a petrol vehicle there should be little change. The cost differential for fuelling and running a gas/petrol bi-fuel vehicle is much greater. However since only 12% of the vehicles obtained are gas, this cost change is very marginal.

C2.2 Energy

There are no quantifiable objectives or targets in the area of the environment and therefore there are no results here. As reported in section 2.1, operational fuel consumption data was incomplete, but suggested that there was no significant impact on energy consumption as the increase in volume of ethanol purchased cancelled out the lower volumetric energy density of this fuel.

C2.3 Environment

Although no quantifiable objectives or targets in the area of the environment were set, a simple estimation of the emissions impacts of the measure has been conducted using emissions factor data derived in the parallel measure, 5.1, which involved a similar (but larger) fleet replacement programme by Malmo city hall.

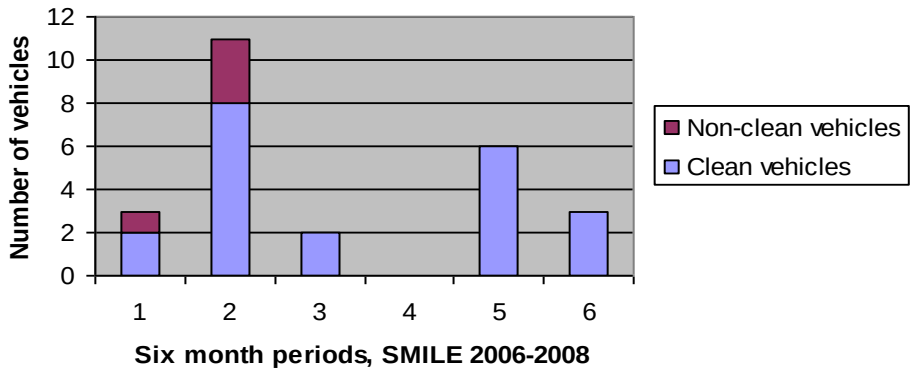
Table 2: A simple estimate of the change in emissions

	BAU	After	Difference	% difference
Total fleet	50 cars	50 cars	0	
Petrol cars	50 cars	29 cars	21 cars	42%
Clean cars	0 cars	21 cars	21 cars	∞
E85	0 cars	18 cars	18 cars	∞
Gas	0 cars	3 cars	3 cars	∞
Distance travelled by:				
petrol cars	3000000 km	1740000 km	1260000 km	42%
E85 cars	0 km	1080000 km	1080000 km	∞
Gas cars	0 km	180000 km	180000 km	∞
CO_2 emissions from:				
petrol cars	570000 kg	330600 kg	239400 kg	42%
E85 cars	0 kg	95040 kg	95040 kg	∞
Gas cars	0 kg	29700 kg	29700 kg	∞
Whole fleet	570000 kg	455340 kg	114660 kg	20%
NOx emissions from:				
petrol cars	165.3 kg	95.9 kg	69.4 kg	42%
E85 cars	0 kg	41.4 kg	41.4 kg	∞
Gas cars	0 kg	6.9 kg	6.9 kg	∞
Whole fleet	165.3 kg	144.2 kg	21.1 kg	12.8%
PM_{10} emissions from:				
petrol cars	11.8 kg	6.9 kg	4.9 kg	42%
E85 cars	0 kg	4.3 kg	4.3 kg	∞
Gas cars	0 kg	0.3 kg	0.3 kg	∞
Whole fleet	11.8 kg	11.5 kg	0.3 kg	2.5%

C2.4 Transport

The original objective was that vehicles would be replaced according to a yearly schedule with 30% of the vehicles being clean in year 1, 40% in year 2, 50% in year 3 (This measure became part of SMILE during the second year of SMILE!). The assumption was that by the end of SMILE that about 50% of the UMAS fleet (both vehicles used by the clinics and the local transport department) would be clean. However, because of reorganisation of the vehicles "ownership" within Region Skåne, the transport department vehicles are no longer part of the UMAS hospital per se, even if they are used almost exclusively by the hospital. Diagram 1 shows the history of car procurement in this measure.

Diagram 1: History of car procurement during 5.8



Originally with a total of 65 cars at UMAS, because of the reorganisation only approximately 50 vehicles can be considered now to be remaining at UMAS. 21 cars were replaced with clean vehicles during the duration of the measure and 4 cars were replaced with non-clean cars. Of all 50 vehicles the replacement amounted to approximately 42%. Among replaced cars 84% were clean.

Clearly during SMILE the replacement rate of all vehicles in the fleet was much lower than claimed by the measure leader since, it was stated, about one third of the fleet was replaced on a yearly basis. If the replacement rate had been maintained then approximately twice as many vehicles in total would have been procured.

This means that in terms of the percentage of vehicles replaced this measure was a success with 71% replacement with clean vehicles in 2006, 100% in 2007 and 100% in 2008. However, because of the low overall rate vehicle replacement in general, this measure could not reach a 50% clean fleet. Since the original objectives of the measure have been met, the measure should be considered a success.

Table 3: The procured vehicles: model, kind and dates

Manufacturer/model	Fuel	Date (month and year)	Replaced *(where known)*
Toyota Corolla	Petrol	April 2006	
Ford Focus FFV	Petrol/E85	May 2006	
Ford Focus FFV	Petrol/E85	June 2006	
VW Caddy	CNG	July 2006	
Ford Fusion	Petrol	July 2006	
Ford Fusion	Petrol	July 2006	
Ford Focus FFV	Petrol/E85	November 2006	
Ford Focus FFV	Petrol/E85	November 2006	
Ford Focus FFV	Petrol/E85	November 2006	
Ford Focus FFV	Petrol/E85	November 2006	
Ford Focus FFV	Petrol/E85	November 2006	
Ford Focus FFV	Petrol/E85	November 2006	
Ford Focus FFV	Petrol/E85	November 2006	
Toyota Corolla V	Petrol	November 2006	
Ford Focus FFV	Petrol/E85	March 2007	
Ford Focus FFV	Petrol/E85	May 2007	
Toyota Aygo	Petrol	May 2008	Toyota Yaris Verso, Petrol
Ford Focus FFV	Petrol/E85	April 2008	Ford Focus, Petrol
Ford Focus FFV	Petrol/E85	April 2008	Ford Focus, Petrol
Ford Focus FFV	Petrol/E85	April 2008	Ford Focus, Petrol
Ford Focus FFV	Petrol/E85	June 2008	Toyota Avensis, Petrol
VW Touran	CNG	June 2008	Ford Galaxy, Petrol

A grey tone indicates that the procured vehicle was not (considered) a “clean car”. The procurement of a Toyota Aygo is considered “clean” because of low fuel consumption. As can be seen at the bottom of the rightmost column, most vehicles replaced similar types of vehicles. The measure leader has stated that similar cars replaced existing cars during 2006 and 2007. This means that new vehicles in general were not larger or smaller compared with the replaced vehicles.

C2.5 Society

Awareness of the potential for using clean vehicles was not particularly high on the part of senior UMAS staff prior to the start of SMILE. Following the start of the measure awareness rose and the majority of decision-makers seem to accept that new vehicles should be clean cars.

There is however a tendency to select biofuel petrol/E85 vehicles. Only 8% of all vehicles obtained during the measure were petrol/gas biofuel vehicles which is a smaller percentage than the 16% of the vehicles which were non-clean cars. The original goals were that about half of the vehicles procured should be gas vehicles. This may show a shift in acceptance towards cleaner cars but not as much in the direction of gas vehicles as had been hoped for on the part of the measure.

It may be the case that the emphasis on procuring like with like vehicles has led to the dominance of biofuel petrol/E85 vehicles. This clearly appears to be the case with the dominant vehicle type, Ford Focus. There may be some conservatism on the part of those using the vehicles: as similar a car as possible to the original is thus considered desirable. Had the majority of the original cars been from a manufacturer which later offered the same model but as a biofuel petrol/CNG variant it might have been possible that CNG vehicles would have been much more dominant in the procurement process.

C3 Achievement of quantifiable targets

This table is completed with the assumption that the business as usual scenario is a direct extension of the baseline since we cannot know in what way the scenario would depart from the baseline. Targets 1-3 are interpreted to be that the percentages of vehicles purchased/leased during that specific year are the subject for evaluation. Target 4 deals with the total percentage of clean vehicles in operation during 2008 and not solely those vehicles that came into use during 2008.

No.	Target	Rating
1	At least 30% of all cars purchased/ leased in 2006 will be clean vehicles	**
2	At least 40% of all cars purchased/ leased in 2007 will be clean vehicles	***
3	At least 50% of all cars purchased/ leased in 2008 will be clean vehicles	***
4	By the end of 50% or more of all vehicles leased and operated by UMAS for use by the hospital staff or for the UMAS transport department will be clean vehicles.	*
NA = Not Assessed 0 = Not achieved * = Substantially achieved (> 50%) ** = Achieved in full * = Exceeded**		

C4 Up-scaling of results

This measure will be up-scaled when spread to other hospitals and the regional transportation department in Region Skåne following the termination of SMILE. It is unclear how quickly this upscaling will occur.

If the intention is that most clean vehicles leased/procured should be gas powered, then this measure has not been a success since only 8% of the vehicles were gas vehicles. To be deemed successful according to the measure intentions (which are not spelled out in measure documents *per se* but were communicated verbally by the measure leader) there will have to be a change so that end-users are more likely to ask for and then use gas powered vehicles. In some cases this may mean that end-users will have to switch to other manufacturers and car models which may add resistance to these changes.

C5 Appraisal of evaluation approach

The evaluation approach cannot be appraised separately from the establishment of the objectives and targets for this measure. Since the objectives deal purely with the provision and use of vehicles and, therefore, do not include fuel use, costs, emissions etc the list of indicators is not helpful in the evaluation process and the requirements stipulated in the GUARD methodology.

C6 Summary of evaluation results

The key results are as follows:

- **Key result** – Despite the reorganisation, this measure succeeded largely in obtaining and using clean vehicles to the extent included in the objectives during each year.
- **Key result** – While the percentage of vehicles that were clean that was obtained each year exceeded the targets in objectives 1-3, the rate of retirement of existing vehicles was less than half the rate that was assumed in the original planning for the measure. This means that it was not possible to reach a total of 50% clean vehicles in the entire fleet by the end of SMILE.
- **Key result** – 20% reduction in CO_2 emissions from the UMAS fleet as a result of vehicle purchasing decisions.
- **Key result** – 12.8% reduction in NOx emissions from the UMAS fleet as a result of vehicle purchasing decisions.
- **Key result** – 2.5% reduction in PM_{10} emissions from the UMAS fleet as a result of vehicle purchasing decisions.
- **Key result** – This measure has largely led to the adoption of bi-fuel E85/petrol vehicles (running largely but not exclusively on ethanol) and a very low level of adoption of other types of vehicles, specifically gas vehicles.

D Lessons learned

D1 Barriers and drivers

D1.1 Barriers

- **Barrier 1** – Reorganisation of car "ownership" within Region Skåne vis-à-vis UMAS led to some uncertainties during 2007 and this may have reduced the level of procurement during that year.
- **Barrier 2** – Possible lack of knowledge about and interest in the range of alternatives to petrol fuelled vehicles may have led to a lower adoption rate and the very high preference for ethanol vehicles.

D1.2 Drivers

- **Driver 1** – Central policy decisions taken within Region Skåne about transportation and fuels.
- **Driver 2** – Participation in the project *per se* led to an internal driver to meet expectations and objectives.
- **Driver 3 –** Using clean vehicles on a daily basis within a large organisation can lead to positive experience of these vehicles by the wider population and can provide good marketing for wider uptake of this measure.

D2 Participation of stakeholders

- **Stakeholder 1 –** Local UMAS transportation department, (although because of the reorganisation, there were periods of time when they felt somewhat unsure about their role).
- **Stakeholder 2 –** Car drivers
- **Stakeholder 3** – Car sharing users
- **Stakeholder 4** – Employees at workplace
- **Stakeholder 5** – Manufacturers of clean vehicles for use for UMAS
- **Stakeholder 6** – Suppliers of clean vehicles for use for UMAS

D3 Recommendations

- **Recommendation 1 –** For an outsider looking into this measure it is clear that there needs to be a clearer delegation of authority which leads to the better fulfilment of the transportation and environmental goals established by Region Skåne.
- **Recommendation 2** – To increase awareness and acceptance amongst the inhabitants of Malmo procurement of clean vehicles with emphasis on gas vehicles, particularly using biogas as developed in other SMILE measures, could be supplemented by marketing campaigns and activities to promote clean vehicles and their benefits.
- **Recommendation 3** – relatively high level of procurement which has occurred could be used to market this measure to other governmental and private organisations.
- **Recommendation 4** – it is worth establishing the reasons amongst senior UMAS staff for the relatively low percentage of procured gas vehicles as it was hoped that the shift in acceptance would be directed more towards gas vehicles for this measure.

D4 Future activities relating to the measure

This has been covered previously under section C4.