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Summary

Pathways to Sustainable Transport among Crafts and Service Workers

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This report documents results from a study of Norwegian crafts -and service companies (C&S) that have adopted electric utility vehicles (EUVs) and/or mobile management applications (MAs)-two technologies that are believed to be of crucial importance for the development of more efficient and sustainable mobility among such enterprises in the future urban landscapes. Currently, adoption of EUVs among C&S enterprises in Norway is low, but there seems to be a strong interest for a wider use in the future. For the smaller craft enterprises today's financial incentives are particularly important for their motivation to adopt electric vehicles, while for the somewhat larger service enterprises benefits related to environmental issues and greener company images are of greater importance. Mobile Management Applications largely affects the travel patterns in the enterprises, but the potential to reduce the amount of travel is currently uncertain. Analyses of driving patterns among a sample of C&S enterprises shows that a replacement of diesel vehicles with electric cars be relatively easily done for 37% of the vehicles, representing 13% of the total transport work. However, an increase in the range of electric vehicles by 50%, or charging of the cars during the day, could increase the number of replaceable vehicles to 64% and the transport work carried out with EUVs to 41%. This would then result in a 41% reduction in greenhouse gas emissions from all vehicles in the C&S sector.

Case studies of EUVs

Qualitative interviews with EUV users in the C&S sector have shown that there is significant variation among C&S industries in their motives for adopting EUVs. The smaller, traditional craft enterprises – painters (decorators), bricklayers, carpenters and roofing workers –are driven mainly by economic benefits, particularly in relation to cheaper fuels and tax reduction. For enterprises in the service sector – cleaners, caretaker services, home care and security – environmental benefits are more important. Decisions to implement EUVs in this latter sector was often related to green certification schemes.

Economic benefits are important when decisions are being made to adopt EUVs, as are issues in relation to organizational *identity* and image, this most clearly spelt out by craft managers.

Implementation in smaller craft enterprises is usually informal through small-scale testing. In the service enterprises, however, EUVs are thoroughly evaluated before being fully implemented. In all cases, substantial informal and formal learning take place. The innovative technology is usually actively introduced and promoted by a particular person, usually a manager with an interest in cars, new technologies and/or environmental issues.

Despite much resistance, electric cars and vans are usually evaluated positively. In craft enterprises, EUVs are used mostly in combination with traditional diesel vans, while in service enterprises they replace all cars.

Battery capacity is a major challenge, particularly for traditional craft businesses. In general, crafts enterprises have more ad hoc oriented travel patterns, which means that limited battery capacity can be problematic, particularly if the company caters for customers located over a wide geographic area. Service enterprises tend to have more predefined mobility patterns where limited battery capacity is more manageable.

Crafts workers are generally enthusiastic about EUVs and nurture a hope that improved models will soon be available. At the time of the interviews (i.e late 2015) general opinion was that the current models were only useful in combination with traditional diesel and petrol cars. EUVs, however, were generally seen as good enough to meet the basic needs of service workers, even though more cargo capacity and driving range would be highly welcome.

Case studies of MMA users

Handyman (HM) is a central supplier of MMA for C&S workers. Interviews were therefore conducted with users in a number of enterprises in order to get more insight on implementation and use of these tools. Implementation is highly dependent on there being entrepreneurs who can push this through in the crafts industry, usually a young person with an interest in technology. Younger craftsmen are generally more used to new technologies, and their working routines are not as strongly internalized as those of older craftsmen. They therefore adjust more readily to the use of HM.

The major motive behind adoption of HM is in relation to potential increased efficiency of billing and registration of man-hours, i.e. by a reduction in the amount of paperwork for both manager and craftsman. Another important reason in most companies was that HM made the management and distribution of assignments/jobs from office to craftsmen easier. Only two of the companies (Plumbing 1 and Electric 2) had an explicit focus on the potential of reduced driving among craftsmen as the reason for implementing HM.

Most companies believed HM would reduce the amount of driving among craftsmen owing to new opportunities for direct re-assignment of work tasks. For example, the craftsmen didn't always have to go into the office every morning to get their assignments or to report hours used in the field, and there was also the potential for sharing of information between crafts workers. Many craftsmen work alone on assignments, and before the introduction of HM they had to visit the office to consult with their colleagues and managers.

Still, trying to measure reduced travel resulting from use of HM was difficult. The one company that had done so during the course of the years before and after the introduction of HM could not find any reduction in driving (measured by the number of kilometres). Most of our interviewees believed that there was potential for reducing the number of trips to the wholesaler for instance, but few companies reported having realized it.

One side effect of the technology mentioned by several firms was a lower frequency of social meetings. The introduction of HM had made trips into the office in the morning redundant, and records of man-hours (on paper before the HM) once a day/once a week were no longer necessary. Thus some expressed concern for a long-term impact on organizational climate and learning.

Crafts and service workers' attitudes to EUV

A web-based survey was conducted among managers in small and medium-sized enterprises in seven key crafts industries to get more information about uses of EUVs, and to find out what interest there was for future adoption. A net sample of 264 crafts respondents was recruited among members of local craftsmen enterprises in Oslo, Bergen, Trondheim and Stavanger. The sample included craft enterprises within the building -and construction segment.

As expected, there was relatively little interest in the adoption of EVs, with approximately only 5% owning or having access to an electric car on a daily basis. The EUV users in our survey were spread across different business areas, although 6 out of 14 were electrical installation firms.

Although there are not many EUV users in this part of the crafts industry, there is a strong likelihood of electric vans being adopted in the near future. Looking two years ahead, about one in four of today's non-users say that it is likely, or very likely, their company will adopt EUVs. Of those who said adoption was unlikely during the following two years, over 27% believed it would be relevant during the next five years. Fifty-one percent of the informants said it was likely their company would adopt EUVs in the coming two to five years.

As mentioned in section two, the current incentives might persuade C&S and service workers into using EUVs. In general, these seem to be having a significant impact on current EUV use, the most attractive being toll-free roads and free parking.

Based on an exploratory factor analysis, we found three distinct groups of attitudes to EUVs: the first including positive attitudes to the practical benefits of using an EUV and a preference for speed and reliability; the second, expressing doubt about the usefulness of EUVs and the risk of investing in them; the third, expressing positive attitudes to EUVs, based on a good image developed among customers and vendors.

There are significant attitudinal differences between enterprises that have already adopted EUVs and those that haven't. The most prominent feature of current users is that they have a good understanding of the mobility benefits, and of aspects related to a positive and environmentally friendly image and economic benefits. For those planning to adopt EUVs in the coming two years, image and economy are more important than the current benefits. Risk-related attitudes are prominent among those who have a long-term horizon on adoption and those reluctant to adopt in general.

Potential for EUVs based on electronic travel diaries

Crafttrans gathered data logs of the transport activity of seven craftsmen companies in order to get a better understanding of how craftsmen travel. The dataset was obtained from the Guard Systems electronic travel log database (TRAVELLOG). TØI and Guard Systems were given permission from these seven companies to access GPS data for their vehicles, data already stored in and retrieved from Guard Systems' operative database of logged travel. The seven companies operated with 115 vehicles and data were obtained for two weeks.

A natural sample of the daily trips of craftsmen with traditional vans was used to estimate the potential for replacement with EUVs based on travel behaviour.

The potential range of diesel vehicles to be replaced depends on the daily travel distance. In general, vehicles covering less than 51 km per day are readily replaced, and in most cases also those in the range 51–80 km. In the case of vehicles driven 80–120 km, there is

potential for vans being replaced on the basis of driving style, temperature, cargo, etc., but at over 120 km replacement is not possible without a charging stop during the day.

Therefore, with a limit of 80 km driving on the maximum day of travel, 41% of vehicles can be replaced but only 13% of the transport work. If all transport could be replaced with EUVs on days of travel less than 80 km, 42% of the transport work would be replaced. A 50% increase in range, achievable in a 5-year timeframe, would result in a much higher substitution of transport work. The share of vehicles would then be 68% and the transport work share 41%.

The potential for replacing transport work may be greater if the transport activities of companies can be redistributed so that electric vehicles are used on the short distance trips they are capable of. Redistributing vehicles would also allow EUVs to be used more in summer, when range is longer than in winter, and is straightforward in theory but in practice can be challenging. The vehicle is also the "personal tool box" of many craftsmen who may be reluctant to change vehicles from one day to the next.

Vans covering short trips are those most likely to be replaced, although they generate little transport work. The potential of diesel utility vehicles being replaced by EUVs includes 23% of vehicles that travel up to only 50 km per day and are 100% replaceable by EUVs. However, they account for only 5% of the transport work of the logged vehicles. Approximately 14% of the total are driven occasionally in the 50–80 km interval and account for 8% of the transport work. It is likely that most of these, too, are readily replaceable by EUVs. The base potential is thus up to 37% of vehicles and 13% of the total transport work. Technical development of EUVs resulting in the winter range being extended to 120 km, which could happen with the next generation of vehicles or by charging shorter range vehicles during the day, will increase the number of vehicles that can be EUVs from 42 to potentially 73, covering 41% of the total transport work of the 115 logged vehicles.

Charging during the day has the advantage of expanding the range the vehicle can cover over the workday. On average, the real winter range (corresponds to all year range) can be expanded by some 40 km on average, i.e. 50% more if the range is 80 km.

Measures to initiate rapid transition to green mobility

All in all, the situation is promising for further growth in use, although a faster transition will require initiatives and continued efforts along several dimensions.

By combining factors on multiple levels, a momentum for change could be developed and help to spur the development of greener mobility among C&S enterprises.

Changes on a landscape level, such as oil prices and global climate, will clearly impact on any transition towards non-fossil fueled mobility systems. In this discussion, however, we focus mainly on the meso and micro-level, where it is reasonable to think that changes may be initiated in a Norwegian context.

Currently, there is strong pressure on a policy level to implement measures that could help to reduce emissions from diesel-engined cars in urban regions. At this level, certain crucial preconditions need to be pursued to sustain and improve the transition process. There is need for *new EUV models* that cater better for the needs of craftsmen; the *incentive system* for purchase and use of EUVs needs to be continued and further developed, and the current *restrictions on ICE vans* in urban areas need to be strengthened.

On a micro level, *continued niche experimentation* among C&S industries is necessary, but these experiments need to be increased in number, scope and diversity if a stronger impact is to be achieved. Better incentive systems may help to make this type of small-scale experimentation attractive for C&S managers. In addition, a more diverse set of technologies should be implemented, involving not only alternative energy systems but also various ICT-based mobility technologies. Thus, systems for low energy mobility among professional users should be integrated with new ideas for smart urban mobility involving systems that can help manage mobility resources more efficiently. There is also need to enhance learning and create larger "networks of niches" that can learn from each other and thus have much stronger impact and exposure.

To stimulate "network effects", it is crucial to expose experiments and ideas on a wide scale along multiple channels. Highly relevant and innovative cases should represent lighthouse cases that can inspire other enterprises and decision-makers. It is also necessary to demonstrate the implication of new technologies more rigidly through longitudinal field studies and research based experiments.

Potential environmental gains

For the purpose of this analysis the assumption is that greenhouse gas emissions and local pollution are nullified 100% when diesel utility vehicles are replaced by EUVs. The effect on emissions from the enterprise within a city and for Norway as a whole is therefore calculated from the annual number of kilometres of travel with EUVs that would otherwise have been diesel utility vehicles.

A categorization of enterprise vehicles based on maximum driven distance in data from the data-loggers shows that 37% of vehicles covered less than 80 km on all days, accounting for only 13% of transport work. Replacing vehicles doing less than 80 km would thus potentially reduce transport emissions from C&S enterprises by 13%. If vehicle travel can be redistributed between vehicles, the potential can be substantially increased.

A theoretical experiment showed that for one of the companies the share of vehicle replaceable could increase from 54% to 84% and the share of transport work from 20% to 47% by optimizing travel with only a few vehicles doing the long-distance trips. In the interviews, users stated that planning trips at this level would be challenging. Those who had successfully implemented EUVs, however, stated that the ability to plan trips better was part of the success story.

New technology increasing range by 50%, or users charging-up during the day, could increase the number of vehicles replaceable to 64% and transport work by EUVs to 41% of C&S enterprises' total transport work, resulting in 41% reduction of emissions. The share of vehicles driven over 10,000 km per year also increases substantially, making the potential easier to realize by increasing the economic gain of users. If range of EUVs could increase to cover all days of transport up to 200 km, then the logger data and opinions of the interviewed C&S enterprises both support the entire C&S enterprise sector's transportation needs potentially covered by EUVs, leading to a 100% reduction of emissions and local pollution.