

Summary:

# Evaluation of Norwegian trials with European Modular System (EMS) vehicles

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*The actual usage of EMS-trucks in the Norwegian transport sector during the time period of 2008-2013 throughout the Norwegian trial period for EMS-trucks transport sector has been relatively low. However, transporters that have been using EMS have experienced considerable cost savings, primarily because they can transport the same amount of goods with fewer trucks. These firm-level cost savings are by far the largest components of the wider economic benefits. These efficiency improvements also cause reductions in environmental costs for a given transport volume. EMS also appears to give small improvements in traffic safety and traffic flow, since one EMS seems to replace between 1.2 and 1.5 regular trucks on the road. After subtracting the administrative costs of the Norwegian Public Roads Administration, the cost-benefit –analysis concludes that the net present value of the trial period between 2008-2013 is between 34 and 126 million NOK. The range of net benefits shows that the estimation is done with a large degree of uncertainty, but even the lowest estimate show positive socio-economic benefits. We have used a national freight transport model to analyse the effects of further expansion of the allowed roads for EMS. The results show that EMS can be expected to give a considerable shift in transport from regular trucks to EMS, and a moderate shift in transport from sea and rail to EMS. The net effect, however, is estimated to be fewer freight trucks on the road.*

The goal of the Norwegian trial period for European Modular System (EMS) vehicles, against which it is evaluated, is:

*The aim of the trial period for EMS-trucks is to find out whether EMS can contribute to more efficient and environmentally friendly transport on a set of high standard roads, without the worsening of the safety of other road users.*

From this goal we derive evaluation criteria for evaluating the positive and negative sides of the trial period. The evaluation will provide information for the Norwegian Public Roads Administration's (NPRA) decision-making-process for the future of EMS in Norway.

This evaluation is limited to experiences from the Norwegian trial period and relevant experiences outside of Norway. The evaluation will not assess whether and how the EMS-trial should be extended.

The EMS-trial has been evaluated according to the following five criteria:

- **Private sector economic impacts:** The EMS-trial has generated benefits for the private sector, e.g. through cost efficiency
- **Environmental impacts:** EMS turns out to cause the same or less environmental harm than regular trucks
- **Traffic safety impacts:** EMS turns out to have the same or lower traffic safety risk compared to regular trucks
- **Traffic flow impacts:** EMS turns out to have the same or lower drag on traffic flow compared to regular trucks
- **Public sector economic impacts:** The EMS-trial has not entailed public sector costs that outweigh the total benefits

In order to evaluate the EMS-trial according to these criteria, it is necessary to assess the actual usage of EMS in the Norwegian transport sector, throughout the trial period.

### Transport sector usage of EMS

Although our estimates contain a large degree of uncertainty, they show that the Norwegian transport sector has had relatively low actual usage of EMS throughout the trial period. The usage of EMS is (legally) limited to 23 main highways with roads connecting them to terminals, and few of the surveyed transporters, truck-owners and truck drivers have actually used them.

We estimate that EMS has the following share of the traffic and transport work on the permitted roads in 2012:

- Between 1,4 % and 4,1 % of vehicle km with heavy goods vehicles (HGVs) (equivalent to between 0,4 % and 1,2 % of the national HGV figures)
- Between 1,5 % and 4,4 % of the ton-km with heavy goods vehicles
- Between 2 % and 6 % of the m<sup>3</sup>-km with heavy goods vehicles
- The two latter points follow from the survey results that indicate that on average EMS carries 7 % more weight and 47 % more volume than regular trucks.

### Private sector economic impacts

The evaluation criteria “The EMS-trial has generated benefits for the private sector, e.g. through cost efficiency” has been met. All findings point towards that EMS entails some cost increases per vehicle-km compared to regular trucks, but considerable cost savings per ton-km and/or m<sup>3</sup>-km. These savings outweigh the firms’ investment costs.

### Environmental impacts

The evaluation criteria “EMS turns out to cause the same or less environmental harm than regular trucks” has been met. All findings point towards that EMS has lower emissions per ton-km and/or m<sup>3</sup>-km compared to regular trucks. For a given amount of transport work, EMS will lead to reductions in CO<sub>2</sub>, NO<sub>x</sub> and PM. Danish and Dutch studies find that EMS only has unnoticeable impacts on noise.

### **Traffic safety impacts**

The evaluation criteria “EMS turns out to have the same or lower traffic safety risk compared to regular trucks” has been met. The findings in the evaluation point out that EMS has both advantages and disadvantages with respect to traffic safety. If a regular truck is replaced by an EMS one-to-one, we consider the traffic safety to be marginally worsened. However, today's practice seems to indicate that one EMS replaces between 1,2 and 1,5 regular trucks. For a given amount of transported goods, this leads to a reduced number of trucks on the road, which we consider to lead to a marginal improvement of the traffic safety situation.

### **Traffic flow impacts**

The evaluation criteria “EMS turns out to have the same or lower drag on traffic flow compared to regular trucks” is met. The findings in the evaluation point towards that EMS have a few challenges with respect to traffic flow, but these challenges are small as long EMS stick to roads that are suited for them. If a regular truck is replaced by an EMS one-to-one, we consider the traffic flow to be marginally worsened. However, since today's practice seems to indicate that one EMS replaces between 1,2 and 1,5 regular trucks, we get a reduced number of trucks on the road for a given amount of goods, which we consider to lead to a marginal improvement of traffic flow.

### **Public sector economic impacts**

The evaluation criteria “The EMS-trial has not entailed public sector costs that outweigh the total benefits” is met. The public sector has not spent any funds on EMS-related adjustments in road infrastructure, so the costs during the trial period have only been administrative costs (about 10 million NOK total for the period 2008-2010).

The findings in the evaluation point to that there are few and small differences in the impact EMS has on road infrastructure compared to regular trucks, and results vary from marginally better, to marginally worse. The actual usage of EMS has been relatively low throughout the trial period, and the usage seems to tend towards lighter goods in larger volumes, leading to a total weight lower than 60 tons per truck. The impact on infrastructure is considered to be minimal.

### **Socio-economic cost-benefit analysis**

Table 1 sums up the socio-economic cost benefit analysis, which has followed the guidelines for socio-economic analysis from the Norwegian Ministry of Finance (2005), considering both quantified and non-quantified impacts.

Table 1. Socio-economic impacts from the EMS-trial in Norway during the period 2008-2013, measured in million 2013-NOK. The low scenario shows the minimum estimates, and the high scenario shows the maximum estimates.

<b>Cost Benefit Analysis</b>	Low scenario	High scenario
<b>Quantified impacts</b>		
<b>Benefits</b>		
Cost savings transport sector	46	137
Environmental benefits	0	1
<b>Sum benefits</b>	<b>46</b>	<b>138</b>
<b>Costs</b>		
Public sector costs (incl. tax distortions)	12	12
<b>Sum quantified socio-economic impacts</b>	<b>34</b>	<b>126</b>
<b>Benefit/Cost - ratio</b>	<b>3,8</b>	<b>11,5</b>
<b>Non-quantified impacts</b>		
Traffic safety		(+)
Traffic flow		(+)

We estimate that the trial period for EMS has generated an economic surplus between 34 and 126 million NOK for the time period 2008-2013. There has in addition been small positive contributions to traffic safety and traffic flows.

### Modelling future scenarios with EMS

Using the national model for freight transport, we analyze the effect of allowing EMS on a larger share of the road network. In the extreme case where EMS-trucks are allowed everywhere, the model predicts that 53 % of the domestic transport work by HGVs (ton-km) will be carried out by EMS. This relatively large shift of transport to EMS would happen on the expense of shifts from regular trucks, rail and sea of the magnitude of 51 %, 2 %, and 12 %, respectively.

It is unrealistic to allow EMS everywhere in Norway. There will always be roads unsuited for EMS. The share of transport work shifted over to EMS, and the corresponding reductions in transport work carried out by other transport modes, are therefore exaggerated.

The model predicts that in the extreme case there will be an increase of 4,5 % of ton-km carried out by road transport. However, it will be carried out by 2,2 % fewer trucks, in spite of some modal shift from rail and sea. This indicates that even if there is a goal conflict between allowing EMS and shifting more goods transport from road to rail and sea, the modal shift effect is not large enough to expect a net increase in negative externalities from road transport. It is also worth noting that with a 50 % increase in fuel prices, the model predicts that the modal shift from rail and sea to EMS is completely neutralized, while the shift from regular trucks to EMS is enhanced.

### Conclusion

By analyzing the experiences from the trial period, our findings indicate that allowing EMS can lead to more efficient and environmentally friendly transport on a set of high standard roads, without the worsening of the safety of other road users. **The EMS-vehicle trials in Norway has reached its aim.**

Further conclusions:

- The socio-economic benefits of allowing EMS in the way it is done in the current situation, more than outweigh the costs
- There can net socio-economic benefits of allowing EMS-trucks on a larger share of the road network, but that will depend on factors such as costs for adjusting the infrastructure, possibilities for shifting goods from regular trucks to EMS, and the extent of local competition with rail and sea. The report provides some “rules of thumb” for assessing where it can be socio-economically beneficial for allowing EMS. This includes assessing to which degree the replacement of regular trucks outweighs any possible replacement of rail transport.

### **Other aspects worth considering in the future decision-making on EMS in Norway**

As noted earlier, it is not in the scope of this evaluation to assess the merits of the rules and regulations for EMS in Norway, but we have some concluding remarks that might be of interest for the future policy making for EMS in Norway. The following bullet points do not constitute any form final list of solutions, and they need careful cost-benefit considerations before any implementation. It is our opinion that these bullet points can give some inspiration on how to take advantage of the strengths of EMS-vehicles, and limit the weaknesses.

#### **Generally:**

- There is **need for more data** on EMS-vehicles in Norway, in order to follow their impacts on relevant aspects
- We recommend a close **dialogue** with the transport industry in finding policy solutions for EMS in Norway

#### **Maintaining traffic safety with EMS**

- When expanding the possibilities for EMS transport in Norway, we see the need for **strengthening traffic control of HGVs in general and EMS in particular**
- Allowing EMS can be an opportunity to only allow vehicles with the **newest safety features**
- It might be beneficial to have additional **special requirements** for driving EMS-vehicles in Norway (e.g. specific driver’s certification), but it is difficult to assess such requirements as of now. Any special requirements are recommended to be subject to cost-benefit analysis.

#### **Have a clear list of criteria used for all assessments of any new road considered for EMS-transport**

- We recommend the NPRA (preferably in dialogue with the transport industry) to establish a **set of clear, objective and measurable criteria for the road standard where EMS-transport can be permissible**.
- The “socio-economic rules of thumb” described earlier can be used as a decision tool in the process of considering new roads for EMS-transport.
- The **Danish “Virksomhedsordningen”** for helping businesses (and municipalities) assessing the possibilities for EMS-transport, can provide tools for how to assess which roads that are usable for EMS-transport.

### **Contribute to efficient usage of EMS-vehicles**

- The guidelines for transporting dangerous goods (ADR) with EMS should be harmonized with Denmark and Sweden (this can be a part of the assessment of generally stricter safety requirements)
- In order to expand the network of connecting roads allowed for EMS in an efficient manner, the Danish scheme “Virksomhedsordningen”, which has been newly simplified, can hold many learning points. It can provide inspiration for how to implement expansions to the network of connecting roads for EMS, but also the possibilities for co-financing between the private sector and municipalities.
- Other possibilities for facilitating efficient usage of EMS-transport are e.g.:
  - Making the bureaucratic process of getting permission to use a connecting road for EMS-transport simpler and more efficient
  - Improving the map service for where EMS-transport is permitted
  - Clearer signage for where EMS-transport is permitted

### **Summary of other aspects worth considering in the future decision-making on EMS in Norway**

The trial period has shown that permitting EMS-transport can generate socio-economic net benefits. Further geographic expansion of where EMS-transport can be permitted provides both threats and opportunities. Possible ways to mitigate the threats can be through stricter safety requirements, stronger enforcing and a clear list of criteria for where EMS-transport can be permitted. Opportunities can be seized through harmonizing guidelines across borders, and making EMS-transport related bureaucratic processes more efficient. Both seizing opportunities and mitigating threats can be strengthened with registering and obtaining more data on the consequences of EMS-vehicles in Norway and through dialogue and cooperation with the transport industry.