Pathway to the future – Scandria®2Act Clean Fuel Deployment Strategy

Summary

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Disclaimer

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1 Introduction

For decades, transport has been an area of EU common policy, including the harmonisation of national laws, regulations and administrative provisions. As a result, the technological, social and tax environments in which transport services are provided has also steadily gained importance. Besides changes in manufacturing and stock management systems, the abolition of internal borders and a consequent fall in transport prices have also led to an increase in goods and passenger volumes. The transport sector accounts for almost a quarter of all greenhouse gas (GHG) emissions in the EU. In contrast to other sectors, it has not seen the same gradual decline in emissions. Here road transport is the largest emitter, accounting for more than 70% of all GHG emissions from transport in 2014 (European Parliament 2017).

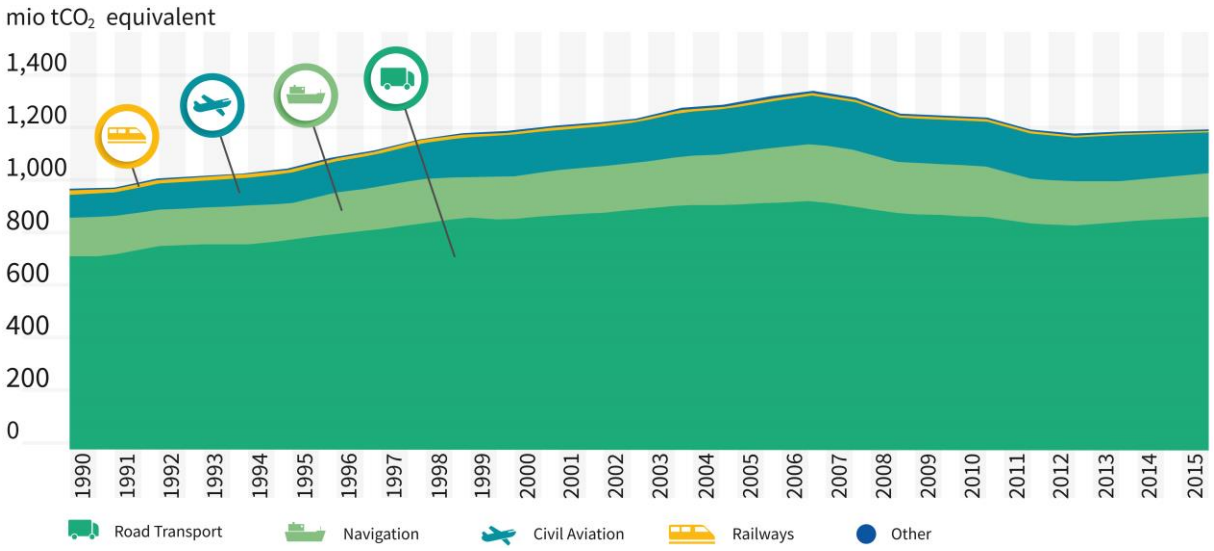


Figure 1: GHG emissions from transport sector by mode (EU28) (authors' own representation based on European Union, 2017)

Aim and scope of the report

It requires appropriate policy instruments that boost mobility by using energy-efficient and environmentally friendly means of transport, and promote innovative mobility solutions with alternative propulsion systems and fuels. The "Clean Fuel Deployment Strategy" (CFDS) is a white paper that includes a list of strategic measures derived from a strategic diagnosis of clean fuel deployment in the Scandria®-Corridor. Addressing fields of action of strategic relevance, it illustrates the development of the clean fuel market, clean fuel technology and clean fuel infrastructure. It identifies relevant measures needed to enable clean fuel deployment from a corridor perspective. It therefore addresses the issues of political coordination, financial incentives, standardisation and information, as well as the financing models of clean fuel infrastructure. The goal is to enable regional and national decision-makers to identify effective and efficient actions in order to support clean fuel deployment.

2 Summary – results of the policy instrument assessment and literature

The assessment of instruments to foster clean fuels in the Scandria region shows that there is not any single instrument (or magic formula) that fits all countries and every stage of market development. However there are tendencies in all countries, which can be also backed up by results from European and North American studies:

- So far, the most effective political actions to foster the use of alternative fuels by private consumers have been upfront financial incentives when buying vehicles. If there are no other strict regulations, the more they cover the price difference between conventional ICEs and alternative vehicles, the more effective they are.
- For primary consumer investments in vehicles a minimum level of refuelling infrastructure is necessary. The way to extend the infrastructure – financed fully privately or with state support – scarcely depends on the opportunities to generate business with the different fuels.
- Strategic and consistent policy with long-term perspectives and commitments is most effective. Short-term actions and quickly changing instruments do not provide the necessary investment security, neither for market players nor consumers. Unstable political decision-making leads to uncertainty, lack of trust and market slumps.
- Non-financial instruments can boost vehicle sales. The can motivate interested consumers and open up new market segments. But in the early market phase they are not appropriate as the sole instrument.
- Communities and regions are frontrunners and supporters in the drive to increase market uptake of alternative fuels. Market growth of innovative products, and hence alternative fuels, originates in densely settled, highly populous regions. Because these communities are tightly interconnected with their surrounding regions in terms of transport, and form part of transport corridors, their actions are catalysts for the whole market. So today, big communities in particular have the power to create a framework which increases the demand for alternative vehicles and supports infrastructure deployment.

The qualitive assessments of the instruments show that there are multiple factors influencing alternative fuel deployment. Empirical studies from different countries complement these overviews. In terms of choosing a consistent strategy towards low emission fuels and alternative propulsion systems, in the best-case scenario effective and efficient policy instruments should contribute to all the goals described in Figure 2.

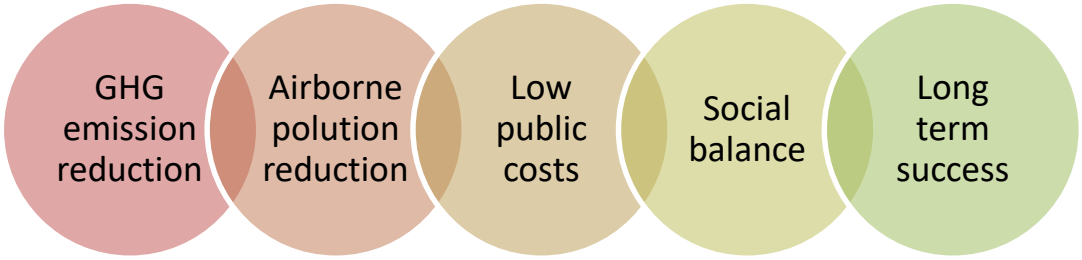


Figure 2: Goals of a consistent strategy towards low emission fuels and alternative propulsion systems

Because conflicts can occur between the goals mentioned over time, instruments will need to be adapted, depending on market success. Regional and national decision-makers along the Scandria corridor (but also elsewhere) should learn from good and bad experiences that have already occurred in the past. However the findings of other countries and regions regarding success or failure of instruments cannot be adopted on a one-to-one basis. They have to be compared with each country or region's corresponding situation regarding market and policy frameworks, and the stage of market development for alternative fuels.

Table 1 lists important factors influencing the attractiveness of investing in alternative fuels and vehicles on the regional and national level. Addressing these factors is relevant to making long-term progress regarding GHG-emission reduction in transport and alternative fuels market uptake.

Factors influencing attractiveness and market uptake of alternative fuels	
Culture & economy	Attitude to mobility
	Attitude to private transport
	Status of private transport and vehicles
	Existence or non-existence of automotive industry
	Road transport dominance – availability of public transport and railway transport
Energy	Fuel prices
	Electricity price
	Fuel dependency (import) – local energy availability (self-supply, export)
	Share of renewable energies and availability of renewables
	Renewable energy potential
Consumer	Consumer driving habits
	Attitude towards environment and climate change
	Level of education and age
	Purchasing power; private/average household income
	Information, interest and awareness regarding alternative vehicles
Charging & alternative fuel infrastructure	Public and private charging availability
	Fast charging options
	Regional and national H_2 and CNG/LNG infrastructure density
	Infrastructure development goals and plans

Policy strategies and instruments	Existence of financial or non-financial incentives
	Design of policy and market incentives
	Long-term vs. short-term political strategies and incentives
	Supply side incentives (infrastructure) and/or demand side incentives (vehicle)
Political communication & public actions	Positive vs. critical public information and discussion
	Support or lack of support for information and awareness campaigns
	Extensive or cautious public procurement as role model
	Consistent policy actions; credibility of actions
Settlement structure, climate and topography	Densely populated urban areas, suburban areas, rural areas
	Very cold areas, temperate climate, winter/summer differences etc.
	Flat landscapes, mountain areas
Transport market	Existence vs. non-existence of road tolls
	Frequency of traffic jams and availability of priority lanes
	Public parking policy, parking fees
	Private and fleet vehicle taxation
	Diversity of transport modes, state support for public transport

Table 1: Factors influencing attractiveness and market uptake of alternative fuels

Most political actions regarding alternative fuels and vehicles so far have focused on private passenger transport. But international road freight transport in particular has been growing, and is predicted to increase even faster in the future. So freight transport's share of GHG emissions will probably tend to increase more and more.

This is the reason why political efforts should focus much more on **road freight transport** than has occurred in the past and is the case today. To impose GHG emission reduction on freight transport is on the one hand easier, on the other hand more difficult because:

- Commercial users are less emotional and very much more rational. The most important factors which matter to them are total cost of ownership (TCO) and suitability of the technology.
- The total cost of a technology matters to commercial users such as road hauliers. But the difference in costs from other available technologies and the costs of their competitors matters to hauliers much more.
- Road freight transport today is a highly internationalised and competitive market. So national and regional actions are very important, but also have to affect hauliers and forwarders from other countries in order to avoid unfair competition. This particularly affects vehicle and emission standards and fuel prices. So it seems very important to at least arrive at a European solution regarding ambitious vehicle standards and minimum fuel taxation.

- The technical options and solutions in road freight transport differ very much from private transport. There are very different requirements for different transport operations regarding payload, transport distance etc. Not all alternative propulsion systems today are technologically ready for every aspect of transport.
- Commercial users – hauliers and forwarders – need long-term planning perspectives. Investments in new vehicle fleets are related to the available infrastructure. Infrastructure investments are mostly designed for 15 years and more.

To promote alternative fuel deployment in freight road transport as well, experts and political decision-makers should discuss strategies and plans for increasing the percentage of alternative vehicles, and coordinate their strategies for expanding alternative fuel infrastructure.

Local and corridor infrastructure perspective

The infrastructure development of refuelling and charging stations is a shared responsibility for market players and policy. In markets with sufficient vehicles and hence sufficient energy demand, infrastructure development is a self-sustaining, market-driven process. But today the market framework and energy demand from alternative vehicles is generally not sufficient to foster such a self-sustaining infrastructure development. In particular most EV charging stations and, to date, H_2 refuelling stations do not offer an adequate business case. However, even if these stations do not offer an adequate business case today, they should be attractive and available to as many regional and international users as possible. With a view to the international mobility and vehicle markets and with respect to an optimal utilisation of the publicly supported infrastructure, communities should not only bear in mind regional or national, but also international infrastructure standards and transport demands in order to avoid insular infrastructure solutions.

We can therefore recommend

- that communities and regions engage in close dialogue and cooperation when it comes to infrastructure development which affects mobility along transport corridors
- that communities and regions should play an active role and be part of national or EU project funding for alternative fuel infrastructure

Status quo and next steps in alternative fuel market development

Analyses of the alternative vehicle markets and instruments to develop the markets reveal large differences between the Scandria corridor countries. With regard to the availability of alternative vehicles, vehicle costs and costs of infrastructure, all countries in the Scandria corridor (and the EU) have nearly the same framework conditions today. What makes the difference are the political actions and political frameworks, which have greater or less ambition to drive the market. As a result of the political actions in the past, the Scandria corridor countries have a very different level of vehicle and infrastructure penetration today. Furthermore there are not only differences between the countries, but also between different alternative fuels in each country.

Examples in Denmark and Norway show how important it is to have a long-term policy oriented towards market success rather than short-term political or financial constraints. The effectiveness of instruments broadly depends on their ability to bridge the price gap between conventionally fuelled vehicles and those using alternative fuels. As shown by Germany, subsidies remain less effective due to their rather low contribution towards bridging the gap. Thus it is important to introduce accompanying instruments that make it more attractive to invest in clean fuel vehicles according to the "polluter pays" principle, e.g. bonus/malus systems. To this extent all clean fuel technologies should be supported, even as there is no "ideal" technology available but rather technologies that have "use-specific" advantages. This is especially important in an international context, as it is necessary to avoid a situation where a certain technology is limited to national borders. Other Scandria®2Act project results show that a lack of technical systems or different technical standards in the Scandria corridor can be major limitation to alternative fuel deployment.

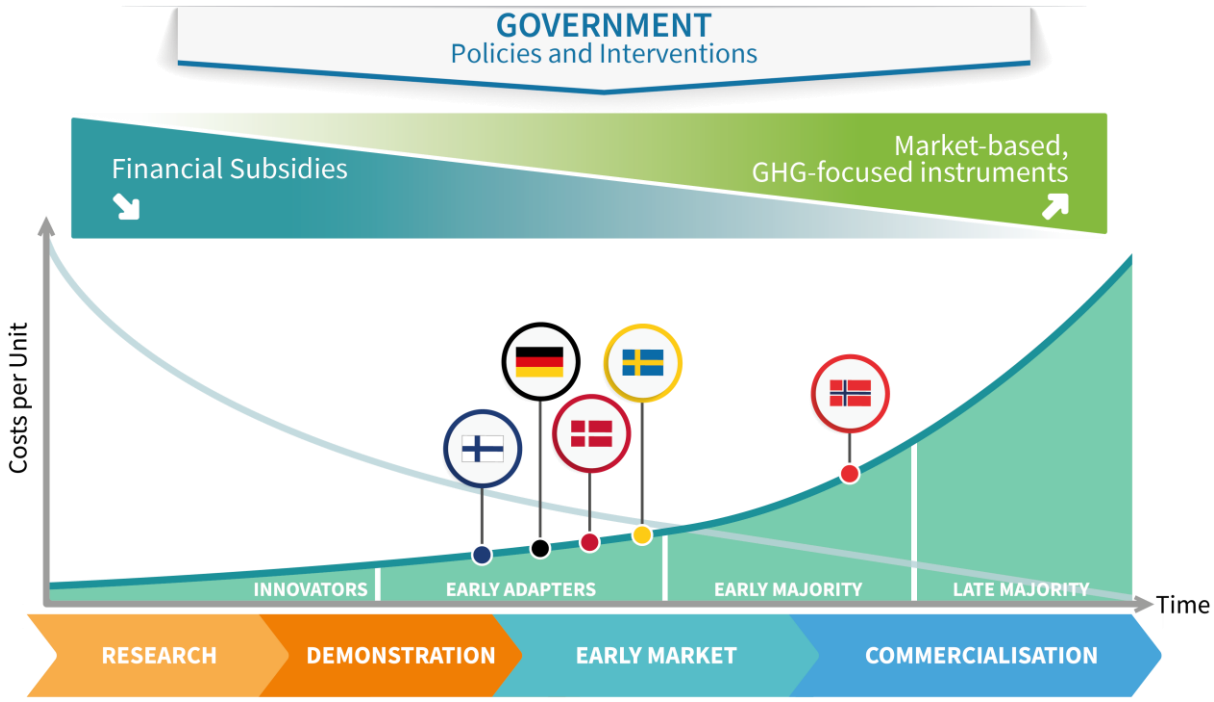


Figure 3: Current market stage of alternative vehicles in Scandria countries

Comparing the current market stage of alternative vehicles and political actions, Norway is by far the frontrunner in the Scandria corridor, while Sweden has made progress and implemented new regulations. Denmark and Germany have recently been gathering pace, followed by Finland.

With respect to the political goals named in Figure 2 and the study results regarding effective political instruments, the actions to foster alternative fuel deployment in the Scandria corridor will probably differ from country to country over the coming years.

While Norway's alternative fuel market share has reached around 50%, its success still depends heavily on financial subsidies, especially tax benefits. To stabilise market share growth but avoid windfall profits and unbalanced public funding, the coming years could be characterised by reductions in direct financial subsidies, and increased alignment of pricing towards CO_2-intensive vehicles and fuels. This assumes improved technological attractiveness of alternative vehicles and further reductions in production costs.

The experience of Denmark's rapidly declining EV market in 2016 and 2017 reveals the enormous significance of political stability for driving alternative vehicle market development. Instruments already in place, such as the registration tax, provide Denmark with a very good starting position to steer market uptake of low emission vehicles. Particularly after the Danish government announced its goal of banning new ICE car registration from 2030 on, Denmark should avoid a quick phase-out of the reduced vehicle registration tax in order to avoid consumer insecurity. Instead of totally phasing out vehicle registration tax reductions, another option could be to link the taxation more closely to each vehicle's CO_2 emissions, not just its price.

In comparison to Denmark, Sweden's market in recent years has shown stable, positive tendencies in BEVs and PHEVs, but a declining market share for CNG vehicles. The most important consumer incentive of recent years has been purchase tax rebates, which especially favoured PHEV and BEV growth. From July 2018 onwards Sweden switched from a "rebate only system" to a bonus/malus system, which from the perspective of public cost and the "polluter pays" principle seems to be a good long-term instrument. It remains to be seen if vehicles running on gas can benefit from a fixed extra bonus of €1,000 in the new system. It could support the temporary tax exemption of bio-CNG, which has a dominant share in Sweden's gas fuel mix.

Vehicle prices in Germany are low in comparison to other Scandria countries, as is vehicle taxation. So far, private users have had low incentives to buy a vehicle using alternative fuels. Public discussion and some recent court decisions about optional driving bans for diesel vehicles in some German cities brought some fresh movement to the vehicle market. The so-called "Umweltbonus" rebate for BEVs and PHEVs was implemented in 2016, but is rarely a strong consumer incentive as long as high emission vehicles have no financial disadvantage. Because two thirds of newly registered German cars belong to commercial fleets, at the beginning of 2019 the taxation for private fleet users of BEVs and PHEVs will decrease from 1% to 0.5% p.a. (countervailing benefit). This will probably increase BEV and PHEV demand. To improve the efficiency of the system and reduce tax shortfalls, low-emission vehicles should benefit from reduced taxation, while taxation for vehicles with higher emissions should be more than 1% p.a. The latest government decision to exempt EVs from road tolls until 2022, and gas trucks until the end of 2020, has given rise to high expectations. This is a high financial incentive for commercial fleets, but the planning perspective is very short. The coming years will therefore provide an opportunity for new road toll pricing legislation for all trucks, with a focus on their CO_2-emissions.

Finland's incentives for clean fuel vehicles are implemented by a CO_2-based taxation system, with lower tax e.g. for natural gas, and no tax for biogas. This could be one reason for the 2018 market increase in CNG vehicles, in addition to the 2018 subsidy for converting conventional vehicles to gas. Vehicle registration tax and ownership tax are dependent on specific CO_2 emissions. BEV vehicle owners pay the minimum, while for PHEVs the owner tax is much lower than for ICEs. New purchase

subsidy programmes for vehicles and charging infrastructure seem to have had a positive effect since the number of EVs, especially PHEVs, has nearly doubled each year since 2015. The question remains whether the market increase of the last three years can remain stable. Most purchase subsidies will end at least by 2021.

3 Recommendations – catalogue of strategic measures

As discussed in the previous chapters, there are no specific political recommendations which fit all Scandria countries. The recommendations in this clean fuel deployment strategy are based on the following **principles to support sustainable advantageous technologies**

- The aim of political instruments and actions should be to compensate higher costs for new technologies and enable price competitiveness in the early market phase
- Political instruments to promote clean fuels should be part of a country's holistic and comprehensive mobility strategy and overall GHG emission reduction strategy
- Political instruments must be introduced taking account of the specific market phase and technology-readiness of each alternative vehicle technology
- Political instruments should focus on stimulating the demand side in order to avoid bad infrastructure investments
- Political instruments should comply with GHG and other emission reduction targets
- Political instruments are important, but other factors such as technological development and energy prices also play a decisive role in fostering clean fuels and technologies. Market success cannot be traced back to one single instrument. Political instruments should therefore be an long-term enabler for clean technologies.
- Market supporting mechanisms should stimulate the market in order to allow a market-driven achievement of goals. However, especially in imperfect markets, regulatory instruments are necessary to guarantee GHG emission reduction and technology development.

Reduce the price difference	•The most important factor for consumers is the price difference between vehicles •Very low-emission vehicles will probabely remain more expensive in the future •It is not only about subsidising low-emission vehicles, but also increasing prices of high-emission vehicles
Upfront support helps consumer	•Consumers prefer upfront financial support, be it tax or rebates •Subsequent (tax) reduction is not that effective
Rebates can avoid overspending	•Rebates are better for controlling public spending and avoiding subsidies for high- income groups •Rebates are more efficient in terms of social responsibility and windfall effects
Tax reduction is effective but expensive	•In many countries tax reduction is the most effective single instrument for clean vehicles •But tax reduction also subsidies high-income groups and allows windfall profits •With advanced market maturity of clean verhicles, tax reduction should be replaced by budget-neutral instruments
Information & awareness support attractiveness	•Considered separately, information campaigns do not have a great effect, but they are important in combination with other actions •Information campaigns emotionally reward consumers of clean vehicles, inform interested consumers and create awareness
Focus on GHG emission reduction	•State support has to privilege technolgies with the lowest GHG emissions •EVs with an electric driving range <50km have only marginal advantages •Energy tax, company car tax, vehicle registration tax and vehicle ownership tax need to have a stronger connection to GHG emissions

Adapt instruments, depending on market maturity	•The more mature the market and vehicles are, the fewer state subsdies are necessary •With growing market maturity comsumers have to be more challenged, and policy instruments have to become neutral for the state budget •Policy framework has to set incentives for industry to reduce costs and prices
Long-term perspective and reliable policy enable investments	•Rapid political changes and replacement of instruments destroy trust and are not effective •Clean vehicle policy has to be transparent in a long-term perspective
Socially balanced state support	•The bigger the clean vehicle market becomes, the more important it is to avoid overspending, especially by high-income groups •In the early commercialisation phase at least, a shift to budget neutrality is recommended
Avoid windfall profits of consumer and industry	•Subsidies for expensive high-class vehicles are not effective, because many consumers would buy the clean vehicles anyway. Such ineffective support should be avoided, also with a view to the efficent allocation of limited public expenses •Overspending and subsidies that last too long create risks of reduced pressure on the industy to invest in improving products and reducing costs
"Polluter pays" principle –consumer has to be challenged, not just privileged	•At the moment clean fuels deployment is mainly driven by public support •Besides clean fuels support, there are still privileges for fossil mobility •A consistent clean fuel policy has to reduce these privileges and focus on the "polluter pays" principle

Figure 4: Political recommendations to foster clean fuel deployment

General recommendations for promoting alternative vehicles in commercial transport

The commercial transport market is characterised by international competition, relatively low margins and relatively rational (TCO-based) decision-making processes. To overcome the cost disadvantages of energy-efficient technologies and low-carbon fuels, decision-makers at all levels could support:

- Actions to promote cooperation along the whole value chain of the transport market, in order to share the companies' investment risk
- All available technologies which can already achieve advantages in terms of environmental and GHG emissions today, because so far it is not clear how fast different technologies will achieve market readiness. In the future different technologies will probably have different "job profiles" as well as regional advantages.
- Road toll differentiation in order to privilege low-carbon fuels and efficient technologies as one of the main drivers for haulier investment.
- Fuel taxation which should be much more dependent on the specific GHG emissions of fuels, at least in the medium term.
- Initial expansion of clean fuel infrastructure on important strategic (international) routes along the corridor. This can be an important incentive for infrastructure visibility. But it has to be combined with actions that stimulate vehicle and fuel demand at the same time.
- Courier, parcel and express delivery is one of the fastest growing markets, with a high impact on urban transport and emissions. Low-emission zones for urban delivery could accelerate market penetration of low-emission vehicles very quickly.

Scandria corridor recommendations

The study analysis shows that Clean Fuel Deployment in the Scandria corridor to date has not been on the same level with regard to infrastructure and vehicles. This is due to political and economic reasons as well as country specifics. In comparison to the past, the technological development of clean vehicles has made considerable progress. However, the challenges are still big. Deeper cooperation and concerted actions between communities and country representatives in the corridor are therefore highly recommended. The following actions could be game changers and catalysts to accelerate clean fuel deployment:

- Intensive discussion between the most important communities along the Scandria corridor regarding clean transport actions.
- Development of a common Scandria corridor clean fuel vision with clean fuel deployment goals. It could be complemented by a common roadmap for clean deployment with concerted actions, including awareness campaigns, in the coming years.
- Collective lobbying for ambitious goals to integrate the external costs of GHG emission into road toll charging – especially with regard to the directive on the charging of heavy goods vehicles for use of certain infrastructures.
- Cooperation on using a common road toll system in future that is also GHG emission-based
- Because road freight transport requires an international perspective, collective analyses of heavy duty vehicle transport flows in the Scandria corridor could be valuable in supporting international infrastructure deployment (at strategically important sites)

- Public support for multi-fuel stations at strategically important sites along the Scandria corridor, as well as common standards for these multi-fuel stations, could stimulate future investments by energy providers
- Closer cooperation and support of cross-border pilot projects could help raise awareness of clean transport for market players in freight movement and private transport
- Even with a rapid market uptake of electrified vehicles, there will probably be a huge demand for liquid and gasified fuels in 2030 and thereafter. So all countries and communities in the corridor should lobby for instruments and projects to increase the amount of sustainable renewable fuels, especially e-fuels, on the EU and national level. Approaches include the national implementation of RED II, extra feed-in guarantees for e-fuels or increasing CO_2 prices for fuels.

The role of different policy levels in supporting alternative vehicles

Even if most road transport movements occur at the regional level, they are not limited by national borders. International road transport, especially road freight transport, increased heavily in the last two decades. So alternative fuel development can only be designed cooperatively, in the best case through the concerted action of EU member states and communities. Actions have to address both the supply and demand side. The EU Commission has made one important step with the Alternative Fuel Infrastructure Directive (AFID), and is going one stage further with emission regulation for cars, light duty vehicles and, for the first time, heavy duty vehicles. These actions should find support at member states level and community level. Looking towards the future, there are three examples for possible cooperation.

- **Fuel taxation:** Especially with regard to international freight transport a GHG emission based taxation should not be implemented just in individual countries. So EU Commission and member states should team up to define a minimum fuel taxation for all fuels in the EU, which is at least partly based on the GHG emissions. Each member state still have the sovereignty for it´s own fuels taxation and can vary the taxation of different fuels on the base of a common EU minimum taxation. In order to reduce emissions, GHG emission based taxation can be an efficient instrument as it
  - Directly addresses private and commercial users who are responsible for the emissions
  - Gives incentives to drive energy-efficiently and to use energy-efficient vehicles
  - Gives incentives for investments in alternative propulsion systems
  - Gives incentives for using low-emission fuels in the long-term perspective

- **Road toll** charging could provide a strong incentive to promote alternative propulsion systems, if it is based on distance and CO2-emissions. So far there have been a multitude of different national toll systems. The EU and EU member states should cooperate to agree on a common toll system for cars, and opt to include CO2 as one factor in the already existing Eurovignette directive. Each member state would be responsible for the individual toll design and the use of the revenues. Additionally, local communities could be given the option of implementing congestion charges to reduce local emissions and drive the shift towards public transport. However, this should be accompanied by an improvement in public transport services.

- **Emission performance standards** for new passenger cars, light-duty vehicles and heavy-duty vehicles are the main driver for industry to invest in alternative propulsion systems. However, setting standards alone will not be successful. Member states and communities have to create a framework to boost the demand for the vehicles. On the national level, fuel and vehicle taxation as well as road toll charging is very important. Initial infrastructure expansion can be promoted by member states and communities. On the local level, long-term targets for low emission vehicles and discussions regarding driving bans strengthen awareness and the need to invest in alternative vehicles.

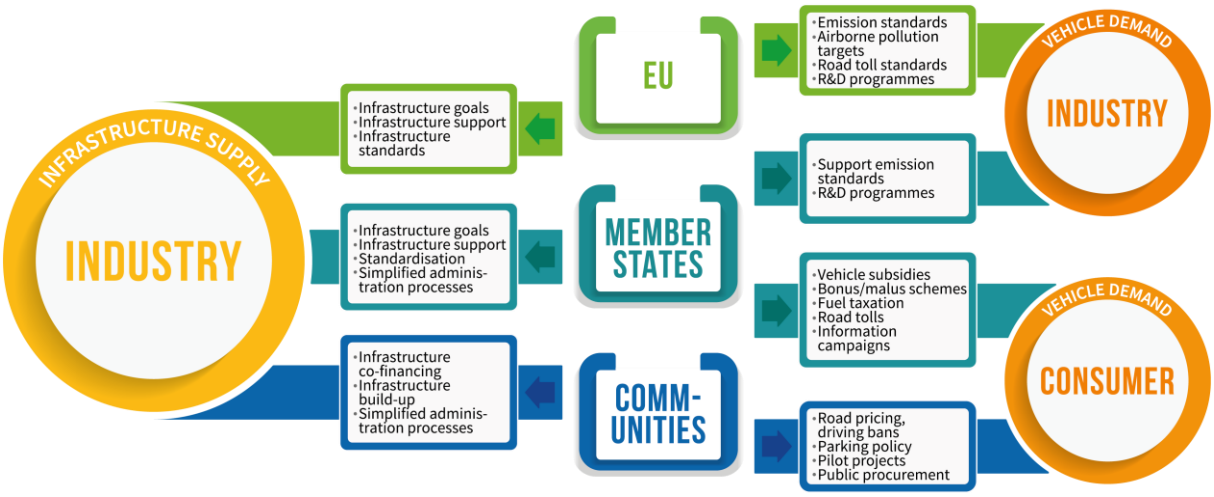
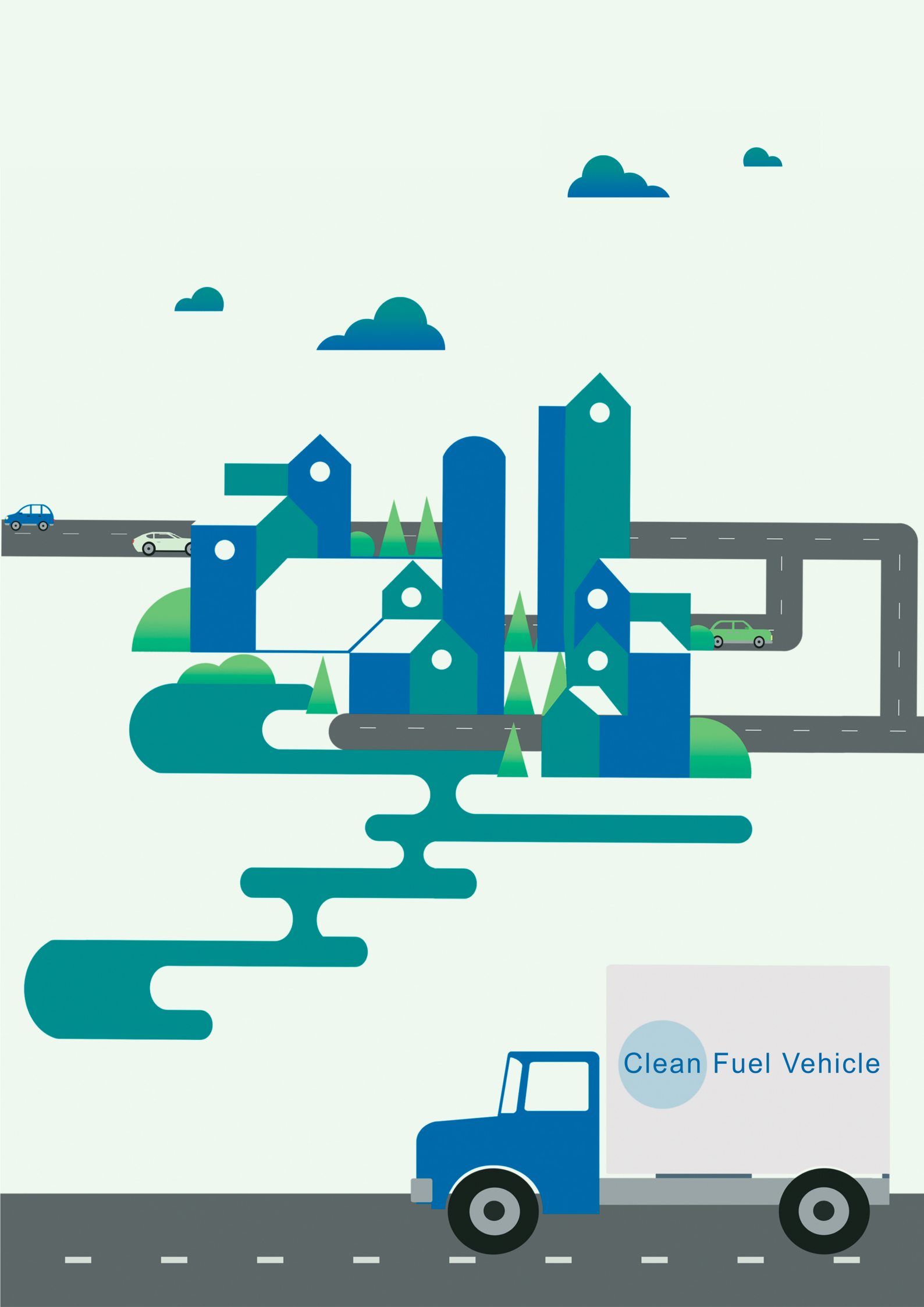


Figure 5: Different policy levels to support alternative vehicles and infrastructure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