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Supporting Policies for the Renewal of Public Vehicle Fleets to Achieve Efficient Carbon Mitigation

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Abstract
The aim of the research is to establish an assessment framework for evaluating transport-related carbon emission reduction options. The reduction of fleet-related emissions must build momentum, as the transport sector remains a substantial contributor to global carbon emissions. Through the use of this framework, better supporting policy for the transition of public service vehicle fleets to electromobility would be prepared. The greatest impact for investment can be achieved by facilitating the transition of vehicles with the largest distances driven. Hence, careful consideration of the operational conditions and the level of efficiency of different modes of public transport would be subject of analysis. The energy consumption of public vehicles can be calculated on the basis of the specific fuel consumption patterns and operational data of fleets. This method can be used to estimate the decarbonisation potential of different vehicle types, which may nevertheless differ significantly. The assessment framework will make abatement costs comparable and provide a basis for the targeted application of supporting policies. As preference should be given to vehicles with the lowest marginal abatement costs to effectively reduce the sector's carbon emissions, these must be identified. The theoretical contribution of this research is an evaluation framework that provides relevant data for decision makers to assess the long-term financial and social impacts of different public fleet renewal supporting strategies.

Keywords: assessment framework, emission calculations, electromobility, supporting policies, marginal abatement costs.

1. Introduction

Barely having began to come to terms with the consequences of the Covid-19 pandemic, the global economy was shaken by Russia's invasion of Ukraine, catalysing the already emerging spurt of inflation. With energy security in serious doubt, fuelling considerable increases in prices, the pace of moving away from the current status-quo was being questioned. Governments implemented various degrees of price controls in an attempt to curb runaway inflation, which has postponed, but ultimately not solved the problem. These factors collectively shape the mobility landscape, especially road transportation. As these events are still unfolding, we do not yet know the path ahead, neither in passenger or goods transportation. Nevertheless, it is obvious that decarbonisation of road transportation and a move to alternative and domestically controlled energy sources will be essential.

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This paper focuses on public transportation fleets as these have by far the greatest mileage, and should be the prime candidates for fleet rejuvenation or renewal. In particular, the replacement of buses is of paramount urgency. This rejuvenation should further embrace a swift move away from petroleum and encompass more vehicles considered more environmentally conscious. Among these, hybrids (referring exclusively to plug-in hybrids with external charging capabilities) and pure electric vehicles will be treated in this assessment.

Newly placed on the road electric and hybrid vehicles supersede existing internal combustion fleets. A reduction in fleet mileage of public transportation is neither an option nor is it desirable. Instead, an augmentation of e-vehicles within the fleets are a more plausible and desirable alternative to curb transport-related local emissions, though admittedly these typically do not eliminate adverse environmental impact globally, and will typically have limited effect on other negative externalities, such as congested traffic.

2. State of the art methods of decarbonisation planning in the transport sector

Recently, governments have started compiling transport decarbonisation plans (TDPs), focusing primarily on public transportation. Among these, some (e.g. New Zealand's) formulated narrower policies to make bus public transport net-neutral rather quickly (e.g. by 2035) (MoT NZ, 2021), while others aim for a broader, more holistic approach by including shipping and aviation on a longer time horizon (e.g. until 2050) (DfT UK, 2021). A strength of these policies is that they propose a handful of diverse alternatives to carbon-based fuels, broadly including electric and hydrogen. However, a significant weakness is the lack of clarity and detailed sub-national planning, which could well spell the downfall of such policies. As stakeholder groups will concur, only "living policies", those with clear and regularly evaluated and updated targets, are worth having. (Green Alliance, 2021).

This lack of subsidiarity and detailed planning is exacerbated by the research predominantly taking place on the macro level, encompassing an entire country or an entire industry. Mezo (regional) and micro (local) level research frameworks are rare, if extant. This masks the underlying conflicts and contradictions, which could be an important source of catalyst for change and more effective policy planning, especially in countries where a bottom-up approach may be comparably prevalent to top-down approaches. Therefore, it would be desirable to gain a comprehensive insight into the full array of relevant costs, throughout the life-cycle of the products. Jasinski et al. conclude the appropriateness of British Petroleum's Sustainability Assessment Model, irrespective of being promoted by an oil corporation. Most studies revolve around energy issues or greenhouse gas emissions (Degen & Schütte, 2022), material throughput is also analysed, e.g. by Cooper et al. (2017). These authors identify six interconnected factors that influence efficiency, and the sustainability of electric vehicles is discussed from several aspects (Borgstedt et al, 2017, Degen & Schütte, 2022). Similarly, Liu et al. analyse the country level environmental impact of the automotive industry in China, employing life-cycle analysis on both consumption and production phases, concluding that with increased production of electric fleets greater environmental pressures mount.

The source of electricity for electric vehicles is a crucial aspect, as various sources argue. Choma and Ugaya compiled a review of Brazilian light vehicle fleets comparing the impact of battery electric vehicles (BEVs) to ethanol-consuming internal combustion engine vehicles. Having considered storage and distribution and environmental impact in an LCA approach, they conclude that under Brazilian circumstances, BEVs may perform more poorly than ethanol-based internal combustion engines, if the source of electricity is included in the assessments. In this report, polluting hydroelectric power plants are addressed (Choma et al, 2017)). A similar warning is put forward by Nęcka and Knaga, who stipulate that if the electricity is generated by combusting fossil fuels, the overall environmental performance of electric fleets is likely to be worse than the current (Nęcka & Knaga, 2021) If the distribution networks (grids) are considered, significant infrastructural investments will be required, into decentralised generation capabilities equally, in high and low density networks alike (Mancini et al. 2020).

3. Materials and methods

The evaluation framework that will be set up would be efficiently usable if it fits in with the regulatory context. To this aim, we will first review relevant policy and planning documents at EU, national and city level. The interrelated elements of the evaluation framework are then would be discussed taking into account the appropriate structure of the methodology and the data requirements.

3.1 Strategic background

Prudent **regulatory practices** at European, national and local level should define goals for the promotion and adaptation of support policies for carbon-neutrality of the public fleets. The use of renewable energy in the transport sector increases year by year, however reduction of external costs related to carbon emissions requires further improvements in the efficiency of the environmental regulations. We will overview some of the strategic policy documents affecting carbon reduction projects of corporates in the transportation sector.

One of the most relevant EU policy documents is the White Paper on Transport with the following title: "Roadmap for a Single European Transport Area - Towards a Competitive and Resourceful Transport System" (COM (2011) 144). Its main statements is that more efficient transport systems improve the competitiveness of European companies and development of the transport sector would be a priority. It is a huge challenge how the reduction of the volume of greenhouse gas emissions from transport can be achieved. EU Member States' emissions should be reduced by 80-95% by 2050 compared to 1990 levels and the transport sector will contribute at least 60% of this large cuts. The main initiatives to provide environment-friendly transport options are the follows: further development and more efficient use of sustainable fuels and propulsion systems, a significant reduction in the number of cars in urban traffic by 2030 and their complete withdrawal from cities by 2050 (Princz-Jakovics, 2019). The final deadline targeted by the EU for starting change-over to electromobility is 2035; from this year onwards, only vehicles with zero local emissions can be sold. Fleet operators would prepare plans for future procurement of vehicles and start turning their fleet to electromobility much earlier. The planned number of hybrid or purely electric vehicles is be based on the available financial sources and supporting mechanism.

On local level **Sustainable Energy Action and Climate Plans** (SECAPs) can be used to address energy and climate issues in a coherent way, including concepts and resulting actual interventions for the better use of renewable energy sources in our cities. After identification of interventions and development options that support municipalities in achieving their climate goals SECAP documents quantify the key indicators related to transport activities and operation of buildings. (Covenant of Mayors, 2016).

Sustainable Urban Mobility Plans (SUMPs) play a significant role in the application for EU funding from different sources, and may even be a requirement. It is advisable to prepare these mobility plans carefully, regardless of the size of the city. SUMPs use horizontal and vertical integration of all transportation modes and they have an important benefit: external costs are taken into account in the planning phase of the proposed measures. These documents can improve the efficiency of transportation planning and help to move towards sustainability through adequate policy regulations in any cities. Detailed guidelines are available for preparing SUMPs (Rupprecht Consult, 2019).

3.2 Setting up an assessment framework

The programming of climate protection measures requires the establishment of an assessment framework to evaluate the mitigation effects of fleet renewals. A higher share of hybrid or pure electric vehicles in the fleet will have positive impact on carbon emissions.

3.2.1 Methodology for calculation of GHG emissions

The procedure outlined by the **GHG Protocol** (WBCSD and WRI, 2004 and 2014) was used to calculate carbon emissions saved from the higher level of electromobility. This protocol is based on the following differentiation of scopes:

- Scope 1: Direct GHG emissions occur from sources that are owned or controlled by the company,
- Scope 2: indirect GHG emissions (e.g. related to purchased electricity consumed),
- Scope 3: other indirect GHG emissions (e.g. all other purchased materials, including fuels).

For the calculation of carbon emissions, we can use the standardized methodology for transport related activities based on the standard EN 16258:2012 titled "Methodology for calculation and declaration of energy consumption and GHG emissions of transport services (freight and passengers)". Two types of conversion factors are proposed according to either the Tank-to-Wheels or Well-to-Wheels approaches. Estimation of energy consumptions and CO_2 equivalent emissions from gasoline or diesel fuels can be performed with these factors. Assessment of emissions related to the vehicles with internal combustion engines is important to be able to identify what is the amount of CO_2 equivalent of burning fossil fuels. Emissions from hybrid and purely electric vehicles can be also estimated by using the average energy consumption value of 300 Wh/km, and calculated with a national emission factor of the energy production depending on the energy mix.

There are other possibilities for preparing detailed calculations. The British Department for Business, Energy and Industrial Strategy's publication on emissions monitoring and emission factors was published in June 2021 (DERFA, 2021). This document details the changes to the previous version of the emission factors and provide actual and overall values for any scopes of emission calculations.

Table 1: Density and GHG emission factors (Source: EN 16258:2012)

Type of fuel	Density	GHG emission factor			
		tank-to-wheels		well-to-wheels	
	[kg/l]	[$kgCO_{2e}$/kg]	[$kgCO_{2e}$/l]	[$kgCO_{2e}$/kg]	[$kgCO_{2e}$/l]
Gasoline	0.745	3.25	$GHG_{gas,\ ttw}$=2.42	3.86	$GHG_{gas,\ wtw}$=2.88
Diesel	0.832	3.21	$GHG_{dies,\ ttw}$=2.67	3.90	$GHG_{dies,\ wtw}$=3.24

The characteristics and scale of vehicle use depends on the profile of the company or organization, that is why realistic opportunities should be formulated for better carbon efficiency by reduction of the size of fleets or changing their composition. With the uptake of e-mobility options transport-related emissions would be reduced, and greater efficiency is achieved. Fulfillment of reduction targets will require more efforts to promote the use of alternative propulsion - including hybrid or pure electric- vehicles (Princz-Jakovics, 2022).

For the calculations of carbon emission savings input data are needed about the existing performance characteristics of the fleet: replaced fossil milage and replaced average fuel fossil consumptions of the gasoline or diesel vehicles depending on the main technological parameters of engines, driving habits, intensity of traffic etc. The assessment of carbon emissions has been made by taking into consideration these input values. However, it is important to note that some other factors could significantly modify the results of the calculations: drastic decline in the value of diesel cars over time, the fluctuation in the price of diesel, the subsidy for electric cars, the tax breaks and the reduction in range due to battery degradation.

Table 2: Model calculation of carbon emission savings for fleet renewals

Type of data	dimension	Value	Content
input	km	$FM_{gas,rep}$	replaced fossil milage (gasoline)
input	km	$FM_{dies,rep}$	replaced fossil milage (diesel)
input	litres/100 km	$AFFC_{gas,rep}$	replaced average fossil fuel consumption (gasoline)
input	litres/100 km	$AFFC_{dies,rep}$	replaced average fossil fuel consumption (diesel)

calculated	litres	$TFF_{gas,rep} = FM_{gas,rep} \times AFFC_{gas,rep} / 100$	total of fossil fuel replaced (gasoline)
calculated	litres	$TFF_{dies,rep} = FM_{dies,rep} \times AFFC_{dies,rep}/100$	total of fossil fuel replaced (diesel)
calculated	tonne	$CO_{2eq,\ rep} = (GHG_{gas,\ ttw} \times TFF_{gas,rep} + GHG_{dies,\ ttw} \times TFF_{dies,rep})/1000$	replaced CO_2 equivalent („Tank-to-wheels" approach)
calculated	tonne for 1 vehicle	$S\ CO_{2eq} = CO_{2\ eq}/TN$	Specific CO_2 equivalent („Tank-to-wheels" approach)
calculated	tonne	$CO_{2\ eq,\ ex} = CO_{2\ eq}/\ N_{ex,tot}$	decarbonisation by existing vehicles
calculated	tonne	$CO_{2\ eq,\ pl} = CO_{2\ eq}/\ N_{pl,tot}$	decarbonisation by vehicles planned to be purchased

Beside the transport related emissions, operation of the public fleet requires other activities. **Other activities** of the company, like operation of the site of the fleet (garages, services, charging points) can be also evaluated with using of GHG Protocol. Direct and indirect emissions depend on the number of service vehicle kilometers done with public vehicles and energy consumption and material flows of site buildings. The methodology for calculation of GHG emissions should be fitted to the complexity of the operation and availability of necessary input data.

3.2.2 Calculation of the Marginal Abatement Cost (MAC)

Identification of the Marginal Abatement Costs (MAC) of the fleet renewal options is also necessary for the strategic planning of interventions for higher level of electromobility. This gives the importance of **MAC** values and designates their role in environmental policy planning. From a social point of view, it is necessary to intervene as soon as the carbon emission targets can be fulfilled, because the external costs are significant. The state or local governments should take into account these abatement costs when planning financial support, because efficiency of such environmental related programs is a crucial sustainability factor.

The total gross cost of carbon saving options for hybrid or pure electric vehicles is given by the cost of acquiring the vehicles, implementation of the associated photovoltaic (PV) capacity and energy storage, optionally reduced by the price of the conventional vehicles sold.

The cost calculations are based on the following principles:

- acquisition costs are calculated as the main component of the total cost of ownership (TCO) based on the planned purchase of hybrid or pure electric vehicles;
- level of the operational costs can be optimized, which requires the availability of PV power generation for on-site vehicle charging,
- further additional investment, such as battery energy storage, can significantly increase the efficiency of the charging system (Princz-Jakovics, 2022).

For the calculation of the Marginal Abatement Cost values we need to estimate costs for 10 years as this is the useful lifetime of a public vehicle. The largest cost item of fleet renewals is the purchase of the vehicles and, if the necessary charging infrastructure is built, the proportional cost share of PV capacity and the cost of battery energy storage.

Table 3: Model calculation of MAC value calculation for fleet renewals

Type of data	**dimension**	**Value**	**Content**
input (from Table 2)	tonne	$CO_{2\,eq,\,pl} = CO_{2\,eq} / N_{pl,tot}$	decarbonisation by vehicles planned to be purchased
input	year	LT_{veh}	estimated lifetime of the vehicle
input	EUR	TCo_{pl}	total investment (procurement) cost of vehicles
calculated	EUR/tonne CO2/year	$MAC_{veh} = TCo_{pl} / CO_{2\,eq,\,pl} / LT_{veh}$	MAC value for a vehicle/year

3.2.3 Prioritization of the measures for fleet renewals

The representation of the MAC calculation results illustrates the challenge of prioritization of the replacement measures for different types of vehicles, see Figure 1. The most economical solution is the first option in this ranking. It has the lowest MAC value and this option (replacement of vehicle type 1) should be implemented first. However, this type of representation of the results can also highlight the most expensive options: in general, the use of in-house PV capacity and battery storage will cause high MAC values.

The calculation results are based on expert estimates and technical specifications of different vehicle types, which need to be refined during the detailed planning and decision preparation phase.

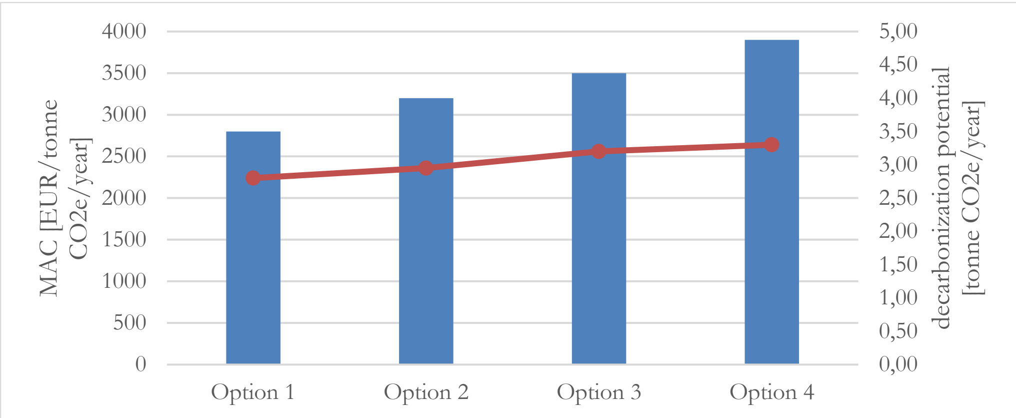

Figure 1: Sample for comparison of different types of options for fleet renewals

4. Evaluation of carbon-neutrality efforts

The carbon savings from fleet renewal interventions and the use of MAC values provide valuable inputs for the cost-benefit analysis of decarbonisation. A detailed assessment requires identification and comparison of costs and benefits at financial and societal levels. These calculations can be used as a basis for formulating proposals for further decision preparation activities to achieve carbon-neutrality until 2050.

4.1 Cost-Benefit Analysis (CBA) of the measures

In the planning phase of purchase of environmental friendly vehicles, a number of factors need to be considered together. The extent of the contribution to decarbonisation may also be an important factor, besides operational aspects and the financial possibilities available for fleet renewals. Due to difficulties at the automotive, commercial and logistical levels, the procurement of these vehicles can take longer time than before, ranging from six months to a full year for hybrid vehicles. Planning should therefore take into account the expected increase in purchase prices. It is recommended that the procurement decision should include projected carbon emission reduction and fuel savings to highlight both the climate and operational benefits of fleet renewals.

CBA is an important part of the project appraisal for such measures. The estimated costs and benefits of the fleet renewal options are compared first from financial perspective and then from social aspects. The social benefits are not realized by the operator, therefore these can be considered as positive externalities of the measures. In the analysis of costs and benefits the general principles (Mishan, 1971) have to be adjusted to this type of measures. For the elaboration of CBA the EU (COM, 2014) and the national guides for transport related projects can be used. The methodological challenges of the CBA as an assessment tool are found in Laird, Nash & Mackie, 2014.

Some aspects to be considered in the evaluation:

- the purchase cost of environmental friendly vehicles is expected to decrease in a longer term due to the declining battery prices. However, it should be mentioned that the future prices of the raw materials needed to produce EV batteries - including lithium - is uncertain. These costs are negatively affected by a number of factors: low mining volumes, fragmentation of supply chains, trade restrictions, etc., and by other factors that can reduce the average prices: continuous technological development and efficiency improvements. Taking all these factors into account, the combined effect of the above described trends is practically unpredictable;
- the financial benefits consist of fuel savings and lower service costs;
- the social benefits can be estimated using the unit cost value of the carbon emissions saved.

The results of the financial analysis of the measures can be used to determine whether the Net Present Value (NPV) is positive and therefore whether the measure is financially efficient. From a societal perspective, the carbon cost savings that can be achieved are the benefits, which may also justify the importance of stricter environmental regulations.

4.2 Methods of decarbonisation planning

The next methodological step is the planning of decarbonisation measures based on the GHG emissions of the fleet renewal options. Different types of offsets can be implemented, the most well-known offsetting measure with high decarbonization potential is using of an own PV (photovoltaic) system. The other forms of sequestration: by forestation and plantation of energy crops are not widely applicable. Further details about the methods of decarbonisation planning would be found in Pálvölgyi et al, 2022. For the calculation of **investment and operational costs of planned developments for hybrid and electric vehicle charging** a conservative estimate can be used: it is expected that the specific cost of PV investments will decrease due to falling solar panel prices.
As an additional measure, **charging of the environmentally friendly vehicles is an important element of the measures.** Expansion of the number of hybrid and purely electric vehicles will inflict higher charging needs, that is why increase of the capacity of the PV system is usually necessary. Depending on the characteristics of the electrical network additional investments, for example installation of battery energy storage, may be also required. The cost of such investment element is included into the total costs and 20-year-long useful lifetime can be given for PV and energy storage equipment. Therefore, the share of the electricity generated for the operation of the planned hybrid and pure electric vehicles needs to be assessed as a major factor in decarbonization planning.

4.3 Recommendations for further decision-making activities

Perhaps the most essential but least specific recommendation is the incorporation or naturalisation of long-term thinking amongst all stakeholders, private and public alike, including all tiers of governance. This requires, and is also the foundation of, strategic planning, which can help to efficiently facilitate a transition towards more sustainable practices. De-jure and de-facto legislative and policy contradictions within and between tiers of governance should be identified and resolved. This would include setting more accountable targets instead of vague goals, which should be negotiated and communicated with stakeholders both internal and external.
On a regional and local level, tighter governmental budgets limit strategic thinking, resulting in seemingly impulsive actions, an urge to get token or pet projects done in order to win favours with the electorate, and even mounting and crippling debt. Great disparities may exist in municipal revenue generation, especially if the structures of territorial governance are fragmented, with countless small municipalities. This effectively prevents the vast majority of municipalities, predominantly in Central and Eastern Europe, from autonomously investing in transportation alternatives (Princz-Jakovics, T. & Horváth, Gy. Á., 2020), as a substantial part of funding will be consumed by maintenance expenditures instead of investments. If national governments want to achieve sustainability in earnest, they will have to address such discrepancies on both the short run, by compensating low-income municipalities, and on the long run, by initiating structural changes, such as territorial governmental reforms.
Furthermore, calls-based or project-based funding is becoming the go-to method of municipal development financing. This allows key policy areas to receive the attention – and funding – they need, whilst demonstrating a potential for a more equitable and needs-based distribution of funds, and approximating an efficient allocation of financial resources. However, the total amount of development funding made available is often

limited to just cover global or European targets and nothing more, even though there would be interest and demand for further funding. This erodes the agility and determination of municipalities: rather than pursuing strategic objectives, they would rather apply for funding on practically any call within arm's reach, lest they miss out on getting anything at all. In turn, they will not readily engage in self-funding of development projects, or else they may lose eligibility on a future call, and spend scarce local funds on projects which could otherwise receive external funding, thus foregoing other projects. A seemingly inevitable consequence is hesitation.

Long-term strategic planning can help overcome these obstacles. First and foremost, long-term visionary thinking, one transcending political cycles should permeate all tiers of governance. Such visions for the future should be the outcome of broad democratic consultations, through meaningful social dialogue, which will serve as a basis of broader acceptance and support for such efforts by the stakeholder social groups. Strategic objectives should then be set in line with these visionary objectives, and in turn, project plans should be compiled in line with strategic objectives.

Presently, numerous strategic documents exist, including internationally standardised ones such as SUMPs and SECAPs, and others with or without international or domestic standards. However, it can be argued that in the case of numerous municipalities, the incentive for creating strategic documents is external, rather than endemic, which casts doubt on the commitment to these strategies. Voluntary participatory organizations, such as the previously mentioned Covenant of Mayors already exist, and governments can make good use of these for representation and consultation. Active and faithful broader participation should increasingly become the norm, rather than a serendipitous accident.

The method of decarbonisation planning we propose has many advantages, but also some limitations should be mentioned. One of the most important barriers is the need to collect and organise data at a sufficient level to be able to calculate real operating costs and key indicators. Costs are influenced by a number of factors that are beyond the control of local authorities: the availability of raw materials for the production of hybrid or electric vehicles slows down production, and there may be delays in procurement due to the constant demand for environmentally friendly vehicles.

5. Conclusion

In this paper, we gave an overview of the problems associated with conventional public service vehicle fleets, which have the greatest annual mileage and are thus crucially important polluters. We outlined the current state of the art both in government policy and assessment approaches and efforts. We identified that some degree of long-term thinking is now prevalent, but a genuinely systemic approach to fleet decarbonisation is yet to be seen. We also emphasized that in assessing decarbonisation efforts, an LCA-based, more holistic approach is beneficial, as considerable pollution may still occur elsewhere, even though local pollution may become negligible.

When the replacement of conventional internal combustion engine powered vehicles is due, it is advisable to commence this replacement operation with the highest fuel consumption, in order to minimise, and thus, optimise carbon emissions. Nevertheless, a timely phasing out of the remaining obsolete fleet is due soon after.

In the planning of the procurement of lower-emissions, net-zero emissions or locally non-polluting, (“green”) vehicles, it is essential that multiple aspects are considered simultaneously, including:

- the level that these measures contribute to decarbonisation efforts;
- the operational and functional usage of the vehicles;
- The scope and nature of available financial resources for fleet renewal.

The main theoretical contribution of this research paper is an assessment framework, which provides the essential data for decision makers and fleet operators, to be able to examine and quantify the long-term financial and decarbonisation effects of fleet rejuvenation efforts, i.e. that of vehicle procurement. In our study, we have highlighted the importance of increasing of the carbon efficiency of public fleets and provided a simplified method for applying the internationally accepted GHG Protocol in the mobility sector. We have highlighted the need to plan in terms of offsetting variables, alignment with strategic documents and follow an adequate preparation process of decarbonization projects. Compared to the literature, we have placed more emphasis on the calculation of social costs, as these inputs support the development of more favourable regulatory frameworks for the environment.

In advancing the strategic planning of interventions for a more advanced electromobility, the abatement costs of decarbonisation options must be identified. As a consequence, quantified Marginal Abatement Costs (MAC) can help the decision-makers pick the most appropriate and efficient approach, ideally not just in a financial context, but in a social and environmental one alike. These MACs ought to be used as a basis for planning supporting urban mobility policies. From a social aspect, it is necessary to act as soon as the carbon reduction targets can be fulfilled, due to the crippling external costs of carbon emissions. Governmental policy stakeholders on all levels should take these abatement costs into consideration when planning and requesting financial support, as the pursuit of efficiency in project financing from scarce taxpayer revenues is of paramount importance.

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