ANNEX 1: A QUICK GUIDE TO BATTERY ELECTRIC VEHICLES IN AID AND DEVELOPMENT SECTOR

Adoption, utilisation, end of life, economic and environmental life cycle | 'Exploring the applicability of BEV in Africa and the Middle East' | Project learnings/findings review 2022-2024

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BACKGROUND AND PROJECT OBJECTIVES

- Transport emissions are continuously on the rise on the planet, road transport and passengers vehicles are the main contributors to those emissions, those trends apply to the humanitarian and aid sector as well.

- The tactics to reduce transport emissions are captured in the Avoid, Shift ,Improve typology, fleet electrification pertains to the Improve lever, the one with minor effects on the achieving the overall goal.

- In absence of studies, literature, return on experience for BEV usage the middle east and Africa we've decided to collect facts and fill this gap.

- We have followed 36 BEV in middle east and Africa among 1st adopters humanitarian agencies and draw learnings on their utilisation, operability and their life cycle in those context of operations.

- The current document captures the main findings of this project that allowed to draw a set of recommendations to the broader sector, increasingly interested in the matter.

Disclaimer: providing an easy digest of an often-complex matter can lead decision makers and practitioners to overlook important issues, we invite you to read the full project report available here xxxx

REPORT SUMMARY

- The 'Avoid, Shift, Improve' typology is a recognized approach to reduce transport related emissions. Fleet electrification is one of the levers of reduction pertaining to the Improve category, and won't allow, alone, to achieve transport emission reduction objectives.

- BEV placement in the fleet should therefore be part of an organisation's broad emissions reduction strategy. Simply aiming at replacing current ICEV by a BEV equivalent, and perpetuating current fleet management practices (solely vehicle-centred) seems unlikely to deliver the maximal emissions reductions.

- Decision making around BEV placement in the fleet is a complex equation involving trade-offs and essentially driven by local factors (need for motorized transport, electricity grid…).

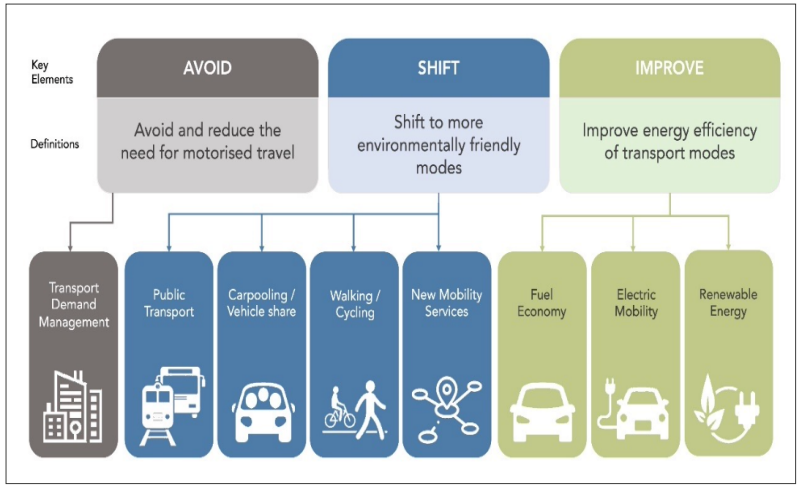
- Local collaborators should be equipped, capacitated and empowered to deal with the topic and its complexities (market surveillance, drivers' sensitization…), that would positively feed the sectors commitment to localisation and allow a better alignment on local sustainable transport trends than on 'imported' solutions.

- Conditional to a correct sizing and placement, BEV have overall a better co2 performance than ICEV, the breakeven is determined by both the co2 emission factor of the electricity and the intensity of usage given to the asset.

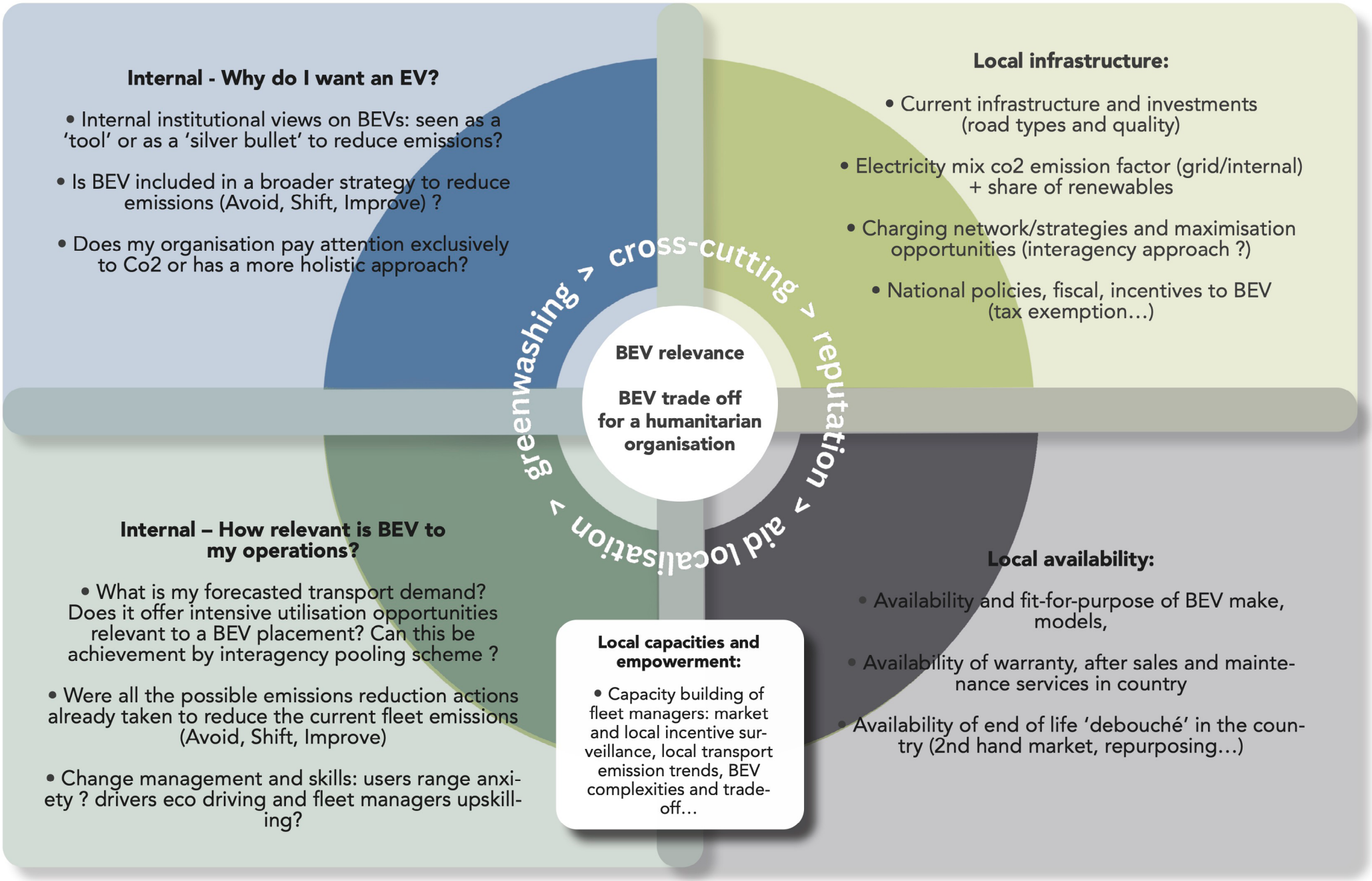
- Co2 eq. approach captures only one portion of the environmental footprint BEV are generating, adopting a more holistic approach to environmental management is recommendable to better gasp the externalities generated by production and end of life phases.

- A BEV battery is constituted of depleting resources and it recycling process still remains an unclosed loop. Rather than betting on the promise of infinite recycling, that information should induce prudence from BEV purchasers who should both limit the size of the battery procured (limit unnecessary resource depletion) and thoroughly place the assets on the demand segment that would generate the most environmental benefits.

- In order to face effectively and efficiently the challenges and risks induced by electrification, humanitarian organisations should actively engage into interagency collaborations (shared chargers, carpooling, ride-sharing). Such practice, by combining electrification with a strong transformation of the sector's mobility would allow an alignment with the Avoid, Shift, Improve typology and maximise impact.



A complex equation, not a silver bullet
What should be considered before making decision on BEV?



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ADOPTION PHASE

Speed read

The participating agencies first adopted BEV in the framework of achieving the emissions reductions they have committed to. They did so with the mindset of assessing the leverage such fleet electrification would provide to achieve their objectives, by simultaneously evaluating and building evidence on the acceptance and operability of such vehicles in their context of operations and by evaluating the change it would involve in their fleet management approaches to maximise their potential. Decisions to go electric although mainly driven by the global decision makers are very much conditioned by local considerations (share of renewables in the local electricity grid, local authorities' incentives…).

Early adoption by aid agencies involves assuming a series of risks (lack of evidence provided by literature and research in low- and medium-income countries…) as well as facing multiple constraints among which sourcing and procurement are at the centre (limited availability of such vehicles in the countries, necessity to manage importation, difficulties to standardise, non-systematic aftersales services and of warranty provision offered…).

RECOMMENDATIONS

Electrification is not enough

1: Placement of BEV should be part of a broader plan to reduce transport and mobility emissions in the organisation in order to ensure maximal emission reductions (Avoid, Shift, Improve)

2: Assess regularly your future mobility needs, and identify the most appropriate transport mode available to cover each specific need (public transport, active mobility…)

3: Move away from the 'army swiss knife' usage allowed by ICEV: consider BEV as a tool to cover specific segments of your mobility demand, not as a silver bullet replacing the ICEV.

4: Identify and tackle possible and fleet management negative practices before perpetuating them with BEV (right sizing, right profiling)

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Recommendations: Face complexities

5: Make the decision to go electric out of a complete contradictive debate, include plan and objectives, rather than on the gambling 'promise' that a BEV sole placement will reduce your fleet emissions.

6: Electrification is a rapidly evolving topic: establish surveillance mechanisms in your countries of operations: manufacturers/ distributors availability, electricity grid energy mix and co2 factor, local incentives…

7: Electrification is a local challenge, assessing BEV relevance in a given context is a complex exercise, decision-making involves trade-offs: such complexity shouldn't be avoided or over-simplified, local fleet management staff should be capacitated and empowered to deal with it.

8: Identify the most intensive utilisation segments of your transport demand to place a BEV in order to guarantee the fastest environmental and financial return on investment (that can be supported by pooling transport demand, internally or interagency).

9: Demonstrate whole life cycle considerations by incorporating battery end of life constraints in your adoption decision making.

10: Avoid fuelling greenwashing. In the case of communicating about the placement of BEV in the fleet, ensure that your organisation demonstrates prudence about the message sent, prefer the labelling of 'test vehicle' than 'zero emission vehicle' for example.

Recommendations: Procurement:

11: Procure locally to guarantee availability of warranty and repair and maintenance skills. In absence of local distributor, global procurement and/or
ad hoc procurement remain feasible on a case by case basis.

12: Include LCA requests in your procurement tenders.

13: A charger is usually procured separately than the BEV: take that in consideration at the moment of launching procurement and coordinating deliveries.

14: Avoid seeking the BEV with the biggest range capacity if that mileage is not representative of your transport demand, shorter segments might as well be more relevant.

15: Consider interagency collaboration to maximise benefits of electrification and flatten both the risks and investment curbs: pooling scheme, shared
chargers.

USE PHASE

Speed read

The BEV are operable and applicable in the context of operations where they have been placed by the participating agencies. That operability is a determining first step to achieve BEV placement broader objectives (emissions reductions), but yet it doesn't constitute alone a guarantee to achieve them.

Challenges faced by participating agencies in this phase are both human and technical. On the human side, BEV placement involve facing user's anxiety's (passengers wonder if the range will allow to arrive at destination, drivers face vehicles specific features…) while on the technical hand BEV placement induced reviewing and adapting the established fleet management practices by giving an increased importance to the type of 'usage' best-suited for the vehicle (identifying transport demand segments more suitable to BEV placement, strategizing charger's localisation, adjust journey allocation to range, include charging constraints in fleet planning…)

RECOMMENDATIONS

Utilisation:

1: Place the BEV in most intensive use segments of your transport demand: BEV utilisation should be maximal to ensure fastest environmental and financial return on investment (against its ICEV equivalent).

2: Take concrete actions to ensure maximised utilisation: clear instructions to dispatch BEV in priority against another more emissive asset.

3: Implement internal and interagency carpooling schemes in order to rationalise upstream transport demand.

4: Source chargers that are matching your BEV onboard charging specificities.

5: Pay attention to the type of charger you want to operate (single or multiple car, smart charging or manual tracking, RFID…).

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Recommendations: Utilisation:

6: Review your journeys patterns and develop a charging tactic (localisation of chargers in the country, availability of public chargers, possibility to share chargers…).

7: Assess and review how charging data will be transferred to your fleet management system.

Recommendations: Change management and upskilling:

8: Engage with passengers/users and communicate about the vehicle's features.

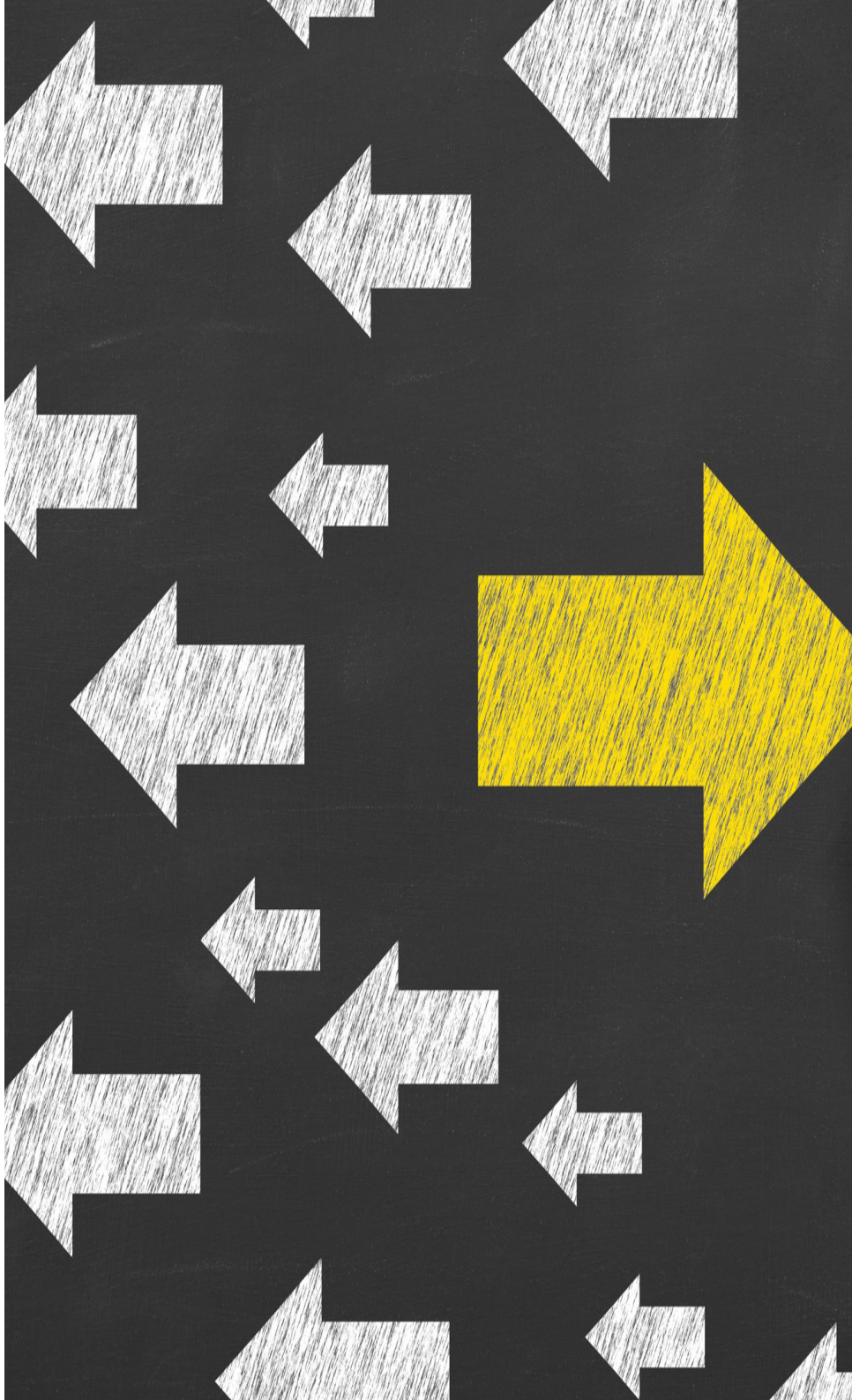
9: Systematize Eco-driving trainings and refreshers for drivers.

10: Ensure drivers are trained and familiar with the BEV specific features (regenerative braking…).

11: Ensure fleet managers have their knowledges, skills and capacities upgraded to the BEV technology.

12: Ensure fleet managers/dispatchers are allocating BEV to intensive use segments of transport demand.

13: Ensure fleet managers are trained to implement clear charging plans: journey allocation, route optimisation (not to jeopardize asset availability if not fully/properly charged).



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END OF LIFE PHASE

Speed read

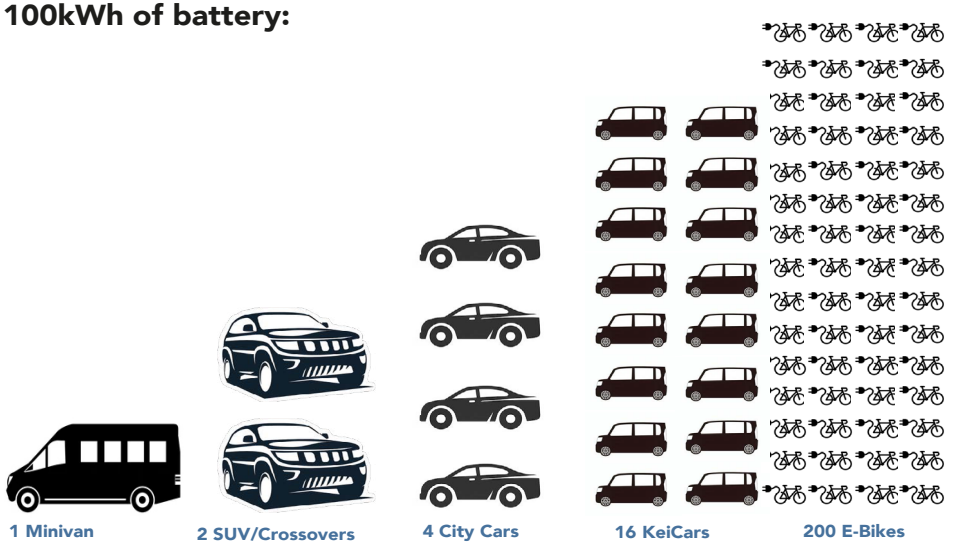
Participating agencies decommissioning practices, although evolving, are still very focused on the use phase of the asset and driven by economical and practical considerations (expected resale value on second hand market, extinction of the manufacturer's warranty period…). In the case of BEV the assets have been so recently placed in fleets that no conclusion yet has been drawn on what would be the optimal disposal standard and what resale value can be expected. The fleet electrification seems however to contribute to an increased attention given to the end of life phase of the vehicle and to move away from the still prevailing practices that 'a transfer of property is a transfer of responsibility'.

The battery pack constitutes the main value of the vehicle, and is therefore at the center of the trade-offs induced by inclusion of BEVs in a fleet: it size determines both the economical investment and the ecological damage induced by its production and end of life.

The battery recycling loop, despite improvements, is far from being closed as recycling rates of strategical depleting raw materials are very small, and the recycling market – although clearly instrumental to the BEV business model- is in a phase of consolidation.

Taking into considerations such end of life constraints in the initial decision making around BEV adoption seems instrumental.

Making sense of 100kWh of battery:



Type	Minivan (100 kWh)	SuV (50 hWh)	City Car (25 kWh)	Keicar / Minicar (6.5 kWh)	E-Bike (0.5 kWh)
Range (km)	360	260	165	80	60
Weight (kg)	2585	1440	1000	474	25
Passenger capacity (pax)	8	5	4	2	1
Unit cost (USD)	43.000	35.000	20.000	11.000	600

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RECOMMENDATIONS

Decommissioning standards:

1: Question your current decommissioning standards, regardless the type of vehicles concerned.

2: Integrate environment in your current decommissioning standards (that are still mainly driven by a sole economical approach).

Batteries recycling:

3: It's not only about the Co2. Be more holistic. Batteries are an illustration that electrification embarks more than co2 considerations: impact on water resources, human rights, resources depletion…

4: The battery recycling loop is not closed: be prudent at the moment of procuring and sizing a BEV (it is more effective to limit the mis usage of scarce resources at an early stage by procuring the smallest battery possible, than gambling on the fact that full recycling loop would be closed anytime soon).

5: Set up 2nd hand market surveillance mechanisms in the country of operation for BEV as well as for battery disposal and repurposing schemes. Assess what OEM /distributors offer on that matter (reverse logistics…).

6: The battery residual value depends on its charging cycles and the way the car was operated during its use phase: ensure drivers eco driving training and good charging practices are implemented.

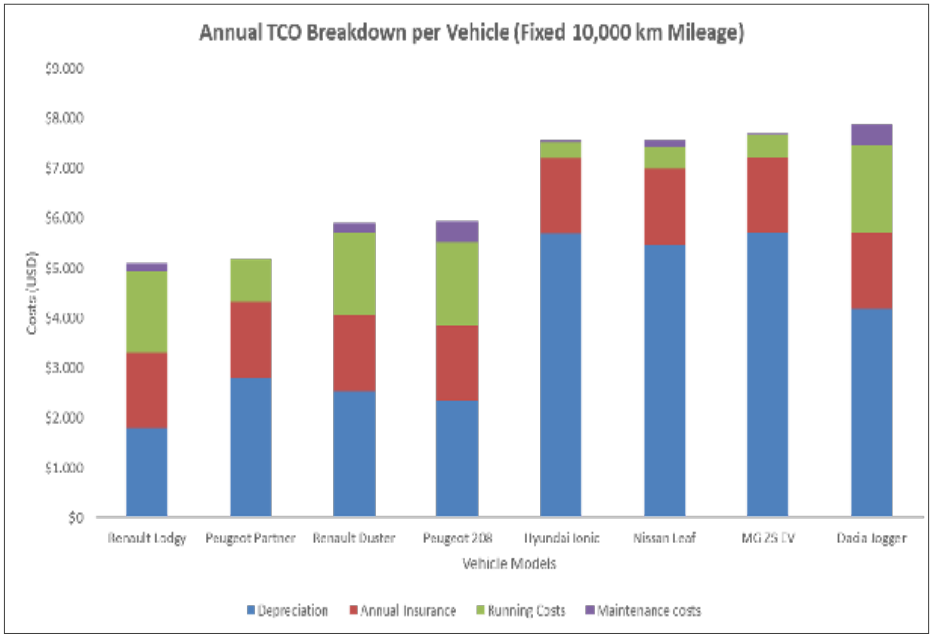
7: Include the use phase and end of life considerations in your BEV adoption phase, integrate it in your decision making.

FULL LIFE CYCLE FINDINGS

Speed read

Comparing BEV and ICEV could be considered as comparing apples and carrots and feed mistakenly the fantasy of readers that the simple replacement of a new technology by an older one would do the environmental job.

However, running this comparison still provided us with precious insights on the current fleet management practices, allowed to identify low hanging fruits to improve environmental performance and on how to best integrate BEV in an existing fleet.



The economical full life cycle review shows that the cost of operating a BEV is within the range of costs involved by operating an ICEV. Their purchase cost is the highest TCO component while there are still uncertainties around their residual value, their maintenance costs and in most cases their running costs are definitely reduced compared to an ICEV. Depending on the fleet profile where they are placed their economical relevance varies: breakeven can be achieved after few thousands of km if placed among 4x4 and can be up to 16000km if among light small ICEV. That brings to the conclusion that in many cases further down-profiling of ICEV can allow to achieve better economic and environmental improvements.

On the environmental full life cycle, the overall co2 performance of the BEV against an equivalent ICEV is better in most scenarios, with a breakeven achieved mainly depending on the electricity emission factor if the sole co2 eq. emissions are considered. It should be noted that co2 is not the only environmental externality and BEV can underperform in other categories.

RECOMMENDATIONS

Recommendations:

1: Systematize a 'full life cycle' approach in your informed decision making
(examples: include production and disposal phases considerations/ criterias to select vehicles; ask vehicles suppliers what end of life services do they offer; challenge your current disposal policies, often based on sole financial considerations (150000km/5years); consider procuring second hand to extend the lifespan of existing vehicles)

2: Implement and support the implementation of Avoid, Shift, Improve

3: Work at downsizing and downprofiling the size of your fleet

4: Embrace a more holistic approach than the sole co2 emissions angle

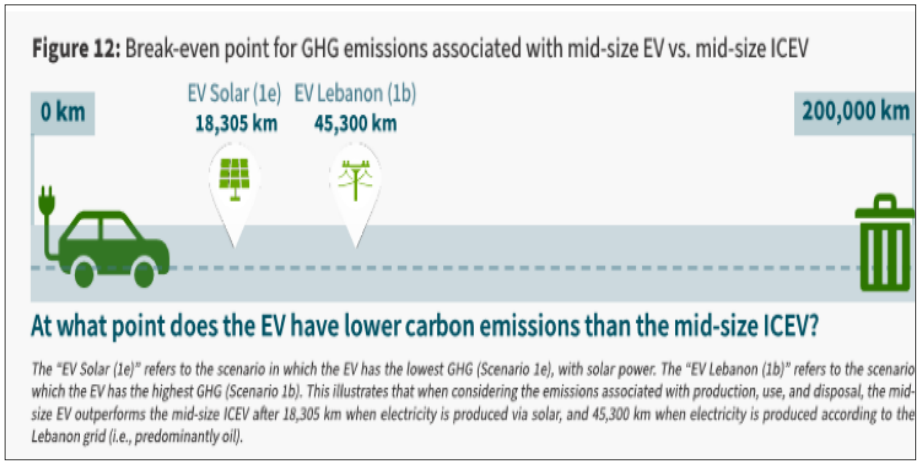
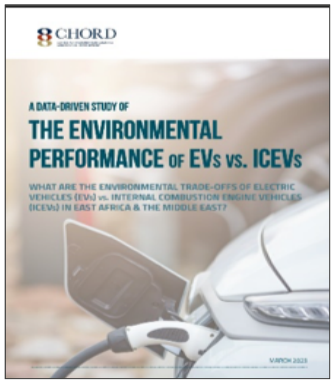


Figure 12: Break-even point for GHG emissions associated with mid-size EV vs. mid-size ICEV

Table 3: Carbon emissions associated with the production and disposal of each vehicle (kg CO_2 eq.)

Vehicle	Production	Disposal	Production & disposal
mid-size EV	10,530	444	10,974
mid-size ICEV	6,589	287	6,876
large ICEV	11,231	320	11,551



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Step by Step guidance

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1. Are we doing our best already to reduce transport and fleet related environmental impact?

- Do we have a fleet emission reduction plan? Does it follow: Avoid, Shift, Improve?
- What are we doing to reduce transport demand?
- Are we pooling transport demand (internal/interacency)?
- Did we run a rightsizing / right profiling excercise within the last 12 months?
- Are we aware about the risks and opportunities BEV represent?

Response: No
Action: 1st things 1st, start with the most impactful leverage to reduce fleet emissions.

Response: Low/limited opportunities
Action: Establish a market/local policies 'watch'. Things can evolve quickly.

Response: Yes
Action: It is legitimate to start considering electrification. Local readiness will now make the difference.

Response: Growing / high opportunities
Action: It is legitimate to start considering electrification.

2. What are the opportunities for electric mobility in my country of operations?

National policies /trends:

- Are the national policies incentive BEV? (Tax exemption...)
- Is the electricity mix Co2 emisison factor improving?
- Are road and charging infrastructures developing? Are there plans to do so? (Investment)

Availability:

- Are BEV available in the country? Are BEV warrenty, after sales services guaranteed in the country?
- Are BEV end of life options exist in the country?

3. We are moving to BEV, what should we bear in mind?

- Source the smallest car/battery pack necessary to your transport needs
- Develop a charging tactic and source the most suitable charger
- Place BEV on the most intensive transport demand segments
- Upskill drivers and fleet managers