

CLIMATE CHANGE AND ENVIRONMENT IN THE ARAB WORLD PROGRAM

Sustainable Transport Series

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Harnessing Motorists' Potential Demand for Hybrid- Electric Vehicles in Lebanon: Policy Options, CO₂ Emissions Reduction and Welfare Gains

Summary

A Choice Experiment conducted in Lebanon attests that under the assumption of tax exemptions and excise duties of hybrid-electric vehicles (following the 2010 suggested tax amendments by the Lebanese Ministry of Finance), car buyers would actually be saving \$5,100 by buying a hybrid-electric instead of a conventional gasoline vehicle and would enjoy a 30.5% reduction in fuel consumption and 20.5% CO₂ emission reduction per car per year, putting the yearly net benefit at a high of \$5,684 per brand new car sale. This would lead to total fuel cost savings of \$16,016,000 and 19,600 tons of reduced CO₂ emissions per year.

Recommendations

- Additional financial and non-financial measures are required for the creation of a thriving hybrid-electric vehicles (HEV) market in Lebanon as proposed in MoE et al. (2012).
 - » Extending tax (e.g. VAT) exemptions on HEV spare parts (e.g. battery and electric motor) which are known to be expensive and potential deterrents both to suppliers and buyers.
 - » Exempt buyers from the relatively high registration fees
 - » Providing buyers with preferential loan conditions (e.g. extension of loan repayment periods, reduced loan interest or full subsidy on loan interests for heavy mileage motorists such as taxi drivers).
 - » Reconsidering road-usage fees according to fuel efficiency and emissions instead of engine displacement would be considered a key incentive as well.
 - » The importance of raising citizens' awareness about critical issues such as climate change, air quality degradation and potential mitigation measures and strategies dealing with these problems (of which HEVs are but one example). This may help shift preferences in favor of HEVs, with the welcome side-effect of relieving part of the need for fiscal and financial incentives to promote the demand for hybrid and other types of clean-fuel vehicles.

The Climate Change and Environment in the Arab World Program aims to understand the climate change and environment policy process in the region and define the most appropriate policy recommendations by linking development in applied sciences on issues related to climate change and environment to social sciences.

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Problem Statement and Key Messages

Air quality degradation is linked first and foremost to the transportation sector in the Arab region with about 90% of total emissions of carbon monoxide resulting from transportation activities (Chaaban, 2008). In Lebanon's capital, Beirut, current measured levels of ozone and smog are several times higher than the world norms. Indeed Lebanon had an estimated 1.55 million registered vehicles in 2007, of which 1.25 million are passenger vehicles (MoE et al., 2011), and a relatively elevated vehicle ownership rate of around 1 vehicle for every 3 persons (MoE et al., 2012). Motorists along the highway north of Beirut are exposed to air concentrations of $22 \mu\text{g}/\text{m}^3$ of fine particulate matter ($\text{PM}_{2.5}$), twice the acceptable level set by the World Health Organization (WHO), increasing the probability of death by 20% (Baalbaki et al., 2013). According to Chaaban et al. (2001), a reduction of $10 \mu\text{g}/\text{m}^3$ in particulates (PM_{10}) could save 80 lives per year, prevent 3000 hospital admissions and lead to overall estimated cost reductions of around \$10 million of which \$5.4 million are pure medical costs.

Therefore passenger vehicles would be a very worthwhile focus for policy interventions aiming to reduce all manner of transport-related emissions. A new study by AUB researchers investigates motorists' preferences for, and propensity to purchase, HEVs and their readiness to switch to them by means of a survey-based behavioral model of transport mode choice and hence indirectly gauge the value that they place on air quality.

The Viability of an HEV Market in Lebanon

In an effort partially to mitigate air quality degradation caused by the transportation sector, the Lebanese government enforced Law 341 in 2003 that banned the use of industrial diesel for transportation, and also banned leaded fuel. However, the need to consolidate and enforce programs and policies associated with Law 341/2001 on reducing air pollution from the transportation sector is not being seriously addressed. In its 2010 budget proposal, the Ministry of Finance (MoF), under the suggested tax revenue amendments, included Article 83 which states that HEVs would be exempt at imports from custom duties and excises for a period of three years, but the suggested amendment has not seen the light of day yet.

Partial tax cuts would provide a win-win situation for both government and vehicle buyers.

Of the range of available clean-fuel vehicles, HEVs stand out as they are the closest to conventional gasoline vehicles, and hence a motorist's decision to switch to them would be a smooth and straightforward affair. HEVs combine an electric motor and battery pack to the internal combustion engine found in conventional vehicles. They do not require additional infrastructure investments or changes such as electrical grid modification or special fuelling stations. Key advantages of HEVs over conventional and comparably clean and efficient technologies (clean diesel, compressed natural gas) include: 1) reduced emissions of air pollutants; 2) substantial decreases in fuel consumption; 3) in most cases, lower cost of purchase, fuel and maintenance despite their higher initial costs and 4) being stepping stone technologies to the large-scale electrification of fleets and the subsequent reduction of road transport CO_2 emissions.

The authors suggest that a potential mitigation measure to rampant air quality degradation, although not sufficient on its own, is the promotion of HEVs that stand out in the range of zero- and/or low emissions clean-fuel vehicles as they do not require any behavioral change on the motorists' side or additional infrastructure investments from the public sector side. In addition to the resulting fuel cost savings and CO_2 emissions reductions, HEVs can contribute to the restoration of air quality in Beirut and Lebanon as a whole.

Tax incentives Can Lead to a Viable HEV Market, Decrease CO₂ Emissions and Generate Welfare Gains

A choice experiment (CE) was designed to elicit a sample of 450 motorists' preferences for, and propensity to purchase, HEVs and their readiness to switch to them and hence indirectly estimates the value that they place on air quality. To better understand the implications of motorists' willingness to switch to HEVs in terms of motorists' welfare, reduced CO₂ emissions, and policy-making, probabilistic outputs obtained from a survey-based behavioral model of transport mode choice described by the CE data are used to simulate the share of motorists who would purchase an HEV. Model outputs were used to simulate aggregate switching behavior under four alternative scenarios of financial incentives that range from a do-nothing scenario to full custom and excise exemptions to discounted taxes and registration fee waivers. From these probabilities, the following results were simulated: the average fuel consumption reduction, CO₂ emissions reduction, net financial benefits composed of the monetized fuel consumption savings minus the additional cost of purchasing an HEV, social benefits from reduced CO₂ emissions and the resulting total net benefits, all expressed per year and per brand new vehicle sale.

The Simulated Scenarios Included

Scenario 1 – This scenario assumes that an HEV market exists in Lebanon where both hybrid and conventional gasoline vehicles face the same current custom and excise tax system. Motorists are perfectly informed of all customs/taxes that apply to purchasing HEVs, the higher maintenance costs they face and their lower emissions. They are however unaware of their higher fuel efficiency.

Scenario 2 – The same conditions as Scenario 1 apply except for the fact that motorists are aware of the higher fuel efficiency of HEVs.

Scenario 3 – HEVs are exempt from custom and excise taxes, as per the MoF's suggested tax revenue amendments.

Scenario 4 – HEVs are subject to a 50% discount on combined custom and excise taxes and are exempt from vehicle registration fees.

It is clear from the results of the first two scenarios that incentives need to be offered to establish a viable HEV market in Lebanon. Accordingly, this is reflected in scenarios 3 and 4 that simulate the impact of short term and long term policy measures. Scenario 3 simulates the impact of implementing the suggested tax revenue amendments by MoF in Article 83 which states that HEVs would be exempt at import from custom duties and excises for a period of three years. Given the consequential tax exemptions, this scenario is clearly the most rewarding to motorists as is revealed in the fuel consumption reduction of 30.9%, fuel savings amounting to \$572/vehicle sale/year and emissions reduction of 19.2%. Finally, after having established an HEV market, the government will need to switch to a long-term policy where excise and custom taxes are partially restored. This is depicted in Scenario 4 where motorists benefit from a 50% discount on excise and custom taxes, a win-win situation for both buyers and the government. Under this scenario, a slight drop is witnessed in fuel cost reductions (29.1%), fuel cost savings (\$533/vehicle sale/year) and CO₂ emission reductions (19.2%). Buyers would be subject to a minimal average additional cost per brand new vehicle sale for HEVs amounting to a mere \$282 and would require only six months to break even on their investment by means of fuel savings. A key incentive in this scenario is the exemption from vehicle registration fees which are relatively expensive in Lebanon compared to other countries and are potentially more so for HEVs.

The Issam Fares Institute for Public Policy and International Affairs (IFI) at the American University of Beirut (AUB)

was inaugurated in 2006 to harness the policy-related research of AUB's internationally respected faculty and other scholars, in order to contribute positively to Arab policy-making and international relations. IFI is a neutral, dynamic, civil, and open space that brings together people representing all viewpoints in society. It aims to: raise the quality of public policy-related debate and decision-making in the Arab World and abroad; enhance the Arab World's input into international affairs; and, enrich the quality of interaction among scholars, officials and civil society actors in the Middle East and abroad.



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Given a yearly average of 35,000 brand new vehicle sales in Lebanon (BankMed S.A.L., 2013), and to the extent that our results could be generalized to the whole of Lebanon, national aggregate figures were derived for this scenario and reveal aggregate fuel cost savings amounting to \$18.66 million, which more than compensate the added cost of purchasing HEVs (\$9.87 million), resulting in net private gains of \$8.79 million. In terms of environmental impact represented by CO₂ emissions reductions, these amount to 23,100 tons of avoided CO₂ emissions. With total emissions in the region of 20 million tons, of which the transportation sector contributes about 4 million, Scenario 4 would contribute a 0.12% reduction of total emissions, and 0.58% from transportation emissions proper. As for the social benefit from reduced CO₂ emissions, it is estimated to reach \$392,000/year, raising aggregate net benefits further to around \$9.18 million/year.

Conclusions

- HEVs were selected as they are the closest to conventional gasoline vehicles and accordingly a motorist's decision to purchase them would be smooth and straight-forward.
- The scenario which assumed that HEVs were exempt from customs and excise taxes was the most rewarding to motorists in terms of cheaper purchase price and reductions in fuel consumption and had the highest environmental impact.
- The endorsement of Article 83 proposed by the MoF in 2010 is crucial for the development of an HEV market in Lebanon.
- The mentioned custom and excise tax exemptions seem to be necessary to stimulate initial interest both from the consumer and supply sides, in spite of their three-year period. This transitory phase can be followed by a more sustainable one which would include partial tax discounts, following the example of Jordan, which now hosts around 30,000 hybrid vehicles due to the generous tax cuts HEVs benefit from (Obeidat, 2014).
 - » Partial tax cuts would provide a win-win situation for both government and vehicle buyers, and would almost maintain fuel cost and CO₂ emission reductions. Buyers would be subject to a minimal price premium on HEVs that would require a few months to recoup by means of fuel cost savings.
 - » They would enjoy significant but slightly lower reductions in fuel consumption.
 - » In this case the government would only be foregoing 50% of its custom and excise tax revenues, rendering it a sustainable long-term policy that would effectively abate air quality degradation without emptying public coffers.