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Introduction

- Increase in oil prices (permanent)
- Reduction in the manufacturing cost
- Increases battery life
- Concern over climate change

The EV as an alternative to ICE

- Measures to promote electric vehicles by different public bodies
- The aim of the presentation is to review the main (economic) barriers to the introduction of electric vehicles and main policy measures to overcome





Advantages and disadvantages of electric vehicles

- Advantages
 - Greater energy efficiency (Ahman, 2001)
 - Reduction in greenhouse gas emissions
 - Depends on the technology mix in electricity generation (Hadley and Tsvetkova, 2009)
 - Improved air quality (in cities) and noise pollution
- Disadvantages
 - More expensive than ICE (at least buying)
 - Low demand
 - Low reduction of greenhouse gas emissions





Main (economic) barriers of electric barriers







Need a charging network

- Different types of recharge:
 - Level 1: Slow recharge at home (500-2500\$)
 - Level 2: Fast recharge (shopping centers, hypermarkets,...) (2000-8000\$)
 - Level 3: Hyper-fast (like a petrol station) (40000-75000\$)
- Is the "swapping" a viable alternative?
- Elements to consider in a charging network
 - Information flow (GPS, mobile phones,...)
 - Standardization
 - Smart grid
 - Cost of recharging points and electricity prices, is feasible?





Need a charging network

- What has been done since public policy?
- Direct public subsidies for slow recharge points
 - USA: 2000\$ to electric vehicle owners and public networks
 - Europe: UK (2010), France (2012), Italy (2012), Spain (2012) Holland (2012)
 - Japan: private firm association CHAdeMo (Charge Move), formed by Toyota, Nissan, Mitsubishi, Fuji Heavy Industry and Tokyo Electric Power Company
- Bernardo, Borrell and Perdiguero (2014): A network of super-fast recharge is economically viable if there is sufficient demand (penetration of electric vehicles around 3%)





Stimulate demand for electric vehicle

- The purchase price is higher than an ICE vehicle (even after subsidies). The cost of the battery is the key.
- The public sector try to reduce the purchase price
- USA: Gallagher and Muehlegger (2011), 2.000\$ between 2000 and 2005; and a variable credit (650-3.150\$) from 2006, limited to 60.000 units.
- Canada: Government of Ontario (2010) subsidy between 4.895 and 8.321\$
- Europe: 1) Exempts of registration tax 2) Exempts of road tax 3) Direct subsidy (1.400-6.000€) 4) Deductions on income tax
- Other countries: Israel (inverse relationship between tax level and the degree of contamination), China (7.300\$), Japan (1.000.000¥) or Delhi (15% discount)...





Stimulate demand for electric vehicle

- Although the articles indicate a strong impact (Diamond (2009) reported an increase of 18% for USA, and Chandra et al. (2010) 26% for Canada), I am skeptical
- "Cash for Clunkers" like example
- But, there are alternatives:
 - Tighten pollution standards for vehicle manufacturers (Transport and Environment, 2009)
 - Increase taxes on fuel, particularly in countries with low taxes (Spain, United States,...)
 - Encourage vehicle fleets (taxis, buses, delivery companies, mail firms, ...)
 - Battery leasing (Renault)
- The key is decrease the manufacturing cost





R&D policies

- Batteries: size, weight and energy density
- International Energy Agency (2008): Lithium batteries have between 2012-2015 a cost of \$ 300-600 per kWh. A 20kWh battery between \$ 6,000-12,000.
- USA: American Recovery and Reinvestment Act (ARRA), Partnership for a New Generation of Vehicles (PNGV), FreedomCAR, Advanced Research Projects Agency (ARPA-E)
- Europe: JOULE I and II to among others European Electric Road Vehicle Association (AVERE) or Association of Cities Interested in the Use of Electric Vehicles (CITELEC)





R&D policies

- Japan: Ministry of International Trade and Industry very active since 1971 (Ahman, 2006)
- China: 1.46 billion dollars to help the auto industry carry out technological innovation projects (Brown et al., 2010)
- Increased collaboration between the producers of batteries and vehicles
- Two additional elements: reliability and recycling





Programmes of sustainable road mobility

- A reduction in the time and financial costs of travel
 - Permission for electric vehicles to use the High Occupancy Vehicle (HOV) lanes
 - Differentiation in tolls charged according to levels of contamination
- Establishment of "Park & Ride" sites at interchanges
 - Meier-Eisenmann et al (2001) Swiss canton of Ticino (82% of four-wheeled electric vehicles use the parking areas reserved specifically for them)





And, with the crisis?

- Difficult to meet the programs, with a high cost, promised
- Difficult to increase spending in the future
- Greater scope for measures that do not involve spending
 - Stricter environmental regulation
 - Stricter pollution standards for ICE
 - Increase fuel taxes ("green taxes")
- Collaboration between companies and governments (Japan as an example)
- Distribution of risks and benefits





Conclusions

- Electric vehicles can be an alternative to ICE
- Technological development as a key to the introduction of electric vehicles (public support)
 - Lower costs of the vehicle => Increased demand=> viable network recharging
- Inefficiency of direct subsidies for slow recharge points or purchase green vehicles
- With the crisis, more difficult to implement expenditure policies
- Collaboration between companies and public administration



Thank you!

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