

Why does public policy matter? Why are government interventions needed, and how should these be shaped? In this lecture, we focused on the first question: why should government intervene to stimulate electric mobility?

## Justification

In a democratic society, *government intervention* must be justified. It is not enough to specify the problem to be solved and the goal to be reached. We must also ascertain the *public interest* at stake. Public interests are, for example, concerned with public health and safety, and protecting the weakest members of society. Government is in place to *defend* public interests and *safeguard* public values. We see governments around the world embracing electric mobility as a solution or part of the solution to a wide range of problems where the public interest is at stake. Which problems then are electric vehicles supposed to solve?

## Public health policy

*Air quality* is a serious challenge in many cities today. Road traffic is a major cause of urban *air pollution*, as the car exhaust fumes of conventional cars, trucks, and buses contain many *compounds that affect our health*, including NO<sub>x</sub> and particulate emissions. NO<sub>x</sub> refers to both nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub>), which contribute to the formation of smog and acid rain.

Internal combustion engines on diesel and gasoline also emit fine particulate matter in the form of soot. Chronic *exposure to particulates* in ambient air leads to a number of *health risks*. All types of very fine particulate matter can penetrate



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deeply into sensitive lung tissue and damage it, not only causing or worsening respiratory diseases, such as emphysema or bronchitis, but also affecting the cardiovascular system and aggravating existing heart disease.

Research of the [Joint Research Center](#) and the [World Health Organization](#) shows that, on average, traffic is the biggest source of air pollution worldwide, responsible for one-quarter of particulate matter in the air. So, now you understand why governments around the world are embracing electric vehicles. Electric vehicles are emission free, and moreover, they are silent, and hence bring major improvement to the ambient air quality and the liveability of the urban environment.

The importance of this improvement cannot be underestimated, when you realize that already more than 50% of the world's population lives in cities and that, between today and 2050, the population in urban regions will increase with 2.5 billion people.

## Climate change policy

Conventional vehicles not only emit NOx and particulates. The combustion of hydrocarbons also results in *carbon dioxide emissions*. Carbon dioxide is by far the biggest contributor to the phenomenon of *man-made climate change*. In December 2015, the United Nations Framework Convention on Climate Change (UNFCCC) adopted the so-called Paris climate agreement, which entails a commitment to keeping the *global temperature rise* this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even



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further to 1.5 degrees Celsius. The *threat of global warming* is another reason why governments are interested in emission-free electric mobility.



Figure: Logo for the 2015 UN Climate Change Conference in Paris

Within the framework of the Paris climate agreement, many countries also signed the [Paris Declaration on Electro-Mobility and Climate Change & Call to Action](#).

These countries strive to have at least 20% of all vehicles on the road to be electrically powered by 2030. Now you may object that electric vehicles may cause indirect emissions at the site where electricity is produced, and you are right. You should realize, however, that it is a lot more cost-efficient to remove CO<sub>2</sub> from the flue gas of a large power plant than to handle the distributed emissions of millions of vehicles on the road. And by the way, even if electricity is made from coal, the [well-to-wheel emissions](#) of fully electric vehicles are still lower than those of vehicles using fossil fueled internal combustion engines. Moreover, as more and more electricity is being generated from renewable energy resources, the *carbon footprint* of the electric power system itself should gradually be decreasing.



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## Energy policy

All societies are powered by energy, and the share of electricity in energy use is increasing. Besides the environmental quality of the electricity production mix, with the risk of adverse public health and climate change effects, governments are also concerned about the *long-term security of energy supply*. These concerns explain why governments stimulate the exploitation of renewable energy resources, especially *hydro, solar and wind*. Electricity from these sources is emission-free in both generation and end-use. Unfortunately, the *supply* of most renewable energy sources is variable. Hydro power is subject to *seasonal fluctuations* and may suffer from years of drought. Solar and wind energy do not only vary by season, but also show strong daily and even shorter fluctuations. In other words, a power system with a large share of variable renewable sources needs a lot of *flexible standby capacity* to cover for periods when sun, wind and hydro cannot deliver. However, standby generation capacity is often gas-powered, which is not only expensive, it also eliminates part of the environmental benefit of the renewable power system. The alternative is to solicit demand response from the electricity end-users: the concept here is that variations in the supply of electricity from renewable sources are matched by flexibility in electricity demand.

Now, this is where electric vehicles come in: a huge *flexibility potential* on the demand side can in the future be unleashed by *controlled charging* of their batteries, that is, in response to the fluctuating supply of electricity from renewable sources. This strategy is also known as *Grid-to-Vehicle (G2V) steering or smart charging*. At the same time, the combined batteries of electric vehicles represent



a substantial storage potential, so that Vehicle-to-Grid (V2G) services are also possible: the batteries can supply power to the grid during times when renewable sources fall short.

Policy domain	Policy goal	Specific policy targets
Public health (& environment)	Air quality	Limit NOx, Sox, particulate emissions
Climate change	Limit global warming	Reduce greenhouse gas emissions, esp. CO <sub>2</sub>
Energy	Energy security/affordability	Renewable energy sources, energy efficiency and decarbonisation
Transport	Mobility/accessibility	Reduce congestion and ensure an efficient decarbonised transport system
Economy	Increase social welfare	Ensure competitive technology/industry, create jobs

Table: Overview of policy domains, goals and specific targets in which electric vehicles can contribute

## Mobility policy

Transport of persons and goods is a key factor of *economic value creation* in any society. The transport policy maker will want to know if electric vehicles will be able to perform the same duties as conventional vehicles. Will electric vehicles change mobility patterns, and how? What refuelling infrastructure will be required? Just recharging for battery electric vehicles, or hydrogen refuelling for fuel cell electric vehicles, or both? In modern societies, car use is considered a key element of individual freedom. Any interference with this freedom is politically sensitive.



Yet, policy makers are challenged to accommodate *future mobility needs* in a responsible way, that is: efficient, clean, affordable and inclusive. However, using a car does not necessarily imply owning a car. In western societies, the young urban generation is more and more inclined to *car sharing* and to using Uber-type services, if they are not walking, biking or using public transport. The electrification of cars also gives a spur to autonomous, self-driving vehicles. In the future, cities may thus be able to reduce the space for car parks. Anyway, the future of mobility with electric cars holds a lot of promise for improving the liveability of the urban environment.

## Economic policy

*Economic growth* is probably the most important objective of economic policy, in order to create more *welfare* for society. In view of the challenges posed by climate change and the transition to a sustainable energy system, the new economic policy mantra is “*green growth*”. It is in this perspective that policies to support electric mobility may be designed. Just as an example: in its R&D programs, the European Commission has for years been striving to establish a strong European technology position in battery technology.



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