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Rest in peace Moped, electric scooters are there

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In the last decade two-wheeler electric vehicles have been taking over the streets of Asian capitals, to the point that it is time to declare the gas moped commercially dead. Rest in peace.

While in the western world electromobility remains the domain of a technological elite, it has already arrived to the masses in Asia. China counts over 180 millions e-bikers and produced nearly 37 millions e-bikes in 2013[2]. There, 450 millions bicycle users are waiting to buy an e-bike as their next mean of transport[3]. In all South-East Asia countries where driving a two-wheeler vehicle is more popular than driving cars, electric vehicles are displacing gas vehicles as the dominant mode of urban transportation.

Two-wheel electric vehicles come in different kinds[4]. If it has pedals, then it is called an electric bicycle, the equivalent of a moped. Otherwise it is called an electric scooter. It is dignified to the motorbike category if its top speed is above some legal limit -- 50km/h here in Vietnam. All are powered by batteries which are reloaded by plugging into a domestic wall socket, demonstrating that the need for a dedicated charging infrastructure was a myth.

The advantages of this mean of transportation are that it generally does not require a driving license, is faster than a bicycle, more convenient than bus and cheaper than a motorbike. Indeed the average e-bike in Asia costs only 167$. The market is very different in the western world, where the average e-bike costs 800$ in the USA and 1,500$ in EU[5]. The savings on fuel costs are also real, even in a dirt cheap oil year.

In some places electric two wheelers have an image issue, as the first segment to have taken the market is e-bikes designed for high schoolers. But producers upgrade technology and design every year. For example, for 720$ in Vietnam one can have the electric scooter illustrated on Figure 1, which goes up to 50km/h, carries two adults thanks to a 1200W power motor, has a 100km range and copies the design of the Vespa Primavera, an iconic Italian model. This cost is about the average monthly salary in Hanoi, or six times the monthly minimum wage in Vietnam.

As the technological frontier moves, the market shifts from basic e-bikes --who already pushed out the good old gas moped into obsolescence-- to bigger electric scooters. This is mostly happening without government subsidies or targeted policy. The market shifts because there is demand and technological progress. The demand pull is allowed by light regulatory constraints, in contrast with motorcycles which are more heavily regulated, not to say squarely banned from some downtown streets in many Chinese cities.

The number of road accidents with e-bikes and e-scooters can only increase a lot, along with the popularity of these vehicles. The accumulation of risk factors to the drivers is worrying, they include: teenage, no driving license, riding a vehicle with high acceleration, high speed, wearing no protection, riding in urban traffic, weakly enforced vehicles standards and traffic regulations. Risk factors to others also include: no registration make it easier to run away after hitting someone, the use of the bikes lanes endangers slower traffic. There is a controversy about the low noise of electric vehicles: pedestrians can't hear them coming. Most available studies look at electric or hybrid cars, not at two wheelers, and the other risk factors listed above make it difficult to determine causality, and conclude with robust confidence that silence is a risk factor. I would prefer to make the rest of the traffic quieter than to make the electric vehicles louder.

Is this technological shift a good thing for the environment? Electricity is not yet so green everywhere. More advanced chargers and systems are required to make the electric vehicles a part of the smart grid. Another problem which remains to be managed is that the most popular models have a lead-acid battery. Lead pollutes, especially in countries where the recycling system is inefficient, and each battery contains 10kg of it.

But at the city scale, the environmental benefits are clear: the e-vehicles are silent and release no exhaust fumes. The advantages regarding the local air quality are especially important in Asian capitals, which are the most polluted cities in the world. According to our estimates[6], a typical gas scooter emits 0.1g of fine particulates per kilometer, or 400g per year. A typical electric scooter causes ten times less emissions, in a country like Vietnam where half of the electricity comes from coal.

The market cannot be trusted to produce lighter and cleaner gas vehicles. The switch to electric two wheelers and cleaner power appears a more powerful way to solve the Asian cities air quality crisis.

Illustration 1. Photo credit: Author

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[2] INSG Insight (September 2014 - No.23) The Global E-bike Market

[3] J. Weinert, C. Ma, and C. Cherry, "The Transition to Electric Bikes in China: History and Key Reasons for Rapid Growth," (2007). DOI : 10.1007/s11116-007-9118-8

[4] Xuan Truong Nguyen, Quang Hung Nguyen. SERVICE ISSUES: overview of electric vehicles use in Vietnam. *Armand Peugeot Chair International Conference: 3 rd Electromobility Challenging Issues*, Dec 2015, Singapore, Singapore. 2015, <https://sites.google.com/a/essec.edu/electromobility-challenging-issues-2015/>. <hal-01239618>

[5] Pike research

[6] Fine particles (PM10) emissions factor for an average asian four strokes motorcycle is 0.1g/km . Driven 4000 km per year, that is 400g of pollution per year. Fine particles (PM10) emissions factor for the average vietnamese coal power plant are estimated to be around 0.45 - 2 g/kWh. Let us take 1 g/kWh for coal plants, and 0.5 g/kWh systemwide, since the rest is hydro or gas. Figure 1's motorbike (bigger than most sold) uses 2kWh / 100 km. Over a year, that is 40g of pollution.