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Plugged in to the future

Will electric cars ever take over our roads, or are they too pricey and too tricky to charge? A select fleet of drivers in Oxford and London has been testing a prototype electric Mini. So were they won over? **Leo Hickman** takes one for a spin and finds out

On 6 July last year, the US Patents and Trademark Office in Virginia received an application from General Motors to trademark the term "range anxiety". With just a few months to go before GM was set to launch its much-anticipated Chevy Volt - a plug-in hybrid, which would go on to earn the title of "most fuel-efficient compact car in the US" - the company's marketing team was on the offensive. It knew that prospective buyers would need to be convinced early on that the Volt would not have a limited range, as has proved the case with standard electric cars.

"It's something we call 'range anxiety' - and it's real," explained Joel Ewanick, GM's head of marketing, when quizzed about the trademark application by car gossip website Jalopnik.com. "We're going to position this as a car first and electric second . . . People do not want to be stranded on the way home from work."

"Range anxiety" is very much on my own mind as I traverse the M40 between London and Oxford at 70mph in a prototype all-electric Mini E lent to me for the morning by BMW, the company currently conducting the world's most comprehensive trial aimed at gathering data on what it will take to convince people to ditch the internal combustion engine and go electric. (Yes, the same BMW that sells around 1.5m internal combustion engines globally each year.) As I look down at the gauge showing me that the car has less than 50% charge left, I have to keep reminding myself that the engineer who showed me round the car at Mini's Mayfair showroom said the car's 100-mile range at full charge would "easily" get me the 55 miles to BMW's Cowley plant just outside Oxford - with or without the air-con on full blast.

I ease off the accelerator a little;

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something that, somewhat counter-intuitively, causes the battery to start charging momentarily owing to the re-generative braking system. Having been in the car less than an hour, I'm already having my preconceptions about electric cars challenged, most notably by the fact that I am travelling at the national speed limit in one of the pokiest set of four wheels on the road. This is not the milk float of eternal jokes.

The technical details of the Mini E are certainly noteworthy: it is, I'm told by the engineer, powered by a battery that's the "equivalent of 5,088 AA lithium ion cells"; it has a speed limiter fitted on its reverse "gear" because, without it, the car could go at top speed (95mph) both forwards and backwards (yes, that thought scared me, too); and any sound file can be installed into the car's computer to rectify the fact that the engine is near silent and could therefore be a potential danger to pedestrians. ("You could load in anything you like: the EastEnders soundtrack, or a clip-clopping horse noise," says the engineer, smiling. "Warwick University is now experimenting with different sounds to find the optimum safest sound.")

'gear' - without it could go at its top speed of 95mph backwards

But I'm not too interested in all this, to be honest. As a driving experience, the Mini E amply disproves the popular notion that electric cars cannot meet the needs of your average petrolhead. I want to better understand why there is still a reluctance among some to drive these things - and how far off we are from overcoming this. The roadblock to the mass acceptance of electric cars is, yes, range anxiety, but also the perceived inconvenience of charging these vehicles. BMW has built 400 Mini Es with the sole purpose of understanding how these two huge hurdles might be cleared in time

The Mini E has a speed limiter fitted on its reverse

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for its first all-electric production vehicle, the i3 MegaCity, which it expects to launch globally in 2013.

Over the past 18 months, BMW, working with researchers at Oxford Brookes University and partly funded by the government's technology strategy board, has held two separate six-month trials in the Oxford/west London area. Forty hand-selected "pioneers" were invited to drive the Mini E with the intention of reporting back with both their honest opinions and hard data about usage. Similar trials have also been held in Los Angeles, New York, Berlin and Munich, with the same cars soon set to move on to new trials in Paris, Beijing and Tokyo.

The conclusions so far cement the view that range and charging are still the key issues, says BMW's Sarah Heaney, who has overseen the UK trials: "Range is still the big cloud that hangs over electric cars. It is the No1 resistance to change. Charging, and availability of charging points, is the next barrier."

Sarah Brown, a primary school teacher based just outside Oxford, was chosen for the trial because she represented a typical suburban commuter. "I used it mainly for my daily commute around the Oxford ringroad, which comes to about 15 miles return," she says. "I suppose I was doing about 350 miles a month in total. I didn't need to charge it at work because I got into the habit of charging it at home every two to three days."

With a specially fitted charging point in front of her cottage, Brown says she never once needed to charge the car anywhere else. Using a domestic 13amp socket, it takes about 10 hours to charge the Mini E, but this can be reduced to about three hours at public charging points.

"I own a Mazda5 people carrier that runs on petrol," she says. "I have calculated that it costs me about 20p per mile in petrol. But I calculated that the Mini E was costing me about 2p a mile in electricity. We did find ourselves using the Mazda less and less when we had the Mini E."

So would the huge cost advantage ever lead her to trade in her Mazda for an electric car? "I would be tempted, but the charging time and range would have to improve," she says. "The way I would work it would be to rent a petrol car for the longer journeys when we need to, say, visit relatives on the other side of the country."

The price of an electric car typically falls anywhere within the £15,000-£30,000 price point, which, despite the obvious allure of the fuel savings on offer and the carrot of government grants, is way beyond the reach of most drivers. But that is expected to fall as electric cars become ubiquitous over the coming decade - something many city mayors are keen to encourage because of an electric car's lack of tailpipe emissions. For example, in May, Boris Johnson, London's mayor, announced that for a £100 annual fee, electric car owners could use any of the 1,300 charging points scheduled to be installed across the capital by 2013. (Although, a year earlier, he had promised 7,500 points by 2013.) At present, there are just over 2,000 electric cars registered for exemption from central London's congestion charge.

The experience of Keren Barber - another of BMW's pioneers - was rare in that she got to drive her Mini E in and out of central London each day as part of her trial. As a resident of Chiswick in west London, she drove into her work at a bank on Saville Row each day, taking advantage of four nearby charging points and four hours of free parking offered by Westminster council to electric car drivers.

"Even though there was a lot of competition for the charging points near my work, I found I never used our charging point at home," she says. "I live in a private development with a private drive so I did have the opportunity to do so, but I just always ended up doing it at work. I can see that without a private garage, or off-street parking, it would be a problem as you'd have to have the charging cable draped across the pavement."

Berber admits to charge anxiety, though: "The de-charging is very variable. Broadly, a 100% charge equals 100 miles, but sometimes you see a big drop when you're driving and that can be unsettling. I never risked going below 25% charge."

Berber says that, with her husband Asa, she continued to use her Mercedes diesel for weekend trips during the trial. "But I also started using the Mini for commuting, rather than use public transport as before," she adds.

And, with this admission, she highlights one of the key societal issues that a mass switchover to electric vehicles would raise: yes, localised air pollution would drop dramatically, but would going electric only further aggravate congestion on urban and suburban roads, especially if concessions such as cheap parking encourage drivers to reject public transport?

Furthermore, the central, unavoidable criticism of going electric is that the "pollution free" claim is largely a mirage. As long as the electricity consumed by the car is generated by a fossil-fuelled power plant then the pollution is only deferred from the tailpipe to the smoke stack. While this is true, from a strict CO_2 point of view, David MacKay, a Cambridge University physics professor and the Department of Energy and Climate Change's chief scientist, has calculated that an electric car produces about as much CO_2 per passenger kilometre as the most fuel efficient "fossil cars", as he describes them. And if our energy sources decarbonise over the coming decades - as is current policy - so the electric car really begins to come into its own.

But big questions still need to be answered about the huge additional demands a rapidly growing fleet of electric cars would place on an electricity grid already struggling to balance supply and demand.

Similarly, current concerns over the high price of batteries - and the energy-intensity of their highly pollut-

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ing production - has to be viewed, say EV advocates, against the fact that battery technologies are fast advancing, as is the scale of their production, which should force prices down and improve their environmental credentials. This month, for example, the University of Leicester announced its involvement in a European research project aimed at developing zinc-based batteries for electric cars that could prove to be far less energy-intensive in their production than the lithium ion batteries currently in favour.

But so-called "range parity" - equalling the typical range of an internal-combustion engine on a full tank - is just as important a goal for battery manufacturers. The current world-record distance for driving an electric car on one charge is 623 miles, achieved by members of the Japan Electric Vehicle Club in a converted Daihatsu travelling at 25mph around an oval race track. But most electric cars on sale today cannot yet challenge the 300-mile range of the average internal combustion engine. The Nissan Leaf, an all-electric five-door hatchback that launched in the UK in March with a £30,000 price tag, boasts a maximum range of about 100 miles.

One work-around that seemingly nullifies the concerns over range and charging is the brain child of the world's most prominent electric car advocate, Shai Agassi. In his native Israel last year, he launched a startup called Better Place that allows electric-car users to swap their drained battery for a new fully charged one at a network of "switch stations" at the same time as it would take to fill a car with petrol. And because Better Place owns the batteries, the owner of the car need not worry about the deteriorating condition or high price of the battery.

If the idea gains traction - Agassi is already in talks with the Chinese government, which promised last year to invest $15bn in seed money to kickstart its own electric car industry - then it could seriously challenge not just our perception of electric cars, but also the interests of oil companies with their vast global network of petrol stations.

But BMW tells me that it doesn't see itself following this path. Rather, it is confident that when it finally launches its MegaCity in 2013 its customers will be content to charge the car themselves. It accepts, though, that this will mean the car will only ever really be suited to what it describes as the "suburban" driver.

The trial data BMW has collected over the past 18 months is telling it that the perception many of us have that we need a vehicle with an extended range just isn't borne out by the facts. It has found that the average "trip distance" driven by its Mini E pioneers was 8.6 miles, and that the average daily distance driven was 27.5 miles. This largely mirrors the data it received from a control sample of drivers using the "normal" Mini Cooper. It also found that the pioneers were charging their cars an average of 2.7 times a week. And, when quizzed, most said that they expected to be an owner of an electric car within five to 10 years; good news for the government's climate change watchdog that wants to see 1.7m electric cars on UK roads by 2020.

Personally, I enjoyed my short time with the Mini E, but I can see why there is still some way to go before electric cars become fully normalised within our driving culture. Collectively, the purchase price, the charging and the range all still slightly outweigh the advantages offered by the vastly cheaper refuelling costs and the promised (but far from conclusive) environmental gains.

"We looked into buying an electric car once the trial period finished," says Keren Barber. "But at nearly £30,000, the Nissan Leaf was just too much for us. As were the Peugot iOn, Citroen C1 Ev'ie and Mitsubishi i-MiEV. They were all between £16,000 and £30,000. This price, plus the hassle of charging, is just not worth it. It still all feels a bit premature."