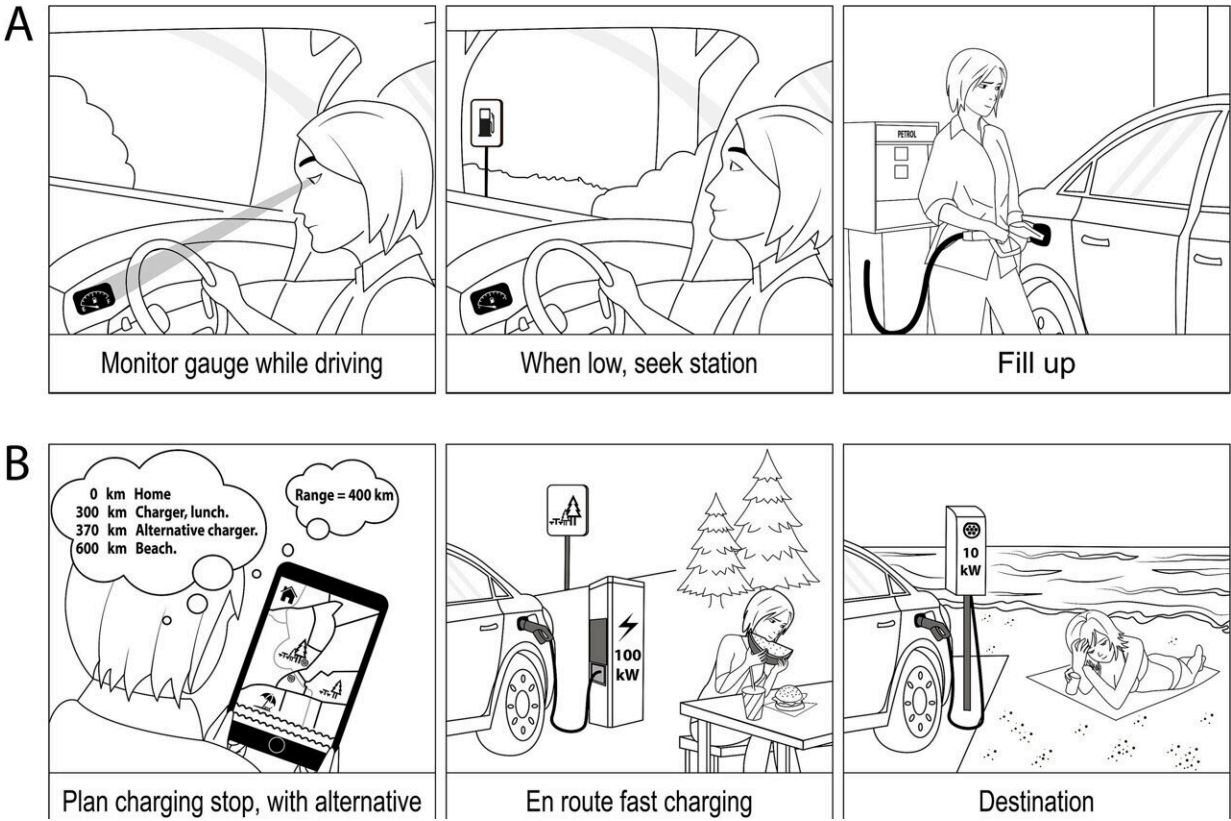


# How electric vehicle drivers can escape range anxiety

April 25 2024, by Gustav Löfgren



Graphic: Three major mental models and associated refilling strategies were identified in this research: (A) Monitor gage, when low seek refill; this is the primary strategy for liquid fuel refilling. (B) The planning model, predominately used for EV long trips, o. Credit: Chalmers University of Technology | Willett Kempton

Two of the biggest challenges faced by new and potential electric vehicle (EV) drivers are range anxiety and speed of charging, but these shouldn't have to be challenges at all. That is according to a study by Chalmers University of Technology, Sweden, and the University of Delaware, U.S. Researchers discovered that a change in refueling mindset, rather than improving the size or performance of the battery, could be the answer to these concerns.

The transition from filling up at a [petrol station](#) to recharging your electric vehicle in the most convenient location for you, requires a whole new way of thinking about refueling a car. However, new EV drivers often remain in their old mindset and get stuck constantly checking the gauge and planning for the next charge point. This can lead drivers to feel anxious. But what if they are thinking about it all wrong?

Researchers have now identified three different types of behavior around refueling a car, which are described in the paper "Mental models guide electric vehicle charging" recently published in the journal *Energy*. They are:

1. The monitor fuel gauge model—the driver refuels when the fuel is running out
2. The planning a trip model—the driver plans when and where they will stop to refuel their vehicle along a journey
3. The event-triggered model—the driver automatically plugs in as soon as arriving home or work

The first model represents how most people refuel a petrol or diesel car, and the third model is the best for optimum electric vehicle usage.

"Experienced electric vehicle users have chosen an event or location to trigger their plug-in; for example, they will automatically plug in when they come home or get to work, so it becomes part of their morning or

evening routine, which makes it less of a chore to think about charging.

"There is a lot of emphasis on the time it takes to charge an EV, but if you do it overnight, it is just the time it takes to plug it in. So really, it is just the long trips that you need to plan for," says Professor Frances Sprei, of Chalmers University of Technology, who led the study, along with Willett Kempton from the University of Delaware.

## **The right infrastructure in the right places**

This change in mindset requires the right infrastructure in the right places. The best places to charge for a long time, are either at home or at work, since people spend long periods of time there already, so charge points need to be available to people in these locations.

In contrast to this, a lot of European cities are currently focusing on roadside charging, which might conflict with the needs of other road users, such as pedestrians and cyclists.

"In order for people to be able to use EVs in the best possible way, policies need to adapt to ensure that people have access to charging infrastructure close to their home or workplace where possible," says Professor Sprei.

## **The biggest battery isn't always the best**

This change in mindset could also encourage more people opting for an electric vehicle, in order to reach global and European emissions targets.

For potential EV drivers, there is also the question of battery size to reduce range anxiety.

"We do see a trend, that you need to have this really large battery. But according to other research, you will generally be ok with a slightly smaller battery than the range you would have on a gasoline tank, since the only time you would need a larger range is for a six hour or longer journey, in which case the driver could charge on the go.

"There is too much emphasis on the need for really long ranges, and this leads to increased price for the [vehicle](#) and increased resource use of the EVs," says Professor Sprei.

In conclusion, for most people's everyday driving, the new study shows that you don't have to think too much about charging at all. In terms of cost, it is also a lot cheaper to charge slowly overnight or at work than fast charging on the go, and it is better for the health of the battery.

**More information:** Frances Sprei et al, Mental models guide electric vehicle charging, *Energy* (2024). [DOI: 10.1016/j.energy.2024.130430](https://doi.org/10.1016/j.energy.2024.130430)

Provided by Chalmers University of Technology

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