**If you’re one of the rapidly growing number of drivers who now own an electric vehicle, then there’s a reasonable chance you’ve got a driveway and you’ve had your own EV charger installed on the side of your house or, if you’re really posh, in your garage!**

**That’s already saving you a bunch of money compared to using the public charging network. But there is a limitation on your domestic system. And that’s the fact that electricity comes to our homes as alternating current, or AC, and your car battery wants you to give it electrons as a direct current. That means somewhere along the line the current has to be converted from AC to DC. And that means an inevitable loss of energy in the process.**

**But what if you could provide your beloved EV with direct current instead, without any of the annoyingly wasteful conversion stuff?**

**Well, now you can…**

**Hello and welcome to just have a think.**

**Way back when Edison and Tesla were battling it out for electricity grid domination, clever engineers were figuring out ways to convert direct current supply into alternating current and vice versa.**

**Transforming DC to AC was achieved with inverters, which is a technology many of us are now familiar with if we have solar panels on our roofs.**

**They do the job using a specifically configured series of switches that open and close in a sequence that takes in the direct current and outputs it as alternating current.**

**Converting in the other direction, from DC to AC required the invention of a rectifier – so called because it literally rectifies or straightens out the alternating current’s wave form. Early versions were pretty crude, but with the advent of semi-conductor technology in the mid-twentieth century, solid state rectifiers came onto the market, and that’s essentially the method still in use today.**

**There are various configurations, but the most common version is the called the four-way full bridge rectifier, and it works like this.**

**Four diodes are arranged in a diamond configuration inside the device. A diode is a semiconductor that only allows current to flow through it in one direction. The incoming AC supply is connected at this point between diodes 1 and 2 and the neutral return goes here between diodes 3 and 4. The DC output wire is connected between diodes 2 and 3 with a negative wire going back to this point between diodes 1 and 4.**

**So, when the alternating current is moving in the positive direction it can’t flow through diode 1 and has to flow through diode 2. As it comes back out of the load the current flows through diode four on it’s way back to the transformer. Then as the alternating current reverses direction, the current flows through diode three, into the load and then all the way back and up through diode one before again returning to the transformer. That turns the AC sine wave into a different wave that looks like this. To make things a bit smoother, a capacitor is added to store and release charge very quickly to fill in the low points in the wave.**

**Inverters and rectifiers both use a little bit of energy to do their work – and it can be a pretty significant drain on the overall system. If you’ve got solar panels on your roof, then the DC current from them goes through an inverter to change it to an AC supply that your home electrical system can accept. But if you’ve also got an electric vehicle then the AC supply from your wall charger has to be converted back into direct current by the car’s onboard system before being used to charge up the batteries. Overall losses in all of that lot can amount to more than thirteen percent.**

**And that’s where a new US start up called Enteligent claims to have come up with a smart solution. Their so-called ‘Time of Light’ EV charger can take DC current straight from your panels, bypassing both your home AC electrical system AND your vehicle’s onboard converter to put DC charge directly into the batteries. Their device has a rated power capacity of twelve kilowatts which is significantly higher than a standard seven-point-five kilowatt charger, and Enteligent claims to be achieving a twenty percent energy saving by avoiding all the conversion losses.**

**When there’s not enough sunshine to get useful power from your rooftop panels, the Enteligent device is able to draw AC power from your home system and convert it into DC current more efficiently than your vehicles own AC-DC converter.**

**Now you might be thinking, hang on Dave – I do all my car charging overnight when there’s cheap electricity and the sun is very definitely not shining. So why do I need one of these contraptions.**

**Well, here’s the thing. As EVs rapidly grow in popularity, which they are already doing by the way, despite the best efforts of certain media outlets to convince you otherwise, then before long there’ll be millions of chargers all set to automatically come on at 2am and switch of at 6am which means that period of the day will no longer be ‘off peak’, will it? It’ll very definitely be ‘on-peak’. That means a headache for the grid operators and most likely the removal of preferential rates on your electricity bill.**

**So, if vehicles can be charged directly from sunlight wherever that sunlight happens to be at any given time of day, BY DEFINITION that will spread the demand throughout the day, especially if you look at it across the entire USA or somewhere like Australia, or on a continental level here in Europe.**

**And imagine the impact this technology could have in commercial urban settings like shopping malls for example. Fifty percent of America’s paved land is taken up by parking lots, most of which could easily be covered over with canopies supporting solar panels. That’s already happening in some places of course, but the potential for growth is huge.**

**In a previous video I looked at a study that found that if solar canopies were installed in the more than three-thousand-seven-hundred Walmart supercentres across the US, they could represent something like eleven gigawatts of generating capacity, which is about the same as a dozen typical coal fired power plants.**

**The trouble is, at the moment they have to be hooked up to the grid to get a valid permit. That means frustrating delays in bureaucracy, and, in many cases, it requires significant upgrades to local utility networks. Bypassing all of that and installing a direct DC to DC charger on solar canopies would make the whole thing a lot more attractive for those commercial operators and would take a huge amount of strain of the shoulders of the grid operators.**

**Enteligent are not alone though. They do have some competition. One of the best-known brands in the industry, Solar Edge, is developing a bi-directional DC-coupled EV charger**

**that also allows direct EV charging from solar PV systems without the need for AC-to-DC conversion. Their system will apparently have the capability to charge up to TWENTY-FOUR kW by simultaneously drawing electricity from your rooftop PV array, a home battery if you’ve got one, plus a bit from the grid.**

**That really is clever!**

**Solar Edge reckon their new charger should be available in the second half of twenty-twenty-four, and it will also support Vehicle-to-Home (V2H) and Vehicle-to-Grid (V2G) functionalities​.**

**Another company, Delta Electronics** **already specializes in the power electronics and technologies that are essential for efficient DC-to-DC conversion and they’re also focusing on the integration of EV chargers with solar PV systems to enhance the overall energy management of domestic homes.**

**So, as usual, while the spurious debate about the viability of electric vehicles rumbles on in the media, scientists and engineers are quietly getting on with the job of solving problems and ironing out wrinkles so that you and I can take advantage of more and more renewable energy as we race toward our twenty-fifty net-zero target. And I reckon that’s worth celebrating.**

**You might feel otherwise of course, and you have every right to express your opinion. If you’re feeling the urge to do that right now, then as always the place to leave your thoughts is in the comments section below.**

**That’s it for this week though. A massive thank you to the channel’s Patreon supporters who help keep the channel completely independent and free of ads and sponsorship messages. If you find these videos useful and informative and you feel like you could support the channel for about the price of a coffee each month, then why not pop over to patreon.dot.com forward slash just have a think to have a look at the exclusive benefits you can enjoy there.**

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**As always, thanks very much for watching! Have a great week, and remember to just have a think.**

**See you next week.**