



Hydrogen Power for a Better World

H-Power™ EV Charger Launch Event

10.00am 5 December 2019

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Agenda

10:00am	Arrivals and registration
10:15am	Welcome
10:20am	Introduction to AFC Energy
10:35am	H-Power™ EV Charger
11:00am	Demonstration of H-Power™ EV Charger
11:15am	Announcement
11:30am	Q&A
12:00pm	Conclude



Housekeeping

- Presentations will be published on our web page or can be obtained from info@afcenergy.com.
- All mobile phones to be set on silent please.
- No smoking is allowed on site.
- Be aware of safety signs and remain in compliance. If in doubt please seek assistance from an AFC Energy representative.
- In the event of an alarm follow the instructions from the AFC Energy representatives.
- If in the unlikely event, evacuation is required, AFC Energy representatives will escort everyone to a nearby muster point, Please follow their instructions and walk in an orderly fashion to the muster point.
- Toilet access is located in the reception area.
- For further information on our products please visit www.afcenergy.com or arrange for a visit by calling 01483 276726.



Introduction to AFC Energy

AFC Energy - Introduction



Who We Are:

Recognised global leader in Alkaline Hydrogen Fuel Cell technology

Our Core Vision:

To be a leading provider of low-cost clean energy solutions across the Hydrogen Value Chain

Key Short-Term Market Focus:

- > Electric Vehicle Charging
- > Distributed Power Generation

Our Technology has been developed to:

- > be modular, scalable and easily transportable
- > have high efficiency (~60% at fuel cell module)
- > support glide path to net zero emissions when used in portfolio technology setting
- > integrate with energy storage for fast response / rapid power dispatch
- > be grid independent, and
- > enable flexible siting – outdoor, enclosed, containerised

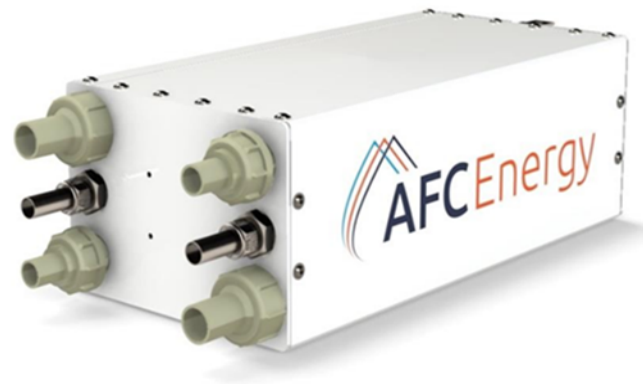


AFC Energy 240kW Alkaline Fuel Cell System Installed in Stade, Germany

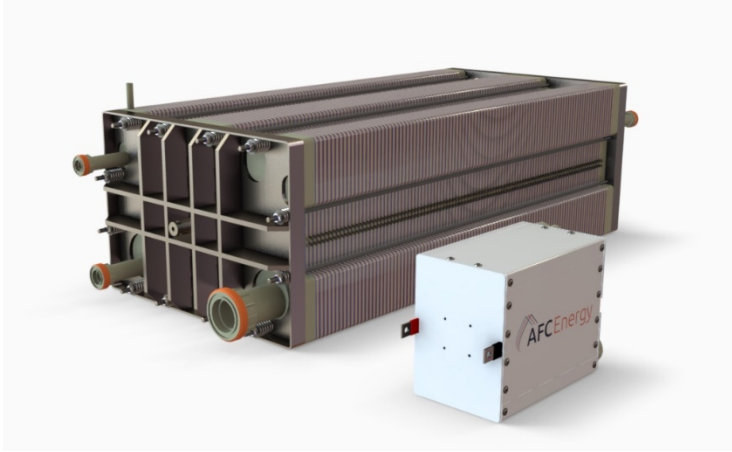
AFC Energy's Technology Platform



HydroX-Cell(L) TM Alkaline Fuel Cell	HydroX-Cell(S) TM Alkaline Fuel Cell
Modular Stack 10kW	
Scalable to multi MW applications	
Accepts Low grade H ₂	
Zero Greenhouse emission	
Liquid Electrolyte	Solid Membrane
Stationary	Stationary and mobile
Operation density 220mA/cm ²	Operations density >1000mA/cm ²
Available now	Available 2022



AFC Energy's Technology Scalability



HydroX-Cell(L) 10kW stack (left) and HydroX-Cell(S) 10kW stack (right)
Fuelled EV Charger Unit



72kWh (scalable) Hydrogen



40ft ISO Container – 160kW (June 2020) / 400+kW (June 2021) / 1-2MW (2022)
Installation



Multi-MW Rendered Off Grid Fuel Cell

So Why EV Charging?

RAC Breakdown Cover Insurance Route Planner Shop
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Home > Drive > News > Motoring news > Concerns raised about UK power cuts - how ready are we for electric vehicles?

Concerns raised about UK power cuts - how ready are we for electric vehicles?

21st Aug 2019

Share [Facebook] [Twitter] [LinkedIn] [Email]

The UK's readiness for a future without traditional fuel has caused some debate in recent weeks – but should you be concerned?

Mark Salt, chief executive of SaveMoneyCutCarbon, recently warned that a potential surge in EV sales in the UK could lead to widespread power cuts, as the National Grid struggles to cope with demand.

But with EV sales already growing, ahead of the UK's 2040 ban on petrol and diesel cars, are we ready to go green or is the UK still on the EV starting grid?

In a recent MailOnline article, Mr Salt claimed there might not be enough energy to power the switch to EVs, particularly if the technology generating the power is not upgraded.

'A rapid upsurge in hybrid and full electric vehicles could create real concerns,' he said.

The warning comes off the back of a series of power outages that struck various parts of the UK earlier this month, causing widespread disruption and travel chaos.

"If these challenges are not addressed, the uptake of EVs will impact the UK's electricity networks as they were not designed to cope with these additional, and significant, demands."

Street
A proportion of our low voltage networks will be overloaded without action, potentially leading to power outages. The main solutions offered are smart charging and upgrading the cables and transformers at significant expense and disruption.

Town
Our high voltage networks will need upgrading to avoid reliability issues as fault resilience will potentially be severely impacted without action.

Region
Our transmission networks may need significant investment to ensure that they are fit for purpose.

CATAPULT
Energy Systems

Preparing UK Electricity Networks for Electric Vehicles Report

2018

Government has focused on EVs to decarbonise the economy obliging us all to look at alternative technologies

The H-Power™ EV Charger

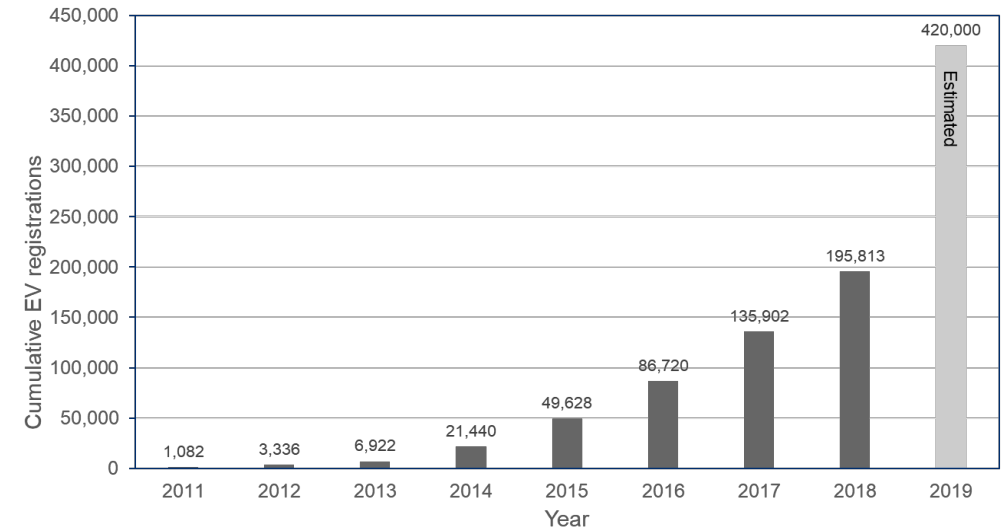
The Electric Vehicle Revolution

The EV has arrived and is an increasingly large proportion of the market.

- By 2025 an estimated 100 million EV's will be on the road worldwide.
- In 2019 UK EV sales are up by 378% (SMMT).
- Doubling total number of EVs on the UK roads.
- The market will continue to grow rapidly to meet Government targets.
- To resolve consumer concerns over range battery performance and charging infrastructure will increase

UK Cumulative Electric Car Registrations (all types)

Source: SMMT



EV Charging: The Current Paradigm

Currently...

Most EV's are charged at home, or at a third party, network connected charging point.

Need to grow en-route and destination charging infrastructure to improve usability and eliminate range anxiety

There are six risks for operators

- > Can my DNO supply the power needed?
- > When can my DNO upgrade its supply and how much will it cost?
- > How fast will EV grow?
- > What proportion of charging will be made en-route or at destination?
- > How will battery size and technology change?
- > Will government policy change?

With so much uncertainty can you afford to

- > Estimate demand, finance and wait for a grid upgrade now
- > Wait for demand to grow and potentially lose control and revenue

AFC Energy's solution - low entry cost which can grow with demand



Risk – network reinforcement

Some context to these points:

This year, a large Council approached their DNO to reinforce their power supply...

They were told that a realistic time frame for works to start was ...

7–10 years

Waiting this long would mean failing to meet policy makers expectations.

Why could this happen, because there are :

- Technical constraints,
- Planning constraints,
- Environmental constraints,
- Political constraints, and
- Financial constraints...amongst many others.



Context : One Car = New Housing Estate

Early electric cars had low charging rates:

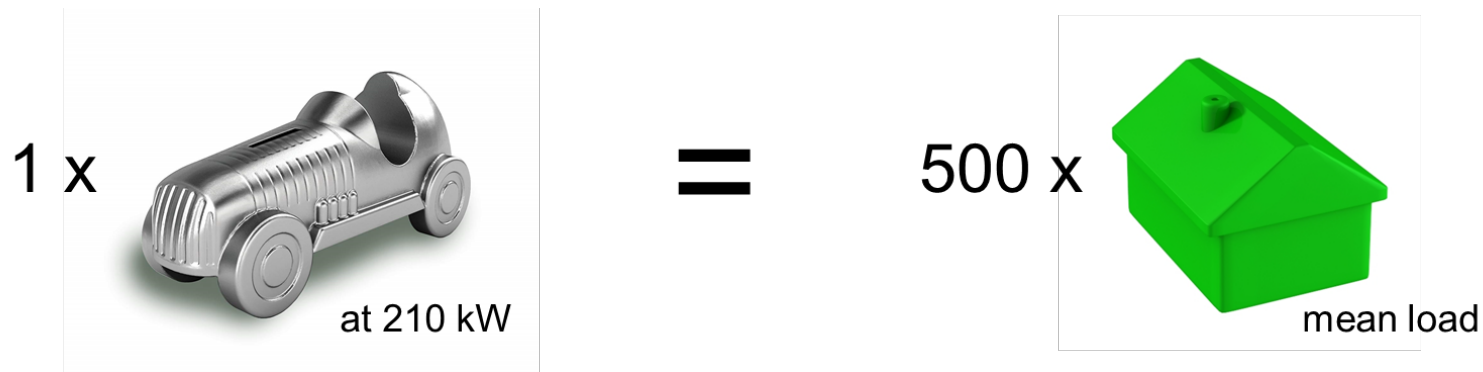
- A typical electric car (Nissan Leaf) has an overnight charge rate of 3.6 kW, and a fast charge rate of 46 kW
- Industry is already launching vehicles with faster charging rates
- The current fastest charger is ~350 kW, and the current fastest charge rate acceptable by a car is 210 kW
- All constrained by network supply infrastructure

Example:

To give context the average UK house has a mean load of 0.430 kW

A single car charging at the 210kW rate is equivalent to the load of nearly 500 houses!

Additionally, few electric cars are used for long battery draining journeys... which is all set to change

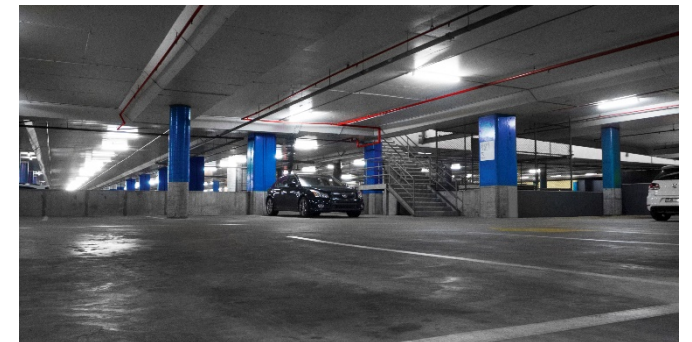


EV Charging: An Opportunity.

Customer service = availability, speed of charge, convenience and ease of use

- Car Parks are, of course, the ideal “away from home” charging location both for...
 - Consumers, and
 - Fleets
- Need to upgrade traditional car park power supply infrastructure which may be limited.
 - cost – may vary from £ 000s to £ millions...
 - timing – may vary from months to years...
 - Investment decision - do I upgrade for demand today, 2030 or 2040?

The need is for an appropriate solution which can be deployed and scaled rapidly to match demand and overcome constraints.



EV Charging: Flexible/transitional solution

- ▶ Long term - the low cost solution may possibly be the Grid (economies of scale)
- ▶ Short to medium term - a flexible or transitional solution
 - ▶ Traditionally, the domain of diesel and gas generators

... but, EVs need a clean non polluting solution.
- ▶ Which is why you need an H-Power™ EV Charger



EV Charging: The Solution

Introducing the AFC Energy H-Power™ EV Charger solution...



H-Power™ EV Charger : What are our customers asking for?



Needs	AFC Energy Product spec
End users	
> Fast and rapid charging	✓
> DC and AC supply	✓
> Availability (24/7)	✓
> Competitive pricing	✓
> No emissions	✓
Operators	
> Availability (deployable now)	✓
> High utilisation	✓
> Health and Safety Compliant	✓
> Low fuel quality	✓
> Low financial risk	✓
> Low commercial risk	✓ Scalable modular design can grow with demand
> Site agnostic	✓ Redeployable

How novel is this, and why is now the right time?

- Fuel cells are not new – they were used to power the Apollo space missions... over half a century ago.
- The technology is well proven and is coupled to simple ancillaries. This means it is reliable and requires little maintenance.
- They were expensive and struggled to compete in a carbon obsessed world, where emissions were assigned zero negative value.
- Comparison with fossil fuel solutions misleading as target market is where grid and temporary diesel are not available
- Building world class product support network



H-Power™ EV Charger : The Future is Here.



**Demonstration Model is out NOW
and available to view and test.**

**Production Models are available
from June 2020.**

H-Power™ EV Charger : Timeline for Delivery and Pricing



Standard modules – increasing capacity as market grows

H-Power™ EV Charger	20kW	available now for delivery in 2020
	160kW	available now for delivery June 2020
	480kW	available for delivery from 2021
	1MW+	available for delivery from 2022

Pricing

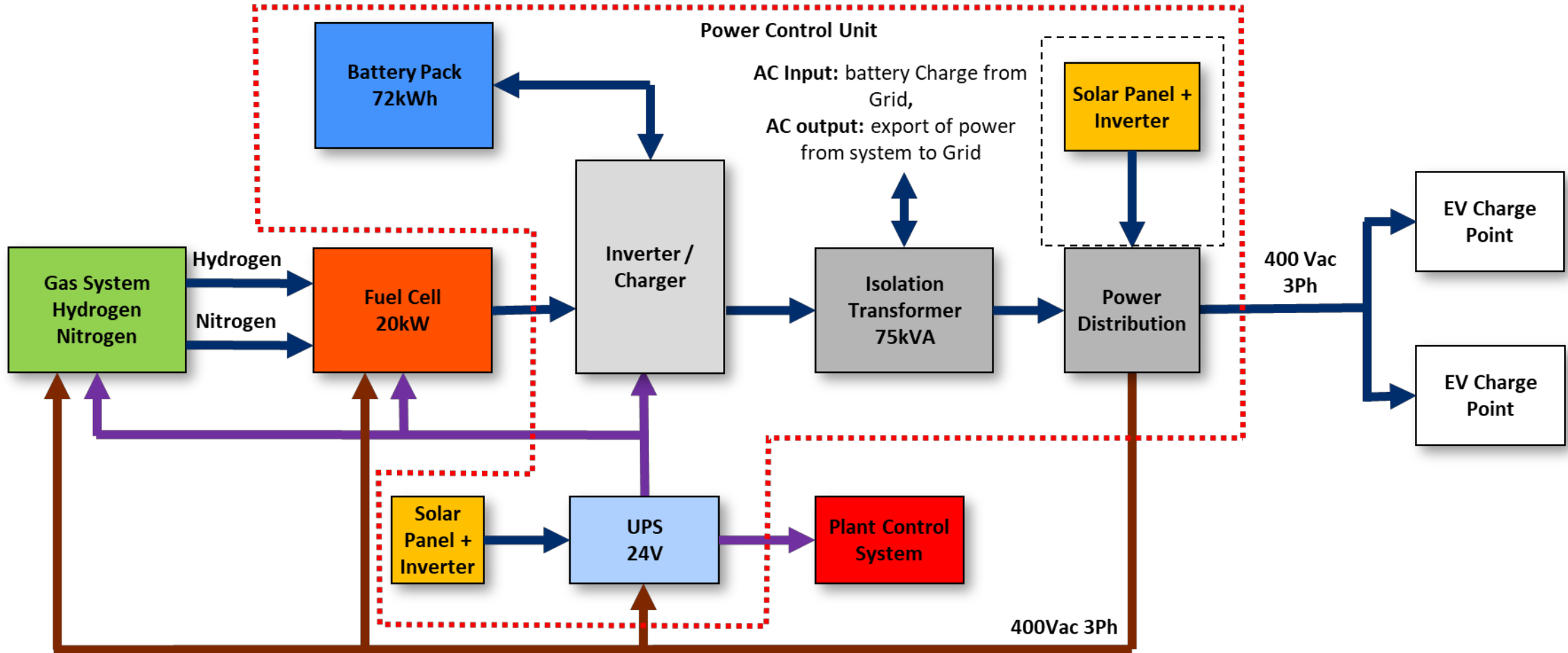
- Initial capital investment from £5,100 per kW to £10,500 per kW
dependent on capacity dependent on size and configuration
- Operating cost of 30p/kWh (using ammonia fuel) for fast and rapid charging

Tailored solutions

- Non-standard sizes available
- Battery and fuel cell size can be varied to manage availability
- Bespoke solutions available including local private micro grids.
- We can find operating partners to take off balance sheet.
- We will procure fuel if customer desires

Demonstration of H-Power™ EV Charger

H-Power™ EV Charger



Announcement

AFC Energy “Official EV Charging Partner” to the British Motor Show 2020



Q&A



Thank you for your kind attention.

www.afcenergy.com
