Investigating The Positive Effects Electric Car Smart Charging Can Have On The National Grid Frequency Response Within The UK

NEWCASTLE COLLEGE UNIVERSITY CENTRE

nationalgrid

SIEMENS Ingenuity for life

Introduction

Researcher **Thomas Manley** is a 23 year old electrical test technician employed by **Siemens;** specialising in the transmission and distribution industry. Siemens AG is a German conglomerate company specialising in the energy sector with the **national grid** being a key stakeholder.

Aims

⇒ **To create an idea which could help move Britain one step closer to the 2050 carbon emission policy & further.**

⇒ **To bring a positive out of the mass increase in demand the grid will face with electric cars**

Objectives ★

⇒ **Analyse how the national grid maintains a stable frequency.**

⇒ **To research data and provide trends on generation ratios.**

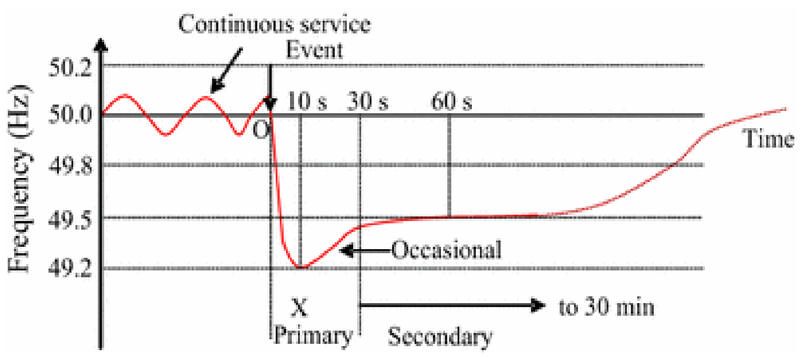
⇒ **To analyse how quickly electric cars are increasing.**

⇒ **To investigate how electric cars can be used as grid storage.**

What is Frequency Response

The national grid maintain a consistent electrical frequency and it's a vital part of the UK's infrastructure . If neglected it can have serious implications damaging equipment when providing electricity on a national scale

Tolerance = 50Hz ± 1%



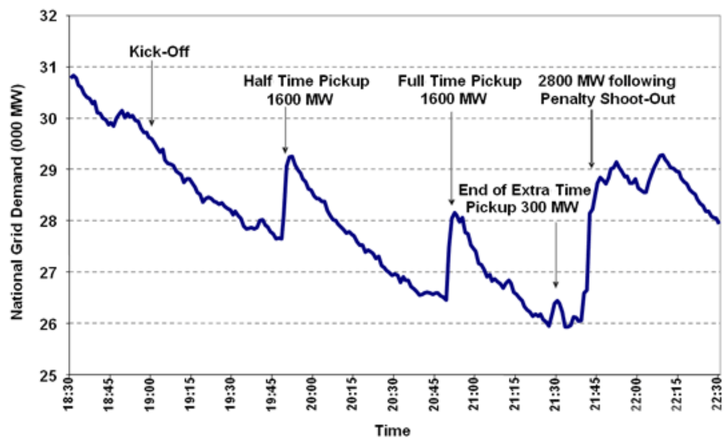
Supply > Demand = Frequency Increases

Supply < Demand = Frequency Decreases (Primary Response utilised)

Frequency is the number of complete cycles per second in alternating current direction. The best **solution currently** is to use **energy storage systems** to instantly draw or pump power to and from the grid– but this is **unjustifiably expensive** with an **extensive payback rate.**

Statistical Research

1800 Watts

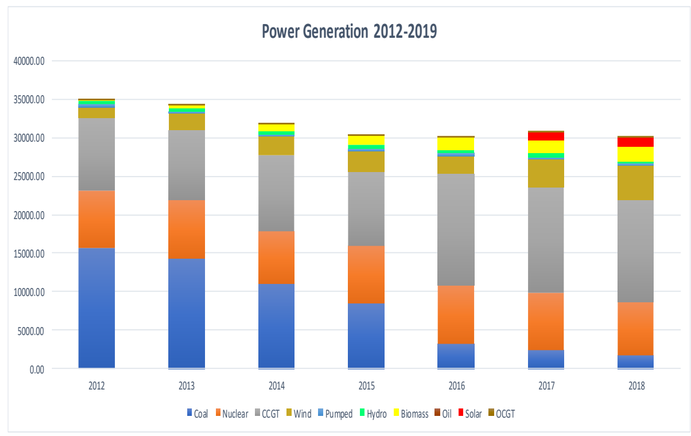


At 7 o'clock every night on the break between soaps or sporting events a huge percentage of brits go and **boil the kettle** , and this can make the grid demand soar **up by 10GW in a matter of minutes**.

The grid often has to utilise power from other countries via the **interconnectors which is costly**. But increased grid storage is a long term solution to this.

What this shows?

- The grid demand is **reducing,** WHY? Evidence suggests **global warming** is to blame.; hotter summers & more home use solar power.
- Renewable generation has **doubled** in the last **5 years**
- Wind is the **3rd biggest contributor**, rising every single year
- Nuclear energy has not changed at all– Adjusting the levels of **energy output quickly** in response to the demand is **difficult and expensive** to do.



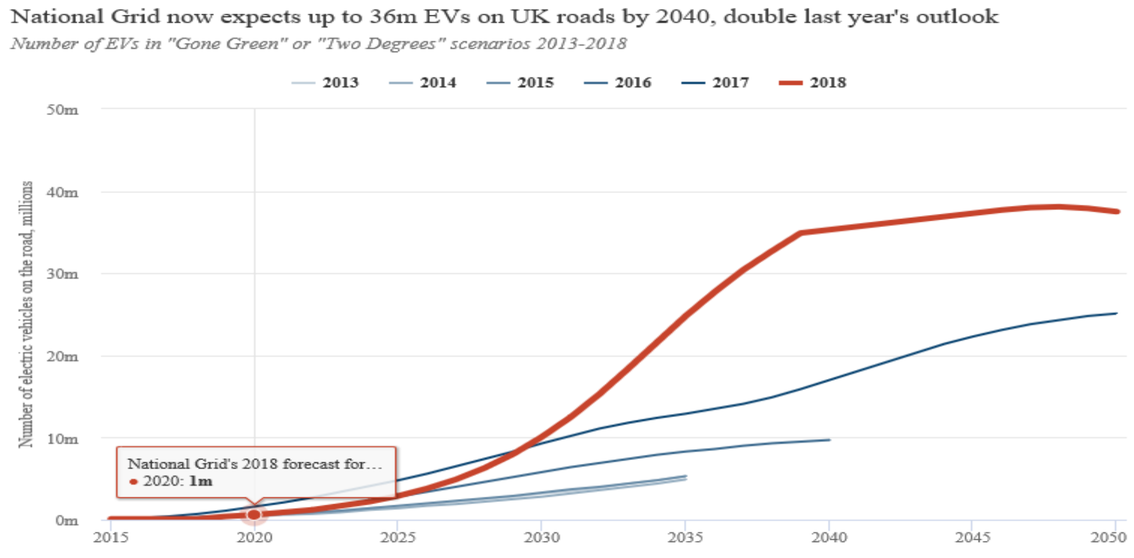
The solution

The process would follow a **trial storage park.** And consumers would enter the **estimated time of departure** if possible, cars that are there overnight can be utilised and ensured to still be charged for when you need them.

Peak time 5pm-7pm, is when the frequency is hardest to maintain, and costs for electricity are highest, conveniently it is also the busiest time for shoppers.

The increased **demand** will warrant the same energy as a nuclear power plant costing **£9 billion** to build. Instead of dealing with that demand of people getting in from work and charging there car, the smart charging can spread out the charge throughout the **night to lower the demand extensively.**

Outcome



New Petrol and Diesel vehicles to be Banned from 2040

202,000 EV's → **1 million EV's** → **38 million EV's**

2019 **2020** **2050**

UK daily use 2018– 823GWh

60 KWh x 38 million = 2280 GWh

Summary

Reduce Peak Demand = easier forecasted usage.

Then pump or draw energy to maintain stability

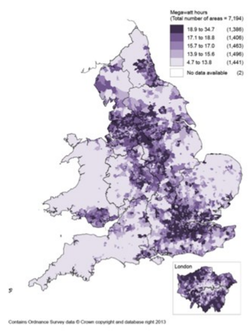
Interim Findings & Conclusion

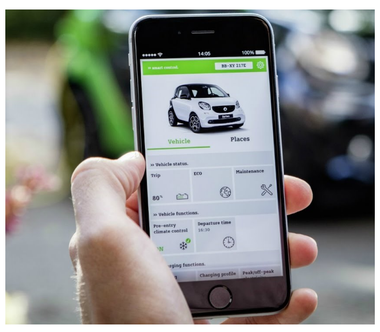
EVs can provide a dual benefit of **decarbonizing transportation** while **lowering the capital costs** for widespread renewables integration, so the **benefits** are clearly there. But there will be some challenges involved , such as **implementation** and **policies** as well as a **grid scale connection.**

Forward Plan

The forward plan is to:

- Invest more research into **case study** analysis.
- The key **challenges** will also be diluted such as battery degradation.
- Carrying out more research in terms of what would persuade **consumers** to opt for this system.
- Looking closer at the **costing** to implement this process.





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