Storage – what are the options?

- Progress with Batteries
- Applying the Technology
- Related Products and Services

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Which Battery Technology?

- The last 10 years has seen a revolution in battery technology
- Mobile phones have moved from 2 hour usage to 10 hour usage and capable of acting as a computer
- These batteries allowed the electronics industry to develop new products e.g iPads, Laptops
- Small batteries with a very high packing density
- The battery technology used by all, today, is Lithium Ion
- Investment and mass production has driven down the cost of their manufacture

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Battery development

- The very high packing density of Lithium Ion batteries has lead to other products being powered by a battery
- The battery has lead to products that are safer use – no more “live” cables
- These changes have totally changed the building industry and improved its safety record
- These batteries started powering larger and larger products
- As more companies became aware of the packing density more products were developed and this lead to the Electric Vehicle (EV)

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The Development of the EV

- When Nissan announced they developing an EV for mass production, many car manufacturers thought they were mad!
- The early Nissan Leaf had a range of 85miles and this caused the term “Range Anxiety” among users.
- However the battery technology has improved and now provides a range of 300 miles plus
- Tesla came on the scene with a car not only with a 300 mile range but also was the fastest accelerating production car
- This dispelled the “milk float” image
- Now EVERY Car Manufacture are developing a range of EV’s
- New players like Apple, Dyson, Google coming into car market – serious competition

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EV's are a solution to City Pollution

- Deaths from pollution now published and is a "driver" for change – 30,000 in London
- Transport is the biggest polluter
- Diesels are the worst and will be the first to go
- Old Diesels are now being banned from entering some major Cities
- Diesel cars are already no longer economic to make – 30% falling sales
- The change over to "clean" EV's is happening fast – 2019 / 2020
- Some Countries banning fossil fuel powered vehicles by 2025

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EV Battery Investment

- Investment in new battery plants is £B's
- Big brands, LG, Samsung, Panasonic (Tesla) and BYD
- Investment in new EV's is massive, full range of vehicles in 2 years
- China is the largest market for EV's together with the largest battery manufacturing plants in the World – suppliers to the Big brands
- Next battery technology for EV's - Solid State Batteries in development, Porsche, Toyota, BMW & Dyson – reason being they can handle a 5 minute superfast charge – more expensive and unlikely to be necessary for most EV's

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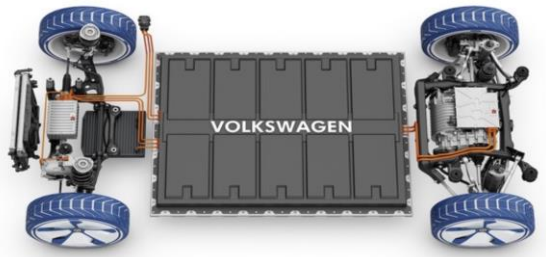
New EV's from ALL Manufacturers

- If mainstream Vehicle Manufacturers are to survive they must invest in EV's
- Much easier and quicker to develop than Petrol / Diesel vehicles – a battery and an electric motor!! No complicated engines, gearboxes, emissions, etc
- Present battery range 300 miles and 30 minute charge
- Future range 500 miles and a 5 minute superfast charge being developed
- Not just cars, but vans, buses and lorry's in the pipeline



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”Clean” delivery Vehicles

- Some Cities putting a ban on diesel vehicles - to reduce pollution – higher taxes followed by legislation
- Petrol will be next to be banned in some Cities, probably by 2025
- All sizes of electric delivery vehicles are being developed, many now on sale and the start of mass production – which drives down costs
- Even heavy transport can now be powered by battery electric
- Changing face of vehicles running around Cities

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Public Transport

- All moving to “clean” electric
- Hydrogen fuel cell was thought by vehicle manufacturers to be the future after petrol / diesel - Battery technology has turned that on its head - lower cost solution and quicker to develop
- Industry gearing up fast with new products hitting the market now
- But EV’s need a charging network which is starting some to scratch their heads!

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Electricity for charging EV's

- Where will charging facilities be required?
- Most cars travel less than 20 miles / day
- So most will be charged at home / on street charging from lamposts
- Fast chargers only required by those driving large distances
- But electricity for charging needs to be "clean"
- Significant growth in Solar and Wind to charge EV's on the agenda
- Solar and Wind heading to be the lowest cost electricity generator and can be connected to the distribution network
- To avoid grid surge problems, additional battery storage will be required on the grid
- All batteries, large and small, can share a common platform and work as one

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Problems for EV manufacturers

- Need to ensure a secure supply of “clean” electricity for charging their EV’s. At present some manufacturers think they are all being sold the same “clean” electricity.
- With todays grid mix of electricity, an EV is only as clean as todays Petrol car!
- Car manufacturers making losses on present diesel sales and need EV take off fast – massive promotion planned
- Big threat is China, new Car Manufacturers are setting up and threatening to undercut prices by 40%
- Of course with the majority of the batteries been made in China, ensuring an adequate supply is the risk to the car makers

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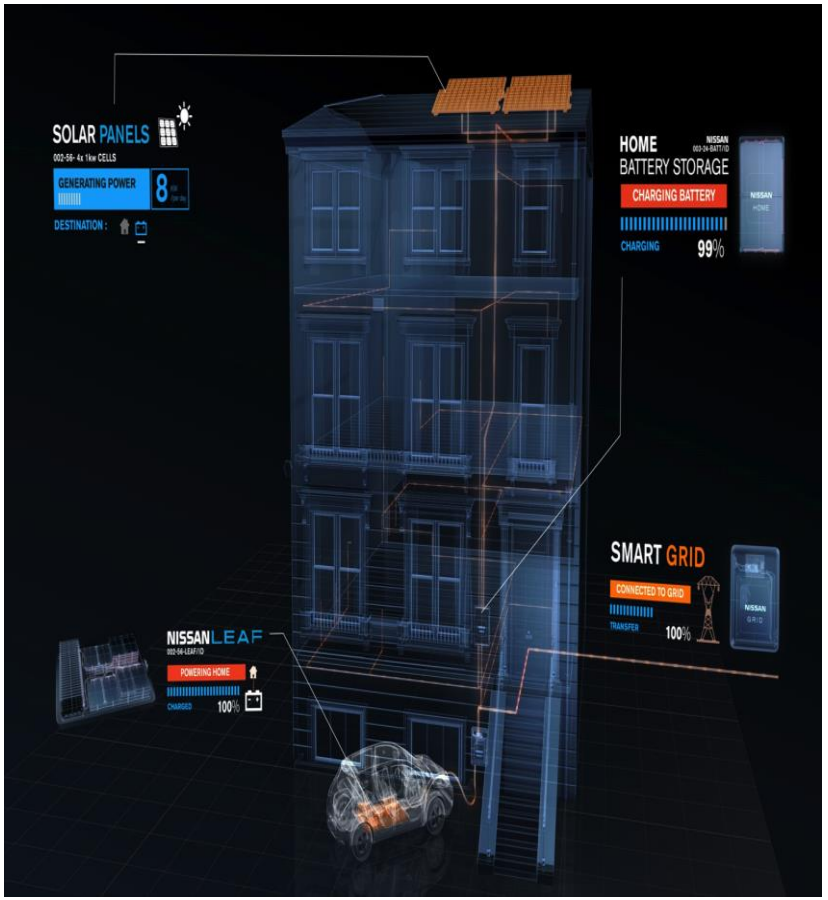
Smart technology- Vehicle to grid (V 2 G)

- Nissan / Audi / Mercedes, VW, etc offering a home storage system that also talks to your EV and powered by Solar
- Massive spare capacity in a car battery with 300 mile range
- Time of use ”Smart” metering for domestics on the horizon along with time of use tariffs
- All batteries can be remotely controlled – can trade spare energy!
- Taking energy from the grid or putting electricity into the grid avoids need for expensive standby generation or new power stations along with many grid upgrades



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Future energy provision

- The change over to “clean” electricity is going to be rapid
- Battery storage is a “game changer” for transport, buildings and the grid
- Yes we still need a grid but of reduced capacity and better balanced as a result of batteries
- The end of diesel and then petrol will come fast – hence BP/ Shell / Total investing in renewables and EV charging
- Energy companies are becoming service industries and not power producers, changing their business model – EoN, Centrica, EDF, etc
- The end of pollution – a “clean” future

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So what changes can we expect soon?

- Buildings will be electricity generators
- New housing developments will need to calculate the impact on the grid – Solar, storage and V2G will change dynamics and impact on the grid
- Buildings will be all electric, Gas not a secure supply and also a source of pollution and will be a problem, by 2030
- Solar canopies on car parks, linked to EV charging, will be common place
- Planning and Building Regulations will be “drivers” at no cost to Government
- Pollution taxation highly likely
- Government will have to control the transition to avoid energy suppliers going bankrupt!

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Some Suggestions - Opportunities for LA's

- Lead by example – make LA a showcase
- Impose "Merton Rule +" (previous Pickles words are not law!)
- Encourage deployment of Solar, Onshore Wind and Storage
- Social Housing will need battery storage to avoid "red zone" cost impact of "time of use" smart metering – free offers coming to the market..
- Replacement LA vehicles should be electric
- Encourage retailers and commercial businesses to clean up their act
- Install Solar canopies on surface car parks – earnings from charging EV's
- Convert lampposts to be EV chargers
- Impose constraints on diesels in built up areas – congestion charge!
- Look at your land for deployment of Solar and Wind – earnings
- Reduce reliance on the Big 6
- Be in control of your future energy costs while solving pollution!

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Thank You

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