

Innovation and governance of the power sector to enable a high penetration of electric vehicles

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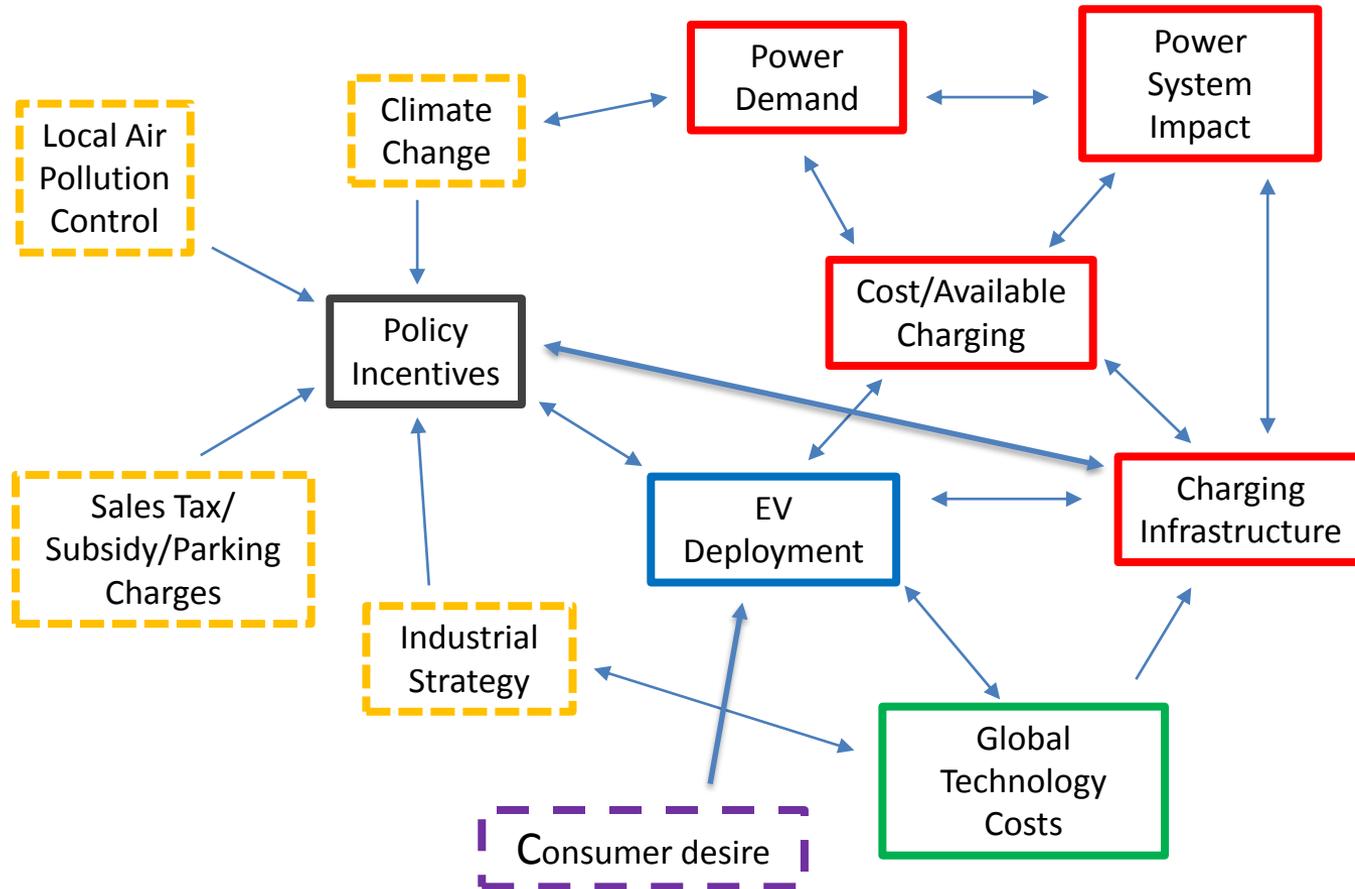
New Thinking For Energy



Agenda

- Session 1: Innovation, new technologies and deployment policies
- Session 2: Power sector management and governance for an electrified transport sector
- Session 3: Speed of transition and anticipating tipping points

EV Deployment – Points of Influence

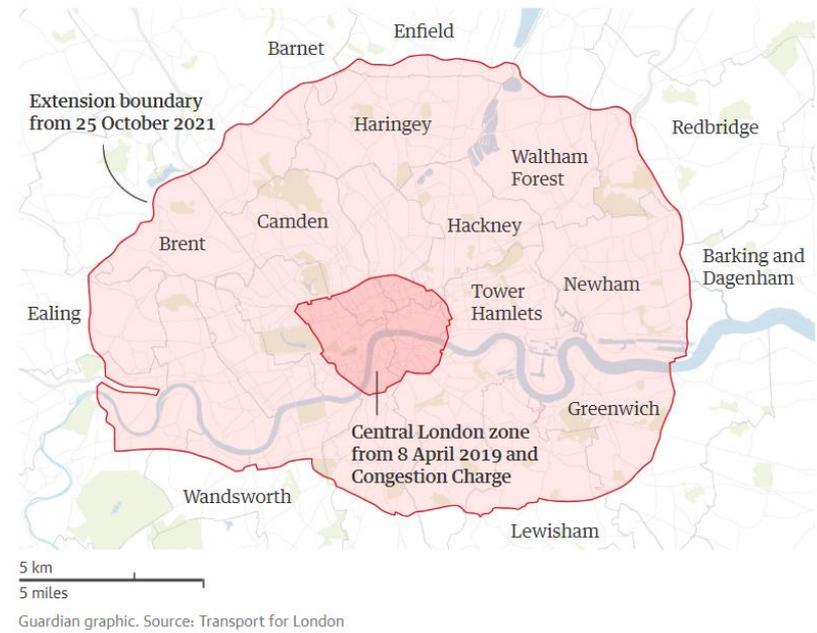


Environmental Control

Transport is the largest emitting sector of the UK economy at 121 MtCO₂e, with 26% of UK greenhouse gas (GHG) emissions in 2016. Emissions in domestic transport rose for the third consecutive year in 2016.

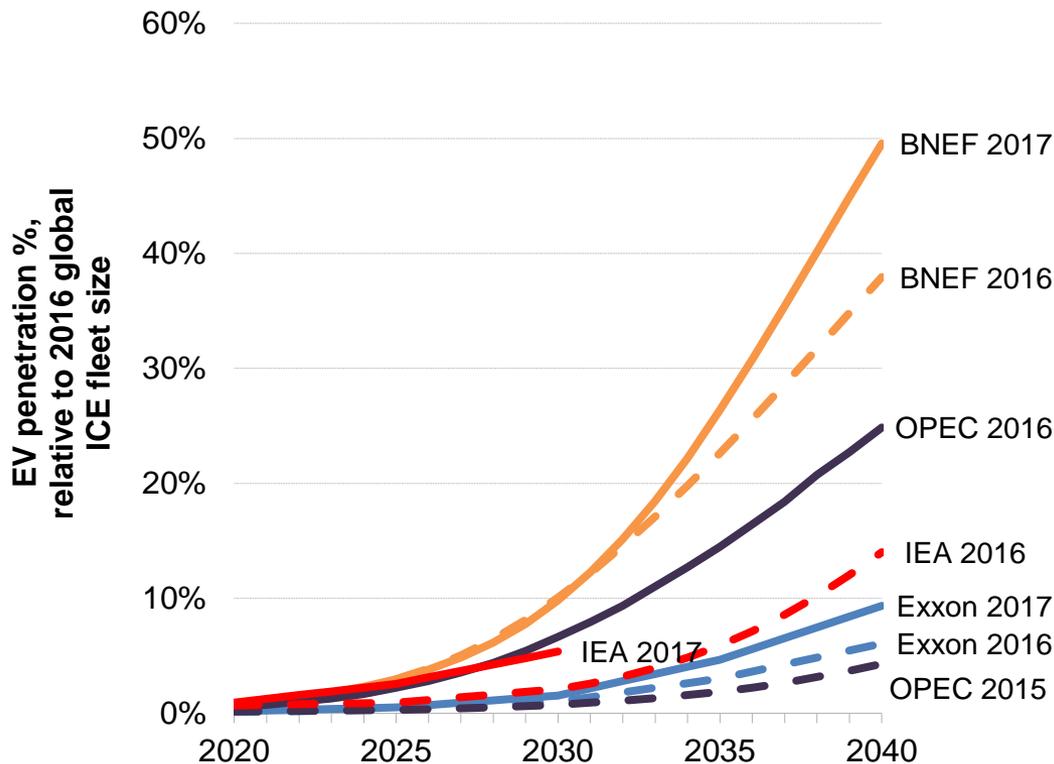
Demand for travel continues to grow, fleet efficiency reductions have slowed and biofuel usage has reduced. The global market for electric vehicles (EVs) is increasingly positive, and UK support should continue while the market develops, delivering significant additional benefits in improving air quality: CCC 2017

By 2021 the London ultra-low emission zone will extend to the North Circular and South Circular roads



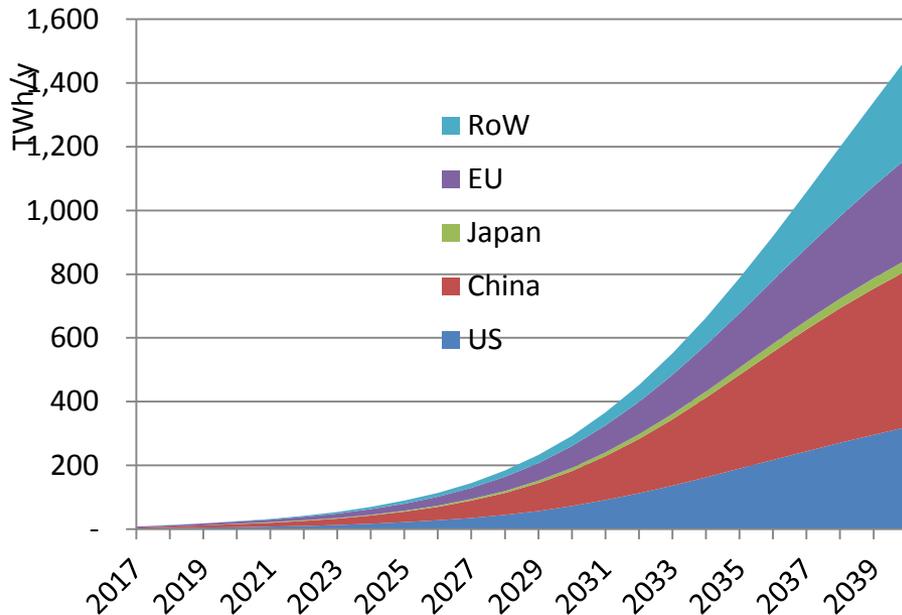
“non-compliant” vehicles will pay a daily charge of £12.50
1.2m non-compliant cars and vans registered in London

Significant differences with global forecast for EVs



- BNEF – 559 million cars on road by 2040 – 1/3 of global fleet
- IEA – NPS 120 million by 2030: EV30 – 220 million by 2030
- OPEC global fleet of hybrids, plug-ins and pure battery EVs 338 million by 2040

Impact on Power Demand



Source: Chatham House - 2018

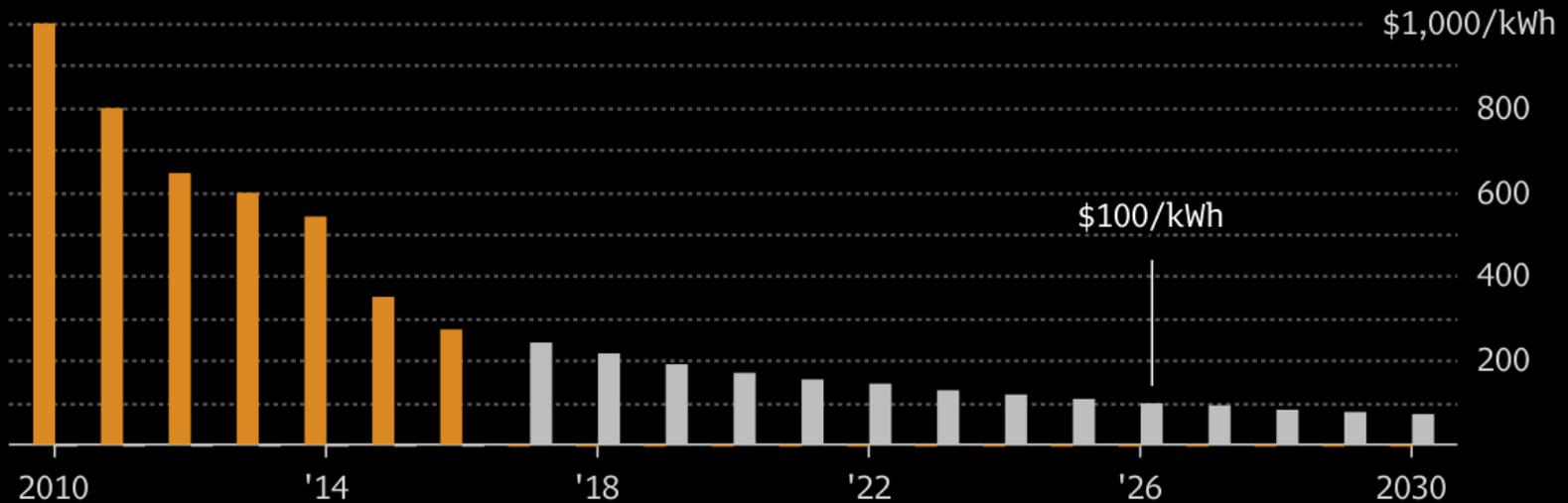
- Expected battery sizes by 2030: BEV 70-80 kWh; PHEVs – 15 kWh
- IEA – In 2030, the worldwide electricity consumption from EVs reaches 404 TWh in the New Policies Scenario and 928 TWh in the EV30@30 Scenario.
- BNEF - By 2040, EVs will be displacing 8 million barrels of transport fuel per day and adding 5% to global electricity consumption – 1400 TWh

Falling storage costs

Getting Competitive

Battery prices seen reaching key level of \$100 per kilowatt hour by 2026

■ Actual lithium-ion prices ■ BNEF projections



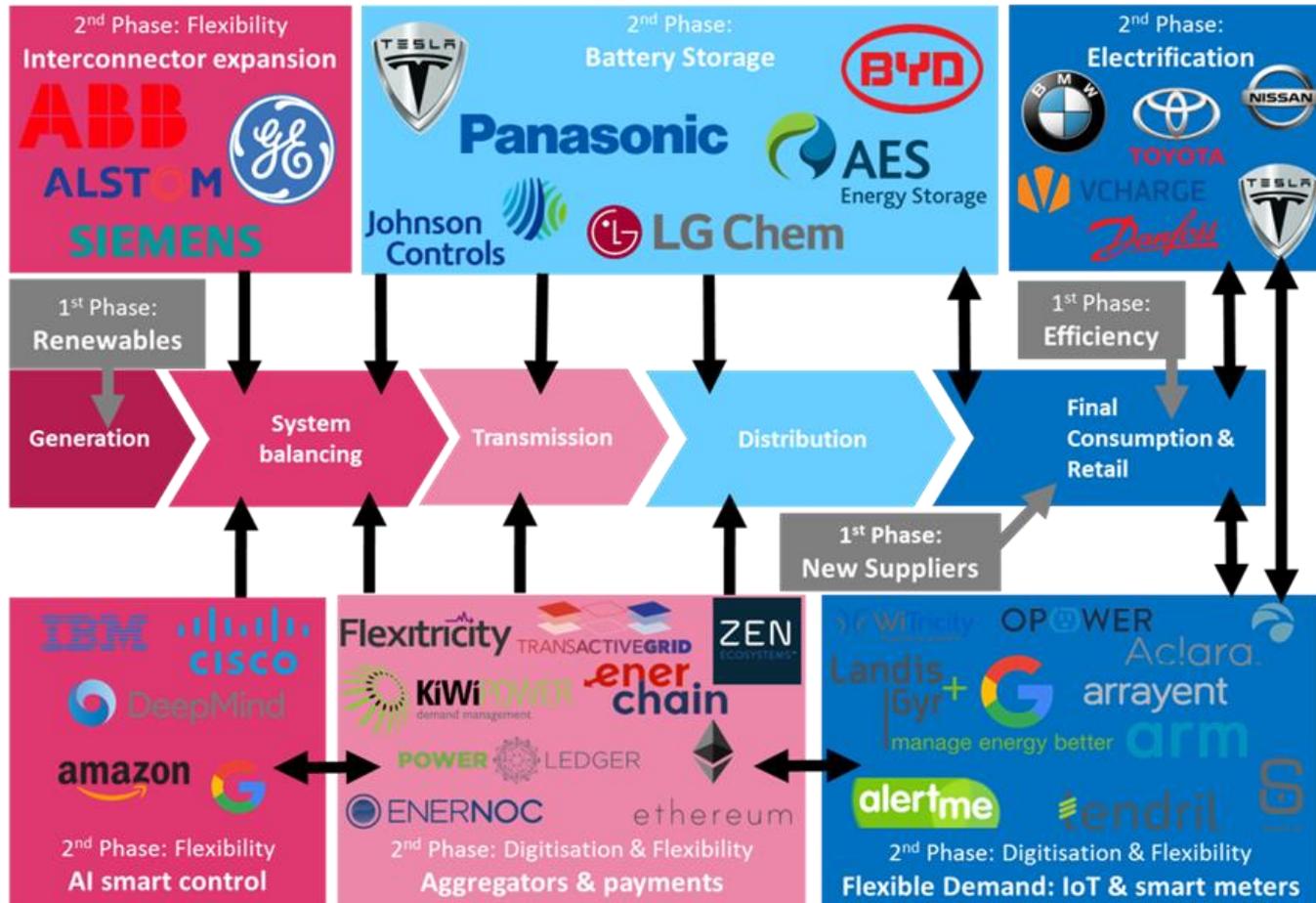
Source: Bloomberg New Energy Finance

Bloomberg

Charging Infrastructure

- Public EV charging infrastructure investment is accelerating, growing seven-fold globally in 2016 to \$6 billion, across 880,000 charging points.
 - In UK – EV's have risen by 98% between 2012-16 – 100 000 vehicles
 - Charging infrastructure risen by 44% - 12 000 points. (PWC)
 - NEV (new energy vehicle) public charging points in China grew to 214,000 in 2017 – 51% year on year growth
 - US, 50 000 public and private charging points – 10% increase on previous year
- UK – 78% of EV owners have access to off street parking; In London – 48% have off-street parking – UK average 72%
- UK: 35% of EV owners charge between 5-8pm

Changing Corporate Engagement in Power Sector



My questions for workshop

- To what extent will:-
 - Power sector affect the deployment rate of EVs:
 - Under-estimation of deployment of EVs
 - Bottle necks in domestic charging, especially for fast charging
 - Pace of public charging installation affected by distribution grid limitations
 - Higher charging/installation costs
 - EV deployment impact upon power sector:
 - Increase in power demand
 - Opportunities for smart charging and VtG offers cheaper flexibility mechanism
 - Need to strengthen distribution system leads to higher network charges
 - EV deployment leading to lower cost for grid level stationary storage, technology costs and/or 2nd life batteries
 - Acceleration of decentralisation – home storage/solar linkage
 - New market actors – different interests, financial power

Flexibility: Charging

- The UK could benefit from 11 GW of additional flexibility by 2030, due to smart EV charging
- To match a typical 500 MW power station for one hour would require around 330,000 V2G EVs depleting their 60 kWh battery banks by only 10%, assuming only 25% of vehicles were connected to the grid and willing to discharge to the network.