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Electric planes and energy density

Boeing and Airbus are battling to create the most fuel efficient planes, thus allowing their customers to save money on ever increasing cost of fuel. Yet, their planes are fuelled by kerosene (widely used as fuel in aviation) instead of energy from the grid, which is cheaper. So, why aren't large airplane manufacturers working harder to transition into renewable fuels.

The aviation industry has one large problem to solve before it successively can transform into renewable energy sources. The energy density of its energy source. Energy density is defined as the amount of energy sored in a given system of region of space per unit volume, for example the amount of energy we can harness from 1 kg of material. This is where the problem with renewable fuel sources arise. Kerosene, for example, has an energy density of 43 MJ/kg. Whereas even the best lithium batteries (as of 2018) only gives 1 MJ/kg.

The basic concept of why a plane flies is that the lift equals the weight of the plane. In short, the problem with low materials with low energy density arise because, using batteries to create the same amount of energy as kerosene would increase the weight of the energy source by more then 40 times. This would result in the plane being heavier and that you would need more power → more weight. With some rough calculations you get that is the mass is doubled, the power required is increased by a factor of 8. This leads to the fact that electric commercial airliners aren't feasible with todays technology.

The other main way of powering electric engines are hydrogen and fuel cells. The biggest problem for hydrogen fuel cells today is the cost and accessibility of hydrogen. But hydrogen has I big advantage when it comes to aviation. Its high energy density of around 140, well over 3 times traditional jet fuel, making it ideal for powering large aircrafts.