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Design of Photovoltaic Systems

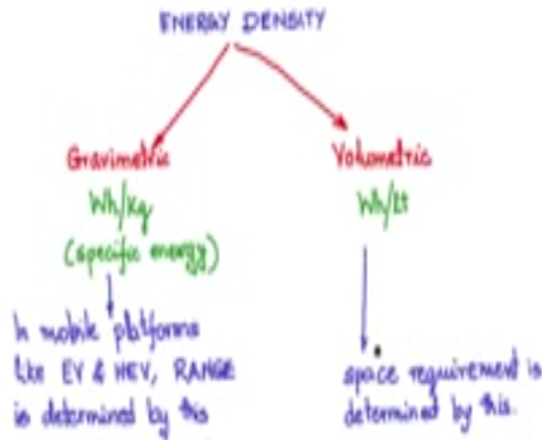
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NPTEL Online Certification Course

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4 ENERGY AND POWER DENSITIES



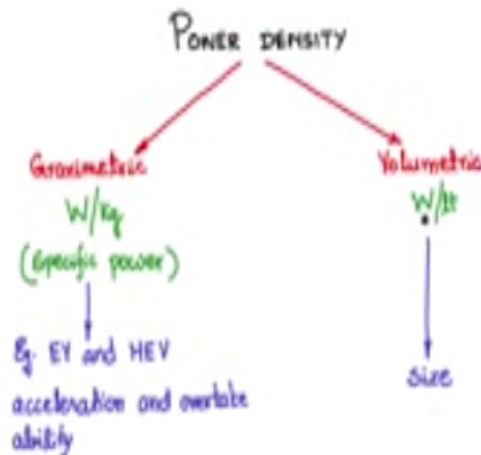
Energy and power densities these are neutral a set of parameters that are very important for deciding the size of the battery energy and power density have a appearing on determining the volume size space requirement for a given application in housing the battery for the given application if you consider the energy density there are two specific types one is called the gravimetric energy density and other is called volumetric energy density and as the name indicates gravimetric energy density is having units of Wh / kg and volumetric energy density is having the units Wh / liter.

So this gravimetric energy density Wh / kg is also given in the literature as specific energy in some literature you will see that specific energy so do not get confused, so Wh / kg so for every kg of the battery materials battery package it will deliver, so much Wh / x amount of whatever no that is the meaning of the gravimetric energy density likewise for every liter of the battery

package it will deliver X amount of Wh or capacity in terms of Wh for a given volume and that is the volumetric density.

The volumetric density has a direct bearing on size and the space requirement is decided are determined by this parameter gravimetric energy density has a lot of significance on mobile platforms on static platforms the rate does not play that much of a role as the space so the gravimetric energy density is used more in mobile platforms like for example electric vehicles and hybrid electric vehicles EV and HEV the range of the vehicle how far the vehicle can operate before the battery is down before the battery is completely discharged is determined by this parameter.

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So it is a range determine if you consider the power densities here again there are two types gravimetric power density and volumetric power density and again as the name suggests gravimetric power density has the unit's Wh/ kg and volumetric power density is in Wh/ liter gravimetric power density is also called a specific power in literature and you will get to see that if you are referring to certainly literatures.

So specific power for gravimetric power density and specific energy for gravimetric energy density are alternate names for gravimetric power and energy densities respectively, so here again the Wh/ liter is having a direct bearing on the size of the battery it indicates that for a given volume you can draw so Wh the instantaneous Wh out of the battery this has this gives an

indication on how much amount of the charge current that you can draw out of it at a given instant likewise Wh/ kg specific power has a bearing on mobile platforms like Ev and hybrid electric vehicles just like the Wh/ kg the gravimetric energy density had a bearing on the range of the electric vehicles the Wh/kg has a bearing on the acceleration or the overtaking ability of an electric vehicle.

So that decides the or taking ability of the electric vehicle one must note however that energy density and power density and the power density both of these cannot be high in a given battery it so happens that the battery chemistry is such that if the energy density is high the Wh density is high the power density or the Wh density is low or if the power density is high the energy density is low.

So these two seem to offset each other and as a result you if you have a high range you may not have a high acceleration capability or if you have a high acceleration capability you may not have a large range so these the choice of the battery will always be a compromise between these two parameter that is the energy and the power densities.