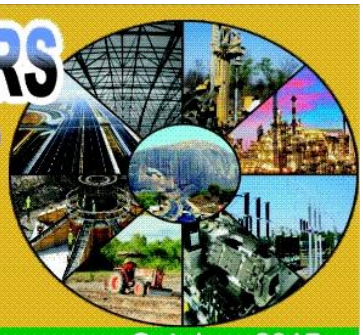
# NIGERIAN SOCIETY OF ENGINEERS
## MAITAMA TECHNICAL DIGEST


www.nsemaitamabranch.org.ng
Email: nsemaitamabranch@gmail.com
Tel: +234 805 671 1032, +234 812 057 8630



Vol. I No. I | *NSE Maitama...upholding the dignity of Engineering profession* | October, 2017


Maitama Technical Digest is the fulfillment of the cardinal programmes of the Society on professional development of its members through knowledge impartation. This Digest will no doubt be used to educate Engineers and the general populace on new trends in Engineering. In this first edition, our focus is on Electric cars, which is been adopted by some countries as a replacement for fossil fuel cars.

An electric car is a car powered by an electric motor rather than a gasoline engine.

There are several reasons for the continuing interest in these vehicles, which are:

- Electric cars create less pollution than gasoline powered cars, so they are an environmentally friendly alternative to gasoline-powered vehicles (especially in cities).
- Vehicles powered by fuel cells are electric cars, and fuel cells are getting a lot of attention right now in the news.

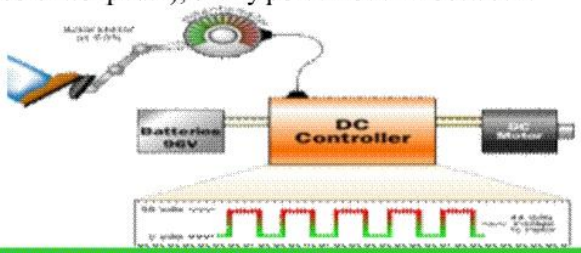
This electric vehicle began its life as a normal, gasoline-powered 1994 Geo Prism. Here are the modifications that turned it into an electric car:

- The gasoline engine, along with the muffler, catalytic converter, tailpipe and gas tank, were all removed.
- The clutch assembly was removed. The existing manual transmission was left in place, and it was pinned in second gear.
- A new AC electric motor was bolted to the transmission with an adapter plate.
- An electric controller was added to control the AC motor.

The heart of an electric car is the combination of:

- The electric motor
- The motor's controller
- The batteries

The controller takes power from the batteries and delivers it to the motor. The accelerator pedal hooks to a pair of potentiometers (variable resistors), and these potentiometers provide the signal that tells the controller how much power it is supposed to deliver. The controller can deliver zero power (when the car is stopped), full power (when the driver floors the accelerator pedal), or any power level in between.




Electric cars can use AC or DC motors:

- If the motor is a DC motor, then it may run on anything from 96 to 192 volts. Many of the DC motors used in electric cars come from the electric forklift industry.
- If it is an AC motor, then it probably is a three-phase AC motor running at 240 volts AC with a 300 volt battery pack.

DC installations tend to be simpler and less expensive. A typical motor will be in the 20,000-watt to 30,000-watt range. A typical controller will be in the 40,000-watt to 60,000-watt range (for example, a 96-volt controller will deliver a maximum of 400 or 600 amps). DC motors have the nice feature that you can overdrive them (up to a factor of 10-to-1) for short periods of time. That is, a 20,000-watt motor will accept 100,000 watts for a short period of time and deliver 5 times its rated horsepower. This is great for short bursts of acceleration. The only limitation is heat build-up in the motor. Too much overdriving and the motor heats up to the point where it self-destructs.

AC installations allow the use of almost any industrial three-phase AC motor, and that can make finding a motor with a specific size, shape or power rating easier. AC motors and controllers often have a regen feature. During braking, the motor turns into a generator and delivers power back to the batteries.

Right now, the weak link in any electric car is the batteries. There are at least six significant problems with current lead-acid battery technology:

- They are heavy (a typical lead-acid battery pack weighs 454kg or more).
- They are bulky (the car we are examining here has 50 lead-acid batteries, each measuring roughly 6" x 8" by 6").
- They have a limited capacity (a typical lead-acid battery pack might hold 12 to 15 kilowatt-hours of electricity, giving a car a range of only 50 miles or so).
- They are slow to charge (typical recharge times for a lead-acid pack range between four to 10 hours for full charge, depending on the battery technology and the charger).
- They have a short life (three to four years, perhaps 200 full charge/discharge cycles).
- They are expensive .

## Battery Problems

You can replace lead-acid batteries with NiMH batteries. The range of the car will double and the batteries will last 10 years (thousands of charge/discharge cycles), but the cost of the

batteries today is 10 to 15 times greater than lead-acid. Prices for advanced batteries fall as they become mainstream, so over the next several years it is likely that NiMH and lithium-ion battery packs will become competitive with lead-acid battery prices. Electric cars will have significantly better range at that point.

When you look at the problems associated with batteries, you gain a different perspective on gasoline. 10litres of gasoline, which weighs 6.8kg, costs N1450 and takes 30 seconds to pour into the tank, is equivalent to 454kg of lead-acid batteries that cost $2,000 and take four hours to recharge.

Any electric car that uses batteries needs a charging system to recharge the batteries. The charging system has two goals:

- To pump electricity into the batteries as quickly as the Batteries will allow
- To monitor the batteries and avoid damaging them during the charging process

The most sophisticated charging systems monitor battery voltage, current flow and battery temperature to minimize charging time. The charger sends as much current as it can without raising battery temperature too much. Less sophisticated chargers might monitor voltage or amperage only and make certain assumptions about average battery characteristics. A charger like this might apply maximum current to the batteries up through 80 percent of their capacity, and then cut the current back to some preset level for the final 20 percent to avoid overheating the batteries.

## Disadvantages of Electric Cars

Much of the talk in the automotive world is about electric cars. They are no longer the future -- they are now. But should you run out and buy one? You might want to think twice after hearing about some of the disadvantages.

### -- Limited Range

This is obviously the biggest disadvantage -- most electric cars will run about 150 miles before needing to be recharged. If you are only doing short local runs, you'll be fine. Anything longer is impossible or anxiety-producing.

### -- High Vehicle Price

You pay a premium to buy an electric car. Depending on the model, it can cost tens of thousands of dollars more than a comparable gasoline car.

### --Limited Charging Infrastructure

Charging your car at home is no problem -- a home charging unit will run you about $1,000. But there are very few public fast-charging stations around to give you that extra juice when you are out on the road.

### -- Service Problems

Will you be able to find someone to service your electric vehicle if/when it breaks down?

# ENGINEERING NEWS

## China Unveils the Worlds Largest Floating Solar Plant

2017 has been a big year in renewable technologies. Although many countries are joining efforts to improve Eco-friendly technologies, perhaps China is leading the way in innovation.

Recently, continuing China's reign of innovative "green" technologies, was their implementation of the world's largest floating solar power plant

The plant, engineered and installed by Sungrow, announced the world's largest floating solar power plant entered operation earlier in May. The **40 MW** plant will power over **6,500 homes.**

Built and installed on top of an abandoned mining operation, the plant will not affect any marine life. It is a small but a great step in the direction of clean energy.

**[Image Source:** ***Sungrow via PR Newswire*****]**

## DO YOU KNOW THAT GAS CYLINDERS EXPIRE?

**Expired Cylinders** are not safe for use and can cause lethal accidents. Here is how you can check the **expiry date** of LPG **cylinders**: On one of three side stems of the **cylinder**, the **expiry date** is coded alpha numerically which starts with A, B, C or D followed by a two digit number. e.g. D06.

A stands for 1st Quarter (January-March)
B stands for 2nd Quarter (April-June)
C stands for 3rd Quarter (July-September)
D stands for 4th Quarter (October- December)