science VIEW

Student's Magazine, Issue: 7, 2022

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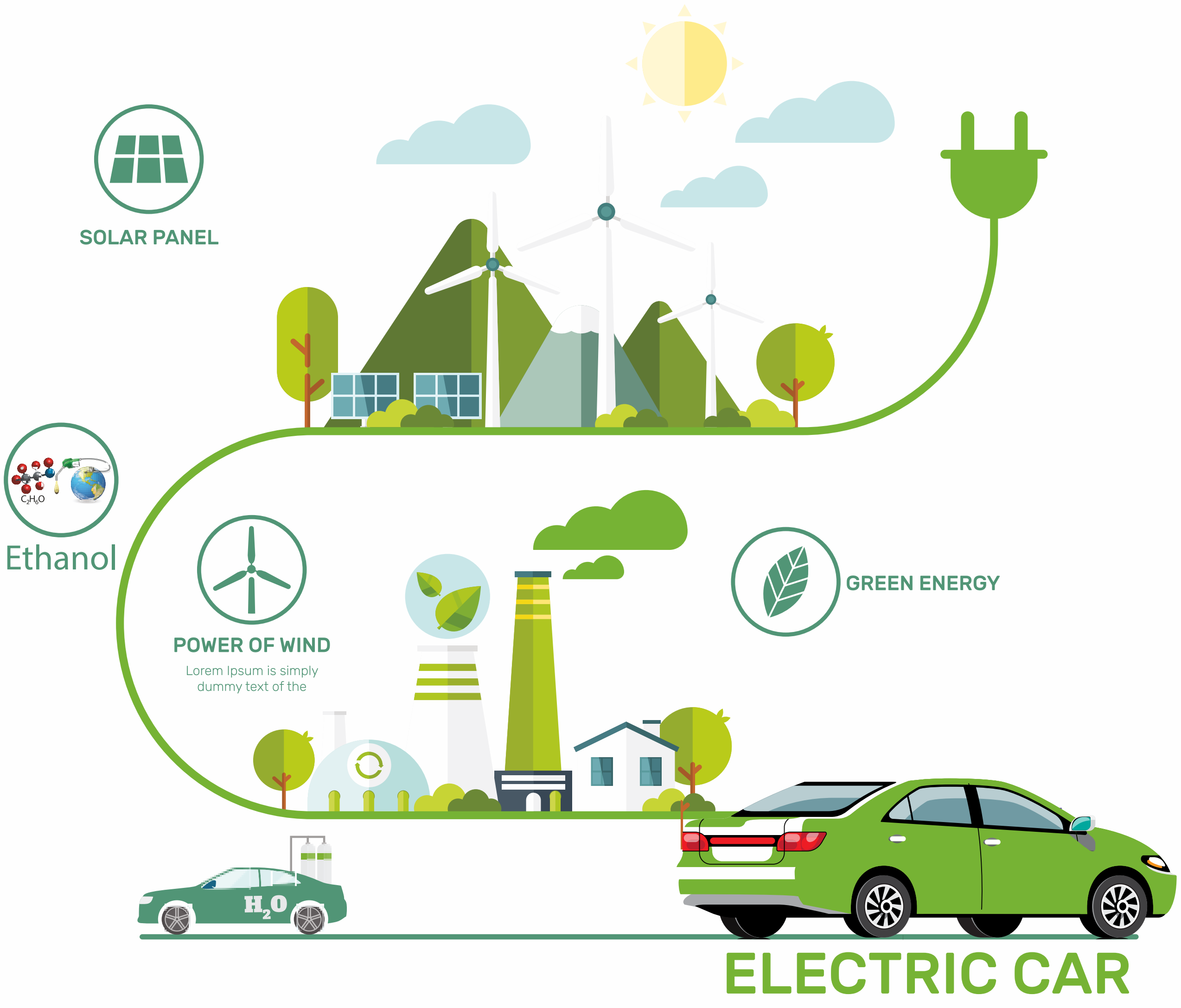
THE New Age TRANSPORTATION Alternate FUEL



From the Editor's desk...

We are happy to release the seventh issue of GSFC University's e-Magazine – **Science View.** I feel fortunate to be a part of this issue of the magazine which is known to be **a magazine for the student, by the student.**

I would like to thank to all my team members who helped me during the course of making this issue successful. I wish to extend my gratitude to all faculties and wonderful students participated dynamically in materializing this magazine.

I am also heartily thankful to university management for providing me such an opportunity, furnishing their support and encouragement.

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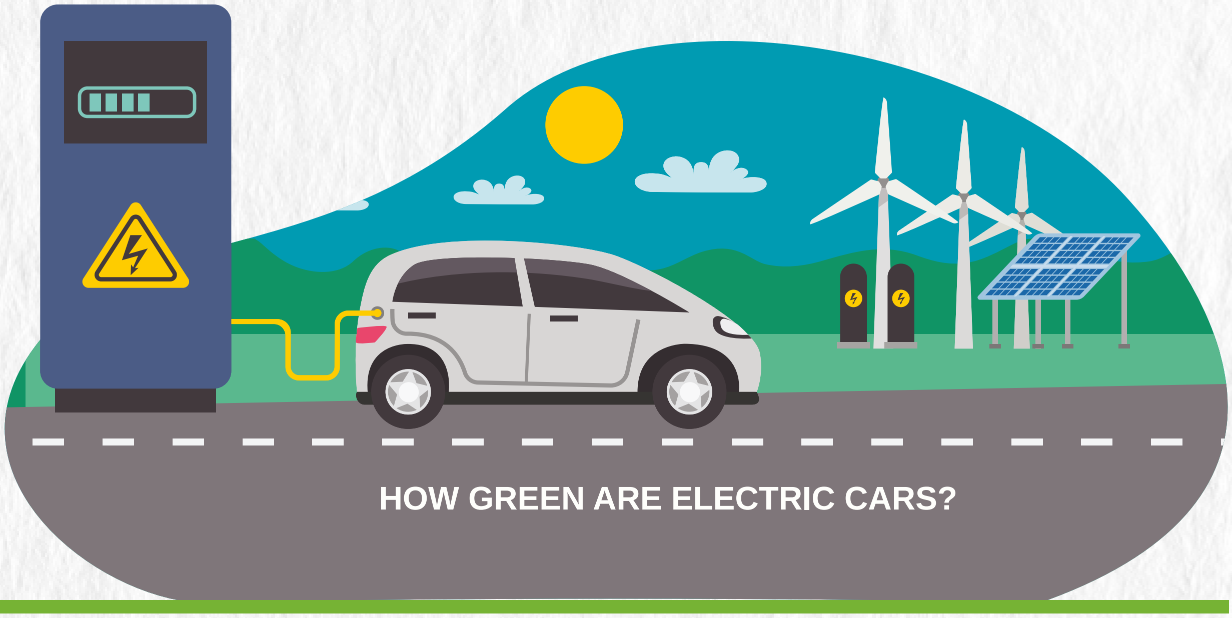
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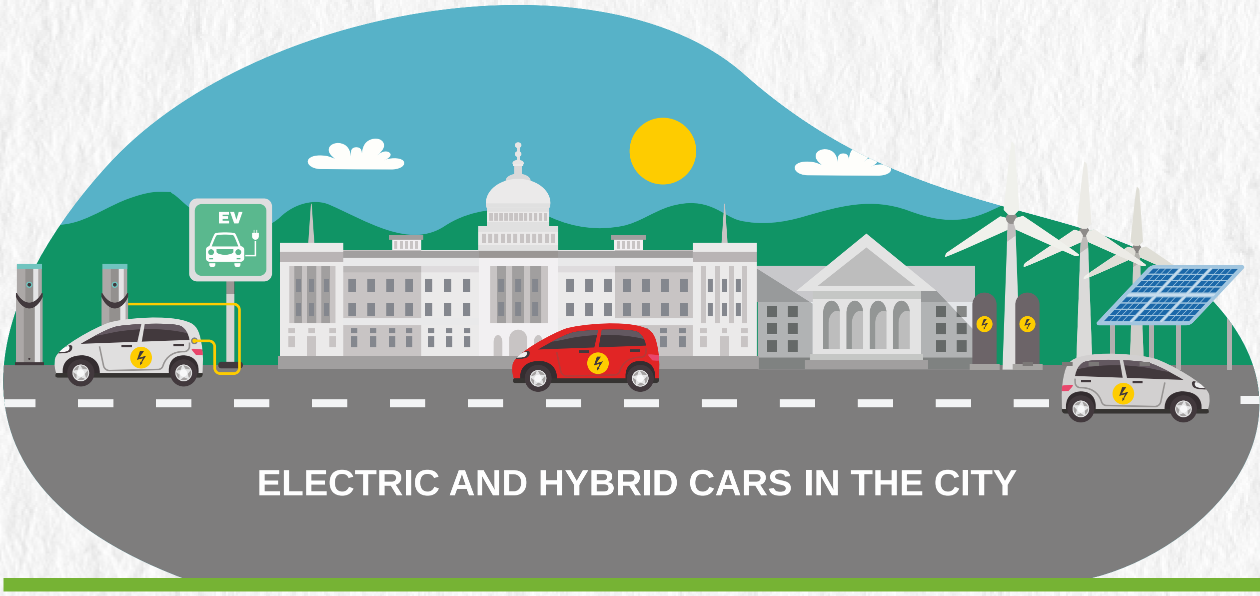
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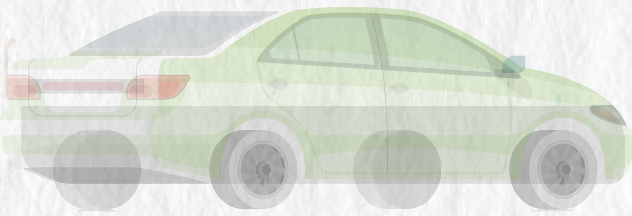

TRANSPORTING IN TRANSPORTATION

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PREFACE

Have you ever thought about how transportation started and what was used in ancient times for transportation? Or else have you thought about how innovatively the person invented the vehicle, which got immersed result into electric vehicles.

It was the 4th millennium BC in lower Mesopotamia, where the Sumerian peoples inserted rotating axles into a solid disc of wood. It was only in 2000 BC that the disc began to be hollowed out to make a lighter wheel. This innovation led to two major factors - Transport and Agriculture, which now touched on the high picks. In this era wheeled cart was introduced, which was based on 2 wheels behind and an animal in front. This was the first road vehicle discovered.

This wonderful discovery had change the plate of transportation. If we see the chronology is the dam site of transportation. As the human revolution has been taking place with time, transportation of transporting had intensively taken place. It was the first "SteamBoat" in 1787, which was made peripatetic through the water.

During the 18th and 19th centuries, there were significant developments in transportation due to the Industrial Revolution. Beginning in Britain, the Industrial Revolution saw the development of advanced machinery and manufacturing that changed the way the world produced and traded goods. Alongside these industrial developments, more advanced modes of transport were also created to cater to the developing world. During the Industrial Revolution, the first bicycle was made, the first motorways were invented, and the first car was built.

The first "Motorcycle" in 1885, "Gas Car" in 1889, and "Diesel Truck" in 1892 played a classic role in the evolution of roadway hauling. They haven't thought about how this invention will be put into a different form in the future. In the early 20th century i.e. 1999 "Segway" was manufactured and by 2001 segway was launched in the market. Segway is too simple to manage, handle, and eco-friendly. Everyone thought that there was a self-driving car since the mid 19th century but actually in 1980 it was initiated and by 2009 it is being with everyone. That's the most beautiful twist!!!

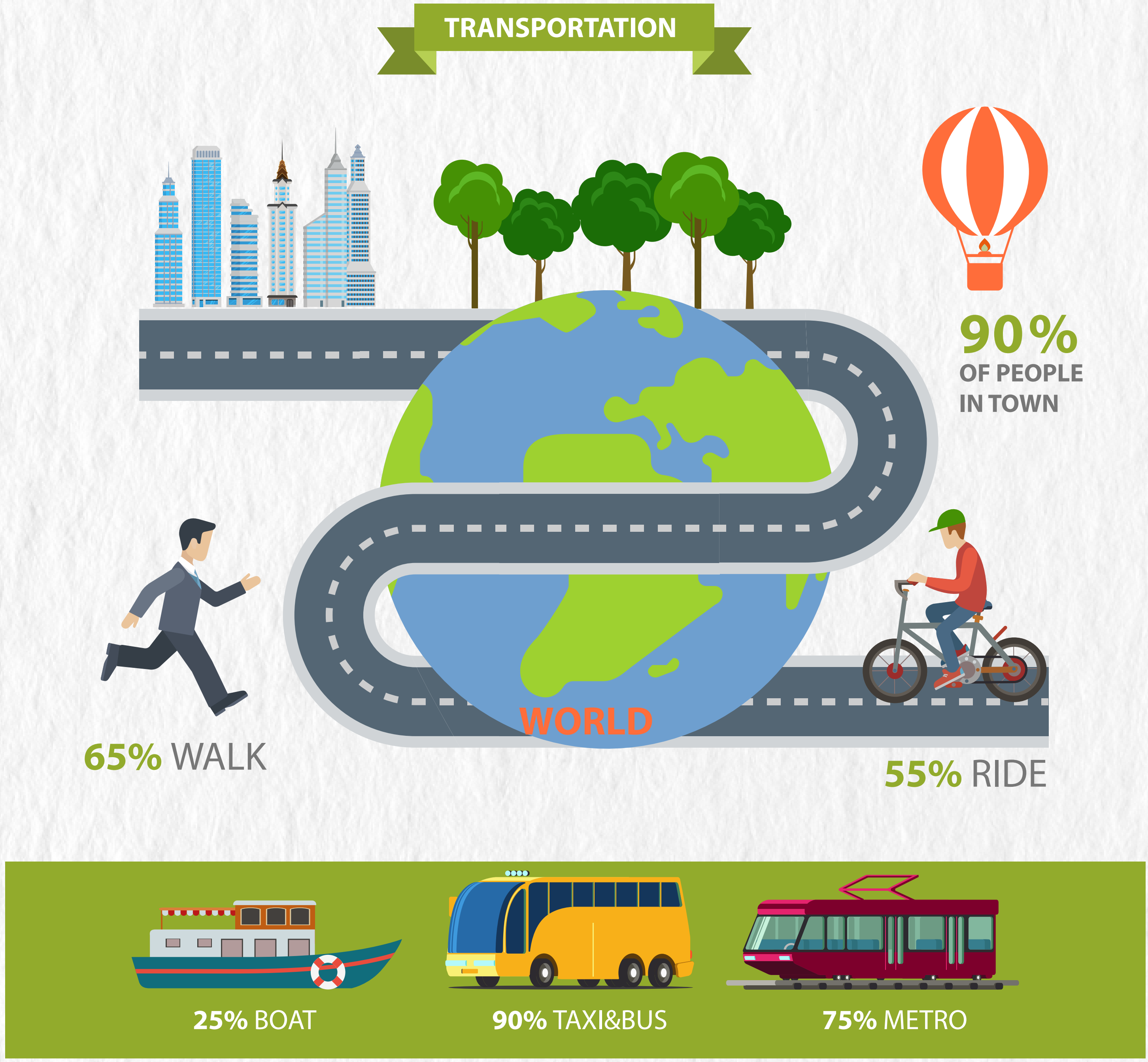
If we go into the depth of the last 10 years, the world's population growth and pollution due to industrial vehicles are directly proportional. The fantastic evolution due to industries leads to dangerous results for human life and world pollution. We had seen smoke on a sunny morning, foam floating on the river, and plastic littering the streets. These all are the forms of pollution which we see in our surroundings in day-to-day life. The most played role in pollution is by "vehicles". Now and then, day in daily life we see vehicles releasing smoke into the environment. The harmful C02 gas had a very bad effect on the environment

CONCLUSION

If we move to 1806 Swiss Engineer Francois Issac de invented an internal combustion engine that used a mixture of hydrogen and oxygen as a fuel. But the car he designed to go with it failed. This little step for the environment had made footprints for 20th-century generations. At the beginning of the 21st century, interest in electric and alternative fuel vehicles in private motor vehicles increased due to: growing concern over the problems associated with hydrocarbon-fueled vehicles, including damage to the environment caused by their emissions; the sustainability of the current hydrocarbon-based transportation infrastructure; and improvements in electric vehicle technology. But besides that, the main problem held in electric batteries was their manufacturing. Nowadays we are replacing coal with hydropower, fossil fuels with solar energy, and petrol-diesel with electric vehicles. EV is minded to be cleaner, greener, and sustainable. But as per history, every shiny thing had resulted in to damage the environment or else making sacrifices to human life. The same goes for an electric vehicle, the hidden story behind a shiny exterior of an electric vehicle lives a story of blood batteries. The EV batteries are made up of rare metals such as cobalt and lithium. The cobalt gives stability and allows it to operate safely. Cobalt is found in the earth's crust i.e. crustal rocks. 56.5% cobalt is used in batteries. Cobalt is found all over the world but DR Congo is the second largest country in Africa for cobalt production. Cobalt mining in congo is based on Industrial mining and Artisanal mining.

Artisanal mining neither has labor law applicable nor safety protocol. This mining in Congo produces 20-30% of total cobalt. Among 200,000 miners there are 40,000 miners as children. These children after too much work and labor where there are narrow tubes and only 20% of oxygen worth without masks and gloves, at end of the cobalt sale get only $1. Cobalt is a global industry, estimated to be worth $13.63 billion by 2007, but money does not reach these children who are spotting and extracting the metals. Many parents had lost their children in this mining due to poverty. Sending children to the mines is not a choice but a necessity. Between 2014-2015, Artisanal miners death 80 miners in congo. In 2019 accident killed 43 miners at a time. Accordingly, one estimated 2,000 illegal miners die every year in Congo. Many suffer exposure, cobalt can cause respiratory disease, skin disease, and life-changing injuries. In controlling the pollution of the environment, we are heel to

destroy human life. Despite getting an option for vehicle pollution we can't able to get an option for human life. Today there are 2.5 million EVs on the roads and the government is expecting 66 million EVs by 2040. By 2040 cobalt production increases by 585%. This is why EV kills people before it hits on the roads. So as this EVs have blood batteries we have now to deal with other alternate fuels which saves the human lives as well as saves the environment. EVs are cleaner to environment but killer to human lives.



Xenobots: The First Reproducing Transportation Bio-Machine.

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Abstract

Since ages human beings are tempted to live long and making efforts to discover effective medicines, devices, and therapies which contribute to make their life comfortable. The concept of life which we know is the organisms who have the ability to grow, the one who can reproduce, the metabolism occurring within their bodies, their cellular organization and consciousness.

This all characteristics we look for in an organism for it to be living and that's what became the actual meaning of life for us. The basic terminology 'reproduction' is vital for every organism to sustain its existence on this earth, and all organisms are constantly battling with entropy. The diverse form of replication, involves fission, budding, fragmentation, vegetative propagation, parthenogenesis, hermaphroditism, etc. The paper published by **PNAS- Proceeding of National Academy of Science** has described an incredible and fascinating synthetic life created with the help of Artificial Intelligence. No codes are required for these programmable living robots. The use of evolutionary algorithms played a vital role in creating this unknown life known to us as **'Xenobots'**. Generally, when we think of robots, we usually imagine something which is made of plastic or metal. **Xenopus laevis** - an African clawed frog's embryo, the scientist tried to disassemble its blastula stage embryo with the help of forceps or tinier electrodes to create something movable. Hence, it was their prior task to let it move in a specific direction. The coauthor of PNAS and scientist Douglas Blackiston thought of using different cells as a building block to create a Biobot from a Xenopus embryo. The Xenobots are neither living nor non-living as they have a place somewhere in middle as per our thinking towards living and nonliving. They are considered to be nonliving because they lack a brain and a nervous system yet they are considered to be living because they possess a different way to replicate which is not seen in any living species throughout the evolutionary history of any organism that is 'Kinematic Self Replication'which is observed at the molecular level. It is not something new as it was proposed in late 1940 by John Von Neumann, a mathematician. The few questions we desire to know are how these cells are able to work together and communicate to make the specific functional structure and how they do Kinematic Self Replication by piling things up.

Introduction

Scientists Sam Kriegman, Douglas Blackiston, Michael Levin, and Josh Bongard created a microscopic Biobot with the help of artificial intelligence. Solving human problems by preparing machines is Robotics but instead of machines, they used living tissues to do so. This type of life created in laboratories by using tissues is Biobot. Biobot includes mechanical design plus living tissues. We are always amazed by the life-sustaining around us. The life around us always inspires us to think about their astounding abilities.

Journey of Biobots

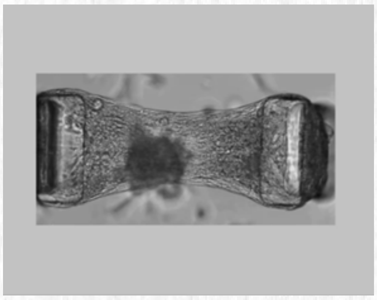


Figure 1 Biobot made in 2014

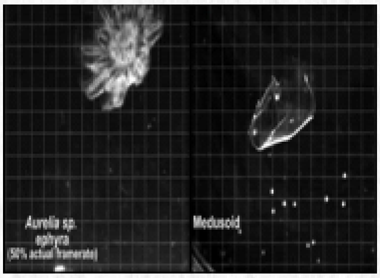
The earliest Biobot (Figure 1) is made up of plastic backbone and mouse heart muscle tissue. The contraction of the heart muscle let it do contractile movement which hence leads to rough locomotion in an aqueous medium.

Taking inspiration from the various organisms, scientists created the next version of this, which was influenced by sea turtles' mobility (Figure 2).

(Figure 3)

(Figure 2).

Another Biobot was based on the articulation motion of muscles. Changing voltage around the two arms allows Biobot to manipulate things in its surrounding.



(Figure 4)

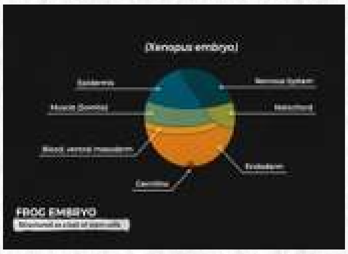
(Figure 4)The biomimicry of Aurelia was done using the artificial building block and layered with the help of heart tissue. Another similar example of this is the biobot of stingray (*Figure 5*) which gets excited by light. They sense photons and move accordingly. It has a backbone and a rat heart muscle cell. These all biobots get excited by an external stimulus to work whereas the Xenobots are capable of operating on their own.

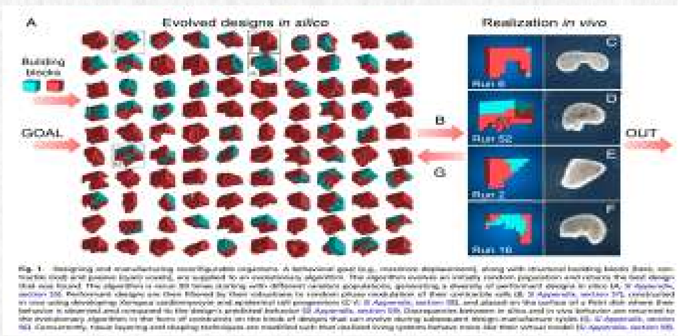
(Figure 5)

Xenobots: reproducing biobot

Xenobot - a biological robot that was created without cloning or manipulation of its genetic material. They were created with artificial intelligence, with the help of an Artificial program called Voxcad. Xenobots do not require artificial components for their backbone while it is made up of a fertilized egg of **Xenopus laevis-** a frog. Voxcad creates a virtual environment to predict the movement of various structures of Xenobots and as well as their path. The fertilized egg of Xenobots contains a cluster of cells and each cell of blastula have a preassigned purpose. The pluripotent cells are collected from Xenopus embryo and raised for 24 hours at 14°C in mild saline solution.

We can observe above the Xenopus embryocells have a predetermined function. They are already assigned with the purpose of what they will be formed into. This property was made in use by scientists to disassemble the desired cells from the embryo and then transferred them into a media where they get adhered to assemble. This adhered embryo structure was determined in Voxcad virtually where each cell was assumed to be a cube which is known as a voxel. They created thousands of digital Xenobots and a few of them were filtered out according to the desired structure and function. The iterated design with desired behavior is assembled in the laboratory. The Voxcad is divided into two types of cells i.e., passive and active, technically we call them voxel. The placing of a voxel in a random pattern and running this design in an evolutionary algorithm helps to select the required structure based on their behavior and movement The passive voxel suggests the non-motile tissue like skin cells, which provide a structural framework. While active one is taken to be cardiac tissue, which can contract that may provide the specific locomotion to xenobot. These voxels are placed in different patterns to obtain the desired designs for implementation(Figure 6). The cells are designed by taking the reference of the provided voxels structure. The Insilco approach and in vivo technique together play a major role in creating a xenobot. The first Xenobot created was a spheroid and it constantly piling up the debris(Figure 7) which is a mindless uncoordinated act.






(Figure 7)

If we replace this debris with xenopus stem cells these biobots will pile up these stem cells to give rise to new xenobot the process is known as 'Kinematic Self Replication'. For this type of reproduction to occur the Xenobots must have an accurate design so it can smoothly pile up cells. For this purpose, the voxcode suggested the C-shaped xenobot which is also known to be Pacman shaped biobot. The cells get collected in its C shape mouth that's what makes them do replication comparatively easily from other voxels designs. The presence of cilia let this creature spin around rapidly.

To determine whether this reproducing biobot are able to move in provided direction or not, scientist placed them in a 0.5nm maze tube which was less than the diameter of the human capillary. They successfully followed the right path while traditional robots require a navigation system. Their incredible ability to work in a team and repair mechanisms amazed scientists and give hope for various future perspectives of it. The repairing mechanism of the xenobot is still under study. The individual xenobot can live for 10 days without any food source in an aqueous environment. The continuous enhancement of raw materials can give limitless generation.

Conclusion

Xenobots can be a powerful tool to pile up microplastic from oceans. Their ability to repair can be helpful in learning regenerative medicines, to repair damaged tissue. Moreover, the in vivo automated transportation of micro-particles using bio-robots is one of the key technologies to achieve in vivo applications, such as drug delivery, cell delivery, thrombus elimination, and cell surgery. They can be effective against a treatment like peripheral and diabetic neuropathy, preventing paralysis, removing plaques from arteries, identifying cancer, digest toxic products. The introduction of RNA molecules in them can give them molecular memory, if they experience something in the environment that can be detected by fluorescent markers. This property may helpful in detecting radioactive contamination, and chemical pollutants.

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The New Age Transportation and Alternate Fuels

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To reach transport greenhouse gas emissions reduction targets and lower air pollution, the European Union is relying on, among others, increasing the use of alternative fuels in transport. These include biofuels, electricity, hydrogen, liquefied petroleum gas, natural gas and synthetic and paraffinic fuels. In order for that to realistically happen without curbing mobility, market uptake of powertrain technologies is needed. This paper reviews alternative fuels in transport systems by identifying state-of-the-art developments, comparing their evolution since 2015 and gauging the market prospects of the powertrain options. The road, rail, water and air transport systems are considered. In conclusion, the EU transport systems are evolving at different paces and thus with differing degrees of success, without a single fuel clearly dominating the alternative fuel transport system yet.

The European Union (EU) transport systems (including aviation) generated 1,097 megatonnes of greenhouse gas (GHG) emissions in 2017 (EEA, 2019). The EU has the ambition to decarbonise the transport systems by, among others, increasing the use of alternative fuels, including electricity (EC, 2018b). As can be seen, the railways made a marginal contribution to transport GHG emissions. The objective of this paper is to review alternative fuels in transport systems by (i) identifying state-of-the-art developments, (ii) comparing their evolution since 2015, and (iii) gauging their market prospects. This includes not only the fuels per se, but also the vehicles that can be powered by those fuels. The focus of this paper is on alternative fuels, as defined in Directive (EU) 2014/94: electricity, hydrogen (H2), biofuels, synthetic and paraffinic fuels, natural gas (liquefied natural gas (LNG) and compressed natural gas (CNG), including biomethane) and liquefied petroleum gas (LPG) (EU, 2014). For a more recent legal definition of biofuels and advanced biofuels, see EU (2018). Beyond the scope of this paper are autonomous vehicles, two- and three-wheelers and other transport systems such as pipelines as well as an analysis of the contribution of each fuel to reduce air pollutant and GHG emissions (see e.g. Edwards et al. (2014)) and lifecycle impacts (see e.g. EEA (2018a)).

The transportation sector creates approximately 22% of total greenhouse gas (GHG) emissions in European Union states (European Environment Agency, 2019). Considering the advantages of alternatively fueled buses in urban areas, several European cities and regions endeavor to accelerate the electrification progress of the public transportation system. For example, before 2025, several cities (e.g., Athens, Paris, Copenhagen, Berlin, and Madrid) and government (e.g., Norway) have the plan to abandon diesel vehicles or stop purchasing conventional buses. In 2016, to achieve zero-emission transportation, European countries have proposed the Clean Bus Deployment Initiative to cut carbon emissions from the public transportation system. Over 80 cities, regions, manufacturers, and other organizations have signed the Clean Bus Declaration. In particular, Copenhagen in Denmark and Oslo in Norway develop a blueprint to have 100% public transit electrification by 2030 and 2028, respectively. Therefore, the governmental policymakers and transit operators in European countries are facing challenges in the transition period to purely electrified public transportation systems. In order to support their decision-making, lifecycle analysis has been widely applied to understand the overall and long-term worth of public transport electrification. The energy mix determines the environmental performance of electric vehicles (Faria et al., 2013). Moreover, with the maturing of electric vehicle technologies, it is important to determine when or how to achieve purely electrified public transportation systems. Therefore, it is important to investigate the lifecycle cost of battery-electric buses considering the existing energy mix and possible future conditions. The results can help policymakers and operators to design proper strategies to maximize the benefit and minimize the side effect of transportation electrification.

Lifecycle analysis associated with passenger cars and buses, which are powered by alternative powertrains, has gained worldwide attention. Mahmoud et al. conduct a comprehensive review of buses with detailed alternative powertrains considering the economic, operational, energy, and environmental characteristics (Mahmoud et al., 2016). The review pointed out that the lifecycle cost-benefit of the battery-electric bus highly depends on operational characteristics and energy resources.

In the United States, by assessing the value of lifecycle emissions and oil consumption for different vehicle types power by alternative fuel technologies, Michalek et al. indicated that the external costs of plug-in vehicles are largely dependent on GHG and SO2 emissions from battery manufacturing and vehicle charging (Michalek et al., 2011). Mckenzie and Durango-Cohen applied a hybrid input–output model to analyze the life-cycle economic and environmental performance of alternative fuel transit buses (Mckenzie & Durango-Cohen, 2012). The results showed that buses powered by alternative fuel have lower operating costs and emissions. However, the lifecycle cost of alternative fuel buses is higher than diesel buses. By comparing lifecycle environmental impact from convention buses and battery-electric buses, Cooney et al. indicated that energy resources dominate most impact categories in the operation phase (Cooney et al., 2013). Moreover, battery production can significantly affect global warming, carcinogens, ozone depletion, and eco-toxicity. Bi et al. compared the impact of different charging technologies on the lifecycle performance of battery-electric buses in terms of energy consumption and GHG emissions (Bi et al., 2015). The results show that the wireless charging system outperforms the plug-in charging system in terms of lifecycle energy consumption and GHG emission. Bi et al. investigated the lifecycle performance of the battery-electric bus system with different charging methods and compared the cost to both conventional diesel and hybrid bus systems (Bi et al., 2017). Tong et al. conduct a lifecycle cost analysis for transit buses powered by different sources, such as diesel, diesel hybrid-electric, compressed natural gas, liquefied natural gas, and electricity (Tong et al., 2017). The study considered GHGs and criteria air pollutants together with ownership costs to estimate total costs. The results showed that diesel buses have lower lifecycle ownership costs than alternative fuel-powered buses. Moreover, the battery-electric bus can significantly reduce city-level air pollutants.

In Europe, Brand et al. introduced the U.K. transport carbon model which covers the transport-energy-environmental issues from energy demand reduction to lifecycle carbon emission and external costs (Brand et al., 2012). Antonio García Sánchez et al. investigated the impact of the Spanish electric mix on different powertrain technologies in terms of lifecycle energy consumption and GHG emissions (Antonio García Sánchez et al., 2013). Among all powertrain technologies, battery-electric buses generate the lowest GHG emissions. By extensively simulating different bus routes, Lajunen investigated the cost-benefit of hybrid and electric buses and pointed out that electric bus is one of the best choices to decrease energy consumption and emissions (Lajunen, 2014). Ribau et al. indicated the importance of driving profile and the tradeoff between investment cost, efficiency, and LCA in the powertrain design of hybrid electric vehicles (Ribau et al., 2014). The results show that fuel-cell powered hybrid vehicles lead to a lower lifecycle cost and higher financial savings potential than plug-in electric hybrid vehicles. Lajunen investigated the lifecycle cost and energy consumption of different charging power and battery requirements considering electric buses on different operating routes (Lajunen, 2018). The results show battery size has a limited impact on the lifecycle performance of fast charging buses. Harris et al. developed a framework to access the lifecycle of alternative bus technologies considering the uncertainty of these technologies (Harris et al., 2018). By comparing to the diesel bus, the results showed that the electric bus can significantly reduce GHG emissions. However, the lifecycle cost of electric buses is 129–247% higher than the conventional buses. By considering emissions associated with fuels and batteries producing process of alternative bus powertrains, Xylia et al. proposed a model to optimize the location of bus chargers using a life cycle perspective (Xylia et al., 2019). The results show that electric buses with larger battery sizes may not lead to a significant drop in total emissions. Nordelöf et al. point out that impacts related to emission decreases with the degree of electrification which is based on renewable energy resources (Nordelöf et al., 2019). Recently, Zhang et al. uncovered the impact of battery degradation on electric bus fleet operation (Zhang et al., 2020). The result shows that maintaining proper depth of discharge during the operation would able to extend battery lifespan up to three years. Moreover, they also point out that battery degradation would significantly affect the lifecycle cost of electric bus fleets.

Moreover, Sharma et al. investigated the economic and greenhouse performance of passenger vehicles with alternative powertrains in Australia (Sharma et al., 2013, 2012). The simulation results show that Class-B electric vehicle has worse performance than an equivalent conventional vehicle in terms of ownership cost and lifecycle emissions. The major reason is that electric vehicle has significantly higher embedded emissions where battery contributes about 50% of the electric vehicle embedded emissions. Bases on on-road tests in Macau, China, Zhou et al. compared the lifetime carbon dioxide emission of battery-electric buses and conventional buses (Zhou et al., 2016). They pointed out that the impact of air-conditioning usage on energy consumption is larger than passenger load. Moreover, Song et al. conduct a lifecycle assessment to compare the traditional diesel public buses and electric buses in terms of GHG emission by using real-world data in Macau (Song et al., 2018). The result shows that electric buses can hardly reduce GHG emissions from traditional diesel public buses based on current electricity distribution.Enrique et al. investigate the life cycle environmental impact of manufacturing BEV and BEB in Brazil considering geographic characteristics (Enrique et al., 2019). As a result, manufacturing BEB and BEV in Brazil is not environmentally competitive unless the impact of metal extraction and metal use can be reduced.

According to the results from the existing works, the lifecycle cost of electric vehicles varies with the analysis methods, data resources, geographic locations, and other impacts. However, to the best of the authors' knowledge, limited work explored the performances of alternative fuel buses in different countries by partially considering local climate, battery degradation, and operation characteristics. By addressing the existing limitations, we explored the lifecycle economic and environmental performance of buses with different powertrains in European countries. Based on the results, we provide insight into the tradeoff between economic and environmental benefits during public transport electrification progress. And several suggestions are proposed to speed up the electrification progress of the public transportation system.

The new age transportation an alternate to fuels.

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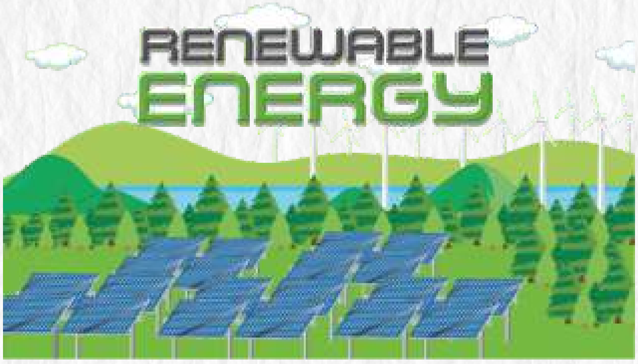
Mankind has always strived to be better in all aspects, let alone be transportation. The invention of wheel remarked the beginning of a whole new era of inventions and discoveries. With the development of technology, we started using natural resources like petroleum to develop machineries which could transport utilities from one place to other, wherever the roads lead. But our development doesn't come at a cheap cost. The inefficient use of the natural resources, which are limited in quantity as well as non-renewable, will lead to their shortage in near future. So, mankind has to find a way out. And since evolution is a continuous process, we even figured out a way from the above problem. We developed vehicles that propel on renewable sources of energy. We did realize that we were a little late in implementing these practices, that we had done major damage to the ecosystems around us with the uncontrolled use of natural resources, but, it is better to be late than never.

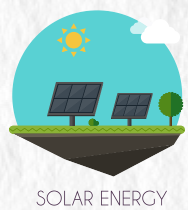


We all are living in the era of renewable energy. The transportation sector is one of the most iconic sectors where renewable energy has been a game changer. The concept of electric cars dates back many years, but it is the recent times where they have been implemented. And not just as a concept, but as a practice. We see many countries switching their public transportation system to fully electric vehicles. In fact, citizens are buying electric vehicles for their personal use. But it too has a flaw. If the electricity used to power these vehicles is not produced by renewable methods of production, then it does no good. The source also has to be renewable, then in real sense we can say that it is environment friendly. One way to overcome this problem is by introducing renewable methods of electricity production like tidal energy and wind energy. The other way is by looking for an alternate, more renewable source- like Solar.

The Sun is the biggest source of energy for all life forms on Earth, and the biggest perk is that it is free! So, development of Solar powered trains, cars and other modes of transportation took place. The best part of it is that it is emission free, which means we are not harming the mother nature. Many countries have solar powered public transportation systems, which have helped them to reduce their carbon footprints.

We took a leap forward and introduced Hydrogen cars! Cars that run on hydrogen as a fuel source. Although the production of Hydrogen gas is complex, it is the most abundant element in the universe, meaning it is a never-ending source of energy. Also, Hydrogen powered vehicles emit water-vapor and warm air. As of now Hydrogen powered cars are a concept, but so were electric cars when they were first introduced. In a couple of years, we might manifest the power to produce Hydrogen efficiently, so as to fuel our vehicles. We have also achieved success in making biofuels- biodiesel that can be manufactured from vegetable oils, animal fats, or recycled cooking grease for use in diesel vehicles.

Our Future will be green if we switch to green. Our future depends on our sustainable use of natural resources. To keep the wheels of the chariot of human civilization spinning, we have to switch to green and more renewable sources of energy, and we are proceeding in that direction in an accelerating pace.



Reimagining the future of transportation with digital technologies

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The pandemic has catalyzed the emergence of a low-touch economy, where services are being rendered remotely at unprecedented scale and speed. This trend is likely to continue. That said, the movement of people and goods across borders will not stop. While working from home may have reduced the need for travel in recent times, the sector's criticality won't diminish despite its economie performance being muted for a while. Trade flows are and will continue to change, basing the competitiveness of nations and the cooperation between countries and blocs. Travel patterns would arguably mimic that.

The next crucial step is to drive value creation within the sector, for which radically improving asset and people productivity, reducing costs, and cutting waste are critical. This is where digital can help, enabling effective route and capacity planning, seamless linkages with allied sub-sectors, improving safety and customer experience, reducing pilferage, environmental performance, and access to new markets.

The transportation sector in India

Currently, India's logistics costs are 13% of the GDP compared with the US at 8% and Europe at 9%. The Government of India sees this as a significant area of improvement that impacts allied sectors like manufacturing too. CRISIL research states that 70% of our freight moves by road, which costs ₹2.58 per tonne-km, compared to Rs.1.41 for railways and 21.06 per tonne-km by waterways. One way to increase our logistics competitiveness is to develop ports and inland waterways to increase freightage by less expensive modes.

Ports and inland waterways

Digital evolution is already underway at India's biggest and busiest container port that mainly exports grain and imports petroleum, heavy machinery, textiles, and chemicals. Sensors will monitor movement at the port, guiding the safe passage of ships and enabling higher traffic levels. The use of lot will extend to energy savings, predictive maintenance of various assets including cargo handling equipment, and checking pipeline corrosion to prevent hazardous leaks Using drones with video streaming and image processing for round-the-clock vigilance is planned. And port communication systems are being beefed up for synchronizing all operations.

The Government has recently confirmed plans of developing eight waterways and 50 river ports over the next five years. Their larger digital agenda includes leveraging technology for berthing, night navigation, and dredging.

Some ports in Europe have operationalized the concept of digital twins for simulating all processes at the port, integrating AI, analytics, and lot for generating what-if scenarios to pre-empt outages and reimagine possibilities. If implemented in India, this could be a game-changer for enhancing the efficiency of our ports.

Railways

This sector is changing as it seeks to compete with airlines for passengers and shipping for freight. The focus areas across the globe continue to be transporting people and goods safely, with speed. Enhancing passenger experience, upgrading infrastructure including network capacity, improving operational metrics, and reducing waste are priorities too. In this context, the Indian Railways is beginning to use 3D printers to design and print coach components in-house based on their requirements.

Smart video analysis, facial recognition, and matching information from multiple sources are becoming norms for passenger security An interesting safety area being addressed using lot is Hot Axle Box Detection - detecting critical conditions in freight wagon axles proactively to prevent serious failures and consequential accidents

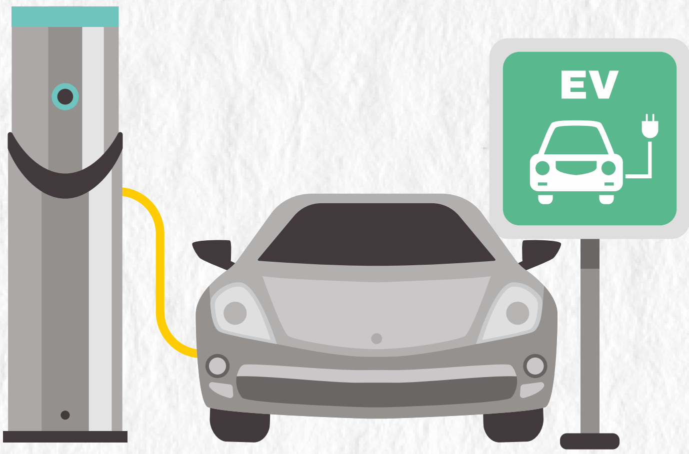
Additionally, smart connectivity provides information, entertainment, and services to passengers and helps railways analyze service deficiencies and craft new offers. With superfast trains diminishing journey time, delivery of hi-speed broadband has gained importance.

Roads and vehicles

With autonomous vehicles gradually finding their way onto our roads, this sector is experiencing some fascinating developments worldwide. Today's cars are data centers equipped with sensors and actuators, with microcomputers running over 100m lines of code. Sensors connect vehicles to other vehicles and the surrounding infrastructure, prevent collisions, and ensure smooth traffic flow As 50% of collisions occur at intersections, trials are on in countries like Australia to make them safer CCTV feeds combined with sensor data enable smart parking traffic light management, and rapid emergency response. Vehicle tracking systems are being used for fleet management and public transport management.

Internet of Vehicles (loV) helps in timely preventive maintenance to keep vehicles on the road more than in the workshop. As the stress on road networks intensifies, there is a focus on using acoustic sensors to convert the existing embedded fiber optic infrastructure into various distributed sensors to manage traffic flows and reduce emissions intelligently.

In a country like India, autonomous vehicles, shared mobility solutions, and e vehicles are the key to reducing the stress on our infrastructure and making our cities more livable. Interestingly, the benefits of these alternative modes of transport are not lost on citizens. In fact, according to a report by Avendus Capital, the electric vehicle (EV) market in India is likely to be a 250,000-crore opportunity by 2025, with as much as 16% penetration in the two-wheeler segment.



Airports

Till Covid19 struck, passenger and freight traffic at airports grew exponentially, faster than the existing infrastructure could handle. To keep pace, passenger experience, ground operations, security, runway monitoring, and site management had to be reimagined. Airports in India responded quickly, implementing measures like contactless boarding and payments, thermal scans, automatic hand sanitizer dispensers, etc., to ensure safe travel.

Moreover, one of India's private airports embarked on a project to improve the productivity of its people and air-side assets. With air traffic estimated to double in a decade, construction of new terminals and runways is necessary, but figuring how to get the best out of sunk investments appeared to be a good place to start The team deployed cameras and IoT to improve safety and security and get various teams - passenger and crew transportation, catering, security, cleaning staff, ground support, and others - to work seamlessly. Closer coordination will reduce aircraft turnaround times and allow more take-offs, which will, in turn, have an appreciable impact on the airport's financials

The future of transport is digital

The future of transportation includes vehicles as computers on wheels, autonomous aerial vehicles, the hyperloop for long-distance transport, greening, and energy efficiency of the highest order, advanced traffic management to preclude jams and gridlocks, unprecedented speeds, accident-free thoroughfares, and fully integrated multimodal transportation. The digital age will empower the traveling customer and disrupt how transport providers operate and manage their services.

Alternative fuels

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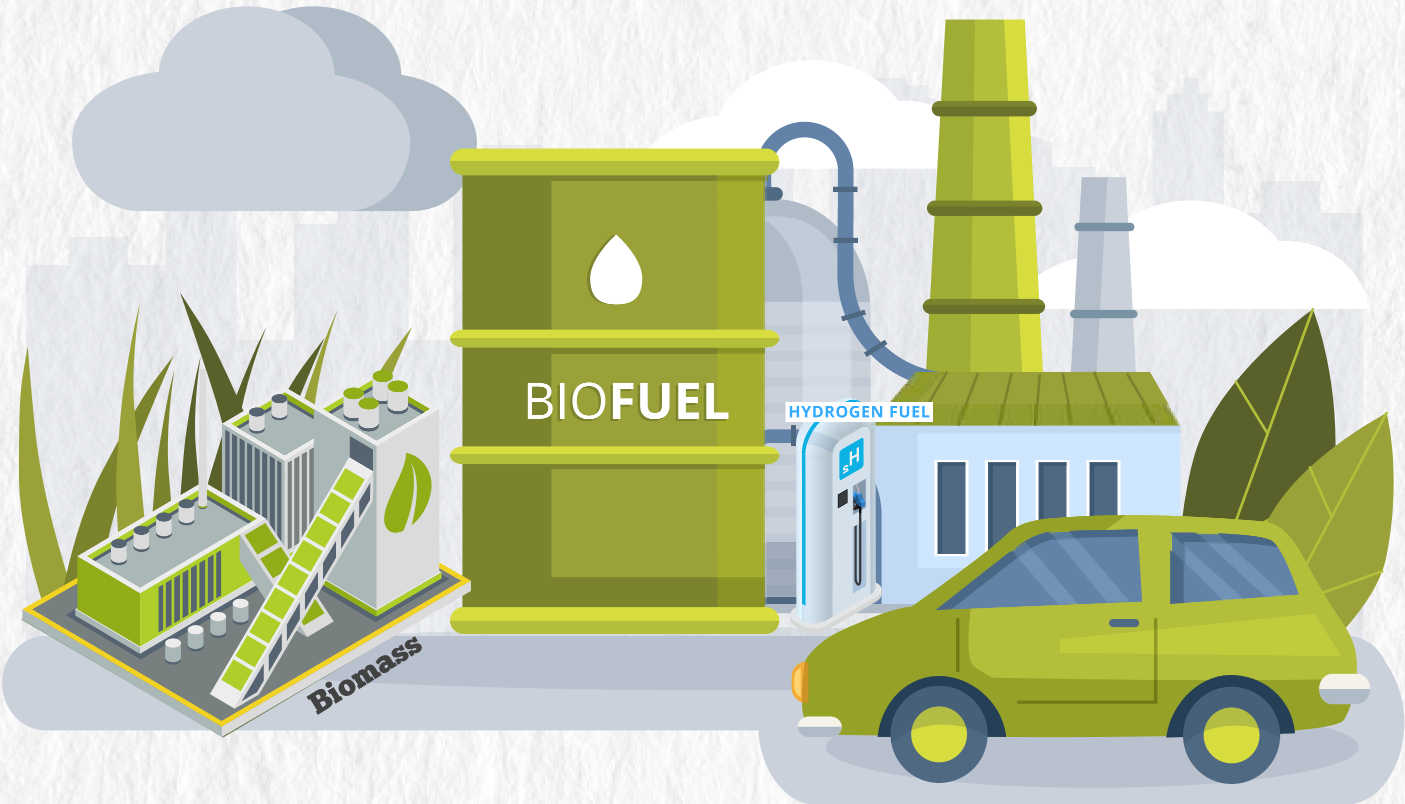
Half of the world eats unhealthy food which cause diseases , now to avoid all this we take precautions and consume healthy food. Likewise in the case of the environment, if we maximize the use of alternative fuels it reduces the emission of carbon dioxide compared to other petroleum fuels. It is more eco friendly than petroleum based fuels.

Alternative fuels are obtain from sources other than petroleum, often they give rise to the less pollution which after all relief the environment. It also know as non conventional fuels these are the sources that are endlessly replenished by natural processes .It entails the hydrogen , biodiesel, propane, natural gas, bio fuel, biomass, LPG, bio gas, CNG, and gasoline. The selection of alternative fuel based on 4 E's i,e economical, efficient, eco-friendly and ecological.

"Looking at today's world alternative fuel vehicles are prodigious .Some vehicles and engines are designed for alternative fuels by the manufacturer which satisfy the need's of customer demands especially for conservationist ,ecologist and environmentalist .The government is encouraging the adoption of electric vehicles such as electric cars, propane vehicles and trucks that run on biodiesel.

There are so many pros like to save other resources, more effective and long lasting ,reduce carbon emission and it reduce the global warming effect but there are cons too like high capital cost, low efficiency ,it takes a lot of space to install, this aren't 100 percent carbon free , it have some specific limitations like renewable energy devices needs recycling.

So the challenge is , can the world shift to alternative fuels completely avoiding the carbon fuel habits ?



Digital Age Transportation: The future of urban mobility

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CHANGE is coming to transportation, whether we are ready for it or not. You can see it in automakers' focus on next-generation vehicles, in the arrival of services that help urbanites get around without owning a car, in the widening recognition that the "information everywhere" world will utterly disrupt the transportation status quo.

Every feature of the automobile, from its drive train to its communication with the world around it, is being rethought. "Smart infrastructure" projects are becoming com¬monplace. Sharing rides, bikes, and cars and other entrepreneurial business models are spreading, built on the recognition that empty car seats and idle vehicles form an immense "wasted asset." The ability to gather road and transit mobility data—from smartphones or dedicated transceivers—and push informa¬tion back to users is changing everything from infrastructure planning to commuters' daily experience. The question of who pays for transportation—and how, and under what circumstances—has become ever more lively as the ability to track vehicles and to use electronic means of payment spread.

Services like real-time ridesharing and car sharing, for instance, are helping urbanites get around without owning a car and are making the private vehicle a de facto extension of the public transportation system. New apps are allowing commuters to compare the time, cost, convenience, carbon footprint and health benefits across all modes of public and private transport, broadening their range of choices and allowing for on-the-fly decision making that takes into account real-time conditions. For their part, automakers are focused on next-generation "connected vehicles" that can access, consume, create and share information with other vehicles and surrounding infra-structure in real time—improving traffic flow and safety. And dynamic pricing mechanisms for roads, parking spaces and shared-use assets are helping balance supply and demand, much the same way the airline and hotel industries have been pricing seats and rooms for years.

The result of these innovations—and of the ecosystem of creative players that have been drawn to transportation, from information technology companies to ridesharing pioneers to app makers—is that the mobility field will look very different going forward. It will be:

Massively networked, with ubiquitous con¬nectivity throughout the system

Dynamically priced, so as to balance sup¬ply and demand

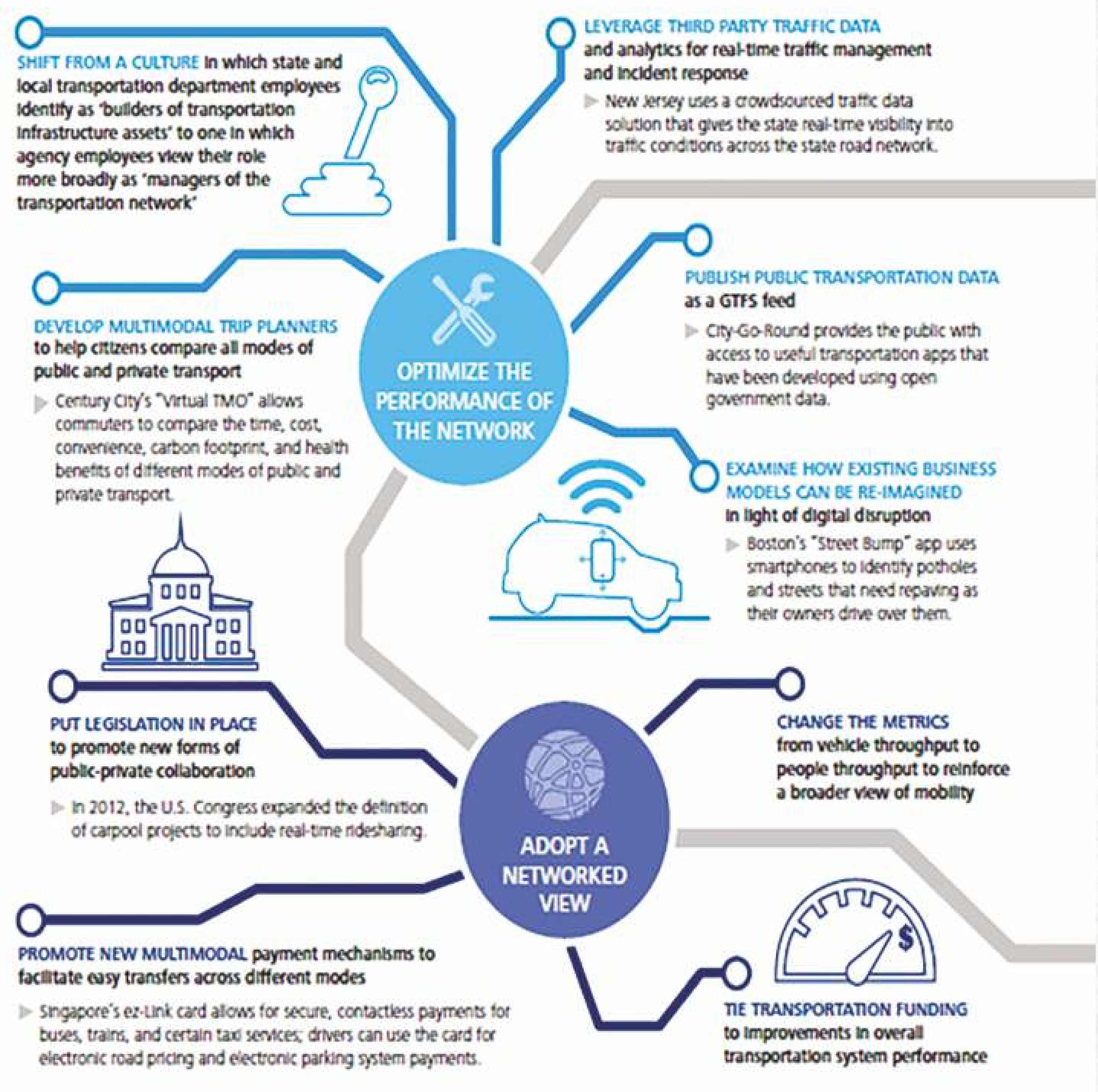
User centered, taking into account users' needs, priorities, data flows, and dynamic responses to conditions

Integrated, so that users can move eas¬ily from point A to point B, regardless of mode, service provider, or time of day

Reliant on new models of private-public collaboration, which take advantage of the increasingly diverse ecosystem of public, private, and nonprofit entities that are working to meet the mobility challenges of the 21st century

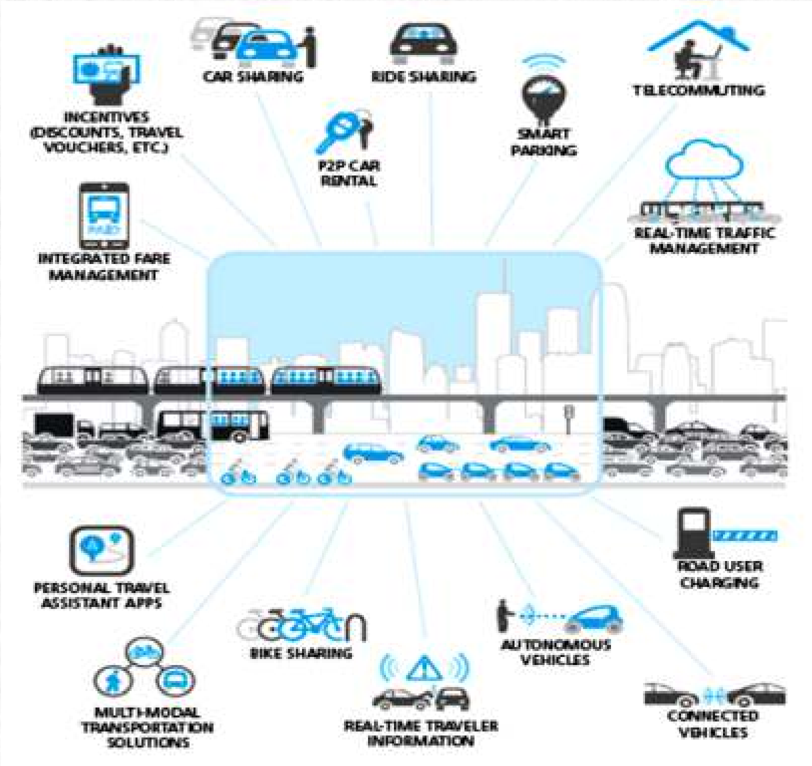
To take advantage of these innovations, policymakers must start laying the groundwork for a digital-age transportation system (see figure 1).

Figure 1. Preparing for the future urban transport system: A roadmap for public transportation officials



Digital-age transportation

The most revolutionary changes are com¬ing from the encounter of information technology (IT) with. According to Thilo Koslowski, who leads the automotive practice at the Gartner Group, “Similar to the way telephones have evolved into smartphones, over the next 10 years automobiles will rapidly become ‘connected vehicles’ that access, consume, and create information and share it with drivers, pas¬sengers, public infrastructure, and machines including other cars.”



The arrival of “big data” is helping traffic control centers respond more quickly to acci¬dents and backups, while helping individual travelers navigate their moment-by-moment decisions. According to David Hornik, a general partner at venture capital firm August Capital, “Everything is a big-data problem right now. The biggest change is that every device, every vehicle, everybody is manufac¬turing huge amounts of information.” Cities are beginning to use the digital exhaust gener¬ated from these devices in powerful new ways.

There is no aspect of travel that is not being transformed by IT. Route planning, finding one’s way while in the car or on foot, collect¬ing fares or tolls, congestion and road pricing, traffic management, deciding among different transportation options for a given trip, reduc¬ing trips through telecommuting—all are evolving at dizzying speed.

Many of the innovations affecting trans¬portation are geared toward giving individu¬als greater choice in how to get around. The challenge, then, is to harness the extraordinary innovation taking place to make far more efficient use of the existing trans¬portation system. Just what that will look like is uncertain. But, it is certain to have some basic features.

There is no instant solution to this greed lock system—The new age transportation system or new generation urban transportation system will connects transportation mode, service and technologies together in innovative new ways that pragmatically address the seemingly intractable problem.

Reliant on new models of public-private collaboration

The hardest question when looking at the future of transportation, of course, is how change is going to be organized and paid for. The assumption about most roads, bridges, and other auto-related infrastructure in the country, has always been that they are a public good, and therefore should be funded partially by users through tolls, and partially through public subsidies ultimately paid by the general tax base. Financing has been largely provided by the private sector in the bond markets. But in recent years, as the gap between available public funds and infrastructure needs has grown ever wider, another model has taken hold: the public-private partnership, or PPP, which involves the use of private sector equity and risk sharing. This has been the force behind the creation of high-occupancy toll lanes.

If a new transportation system is going to come into being, government will neither be able to fully fund it nor take primary responsibility for it at current taxing or toll levels; it is having enough trouble just keeping up with the status quo. Moreover, the sheer complexity of a transportation system that works for everyone—unlike the current system—argues that many players will have to be involved. One way that government can prime the private sector’s creative pump is through challenges that arrive at transportation solutions without calling for heavy public spending on research and development.

Looking Ahead

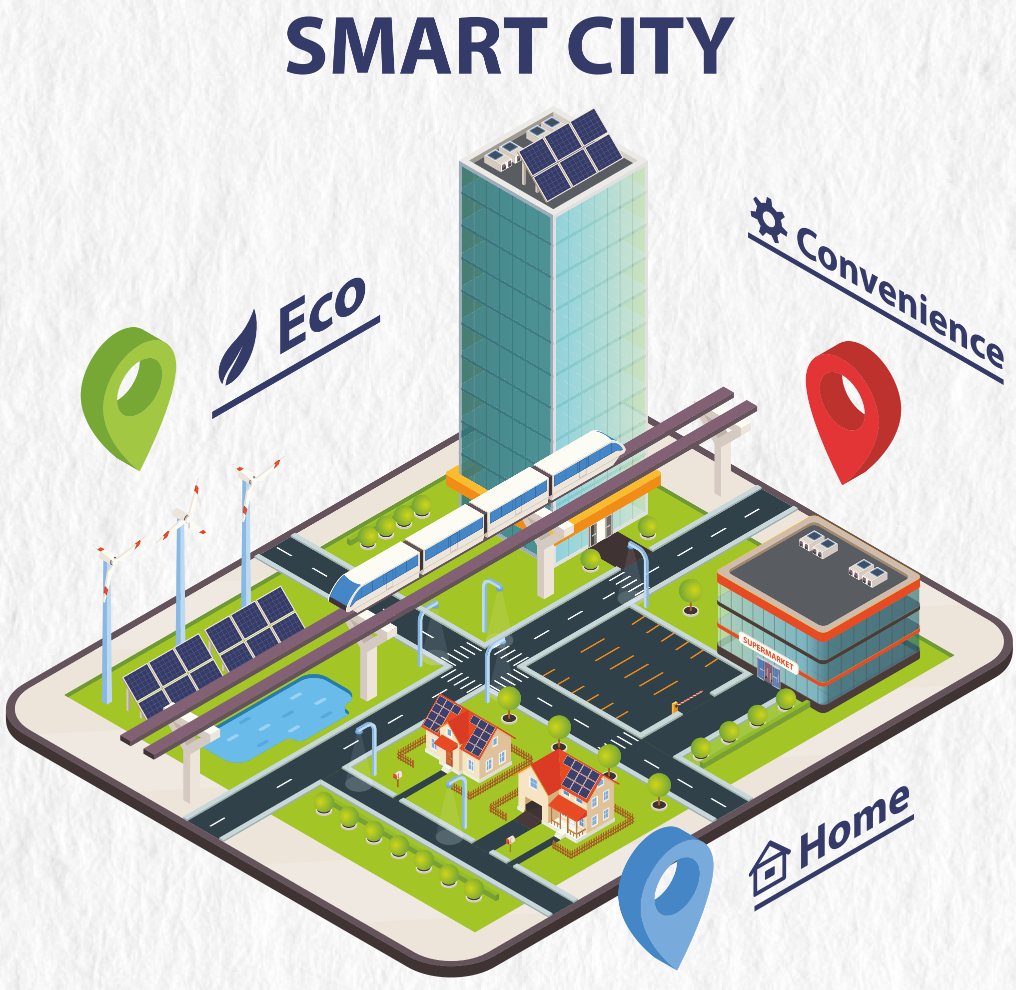
If anything, the dizzying pace of change in transportation is likely only to accelerate. The players pouring into the field consumer electronics, mobile communications, app makers, smart infrastructure and smart transport entrepreneurs, forward thinkers in the automotive industry are transforming it and creating opportunities for even newer players. Others are arriving with experience in solving problems in other fields energy conservation, for instance, or telecommunications and bringing fresh insights with them that, in turn, strike new sparks among existing transport thinkers.

As the scenarios above suggest, we are already seeing aspects of what this new world might look like. Smartphones are expanding their reach in both numbers of users and phone capabilities, and thus creating new models for getting people from point A to point B. Social networking is abetting new ways of thinking about organizing communities and motivating change. Insights into human behavior think gamification are rewriting how we approach transportation problem solving. And, of course, emerging technologies are changing pretty much every aspect of how we get around. As a field, transportation has become rich with possibility.

The challenge, especially for government, is to find its footing in this dizzying environment (see figure 1). This means asking hard questions: Are there existing laws that need to be changed or updated to meet tomorrow's realities? How can the public sector best get out of the way of innovation, yet also meet the need for a public conversation and possible legislation on such issues as privacy and dynamic pricing? If government is going to seize fresh opportunities to lay the groundwork for emerging technologies and entrepreneurial models, how can it make the wisest use of its limited resources?

There remains a lot of work to do. Standards for the technology that will be crucial to the new mobility have yet to be finalized. Frameworks for public-private partnerships must be put in place, monitored, and adapted as needs change. The simple notion that people's mobility, rather than vehicle throughput, ought to be at the center of the system will demand a change in culture throughout public transportation departments. There will undoubtedly be a public role, perhaps a central one, in making it easier for travelers to experience an integrated transportation system. Providing safe and reliable infrastructure with the capacity to handle demand will undoubtedly remain a core government function, even if the models for how to finance and create it change.

Still, what is most exciting about this particular moment is that the opportunities seem unlimited for both the private and public sectors to make human mobility cleaner, safer, more efficient, and more enjoyable. Finding our way into this new era may take work, but there's no question that we have crossed its brink.



Alternative fuel

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We keep complaining about the hot barbeque weather outside, the unusual heavy rain, and the extreme freezing winter. These are greenhouse effects only, which we might have not cared about. But since we have lately realized about the damage and also began to find a solution for it. Alternative fuels are the answers that came for it.

"Alternative fuels" sounds like some boring way of fulfilling our needs, but it actually is quite interesting and paves way for much grander things. To generate electricity both coal and sunlight are taken to account. Though, solar energy produces one fifth amount of energy compared to coal energy. This might seem like solar energy isn't that efficient in comparison to the existing coal energy, but it doesn't trigger greenhouse effects like the carbon containing resources. In fact, the total daily amount of sunlight that hits on earth is around 173000 terawatts, that is like 10000 times more than the total usage of the globe, woah! seems like we have been wasting a lot of free energy and the worst is paying more for the same.

"let's go for a ride" or "Chal ek round maar ke aate hai" might seem easy and fun to listen and do on a Saturday night or after tuition classes or so. But this one round might make a huge difference to the already damaged nature, since 27% of the total global warming is caused by just cars. For this development of plug-in hybrid cars which charges the battery through engine and while braking and utilizing the same to drive the vehicle for more 35 to 40 kms extending the range and decreasing the carbon emission from the vehicle. CNG and LPG is the most widely used alternative fuel in India, which makes the most sense keeping the vehicle density of the country. CNG emits least carbon particles in comparison to diesel and petrol. CNG is the cheapest, cleanest and widely available alternative fuel in the country right now.

The best alternative fuel in my personal opinion should be avoiding unnecessary usage of carbon emitting practices, as in controlling the usage of such activities as small factors like using fans, lights or other unnecessary electrical appliances. Carpooling, bike pooling, sharing of rickshaw rides, travelling through public transports eventually controlling the greenhouse effect alongside providing more job options for more public transport services and maintaining them, also fulfilling the most important factor of "berozgaari", keeping the economic conditions of a country like India.

At last, we must understand and start adopting the concept of alternative fuels as the "BLACK GOLD" and the "LIQUID GOLD" aren't available for much longer.

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