# The Future Is Here

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***IMC Chamber of Commerce & Industry***

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Thank you for giving me the opportunity to stand up and make some bold statements about the future time and again. Back in 2005, when fast computers were awe-inspiring shining objects of the time, you let me tell you that in a few years, you will be carrying something in your pocket which could not only do easy things like very fast computing but will also combine with it new forms of voice and data communication, entertainment and some useful things like a watch, a camera, a radio, etc.. It happened 3 years later but before that, in 2007 I got the opportunity to explain how and why the global economy will crash. Later in 2008, we talked about the oil crash from $140 per barrel when the belief was that it was heading upwards. I enjoy these sessions at IMC because of the lively participation.

Many of the things that you take for granted today, are going to change soon. Why is an impending change not so obvious to most people? Because we have been trained to only study and understand the direct connection between an action and the outcome. That does not prepare us for the real world, in which most outcomes are the result of multistage events with one event feeding the other. Often the root cause is 3 to 5 levels away from the final effect that surprises you.

I will do that today. However, my intent is not to give a comprehensive view of the future. My objective is to shake you out of your comfort zone and make you start looking for relevant dots around you and connect them to the future of your industry.

In this 25 min presentation, I have selected only 5 technologies out of over 20 which are set to disrupt many industries and businesses. Even within them,
I have covered only a few examples which might be interest to members of the Chamber. In particular, I have left out digital technologies, barring one.

**What if I tell you this?**

- **Many of the Auto-component manufacturers and also the automobile engine lube business will be in trouble in about 10 years and rapidly decline thereafter.** It seems like a crazy statement to make given that the IBEF has predicted that India's auto component industry's exports will rise from $11.2 billion to at least $80 billion by 2026.
- **No new petrol and diesel engine cars, hybrid or otherwise, will be produced in just 14 years from now.** Strange given that debate globally is on efficient petrol vs. diesel and that the venerable Fleet News recently published a survey that 79% of car owners in the UK believe that by 2030 most cars would be hybrids
- **Many people in this room will not even bother to own a car in 10 years.** It seems like a crazy statement to make given that a serious study by the International Energy Agency has predicted that car ownership in India will grow 775% by 2040 over the base in 2016.
- **Oil price could drop to $12-15 per barrel about 7 years.** This might sound confusing given that the World Bank has predicted $80 per barrel in 2024. I had predicted on Jan 1, 2016 that oil price would drop initially but will climb up above $ 50 a barrel later in the year when the general expectation was that it would be much lower. By the way, the price has crossed $50 this month. It could rise in the short-medium term. I will explain why I am bearish on oil in the long term
- **Aluminum conductors, transmission line towers, insulators, and other related products in the T&D industry, etc. will suffer demand drop in 10 years**. How can this happen when the Government is talking about doubling the investments in generation and distribution?
- **It will make no sense to put up large conventional Power plants in less than 5 years**

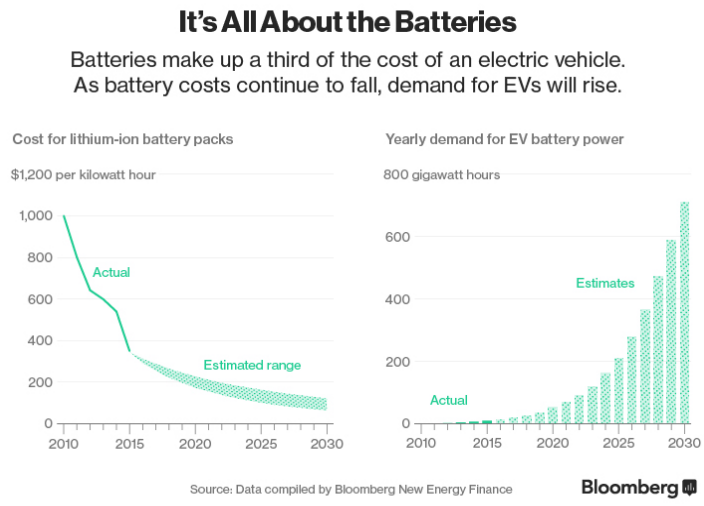
  What will happen to all the investments being planned and the downstream investments? Many existing power generation utilities will need to discover a new business model or become unviable.

There is a lot more that will happen when you add the impact of social and technological changes that are taking place but these few examples are all that can be fitted into today's short session.

My intent today is to wake you up, to make realise how the world has changed much more than you think it has, why we need to think differently, be equipped and be trained differently to deal with the world that is getting disrupted. Not all the incumbent players will be able to win in the new paradigm. Everyone talks of changes but most take it for granted that changes will be gradual and that they will get time to react. The fact, however, is that most of them cannot even feel the most rapid and significant changes, mainly because these changes are happening in business and industries which are far away from theirs. Many will eventually impact them. Those are the remote dots that have to be noticed and connected to your own dot.

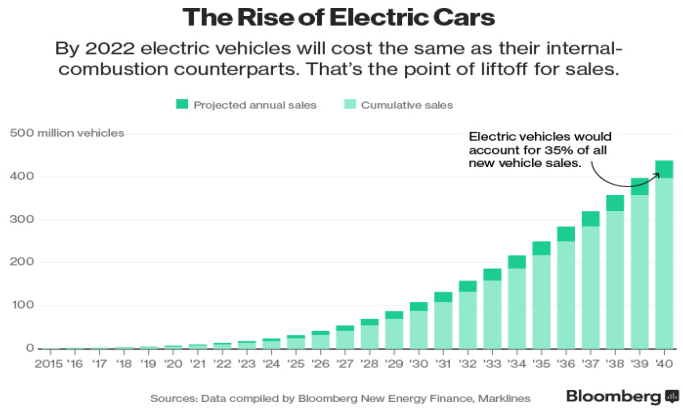
In the past too, there were many disruptions but most people have forgotten those lessons. The decline of the railways (outside India) when road networks took over was very rapid; the decline of horse carriages earlier and of black & white TV later were rapid, photo-film cameras and main frame computers died rapidly. America and Europe invested in roads and simultaneously cars became affordable, and horse carriages went kaput and the railways declined. In less than 5 years after it became technologically possible to compress a lot of features into phone, the Smart Phone came along and Nokia phones became history.

Let us look at Li-Ion Battery. The combination of technological advancement over the past two decades and high manufacturing volume because the demand for batteries has gone sky high due to various mobile devices that we use every day, has led to a drastic drop in the cost of manufacturing Li-Ion batteries



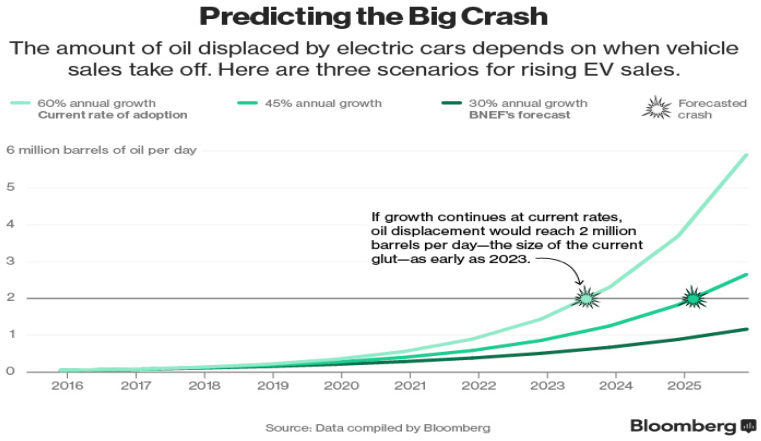
-down from $1000 per KWh in 2010 to $300 in 2016! This process of reducing costs will go on for a long time because the economic technology limits have not been hit yet. If it even continues to drop at the current rate, the cost of the Li-Ion batteries will drop to $ 100 per KWh by 2024 which will make it possible to theoretically replace petrol & diesel engines in cars completely. High cost of batteries which make up a very large component of the cost, made an EV unviable in the past. Now that is set to change. The chart shows Bloomberg's prediction but I believe that it is conservative.

Bloomberg expects 35% of all new cars in 2040 to be EVs whereas I expect a complete shift to EV as early as 2030. There are others with more aggressive forecasts than mine.




Further, I believe that there will be a huge opportunity for developing conversion kits for existing vehicles which will be a combination of software and hardware. The conversion from Petrol to CNG in India was limited by the availability of CNG, long waiting lines for charging due to paucity of charging stations, as well as the space taken up by the cylinder in the luggage boot.

If that complete shift to EVs happens in 2030, a 5.7 million barrels per day drop in demand for oil whilst individual OPEC countries will be fighting with each other to maintain current levels of oil production, and can cause the oil price to slide to the $12-15 per barrel range. Much before that, may be by 2021, the demand for oil from the automobile industry may drop by about 1.5 to 2 billion barrels per day. If that happens you may see oil prices dropping to $ 20-25 per barrel because by then the EV story will be clearly visible and probably the shale oil extraction technology would have cut costs further.



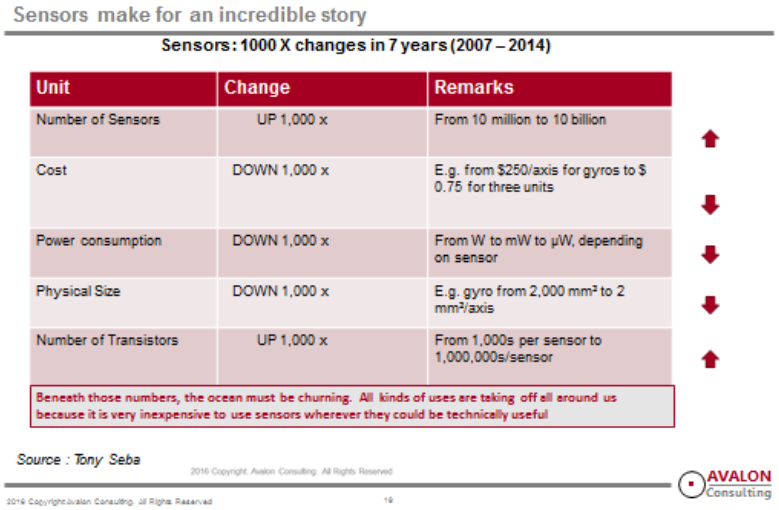

It may be argued that these Li-Ion batteries need to be charged every day and that will require electricity to be generated which, in turn, may require petroleum as raw material.

There is another bad news for oil. While all this happening with Li-Ion batteries, the installed cost of Solar photo voltaic cells has dropped to $2 per W (An 80% drop between 2011 and 2016) and is expected become even cheaper less than $1 per W by 2020. Soon there will be solar charging stations for EVs and EVs may not have to depend upon electricity from the grid. Batteries may even get charged with solar cells on the car roofs and bonnets. With that not only the need to connect with the grid go but also one of the limiting factors for an EV to go main stream is that it needs to be able to travel at least 320 km on a single charge. That minimum has been achieved this year in trials. Tesla Model 3 with more than 200 miles (320 km) per charge is expected to be launched by end March 2017 at a price of $ 35000 which is the price of an average car in the US.

Do you know that a successful experiment has been done to light up an entire French village using solar cells laid directly on the main road passing through the village?

Let us look at Sensors whose technology has come of now age. There are different types of sensors which can see, taste, hear, smell, and feel. Sensors make everything smart, from phones and toothbrushes to cars and Johnny Walker smart whisky bottles. How about a charger for your smart phone that picks up energy from your movement when you walk or jog? It was displayed at

CES 2016. Once sensors are combined with Artificial Intelligence software, they can make any device act nearly like human beings. This is not science fiction.



Sensors make for an incredible story

Sensors: 1000 X changes in 7 years (2007 – 2014)

| Unit | Change | Remarks |
|---|---|---|
| Number of Sensors | UP 1,000 x | From 10 million to 10 billion |
| Cost | DOWN 1,000 x | E.g. from $250/axis for gyros to $ 0.75 for three units |
| Power consumption | DOWN 1,000 x | From W to mW to µW, depending on sensor |
| Physical Size | DOWN 1,000 x | E.g. gyro from 2,000 mm² to 2 mm²/axis |
| Number of Transistors | UP 1,000 x | From 1,000s per sensor to 1,000,000s/sensor |

Beneath those numbers, the ocean must be churning. All kinds of uses are taking off all around us because it is very inexpensive to use sensors wherever they could be technically useful

Source : Tony Seba



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There is a massive explosion in the market for smart sensors. It is expected to grow to $10.5 billion in 2020, a growth of 36% CAGR from now but that in spite of a massive unit price reduction. The demand grew 1000 X. Can imagine another industry like that? Beneath those numbers, the ocean must be churning. All kinds of uses are taking off all around us because it is very inexpensive to use them wherever they could be technically useful. Google, Apple, Tesla and even Nissan are testing driverless cars using sophisticated sensors. The first commercial run of an autonomous truck happened when a Budweiser beer truck was transported across California in November 2016. Many months earlier driverless taxis started in Singapore. Uber has big plans. Imagine what will happen to drivers when more mainstream car companies like GM, Ford, Toyota, etc. join Tesla, Apple & Google to make autonomous vehicles. The driver profession will exist for new more decades in India but the writing is on the wall. Even today, with just Uber and Ola, it is uneconomical to have a car and driver in India. Why would any of you want to own a car in the next 5 to 10 years, if you can get your choice of vehicle at your convenience with a driver? Going further, it would be safe to assume that some of us may be travelling in driverless taxis in India in just a few years. It may be a service provided by Uber or Google or Toyota or whoever. By the way, General Motors have already invested in Uber's competitor, Lyft, with that in mind. They may sell transportation service in self-driving cars in the future and not sell cars.

Show me how many industries have grown at such a scorching rate as these three, Li-Ion Batteries, Solar Cells and Sensors?

Spare a thought for the huge auto component industry if there is no production of cars with petrol or diesel engines! It is a $700 billion industry globally. A lot of under the hood components will disappear and will be replaced by fewer new components when EVs displace conventional vehicles. Some say 90% of the components will be gone. Not required anymore! This will also impact auto repair shops which will now need to deal with motors and other electrical & electronic components as opposed to mechanical. Actually automobile lubes (except for breaking fluids) will get impacted. Think of Castrol. A part of their product portfolio will go but the good news for them is that petrochemicals, one of their raw materials will get cheaper.

Petrochemicals are going to get cheaper because oil prices will drop. Unless the ME turns into a global hub for producing value added petrochemicals instead of exporting oil, the economies of those OPEC countries will get decimated and India's export to labour to the ME will decline.

Allow me to switch to power utilities. We have a generating capacity of 3.02 lakh MW in India, some additions are on the way and some capacity is lying idle due to want of fuel linkages. Most generating Utilities and distribution companies depend upon demand charges. If that disappears, the energy charges will not be sufficient to give them profits. With low cost Li-ion batteries, it will be cheaper to charge the batteries when the cost of power is low and use that power, when your power requirement peaks. You might say that since there is no 'time of day' pricing in India we don't have that problem. When the cost of generating solar power drops as it will to below Rs. 2 per KWH, why would anyone want to buy thermal or hydel power? The fact is that the cost of solar energy without Government subsidy is set to become lower than even the cost of transmitting power to the user from the generating plant by 2025. Therefore, even if power is generated at zero cost at a power plant, it will not be able to compete with localized solar power. This means that many inefficient power plants will be moth balled and no new conventional energy power plants will come up after a certain date. It also means that the demand for power transmission products will drop quite severely in another 10 years. E.g.

transmission towers, certain types of aluminium and copper cables, etc. Germany's plan is to generate 80% % of its electricity from renewable sources, largely solar and wind, by 2050. Many others are contemplating moves like that. It is not for nothing that Modi is pushing heavily for solar energy.

This will also contribute to the lowering of demand for oil and gas because of which price of oil will drop substantially. Another consequence is that there will be a massive reduction in greenhouse gases and particulate matter pollution once solar energy generation replaces large parts of convention energy and when cars switch to EV. Hence our future generations have hope to breathe the clean air. Imagine what will happen to the multibillion dollar industry that produces pollution control devices and consumables (bag filters to catalytic convertors – gone!!).

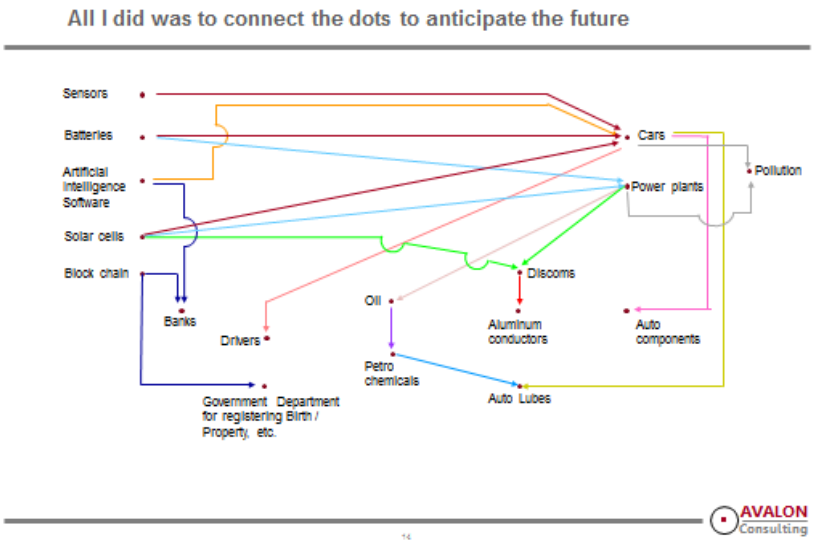
I have been writing for a couple of years in my annual January 1 note to watch out for block chain technology. Now that technology is almost ready to jump into certain sectors commercially before going main-stream later. Hence I could not resist the temptation to talk about at least one important digital technology.

What is block chain? Simply put, it is a technology that allows parties who don't know each other and can therefore not trust each other, to transact business at low risk. You might say that Banks do just that. A bank is a safe institution that depositors normally trust with their savings and who in turn lend money to those who they trust through certain mechanisms and security arrangements are used to make borrowers repay with interest. Block chain technology eliminates the need for a costly institution like a bank to be an intermediary by having interconnected ledgers in the digital space which can quickly check, verify and confirm. These ledgers can store information about assets, personal particulars, certificates, etc. It can instantly match data from those ledgers as is relevant for a transaction. Why do you then need Banks? Why should Government departments have large unwieldy departments for registering & maintaining birth & death records, driving licenses, criminal records, etc.? They are not going to be needed when blockchain technology goes main-stream. Banks will have to reinvent themselves. In fact, HSBC has started a project along with Bank of America Merril Lynch to use block chains for trade transactions. "Over $2 trillion of trade today depends on the physical exchange of documents.

What we've shown is blockchain has the potential to take away paper, which could be completely revolutionary if commercialised." said" Vivek Ramachandran, global head of product and propositions for global trade and receivables finance at HSBC. According to Ramachandran, blockchain technology could serve as a trustworthy intermediary to share information between buyers and sellers. This would make international trading quicker and cheaper.

Trust me, this is just the start of a revolution. Globally 30 blockchain start-ups got VC funding of $ 290 million just in the first 6 months of 2016. You will hear a lot about block chains as the Internet of Things develops and thousands (and even millions) of IoT devices including autonomous cars have to be connected to make them work efficiently, quickly and at low cost with huge volumes of data passing from the devices to suppliers and device owners.

The objective of my lecture is not to leave you in a sense of awe and excitement or fear about the future that is knocking at our doors. Instead it is to tell you to anticipate how each of this is going to make your business future-ready. The future is pregnant with opportunities. It is for you to benefit by adjusting and aligning to the megatrends, a few of which I explained today.




In order to be able to do that, start by connecting an event today with likely outcomes and those likely outcomes with subsequent outcomes like I did today. You will see the future now!