



## The Institution of Engineers (India)

(ESTABLISHED 1920, INCORPORATED BY ROYAL CHARTER-1935)  
**QATAR CHAPTER**



**51<sup>st</sup>** ENGINEERS' DAY 2018  
**Souvenir**

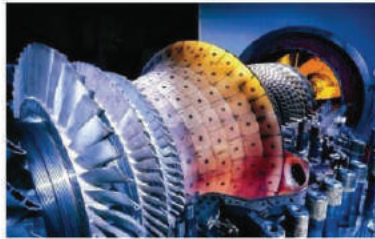
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Tel: +974 44077280 Fax: +974 44862721  
E-mail: [sales@salam-petrol.com](mailto:sales@salam-petrol.com)  
Web: [www.salampetroleum.com](http://www.salampetroleum.com)  
The Gate, Bay Tower 2, 5<sup>th</sup> Floor, West Bay.





*H. H. Sheikh Tamim bin Hamad Al-Thani*

Amir of the State of Qatar



*H. H. Sheikh Hamad bin Khalifa Al-Thani*

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**DOHA CABLES has been awarded the following prestigious projects from KAHRAMAA:**

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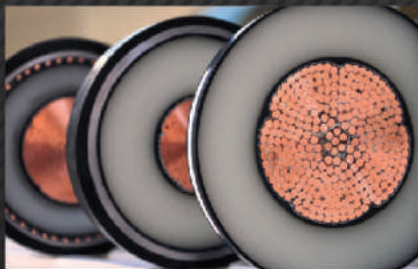
We have the one of the best state of the art "On site" HVAC testing system ,to carry out the "Withstand voltage tests on extruded cables" .The test system operates in a frequency range from 20 Hz to 300 Hz and complies with the requirements according to IEC 60840 and IEC 62067. The test system facilitates testing of high-voltage cables that can be several kilometers in length. These systems can even be used to test ultra-long submarine cables that connect offshore wind farms. The test system can be set up on-site within an hour without cranes or similar equipment.

#### POTENTIAL MARKET

We have our sights set on exploring markets in new territories as below:

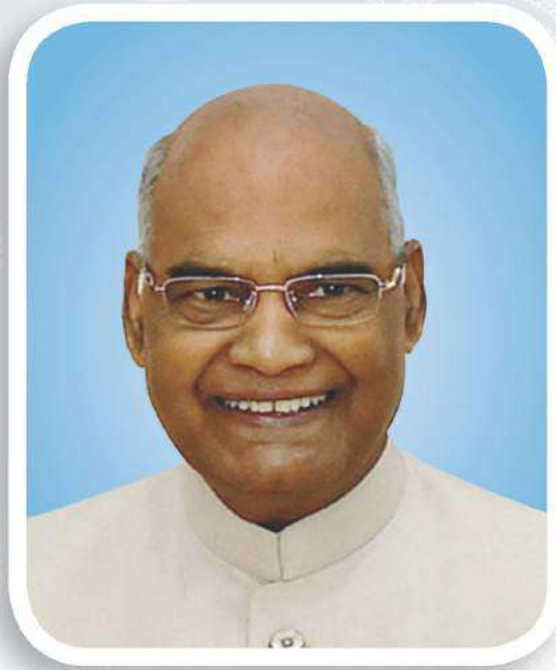
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In addition, the broad direction of the group is to become more self-sufficient in the State of Qatar, and thus, steps are being taken to build three factories to produce copper wires, aluminum bars and drums for cables projects.



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**DOHA  
CABLES**



*H. E. Ram Nath Kovind*  
President of India



*H. E. Narendra Modi*  
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**E-mail : info@stream-qatar.com United Building 4th Floor**  
**(Beside Ooredoo Building) Al Saad, P.O. Box 22647, Doha - Qatar**  
**Web : www.stream-qatar.com/**





## Dr. Sir Mokshagundam Visvesvaraya

September 15 is celebrated every year in the country as “Engineers’ Day” to commemorate the birthday of the legendary engineer Sir Mokshagundam Visvesvaraya. Sir Visvesvaraya, an eminent Indian engineer and statesman was born on 15th September 1861, in a remote village of Karnataka, the State that is incidentally now the Hi-tech State of the country. Due to his outstanding contribution to the society, Government of India conferred “Bharat Ratna” on this legend in the year 1955.

He was also called the precursor of economic planning in India. His learned discourse on economic planning in India, Planned Economy for India and Reconstructing India, was the first available document on the planning effort of the country and it is still held as the parent source matter for economic planners.

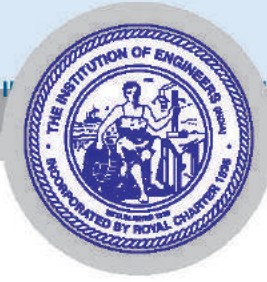
### **“ Digital Transformation: A New Industrial Revolution”**

September 15 is celebrated every year in the country since 1967 as “Engineers’ Day” to commemorate the birthday of the legendary engineer Sir M. Visvesvaraya. A theme of national importance is chosen every year by the Council of the Institution and celebrated at its various Overseas / State / Local Centres to educate the engineering fraternity in general and the society in particular. This year the 51<sup>st</sup> Engineers’ Day will be celebrated all over the country and the Council of the Institution has selected the theme as “ Digital Transformation: A new Industrial Revolution” to mark the occasion.

Industries around the world are now facing substantial challenges due to recent environmental, societal,

economic and technological developments regarding disruptive concepts of Internet of Things, Cyber Physical Systems or Cloud based Manufacturing, which lead to the fourth stage of industrial revolution. Increased digitization which waves out traditional and conventional production concepts including mass production, batch production, continuous process flow and project is the need of the hour. The first industrial revolution utilised water and steam power for mechanizing production. During second industrial revolution, application of power was more with the objective to obtain mass production. During third industrial revolution, industrial automation was introduced, which involved vast application of Electronics and

Information Technology. The fourth industrial revolution, termed as Industry 4.0 is empowered by wide range of digital technology not only in digital realm, which involves artificial intelligence, machine learning, advanced robotics and new formation of automation, but also in physical realm including new materials like graphene, genetic advances as well as biological realm which involves sensors, Internet of Things, Block Chain and Distributed Ledgers, 3D Printing, autonomous vehicles like drones, so on and so forth.



# The Institution of Engineers (India)

AN ISO 9001 : 2008 CERTIFIED ORGANIZATION (ESTABLISHED 1920, INCORPORATED BY ROYAL CHARTER 1935)  
HEADQUARTERS: 8 GOKHALE ROAD, KOLKATA 700 020, INDIA

## *How does the Institution serve the Engineering Community?*

*The services rendered by The Institution of Engineers (India) to its Members are primarily through a variety of technical activities and functions such as :*

- Dissemination and updating of engineering and technological knowledge and diffusion among its members, the information on all matters affecting engineering, through Technical Activities, such as seminars, symposia, continuing education courses, workshops, paper meetings, conventions, conferences, etc at both national and international levels;
- Providing access to R & D activities and engineering practices through engineering and technological disciplines;
- Focusing on new developments, techniques, products, processes and other issues of topical interest;
- Highlighting emerging engineering and technological scenario through comprehensive coverage in the tabloid IEI News published monthly along with authoritative discourses and state-of-the-art reviews on specialized engineering issues in the Technorama published annually;
- Extending engineering information and library services at its Headquarters and at the State and Local Centres;
- Inculcating and promoting amongst engineers and technologists a growing commitment to the social objectives of the profession;
- Fostering national and international cooperation in engineering and technology;
- Acting as an accreditation body for courses in engineering;
- Acting as qualifying body and conducting examinations under its non-formal education programme, to cater to the needs and aspirations of prospective entrants to the profession;
- Recording appreciation of and extending recognition to individual achievements and activities in advancing the art and science of engineering and technology;



## MESSAGE



**Ambassador**



**भारतीय राजदूतावास**

السفارة الهندية  
EMBASSY OF INDIA

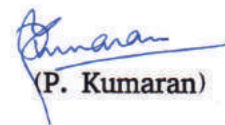
P. O. Box 2788, DOHA - QATAR  
Tel.:(+974) 4425 5703, Fax : 4467 0448  
E-Mail: [ambassadorindia@qatar.net.qa](mailto:ambassadorindia@qatar.net.qa)  
Website : [www.indianembassyqatar.org](http://www.indianembassyqatar.org)

I am happy to note that the Institution of Engineers (India), Qatar Chapter, is launching a souvenir on the occasion of Engineers Day. The Institution of Engineers (India) (IEI), Qatar Chapter, has been actively involved in organising several activities and events which have contributed to the academic and professional development of the engineering fraternity as a whole. IEI brings together a large and successful segment of the Indian expatriate community here in Qatar and its contributions to the growth & development of Qatar are well acknowledged.

Engineers Day marks the birth anniversary of Sir Mokshagundam Visvesvaraya, a legendary engineer and Bharat Ratna recipient. The event held to mark this auspicious occasion and the souvenir is a fitting tribute to the contribution of the great man to the development of Modern India.

India has taken impressive strides in science and technological development over the years. The Government of India has taken a number of initiatives to leverage our skills and experience in this sector. Initiatives such as 'Make in India', 'Smart Cities', 'Start-up India' and 'Digital India', draw on our success in the engineering field to contribute to the overall development of the country.

I congratulate the Institution of Engineers (India), Qatar Chapter, for their stellar contribution to bolstering India-Qatar relations, and wish them the very best in their further endeavours.

  
(P. Kumaran)



*The Institution of Engineers (India) - Qatar Chapter had organized the 50th Engineers' Day on 22.09.2017 at Radisson Blu Hotel, Doha.*

## MESSAGE



**Sisir Kumar Banerjee, FIE**  
PRESIDENT

### The Institution of Engineers (India)

AN ISO 9001 : 2008 CERTIFIED ORGANISATION

(ESTABLISHED 1920, INCORPORATED BY ROYAL CHAPTER 1935)

**HEADQUARTERS : 8 GOKHALE ROAD, KOLKATA - 700 020, INDIA**

Ph : (91) (33) 4010 6204 • Website : <http://www.ieindia.org>

*“98 Years of Relentless Journey towards  
Engineering Advancement for Nation-building”*

I am happy to note that Qatar Overseas Chapter of The Institution of Engineers (India) is celebrating the 51st Engineers' Day on the topic “Digital Transformation: A New Industrial Revolution” on September 28, 2018 to commemorate the Birth Anniversary of Bharat Ratna Sir Mukshagundam Visvesvaraya, the father-figure of Indian engineers.

In the era of digitisation and Internet of Things, industries are now more dependent on digital technologies. Synchronisation of men, material and process through IoT are now an integrated part of any process industry. In the milieu of rapid development in industrial processes and production of quality goods, industries have to transform themselves to the digital world to improve competitiveness in an ever-changing economic scenario.

I am hopeful that deliberations, on this subject, would highlight means to achieve this digital transformation in a cost-effective way, so that, Indian industries can achieve higher levels of competitiveness through this emerging technological paradigm.

I wish celebration of Engineers' Day at Qatar Overseas Chapter a grand success.

(Sisir Kumar Banerjee)



*Appreciation of Executive Committee on 50th Engineers' Day celebration held on 22nd September 2017 at Radisson Blu*

## MESSAGE



### The Institution of Engineers (India)

[ ESTABLISHED 1920, INCORPORATED BY ROYAL CHARTER 1935 ]

8 GOKHALE ROAD, KOLKATA 700 020, INDIA

<http://www.ieindia.org>

**Maj Gen (Dr) S Bhattacharya, VSM (Retd)**  
SECRETARY AND DIRECTOR GENERAL



Ph : +91-33-22238230 (DIRECT)  
Ph : +91-33-40106203 (EPABX)  
Fax : +91-33-22238345  
E-mail : [sdg@ieindia.org](mailto:sdg@ieindia.org)

*98 Years of Relentless Journey Towards  
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Digital transformation is the integration of digital technology into all areas of a business, fundamentally changing how we operate and deliver value to customers. This process helps an organization to keep pace with emerging customer demands now and if sustained, in the future. It also enables an organization to improve competitiveness in an economic landscape that is constantly changing with advancement of technology.

The fourth industrial revolution, termed as Industry 4.0 is empowered by wide range of digital technology and is focused on creating intelligent products, processes and procedures that leads to ubiquitous connectivity of people, things and machines. The vision of Industry 4.0 is likely to be adopted worldwide and it might influence other technological initiatives and cooperative efforts in the future world.

I wish the event a grand success.

Maj Gen (Dr) S Bhattacharya, VSM (Retd)



*Annual General Meeting was held by Qatar Chapter of The Institution of Engineers (India) on 29th March and 30th July 2018, at the Indian Cultural Centre.*

## MESSAGE



## The Institution of Engineers (India)

(Established 1920, Incorporated by Royal Charter 1935)

Affiliated to IBPC, Under the aegis of Embassy of India - Qatar Chapter

P.O Box: 18523, Doha-Qatar, E-mail: [ieiqatar@gmail.com](mailto:ieiqatar@gmail.com), Website: [www.iei.qa](http://www.iei.qa)

*Celebrations throughout the world are taken to great heights and strides during the Engineers day in remembering the realized past and visualizing the future of the tenets set out by revered visionary Bharat Ratna Sir M. Visvesvaraya.*

Being part of such grand Celebration for the year 2018 gives me sense of great pride and privilege, as I write this message from my desk at the Qatar Chapter Doha.

As the country of Qatar has very well progressed in the last decade as one of the foremost and fastest developing countries in the world, especially welcoming of 2022 FIFA World Cup, blessed

The Qatar Chapter of IEI is indeed happy to publish this technical souvenir on the 51<sup>st</sup> Engineer's Day to mark the birthday of Bharat Ratna Sir M. Visvesvaraya, the doyen of Engineering fraternity whose creative genius nearly revolutionized the concepts of planning for community welfare of both the rural poor as well as urban masses.

I whole heartily commend all the enthusiastic dynamic & dedicated Engineer Member of all the past and present Executive Committees, who have made a name in the engineering fraternity for their selfless services in uplifting the status of Engineer & Engineering profession. But the task is growing more and more complex, with ever expanding technological development and advancement of engineering field and applications.

The theme chosen for this year's commemoration is "Digital Transformation: A New Industrial Revolution" This is a very relevant topic in the current context. I have profound optimism that discussions on the Engineers' Day Theme will emerge in to exciting ideas, developments and opportunities for the Engineers in the coming years.

Engineers Day is the day of reverence and conscientious thinking for all Engineers. This day belongs to the Engineering community and all Engineers shall feel proud to be associated with this highly important and noble profession.

I take this opportunity to express my sincere thanks and gratitude to our well-wishers and supporters for their guidance and support which has enabled the Qatar Chapter to function as a truly professional body in Qatar. I also take this opportunity to congratulate all fellow Engineers on the occasion of the 51<sup>st</sup> Engineers' Day and wish them a great success.

**Er. Abdul Sathar FIE**  
Hon. Chairman



*A Technical Seminar on "Cathodic Protection and Corrosion Control" was held by  
Er. Santhosh G Prabhu, General Manager, MEECC at ORYX ROTANA HOTEL on Friday 1st June, 2018.*





## ACTIVITIES OF THE IEI QATAR CHAPTER

**Dr. Abdul Hameed Pathiyil** - Honorary Secretary

B.Tech, MIT, MBA, M.I.E, C.Eng, PhD

The visionaries amongst the engineers thought it necessary in the early twentieth century to establish in India a professional society encompassing all disciplines of engineers. The sapling planted in the 1920 has, by now, grown to a big tree and the track record of The Institution of Engineers (India) has been a matter of pride for all engineers.

The Institution of Engineers (India) was granted the Royal Charter of Incorporation 1935 by His Majesty the King George V of England in 1935, "to promote and advance the science, practice and business of engineering in all its branches in India". Starting with this humble beginning, The Institution of Engineers (India) is now a unique professional body encompassing 15 engineering disciplines and with an overall membership of over 800,000

The Institution of Engineers (India) is the first professional body to represent India in several International Bodies, such as the World Mining Congress (WMC), the World Federation of Engineering Organizations (WFEO), the Commonwealth Engineers' Council (CEC), the Federation Internationale du Beton (fib), and the Federation of Engineering Institutions of South and Central Asia (FEISCA). It also has bilateral agreements with a number of professional societies across the globe.

The council of the Institution of the Engineers of India established an overseas chapter in the State of Qatar in the Arabian Gulf in July 1991 for the benefit of its members residing and practising engineering profession in Qatar. The jurisdiction of the Qatar Chapter shall be the geographical boundaries of the State of Qatar. The Qatar Chapter operates under the sponsorship of the Indian Embassy in Qatar and under the patronage of the Ambassador of India. IEI Qatar Chapter was formally inaugurated on July 26, 1991 by the then President of IEI Mr. P. J. Mehta accompanied by SDG Mr. K. N. Mazumdar. The aims and objectives of the chapter are to promote the general advancement of engineering and to facilitate exchange of opinion and ideas in engineering profession amongst Members of the Qatar Chapter and for that purpose

To promote co-operation and co-ordination among all Members residing in the State of Qatar and between the Chapter and the Headquarter of the Institution in India. All the members of the preparatory committee and the founding committee had contributed greatly in the formation of this chapter but exemplary contributions of Er. John Mathew, Er. Animesh Sarkar, Er. U.U. Menon, Er. Debashis Roy etc would be ever remembered.

Qatar Chapter has been providing support and counseling services to the Engineers in Qatar to become Corporate

Members, Chartered Engineers and Professional Engineers of the Institution. Levels of Corporate Memberships are Fellow (FIE), Member (MIE), Associate Member (AMIE).

The Institution records its appreciation of the services rendered by the Indian Embassy officials and the IBPC of their support. IEI Qatar Chapter has begun offering the Professional Engineering (PE) examination facilities in Qatar. PE certification has assumed a great significance after the formation of "Engineers Mobility Forum", a global body for the free movement of Engineers holding PE certification of any member country with mutual recognition.

As Honorary Secretary of the Qatar Chapter, I consider it a privilege to present this overview of the activities since 51<sup>st</sup> Engineers Day celebration on 28<sup>th</sup> September, 2018.

The Institution of Engineers (India) - Qatar Chapter had organized the 50th Engineers' Day on 22.09.2017 at Radisson Blu Hotel, Doha. Mr. Hemant Kumar Dwivedi, First Secretary, Embassy of India was the Chief Guest and Dr. Ashok A. Ghatol Former Vice -Chancellor, Dr. Babasaheb Ambedkar Technological University was the keynote speaker. Among Guests of Honor were- Er. Ahmed Jassim Al-Jolo, the Chairman of the Federation of Arab. More than 250 engineers and invited dignitaries had attended this great event.

Full day workshop on "Contracts Management of International Construction Projects under FIDIC Contracts" on Friday 3<sup>rd</sup> November 2017 at Hotel Radisson Blu. Eminent speaker Er. Sunil Kulkarni, Director - Contracts & Procurement at Qatari Diar, delivered an in-depth presentation, which was attended by 100 practicing Engineers from various contracting and consulting organizations.

Full day workshop on "Entrepreneurship Development Programme" on Friday, 1st Dec 2017 at Hotel Radisson Blu, Mr. Dilip N. Dharurkar, a successful entrepreneur and Managing Director- NAC Group of Industries, Aurangabad-India delivered an in-depth presentation, which was attended by 100 practicing Engineers from various contracting and consulting organizations.

Full day Workshop on "Flow Network Design and Surge Analysis" on Friday, 23rd Feb 2018 at Hotel Oryx Rotana. Professor Arun Moharir, Chemical Engineering Department, Indian Institute of Technology, Mumbai conducted four technical sessions. 40 Engineers benefitted from the workshop IIT Mumbai announced special discount for online Piping Engineering Certificate Course to the members of IEI Qatar Chapter.



*Full day Workshop on "Flow Network Design and Surge Analysis" on Friday, 23rd Feb 2018 at Hotel Oryx Rotana.  
Professor Arun Moharir, Chemical Engineering Department, IIT, Mumbai.*

IEI Qatar Chapter gave a warm reception to its founder Secretary Er. Animesh Sarkar at Holiday Villa 23<sup>rd</sup> July, 2018. Members of the Past and Present Executive Committees, IEI Corporate Members (IElans) attended the function. Founder Secretary Er. Animesh Sarkar expressed his total satisfaction and happiness over the great/tremendous progress achieved by the Qatar Chapter after his departure from Doha 3 years ago. He congratulated the office bearers and the Executive Committees of all past and present committees of the Qatar Chapter in achieving this great feat and thanked the Indian Embassy for the support and guidance extended to this professional body since its concept and formation in Qatar. During his reception founder Chairman Er. John Mathew expressed his message over telephone from Bangalore.

A Technical Seminar on "Cathodic Protection and Corrosion Control" was held by the Qatar Chapter of The Institution of Engineers (India) at ORYX Rotana Hotel on Friday 1st June, 2018. The Seminar was well attended by around 100 member engineers. Er. Santhosh G Prabhu, General Manager (Sr. CP Engineer) of Middle East Engineering and Corrosion Control (MEECC), conducted the Technical Seminar on Cathodic Protection and Corrosion Control. He is a Certified NACE CP Technologist and a Member of NACE and ICorr.

A Technical Seminar on "Risk and Insurance in Construction Projects" was held by the Qatar Chapter of The Institution of Engineers (India) at ORYX Rotana Hotel on Friday 20th July, 2018. The Seminar was well attended by around 80 member engineers. Mr. Rishi S Iyengar, Vice President & Construction & Infrastructure Practice Leader, Marsh Qatar, conducted the Technical Seminar on Risk and Insurance in Construction Projects. The seminar sponsored by MARSH Qatar LLC, They are one of leading institutions in the field of Finance & Risk Management in Qatar. The seminar covered in the topics of identify and manage risks in construction projects, types of risks inherent on construction projects such as financial, contractual, operational and environmental and can be caused by both internal and external sources.

The Institution of Engineers (India) Qatar Chapter was conducted 51st Engineers' Day Theme Seminar on "Digital Transformation: A New Industrial Revolution" at ORYX Rotana Hotel on Friday 10th August, 2018. The Seminar was well attended by around 100 plus member engineers. Every year IEI QC celebrating theme seminar prior to their Engineers' Day celebration. Er. Nagarajan Nehruji, Director of Conserve Green Building & MEP Solutions is a seasoned Construction Professional with 16 years of experience all-round the life cycle of construction industry. He has graduated from Thyagarajar College of Engineering, Madurai in 2002. Er. K M Bazeeth Ahamed is an USGBC LEED Faculty, Certified Energy Manager & Auditor, ASHRAE Certified Building Energy Assessment Professional & Consultant in Green Buildings. He has completed his Post Graduation in Mechanical Engineering from Birla Institute of Technology in 2002 and has spent 18 years in Academics, Research, MEP Contracting, Energy Audits and Green Building Consultancy.

Annual General Meeting was held by Qatar Chapter of The Institution of Engineers (India) on 29<sup>th</sup> March 2018, at the Indian Cultural Centre. AGM was well attended by 34 member

engineers. Er. Seenu Pillai, as an Election Officer conducted election for new 12 members' executive committee where 26 members contested. As a customary, Outgoing Chairman Er. Aniruddha Kulkarni proposed names for office bearers and new executive committee members unanimously selected office bearer's for next two years term during a meeting held on 04<sup>th</sup> April 2018 at ICC. Er. Abdul Sathar as Hon. Chairman, Er. Niranjana Limaye as Hon. Secretary and Er. Sajeeth George as Hon. Treasurer. Incoming Chairman, emphasized on continuing the legacy as a most dynamic overseas chapter of IEI for benefit of the engineering fraternity in Qatar.

The Institution of Engineers (India), Qatar Chapter held their 28th Annual General Body Meeting (AGM) on 30th July, 2018. Honorary Chairman Er. Abdul Sathar welcomed the gathering. He also talked about the active role the Qatar Chapter is playing in the professional development of its member engineers, outlining the forthcoming program. Chairman requested to all Engineers to take initiative to enroll for Corporate Membership.

Past Treasurer Er. Venu Madhav presented the Audited financial report for the year 2016-18 and Er. Sajeeth George, Hon. Treasurer proposed budget for the year 2018-19 and were adopted unanimously. Hon. Chairman proposed Er. Seenu Pillai as Hon. Advisor of IEI Qatar Chapter. The event was compered by Er. Sunil Kulkarni..

We conducted the IElans Chapter monthly meetings in 2018, to support our AMIE aspirants providing them the online Library Facilities and necessary support for UPDA qualification process.

Since its inception, the Qatar Chapter of the Institution of Engineers (India) this overseas chapter has been rendering excellent professional services to the engineering community of Qatar in consistent to the objective of the Institution uninterruptedly for last 27 years. One of the major activities is the regular technical seminars and workshop conducted for the member engineers in Qatar. It also promotes general advancement in engineering and technology, provides a platform for technical interaction for continuous professional development of the engineering community of Qatar.

On behalf of IEI Qatar Chapter, I extend our sincere gratitude to our sponsors, all organizations and fellow engineers for their valuable support in our activities. We look forward to your continued support in the years to come, so we could be partners in progress.

As Qatar marches ahead in progress, as a premier wealth creation and knowledge creation center in the world, Institution of Engineers (India) Qatar Chapter will also march ahead and will continue to provide its fullest professional support in the endeavor.

Thank You  
**Dr. ABDUL HAMEED, FIE**  
Hon. Secretary



*A Technical Seminar on "Risk and Insurance in Construction Projects" was held by the at ORYX Rotana Hotel on Friday 20th July, 2018. Mr. Rishi S Iyengar, Vice President & Construction Practice Leader, Marsh Qatar.*



# SINGLE USE PLASTIC: CHALLENGES AND DAMAGE CONTROL STRATEGIES

Shahwaz Mustafa Khan

Environmental Engineer (M.Sc., M.Tech, C.Eng. AMIE, SIIRSM, GradIOSH)

## ABSTRACT

Plastic is a miracle material invented by human in modern era. This is due to plastic countless lives have been saved in the health sector, the growth of clean energy from wind turbines and solar panels has been greatly facilitated, and safe food storage has been revolutionized. With continuous increase of World's population, amount of waste generation also increase exponentially and especially plastic pollution spread like an epidemic that needs immediate action. As plastic is composed of major toxic pollutants, it has the potential to cause great harm to the environment in the form of air, water and land pollution. Much of that waste does not make it into a landfill, but instead ends up in our oceans, where it is responsible for killing seabirds and marine mammals every year throughout the world. Every year thousand tonnes of plastic dump into our oceans, lakes, rivers and water bodies. Worldwide reliance on disposable plastic packaging is overwhelming our planet and it is estimated that by 2050, the oceans will contain more plastic than fish by weight. Plastic pollution crosses international border and sectors; it is an environmental and social justice issue. United Nations declared 'Beating Plastic Pollution' as worldwide theme and recognized India as global host country to celebrate World Environment Day-2018. According to United Nations, every year the world uses 500 billion plastic bags. We produced more plastic than in the whole last century whereas 50% of the plastic we use is single-use or disposable and plastic makes up 10% of all of the waste we generated. Disposable plastic items represent 50% of marine litter whereas 95% disposable plastic packaging is wasted. For the good of the planet, it is time to rethink how we use plastic and must reduce our collective plastic footprint. Collection of plastic waste and utilize the same through recycling is one of the solutions for plastic waste management and resource utilization. Redesign and innovative make plastic products easier to recycle and improve waste collection, sorting and reprocessing. Scale up to the adoption of reusable plastic packaging will help to reduce plastic waste generation. World leaders need to establish a global plastic protocol and create visible market for recycled plastic to encourage entrepreneurs for plastic waste recycling. Countries may also put in place deposit schemes and establish clear regulatory frameworks for biodegradable plastics. Countries should also support research and development programs to find innovative ways to replace single use plastic in everyday life, plastic waste management, reuse and recycling technologies.

**Keywords:** United Nations, Plastic Pollution, Single-use plastic, Recycling, Research, Policy.

## SINGLE USE PLASTIC AND ITS CHALLENGES

Alexdander Parkes created the first man-made plastic and publicly demonstrated it at the 1862 Great International Exhibition in London. The material, called parkesine, was an organic material

derived from cellulose that, once heated, could be molded and retained its shape when cooled. Single use plastics, often referred to as disposable plastics, are commonly used for plastic packaging and include items intended to be used only once before they are thrown away or recycled. Single use plastics also referred to as disposable plastics, are commonly used for plastic packaging and include items intended to be used only once before they are thrown away or recycled. The United Nations Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) estimated that land-based sources account for up to 80 percent of the world's marine pollution, 60 to 95 percent of the waste being plastic debris. Marine debris is a global transboundary pollution problem. If the growth in plastic production continues at the current rate, by 2050 the plastic industry may account for 20% of the world's total oil consumption. It is estimated that between one to five trillion plastic bags are consumed worldwide each year. Five trillion in a year is almost 10 million plastic bags a minute. If tied together, they would go around the world seven times every hour and cover an area twice the size of France. Single-use plastic bags and Styrofoam products are widely used because they are strong, cheap and hygienic ways to transport goods. Plastic groceries bags consume less energy and water to produce and generate less solid waste than paper bags, talking up less space in landfills. However, some of the characteristics that make them commercially successful – price, durability and resistance – also contribute to making them environmentally unsound (when mismanaged) and difficult to recycle. Some studies suggest that plastic bags and Styrofoam containers can take up to thousands of years to decompose, contaminating soil and water, and posing significant ingestion, choking and entanglement hazards to wildlife on land and in the ocean.

**Current scenario of single-use plastic:** The world produces more than 400 million tons of plastic every year that includes largest industrial sector as plastic packaging that constitutes around 36% to total plastic produced. Building and construction projects utilize 16% of single-use plastic produced whereas textile 14%, industrial machinery 1%, consumer and institutional products 10%, transportation 7%, electronic 4% and other areas use 12% of single-use plastic produced worldwide. Global utilization reflects that 26% of total produced single-use plastic produced in North East Asia, followed by 21% in North America, 17% in Middle East, 16% in Europe, 12% in Asia & the Pacific region, 4% in Central and South America, 3% in Former USSR region and 1% only in African countries.

**Plastic waste:** About 300 millions tons of plastic waste was generated in 2015 and this growth in plastic waste generation happened only over last 60 years. In 2015, plastic packaging waste accounted for 47% of the plastic waste generated globally, with half of that appearing to come from Asia. While China remains the



*51st Engineers' Day Theme Seminar on "Digital Transformation: A New Industrial Revolution" at ORYX Rotana Hotel on Friday 10th August, 2018. Conducted by Er. Nagarajan Nehruji, Director of Conserve Green Building & MEP Solutions and Er. K M Bazeeth Ahamed is an USGBC LEED Faculty, Certified Energy Manager & Auditor.*

largest worldwide generator of plastic packaging waste whereas the USA is the largest generator of plastic packaging waste on a per-capita basis, followed by Japan and European Unions. According to recent estimates, 79% of the plastic waste ever produced now sits in landfills, dumps or in the environment and only 9% has been recycled and 12% incinerated. China is the largest generator of mismanaged plastic waste (2010) that accounts about 8.8 million Mt/year that is about 27% of world total figure. In 2015, total packaging waste generation was 141 million tonnes. A huge amount 121.26 million tonnes, i.e. 86% of this waste disposed and littered which includes 56.4 million tonnes (40%) landfilled, 19.74 million tonnes (14%) incinerated and 45.12 million tonnes (32%) leaked into the environment. Only 19.74 million tonnes (14%) generated waste reached to recycling process, which includes 2.82 million tonnes (2%) effectively recycled, 11.28 million tonnes (8) recycled into lower value applications and 5.64 million tonnes (4%) lost in the process of recycling. Plastic is the most prevalent type of marine debris found in our ocean and Great Lakes. Plastic debris can come in all shapes and sizes but those that are less than 5mm in length are called microplastics.

**Impact on Food Chain:** About 236 thousand tonnes of microplastics enters into the ocean every year. A range of animals throughout the marine environment, including corals and zooplankton, consume these particles. Once in the ocean, persistent toxic chemicals such as bisphenol A and pesticides stick to and accumulate on plastic particles, adding extra contamination. As a result, fish and wildlife are becoming intoxicated. Consequently the toxins from plastics have entered the food chain, threatening human health. Microplastics can accumulate in fish, birds and other marine life. Chemicals leached from the plastics contain compounds like polybrominated diphenyl ether (PBDE), bisphenol A (BPA) and phthalates. These chemicals have been established to upset the endocrine system and thyroid hormones and can be very destructive to women to reproductive age and young children.

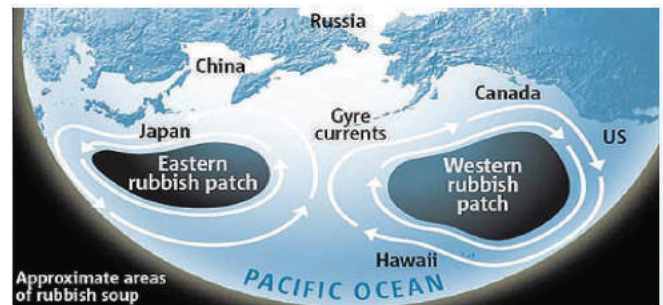


Plastic pollution & marine debris at South Senthil Island, Bay of Bengal, Photo source: SAF-Coastal Care

**Impact on Land, Air & Water:** Plastic wastes have resulted in the destruction and decline in quality of the earth's land surface in term of use, landscape and ability to support life forms. Mainly, it is because plastics leach hazardous chemicals on land, forms breeding ground for diseases, and litters available space thereby reducing the productive land areas. The bulk of plastics also end up in the landfills and since they take years to breakdown they heap up causing significant health implications to plants, people, and animals within the surrounding. Due to burning of plastics waste hazardous chemicals released into the air and cause air pollution. Polluted air will lead to various health hazards to human, animals

and plants. Deposits of air pollutant on land will cause land contamination as well. Whenever plastics are dumped in landfills, the hazardous chemicals present in them seep underground when it rains. The leaching chemicals and toxic elements infiltrate into the aquifers and water table, indirectly affecting groundwater quality. Many lakes and oceans have reported alarming cases of plastic debris floating on water surface, affecting a great number of aquatic creatures.

**Plastic Islands:** The Great Pacific garbage Patch, also known as the Pacific Trash Vortex or gyre, is located in the central North Pacific Ocean and is larger than the state of Texas. There are also garbage patches in the Indian and Atlantic Ocean. The patches are defined as containing a higher amount of plastic as compared to surrounding oceans. To date, five patches in total have been discovered. Plastics are transported and converge in the ocean where current meet. Sea Education Society scientists studied plastics in the Atlantic and calculated there are 580,000 pieces of plastic per square kilometer.



Plastic Islands in Ocean, Photo source: Earthly Issues, Charles Welch

**Microplastics status in Qatar:** A research study from Qatar University Environmental Science Centre (QU-ESC) documented the evidence of microplastics in Gulf seawater specially in the marine waters off Qatar. Polypropylene microplastics were the most common type of plastic polymer found with most plastic particles in marine water. ESC's former director and professor Dr. Jeff Obbard mentioned that such microplastics are commonly associated with general plastic packaging waste, and marine fishing nets. He noted that the level of microplastics found in Qatar's marine waters are still relatively low compared to some other locations around the world, but vigilance is needed. Qatar's coastline is susceptible to marine debris due to the country's rapid urbanization and economic development. Plastic can also affect Qatar's coastline from further afield, as it drifts long distance on ocean currents and tides. The study highlights the need for continuous monitoring of microplastics in Qatar's coastal seawater in order to safeguard the marine environment and its ecology.

### DAMAGE CONTROL STRATEGIES

The global commitments against single-use plastics underline a general sentiment to act against plastic pollution. Bans on plastic bags and Styrofoam items can effectively counter some of the symptoms of plastic overuse. Better waste management systems, along with circular thinking, can help achieving long-term impacts and better address the problem of plastic in the environment.

**Circular economy** – Government leadership, producer responsibility & consumer education, and awareness will enable market mechanisms that drive higher resources productivity,

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innovation and economic growth. **Design** – products and packaging are designed to last longer and be more durable, using more sustainable materials that can be easily recycled at end-of-life. **Produce** – Business collaborate and coordinate across sectors to reduce greenhouse gas production and fossil fuel use. **Distribute** – retailers offers products that can be easily reused or refurbished, offer end-of-life take back or maintenance and repair services, and support producers in providing education and awareness to consumers. **Consumer** – there are many ways consumers can contribute to a circular economy, like making greener buying choices, sharing assets (e.g. cars, tools) and repairing them or offering them so others for reuse and refurbishing. **Reuse & Repair** – Producers are fully responsible for recovering materials from their products and packaging throughout their lifecycle. **Recycle** – improved, cost efficient collection and treatment systems will lead to fewer materials ending up in landfill and support the economics of circular design.

**Awareness and Education:** Social awareness and education are essential to shape and encourage changes in consumer behavior, but a gradual, transformational process is necessary. A longstanding change in cultural attitude towards environmental matters is often not attainable through brief or stand-alone awareness campaigns. It is instead best achieved through embedding messaging in regular didactic practices and school curriculums from a very young age. Public awareness strategies can include a wide range of activities designed to persuade and educate. These strategies may focus not only on the reuse and recycling of resources, but also on encouraging responsible use and minimization of waste generation and litter.

**Voluntary reduction strategies and agreements:** Reduction strategy is also an option to lessen the number of plastic bags and the amount of single-use plastic packaging. As opposed to bans and taxes, the value of reduction strategies is that they do not attempt to force sudden changes in the market. They build on understanding that for the change to be long-lasting, it needs to be voluntary and based on choice. The promotion and adoption of reusable bags as alternatives to plastic bags is an example of a reduction strategy where the choice rests with the consumer. Voluntary agreements between the government and producers/retailers can act as an alternative to bans and be an effective instrument demonstrating public-private collaboration.

**Policy Instruments:** Governments have introduced different policy tools, from bans, to economic instruments such as taxes. The ban can be total or partial for those of certain specifications, e.g. plastic bags <30µ thickness. Bans on single-use plastic can be step towards more comprehensive policies aiming at reducing the generation of plastic waste and at replacing single-use plastics with more sustainable, environmentally-friendly alternatives. Levy may impose on supplier of plastic bags of domestic producers or importers. Levy can also be imposed on the consumers, they have to pay charge on each bag sold at the point of sale as per standard price defined by law. A combination of regulatory (ban) and economic instruments (levy) may also provide a solution to control use of plastic for instance a ban on thin plastic bags and a levy on thicker ones. To date, regulations on plastic bags and Styrofoam products have been introduced at the national level in more than 60 countries and more will follow.

**Roadmap for policymakers:** United Nations suggests a 10-step roadmap to guide governments that decide to opt for a policy approach (the introduction of a ban or levy). The roadmap draws upon the experiences, both positive and negative, of over 60 countries that have already implemented bans and levies on single-use plastics primarily plastic bags and Styrofoam. **Step-1:** Know the baseline - identify the most problematic single-use plastics, assess current causes, assess extent, assess impact, evaluate consumers' willingness to pay. **Step-2:** Evaluate Possible Actions – regulatory, voluntary, economic and combination of all. **Step-3:** Assess impacts of preferred option – social, economic and environmental. **Step-4:** Engage Stakeholders – government (central and local), industry, retailers, waste management authority, citizens and tourism associations. **Step-5:** Raise awareness - education programmes, TV adverts, campaigns to explain – why is the policy being introduced? and what are the expected benefits? and what are the punitive measures?. **Step-6:** Promote alternatives - eco-friendly, affordable and fit for purpose. **Step-7:** Incentivize industry - allow enough time for the transition, offer tax rebates, keep certain eco-friendly materials tax free. **Step-8:** Ringfence revenues - support waste minimization and recycling industry, environmental projects and to finance awareness initiatives, communicate the chosen purpose. **Step-9:** Enforce - set roles and responsibilities, ensure sufficient human-power for enforcement, communicate the enforcement process, prosecute offenders in line with policy revisions. **Steps-10:** Monitor and adjust policy - audits, surveys, studies and keeps the public updated on progress.

**Qatar's Strategy:** An article published in Gulf Times mentioned that on occasion of World Environment Day, HE the Minister of Municipality and Environment Mohamed bin Abdullah al-Rumaihi has called for efforts to meet the challenges of plastic pollution in everyday life. The Minister said that there is an urgent need to draw attention to the extent of the devastating risks posed by plastic material to marine pollution and the direct threat to the environment and marine organisms, which have adverse effects on human health. The Minister has said that Qatar, under the wise leadership of His Highness the Amir Sheikh Tamim bin Hamad al-Thani, pay great attention to the protection of environment that effectively translated into Qatar National Vision 2030, the fourth pillar of which focuses on environmental development and environmental conservation for future strategies.

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*IEI Qatar Chapter gave a warm reception to its founder Secretary Er. Animesh Sarkar at Holiday Villa 23<sup>rd</sup> July, 2018. Members of the Past and Present Executive Committees, IEI Corporate Members attended the function.*

When you look at the light bulb above you, you remember Thomas Alva Edison.  
When the telephone bell rings, you remember Alexander Graham Bell.  
Marie Curie was the first woman to win the Nobel Prize.  
When you see the blue sky, you think of Sir C.V. Raman.

*Dr. A. P. J. Abdul Kalam*

# Reducing damage caused by rundown pipelines using Artificial Intelligence and Robotics

Hrishikesh Srinivasan

## Objective:

To Identify Hydrocarbon leaks for LNG and other hydrocarbon products rundown pipe lines to avoid fire/ disaster and save cost early (sudden break down of pipe line – Products revenue lost).

## Introduction:

Liquefied Natural Gas (LNG), is a very important product which many big companies like ExxonMobil, Shell, Total, Conoco, Chevron, etc. produce in many places around the globe. LNG is mainly used as fuel to generate power using generators. Qatar has been the leading producer of LNG since 2014 and they have continued to excel in the production of LNG and other crude by-products. Even if the oil and gas industry seems to be bringing huge fortunes to companies and countries, the industry also has its disadvantages. One of the biggest disadvantages has been the safety of workers and loss of revenue, infrastructure and other facilities. Many Oil and Gas companies all around the world have suffered have loss of lives and revenue due to gas and oil leaks that occur in rundown pipe lines. This has been due to poor monitoring and lack of manpower to continuously monitor the pipelines at remote locations. However, this problem can be solved using Artificial Intelligence and Robotics. Artificial intelligence is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans and other animals. This field is being used in many places nowadays and is believed to be the future of technology. This field can be of great benefit to the oil and gas industry as well.

## Drone Technology:

Drones are unmanned aerial vehicles which are widely used in many current day tasks from wedding photography to military operations. This technology involves various engineering fields, especially aeronautics, robotics and artificial intelligence. Drones can be of variable size depending on the task needed to be completed. Drones can be classified into the following types:

- Target and decoy – providing ground and aerial gunnery a target that simulates an enemy aircraft or missile
- Reconnaissance – providing battlefield intelligence
- Combat – providing attack capability for high-risk missions
- Logistics – delivering cargo
- Research and development – improve UAV technologies
- Civil and commercial UAVs – agriculture, aerial photography, data collection.

The drone we can use in this project will be of the type , Civil and commercial UAV's since we will be monitoring and collecting data from rundown pipelines.

## Materials Required:

- Light, strong, composite and durable material for drone body and propellers (carbon fiber is recommended).
- Solar panels to be fitted in order to power the drone.

- Gas sensors which are of small size.
- Monitors, which are connected to the gas sensor, to display readings in the control room.
- Specially designed remotes to control the drones.
- Alarms connected to the sensors or central monitoring system.
- Small compatible GPS to be fitted inside the drone.

## Method:

A small robotic drone device can be used to monitor the rundown pipes and continuously alert the control room of what is going on in and around the pipe lines. The drone will be made of light material and will be able to withstand heat. The device will be powered using solar energy and will have solar panels fitted and a battery attached inside it. The drone will also be fitted with an inbuilt GPS so that its location can be tracked. It will have propeller blades attached to it for continuous movement which will be operated by people assigned for the job. The device will be controlled by a remote control specifically made for controlling the drone. The robot can also move on its own in an assigned area but can be controlled using remote control. The drone will move around the pipelines in the area where it has been placed. The robot will have gas sensors placed inside it which will be connected to a monitor in the control room so that the gas levels in the air can be monitored. The sensor will continuously feed the values of concentrations of various gases present in the air like sulfur dioxide(SO<sub>2</sub>), carbon monoxide(CO), nitrous oxide(NO<sub>2</sub>, etc. The gas sensor will feed the values to the central monitoring system through radio waves. If the concentration of a particular gas is found to be abnormal or more than the regular level, an alarm, which is connected to the central monitoring system, will go on in order to alert the staff. Many of these robots can be used all over the area where the pipelines are situated and the readings from each gas sensor will be monitored in control room. The device can be repaired if there is any damage and if the drone fails in the middle of navigation then a signal will be sent to the remote control along with its location so that staff can go to the exact location and rectify the damage. This device can prove to be cost, life and resource sharing since there will not be any need of staff to monitor the pipelines and the readings from the gas sensor can be used to find and rectify the damage as soon as possible.

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## COMMERCIAL AIR CONDITIONERS PRODUCT RANGE



VRF System



Package Units

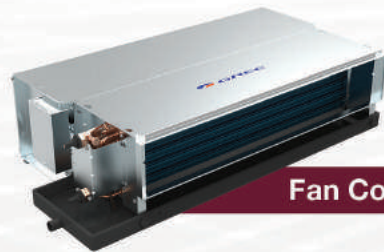


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U-Match  
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Air  
Handling  
Unit



# GDPR in Context of Middle East.



## What is GDPR?

On May 25, 2018, the General Data Protection Regulation (GDPR) has come into effect. It has been dubbed as one the most evolutionary piece of regulation in the past few decades in the realm of personal data protection. Intended to protect personal / sensitive data of Data subjects in Europe, its ripples will be felt across the world. We have already seen some high profile lawsuits against giants such as Google and Facebook.

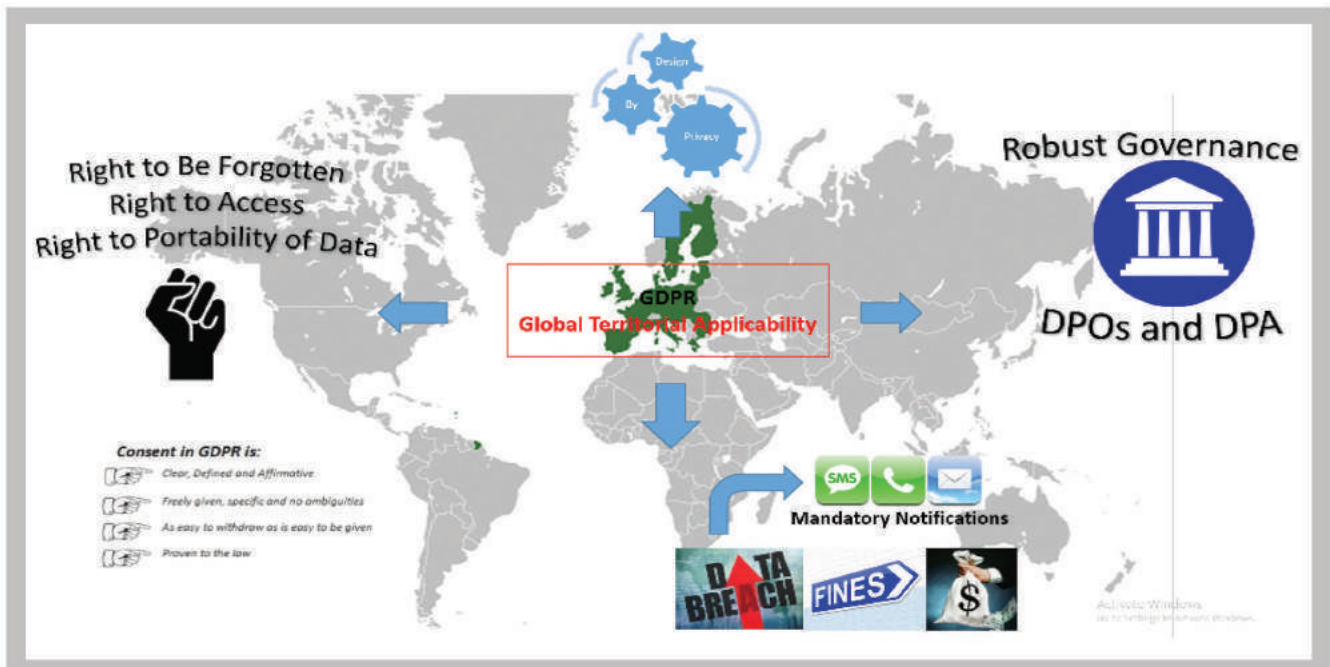
## What exactly is the General Data Protection Regulation or the GDPR as it widely known?

GDPR is advance set of rules issued by the European Commission that will govern on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)

The key objective of GDPR is to ensure that EU data subjects have complete control over their personal data and to ensure strict compliance of regulations by way of hefty fines and penalties.

## The key changes effected within the GDPR are:

1. Global Territorial applicability of the regulation.
2. Robust Governance in place.
  - a. Appointment of Data Protection Officers and Data Protection Authorities
3. Enhanced rights to its subjects:
  - a. Right to be forgotten
  - b. Right to Access
  - c. Right to Portability of data
4. Concept of Consent made unambiguous.
  - a. Consent should be clear, defined and affirmative
  - b. Freely given, specific and unambiguous
  - c. As easy to withdraw as is given.
  - d. Proven to the law
5. Ensuring Privacy by Design
6. Hefty fines and penalties in cases of data breaches.
7. Mandatory data breach notifications



## Legal Implications

The pan-global jurisdiction of this regulation is the biggest / most significant change from previous regulations. It remains to be seen though how EU commission will exercise this jurisdiction in a global landscape. Will discuss this further ahead in the article.

GDPR makes its applicability very clear - it will apply to the processing of personal data by controllers and processors in the EU, regardless of whether the processing takes place in the EU or not. GDPR will also apply to the processing of personal data of data subjects in the EU by a controller or processor not established in the EU, where the activities relate to: offering goods or services



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to EU citizens (irrespective of whether payment is required) and the monitoring of behavior that takes place within the EU. Non-EU businesses processing the data of EU citizens will also have to appoint a representative in the EU.

Simplistically put “GDPR will apply on all companies that process personal data of data subjects residing in EU, regardless of where the company is located”.

Secondly, I am still wondering how does EU intend to exercise its Global jurisdiction. Well, there may be situations when it can, for e.g. Let us assume a company supplies goods to EU through an established contract with a company in EU. As part of the order booking process, it collects some personally identifiable information (PII). In the case of a Data breach leading to loss or leakage of this PII, the EU commission may be able to levy fines / penalties on the company as the company may have some legal / contractual bindings within EU.

What if the company did not have any legal / contractual binding within EU? May be block this entity from engaging any further and doing business. However, will it be really effective or will it impact the business?

### GDPR Awareness in the Middle East

IMHO, there is not enough awareness about GDPR in the region (Middle East / GCC) and its implications.

I would have expected the EU Commission and the EU members to drive awareness about GDPR, at least in countries outside EU where they have significant business interests. GCC fits the bill. Most of the EU countries have considerable business interests in the region, yet there has been no significant awareness about the GDPR in the region.

However, from an EU perspective we need to understand that this is **not a global or an international law** however, it is a law, which has global ramifications. In many ways, it is still an internal law to EU.

GDPR only applies when the data subject is in legal / geographical boundaries of EU. Hence, it is the EU establishment’s responsibility to educate and create awareness amongst these data subjects. If a business has an EU establishment – they will anyways inform their global counterparts, plus if the business is done on purely contractual basis then it becomes a matter of jurisprudence.

### GDPR Impact on Middle East

Middle East (and specifically GCC) does huge amount of business with the EU region. Just the trade between EU and GCC for the year 2016 was in excess of Euros 138 Billion. As such, there will definitely be implications and impacts of GDPR to businesses in the region.

Further, the region is a major aviation zone transiting passengers across the world and an affordable tourist destination. As such, a huge number of EU residents use these airlines to travel across the world and to vacation in the sun soaked beaches and deserts.

Other sectors that may be impacted include Telecom, Leisure (Hotel, sightseeing / tour companies etc.), Finance (Banking and Insurance) and Retail.

In addition, the region relies on a huge expat workforce from across the world including the EU.

A recurring question amongst the local businesses that employ EU workforce is would they be impacted by GDPR just for the fact that they hire Europeans? The same would also hold for consultants and temporary work force that work on short term projects.

There is no simple answer to this and it will depend on a number of factors identified in the Article (2) and (3) of the GDPR. This will require legal interpretation and not all business may want to spend on that. Further, local businesses (at least the small and medium ones) may desist from employing EU workforce as a Risk mitigation strategy.

### Is the region ready yet?

Although organizations in the telecom, finance and aviation domain have started taking steps to comply with GDPR, a major part of the local businesses including those involved in trading with EU countries are not yet ready. Worse, most of them have just (if at all) started to THINK about the GDPR and ponder what they need to do?

Awareness is necessary to drive this, here in Qatar the government has issued a Personal Data Privacy Protection law, which is aligned to the principles espoused in GDPR, and this may be a catalyst for local companies in Qatar. However, we need to see how this takes shape generally in the region.

Cultural Perceptions is another area of concern about Privacy. So, while sharing Personal ID Cards / Smart Cards (read Digital Certificate) with your trusted employee (Managers or Mandooops as we call them locally) is pretty common for carrying out government transactions this may be unheard of in the western world. Ditto goes for sharing ATM Cards or Credit cards along with the secret PINS with the waiters / cashiers in the restaurants or commercial establishments.

Similarly, while it may be a taboo locally to snap (picture) females in public areas, this may be an acceptable act in the Europe.

Therefore, a lot needs to be done to ensure that the concept of privacy is aligned globally.

Moreover, we may have already missed the bus considering that GDPR is already effective on May 25. However, as they say it is never too late.

### Samir Pawaskar

Samir, is a Cyber Security and Privacy expert based in Qatar. He has more than 20 years of experience in diverse industry verticals and roles and is currently Head – Cyber Security Policy and Standards @ Q-CERT.

With inputs from Rakesh Jha (Privacy Expert)

### Disclaimer:

The views and opinions expressed in this article are those of the author and do not necessarily reflect the official policy or position of the organization where the author works. Any legal views expressed in the article is of the author and readers are expected to carry their due diligence including seeking a view from a legal expert.

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Honorary Chairman

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F-1235792

Mob: 55873526

E-mail: sathar@gmail.com



**Dr. Abdul Hameed Pathiyil**

Honorary Secretary

B.Tech, MIT, MBA, F.I.E, C.Eng, PhD

F-120767-5

Mob: 55391148

E-mail: ahameed\_p@hotmail.com



**Er. Sajeet E George**

Honorary Treasurer

BE, MIE, C.Eng(I), PMP, ACI Arb

M-151958-6

Mob: 55894863

E-mail: sajeetgeorge@hotmail.com



**Er. Seenu. Pillai**

Honorary Advisor

B.E, M.I.E., LEED AP BD+C, QSAS CGP

M-135100-6

Mob.: 5562 6509

E-mail: seenrajan@yahoo.co.in



**Er. Durai Manivannan**

Honorary Joint Secretary

B.E. (Ag.), M.Tech., M.I.E

M-130376-1

Mob: 70557900

E-mail: mdmanivannan@yahoo.com



**Er. Shyam Sundar**

Honorary Joint Secretary

M.Eng. (Ph.D), AMIE, C.Eng(I), C.Eng(US) ASCE, MICI, GSAS CGP

AM 1226072

Mob: 55453106

E-mail: dg@shyams.com



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## Qatar Chapter

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B.E., M.E., FIE

F-114709-5

Mob: 50720823

E-mail: aniruddhask@yahoo.com



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B.E., F.I.W.W.A., F.I.E., P.M.P., C. Eng.

F- 1236268

Mob: 55949031

E-mail: dipak.dahake@gmail.com



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(Immediate Past Treasurer)

M. Tech, B.E., PGDM, FIE, C.Engg

M-135101-4

Mob: 77027027

E-mail: venumdh@gmail.com

### Executive Committee Members



**Er. Maheshwaran. T**

(Exe. Committee Member)

B.E., PGDIPMM, PMP, M.I.E

AM-80765-9

Mob: 55221923

E-mail: maheshvelu@gmail.com



**Er. Ashik Koorimannil**

(Exe. Committee Member)

B.Tech, D.I.M., M.I.E, C.Engg., P.E

M-144432-2

Mob: 77675860

E-ashikkoorimannil@gmail.com



**Er. Syed Raziulla**

(Exe. Committee Member)

B.E., M.I.E, C. Eng.

M-134458-1

Mob: 55648386

E-mail: raziullasyed@hotmail.com



**Er. Salihudeen K.M.**

(Exe. Committee Member)

B.Tech, MBA, FIE, C.Eng

F-1153583

Mob: 55569233

E-mail: msalihudeen@yahoo.com



**Er. Sanjay Jain**

(Exe. Committee Member)

B.E., M.I.E, PMP, ACI Arb

M-151959-4

Mob: 55593688

E-mail: sanjayj@keoic.com



**Er. Sunil Kulkarni FIE**

(Exe. Committee Member)

B.E. Civil Engg, FIE, CEng (India)

F-123689-6

Mob: 66720976

E-mail: sunilight@gmail.com



**Er. Anand M Nadgir MIE**

(Exe. Committee Member)

BE (Electrical), PG Dip (Sales)

M-1603382

Mob: 66754216

E-mail: anands47@yahoo.com



**Er. Ajay Kumar Singh FIE**

(Exe. Committee Member)

B.E. Civil, FIE, C.Engg, Dip.in QA & LA of ISOs, Nebosh-IGC

F-113035-4

Mob: 50484650

E-mail: aksingh1965@rediffmail.com



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# Investigation of issues affecting implementation of Building Information Modeling in project controls



**Mohamad Fekry.**  
MSc, PMP, LEED, ICIOB  
Construction Engineer, CCC

Compared to other advanced countries, the region of Middle East and North Africa (MENA) is lagging behind in exploring the extensive use of Building Information Modeling (BIM) and its use seems to be only limited to a tool of visual presentation and data collection. However, nowadays it becomes a contractual requirement in many of Qatar mega projects, this may establish a way to develop Qatar construction industry and avoid schedule and cost deviations suffered by many of projects.

Senior management needs to embrace the full potential of BIM implementation to reach the required integrated project delivery (IPD) with ideal projects controls. This forms the background into the research which will study the benefits and the impediments of BIM implementation in project controls management (PCM), and investigate further to what extent Qatar construction industry can embrace the role of BIM in PCM.



Figure (1): Project Controls Scope

BIM implementation allows for work integration and promotion of continuous cooperation and coordination between different disciplines, departments, and companies under one contract; serving all departments that contribute to successful project management.

Challenges and impediments were identified in the way of integrated implementation of BIM in project controls processes, some of these are the decision makers' unawareness of BIM feasibility, one-sided view of gaining the benefits, and delay in issuing local rules and regulations.

The study leads to a conclusion that direct implementation of BIM in project controls processes is rare and not easy to be ideally applied immediately however, it is possible if a number of factors are available including but not limited to rules, regulations, awareness, active participation and education. Qatar Construction industry may not reach yet full implementation of all BIM applications but the evolution is in a continuous manner and expected that progress will not stop.

Research seeks to measure the effectiveness of integration of BIM into projects controls, investigate the issues affecting the ideal implementation and how they can be rectified. Accordingly, the research will find out the feasibility of using it in Qatar mega projects aiming of enhancing the project controls management.

The implementation of BIM is now spreading from the design activity to other phases of the construction projects, but its use is still limited (Kerosuo, H, et al, 2015). BIM implementation is mainly to fulfil the employer requirements of visual presentation, data collection and facility management whilst ignoring its benefits in the project controls.

What is the effectiveness of integration of BIM into project controls? What are required from BIM team and controls team to achieve ideal collaborative project workflow?

Compared with the desk study, what is the current stage of BIM implementation in Qatar projects controls?

Is BIM implementation effective and recommended for all projects? When will it be not recommended?

What are the issues affecting BIM implementation in project controls in Qatar?

Why are the issues occurring? How can they be rectified?

## DISCUSSION AND FINDINGS

Since the targeted participants in interviews and questionnaires are all working in major projects the results showed that using BIM is a common practice in all major governmental projects but mostly in limited applications, however, the small subcontractors' awareness and implementation of BIM are very limited so far. Their relationship with BIM will not differ than the normal people who are likely thinking only about 3D model allowing for good navigation inside the building.

Most of participants expected that within 5 to 10 years BIM development will reach completed integration project delivery with all available applications in time and cost management. The interviewees who worked in Europe specifically in Germany faced similar barriers in the way of the BIM implementation and its integration into the projects activities and took more than 5 years to be implemented with completed plan including university education.

Different levels scheme is proposed for the use of BIM in supporting PCM processes as follows (figure 2):

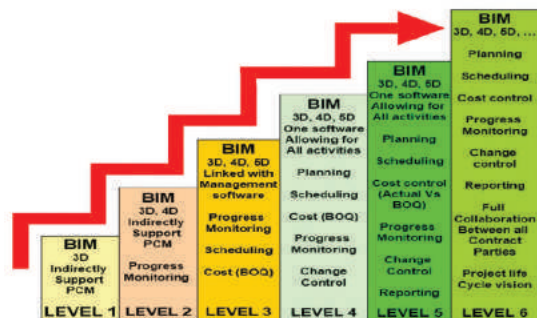


Figure ( 2): Proposed levels of BIM implementation in supporting PCM

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BIM is the operation of building the project virtually to allow for full navigation and how fast we can complete that building virtually it will allow us to control the project better. It seems expensive at the beginning due to additional requirement/resources without getting immediate output, but in the project life span, the total benefits gained by BIM will cover what was spent at the beginning. This may be the only way to convince the contractors through showing the feasibility in business outcome, that step should follow the governmental clients' steps of stating the obligation and rules of using BIM in all mega projects. Qatar will not be the beginner in that; it has been preceded by other countries such as UAE and UK, where they set rules in 2015 and 2016 respectively.

The consensus on the importance of the BIM is found in the projects thus there should be no delay in its implementation. Delay of BIM implementation comes from the contractors' decision and their expectation of BIM utility in saving cost. Here the role of the client will be most important to assure the tenderers with same level of BIM implementation is required from all competitors.

BIM implementation exceeded the three - dimensional and visual presentation services to the scheduling and monitoring the project progress by linking the model with the planning software containing the cost and resources and relevant productivity that will be closer to reality in presentation.

The reluctance in serious starting is still noticeable and justified by some participants that they were not guided to the right track. The survey showed that the absence of Qatari standards is one of the important reasons that hinder the use of BIM on a wider scale. This is in line with what we found in the secondary information as one of the causes of delay. 20% of Architecture / Engineering / Construction (AEC) organizations in the Middle East are using BIM or in the process of adopting BIM, with more professionals beginning to adopt BIM although most professionals within this region still look at BIM just as an advanced AutoCAD tool (Gerges, M., et al, 2017). The transition to level of integration project delivery with fully project controls is not in quick move unlike the first step of using BIM in quantities take off and clash detection, these activities have convinced the managers faster. In other side, the planners are confident in their completed view of the building and feel mistakenly that the BIM may add nothing to them as conducted interviews have shown.

BIM represents an important safety factor that prevents mistakes, reworking and saves time which may lead to improve cost saving more than investing in BIM equipment and resources. Before BIM, it was mandatory to build a mock up to facilitate navigation and getting the client opinion about the building finishing. Actually, it costs much more for such temporarily building to be completed, inspected then removed. BIM will allow for all that with no cost compared to the mock up and with provision of changes as per client requirement.

Cost controlling requires two inputs; the actual quantities with actual rates and another report of the contract quantities with relevant rates to compare both considering all direct and indirect actual cost related to that component. It is huge effort and using BIM will not add that much value compared with traditional ways. The only way to activate cost controlling is working in traditional way of cost controls deliverables using the same BIM coding from the start of the project. Figure (2) shows how BIM can support PCM in proposed levels scheme.

BIM allow projects reports reach the management and client representatives more comprehensive and faster consequently, the expected decision will be correct and influential. That is why it became obligation in some countries, because they have the vision which noticed the extent of BIM development and how the future ready for wide implementation. Changing is essential in order to be in line with the spirit of the new era.

The study reveals that the implementation of BIM in project controls is indirectly used but without clear procedure, it is individual attempts rather than rigid performance based on fixed standards. The results after collecting the data tend to the adoption of research hypotheses, the majority of the responses show unfamiliarity with all BIM applications. BIM experts are not optimistic enough in rapid change and PCM is far from BIM support in job tasks in direct way.

It is recommended to take the advantage of cumulated experiences, studies results, and other countries approaches. The regulations should be adopted seriously by the contracting companies determining its feasibility to get tangible profit then reflecting that in the internal procedures.

Activation of what stated in BIM executive plans is the way of making BIM effective in project controls. Otherwise, it will add new formalities only to meet employer requirements without real belief and serious actions to gain its benefits. In summary, the solution is in following the existing procedures and convincing management to avoid giving BIM the same fate as sustainability requirements and risks management with endless arguments about their feasibility.

Although there may not be direct communication and clear workflow between BIM team and project controls team, the interaction may be intangible and the current practice in the BIM in level (1) will eventually lead to save time and cost in its applications. Central BIM department may serve more; it should not be separated and tasks should be coordinated with other departments. Workflow in figure (3) can show that proposal.

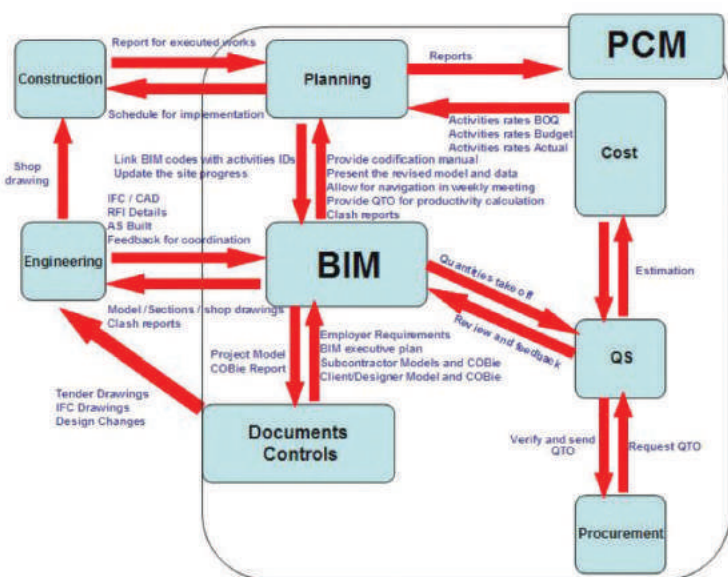


Figure ( 3): proposed flow chart of BIM implementation in Construction Company



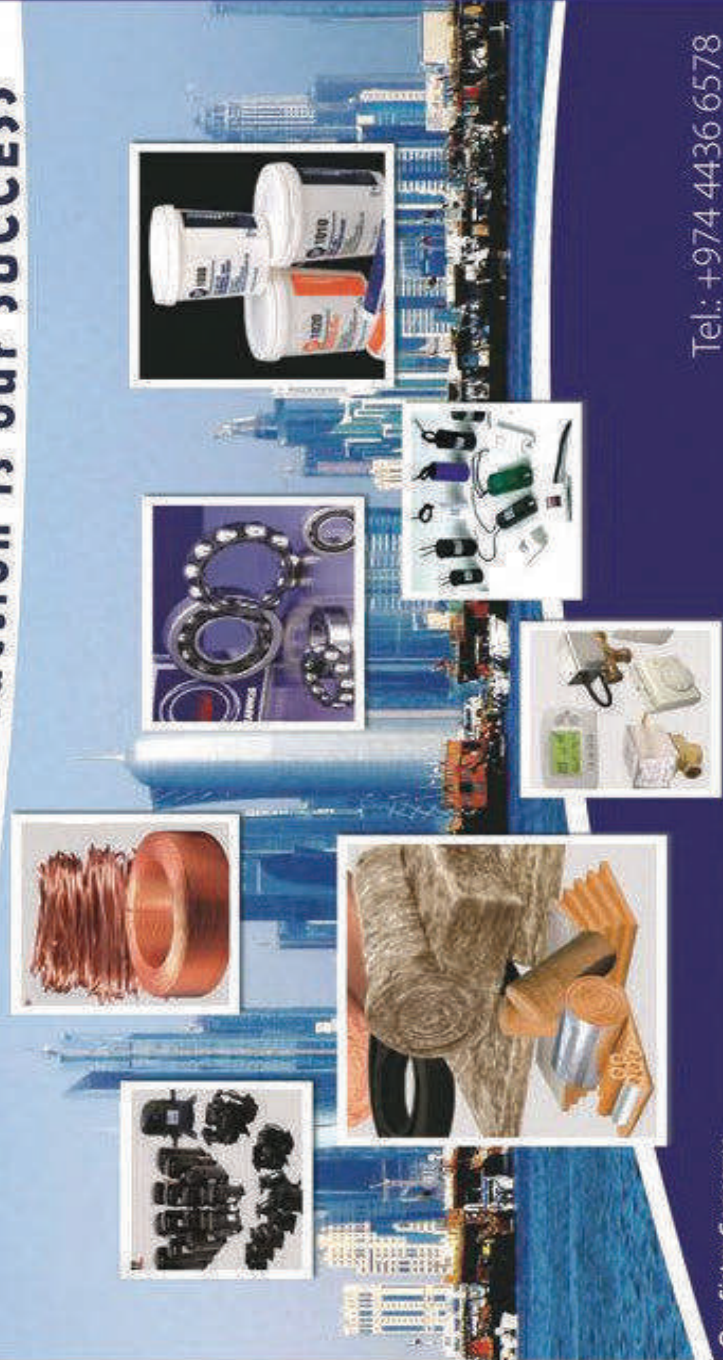
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# Influence of Digitization in the Lifecycle of Built Environment



**Er. Nagarajan Nehruji**  
Co-founder & Director  
Conserve Green Building & MEP Solutions



**Er. K M Bazeeth Ahamed**  
Co-founder & Director  
Conserve Green Building & MEP Solutions

## Understanding Digital Engineering

Digitization is the process of converting information into a digital format ie into bits and bytes. Digital information is readable by computers/controllers Application of Digital Information in Engineering is Digital Engineering.

## Digital Engineering in Construction

In construction sector digital engineering lead to convergence of emerging technologies such as Building Information Modeling (BIM), Geographic Information Systems (GIS), Augmented Reality, Artificial Intelligence and related systems to derive better business, project and asset management outcomes.

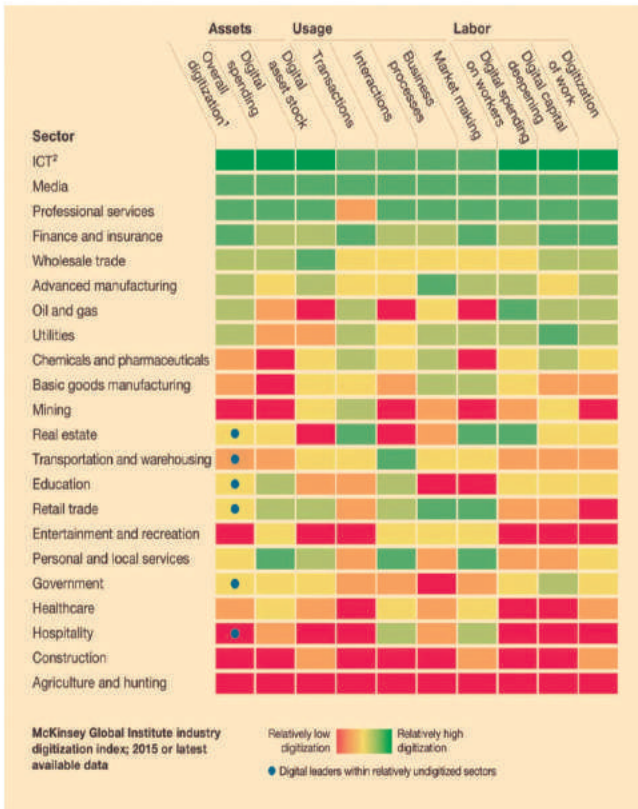
Even though construction sector adopted digital engineering, the rate and pace of adoption is relatively low

Studies shows that construction sector in placed in 21st place out of 22 sectors included in the study. Construction Industry lags by around 20 years compared other sectors such as automotive, manufacturing etc

## Opportunities to adopt Digital Engineering in Construction:

The late adoption of digitization in construction sector provides ample opportunities for young Engineers and entrepreneurs to adopt them now and in near future.

The table below presents various stages in construction and digital engineering adoption



1. Based on a set of metrics to assess digitization of assets (8 metrics), usage (11 metrics), and labor (8 metrics).  
2. Information and communications technology. Source: McKinsey & Company; Appbrain; Bluewolf; Computer Economics; eMarketer; Gartner; ICD Research; LiveChat; US Bureau of Economic Analysis; US Bureau of Labor Statistics; US Census Bureau; McKinsey Global Institute analysis

PHASES OF PROJECT	ADOPTION STATUS
SITE SURVEY	TRIPODS DIGITAL WITH SENSORS
DESIGN	2D / 3D
ESTIMATION	EASY PRO, BLUE BEAM, BUILDING CONNECTED
PLANNING	PRIMAVERA / MS PROJECT
EXECUTION / CONSTRUCTION	OPPORTUNITY AVAILABLE
INSPECTION	OPPORTUNITY AVAILABLE
CONSTRUCTION MANAGEMENT	OPPORTUNITY AVAILABLE
FACILITY MANAGEMENT / ASSET MANAGEMENT	OPPORTUNITY AVAILABLE



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- ✓ ICS/SCADA Security Implementation, Assessment and Audit
- ✓ Marine Security Implementation, Assessment and Audit
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Contacts –

Riyaz Husain Rizvi	Executive Director	55802543	<a href="mailto:riyaz@infoserve.com.qa">riyaz@infoserve.com.qa</a>
Nadeem Khan	Business Development	50389455	<a href="mailto:nadeem@infoserve.com.qa">nadeem@infoserve.com.qa</a>
Ravi Chilamban	Training Manager	55136810	<a href="mailto:ravi@infoserve.com.qa">ravi@infoserve.com.qa</a>

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BIM 360 can be extensively and effectively used in various stages of life cycle of built environment.

Apart from digitization advancements in core construction areas, opportunities are also available in project communication, collaborate. For instance, project teams can use combination of screen capture and cloud storage to communicate with team members working in different time zones

### Conclusion:

Adoption of digital technology with unique human characteristics such as creativity, ethics, emotion and intuition is the key to success in the construction industry

Design	Construction Documents	Pre-Construction	Construction	Commissioning and Handover	Operations
BIM 360 Team					
BIM 360 Glue					
BIM 360 Docs					
			BIM 360 Layout		
		BIM 360 Plan			
			BIM 360 Field		
				BIM 360 Ops	

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# Elevators are going Green



**Anand M Nadgir**  
Dept Head- Elevator Division,  
Hamad & Mohamad Al Futtaim

Each day, more than seven billion elevator journeys are taken in tall buildings all over the globe. To keep pace with an influx of urban dwellers and rising sea levels, developers will not only need to build higher, they will also need to devise greener vertical transport: that is, safe and sustainable ways to move residents from the ground up into the sky.

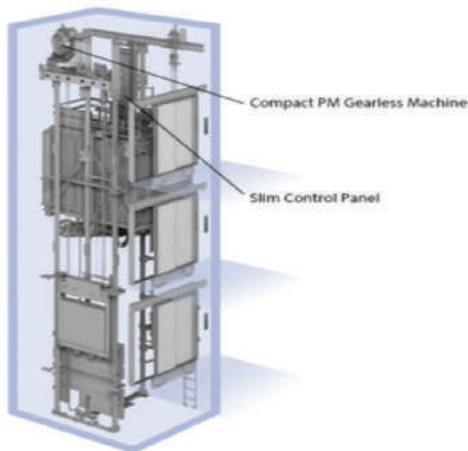
Here are 03 major latest technologies used in the elevator industry to save energy.

## 1. Machine-Room-Less Technology:-

Introduced in the mid-1990s, machine-room-less (MRL) technology was one of the biggest advances in elevator design. Miniaturization has made it feasible to house the MRL machinery right in the elevator shaft rather than in a costly rooftop machine room.

### Benefits of a Machine room less elevators:

1. Saves building space, as it does not require additional space for the machine room.
2. Uses no oil with the drive systems.
3. Save building electricity up to 70%



## 2. Regenerative Drives:-

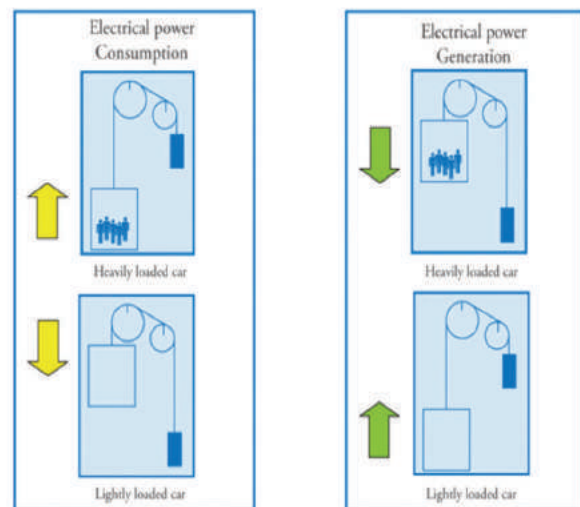
Green elevators do not just stop with reducing energy consumption — some of them give back much of what they take. Regenerative drive systems recover energy that would normally be dissipated as heat and put it back into the building's electrical system. Not only does the technology produce power for lighting and air conditioning, it also saves money by reducing the need for machine-room cooling. Regenerative drives reduce power consumption during peak periods, contributing to a building's overall

Operational bottom line. Most of the major elevator companies offer this technology.

Regenerative elevator drives addresses the three energy losses noted above by capturing lost energy and allowing the motor to essentially act as a generator during periods of low load.

Energy generated is then sent back to the power grid. In addition, while you might argue it does not offset a whole lot, the heat that normally would have dissipated within the building envelope no longer needs to be offset by the building's HVAC system.

## REGENERATIVE DRIVE - HOW DOES IT WORK?



## 3. Destination Floor Dispatch/Reservation Control System:

This control system is an intelligent group control system, which leverages elevator usage data on a daily basis, to give priority to congested floors. In addition, it also adopts the latest technology to save energy according to the passenger traffic situation in the building.

The Destination Floor Reservation System (DFRS) assigns an elevator to a passenger based on the best efficiency at that moment. It requires a passenger to register his/her desired destination floor at the lift lobby and the control system shall pre-assign in advance the passenger an elevator car. This arrangement ensures that the elevator hall is never congested.

### Benefits of Destination Control System:-

1. Reduced waiting time.
2. Less travel time
3. Fewer Stops of the lift thus saves energy
4. Easy to operate & can reduce the need lift shafts by 25%
5. Energy efficient with smarter lift controls.

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## MANAGING RISKS IN CONSTRUCTION PROJECTS

**Mr. Rishi S Iyengar,**  
Vice President & Construction & Infrastructure  
Practice Leader, Marsh Qatar

### Are you covered for financial loss from project delays?

Construction projects carry significant risk and uncertainties. There are therefore a number of questions you should ask yourself before and during the lifecycle of a development, including:

- Will the project be finished on time?
- Will the build cost escalate as construction materials and sub-contractor labour become more expensive?
- What's our contingency in the event of contractor liquidation?

In addition to the above, you may ask whether your organisation has considered its own financial loss as a result of a major delay. An incident such as a large fire and/or escape of water has the potential to lead to a one- or two-year interruption.

### Who will indemnify you for your financial loss?

Following damage such as this, the construction works cost of reinstatement should be met by the insurers of those works. However, the contractor is unlikely to have to meet a claim for liquidated damages following a major event. So who will indemnify you for your financial loss?

Take the following example: A university is constructing a 350-bed student accommodation block and it anticipates charging QAR 750 per room in weekly rent over an approximate 40-week academic year. Therefore, the total yearly income for the block would be QAR 9.89 million.

If, on the day before practical completion, there was a major fire, which resulted in a two-year re-build, the university could potentially sustain a financial loss in excess of QAR 19 million, plus any additional costs incurred for alternative accommodation for the students who have already signed tenancy agreements.

As highlighted above, delay risk can amount to a significant sum of money. With the increased demand for quality student accommodation, these schemes are getting larger and more complex, resulting in higher financial risks in the event of a delay.

Standard contractor-arranged insurance programmes do not provide insureds with protection against such scenarios. There is, however, a solution – an owner-controlled insurance programme (OCIP).

An OCIP is project insurance purchased by the employer, which provides cover for material damage to the contract works and can insure the financial loss as a result of a delay in completion arising out of the damage.

The OCIP approach provides insureds with the comfort of knowing that, in the event of a major delay in completion, the consequential financial loss (and alternative accommodation in the example above) can be insured, providing balance sheet protection for this risk exposure.

### Rising Risk: Three Considerations for Tall Tower Projects

Doha's skyline has risen over the past few years due to an increase in the number of tall towers being built across the city.

Tall towers (defined as those buildings with more than 20 floors) provide much needed additional space for residents and businesses flocking to urban areas. But such monumental projects need careful and extensive risk management.

In order to mitigate against costly delays, damage, or even litigation, developers and contractors should pay particular attention to the following during a tall tower construction project:

#### 1. Plan for the risk of higher losses

Tall towers are complex structures to build, and therefore the associated risks can have an even greater impact. While fire and/or the escape of water can cause serious damage and delay to any project, these have a multiplied impact on a tall tower. The same can be said for third-party liability risk or inherent defects.

#### 2. Be aware of urban risks

These buildings tend to be located in high-density urban areas, meaning that construction typically takes place in tight environments. The proximity to people, properties, businesses, parks, and areas of historical significance is therefore much greater, heightening third-party liability risks. In addition, tall buildings can often be located near transport lines or key infrastructure and carry a risk of disrupting nearby operations.

#### 3. Consider risks unique to tall buildings

These projects are complicated and carry additional risks to other construction projects. Tall towers can block out light, leading to right of light disputes. The increase in tall towers has put greater scrutiny on obstruction of light disputes, for example a planned London tower at 22 Bishopsgate recently became the target of right of light litigation. Consideration must also be taken to make sure that a building's location and height does not interfere with flight paths.



Bearing in mind this risk profile, careful consideration should be given to the types of insurance purchased for a tall building project. Construction all risks will generally only cover damage to the works and may not cover risks such as delay or litigation, therefore, more tailored policies will be necessary.

**Building a Tall Tower - Could Your Asset Go Up in Smoke?**

Buildings in urban areas across the globe are reaching new heights, but while these towers are providing much-needed new office, residential, or leisure space, constructing such projects comes with increased risk, particularly regarding the possibility of a fire breaking out during the building phase.

We've recently noted that the trend towards tall building construction is on the rise in many parts of the world, such as the UK and the Middle East. Tall towers, defined as those with more than 20 floors, are being constructed to greater heights and in greater numbers than before.

At Marsh's recent Infrastructure Risk Management Forum in 2017, fire risk emerged as a key concern for those involved in constructing tall towers. Fire is a concern in the construction phase of any project, but is particularly worrying in tall tower construction, for the following reasons:

- There is a large concentration of assets at risk in a single project, and a fire could result in severe damage to the works and significant delay to completion, if not a total loss of the asset.
- Sprinkler systems and other fire prevention measures may not yet be in place.

- A fire could occur at levels that are out of reach from conventional firefighting equipment.

Therefore, taking steps to prevent a fire from taking place will be of the utmost importance in these projects.

Recent skyscraper fires linked to building materials

In the construction phase, the materials used to construct the building, the storage of large amounts of materials such as furniture, and flammable materials used in the formwork can all raise the risk of a fire occurring.

For example, the region has seen several tall tower fires, thought to be linked to the materials being used in the construction of projects in the region. This has included a major fire in July 2016 and another tower in March.

When planning a project such as these, you should pay close attention to building regulation in the area where your project is being constructed, particularly as new building codes are being brought in to many parts of the world in an effort to prevent fires in tall towers, and identify and pay close attention to the stages of the project where the risk of fire is greatest. In addition, robust risk management methods and employing contractors with sound track records can ensure that these are controlled and mitigated.

Rishi Iyengar is currently leading the Construction and Infrastructure Practice for Marsh in Qatar. He has an M Sc in Insurance and Risk Management from the Sir John Cass Business School in London and an PGDM (MBA) from the Indian Institute of Management, Bangalore



Seenu Pillai Receiving ABHIYANTRASHREE AWARD 2018 On 51st Engineers Day Celebration in Doha by Karnataka Sangha Qatar on 15 September 2018 For his Contribution to the Engineering Field





## **Procurement Process in state-owned Real Estate Developers in the Middle-East**

**Engineer Sunil Kulkarni,**  
B.E. Civil Engineering, FIE, C.Eng(I)

Real Estate developers usually procure Consultants and Contractors required to deliver their project. They also manage them, thus retaining control over the development. Typically, these comprise, inter alia, the Project Management Consultant, the Design Consultant, the Supervision Consultant and the Contractor. In large projects, there could be numerous consultants and Contractors for various stages and/or phases.

With the advent of technology, most of the processes are computerized with the implementation of support software such as ERP. However certain offline processes continue to be used due to several reasons such as – requirement of signatures, stamps & seals as per practice, documents addressed to / from approving committees, correspondence with external parties, etc. The description in the following paragraphs includes both online and offline features of the process.

### **PURCHASE REQUISITION**

The Project team issues a Purchase Requisition (“PR”) describing the service it requires to be procured. Each PR has a unique number which is represented as the Tender number and eventually the Contract number. The PR provides a brief description of the service and a ROM i.e. a rough order of magnitude- which is a preliminary estimate leading to the creation of a budget and the duration of the service. The PR may also suggest the nature of procurement as requested by the Project team – be it single/sole source, a limited/ classified Tender, public Tender, etc. The PR has a defined workflow based on the Company’s Delegation of Authority (DoA). The workflow allows reviewers to give their consent unless they have some clarifications or reservations which are re-directed to the appropriate individuals for their input. At the end of the process, the workflow records the consent of all concerned individuals. The PR may be rejected any time prior to award, if the service is not required any more or requires re-issuance due to scope and/or budgetary changes.

### **LIST OF TENDERERS**

At the outset, a long list of prospective Tenderers is prepared by the Procurement department. The names in this list could originate from the procurement data base, suggested names from the project team or other departments, etc. Expression of Interest letters along with Non-Disclosure Agreements are then sent to prospective Tenderers if the strategy is other than a public Tender. The Tenderers are provided a brief of the scope of the services, the duration, the Contract type, Contract currency, etc. The Tenderers who confirm their intention to participate are then included in the short list which is then incorporated in the Tender Plan.

### **TENDER PLAN**

The strategy to procure the services is requested by the project team and accordingly the procurement department prepares a Tender

Plan which includes a brief of the scope of the service required, the proposed Contract type, the Tender schedule, the strategy (see nature of procurement above) and justification for it, the budget, the duration, etc. It recommends whether the purchase is intended to be a Direct Purchase from a Single or Sole Source, a Limited Tender (with selected Tenderers) or a Public Tender (invited through the media). The Tender plan is an offline process unlike the PR, and once reviewed by the concerned individuals, it is submitted to the final approver in accordance with the DoA. The final approver is defined in the DoA and depends on the financial range in which the PR amount/ budget lies. For budgets within a lower range it may be a responsible individual within the Company, like a Director or the Chief Executive Officer. For amounts above this range, it’s usually a Committee comprising individuals nominated by the Company’s Board. For very large amounts, the approval of the Chairman or the Board may be required in addition to the Committee. The approval of the Tender Plan is mandatory in order to proceed with the subsequent stages of the procurement process.

### **TENDER DOCUMENTS AND ISSUANCE**

The Tender documents are collated by the Procurement department. These comprise-

- a) Instructions to Tenderers as drafted by the Procurement team comprising appendices requiring the Tenderer to submit further information (profile, current and past projects, financial data, bankers, etc.) and declarations (such as site visit confirmation, compliance with Tender conditions, etc.).
- b) The General and Particular conditions of Contract as drafted by the Contracts’ team (in liaison with the Legal department)
- c) The Scope along with Specifications as provided by the Project team (in liaison with the Design Engineer or the Design consultant if any)
- d) The Drawings as provided by the Project team.
- e) The Schedule of payments (or Bill of Quantities) as provided by the Project team (in liaison with the Cost Consultant or the Quantity Surveyor)
- f) Any other document or information (such as reports etc.).

They are circulated internally to all concerned for their review and consent. Once this is done, the Tender is issued to the Tenderers electronically or by inviting them to collect the same at certain times from the Procurement department’s document control section on the condition that the person collecting should submit an original letter of authority from his/her organization. If there is a Tender fee, then the Tenderer is required to deposit the same in the Company’s account and produce proof of transfer at the time of collecting.

### **TENDER CLARIFICATIONS**

During the Tender process, Tenderers may request clarifications or additional information. They may also seek additional time to submit their bids. The Procurement department may hold mid-tender

meetings with the Tenderers in order to clarify their queries or reply in writing (without holding such a meeting) or use a combination of both actions. In all cases, questions and answers are documented via Tender Bulletins and issued to all Tenderers alike. Tender Bulletins are considered an integral part of the Tender documents. They do not require Company internal approvals unless there's a change in Scope which then may affect the estimated cost of the Service. They are usually addressed serially in question and answer format without naming the Tenderer who issued the queries.

### **TENDER SUBMISSIONS**

Tenders have specific closing dates and times and must be submitted at a certain location in the Company's premises. They may be submitted by courier as well. Usually each Tender is required to be submitted in two envelopes marked Technical and Commercial respectively. Tenders submitted after the closing date may be disqualified.

### **TENDER EVALUATION**

Two teams are formed – one, the Technical Evaluation team (TET) and the other, the Commercial Evaluation team (CET). The former is usually headed by a member of the Project team while the latter, is headed by a member of the Procurement team. Both teams are distinct. Members of the TET comprise PM, Procurement, Project Controls and others as required (and invited accordingly). Members of the CET comprise Procurement, Project Controls, Finance and others as required (and invited accordingly).

The document control section prepares a form listing Tenderers who submitted the Tenders with the date and time stamped on the envelopes. The sealed Tenders are then forwarded to the Committee who first opens the Technical submissions (only) while retaining the Tender bond (if any). The Committee forwards the Technical submissions of qualified Tenderers to the TET.

### **TENDER TECHNICAL EVALUATION AND CLARIFICATIONS**

The TET checks whether the submissions are compliant with the Tender requirements. Alternative Tenders are also reviewed for acceptability. Clarifications with the Tenderers are issued in writing and serially numbered entitled "Post-Tender Technical Clarification" (PTTC). PTTCs' contain a warning that the Tenderer must confirm in its reply that they do not cause a change to the submitted commercial offer (with the Committee). A cost impact due to the PTTCs' or non-compliance with the Tender requirements (except for any alternate Tender) may disqualify a Tenderer from further consideration. Upon completion of the Technical evaluation, the TET submits a report to the Committee entitled "Technical Evaluation Report" which confirms the findings and recommends opening the Commercial offers of those Tenderers who are found to be Technically acceptable. Scoring (marks) of Tenderers is avoided; the evaluation is simply based on technical acceptability. The Committee then reviews the report, seeks clarifications from the TET (if any) and proceeds with opening of the Commercial offers of only those Tenderers who are technically acceptable.

### **TENDER COMMERCIAL EVALUATION AND CLARIFICATIONS**

The Committee forwards the Commercial proposals to the CET for evaluation. The CET follows a similar process as by the TET, in seeking clarifications from the Tenderers entitled "Post Tender

Commercial Clarifications" (PTCC). The CET's objective is to compare fully compliant offers, however this may not be the case always. The CET may even issue PTCCs to Tenderers to withdraw their qualifications without affecting the submitted price. Non-compliance may result in disqualification of the Tenderer. At the end, despite these efforts, minimal qualifications may remain. With the approval of the Committee, the CET then issues the same qualifications to all Tenderers in order to obtain comparable prices. The revised bids are submitted to the Committee in sealed envelopes, opened and again forwarded after recording, to the CET. Negotiations may be conducted by or in the presence of the Committee with each Tenderer in order to reduce the prices. Finally the CET issues a report entitled "Commercial Evaluation and Award Recommendation" to the Committee detailing its findings and recommending the award of the Tender to the Technically acceptable and Commercially lowest tender.

### **LETTER OF ACCEPTANCE**

The approval of the Tender award leads to preparation of the Letter of Acceptance (LoA) by the Procurement team and conversion of the PR into a Purchase Order (PO) in the system. The initial budget in the PR is now converted to a firm commitment in the PO. If the award is for an amount additional to the budget, then the Project team secures the same from Finance department and increases the budget i.e. increases the PR amount. The PO is reviewed in accordance with the workflow mandated by the DoA. The LoA is reviewed by concerned departments including the Legal department. The LoA gives brief details of the list of the documents comprising the Contract, the awarded amount and currency, the time for completion, the representative from the Company for the Contract and other important details. It also requests the Tenderer to submit the name of his representative, submit the bonds and insurances within a certain time and any other pre-condition or requirement in accordance with the Tender documents. It is issued in two originals requesting the successful Tenderer to acknowledge and accept. Each Party retains one original. If the Tenderer refuses to confirm his acceptance of the LoA or declines, the Company may elect to confiscate the Tender Bond (if any) and proceed with the next acceptable Tenderer.

### **TENDER BOND RELEASE**

The Tender bond is returned to the successful Tenderer after he meets all the pre-conditions including LoA acceptance, submission of the Performance Bond or Guarantee (if any), etc.

### **REGRET**

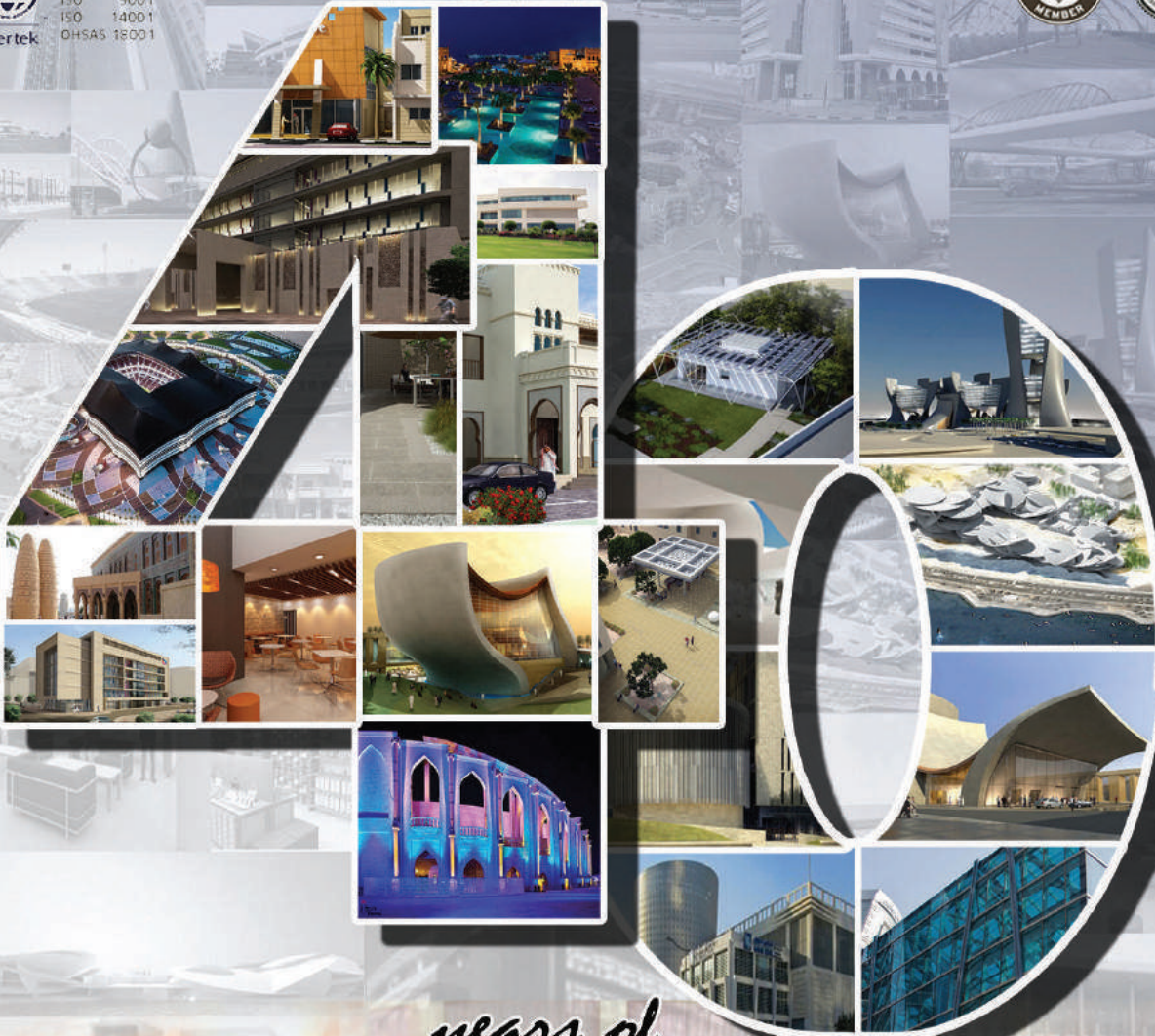
Regret letters are issued to the unsuccessful Tenderers subsequent to the acceptance of the LoA and submission of the pre-requisites as detailed above.

### **CONTRACT DOCUMENTS**

Subsequently the Contract documents are prepared incorporating all the PTTCs and the PTCCs within the original tender documents including all effects of the negotiations. The Contract documents are internally reviewed by all concerned individuals in various departments and an advance copy is provided to the Tenderer for his review and confirmation. The final version then becomes the Contract which is then issued in two originals for signatures by both Parties, each retaining one set for its own use.



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# BASIC CORROSION AND CATHODIC PROTECTION CONCEPTS

Santhosh G Prabhu  
(CP Engineer) - Nace CP Technologist

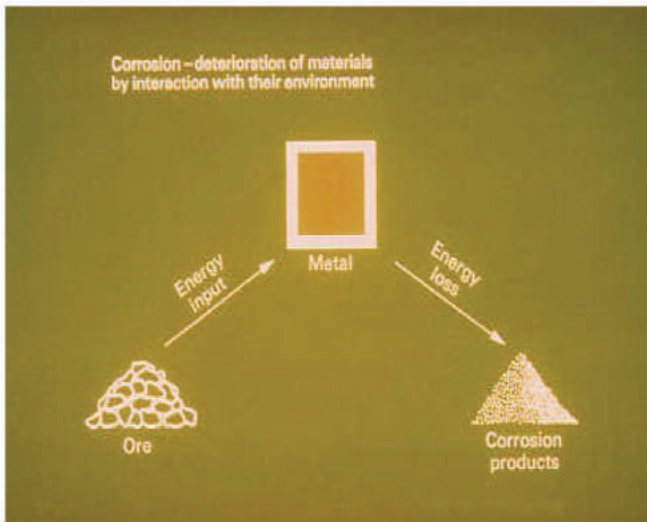
## CORROSION: THEORY AND SCOPE:

Destruction or deterioration of materials due to their reaction with environment. Materials may be metals & alloys or non-metals like ceramics, plastics, rubber. Environments may be gaseous, liquid, or solid.

### We cover only Corrosion for Metals in these slides

**For metals**, corrosion may be thought of as 'Extractive metallurgy in reverse'. It is an oxidation process. It causes loss of metal. Hence, disintegration of a metal by its surrounding chemicals through a chemical reaction on the surface of the metal is called corrosion.

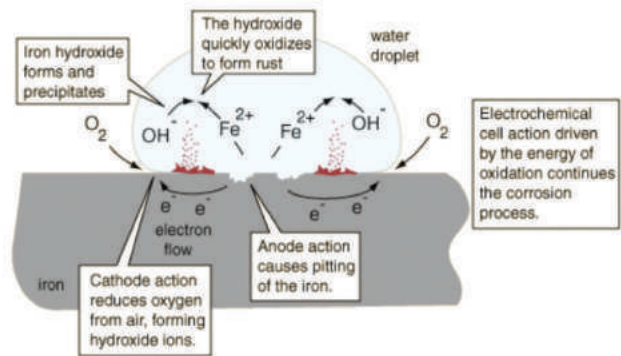
Corrosion is nature's way of returning certain processed metals such as iron, steel, and copper to their native states as chemical compounds or minerals. For example, iron in its natural state becomes an oxidized compound (i.e., Fe<sub>2</sub>O<sub>3</sub>, FeO, Fe<sub>3</sub>O<sub>4</sub>), but when processed into iron and steel pipe, it loses oxygen and becomes elemental iron (FeO). In the presence of water and oxygen, nature relentlessly attacks this steel, reverting the elemental iron (FeO) back to its natural oxidized state.



## CORROSION CELL:

Corrosion is an electrochemical process involving the flow of electrons and ions. Metal loss (corrosion) occurs at the anode. No metal loss occurs at the cathode (the cathode is protected). Electrochemical corrosion involves the transfer of electrons across metal/electrolyte interfaces. Corrosion occurs within a corrosion cell that consists of four parts:

- Anode • Cathode • Electrolyte • Electronic/Metallic Path



## FACTORS INFLUENCING CORROSION

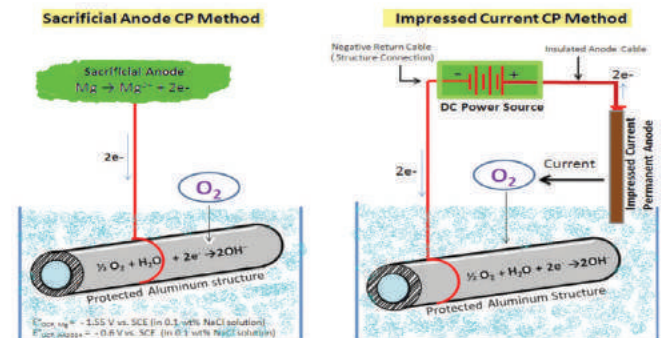
The nature and extent of corrosion depend on the metal and the environment. The important factors which may influence the corrosion process are:

- Nature of the metal
- Environment
- Concentration of electrolyte
- Temperature
- Electrode potential and
- Hydrogen over voltage

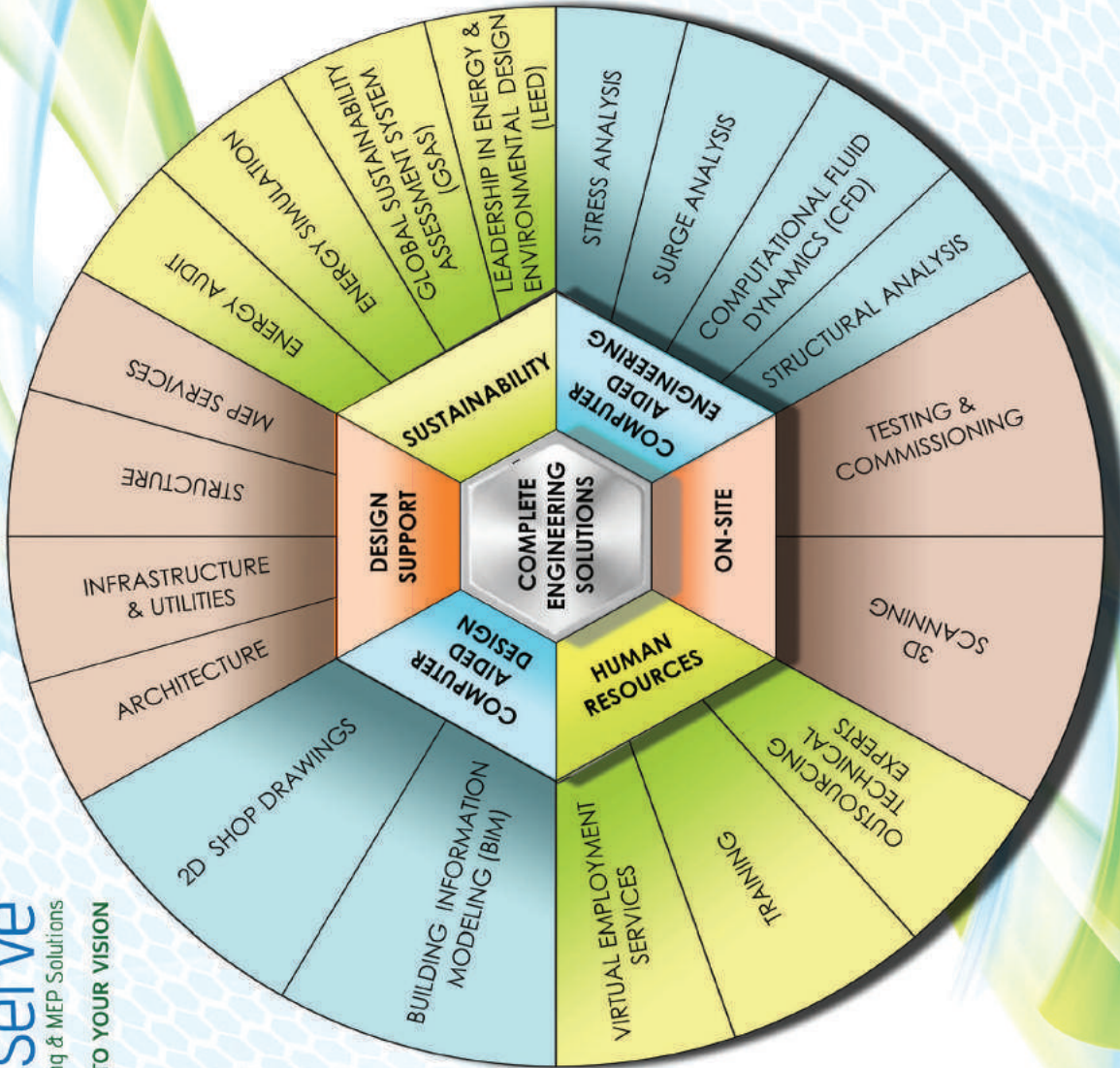
## CATHODIC PROTECTION (CP) – CORROSION CONTROL

Cathodic Protection is a method of corrosion control that can be applied to buried and submerged metallic structures. The material to be protected is supplied with an external cathodic current. The electrochemical potential of the protected material is moved in a negative direction to the immune area. The material is completely protected when it reaches the Protection Potential. The simplest method to apply CP is by connecting the metal to be protected with another more easily corroded "Sacrificial Metal" to act as the anode of the electrochemical cell.

## TYPES OF CP:



Cathodic Protection (CP) Methods



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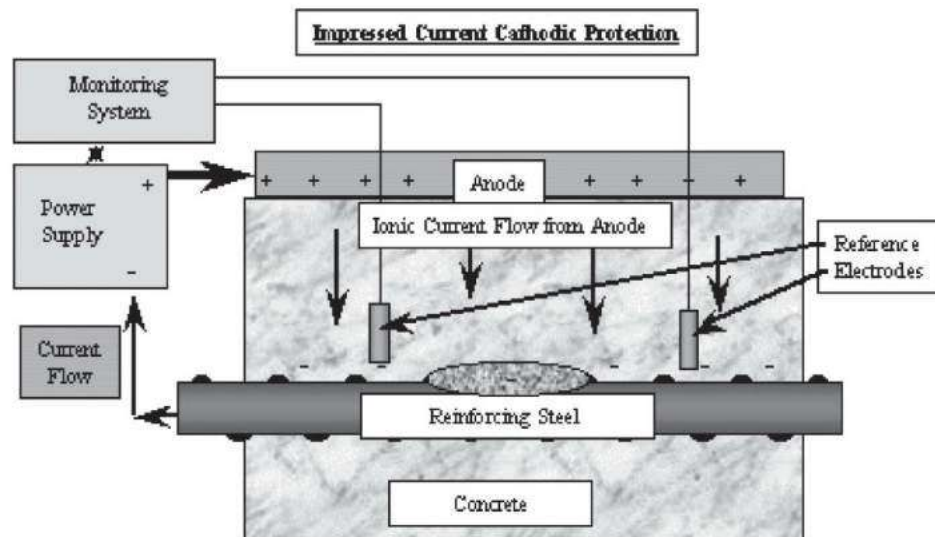
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Al Emadi Financial Square  
Building #1, 2nd Floor, Office #5  
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P.L. Lokhande Marg, Chembur (West)  
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In the usual application, a galvanic anode, a piece of a more electrochemically active metal, attached to the vulnerable metal surface where it is exposed to the corrosive liquid. Galvanic anodes have more active voltage that the target material usually steel.

For larger structures, galvanic anodes can't economically deliver enough current to provide complete protection. Impressed current anodes are manufactured from materials that are consumed at low rates. Impressed current CP systems generally operate at higher current and driving voltage levels than galvanic anode CP systems. The negative terminal of DC is connected to pipeline to be protected. The anode is kept in back fill to increase the electrical contact with the surrounding soil.



Unlike galvanic anode systems where the natural potential difference between the anode and cathode provides the driving force for current, an impressed current CP system must be supplied with power from an external source

### CONCEPT OF POLARISATION

As current is impressed on a metal over time, polarization occurs at both the anode and cathode. Polarization lowers the potential difference between the anode and cathode areas and, by Ohm's Law, the current,  $I$ , drops and the corrosion rate decreases until an equilibrium is reached between polarization and depolarizing effects. Depolarizers include:

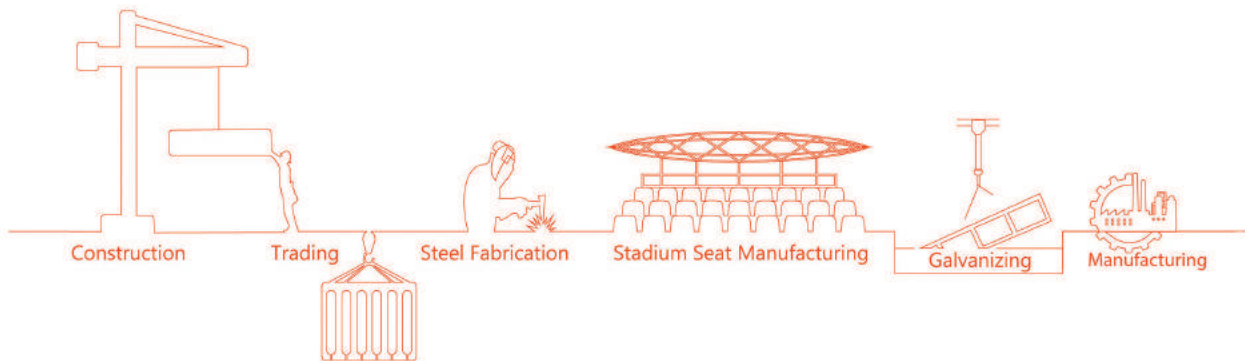
- **dissolved oxygen**
- **microbiological activity**
- **water flow**

Polarization always occurs in the direction to oppose the current flow causing it. When the anode and cathode of a corrosion cell are connected, the resulting current will cause the potential of the anode to approach the potential of the cathode and the potential of the cathode will approach the potential of the anode. As the resistance of the electronic and/or electrolytic paths reduces, the voltage difference between the polarized electrodes also reduces, and both electrodes come to a steady state polarized potential.



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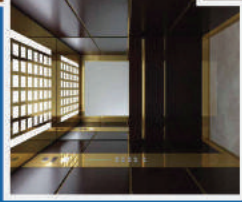
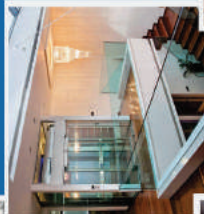
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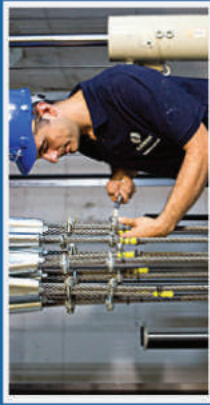


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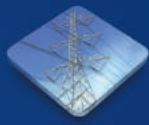
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### Steel Dpt.

Mob. +974 6631 0857  
 Email sales@walco-me.com

### Mechanical Dpt.

Mob. +974 3048 5364  
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