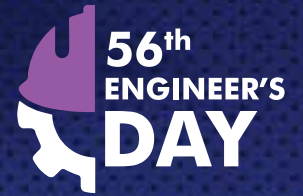
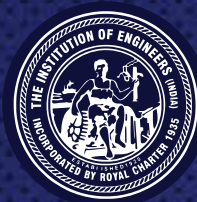


SOUVENIR
2023



Engineering a Resilient Future: Building Stronger, Smarter, Safer



The Institution of Engineers (India)

(Established 1920, Incorporated by Royal Charter-1935)

Qatar Chapter

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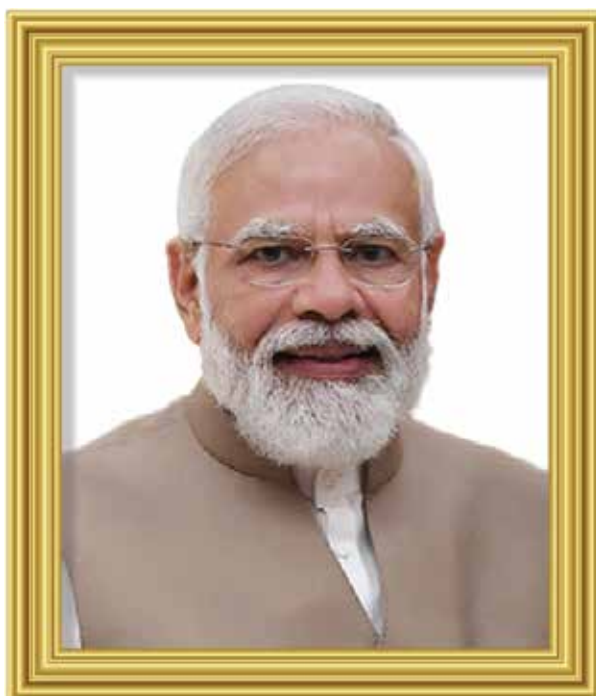
H.H. Sheikh Tamim bin Hamad Al Thani
Emir of Qatar



H.H. Sheikh Hamad bin Khalifa Al Thani
The Father Emir



H.E. Droupadi Murmu
President of India



H.E. Narendra Modi
Prime Minister of India





ABB in Qatar

Building our commitment to a growing economy



ABB has been involved in Qatar since the 1960s and has had a representative office since 1995. ABB has a long-term commitment to Qatar and is proud to contribute to the country's present and future development. Over the years, ABB has been involved in a host of major industrial and infrastructure projects in Qatar, including engineering, procurement, installation, construction, commissioning, and service for all industries.

ABB locations & employees

Located in West Bay, Doha, with around 113 employees.

ABB in Qatar

1960 Asea and BBC (ABB) have been represented in Qatar
1995 First Sales Office was inaugurated.

Did you know?

- Largest installed base of LV & MV drives in District Cooling Plants
- GT (Gas Turbine) replacement with the electrical drive solution, which is the first case in Qatar (2023).
- Supply of more than 50,000 cubicles of low voltage switchgear for various hydrocarbon plants in Ras Laffan (QatarEnergy LNG, Dolphin Energy)
- Rectifiers and Control system for Qatalum
- Power management systems for QatarEnergy
- Electrical & Control System for Al-Shaheen field development of North Oil Company
- Complete Electrical & Automation for Nakilat Ship Repair Yard
- Several modernization and upgrade jobs for all Q companies

Hand in hand with the community

- Member of German and Swiss Business Council Qatar
- Swiss student's delegation visited our office and our HR Business Partner had a presentation regarding overview of Qatar as well as ABB

with some insights on how to do business in the Middle East & more specifically in Qatar

- Supporting Qatar's young talents by creating opportunities for Student Internships and Employment

ABB Motion keeps the world turning, while saving energy every day. Our pioneering drives, motors, generators products and integrated digital powertrain solutions are driving the low-carbon future for industries, cities, infrastructure, and transportation. Through our global presence we are always close to our customers. We help them optimize energy efficiency, improve safety and reliability, and achieve precise control.

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ABB is a global technology leader serving industries, infrastructure and machine builders with world-class drives, drive systems and packages. We help our customers, partners, and equipment manufacturers to improve energy efficiency, asset reliability, productivity, safety and performance. "

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We offer a wide range of reliable and high efficiency motors and generators to help every industry and application reach new levels of efficiency and energy savings. Combining the best available materials with superior technology, a global footprint and application expertise, our electric motor and generator have a well-earned reputation of improving reliability and productivity in the most demanding applications.

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employees

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Operations-Driven Safety & Reliability

In the ever-evolving operational landscape, the safety and reliability of assets stand at the forefront of organizational success. The Operations-Driven Safety and Reliability (ODSR) program presents a multifaceted approach, emphasizing the integration of daily operational insights to enhance asset safety and reliability.



Infrared Windows

Infrared Inspection Windows are an Electrical Maintenance Safety Device that allows a safer method of monitoring and inspecting critical electrical assets. These Electrical Maintenance Safety Devices should be adopted as part of a comprehensive Condition-Based Maintenance System



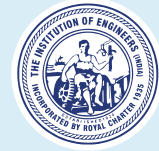
Safe-Connect Solutions

Thermochromic components in these products cause a color change based on temperature ranges, providing 24/7 safety monitoring to give a predictive warning on overheated equipment. The permanent quality of the change can highlight issues in straight and non-continuous load applications, protecting against electrical fire or equipment failure.



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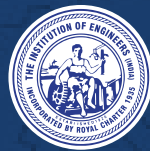
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**BHARAT RATNA
SIR M. VISVESVARAYA**

Science is about knowing,
Engineering is about doing.

HAPPY
ENGINEER'S DAY



The Institution of Engineers (India)

(Established 1920, Incorporated by Royal Charter-1935)

Qatar Chapter (Under the aegis of Embassy of India)



H.E. VIPUL
Ambassador of India

Ambassador



भारतीय राजदूतावास
السفارة الهندية
EMBASSY OF INDIA

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MESSAGE

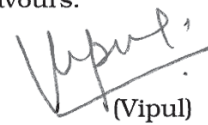
I extend heartiest congratulations to Institution of Engineers (India) Qatar Chapter on the 56th Engineers' Day. I am delighted to acknowledge that ever since its establishment in 1991, IEI Qatar has continued to commemorate this day in honour of the eminent Indian engineer, Bharat Ratna Sir Mokshagundam Visvesvaraya.

I also recognize the commendable efforts of IEI Qatar in hosting numerous technical activities and events over the years. These have significantly contributed to the intellectual and professional growth of the engineering community in Qatar.

As we contemplate the last 76 years of India's independence, a sense of accomplishment fills us when we consider the remarkable progress made by the country in the field of engineering. The prowess of Indian engineers in different fields such as IT, space, manufacturing, defence and automobiles is today universally recognized. Our engineers have also contributed substantially to development of the State of Qatar.

This year's Engineers' Day Celebration is particularly significant as it aligns with the theme, "Engineering a Resilient Future: Building Stronger, Smarter, Safer." This theme underscores the crucial role that engineers play in shaping a more resilient and sustainable future with innovative solutions based on ever evolving technologies.

On this special occasion, I once again extend my warmest congratulations to the Indian Engineers in Qatar and wish them continued success and excellence in their future endeavours.


(Vipul)

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Operating in over 100 countries, Schneider Electric's presence spans markets including the Gulf, North America, Europe, and Asia-Pacific. Schneider Electric caters to a diverse range of sectors, from energy and infrastructure to industrial processes, building automation, and data centers.

The energy landscape both globally and regionally is undergoing significant transformation, propelled by emerging technologies. In the upcoming decade, greater decentralization, decarbonization, and digitization are expected to disrupt the industry. The Gulf region, with its strategic outlook, is poised to play a central role in this energy revolution.

Globally and in the regionally, Schneider Electric is leading the digital transformation of energy management and automation. From energy and sustainability consulting to optimizing the lifecycle of assets, our company provide solutions and services to meet the unique needs of our customers. Moreover, our smart technologies support businesses across the Gulf region to become more energy-efficient, save on energy costs, and meet their sustainability goals.

Life Is On

Schneider
Electric

55th Engineers Day Celebration

At Giwana Hall, Radisson Blu Hotel



55th Engineers Day Celebration





Jaffer Us Sadik
President IBPC



Date: 22 October, 2023

Ref: IBPC/542/IEI/EDC/1023

I am pleased to learn that The Institution of Engineers (India) Qatar Chapter is celebrating the 56th Engineers Day Celebration being held on 10th November 2023, which is observed every year on the birth anniversary of Sir Mokshagundam Visvesvraya, a Bharat Ratna recipient and legendary engineer who dedicated his life to India's development.

I understand that the theme of the occasion is "Engineering a Resilient Future: Building Stronger, Smarter, Safer". I am confident that the topic will provide an opportunity to members of the Institution of Engineers (India), and to those engineers who are residing anywhere in the world, to exchange ideas and deliberate on the subject while observing the 163rd birth anniversary of Bharat Ratna Sir M. Visvesvaraya.

I wish the event a grand success.

Sincerely

Jaffer Us Sadik
President

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Company Background

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TUBO is growing in parallel with the market growth specially in the infrastructure business. TUBO has expanded its range of services to include infrastructure works as a secondary core business and become a specialized Enabling works and Earthworks Contractor in addition to its HDD specialty. TUBO has increased its fleet with the necessary PMV and has recruited a very specialized and experienced infrastructure team to increase its market competitiveness and taking its route to become one of the market leaders in earthworks and enabling field. TUBO's current services include, but not limited to, HDD contracting works including welding of HDPE pipes, Enabling and earthworks works, management and any other HDD related works.

Tubo has become partially acquired, fully managed and operated by [SERVCON](#) as a part of its one big structure that manages and operates multiple companies in diverse business fields.

OUR MISSION

Tubo's mission is "to excel in the delivery of HDD services through quality workmanship and design that exceeds client requirements, delivering projects on time and within budget by a team sharing the same vision." By adhering to this mission, Tubo has been noted for its achievements in HDD works earning recognition and accolades.

OUR VISION

We are committed to becoming the contractor of choice, pursuing excellence through dedication, experience and disciplined employees with an ongoing passion to deliver quality, timely and profitable projects.



Er. Shivanand Roy, FIE
President

The Institution of Engineers (India)

AN ISO 9001 : 2015 CERTIFIED ORGANISATION
(ESTABLISHED 1920, INCORPORATED BY ROYAL CHARTER 1935)

Er. Shivanand Roy, FIE
President



Headquarters : 8 Gokhale Road, Kolkata 700020
Contact : 91- 33-40106202 / 40106204
E-mail : president@ieindia.org

A Century of Service to the Nation

MESSAGE

It is my immense pleasure to note that the Qatar Chapter of The Institution of Engineers (India) is observing the 56th Engineer's Day on 10 November 2023, and a Souvenir is also being published on this auspicious occasion.

Under the theme "Engineering a Resilient Future: Building Stronger, Smarter, Safer," this celebration encapsulates the essence of engineering. In a world marked by change, engineers lead the way, constructing a future that is resilient in the face of challenges. Their dedication and commitment are inherent in their creation, capable of enduring the test of time and nature's elements.

Yet, engineering goes beyond strength; it embodies innovation and intellect. Engineers harness the power of cutting-edge technologies to create intelligent systems, from smart cities optimizing resources to revolutionary transportation solutions enhancing mobility. This drive propels us toward a future where intelligence reigns supreme.

Resilience extends beyond the physical—it encompasses safety and well-being. Engineers act as guardians, meticulously designing structures and systems that safeguard lives. Their unwavering commitment to safety creates an environment in which we can flourish with peace of mind.

In our pursuit of a resilient future, sustainability takes center stage. Engineers champion eco-friendly materials, renewable energy solutions, and sustainable practices, harmonizing progress with preservation. Through their innovations, they ensure a thriving planet for future generations.

I extend my sincere gratitude to the organizers for their efforts in making this event possible. Let us celebrate the remarkable strides we've taken and look ahead with a renewed commitment to building a brighter, more resilient tomorrow.

Er Shivanand Roy

Residence : 4A, Kalakriti Apartment, Lane No.4, Anandgram, Morabadi, Ranchi 834 008
Mobile: 7739852737, **E-mail**: shivanandroy@gmail.com

Past Chairman Er. Debashish Roy Visit To IEI During FIFA World cup





Maj Gen MJS Syali, VSM (Retd.). FIE
Secretary & Director General



The Institution of Engineers (India)

AN ISO 9001:2015 CERTIFIED ORGANISATION
(ESTABLISHED 1920, INCORPORATED BY ROYAL CHARTER 1935)
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<http://www.ieindia.org>

Maj Gen MJS Syali, VSM (Retd.), FIE
Secretary & Director General

Ph. Direct: (91) (33) 2223 8230
E-mail : sdg@ieindia.org

A Century of Service to the Nation

MESSAGE

I am delighted to learn that the Qatar Chapter of The Institution of Engineers (India) is set to publish a Souvenir commemorating the 56th Engineers' Day on 10th November, 2023 on the occasion of the birth anniversary of Bharat Ratna Sir Mokshagundam Visvesvaraya.

The chosen theme, "*Engineering a Resilient Future: Building Stronger, Smarter, Safer,*" captures the essence of innovation and progress. It underscores the pivotal role that engineers assume in formulating solutions that can withstand challenges and adversity. This theme encapsulates the heart of engineering, an artistry of innovation that bridges the gap between aspiration and realization.

In the wake of the global pandemic, the forces of science, engineering, and innovation rally to spearhead recovery. Engineers, at the forefront of this march, blend their ingenuity to shape a future of promise and confront critical issues. Their influence spans across infrastructure, the environment, and societal well-being. This commitment magnifies safety, security, and the quality of life through innovative solutions, nurturing an environment conducive to growth and prosperity.

I extend my heartfelt congratulations to the dedicated members of the Qatar Chapter of the IEI for their unwavering commitment in crafting this Technical Souvenir. Initiatives like this foster a culture of learning and knowledge-sharing, which is fundamental to the advancement of the engineering community. I am confident that the insights conveyed within the pages of this publication will enrich the minds of IEI members, inspiring them to persist in their pursuit of excellence.

Maj Gen (Dr) MJS Syali, VSM (Retd)
Secretary & Director General

Qatar Financial Center-IEI Visit & Meeting





Ahmad Jassim Jolo
Federation of Global Engineers, President



Date: 22nd October 2023

Ref: FGE/IEIQC/2023/L0011

It is immense pleasure to learn that the Qatar Chapter of The Institution of Engineers (India) is celebrating the 56th Engineers' Day on 10th November 2023 and that a Souvenir is being brought out to commemorate the occasion.

I understand that the theme of the occasion is "Engineering a Resilient Future: Building Stronger, Smarter, Safer". I am confident that the topic will provide an opportunity to members of the Institution of Engineers (India), and to those engineers who are residing anywhere in the world, to exchange ideas and deliberate on the subject while observing the 163rd birth anniversary of Bharat Ratna Sir M. Visvesvaraya.

I wish the celebration a great success and convey my good wishes to all members of the Institution of Engineers (India) as well.

Sincerely

Ahmad Jassim Jolo

President

Federation of Global Engineers
Barwa Tower, C Ring Road, Doha-Qatar
Email: president@fge.qa , www.fge.qa

IEI Members FIFA WC 2022 Volunteers





Er. Salihudeen K.M. FIE

B.Tech, MBA, FIE, C.Eng

Hon. Chairman

The Institution of Engineers (India), Qatar Chapter

On the 15th of September 2023, India is set to ignite the celebratory sparks for the 56th Engineer's Day, an annual spectacle that gleams with historical significance and innovative fervour. This auspicious day pays homage to the trailblazing Sir Mokshagundam Visvesvaraya, affectionately known as Sir MV, whose birth on this very date in 1860 continues to illuminate the path of engineers worldwide. Though Sir MV departed this world on April 14, 1962, his enduring legacy weaves a captivating tale that demands our attention.

As I pen these words, my heart swells with pride and a deep sense of privilege. I write to you from the heart of the Qatar Chapter in Doha, where the last decade has witnessed the meteoric rise of Qatar as a global powerhouse, eagerly embracing the 2022 FIFA World Cup with open arms. In the midst of this remarkable progress, the Qatar Chapter of IEI is gearing up to host the 56th Engineer's Day celebration on the 10th of November 2023. Our grand festivities will unfold at the splendid Sheraton Grand Doha Resort & Convention Hotel, Doha, Qatar. Here, under the desert stars, we shall unveil a technical souvenir, a testament to our reverence for the 56th Engineer's Day and a tribute to the visionary Bharat Ratna, Sir M. Visvesvaraya.

Sir M. Visvesvaraya, the luminary Indian civil engineer and statesman, graced the annals of history as the 19th Diwan of Mysore from 1912 to 1919. In 1955, he was adorned with the Bharat Ratna, India's highest civilian honour. It's worth noting that even during the pre-Independence era, under the shadow of British rule, Sir MV was knighted as a Knight Commander of the British Indian Empire (KCIE) by King George V for his remarkable contributions to the welfare of the public. His

legacy transcends borders, with Sri Lanka and Tanzania joining India in commemorating his birthday as Engineers' Day, a testament to his far-reaching impact.

I applaud the unwavering dedication and dynamism of our Fellow Members, both past and present, who have etched their names in the annals of Qatar's engineering fraternity. Our path forward is illuminated by the glow of ever-advancing technology and the pervasive influence of smart engineering across all facets of life.

This year, the Engineers' Day theme, "Engineering a Resilient Future: Building Stronger, Smarter, Safer," has been handpicked by the IEI Headquarters in India. With unwavering optimism, I anticipate that discussions inspired by this theme will birth exhilarating ideas, pioneering developments, and untapped opportunities for our budding engineers in the years to come. Engineers' Day is an ode to the entire engineering community, and every engineer in India should wear their professional pride as a badge of honour.

In this moment, I extend my heartfelt gratitude to our well-wishers and sponsors, whose unwavering support has transformed the Qatar Chapter into a paragon of professionalism in the heart of Qatar. To all my fellow engineers, I offer my warmest congratulations on this momentous occasion of the 56th Engineers' Day and wish you boundless success in all your endeavours. Together, we are charting a unique course toward a resilient future—one that is stronger, smarter, and safer for all.

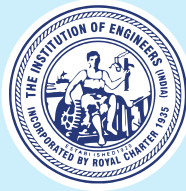


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The Institution of Engineers (India)

(Established 1920, Incorporated by Royal Charter-1935)

Qatar Chapter

(Under the aegis of Embassy of India) (Licensed with Qatar Financial Center (QFC))



Er. Maheshwaran Thanikaivelu

B.E.Civil, FIE, C.Eng. (India), PG. Dip. Materials Mgmt. PMP. CPM - IPMA
Honorary Secretary - Institution of Engineers India- Qatar Chapter

ACTIVITIES OF IEI QATAR CHAPTER

As Honorary Secretary of the Qatar Chapter, I consider it a privilege to provide a brief introduction of The Institution of Engineers (India) and its Qatar Chapter and an overview of the activities on this historic 56th Engineer's Day on 10th November, 2023.

The Institution of Engineers (India) was registered under the Indian Companies Act, 1913 in the year 1920 and was formally inaugurated in 1921 by Lord Chelmsford, the then Viceroy and Governor General of India. The Institution of Engineers (India) was granted the Royal Charter of Incorporation 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 and the track record of the Institution has been a matter of pride for all engineers. IEI 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 practicing engineering profession in Qatar. The Qatar Chapter under the aegis of the Indian Embassy in Qatar, is registered with Indian Business and Professional Council (IBPC) and Qatar Financial Centre (QFC). The chapter has been rendering excellent professional services to the engineering community of Qatar consistently delivering the objective of the Institution uninterrupted for last 32 years. One of the major activities is the regular technical seminars and workshops 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, and reached out to collaborate to sign several MOUs with many institutions and engineering organizations in Qatar. Qatar Chapter has been providing support and counseling services to the Engineers in Qatar to become Corporate Members, Chartered Engineers (C.E) and Professional Engineers (P.E) 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. As Honorary Secretary of the Qatar Chapter, I consider it a privilege to present this overview of the activities on the 56th Engineer's Day celebration on 10th November, 2023.

IEI Qatar Chapter activity report highlights the major accomplishments, knowledge sharing sessions, inspiring professionals with technical seminars and webinars meeting IEI's mission and building build trust among the engineering community in Qatar. This report thanks all the IEI fellow members, Excom members, Edoc committee members and all the volunteers for their support.

The list of the activities held after our 55th Engineer's Day held on 30th September 2022 is presented below.

- On 26th October 2022 – Seminar and Panel Discussion on “Automate Securely” in collaboration with HBK, VISTAS.
- FIFA WORLD CUP 2022: During November 2022 to December 2022 IEI Fellow members actively participated in various activities such as volunteering for FIFA World Cup 2022.
- 25th January 2023 – Beginning of 2023, IEI held its Seminar on “Lean Implementation in Construction” at Kanjani Hall
- 28th January 2023, IEI attended ISHRAE-Qatar conference on Energy and Environment held at Sheraton.
- 3rd April 2023 – IEI Technical Webinar on “Digitisation in Engineering”
- 15th May 2023 – IEI Participation in IBPC hosted ITeQS 2023.
- 3rd June 2023 Webinar on “Empowering the Least Developed Countries through Information and Communication Technologies”
- 7th June 2023, IEI attended QIMA Leadership Summit “ Leadership Challenges in the current Scenario” held at Radisson Blu hotel.
- 15th June 2023 – On the Telecom Day IEI conducted a Webinar on “Engineering Software Series – Common data Environment and BIM 360”
- 28th July 2023 – IEI Women's Wing Webinar on “Engineering and Entrepreneurship”
- 10th August 2023 – Webinar on “Tunneling Projects” in Association with Telegu Engineers Forum-Qatar.
- 20th September 2023 – Engineer's Day Theme seminar titled “Engineering a Resilient Future: Building Stronger, Smarter, Safer” was held at IBIS hotel, Doha, Qatar
- 23rd September 2023 – “Essential Communication Skills for Engineers to Develop Business Acumen Skills for Career Growth” in Association with Telegu Engineers Forum- Qatar.
- 8th October 2023 - Technical Seminar titled “Excitation Control of Synchronous Machines” was held in Radisson Blu hotel, Doha Qatar
- 14th October 2023 - Webinar was held in Association with Telugu Engineers Forum titled “Cost Management”
- 18th October 2023 – Technical Webinar with Engineers Australia Qatar Chapter on “Australian Chartered Engineer – Process and Benefits
- 28th October 2023 – Webinar was held in Association with Telugu Engineers Forum “Health & Safety Management in Construction Projects”



Why Join IEI?

When you join The Institution of Engineers (India), you are instantly connected to the largest and most diverse professional engineering body in India. In fact, IEI has more than 500,000 members working across all fields of engineering around the world.

Become a part of the IEI family and you gain access to a vast network of potential friends, colleagues and mentors.

With industry leading programs and resources, membership is a tremendous asset for any engineer working in India and abroad. Apply now to gain access to the people, places and promote your career, and life, deserves.

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Honorary Fellow (HF)
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Corporate

Fellow (FIE)
Member (MIE)
Associate Member (AMIE)

Non Corporate

Student Member (SMIE)
Member Technologist (MTIE)
Associate Member Technologist (AMTIE)
Senior Technician (Sr Tech IE)
Institutional Member (IM)



Join

Scan the Barcode to learn more and be a part of our family.

IEI Qatar Chapter

The council of the Institution of the Engineers of India established on an overseas chapter in the State of Qatar in the Arabian Gulf in July 1991 for the benefit of its members residing and practicing 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 is licensed with Qatar Financial Centre and its office is located in Royal Plaza, Al Sadd, 4th Floor, Hub Business Center, Workstation 109, C.R. No. 00671

IEI Qatar

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Hazardous Area Classification in Oil & Gas Industry.

A hazardous area is an area in which an explosive gas atmosphere (flammable gases or vapors, combustible dust, flammable liquids, ignitable fibers, etc.) is present, or maybe expected to be present, in quantities such as to require special precautions for the construction, installation, and use of apparatus. The term hazardous area is associated with the installation of electrical and instrumentation equipment so that special design consideration is applied to meet special requirements considering the safety of the operating personnel.

What is Hazardous Area Classification?

Hazardous area classification is the scientific evaluation of facilities where the explosive environment is present and classify them following scientific and engineering principles. To ensure process safety, Hazardous area classification is of utmost importance. Normally, a hazardous area classification is presented on a plan view of plant drawings. These are also known as area classification drawings. To reduce the risk of fire and explosion, the electrical and electronic equipment is installed following the guidelines of hazardous area classification drawings.

During normal operations in chemical and petrochemical facilities small releases of flammable fluids inevitably happen from time to time. The aim of hazardous area classification is to avoid ignition of these releases. Area classification focuses on electrical equipment as a potential ignition source in a flammable atmosphere. The approach is to reduce to an acceptable minimum level the probability of coincidence of a flammable atmosphere and an electrical or other source of ignition. Area classification is the division of a plant or installation into hazardous areas and non-hazardous areas. The hazardous areas are further subdivided into zones.

Purpose of Hazardous area classification

Hazardous area classification provides a basis for the selection and protection required for the electrical equipment appropriate to the defined areas. Area classification also helps for the safe positioning of other potential or continuous sources of ignition (eg. fired heaters, Internal combustion engines, gas /turbine drives ,plant roads, regulating temporary or portable equipment, etc.). It enables the selection of suitable electrical and instrumentation equipment to ensure a safe work environment.

In recent times, it is mandatory for chemical plants, oil refineries, LNG plants, sewerage treatment plants, paint manufacturers, distilling, offshore drilling rigs, Spray Booths, Petrochemical complexes, Laboratory and Fume Cupboards to prepare hazardous area classification drawings as hazardous gas vapors are normally present in all such industries.

Please note that it is not the aim of area classification to guard against the ignition of major releases under catastrophic failures of equipment eg. Rupture of a pressure vessel or a pipeline which have a low probability of occurrence. The risk mitigation for such large releases shall be carried out by proper layout, separation distances, facility sitings, and proper design, maintenance and operation of the plant.

Fire Triangle

Three elements are required to be present together to cause a fire or explosion. These are

- Fuel: This is what burns
- Oxygen: Required to support fire
- Ignition: Heat energy required to start a fire

Fire/explosion can happen only if all three are present together in an appropriate proposition.

Gas properties

Flashpoint- The lowest liquid temperature at which, under certain standardized conditions, a liquid gives off vapours in a quantity such as to be capable of forming an ignitable vapour/air mixture. It is the vapour that mixes with air to form a flammable vapour.

Lower Explosive Level (LEL): Concentration of flammable gas or vapor in the air, below which the gas atmosphere is not explosive.

Upper Explosive Level (UEL): Concentration of flammable gas or vapor in the air, above which the gas atmosphere is not explosive.

Ignition energy: Minimum energy of a spark that can ignite a flammable gas or vapour.

Ignition temperature: The lowest temperature at which flammable gas or vapor gets ignited by itself.

Vapour density: Density of a vapour or gas relative to the density of air, at same temperature and pressure.

Grades of hazardous release

The release of hazardous elements are grouped as follows:

- **Continuous grade:** Release which is continuous or is expected to occur frequently or for long periods. continuous grade release is present for more than 1000 hours per year (>1000 hours per year). Eg: Light hydrocarbon interceptor, seal of floating roof tank, area inside a tank, sump, etc.
- **Primary grade:** Release which can be expected to occur periodically or occasionally during normal operation (> 10 hours per year to < 1000 hours per year). Eg: Sampling points, equipment nozzle
- **Secondary grade:** Release which is not expected to occur in normal operation and, if it does occur, is likely to do so only infrequently and for short periods (<10 hours per year). Eg: Piping flanges and valves, instrument fittings, etc.

Such grading is not dependant on the total rate of release or the characteristics of the released material, but only the probability of the release. Also, some sources may be considered to have a dual grade release with a small continuous or a primary grade and a large secondary grade eg. vent with a dual purpose or a pump seal.

Steps for Hazardous Area Classification

Following are the general steps for hazardous area classification:

- All potential leak sources in the area under review are determined like vents, pump seals, flanges, sample points, instruments etc.
- For each potential leak source the grade of release is determined (that is no. of hours per annum that the leak of flammable material can be expected to occur).
- The degree of ventilation in the area around the potential leak source is established (whether there is adequate ventilation or not).
- Together it is the grade of release and the degree of ventilation near the potential leak source that determine the type of hazardous zone around the leak source.
- The hazard radius around the potential leak source is determined from the category of the fluid leaking. The hazard radius forms a horizontal circle around the potential leak and is valid at the elevation of the leak.
- From the hazard radius and based on whether the release is lighter or heavier than air and the presence / absence of platforms – the extent of the three dimensional hazardous zone around the potential leak source is determined.
- In a similar way, the hazardous zones from all potential leak sources is determined and superimposed. This gives

contours of hazardous area for the concerned facility both in the horizontal and vertical planes.

Hazardous area classification guide

Two widely used systems are followed in industries for hazardous area classification.

1. the Class/Division system and
2. the Zone system

While Canada and the United States predominantly use the class/division system, other parts of the world use the zone system of Hazardous area classification. In the below paragraphs, we will explore the hazardous area zone classification.

Hazardous Area Zone Classification

The Zone system of hazardous area classification, defines the probability of the hazardous material, gas or dust, being present in sufficient quantities that can generate explosive or ignitable mixtures. Refer to Fig.3 that shows the hazardous area zone classification based on hazardous gas release grade. There are three zones, Zone 0, Zone 1, and Zone 2.

The grade of release determines the designation of hazardous zones in the immediate vicinity of the release. In open air situations with adequate ventilation a secondary grade release will lead to a zone 2, a primary grade release will lead to a zone 1 and a continuous grade release will lead to a zone 0

Hazardous area zones

Zone classification will be influenced by ventilation also. IEC 60079-10 categorises ventilation degree as High, medium and low. Poor ventilation may push the zone higher by one level. Poor ventilation may result in a more stringent zone while, with high ventilation the converse will be true. A secondary grade source of release may give rise to a Zone 1 if local ventilation is restricted. (Example in a sump).

Adequate Ventilation is defined as ventilation sufficient to avoid flammable atmosphere within sheltered or enclosed area. This will normally be achieved by a uniform ventilation rate of 12 air changes per hour with no stagnant areas.

Depending on the presence of combustible dusts or ignitable fibers and flyings, the hazardous area is classified in three zones: Zone 20, Zone 21 and Zone 22.

In both the above zone classification the probability of explosion severity reduces when we move from zone 0 (or zone 20) to zone 2 (zone 22).

The extent of the Hazardous area zone

Distance in any direction from the source of release to the point where the gas/air mixture has been diluted by air to a value below the lower explosive limit. Refer to Fig. 3 above that shows a typical example of a hazardous area zone extents.

- Pressure breathing valve (Fig. 3) in the open air, from process vessel.
- A fixed process mixing vessel (Fig. 3); liquids are piped into and out of the vessel through all-welded pipework flanged at the vessel.

For a given release the extent of the zone will vary with the vaporizing potential of the fluid release, the ventilation rate and the buoyancy of the vapor. The 3rd edition of IP 15 provides three methods for determining the extent of hazardous zones:

- Direct Example Approach – limited to common facilities in open areas
- Point Source Approach- release rates are dependent on

process conditions

- Risk-based Approach- an optional rigorous methodology which may reduce the hazardous area determined by the point source approach

Fluid Category of Petroleum Products

The hazards radius for each point of release is a function of fluid characteristics (vapor forming potential) under the circumstances of the release, the release rate and the rate of vaporization. The hydrocarbon fluids are classified into below four fluid categories based their vaporizing potential.

Fluid Category Description

A A flammable liquid that on release would vaporize rapidly and substantially. This category includes:

- (a) Any LPG or lighter flammable liquid;
- (b) Any flammable liquid at a temperature sufficient to produce, on release, more than 40% vol. vaporization with no heat input other than from surrounding.

B A flammable liquid, not in category A, but at a temperature sufficient for boiling to occur on release.

C A flammable liquid, not in Category A and B, but which can on release be at a temperature above its flash point or form a flammable mist or spray.

D Flammable gas or vapor (Natural Gas, Hydrogen, etc)

Table: Fluid Category of Petroleum Products

With the fluid category leaking from the particular leak source established, now the extent of vapour travel (radii) around the leak source can be determined.

Hazardous Area Classification Drawing

The hazardous area classification drawings are in sufficient scale to show all the main items of equipment and all the buildings in both plan and elevation. The boundaries of all hazardous area and zones present shall be clearly marked using the clear shading convention for Zone 0, Zone 1, and Zone 2.

It has to be recognized that however well protected electrical equipment may be, there will always be residual risk if it is placed in areas where explosive atmospheres may occur.

Electrical Equipment Selection in Hazardous Area Classification

Once the Hazardous Area classification of a facility is determined, it is used as a basis for selecting suitable electrical equipment. To reach the intended level of safety, equipment must then be installed correctly, operated within its design envelop and maintained adequately.

As a general policy, electrical equipment should not be located in a hazardous area if it is possible to place it in a non-hazardous area, nor should be placed in Zone 1 if it can be placed in zone 2. The installation and maintenance requirements for electrical equipment in Zone1 locations are more stringent than for Zone 2 locations and Zone 0 are more stringent than Zone 1 locations.

ATEX directives for electrical apparatus for hazardous areas distinguish between two equipment groups as listed below:

- Group I – For use in mines (Methane)
- Group II – Other than mines

Sub-divisions in group II based on ignition energy requirement

- IIA – Atmospheres containing acetone, ammonia, ethyl, alcohol, gasoline, methane, propane or similar gases
- IIB – Atmospheres containing ethylene, acetaldehyde or similar gases
- IIC – Atmospheres containing acetylene, hydrogen or similar gases

Hazardous area – Temperature class

Classification based on ignition temperature (Fig. 4 (a)) of gas or vapour. The maximum surface temperature of selected equipment not to exceed the limiting value.

Fig. 4: Gas group and Temperature Class

Sour area

The area with H₂S (Hydrogen Sulphide) concentration above 50 ppm. H₂S is highly toxic even in very low concentration

Properties:

- LEL – 4% (40,000ppm)
- UEL – 46%
- Autoignition temperature – 260degC
- Gas group IIB
- Sour areas with H₂S concentration below 4% in process stream need not be classified as a hazardous area.

The Ingress Protection or IP rating

Ingress of moisture or other material could affect electrical equipment and cause it to break down electrically and possibly cause arcs and sparks which could be possible sources of ignition. Also personnel protection is required against contact with internal live or rotating parts inside the enclosure, and to the apparatus against ingress of solid objects, dusts etc.

The IP rating (or International Protection Rating, sometimes also called Ingress Protection Rating) provide users more detailed information than vague terms such as waterproof. The IP rating consists of the letters IP followed by two digits.

The first digit indicates the level of protection the fixture provides it's internal parts (electrical and moving parts) from the ingress (interaction or contact) of solid foreign objects (like dust). The second digit indicates the protection of the equipment inside the fixture against harmful ingress (contact) with water.

Examples of IP Rating

- IP44 is protected against solid objects greater than 1mm (0.04 inches) and liquid sprays from all directions.
- IP64 is protected against liquid sprays from all directions.
- IP65 is protected against liquid low pressure jets of water from all directions
- IP66 is protected against strong jets of water from all directions

Codes and Standards for Hazardous Area Classification

Codes and standards define minimum electrical design and installation requirements for electrical equipment to be used in hazardous areas. The following codes and standards provide detailed guidelines for Hazardous Area Classification for industries

- IEC 60079 series
- IP 15
- API 505
- DEP 80.00.10.10
- ATEX – EU Directives

The hazardous area classification and location of equipment must be ascertained before the choice of appropriately certified electrical equipment is made.

Frequency of reclassification of Hazardous Area has to be decided by the industry depending the risks involved. Any new Project must involve reclassification in the local area for the project.



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To earn the highest loyalty of our customers



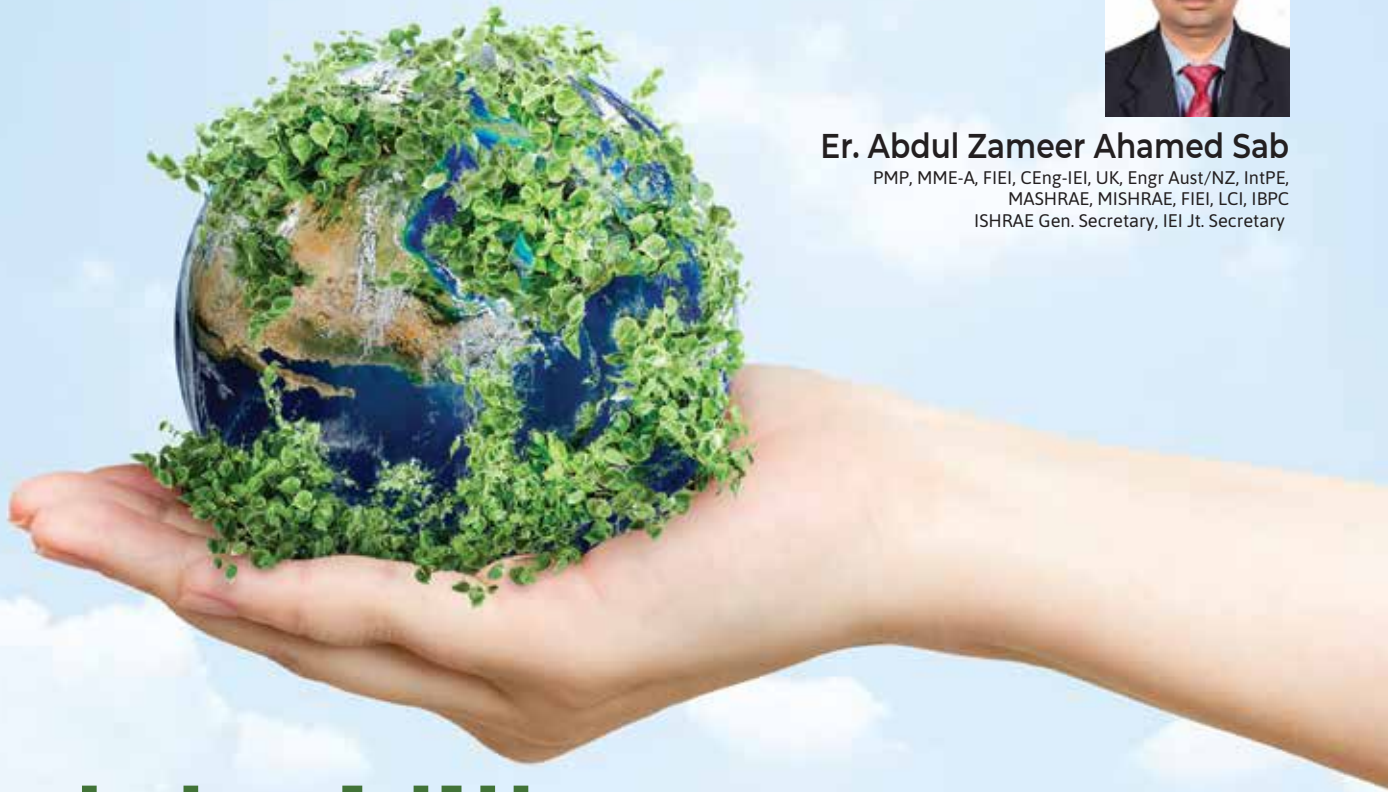
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Sustainability-

Need for Velocity of Innovation

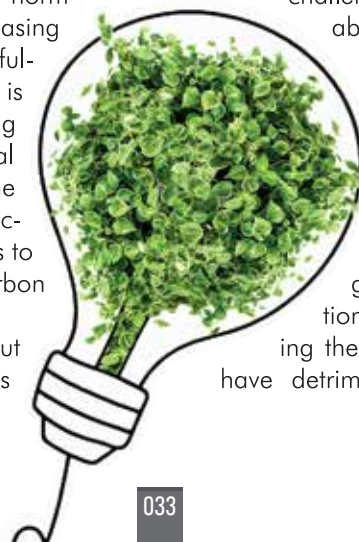
Sustainability is a common word, each of us come across in our day-to-day life. When we hear the word Sustainability, the first thing that comes to the mind is building with green/environment friendly materials or some of the measures to save some part of energy in that building or use of some products to save water etc. It's not the case anymore as Sustainability is becoming a "norm" instead of "like to have" with increasing requirements, opportunities and the mindfulness aligning with business strategies. It is now widely regarded as the next big revolution after the move into the digital world and the changes in the way the organizations are operated. Global expectations have grown to much higher levels to meet the challenges for reduction of carbon footprint.

Sustainability in simple terms is about living within the means of natural systems

and ensuring that our lifestyle does not harm other people. The need for Sustainability or sustainable solutions was felt in the early 90's when the articles were published to make aware the relationship between environmental & economic impacts due to sudden changes in the climatic conditions.

The change in climate is the most important challenge to achieve development in Sustainability in coming years. It adds extra pressure to comply with the norms, to use sustainable products, services and take responsibility for all the social engagement.

Modern sustainability is the integration of the environment, people, and economy. Sustainability grows stronger as the velocity of innovation increases and it suggests that neglecting the environmental and social impact will have detrimental effects on long-term business



growth and profits. As we see all organizations of all sizes double down on digital technology to accelerate growth, hence it's time to accommodate its executed through sustainable solutions.

Sustainability has become a prognostic indicator of a company's performance and is a C-Suite responsibility, starting with the top management.

As per Deloitte's Global Climate Check 21 the two forces responsible for Organizations sustainability actions are:

shareholder pressure and a rise in societal and employee activism. When it comes to sustainability, everyone is a stakeholder. From consumers, customers, executives, politicians, regulators and even you and me. However, some have more influence than others. Sustainability can

es on Organizations accrue ecological debt just as they do technical debt during a digital transformation and the need for speed, agility and simplicity to gain a competitive edge applies as much to an organization trying to fulfill its digital agenda as it does to an organization on the path to sustainability. Now a days most of the enterprises are striving to become digital to the core with Sustainability

As a Technical Manager for Doha EXPO 2023, International Horticultural Exhibition in the heart of Doha which is going to take place from Oct 2023 to Mar 2024, and the main theme is "GREEN DESERT BETTER ENVIRONMENT" with Sustainability as major sub theme. So, Qatar is going to witness every aspect of Sustainable solutions, the green environment and growth of the country to achieve its 2030



Qatar is going to witness every aspect of Sustainable solutions, the green environment and growth of the country to achieve its 2030 Vision. The Expo Project being one of the first International Horticultural Expos to take place in the Middle East with core emphasise on Sustainability.

be part of national, regional governmental strategies, bid commitments or reporting requirements. It is also important to check the organization's legal commitments.

During the United Nations (UN) Climate Action Summit in June 2019, UN Leaders announced the urgency of limiting global temperature rise to 1.5°C in response to the global climate crisis and emphasised on 17 UN Sustainability Development Goals (SDGs) which companies are committing to be aligned. The key SDGs being Carbon Management, Green Energy, Circular Economy, Environment Conservation, Water Conservation and Energy Efficiency. As the digital transformation journey progresses the sustainable business requires organizational wide commitment. Therefore, the Sustainability model emphasises-

Vision. The Project being one of the first green expos to take place in the Middle East with core emphasise on Sustainability.

It's a matter of pride for State of Qatar to host a horticultural Exhibition in desert climate showcasing the "The Green City Concept" within GCC. The main objective of the Expo 2023 Doha Project is to encourage, inspire and inform participants and visitors about innovative solutions for reducing desertification and establishing a sustainable environment. The project is in Al Bidda park with a total of 1.7 million square meters having 3 different zones, international zone, Family zone and Cultural zone. All buildings in the Expo were designed considering the three main aspects healthy, Sustainable & Intelligent.



About the Author:

Abdul Zameer Sab, having 23+ years of Gulf experience in the field of Engineering, Design, Construction, Testing & Commissioning, Handover to Facility Management. Have worked with some core projects including Doha Metro-Goldline, Dubai Metro, Opera House Dubai, Mekkah Metro, Jeddah International Airport.

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Green Hydrogen:

An alternative that reduces emissions and cares for our planet

Decarbonising the planet is one of the goals that countries around the world have set for 2050. To achieve this, decarbonising the production of an element like hydrogen, giving rise to green hydrogen, is one of the keys as this is currently responsible for more than 2 % of total global CO₂ emissions. Find out how this is achieved and what its impact will be in the coming decades.

This technology is based on the generation of hydrogen — a universal, light and highly reactive fuel — through a chemical process known as electrolysis. This method uses an electrical current to separate the hydrogen from the oxygen in water. If this electricity is obtained from renewable sources we will, therefore, produce energy without emitting carbon dioxide into the atmosphere.

As the IEA points out, this method of obtaining green hydrogen would save the 830 million tonnes of CO₂ that are emitted annually when this gas is produced using fossil fuels. Likewise, replacing all grey hydrogen in the world would require 3,000 TWh/year from new renewables — equivalent to current demand of Europe. However, there are some questions about the viability of green hydrogen because of its high production cost; reasona-

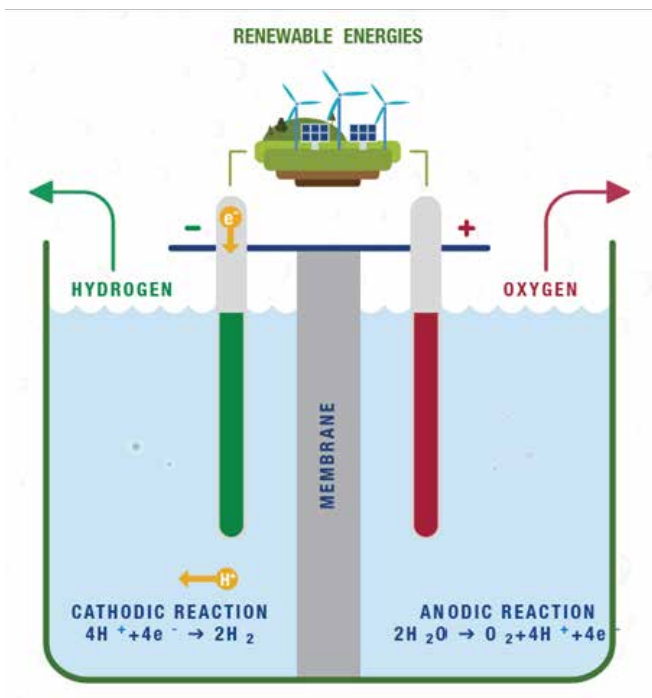
ble doubts that will disappear as the decarbonisation of the earth progresses and, consequently, the generation of renewable energy becomes cheaper. Producing green hydrogen by electrolysis from renewable sources involves breaking down water molecules (H₂O) into oxygen (O₂) and hydrogen (H₂).

- The water used in the electrolysis must contain salts and minerals to conduct the electricity.
- Two electrodes are immersed in the water and connected to a power source and a direct current is applied.
- The dissociation of hydrogen and oxygen occurs when the electrodes attract ions with an opposite charge to them.
- During the electrolysis, an oxidation-reduction reaction occurs due to the effect of the electricity.

HOW IS GREEN HYDROGEN OBTAIN?

Producing green hydrogen by electrolysis from renewable sources involves breaking down water molecules (H_2O) into oxygen (O_2) and hydrogen (H_2).

1. The water used in the electrolysis must contain salts and minerals to conduct the electricity.
2. Two electrodes are immersed in the water and connected to a power source and a direct current is applied.
3. The dissociation of hydrogen and oxygen occurs when the electrodes attract ions with an opposite charge to them.
4. During the electrolysis, an oxidation-reduction reaction occurs due to the effect of the electricity.



Hydrogen as clean energy

Hydrogen is the most abundant chemical element in nature. As noted by the IEA, the global demand for hydrogen for use as a fuel has tripled since 1975 and reached 70 million tonnes a year in 2018. In addition, green hydrogen is a clean energy source that only emits water vapour and leaves no residue in the air, unlike coal and oil. Hydrogen has a long-standing relationship with industry. This gas has been used to fuel cars, airships and spaceships since the beginning of the 19th century. The decarbonisation of the world economy, a process that cannot be postponed, will give hydrogen more prominence. In addition, if its production costs fall by 50 % by 2030, as predicted by the World Hydrogen Council, we will undoubtedly be looking at one of the fuels of the future.

Advantages and disadvantages of green hydrogen

This energy source has pros and cons that we must be aware of. Let's go over some of its most important good points:

- 100 % sustainable: green hydrogen does not emit polluting gases either during combustion or during production.
 - Storable: hydrogen is easy to store, which allows it to be used subsequently for other purposes and at times other than immediately after its production.
 - Versatile: green hydrogen can be transformed into electricity or synthetic gas and used for commercial, industrial or mobility purposes.
- However, green hydrogen also has negative aspects that should be borne in mind:

- High cost: energy from renewable sources, which are key to generating green hydrogen through electrolysis, is more expensive to generate, which in turn makes hydrogen more expensive to obtain.
- High energy consumption: the production of hydrogen in general and green hydrogen in particular requires more energy than other fuels.
- Safety issues: hydrogen is a highly volatile and flammable element and extensive safety measures are therefore required to prevent leakage and explosions.

Impact of green hydrogen

Hydrogen as a fuel is a reality in countries like the United States, Russia, China, France and Germany. Others like Japan are going even further and aspire to become a hydrogen economy. Below we explain what the impact will be in the future:

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Mr. Harman Handaspawar
Senior Director, Strategic Planning & Policy
Central Electricity Authority

Panel Speaker-4
Dr. Ashvini Kumar
Member of Council
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Er. Azeem Salahudeen
Mechanical Engineer

The Future of Sustainable Transportation: A Look at Electric Vehicles (EVs) and Their Impact on Mechanical Engineering



In recent years, the automotive industry has experienced a profound shift towards sustainability and environmental responsibility. Electric vehicles (EVs) have emerged as a leading solution to reduce greenhouse gas emissions and combat climate change. This article explores the pivotal role that mechanical engineers play in the development and advancement of EV technology, and how this is shaping the future of transportation.

1. The Rise of Electric Vehicles

- Overview of the rapid growth of the electric vehicle market.
- The environmental benefits of EVs in reducing carbon emissions.
- Government initiatives and incentives driving EV adoption. The state of Qatar has set us with a good examples with adoption of EVs to its fleet in different departments.

2. The Mechanical Engineering Behind Electric Vehicles

- Battery technology: Innovations in battery design and manufacturing.
- Electric drivetrains: How mechanical engineers optimize EV performance.
- Lightweight materials: Advancements in materials for improved efficiency.

3. Challenges and Solutions

- Range anxiety: Engineering solutions to extend the driving range of EVs.
- Charging infrastructure: Expanding the EV charging network.
- Recycling and sustainability: Addressing the environmental impact of EV batteries.

4. The Role of Mechanical Engineers

- The multidisciplinary approach: Collaboration between mechanical, electrical, and software engineers.
- Career opportunities: How mechanical engineers can contribute to the EV industry.
- Research and development: Ongoing innovation in EV technology.

5. Beyond Passenger Vehicles

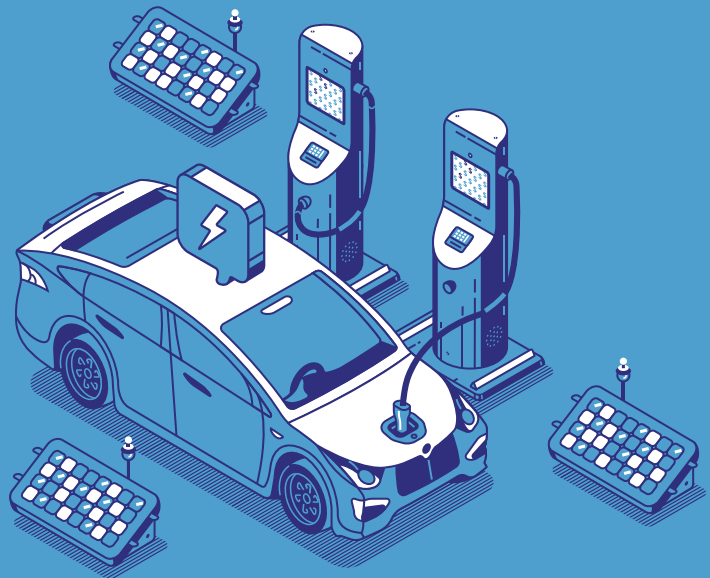
- The impact of electric mobility on public transportation and commercial vehicles.
- The role of mechanical engineering in designing electric buses, trucks, and delivery vehicles.
- Implications for urban planning and infrastructure.

Environmental Benefits: The logistics industry is under increasing pressure to reduce its carbon footprint. Electric delivery vehicles align with sustainability goals, as they produce zero tailpipe emissions. This shift is not only a strategic move for logistics companies but also a response to growing environmental regulations.

Charging Infrastructure: The logistics sector is driving the expansion of EV charging infrastructure, particularly in urban centers and along major transportation routes. This investment in charging networks is crucial for the widespread adoption of electric delivery vehicles.

Challenges and Innovations: While the adoption of EVs in logistics is on the rise, challenges such as charging infrastructure availability and vehicle range

Electric vehicles (EVs) have emerged as a leading solution to reduce greenhouse gas emissions and combat climate change.



5. The Rise of Electric Vehicles in Logistics

Efficiency and Cost Savings: Electric vehicles have been making significant inroads into the logistics and delivery sector. The efficiency of EVs, coupled with lower operating costs and reduced maintenance requirements, is making them an attractive option for companies looking to streamline their logistics operations.

Last-Mile Delivery: The last-mile delivery segment has seen a notable shift towards electric delivery vans and trucks. Companies like Amazon, UPS, and FedEx are incorporating EVs into their fleets to reduce emissions, especially in densely populated urban areas.

limitations still exist. Mechanical engineers are actively working on addressing these issues through innovations in battery technology and logistics vehicle design.

Conclusion: Electric vehicles represent a pivotal advancement in the quest for sustainable transportation. As mechanical engineers continue to drive innovation in this field, the future of mobility promises cleaner, more efficient, and environmentally responsible transportation solutions. The transition to EVs is not only transforming the automotive industry but also creating exciting opportunities for those in the field of mechanical engineering.



Er. Mohammad Shad

Jacobs
Principal Engineer - Mechanical

(M-ASHRAE, M-ASPE, M-IET, CEng-FEI,
ISHRAE President Elect Qatar,
IEI Joint Secretary Qatar).



Selection Criteria of **THERMAL INSULATION**

I *In the world of mechanical engineering, where innovation and sustainability are paramount, the choice of insulation materials can have a significant impact.*

Introduction

Thermal insulation is a material or combination of materials that, when properly applied, retards the rate of heat flow through conduction, convection, and radiation. It retards heat flow into or out of a building due to its high thermal resistance. Buildings are large consumers of energy in all countries. In middle east regions with harsh climatic conditions, a substantial share of energy goes to heat and cool buildings.

In the world of mechanical engineering, where innovation and sustainability are paramount, the choice of insulation materials can have a significant impact.

The right selection of thermal insulation is very important for mechanical services, especially for HVAC & PHE systems. This is very important for Middle east countries as well as the entire world for these services.

The proper use of thermal insulation in buildings does not only contribute to reducing the required air-conditioning system size but also in reducing the annual energy cost.

The objective of this paper is to present an overview of the basic principles of thermal insulation and to survey the most used building insulation materials, their performance characteristics, and proper applications.

Thermal insulation is a major contributor and an obvious practical and logical first step towards achieving energy efficiency especially in envelope-load dominated buildings located in sites with harsh climatic conditions.



Parameters and Performance

The thermal performance of the building envelope is determined by the thermal properties of the materials used in its construction, characterized by its ability to absorb or emit solar heat, in addition to the overall U-value of the corresponding component including insulation. The placement of insulation material within the building component can affect its performance under transient heat flow. The best performance can be achieved by placing the insulating material close to the point of entry of heat flow.

Space air-conditioning can have a large share of energy used to operate buildings. In the average Middle East home, for example, space heating and cooling account for 60–70% of its energy use.

Many parameters should be considered when selecting thermal insulation, including durability, cost, compressive strength, water vapor absorption and transmission, fire resistance, ease of application, reflective performance, effect of thermal mass, vapour permeability, water absorption, cell structure, thickness, thermal conductivity, and total thermal U-value (thermal transmittance). However, the thermal resistance of insulation materials is the most important property that is of interest when considering thermal performance and energy conservation issues.

There are many types of materials available on the market & some of them are listed as fiber glass, mineral wool, polyurethane, phenolic foam, polyolefin, but we need to ensure that all the materials shall comply with all codes, standards, tests & certifications for the right selection of the thermal insulation. On the other hand, we need to move towards new technology and innovation in this world, not only by selection of the insulation, but to choose the right manufacturers for the projects & products to support the environment, climate control, sustainability, energy saving, cost & time saving for the project. Some manufacturers support the industry and their continuous technology improvement of insulation products. For example, as under:

M/s Kimmco-Isover, Fiber glass wool-moved from traditional material insulation to pre-insulated glass wool ducts with excellent acoustic property & Self-sealed insulation products. This improvement benefits by less time for installation & relaxation for workers from previous products' difficulties at the time of installation. Fiber glass materials, in simple words, we can say the Invention of insulation in the world.

M/s Armacell, the pioneer & the world leader in flexible closed cell elastomeric insulation foams in the market, is also continuously doing a great job & moving from basic closed cell elastomeric foam to self-adhesive to realize the potential of insulation and achieve optimal thermal preformation.

M/s Thermobreak, developed and commercialized by the M/s Sekisui Chemical group, produces its innovative physical crosslink technology which offers a clear and more sustainable approach. Physical crosslinking technology that avoids the use of harsh chemicals to crosslink polyolefin polymers. Thermobreak's finer cell structure provides superior insulation, a 100% closed cell structure, ensuring its durability and longevity, making it an excellent choice for applications that require optimal thermal performance.

Codes, Standards, Tests & Certifications

There are some basic codes & standards, tests & certifications required to identify the correct selection of the thermal insulations as follows:

All insulation shall be in accordance with ASTM E84 (UL 723, NFPA 255), ASTM E96, ASTM C411, ASTM C518, UL 181 standards.

Insulating materials shall be acceptable only if they are equal to or better than the grades or classes of fire resistance as follows:

BS 4735, Class Q, (Burning rate nil, and not producing melted droplets.)

BS 476, Part 4, (Noncombustible grade.)

BS 476, Part 5 Class P, (Not easily ignitable.)

BS 476, Part 6, (Fire Propagation Index a maximum of 12.6)

BS 476, Part 7, Class 1, (Surface spread of flame.)

All insulation finishes and coverings shall be classified as Class O surface spread when tested in accordance with BS 476, Part 7.

All adhesives, mastics, coatings, sealers, and primers shall be classified as Class O surface spread when tested in accordance with BS 476, part 7.

All Insulation material Ducts & Pipes shall be complied to Non-Combustible grade as per BS 476 Part 4.

Insulation of insulating materials shall be carried out per BS 5970 and BS 5422.

Insulation must comply with NFPA 90A and 90B.

Insulation materials require ISO certification.

Insulation core materials shall be Class "O" & FM approved embossed stamp.

Thermal Conductivity, Vapour Permeability & density also have very important roles in selecting thermal insulation.

The pre-insulated bonded piping will comply with standard EN253 as a minimum.

Sustainability: Insulations shall be environmentally friendly, with features such as GREEN STAR compliance, RoHS compliance, no CFCs or HCFCs, REACH compliance, zero ODP (Ozone Depletion Potential), and low GWP (Global Warming Potential), under ISO 14001 standards and contributes to LEED, GSAS and ESTIDAMA credit points.

Conclusions

In the ever-evolving field of mechanical engineering, Thermal Insulation stands as a beacon of innovation and sustainability. Insulation manufacturers' new technology, along with its exceptional thermal properties and adherence to stringent safety and environmental standards, makes it a top choice for engineers looking to optimize energy efficiency and reduce their carbon footprint. With the choice of the above descriptions of the insulation, engineering consultants/engineers can not only meet but exceed industry standards, ensuring a brighter and more sustainable future for our planet.

Other than the Manufacturer's proposal of insulation materials on project sites, it is important for the design consultants/engineers to cover all the above Parameters, Preformation Criteria, Codes & Standards, Tests & Certifications in the specification & at the time of material submittals on site it is the responsibility of the supervision consultants or site incharge engineer or client/authority for approval to ensure that all the above codes & standards, Test Results, Third Party Tests for authorized labs shall be submitted with valid & up to date Certificates.



Er. Siyam Ul Hakkim
B.Tech, MIE.



Why Not Utilize 100% Crane Capacity?

Factors Affecting Crane Capacity

Mobile cranes play a vital role in various industries, including construction, logistics, and manufacturing. When it comes to mobile crane safety, it is crucial for every worker involved with a lift to understand the capabilities and limitations of the crane they are using. Every mobile crane has a set capacity that it can hoist within a given radius of that crane. There are several factors that determine the exact capacity (such as boom length, radius, counterweight, etc.) However, even when a crane has a predetermined capacity at a given radius within a crane's particular configuration there are still a few factors that affect a crane's capacity beyond what is stated on the load charts. These factors could be caused by a lack of awareness of the operator, supervisor, rigger, signalperson, and/or external forces exerted on the crane. However, it's crucial to understand the concept of capacity reduction in mobile cranes to ensure safe operations and maintain optimal performance. It is vital to know not only how to determine capacity correctly from the chart but also to recognize the factors that can reduce a crane's capacity below the chart ratings.

Some of the factors are described below:

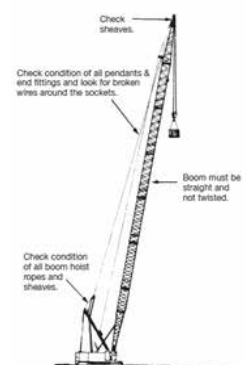
Poor Machine Condition- Load chart rating apply only when the crane is in good condition and well maintained as per the manufacturer specification. The boom is an important element which should be maintained properly.

Check telescopic booms for conditions such as:

- Sway
- Droop
- Cracks around the hinge pin
- Rust (could be sign of crack)
- Flaking or cracked paint (Could be sign of overload)
- Bulges, creases or waviness of the plates in the boom
- Worn pads

Importance of Quadrants

The leverage and capacity of a crane change during rotation of the upper works. Leverage and capacity are also affected by the location of the tipping axis. For these reasons the crane's stability can change during operation.



To provide uniform stability, regardless of the position of the upper works relative to the carrier, the crane's capacity is adjusted by the manufacturer according to the quadrant of operation.

These capacity changes are identified in the load chart by the quadrant of operation

Improper use of outriggers- If lifting on outriggers, the load chart rating applies only when all the outrigger beams are fully extended and all tires are clear of the ground. If these two conditions are not met, then the "on rubber" capacity charts should be used. If lifting on rubber, the load chart ratings apply only when tires are in accordance with the manufacturer's specifications and in good condition, and the specified tire pressure is maintained. Some mobile cranes have load charts for mid-extended outrigger beams. For such cranes, the outriggers should still be extended to the proper point and all of the tires must be clear of the ground. In special circumstances a crane may be operated on outriggers that are not fully extended. In this situation the crane must be equipped with load charts coinciding with this partial extension of the outriggers and there must be a method of measuring the outrigger extension.

Soft Footing- Load chart ratings apply only when the ground conditions are firm enough to support the crane and keep it level during the lift. If the ground is soft or unstable, the tires, crawlers or outriggers will sink or subside causing loss of capacity. In almost all cases, heavy duty blocking having large bearing areas will be necessary to prevent sinking and provide a solid base for the crane.

When a crane sets on its load bearing surfaces, it exerts varying pressures depending on the operating conditions and the quadrant(s) of operation. The lowest bearing pressure is the total weight of the machine distributed over the entire area of the drive tracks or all outrigger supports. Lifting a load over the corner produces the maximum ground bearing pressure, which makes it the most dangerous position. The ground pressure of a truck crane may be higher than that of a crawler crane due to the smaller load bearing surface area of the pads. Pads used for outriggers should be stable and rigid, a minimum of three times larger in area than the outrigger float, and be fully supported.

Side loading- The load chart ratings apply only to freely suspended loads and when the load is picked up directly under the boom tip. If the load is to either side of the boom tip, side loading occurs, which affects the crane's capacity. Side loading is one of the most common causes of boom failure and usually occurs without warning. Side loading can occur when a load is dragged or pulled sideways, when the load starts swinging rapidly, when the crane is not level, and when exposed to high wind speeds. Tilt-up construction methods can also cause side loading of the boom.

Shock loading- Load charts do not allow for impact loads. Shock loads can be caused by rapid acceleration, sudden stopping, sudden load release, and sudden load snatching. For instance, the shock loading increases by approximately 35 percent if the hoist line is traveling at a speed of 400 feet per minute and stops with a stopping distance of only two feet; but the shock loading only increases by approximately 0.5 percent if the hoist line is traveling at a speed of 100 feet per minute and with a stopping distance of 10 feet (Campbell and Dickie, 171). In addition to sudden deceleration and the other conditions mentioned above, pick-and-carry operations also produce impact loads to the machine.

Unlevel crane- The load chart ratings are based on the crane being perfectly level in all directions. One of the most severe effects of being out-of-level is that side loads develop in the boom. Because of side loads all mobile cranes lose capacity rapidly as the degree of out-of-level increases. All load chart ratings are based on the machine being perfectly level in all directions. This applies to "on crawlers," "on riggers," as well as "on rubber" lifting operations.

The target level in the crane cab should be used for initial leveling; however, for critical lifts, a carpenter's level should be used. After initial leveling, place the carpenter's level on the leveling plates provided on the crane, typically located on or under the boom foot pins, then rotate the boom 90 degrees and recheck. The levelness can be double-checked by raising the boom and lowering the load line. The line should lie in the center of the boom in all positions (i.e., end, side, and corner). If making a series of lifts, the levelness should be periodically checked.



Increasing load radius- The load radius may increase during a lift if the hoist line is not vertical at all times. An increasing load radius may be caused by lifting a load that is outside or inside of the boom tip radius. For such lifts, the load will start to swing in and out after the load clears the ground, which increases the load radius, thus reducing the rated capacity of the crane. Lifting "on rubber" can also cause the load radius to increase due to deflections in the boom, tire, and carrier

High Wind Speeds- Almost all crane manufacturers specify in the load chart that chart ratings must be reduced under windy conditions, and they may also recommend a shut-down wind velocity. In almost all cases, when the wind speed exceeds 9.8m/s, it is advisable to stop operations. Wind affects both the crane and the load, reducing the rated capacity of the crane. Never make a full capacity lift if it is windy. In addition, performing lifts in windy conditions makes it more difficult to handle the load.

High Wind Speeds- Almost all crane manufacturers specify in the load chart that chart ratings must be reduced under windy conditions, and they may also recommend a shut-down wind velocity. In almost all cases, when the wind speed exceeds 9.8m/s, it is advisable to stop operations. Wind affects both the crane and the load, reducing the rated capacity of the crane. Never make a full capacity lift if it is windy. In addition, performing lifts in windy conditions makes it more difficult to handle the load.

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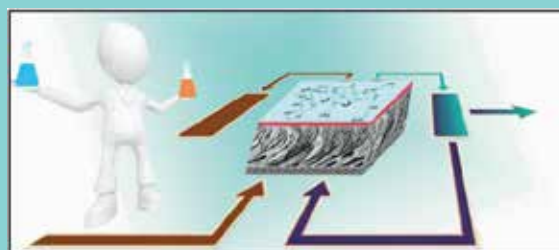
Dr. Wafa Ali
Texas A&M university



Abstract

In this work, a novel surface modification strategy was developed to modify polyethersulfone membrane substrate to create membranes for forward osmosis applications. A novel poly(ethylenimine) crosslinked Hexadecafluorodecanedioic acid polyelectrolyte was synthesized, followed by layer deposition on the surface of an ultrafiltration membrane substrate. While the unmodified membrane was negatively charged, this procedure reversed the surface charge, leading to a positively charged forward osmosis-nanofiltration membrane. Interestingly, at pH7, the zeta potential approached 6.9mV for membrane coated 4.5 as compared to the pristine membrane with a zeta potential value of approximately -11.0mV . Extensive characterization and chemical analyses were carried out to ensure the effectiveness of the developed separation layer. The results revealed that the poly(ethylenimine) crosslinked Hexadecafluorodecanedioic acid was successfully deposited on the polyethersulfone membrane substrate. Preparation conditions, such as curing temperature and time were optimized. It was found out that membrane coated with 3.5 bilayers and cured at 60°C for one hour exhibited optimal water permeability of $21.9 \text{ L m}^{-2} \text{ h}^{-1} \text{ bar}^{-1}$ and solute permeability of $1.66 \text{ L m}^{-2} \text{ h}^{-1}$ as compared to the neat membrane.

In the world of mechanical engineering, where innovation and sustainability are paramount, the choice of insulation materials can have a significant impact.





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Aswathy Padmakumar
B.E. Information Technology



IMPORTANCE OF SOFTWARE TESTING TO BUILD A QUALITY SOFTWARE

Software testing represents the pinnacle of the application development process, where software testers meticulously scrutinize the code through a systematic inquiry.

Software testing serves as the evaluation of a software program's functionality. Put differently, it involves the examination of lines of code within a program to detect bugs, a task that can be executed either manually or through automated testing methods. This procedure is aimed at identifying errors and discrepancies, ensuring that the application's results align with the intended expectations, all of which occur prior to the software's installation and launch.

Why is software testing important?

Software testing represents the pinnacle of the application development process, where software testers meticulously scrutinize the code through a systematic inquiry. This evaluation can be concise or extended until it garners approval from all concerned parties. The primary objective of software testing is to pinpoint and rectify bugs and issues encountered during the development phase, preventing them from surfacing post-product launch. By adopting this approach, the quality of the products distributed to consumers is upheld, leading to heightened customer satisfaction, and fostering trust in the software.

Here are significant rationales for integrating software testing techniques into the application development process:

- Early Defect Identification
- Enhanced Product Quality
- Boosts Customer Trust and Satisfaction
- Security Vulnerability Detection
- Scalability Support & Cost Savings

Software Testing Objectives

Software testing is an activity which aims at evaluating the quality of a software product and to improve it by identifying defects. Software testing strives to achieve its objectives but has certain limitations. However, adherence to the established objectives ensures effective testing. Below are the main objectives of Software Testing.

- To evaluate the work products such as requirements, design, user stories, and code:
- To verify the fulfillment of all specified requirements:
- To validate if the test object is complete and works as per the expectation of the users and the stakeholders:
- To build confidence in the quality level of the test object:
- To prevent defects in the software product:
- To find defects in the software product:
- To provide sufficient information to stakeholders to allow them to make informed decisions, especially regarding the level of quality of the test object:

Types of software testing

The following are the main types of software testing methodologies:

- **Integration testing.** This groups together two or more modules of an application to ensure they function collectively. This type of testing also reveals interface, communication, and data flow defects between modules.
- **Unit testing.** Typically conducted during the application development phase, the purpose of unit testing is to ensure that each individual unit or component performs as expected. This is a type of white box testing and test automation tools -- such as N-Unit, JUnit, and X-Unit -- are typically used to execute these tests.
- **Functional testing.** This entails checking functions against functional requirements. A common way to conduct functional testing is by using the black box testing.

- **Security testing.**

This ensures the software is free of potential vulnerabilities, known flaws and security loopholes that might affect the user system and data. Security testing is generally conducted through penetration testing.

- **Performance testing.**

This tests the performance and speed of an application under a given workload.

- **Regression testing.** This verifies whether adding new features causes a decline in the functionality of an application.

- **Stress testing.**

This assesses the strength of software by testing how much load it can take before reaching a breaking point. This is a type of nonfunctional test.

- **Acceptance testing.** This evaluates the entire system against the desired requirements and ensures the project is complete.

in each case, validating core requirements is a critical evaluation. Just as important, Exploratory Testing helps uncover hard-to-predict scenarios that can lead to software errors.

Even a simple application can be subject to many tests. A Test Management Plan helps to prioritize which types of testing present the most value, given available time and resources.

Software testing constitutes a substantial domain within the realm of software application development. In our discussion, we touched upon a limited scope of this domain, encompassing aspects such as its significance, primary objectives, and various types of software testing. It's crucial to acknowledge that the broader



landscape of software quality assurance encompasses additional vital facets, including manual testing, automation testing, and performance testing. These aspects warrant careful consideration when exploring the extensive field of software testing. Furthermore, we briefly introduced some fundamental aspects of software quality assurance, intending to illuminate a path for those who are keen on delving deeper into this field.

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ARTIFICIAL INTELLIGENCE (AI) IN THE CONSTRUCTION INDUSTRY

Overview

Artificial intelligence (AI) is rapidly revolutionizing numerous industries, including construction. Throughout the Project lifecycle, AI-powered solutions are being utilized to automate operations, Project planning and management, Automated construction and 3D printing, Enhanced design, Tendering, Estimation & Contracts and increase safety, and make smarter decisions in the Construction projects. This article will explore the AI revolution in construction in more detail, discussing the key trends and applications of AI in the industry. It will also highlight the benefits of AI for construction companies and their clients, and examine the challenges that need to be addressed in order to fully realize the potential of AI in construction.

Applications of AI in construction:

AI-Enhanced Design: AI has the potential to completely alter how we design structures. Numerous design choices can be explored using generative design tools based on characteristics like materials, cost, and performance standards. This can assist engineers and architects in developing designs that are more sustainable and efficient. A 3D model-based strategy, BIM (building information modeling), offers insights to architects, constructors, and engineers to efficiently plan, construct, manage, and design buildings. The system needs to consider the engineering, electrical, electrical, mechanical, and plumbing activities to present a reliable 3D model.

Sustainability: AI can be used to design and build more sustain-

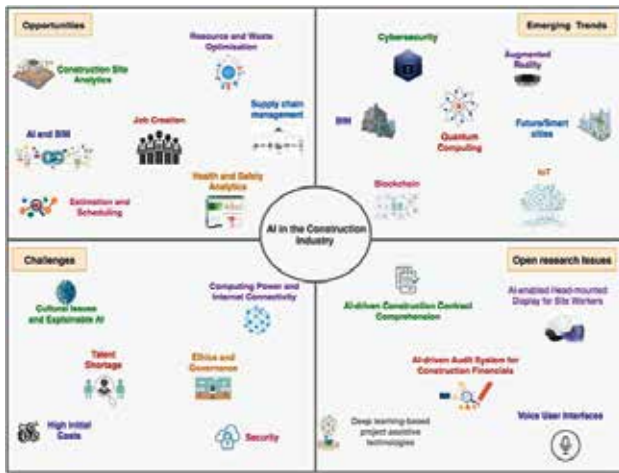
able buildings. For example, AI can be used to optimize energy efficiency and reduce environmental impact .

AI-driven audit system for construction financials : AI-based estimation models have wide applicability in various domains of the construction industry. Particularly, these estimation models are instrumental in the early prediction of construction cost and duration, which are key project success factors . Unreliable project cost and time estimates could have huge economic and financial implications. Under value-driven services, subdomains such as estimation and scheduling, construction site analytics, job creation, AI and BIM integrations with other industry 4.0 tools such as internet of things (IoT) are described.

Project planning and management: AI can be used to analyze historical project data, identify patterns and trends, and generate optimized project plans. AI can also be used to predict potential risks and delays, so that project managers can take preventive action.

Automated construction and 3D printing: AI-powered robots and automated construction equipment are becoming increasingly common on construction sites. These machines can perform a wide range of tasks, such as bricklaying, concrete mixing, and even 3D printing entire structures. Automation can help to speed up construction timelines and reduce the risk of human error.

AI-driven safety measures: AI can be used to improve the safety of construction sites through automated monitoring systems. Machine learning models can identify potential safety hazards, monitor the proper use of protective equipment, and even predict and prevent accidents before they occur.



Quality control: AI-powered cameras and sensors can monitor construction sites for potential safety hazards and alert workers and managers to potential dangers. They can also monitor the quality of construction work, identify defects, and alert workers and managers to issues that need to be addressed. AI can be used to automate quality control inspections and identify defects early on. This can help to reduce the cost of repairs and ensure that buildings are built to the highest standards.

Drones: Drones can be used to survey construction sites and generate 3D models, allowing construction companies to identify potential issues before they become problems.

MEP/ Heating, ventilation, and air conditioning : Data smart home technologies control specific elements in smart houses like light, pressure, and temperature. Moreover, it doesn't require much processing power for a small house but becomes a complex task for huge projects like office buildings. For instance, modern data centers use complex HVAC systems with less cost and high-power efficiency to make the company more attractive than competitors. Construction companies are increasingly relying on off-site factories staffed by autonomous robots that piece together components of a building, which are then pieced together by human workers on-site. Structures like walls can be completed assembly-line style by autonomous machinery more efficiently than their human counterparts, leaving human workers to finish the detail work like plumbing, HVAC, and electrical systems when the structure is fitted together,

Material management: AI can be used to optimize material procurement and logistics. This can help to reduce waste and costs

Here are some illustrations of how AI is being used in construction today:

- AI-powered project management software: This software can help project managers to develop and monitor project plans, track progress, and identify potential risks.
- Automated construction robots: These robots can perform a variety of tasks, such as bricklaying, concrete mixing, and even 3D printing entire structures.
- AI-driven safety monitoring systems: These systems can identify potential safety hazards and alert workers to them.
- Generative design software: This software can explore countless design options based on specified parameters such as materials, cost, and performance requirements.

Benefits of AI for construction companies and their clients

The AI revolution in construction offers a number of benefits for both construction companies and their clients.

For construction companies, AI can help to: Improve productivity and efficiency ,Reduce costs ,Improve safety ,Enhance design

capabilities and Reduce environmental impact

For clients, AI can help to: Deliver projects on time and within budget ,Improve the quality of construction and Reduce the environmental impact of their buildings .

Challenges of implementing AI in construction

Despite the many benefits of AI, there are still some challenges that need to be addressed in order to fully realize its potential in the construction industry.

One challenge is the lack of awareness and understanding of AI among construction companies. Many construction companies are still unfamiliar with AI and its potential applications in the industry. Another challenge is the high cost of developing and implementing AI solutions. AI-powered technologies can be expensive to develop and purchase, and they can also require significant investment in training and infrastructure.

Finally, there is also the challenge of data privacy and security. AI systems rely on large amounts of data to train and operate. This data can contain sensitive information, such as construction plans and financial data. It is important to ensure that this data is properly protected from unauthorized access and misuse.

AI-powered construction equipment can improve efficiency on job sites in several ways:

Reducing time wasted: AI can reduce the amount of time wasted moving around the construction site to retrieve tools, materials, and equipment to perform certain tasks. Workers can be tracked throughout the day using smartphones or wearables, and sensors installed on materials and equipment can track how everything else is moving about the construction site. Once enough data sets are collected, AI can analyze how workers move about and interact with the site to come up with solutions to reorganize the placement of tools and materials to make them more accessible to workers and reduce downtime.

Improving worker productivity: AI and robotics can help workers do their jobs with less stress and strain, which can improve productivity. For example, lifting robots can relieve workers of physically demanding tasks so they can concentrate on the more nuanced aspects of the job

Real-time monitoring: AI-powered cameras, drones, and robots can monitor construction sites in real-time, providing builders and managers with up-to-date information on progress and potential issues. This can help them make more informed decisions and take action more quickly

Automating manual tasks: AI-powered robots can automate manual tasks, such as painting blueprints on construction site floors, freeing up workers to focus on more complex tasks

Optimizing equipment maintenance: AI can be used to monitor construction equipment and predict when maintenance is needed, reducing downtime and increasing productivity

Conclusion

Fortunately, or unfortunately, AI cannot replace humans wholly. In several cases, it still needs human assistance for proper functioning, especially in construction, where every event or decision depends on several other external factors leading to varying consequences. The AI revolution in construction is still in its early stages, but it has the potential to transform the industry. AI can help to make construction more efficient, safer, more sustainable, and more cost-effective. Construction companies that are able to successfully implement AI solutions will be well-positioned to compete in the future. Overall, AI-powered construction equipment can help construction companies optimize their processes, reduce downtime, and improve productivity, ultimately leading to more efficient job sites

Technical Seminar January 2023

Lean Implementation in Construction

The Institution of Engineers (India)
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SEMINAR ON LEAN IMPLEMENTATION IN CONSTRUCTION

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Founder, Institute Management Solutions IP & Management Consultant
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AN INTRODUCTION TO LEAN CONSTRUCTION FOR CIVIL ENGINEERS

Lean Construction

In the ever-evolving field of civil engineering and construction, the concept of "lean" has gained substantial traction in recent years. Born from the principles of lean manufacturing, lean construction is a systematic approach aimed at maximizing value while minimizing waste throughout the construction process. In this article, we will delve into the fundamental aspects of lean construction, its principles, and its relevance in today's construction industry.

Origins of Lean Construction

To understand lean construction, we must first look back to its roots in lean manufacturing. The concept of "lean" was popularized by Toyota in the 1950s, revolutionizing the automotive industry. It was about optimizing every aspect of production, from minimizing excess inventory to reducing lead times. This philosophy soon found its way into construction, giving birth to lean construction.

As the construction sector grappled with issues like budget overruns and inefficient workflows, it became clear that lean principles could be adapted to address these challenges. This marked the inception of lean construction, challenging conventional project management practices by targeting issues like overproduction,

poor communication among stakeholders, and a lack of synchronization between project phases. It was akin to a torch passed from manufacturing to construction, illuminating a path toward a more efficient and value-driven future.

Fundamental Principles

At the core of lean construction are several key principles:

1. **Maximizing Value:** At the heart of lean construction lies the unwavering commitment to maximizing value for the customer. This principle emphasizes understanding the unique needs and desires of the client and delivering precisely that, eliminating anything that doesn't contribute directly to the project's value. By aligning every decision and action with the goal of enhancing value, lean construction ensures that resources are invested wisely and that the end result meets or exceeds expectations.

2. **Minimizing Waste:** Waste, in its myriad forms, has long plagued construction projects. Lean construction tackles this issue head-on by recognizing and reducing different types of waste, often referred to as the "8 Wastes." These include overproduction (doing more work than necessary), excess inventory (hoarding of materials), waiting (idle time), defects (rework and errors), and underutilized talent (not leveraging the skills of workers efficiently),

among others. By identifying and eliminating these sources of waste, lean construction optimizes both time and resources.

3. Continuous Improvement : A cornerstone of lean thinking is the relentless pursuit of improvement. Lean construction projects embrace a culture of continuous improvement, often through methods like Kaizen. This entails regularly evaluating processes, seeking feedback from team members, and implementing changes to enhance efficiency and effectiveness. It's not a one-time effort but an ongoing commitment to getting better with each project.

4. Collaborative Approach: Lean construction encourages collaboration among all project stakeholders, from architects and engineers to contractors and suppliers. Effective communication and teamwork are essential for success. The collaborative approach fosters a sense of shared responsibility, where everyone works towards common project goals. The Last Planner System (LPS) is one example of a tool that facilitates collaborative planning and scheduling among different parties.

5. Pull Planning: Lean construction challenges the traditional "push" approach to project scheduling, where work is driven by predetermined timelines. Instead, it advocates for "pull planning," where work is scheduled based on actual demand and the pace at which tasks are completed. This approach minimizes overproduction, reduces bottlenecks, and improves workflow efficiency.

By delving deeper into these fundamental principles, we can better appreciate how lean construction goes beyond a mere methodology; it's a philosophy that reshapes how we approach construction projects. It empowers civil engineers and construction professionals to build not just structures, but a more efficient, sustainable, and prosperous future for the industry. As we navigate the complexities of modern construction, the principles of lean construction serve as our guiding stars, illuminating a path to efficiency and excellence.

Waste Reduction

Waste reduction lies at the heart of lean construction. Construction projects are notorious for generating waste, whether it's materials left unused, rework due to errors, or downtime caused by poor planning. Lean construction strives to eliminate these inefficiencies.

One of the most impactful tools in waste reduction is the Last Planner System (LPS). LPS involves the collaborative planning and scheduling of tasks, where the last planner (typically the contractor or subcontractor) commits to completing a task by a specific date. This approach minimizes delays, enhances coordination, and reduces overproduction.



Lean Construction in Action

The Children's Hospital of Philadelphia (CHOP), USA: CHOP adopted lean construction methods, including pull planning, target value design, and integrated project delivery, for its \$1.5 billion expansion project. This approach reduced construction time by 15%, saved \$80

million in costs, increased patient satisfaction by 20%, and improved safety and sustainability.

The Shard, London, UK: The Shard, Western Europe's tallest building, employed lean construction techniques such as modularization, just-in-time delivery, and daily huddles to overcome urban site challenges. This resulted in minimal disruption, waste reduction, and successful project delivery.



Figure 1: Lean construction principles

The University of California, San Francisco (UCSF), USA: UCSF utilized lean construction methods like stakeholder involvement, co-location of teams, value stream mapping, and continuous improvement for its 289-bed hospital complex. This approach reduced design errors by 75%, increased productivity by 30%, reduced change orders by 50%, and improved patient outcomes by 40%.

Summary

Lean construction is not merely a buzzword; it represents a paradigm shift in the construction industry. By prioritizing value, minimizing waste, fostering collaboration, and embracing continuous improvement, lean construction has the potential to revolutionize how we approach construction projects. As civil engineers and construction professionals, it's essential to stay attuned to these principles and explore ways to integrate them into our projects. In the end, lean construction isn't just about constructing buildings more efficiently; it's about building a more efficient and sustainable future for the industry.



Er. Masthan Shaik
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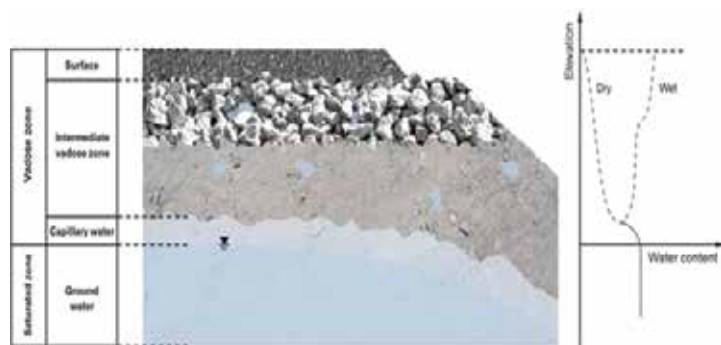
Pavement Material Characterization

Having 28 years of experience in the field of Civil Engineering, mainly in Highway Construction and Supervision of Roads and Bridges. experienced in highway Pavement Material characterization and performance, Selection of material for concrete, unbound and asphalt mixes are the key challenges for the road construction activities. Material is one of the major key performance indicators in terms of project completion on time and performance of the road for the design life.

Highway Flexible pavements are constructed with several layers of fill, Subgrade and unbound granular materials (UGMs), such as the Sub-base and Base course layers which rest directly on the formation (subgrade) layer. The unbound layers provide the structural support for the overlaying bituminous layers. Performance of Subgrade has direct influence on the performance of the road. The subgrade protected by the asphalt layers over excessive deformation by spreading the load and reducing the stresses. Hence the mechanical properties of these materials are important for the overall performance of the structure. The total deformation in the UGMs and subgrades due to the impact loading from the moving traffic consists of recoverable (resilient deformation) and plastic deformation (permanent deformation). The resilient deformation is associated with the bottom-up fatigue cracking of the Asphalt Concrete, whereas the permanent deformation accumulates with the number of load applications and contributes to the surface rutting. This paper describes two of the most important material properties of the unbound layers of the pavements, i.e. the resilient and the permanent deformation properties.

The Mechanistic-Empirical Pavement Design Guide (MEPDG) is to identify the physical causes of stresses in pavement structures and calibrate them with observed pavement performance. Mechanistic – Empirical (ME) design approach of flexible pavements aims to predict and control these deformations through proper understanding of the materials' behavior and mathematical modelling. This requires good understanding of the material characteristics under various influential factors. This is usually achieved through extensive laboratory testing and field studies. Among the different factors affecting the mechanical properties is the moisture content (w) of the layer. Moisture constantly varies in the structure, dependent on the ambient climate and seasonal variations. Predictions of the seasonal variations of the unbound layer's mechanical properties is therefore essential for a rigorous design approach.

The characterization of the mechanical properties of the UGMs and subgrade materials is generally carried out in the laboratory using the Repeated Load Triaxial (RLT) test for estimating resilient deformation properties. Furthermore, the protocol is applicable for characterizing permanent deformation properties of coarse-grained materials (base course and subbase materials). No protocol exists for estimation of permanent deformation characteristics of materials with high fine content (subgrades). For resilient behavior, the protocols demonstrate an applica-



tion of a multi-stage (MS) set of different stress paths for 100 cycles, each completed before moving on to the next one. This provides a resilient stiffness MR estimation over a broad stress regime allowing fitting the data set to a mathematical model. The protocol further describes an MS approach to obtain the permanent deformation properties of the material by applying a set of different stress paths for 10,000 cycles each before moving on to the next one. The protocol standard prescribes two sets of different combinations of stress levels, namely "high stress level" (HSL) and "low stress level" (LSL).

The objective of this paper is to give a brief overview of the resilient modulus and permanent deformation characteristics of unbound layers and subgrade materials and specifically their moisture dependency. This has been achieved by running RLT tests on a large amount of materials. For the coarse-grained materials the matric suction developed at dry states in the samples was not considered as it is believed to be negligible. Similarly, close to saturation, development of positive pore water pressure was disregarded since the tests were carried out under free drainage conditions. For subgrade materials with high fine content, this is not true and negative pore water pressure (matric suction) at low moisture content can contribute considerably to higher bulk stress of the material. Thus, in a proper analysis of fine grained materials matric suction properties to be included in the mathematical modelling.

Moisture in Pavement structures: Moisture balance in pavement structures continuously evolves over time. During the construction phase, pavement unbound materials are usually compacted at values close to their optimum moisture content in order to reach maximum dry density conditions. However, after construction, this moisture content changes to a natural equilibrium state that is usually lower than the optimum moisture content but is greatly dependent on the ambient environmental conditions, material properties, crack severity of the bituminous bound surface layers, and the groundwater table level. The moisture content can still deviate from the equilibrium state due to seasonal climatic factors such as rainfall, groundwater table variations, and freeze and thaw actions.

Conceptual model of the relation between road and ground water

The pavement cross section divided into Vadose Zone (Surface water Zone, intermediate vadose and capillary water zone) underlined by a saturated zone. The moisture in the vadose zone is highly dependent on the ambient climate, the local geometry and material properties of the pavement structure. It can therefore vary from being low during dry periods to very high or almost saturated through wet periods or the spring thaw period, with locally developed ice lenses. A large part of the induced loading from the heavy traffic is distributed through the vadose zone. Hence, the mechanical parameters of these layers need to be updated accordingly as they are moisture dependent.

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Resilient modulus modelling:

The stiffness of pavement unbound materials and the subgrade soils are widely characterized by the resilient modulus MR that is usually obtained from RLT testing. The resilient modulus represents the stress strain behavior of unbound materials under repeated traffic loading, analogous to the elastic modulus used in the elastic theory. In RLT testing, the resilient modulus is defined as the ratio of the cyclic deviator stress (σ_d) to the recoverable axial strain (ϵ_r). The resilient modulus measured under conditions representative of the stress state induced by traffic loading and the ambient environment that is experienced by the unbound materials in the pavement system.

Several researchers have proposed mathematical models that describe the stress dependency of the resilient modulus for unbound layers and subgrades with high fine content. These models have mainly been developed from curve fitting of laboratory RLT test data and do not directly account for environmental factors that are mainly related to variations in the material moisture content. For coarse-grained unbound layers a total stress approach can usually be assumed, and the resilient modulus is commonly described according to the universal model as $M_R = k_1 \left(\frac{\sigma_v}{p_a} \right)^{k_2} \left(\frac{\sigma_v}{p_a} + 1 \right)^{k_3}$

Permanent deformation modelling

The mechanical resistance of UGMs and subgrades to plastic deformation during cyclic loading derives mainly from particle interlocking and friction between the aggregates. The induced stress pulses cause relative movements between the aggregates that to some extent are not recoverable and results in further compaction of the material, particle crushing or material migration. Presence of moisture films provide local pore pressure to reduce the effective stress. This decreases the internal friction among the particles and therefore aids in their relative movements. Hence, the accumulation of permanent deformation increases as the moisture content increases. Generally, the development of permanent deformation in UGM can be characterized as consisting of two phases. In the initial phase, there is a rapid increase in permanent strain with load applications. This phase is described as post-compaction, which is accompanied by densification of the material, reduction in pore volume and volumetric change of the material. In the second phase, the deformation rate becomes more or less constant and is dominated by volume change, although shear deformation rises at an increasing rate. At failure, only shear strain movements take place without any volume change.

Some of the Models which are described more in details are of

1. Tseng and Lytton model
2. Gidel et al. model
3. Korkiala-Tanttu model
4. Rahman and Erlingsson model

All the models used were able to capture the main behavior of the

experimental accumulated permanent deformation development for both UGMs and subgrade with the number of load repetitions in MS RLT tests using the time hardening formulation. The quality of prediction is inherent in the models. Generally, the Rahman and Erlingsson model performed better than the others. The predictions of the shakedown ranges by the different models were also sufficiently accurate. However, the models were developed based on the MS RLT test that does not take into account the effect of principal stress rotation occurring in real pavement structures under moving traffic loads. Hence to implement the models for field conditions, some modifications may be necessary and should be subject to further investigations.

The unbound layers and the subgrade of a pavement structure provide a significant support for the structure as a whole. Hence the mechanical properties of these materials are important for the overall performance of the structure. These materials are both non-linearly stress dependent and highly affected by their moisture content. This paper describes two of the most important material properties of the unbound layers of the pavements, i.e. the resilient and the permanent deformation properties.

The resilient properties of UGMs and subgrades exhibit stress dependency that can be well captured by the universal model or the enhanced model by Cary and Zapata for materials with high fine content. Bishop's effective stress approach can be used for fine-grained materials for estimating the effective stress in the layer. UGMs and subgrade materials are further highly moisture content dependent. Either the AASHTO sigmoidal model can be used to describe the moisture dependency or the simple exponential model.

The stress dependency of UGMs can be captured by the universal model or the enhanced model by Cary and Zapata (2011) for materials with high fine content. The Bishop's effective stress approach can be used for high fine content materials for estimating the effect of suction. UGMs and subgrade materials are further highly dependent on moisture content. Either the AASHTO sigmoidal model can be used to describe the moisture dependency or the simple exponential model described in this paper. The paper further discusses four models to characterize the accumulation of permanent deformation with the number of load repetitions in repeated load triaxial (RLT) testing. The models are all developed to fit single stage (SS) RLT test results but have been extended to fit multi-stage (MS) RLT test results with the aid of the time hardening scheme. The advantage of the MS RLT tests over the SS RLT tests is that it applies a range of stress paths on a single specimen, thus taking into account the effect of stress history and reducing the time and effort required to test a separate specimen for each stress path.

The objective of this paper is to give a brief overview of the resilient modulus and permanent deformation characteristics of unbound layers and subgrade materials and specifically their moisture dependency. This has been achieved by running RLT tests on a large amount of materials. For the coarse-grained materials the matric suction developed at drier states in the samples was not considered as it is believed to be negligible. Similarly, close to saturation, development of positive pore water pressure was disregarded since the tests were carried out under free drainage conditions.

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LEED AP, CFPS, MME (A)



SUSTAINABILITY TOWARDS A BETTER FUTURE

“The greatest threat to our planet is the belief that someone else will save it.”

– Robert Swan, Author



What is Sustainability?

Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations.

The Genesis of Sustainability.

The concept of sustainability as we know it today, was first introduced in the Brundtland Report, also known as Our Common Future, published by the United Nations in 1987. This report was the first to recognize the disastrous environmental effects of economic development and globalization, and aimed to provide solutions to problems arising from rapid industrialization and population growth.

Why Is Sustainability Important?

The National Environmental Policy Act of 1969 committed the United States to sustainability, declaring it a national policy "to create and maintain conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations."

Achieving Sustainable Development is the requirement of time :

Many of the challenges facing humanity, such as climate change, water scarcity, inequality, and hunger, require a global approach and a commitment to sustainable development.

As Mahatma Gandhi once said, "Be the change you want to see in the world." This change must begin with us, and here's how we can get started:

Sustainable Building Technology

Greater energy efficiency is the best way to achieve the benefits of sustainability. Sustainable building construction plays a vital role in every stage of development and design. Every aspect of the structure, design, materials, and systems used to run and maintain the building project must be as sustainable and efficient as possible.

Solar Power

Harnessing the sun's infinite solar power has been the oldest and most utilized form of sustainable technology. Encouraging residential communities to use solar panels to reduce power consumption will help in generating the dependency on fossil fuels.

Smart Appliances

It's hard to imagine a time without appliances in our modern world. Our natural energy resources primarily power homes and commercial buildings, necessitating the use of smart appliances to achieve energy efficiency. Innovative technology emphasizes the installation of energy-saving and self-sufficient devices. Intelligent household appliances

"Be the change you want to see in the world."

-Mahatma Gandhi



such as refrigerators, microwaves, dishwashers, and lighting kits are examples of such efficient technology. The technology focuses on establishing zero-energy homes as well as commercial buildings.

Cool Roofing System

Sustainable roofs are emerging green design technology to reflect heat and sunlight. They help maintain standard room temperatures in homes and office spaces by lowering heat absorption and thermal emittance. The technology uses reflective paints and unique tiles that absorb less heat and reflect away most solar radiation. They can effectively reduce dependence on the air-conditioning system and, in turn, mitigate energy use and decrease green-

house emissions.

Water Efficiency Technologies

Several water-efficient technologies are a reliable part of sustainable construction technologies. Essentially, the technologies encompass the reuse and application of efficient water systems. Examples include dual plumbing, greywater reuse, rainwater harvesting, and conservation fixtures. The technology sufficiently manages water supply, recycled and used for non-potable purposes like washing cars and flushing toilets.

Self-Powered Buildings

The advancement of self-powered buildings is an art of sustainable construction technology since self-powered buildings achieve zero-energy construction. It can generate sufficient power to support their energy needs and even direct surplus energy into the facility grid. In most cases, wind generation technology is prevalent in skyscrapers, with wind turbines mounted at the rooftops. The constant and heavy air currents at higher altitudes propel the turbine blades, which generates the energy requirements for the building.

We have a responsibility to understand that what we build today must endure and improve the lives of future generations. Green buildings and the technology that comes with them are aimed at reducing and eventually eliminating the universal effect of the built environment on our natural environment



About the Author:

Imran Kamurudeen is Senior Mechanical Engineer with 19 years of gulf experience and 21 years of total experience. He has expertise working on LEED and GSAS-related projects and is a LEED AP (BD+C) certified individual. He is UPDA & QCD Approved Grade-A Engineer holding CFPS Certification from NFPA.

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January 2023



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 - FITTINGS & ACCESSORIES
- District Energy - MARINE - OIL AND GAS industry
 Country of origin: POLAND

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- STRAINERS
- NON-RETURN VALVES

Country of origin: POLAND & INDIA



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 - ELECTROSTATIC FILTERS
 - INDOOR AIR QUALITY PRODUCTS
- Country of origin: ITALY

DIEHL Metering

- ULTRA SONIC METERING
- BTU METERING
- FLOW MEASUREMENT
- ENERGY MANAGEMENT SOLUTIONS

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Er. Paul Jacob Palayil
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Artificial Intelligence Applications and Challenges

Abstract—Artificial Intelligence (AI) is part of everyone’s life hand in hand with Human Intelligence. Interconnected technologies of Engineering, Computer Algorithms and other innovations in AI expected to alter the way we live, work, connect and relate to ourselves in future. AI can handle repetitive, data driven tasks and give results with precision of predictions and recommendations too. Automated operations, robotics replacing human intervention on execution of routine tasks because of Machine Learning (ML) and Deep Learning (DL) is most visible nowadays. According to Gartner; AI appears to emulate human performance typically by learning, coming to conclusions, understand complex content, engaging in natural dialogs with people, enhancing human cognitive performance, or replacing humans on execution of non-routine tasks too in future. This literature review details some most advanced applications with examples and concerning matters of AI.

1. INTRODUCTION

AI focuses on the study of autonomous algorithms or computer programs with the capacity to think, learn, and act independently. McCarthy, Minsky, and Rochester defined the idea of AI in the 1950s, which can be considered the beginning of AI history. Today’s AI can comprehend, identify, and resolve issues from both organized and unstructured data - and in some situations, without being explicitly trained. The Traditional AI perform specific tasks based on predefined rules and patterns, Generative AI employs advanced ML, often DL models such as Generative Adversarial Networks (GANs) or Variational Autoencoders (VAEs). Together with training on massive datasets to understand the patterns and underlying structures it learns to create entirely new data that resembles human-created content. Businesses can apply them to; Create realistic product prototypes, Generate personalized content for customers, Design compelling marketing materials, Enhance data analysis and decision-making processes, Develop new and innovative

products or services, Automate repetitive tasks, Streamline operations, Gain a competitive edge in the market & Enhance creativity.

2. LITERATURE REVIEW

A. AI & Healthcare

AI was crucial in responding to Covid-19 outbreak and in the development of the vaccination where it was utilized to evaluate the combinations of substances and procedures as well as data processing. AI applied Positron Emission Tomography (PET CT) & Magnetic Resonance Spectroscopy (MRS) can detect diseases and identify cancer cells.

AI use in Lab technology are through Image Analysis and Predictive Modelling. AI can help analyze chronic conditions with lab and other medical data to ensure early diagnosis. The AI program CHARLES®, designed in partnership with Microsoft and its Azure platform, serves as the forerunner for the launch of Bureau Veritas’s AI Augmented Labs. AI uses the combination of historical data and medical intelligence for the discovery of new drugs. PathAI creates AI-powered technology for pathologists. The company’s ML algorithms help pathologists analyze tissue samples and make more accurate diagnoses to improve diagnostic accuracy & treatment results. AI used to detect skin cancer more accurately than dermatology experts. AI app BioBeats can track and



Robots are gradually taking over surgeries requires more precision & cleaning. Intuitive Surgical, using their Da Vinci machines to control the robot’s arms for complex cases.

evaluate user behavior and identify first signs of depressions etc. Deepmind health has undertaken may AI based apps and developed programs in Healthcare. The human brain scan and treatment uses robotics and AI for scanning. Cambio Health Care developed computerized clinical decision support system for stroke prevention (Cambio CDS apps) that can give the physician a warning for patient's heart stroke. Coala life, their digitalized Heart Monitor can predict cardiac diseases.

Challenges and trends

AI-driven diagnostics and treatment recommendations will become more accurate and widely adopted. ML algorithms will enhance drug discovery processes, making them faster and more cost-effective. AI will advance in predicting health outcomes, offering individualized care plans, and even treating illness as it continues to develop. Healthcare professionals will be able to treat patients more effectively. Remote patient monitoring, AI-powered alarm systems, and virtual assistants using Natural Language Processing (NLP) solutions etc. are widely used now. The application of AI across a broader variety of specialties, such as oncology and neurology has already been made. Neuralink hopes to use its microchips to treat conditions such as paralysis and blindness, and to help certain disabled people use computers and mobile technology. It's First-in-Human Clinical Trial is Open for Recruitment.

B. AI in Cyber and Data security

Data security is one of the most prevalent and critical applications of AI for identification of unknown threats, Flaw identification, Threat prevention, responding to threats and recognize uncharacterized actions. Cybersecurity companies have developed software and platforms powered by AI to detect the online threats in real-time. Deep Instinct, Computer Vision, Cofense, Cybergraph, Microsoft's Cyber Signals applications uses ML, DL & neural networks to enhance the security efficiency rate. AI also improves network monitoring and threat detection technologies by minimizing noise, delivering priority warnings & vulnerability reports, utilizing contextual data backed by proof, and using automated analysis based on correlation indices from cyber threat intelligence.

Challenges

AI and ML are already being used as tools by malicious governments and criminal hackers to identify and exploit threats in threat detection models. Firms needs to invest heavily on the cybersecurity and all connected devices to meet the compliance requirements.

C. AI in Customer Service & Communications

AI robotic processing automation (RPA)for routine tasks in scalable and adaptable performance requirements is common. Chatbots, voice assistants, and other messaging apps that use conversational AI for providing automated round-the-clock support in contact centers, insurance enrollment and billing, claims processing, and medical coding, among other applications in healthcare, finance, retail and travel sectors.

A wide range of business sectors have utilized AI technologies to produce news stories, social media posts, legal filings and banking reports. AI's human-like correlations, especially when expressing itself in textual analysis available in a conversation box called ChatGPT. GPT-4 is the most recent version of OpenAI's Large Language Model (LLM). Alphacode (transformer-based language model) & Bard by Google are other examples. Both AI systems accomplish this by synthesizing the data after mimicking human speech and language. DALL-E (OpenAI) has demonstrated the capacity to generate graphics from simple instructions. Siri, the famous virtual assistant from Apple is most popular AI app like Alexa, Cortana, Echo, Google duplex. Conversational AI/chatbots has introduced new forms of human communication through

touch, facial expressions and contextual awareness with each passing day.

D. AI in Education

AI performs (by using Data and Learning Analytics) non-educational tasks like facilitating and automating personalized messages to students, grading paperwork, arranging and facilitating parent and guardian interactions, managing enrollment, courses, and HR-related topics. Digitization of content like video lectures, conferences, and textbook guides can be made using AI. We can apply different interfaces like animations and learning content through customization for students from different grades. The co-bots, or robots



Qlickhealth, in Qatar uses humanoid "Kebbi" for Autism Spectrum Disorder kids for education and rehabilitation. Popular eLearn Apps; Gradescope, Ivy Chatbot and Cogni uses audio and video contents & integral lesson plans.

collaborate with teachers or other students to teach youngsters regular skills like spelling and pronunciation while also adapting to the students' capacities.

Without the direct involvement of the lecturer, a student can access learning material and Voice Assistants for tuton. Using Simplilearn, hyper-personalization techniques can be used to monitor student's data thoroughly, and habits, lesson plans, reminders, study guides, flash notes, frequency or revisions etc.

Challenges

At all levels of education, AI will likely be transformative. Students will receive educational content and trainings tailored to their specific needs with optimal educational strategies based on students' individual learning styles. Over reliance on technology, all-inclusive public policy & equity, social issues, Privacy concerns, ethics and transparency are issues to be resolved.

E. AI in Finance

Financial organizations are turning to AI to improve their stock trading performance and boost profits. Customers looking for help regarding complaints, wealth management solutions can easily get it through SMS, mails or online chat, all AI-powered. AI can also detect changes in transaction patterns and other potential red flags that can signify fraud aside from verifications & task automation. AI can predict loan risks. HDFC bank has developed an AI based chatbot called EVA by Senseforth. Alphasense AI powered financial search engine helps investment firms gain on information edge. Japan's leading brokerage house, Nomura Securities research and analyze the insights of experienced stock traders with the help of computers set to introduce a new stock trading system.

F. AI in Navigation, Travel and transport

At the Qatar Computing Research Institute, Satellite imagery is used to supplement mapping data to improve GPS navigation. Road Tagger works with unique combination of a convolutional neural network (CNN), which issued in image processing, and a graph neural network (GNN), which establishes relationships between nodes in a graph. It identifies information about roads, such as their lane count, emergency event, parking spaces and bike lanes with a high degree of accuracy. Drivers may receive a head-up regarding

merging or diverging lanes as a result.

Electric Autonomous Aircraft designs underway using AI. Truck Platooning, Ride sharing, Traffic Management, Qlickhealth, in Qatar uses humanoid "Kebbi" for Autism Spectrum Disorder kids for education and rehabilitation. Popular eLearn Apps;



Gradescope, Ivy Chatbot and Cogni uses audio and video contents & integral lesson plans.

Route Planning etc. uses AI technologies such as predictive analysis, big data analysis, and a visual search engine to track road networks in real-time and reduce congestion makes transportation efficient and reduce the delivery costs. Uber makes use of AI in all possible ways, so is Google Maps to make commutes easier. With AI-enabled mapping, the search giant's technology scans road information and uses algorithms to determine the optimal route to take — be it on foot or in a car, bike, bus or train. It also has voice assistant and creating augmented reality maps to help guide users in real time.

Autonomous vehicle like Tesla's self-driving car uses AI like computer vision, image detection and DL to build cars that can drive around without human intervention. How far we are from using robotaxi's?

G. E-Commerce

AI can help reduce the possibility of credit card fraud taking place. AI-driven algorithms personalize the user experience, increase sales and build loyal and lasting relationships. Companies use AI to deploy chatbots, predict purchases and gather data to create a more customer-centric shopping experience and recommending the right products.

Whole Foods has relied on Amazon's Just Walk Out to give its stores a competitive edge. The system uses computer vision, sensor fusion and DL to track every item customers put in or take out of their cart and build a matching virtual shopping cart. Customers can connect their payment method when they enter the store and get a digital receipt after leaving without any checkout interaction.

H. Robotics

Robots powered by AI use real-time updates to sense obstacles in its path and pre-plan its journey instantly. It can be used for: Carrying goods ensuring faster delivery & Inventory management, Cleaning offices and equipment. Infusing AI into the production makes smarter factories, boosting productivity and lowering costs. AI may be utilized in assembly lines, inspections, supply chain optimization, improving performance using sensors, designing and in post-production activities.

The Hanson-created Sophia is an incredibly advanced AI social-learning robot which can efficiently communicate with natural language and use facial expressions of human-like emotions. Developed in 2021, Ameca is also one of world's best human-shaped robot of human-robotics technology.

I. Smart cities and infrastructures

Systems and technologies in Power Grids like FACT devices Flexible AC transmission System), penetration of Renewable Energy Sources (RES), Automatic Grid Protections, Smart substations, Smart

metering, Smart buildings ensure latest use of AI in bringing system security & reliability. Real time monitoring, predictive management ensuring resources optimization as well.

J. Agriculture

AI is used to identify defects and nutrient deficiencies in the soil. This is done using computer vision, robotics, and ML applications, AI can analyze where weeds are growing. AI bots can help to harvest crops at a higher volume and faster pace than human laborers. Blue River Technology has developed a robot called See & Spray which uses computer vision technologies like object detection to monitor and precisely spray weedicide on cotton plants. Precision spraying can help prevent herbicide resistance.



Tevel. Apart from this, Berlin-based agricultural tech PEAT has developed an application called Plantix (using image and pattern recognition) that identifies potential defects and nutrient deficiencies (about 95%) in the soil through images. Users are then provided with soil restoration techniques, tips, and other possible solutions.

3. PROS & CONS

AI tools used for quick processing and analyzing the data are going to replace human skills in many areas which will lead unemployment problems, when the human society is in dystopia. Quantum ML algorithms can perform complex computations faster, enabling more advanced AI capabilities. One way to prevent an AI disaster might be to regulate how AI is developed and used. Addressing potential risks posed by AI could begin with steps like appropriate risk-management strategies, conducting research to determine how AI can better meet designer's intent, and devising responses to issues related to racism, sexism, and other AI biases.

4. DO WE HAVE CHOICE?

Face book, X etc. uses face verification to tag your friends, ML algorithms to design your feed based on interests and (by ML, DL & NLP) identify hate speech. Despite all concerns on ethics, compliance, regulations, bias, we hope the world will use AI to get quality, precision & profits to help grow civilization while tackling the raised concerns with time.

5. WHO WILL BE AFFECTED?

More impact by this AI transformation will include office support, customer service, hospitality jobs, Travel agents, drivers, Coders, Data entry jobs, Logistics operators, clerks, retail salespersons, administrative assistants, teachers, traders, analysts, Blue collar jobs, tech jobs and cashiers.

6. WHAT TO DO?

To pursue the skills what is needed to become relevant in the given field by suitable Trainings, Development & related management of AI implementation and its operations.

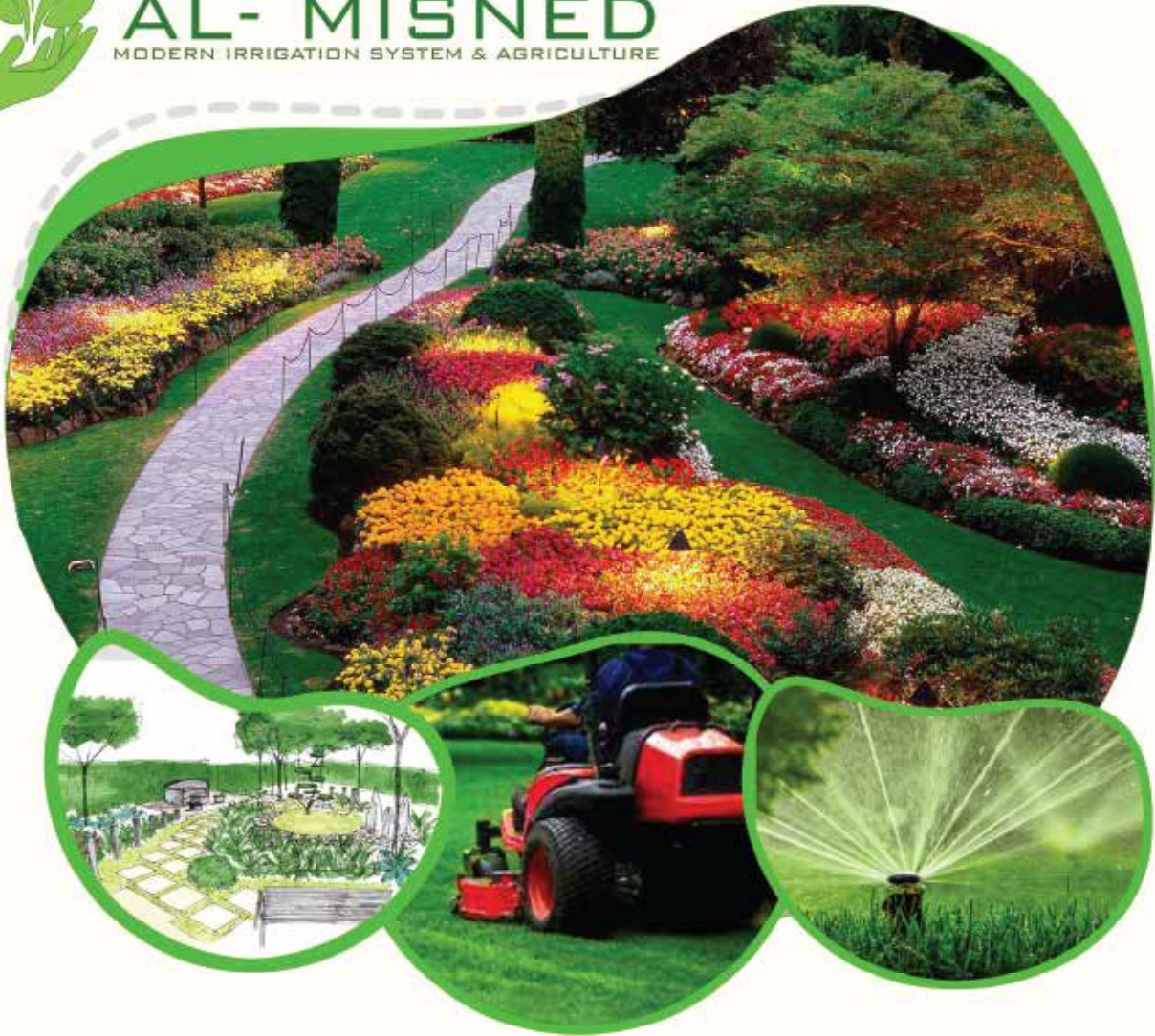
7. CONCLUSION AND RECOMMENDATION

Understanding the strategic directions and overall trends of AI innovation will help Leaders identify the opportunities enabled by new technology and define strategies for new challenges.



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TEMPERATURE ANALYSIS OF CONCRETE STRUCTURE

Part 1 – Synopsis:

A reliable estimate of the possible induced actions in any structure under ambient temperature variations is an essentially critical aspect of structural design which can be misinterpreted often by many engineers. The consequence of such ignorance in design can potentially lead to very undesirable outcomes ranging from unpleasant aesthetics to potentially dangerous downgrading of structural member capacities. The primary purpose of this article is to provide a better understanding about the behavior of reinforced concrete structure under induced or ambient temperature effects and to provide a systematic method for temperature analysis of the structure.

Part 2 - Reference Design Documents:

- ✚ CIRIA C766 - Control of cracking caused by restrained deformation in concrete. (year of publication 2018)
- ✚ TR 67 - Movement Restraint and Cracking in Concrete Structures. (with Amendment 01, 01 May 2008)
- ✚ ACI 314-19 - Building code requirement of structural concrete. (October 2019)
- ✚ ASCE-07-16 - Minimum load requirements of Buildings and other structures (year of publication 2017)
- ✚ QCS 2014 - Qatar Construction Specification

Part 3 - Temperature Loads:

The ASCE 7-16 code requires that structures and their elements are designed for cumulative effect of self-straining forces and contraction or expansion effects arising from environmental or operational temperature changes, shrinkage, moisture changes, creep in component materials, movement caused by differential settlement or combinations thereof.

Temperature load during construction and permanent stage should also be considered in analysis and design. The short-term temperature variations can be due to either of the following effects:

- Daily temperature variation
- Solar radiation

The daily temperature variation is the rise/ fall between peak and low daily temperatures, while the solar radiation is the heat imparted on the surface of a structure.

Seasonal temperature variation can be calculated based on the average temperature values during the time of casting concrete and the average temperature variations throughout other seasons.

The average value for seasonal temperatures in Qatar can be extracted from reliable meteorological data or directly measured for a specific site. The table below provides a sample of such values.

Climate data for Doha													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	31.1 (88.0)	33.9 (92.9)	38.9 (102.0)	41.8 (107.2)	47.7 (117.9)	51.1 (124.0)	51.9 (125.4)	49.9 (119.8)	45.5 (113.9)	41.4 (106.5)	38.9 (102.0)	32.1 (90.0)	39.1 (102.4)
Average high °C (°F)	23.1 (73.6)	27.7 (81.9)	32.3 (90.1)	36.2 (97.2)	41.1 (106.0)	45.3 (113.5)	46.7 (116.1)	43.9 (110.9)	39.9 (103.8)	35.1 (95.2)	31.1 (88.0)	25.4 (77.7)	32.8 (91.0)
Daily mean °C (°F)	17.2 (63.0)	17.8 (64.0)	21.2 (70.2)	25.1 (77.2)	31.1 (88.0)	35.3 (95.5)	36.1 (97.0)	33.9 (93.0)	30.1 (86.2)	26.1 (79.0)	22.1 (71.8)	18.2 (64.8)	23.8 (74.8)
Average low °C (°F)	12.1 (53.8)	13.7 (56.7)	16.7 (62.1)	20.8 (79.4)	27.7 (81.9)	31.1 (88.0)	31.9 (90.4)	29.9 (85.8)	26.1 (79.0)	21.4 (70.5)	17.1 (62.8)	13.1 (55.6)	19.8 (67.6)
Record low °C (°F)	1.8 (35.2)	5.5 (41.9)	8.3 (46.9)	10.5 (50.9)	15.2 (59.4)	21.3 (70.3)	23.4 (74.1)	22.4 (72.3)	20.2 (68.4)	16.4 (61.5)	12.5 (54.5)	8.5 (47.3)	13.9 (57.0)
Average rainfall mm (inches)	10.2 (0.40)	12.1 (0.48)	18.1 (0.71)	27.8 (1.10)	38.8 (1.53)	51.1 (2.01)	51.9 (2.04)	49.9 (1.97)	45.5 (1.79)	41.4 (1.63)	38.9 (1.53)	32.1 (1.26)	39.1 (1.54)
Avg. rainy days (≥ 1 mm)	1.7	2.1	2.1	3.4	5.0	6.0	6.0	5.0	4.0	3.1	2.2	1.3	2.4
Average relative humidity (%)	71	70	68	62	54	47	46	50	57	65	74	81	76
Mean monthly sunshine hours	241.1	244.6	241.8	225.3	225.3	242.1	255.1	258.4	239.3	201.1	216.6	241.8	242.3

Source: NOAA (1981-2020)

Summary of Average Climate condition Doha, Qatar (Source: NOAA 1981-2020)

Figure 1: Sample Table for Seasonal Temperature Variation in Doha, Qatar

The above values represent the maximum and minimum peaks for ambient temperature as measured for Doha, Qatar. Given the infrequent and short-term nature of these maxima temperatures, it would be too conservative to design the global structure for the equivalent thermal range derived from these peak temperatures. In addition, if the primary structure is composed of relatively deep concrete elements, the inherent high thermal mass would inevitably result in a high thermal lag and therefore the average temperature through the element will not be highly sensitive to short term peaks in the air temperature.

Several temperature record sources for Qatar were assessed to determine the appropriate temperature ranges and associated strains to be used in the calculation of the thermal loads.



Source: <https://weatherspark.com/y/150272/Average-Weather-in-Qatar-Year-Round>

Figure 2: Graph of average maximum, minimum temperature variation Doha, Qatar

From the above data it is observed that the lowest and highest average temperatures can be taken as 12 °C and 42 °C respectively.

Part 4 – Induced Temperature in Reinforced Concrete structures due to seasonal variation:

Based on the discussions presented in previous section, it will be prudent to design reinforced concrete structures for a differential thermal temperature derived from mean maximum and minimum seasonal temperature values.

As per QCS 2014 requirements, and best practice, the concrete cannot be poured (casted) if its temperature rises more than 32 degrees, hence the maximum allowable lower-bound for temperature will be 12-32 = - 20 deg.

Whereas, if the concrete is poured on winter, it will experience the maximum average summer temperature during its lifetime. Consequently, the maximum allowable upper-bound for temperature will be 42-12 = + 30 deg.

Note: The temperature variation on shaded structure will be less than above values which can be calculated as per actual conditions.

Part 5 - Behavior of Reinforced Concrete Structures due to temperature variation:

Daily and seasonal temperature variations along with shrinkage and creep effects will cause dimensional changes to concrete. If the changes are restrained, corresponding thermal stresses will develop in the members. When temperature rises, it will create compression force. Whereas, when temperature drops it will create tension force. This may lead to cracking in the reinforced concrete structures once the resulting tensile stresses exceed the tensile strength of the concrete. The latter can be calculated based on governing Code provisions such as ACI 318-19.

Part 6 - Influence of long-term shrinkage and creep:

Drying shrinkage strain is a function of the migration of water through the hardened concrete and therefore develops slowly. When concrete is placed, it usually contains more water than required

for full hydration. When concrete is exposed to drying condition, both the aggregate and cement matrix shrink as water is lost, resulting in an overall shrinkage of concrete. The rate of shrinkage depends on the ambient humidity, section size and tends to decrease with age. The use of good-quality aggregate and low water to cement (W/C) ratio will reduce the amount of shrinkage developed. Although retention of moisture by curing until the concrete becomes mature is a generally good practice for many reasons, it has little effect on total shrinkage, although it tends to delay the onset of drying and shrinkage. When concrete is subjected to long term stress, it gradually deforms with time. This process is called creep. The amount of creep depends on ambient humidity, size of the element, composition of the concrete, maturity of the concrete when load applied and magnitude and duration of the loading. The ratio of creep movement to initial elastic movement is known as creep coefficient.

Part 7 - Controlling of cracking:

The principle of controlling the cracking by reinforcement are illustrated Fig 03. If concrete starts to contract but is restrained (so that movement can't occur), tensile stress will gradually build up. When this stress reaches the tensile strength of the concrete section, cracks will generate. The formation of cracks will tend to release the stress, but as contraction continues the stress will build up again. If the strength of reinforcement is lower than the force resulting in the formation of the first crack, it will yield, and all future contraction will concentrate at same point so that crack will get wider as shown in Fig 03(a). If the strength of the reinforcement is more than the cracking action, it will remain elastic and as the contraction increases, a new crack will form at the next weaker cross section. The process then continues till enough cracks form to absorb the total contraction as shown in Fig 03(b) or the cracks are so close together that no further cracks can be formed. But this latter situation requires a total strain of around $1000\mu\epsilon$, which is not likely to reach under normal movements. The crack in the first model Fig 03(a) is uncontrolled, while the cracks in second model Fig 03(b) are controlled.

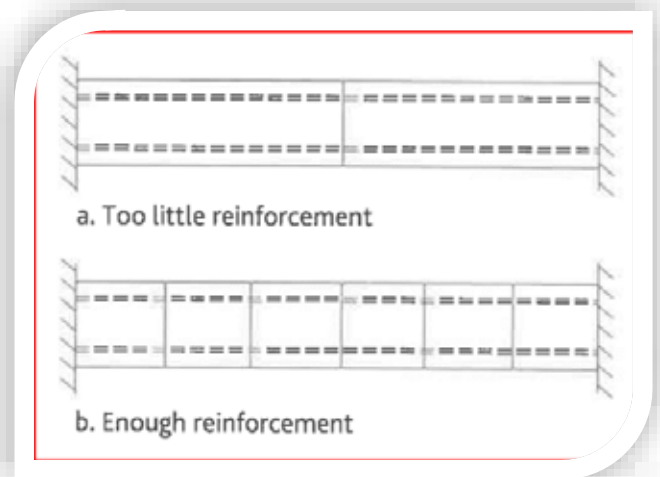


Fig 01 (a)

Figure 3: Response of under-reinforced (a) and sufficiently reinforced Concrete structure(b) due to temperature variation

Part 8 - Design Methodology:

Based on the principles discussed in the previous sections, it is evident that reinforced concrete members will tend to crack due to thermal and shrinkage stresses, and that the occurrence of cracking will tend to relieve the stress. However, if the member has sufficient reinforcement to withstand the induced tensile stresses, it behaves in a ductile form with numerous micro cracks.

The recommended tensile stress for reinforced concrete members ranges from $0.25\sqrt{f'_c}$ to $0.62\sqrt{f'_c}$ based on actual reinforcement of the structure (The ACI 318-19 code recommends providing minimum amount of reinforcement based on tensile strength of concrete as calculated from $0.25\sqrt{f'_c}$).

It is important to note that these cracks might lead to deformation of the structure, hence it is necessary that the deformation of the structure is checked and be limited to allowable design values under service level loads.

This can be generally done by either of the following methods:

1. Stiffness modification method
2. Detailed finite element analysis method

The remaining sections provide a short summary on these approaches.

Part 9 - Stiffness modification method:

As discussed earlier, the induced thermal stress in concrete is based on the level of restraint provided to the structure. The corresponding reduced stiffness of the member/structure after cracking can be calculated based on any reasonable methods based on basic principles of mechanics of materials. In lieu of a detailed crack analysis, simplified values for stiffness modifiers for various members can be taken as recommended by the design Code. Table-1 below shows some recommended values based on ACI 318-19 provisions.

Member and condition	Moment of inertia	Cross-sectional area for axial deformations	Cross-sectional area for shear deformations
Columns	$0.70I_g$	$1.0A_g^*$	$b_v h$
Walls	Uncracked $0.70I_g$		
	Cracked $0.35I_g$		
Beams	$0.35I_g$		
Flat plates and flat slabs	$0.25I_g$		

*The Axial stiffness can be modified as 0.5 to include the creep effect which is vital for temperature loading

Figure-4. The stiffness modifier recommended by ACI code.

Part 10 - Analysis of Structure using Finite element model:

A separate finite element structural model for the member can be developed to analyze the members under induced thermal model. Typically, the model will consist of a small-scale finite element mesh in a commercially popular software such as SAFE® or ETABS® or similar software. The analysis can be run using an axial stiffness modifier of 0.5 to consider the creep effect on slab members. The stress on slab can be examined carefully for all load combinations including thermal loads to identify the locations where the resulting stress values exceed the capacity. The stiffness modifier can be further reduced to decrease the induced stress on the member to limiting values. The stiffness modifier can vary from location to location. For example, at the free edges there can be less reduction in these values (due to possibility of free movement) and can be further reduced at restrained boundaries. This process is explained in the flow chart diagram shown in Figure-4. These crack patterns (stiffness modifier pattern) can be replicated over the full 3D

model to provide a detailed assessment of member stresses, deformation and cracking pattern for the whole structure.

Note: using spring-type supports to represent the support condition may be a preferable option as providing rigid support condition would leads to unrealistic stress concentration as restrains are infinite under such condition.

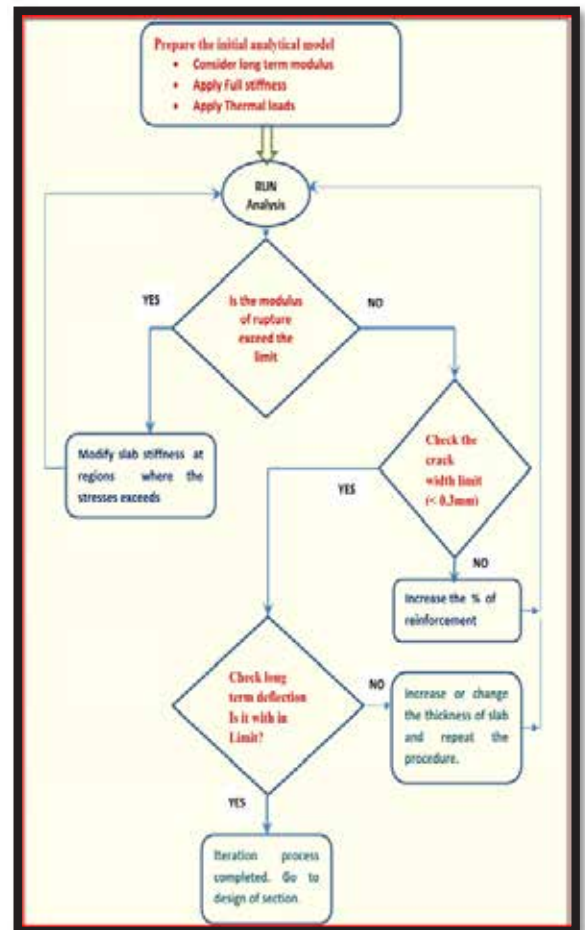


Figure-5. The Flow chart for temperature analysis

Part 11 – Conclusion:

This paper provides a brief discussion on rational methodologies to account for temperature-induced actions in reinforced concrete structures. A reliable assessment of such stress/deformations is essential for the design of such structures and to achieve their intended performance during their intended lifetime. Understanding the behavior of reinforced concrete structures under ambient thermal effects and their intrinsic deformation characteristics may lead to an optimal design of such structures by accounting for the stress-relief under resulting cracks and tends to result in optimized use of reinforcement.

Webinar June 2023

Empowering LDC Through Information & Communication Technologies

The poster features logos for the 50th anniversary of the IIT Madras, The Institution of Engineers (India) Qatar Chapter, and the 75th Azadi Ka Amrit Mahotsav. The title is "WEBINAR ON 'Empowering The Least Developed Countries Through Information and Communication Technologies'". It lists four dignitaries: Inaugural Address by Mr. Nasser Jafar Al Kowari, Guest of Honour by Ms. Sarah A Al Mansoori, Guest of Honour by Mr. Jaber Mohammed Al Ajlani, and Presidential Address by Mr. K.M. Salihudeen FIE. A panelist section lists four speakers: Mr. Sand Varkey, Mr. Sushil Kumbha, Mr. H. Nagarajan, and Mr. Abdul Sattar. Zoom meeting details are provided: Meeting ID: 820 9860 8880, Password: IIEI Qatar, on 03 JUNE 2023 at 6:30-8:00 PM. Registration links are www.iei.qa and www.events.iei.qa.

Webinar June 2023

Engineering Software Series

The poster features logos for the 50th anniversary of the IIT Madras, The Institution of Engineers (India) Qatar Chapter, and the 75th Azadi Ka Amrit Mahotsav. The title is "WEBINAR ON Engineering Software Series". It lists two dignitaries: Chief Guest Mr. Ahmed Jassim Jolo and Presidential Address by Mr. K. M. Salihudeen. Two topics are listed: Topic 1: Common Data Environment and Topic 2: BIM-360. Four speakers are listed: Speaker 1 Mr. Raja Dhamalingam, Speaker 2 Mr. Amboj Thakur, Speaker 3 Mr. Ananth Nag, and Speaker 4 Mr. Balamurugan S. Zoom meeting details are provided: Meeting ID: 820 9860 8880, Password: IIEI Qatar, on 15 JUNE 2023 at 6:30-08:00 PM (Qatar) and 9:00-10:30 PM (India). Registration links are www.iei.qa and https://events.iei.qa.

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Er. Satheesh Chandran
B.Tech Electrical



The Evolving of ELV & IBMS: Paving the Way for Smarter Buildings

As we step into the future, the construction and infrastructure industry are witnessing a transformative shift towards smarter buildings that offer enhanced safety, comfort, and efficiency. A critical driving force behind this transformation is the Extra-Low Voltage (ELV) and Integrated Building Management Systems (IBMS) industry. In this article, we will delve into the current state of the ELV and IBMS sectors and explore how they are shaping the future of modern buildings. The ELV Industry - Powering Connectivity and Security:

The Extra-Low Voltage industry plays a crucial role in modern buildings, enabling seamless communication, security, and automation systems that operate at voltage levels below 50V AC or 120V DC. Key components of the ELV industry include:

1. Communication Systems: Facilitating effective communication is vital for any building. ELV systems encompass data networking, telephone, intercom, and audio-visual solutions that keep occupants connected and informed.

2. Security Systems: In an increasingly security-conscious world, ELV systems step up to the plate with features like CCTV cameras, access control systems, and intrusion detection systems, ensuring robust building security.

3. Fire Detection and Alarm Systems: Early detection of fire incidents is paramount to minimizing potential disasters. ELV-based fire detection and alarm systems provide critical safety measures for occupants.

4. Building Automation Systems: Automating building functions can significantly





improve energy efficiency and occupant comfort. ELV systems enable centralized control of lighting, HVAC, and energy management systems, reducing operational costs.

With urbanization on the rise and the demand for smart buildings increasing, the ELV industry is experiencing steady growth, catering to both residential and commercial spaces.

The IBMS Industry - Integrating Intelligence for Building Management:

The Integrated Building Management Systems (IBMS) industry goes together with ELV, revolutionizing how buildings are managed and controlled. IBMS brings

/multiple building systems into a single, centralized platform, offering several key functionalities:

1. Centralized Monitoring and Control: With IBMS, building managers gain real-time insights into various subsystems like HVAC, lighting, security, and access control, empowering them to make data-driven decisions.

2. Energy Management: IBMS optimizes energy consumption by analyzing data from different systems and implementing strategies to minimize waste, contributing to sustainability efforts.

3. Predictive Maintenance: Preventive maintenance is a game-changer for building operations. IBMS continuously monitors system health, enabling proactive maintenance that reduces downtime and increases system reliability.

4. Data Analytics: Leveraging the power of data, IBMS provides valuable insights into building performance, occupancy patterns, and equipment efficiency, empowering stakeholders to drive better outcomes.

The IBMS industry is witnessing remarkable growth, driven by the adoption of smart building technologies, environmental regulations, and the growing need for cost-effective and sustainable building operations.

The ELV and IBMS industries are at the forefront of reshaping the construction and infrastructure landscape. With smart buildings becoming the new standard, these technologies are powering connectivity, security, and efficiency in ways we could only imagine before. As we continue to push the boundaries of innovation, collaboration between industry stakeholders, architects, developers, and technology providers will play a pivotal role in driving further advancements in ELV and IBMS solutions.



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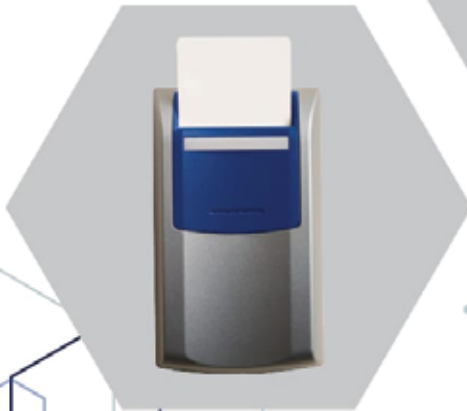
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Er. Shameer Majeed
Mechanical Engineer

Solving Marine Hydraulic System Challenges with NFC Hose Tagging Technology

Introduction

Marine hydraulic systems play a crucial role in the operation of vessels, and two key components of these systems are the hose handling crane and provision crane hydraulic systems. Hydraulic hoses play a critical role in the marine and oil & gas industries, where reliable and efficient fluid transfer is essential. However, vessel owners and shipyard engineers often face significant challenges when it comes to tracking and maintaining these hydraulic hoses. The incorrect tagging of hoses can lead to unnecessary hose replacements and extended project

completion times. Additionally, acquiring accurate specifications and information about the hoses, such as pressure ratings and last changed dates, becomes exceedingly difficult due to the painting over of tubes and fittings. This article aims to explore the difficulties faced in hydraulic hose replacement and provide insights on how to overcome them.

Challenges Faced:

1. Limited Hose Manufacturer Details: One significant challenge is the absence of specific

information about hose manufacturers. This lack of data makes it difficult to assess the quality, reputation, and reliability of the hoses available in the market. Without this knowledge, selecting the right replacement hose becomes a daunting task.

2. Inadequate Pressure Rating Information: The pressure rating of a hydraulic hose is vital to ensure it can withstand the required pressure levels without compromising safety and performance. Insufficient data regarding pressure ratings can make it challenging to identify hoses that are suitable for specific applications and environments.

3. Lack of Complete Hose Descriptions: Having complete descriptions of hydraulic hoses is essential to ensure compatibility with existing systems and understand their specific features and capabilities. Inadequate information about the hoses' composition, materials, and technical specifications can hinder the replacement process.



4. Insufficient End Fittings Details: Different applications and industries require specific types of end fittings for hydraulic hoses. Without complete details about these fittings, it becomes challenging to find replacement hoses that are compatible with existing systems.

The Importance of Accurate Hose Tagging:

Proper tagging of hydraulic hoses is of utmost importance in the marine industry. Each hose serves a specific purpose and must be precisely identified to ensure efficient maintenance and replacement. However, inaccuracies in hose tagging can result in the unnecessary replacement of hoses, leading to increased costs and project delays. The need for an efficient and reliable tagging system has become a pressing concern for vessel owners and shipyard engineers.

INTRODUCING NFC HOSE TAGGING TECHNOLOGY:

To address these challenges, a new solution has emerged: NFC hose tagging technology. NFC is a wireless communication technology that enables the exchange of data between two devices in close proximity. By utilizing NFC tags on hydraulic hoses, vessel owners and shipyard engineers can simplify the tracking and maintenance process significantly.

Benefits of NFC Hose Tagging:

The implementation of NFC hose tagging technology offers several advantages. Firstly, it facilitates quick and accurate identification of hydraulic hoses, eliminating the need for time-consuming manual search and potential errors. NFC-enabled devices, such as smartphones or tablets, can read the information stored in the tags, providing instant access to hose specifications, pressure ratings, and last changed dates.

1. One of the key advantages of NFC hose tagging technology is its ability to facilitate efficient hose replacement processes for vessel owners and service teams. With the NFC tagging system in place, all the necessary details for creating new hoses are readily accessible. This includes crucial information such as hose specifications, dimensions, and specific requirements for the vessel. By having this information readily available, vessel owners and service teams can quickly and accurately order new hoses, ensuring that replacements are made in a timely manner. Suppliers can then use the provided information to create hoses that meet the exact specifications, ensuring a perfect fit and optimal performance.

2. NFC hose tagging technology also improves inventory management for vessel owners and shipyard engineers. With accurate and easily accessible information about the hydraulic hoses, it becomes much simpler to keep track of stock levels and plan for future purchases.

3. The implementation of NFC hose tagging technology contributes to enhanced safety and risk management in the marine industry. By having detailed information about each hose, including its pressure ratings, service history, and maintenance requirements, operators can ensure that the correct hoses are used in each application. By prioritizing safety and compliance, vessel owners can protect their crew, passengers, and the environment.

4. NFC hose tagging technology is its ability to streamline maintenance processes. With NFC tags attached to each hydraulic hose, maintenance personnel

can easily access detailed information about the hose's maintenance history, service requirements, and upcoming maintenance schedules. This helps ensure that maintenance tasks are

performed on time and in accordance with manufacturer recommendations, leading to prolonged hose lifespan and improved system performance.

5. NFC hose tagging technology also enables better documentation and reporting. Through the use of NFC-enabled devices, such as smartphones or tablets, workers can quickly and accurately record important information related to hose inspections, repairs, and replacements. The digital records can be easily accessed, stored, and shared, facilitating effective communication between maintenance teams, shipyard engineers, and other stakeholders.

6. Additionally, NFC hose tagging allows for seamless collaboration with suppliers and service companies. By sharing hose information digitally, stakeholders can ensure that the correct hoses and fittings are readily available, reducing project delivery times and minimizing downtime.

7. Lastly, NFC hose tagging technology can contribute to overall sustainability efforts in the marine industry. By accurately tracking the lifespan of hoses and implementing timely replacements, companies can reduce unnecessary waste and minimize the environmental impact associated with hose failures. Additionally, the digitization of maintenance records and the reduction of manual paperwork contribute to a more eco-friendly approach to documentation and reporting. By embracing NFC hose tagging technology, companies demonstrate their commitment to environmental stewardship while also benefiting from improved operational efficiency and cost savings.

In conclusion, NFC hose tagging technology offers a practical and effective solution to the challenges faced by vessel owners and shipyard engineers in the marine hydraulic system industry. By simplifying hose identification, improving inventory management, enhancing safety measures, enabling real-time monitoring, and providing traceability, NFC technology revolutionizes hose management practices. Implementing NFC hose tagging technology not only saves time and costs but also enhances operational efficiency and safety in the marine industry. Embracing this innovative solution is a step towards a more streamlined and sustainable hydraulic hose management system.





Er. Sreejith Karunakaran
Sr Mechanical Engineer

SEALING SYSTEMS AND METHODS IN ENGINEERING

1. Purpose

The purpose of this article is to outline the general awareness on the methods for various sealing system used in construction projects, Support services, Repair and maintenance of various Rotating and stationary Equipments and instruments in industries, hospitals, and Domestic Applications

2. Types of Sealing with Examples

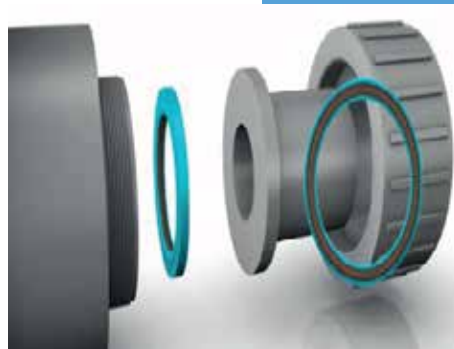
2.1 Static sealing

- Static sealings are used where there are no rotating or reciprocating parts involved.
- Impact/ failure of static sealing are only due to the physical damage ,excess pressure, wear and tear and aging.

Static sealing with an O ring on a threaded PVC joint

2.2 Dynamic sealing

- Dynamic sealings are used where there is rotating or reciprocating parts are involved
- Impact/ failure of dynamic sealings are due to the physical damage ,excess pressure, wear and tear and aging.



2.3

Criteria on selection of sealing materials
Selection of sealing materials depends on the pressure, temperature ,speed , physical properties , chemical properties of the application

2.4 Static sealing – in detail

2.4.1 Non-metallic Materials used in seals.

- Silicone Rubber.
- Natural Rubber
- Nitrile Rubber.
- Neoprene Rubber
- Fluoro rubber.
- Cork
- Asbestos

2.4.2 Various Metals used in seals.

- Copper
- Brass
- Titanium
- Soft Iron, Low Carbon Steel
- Stainless Steel,
- Nickel
- Monel
- Inconel

Dynamic sealing of rotating shaft with a mechanical seal on a centrifugal pump



2.5 Dynamic Sealing – in detail

- Dynamic seals are used in shaft/ piston movement either reciprocating or rotary.



Dynamic sealing of a reciprocating piston in an internal combustion engine

2.6 Types Dynamic Sealing

- Mechanical seals
- Oil seals
- O ring seals
- Gland Packings



Parts of a Dynamic sealing (Simple Mechanical seal) for a centrifugal pump



Dynamic sealing - oil seals with its cross section



Dynamic sealing – O-ring seals -for a reciprocating piston in a pneumatic cylinder



Dynamic sealing – Gland Packing -for centrifugal pump

2.7 Selection of Mechanical seal and Plans

2.7.1 Mechanical seal details

- Selection of sealing materials depends on the pressure, temperature ,speed , physical properties , chemical properties of the application.

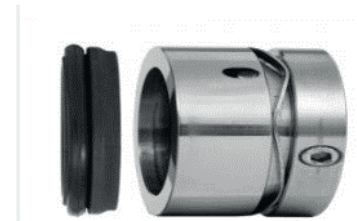
2.7.2 Mechanical seal type based on construction.

- Multi-spring seals.
- Wave spring seals.
- Conical spring seals.
- Bellows seals. Rubber bellow seals. Metal bellow seals. PTFE bellow seals



Conical spring mechanical seal

Wave spring mechanical seal



Wave spring mechanical seal

2.7.3 Mechanical seal mating face materials.

In an engineering sense, the term generally refers to a class of materials that are characterized by their high hardness, high stiffness, low thermal expansion, and good wear resistance. For mechanical seals, these mating faces include silicon carbide, silicon nitride, tungsten carbide, alumina oxide carbon ,ceramic



Carbon Vs Ceramic mechanical seal



Silicon carbide mechanical seal rings

3. Definitions & Abbreviation

PTFE	Polytetrafluoroethylene
PVC	Polyvinyl chloride
SIC	Silicon carbide
TC	Tungsten carbide



Asif Rahmany

President
Engineers Australia | Qatar Chapter



“Transforming the Future: Engineering Innovations Shaping Tomorrow”

As we come together to celebrate Engineering Day in 2023, it is essential to reflect on the remarkable innovations and breakthroughs and acknowledge the instrumental role played by key institutions in fostering engineering excellence and global collaboration. In this context, we extend our heartfelt appreciation to the Institution of Engineers India Qatar Chapter for its tireless dedication to advancing the field of engineering in Qatar. Through its unwavering commitment to nurturing a vibrant community of professionals and promoting engineering excellence, it has significantly contributed to the growth and development of the engineering sector in the region. Equally commendable is the collaborative spirit exemplified by the partnership between the Institution of Engineers India Qatar Chapter and Engineers Australia Qatar Chapter. This collaboration transcends borders and cultures, facilitating the exchange of knowledge and cutting-edge engineering practices. Together, they embody the ethos of global cooperation, bridging gaps and fostering a harmonious synergy that benefits engineers and society at large. On this special occasion, we recognize and appreciate their profound commitment to knowledge sharing, professional development, and the pursuit of sustainable engineering solutions.

In the dynamic world of engineering and technology, each passing

year brings forth remarkable advancements and breakthroughs that redefine our lives. As we celebrate Engineering Day in 2023, it's the perfect time to reflect on some of the most promising developments that promise to shape the future. This article highlights a selection of groundbreaking innovations that engineers have been diligently working on, showcasing their potential to revolutionize various industries and address global challenges.

Engineering stands as a beacon of human ingenuity, driving innovation and progress. Each year, engineers worldwide collaborate to confront global challenges, enhance our quality of life, and lay the foundation for a sustainable future. In this comprehensive article, we delve deeper into the transformative power of engineering, exploring a wide range of pioneering technologies and achievements poised to reshape our world.

The urgency of mitigating climate change has never been greater, and engineers are leading the charge towards sustainable energy solutions. Solar power and wind energy have gained significant momentum, with innovative solar panel designs and efficient wind turbines providing renewable energy on a massive scale. Engineers are also tackling the challenge of energy storage,

breakthroughs in battery technologies making clean energy accessible even when the sun doesn't shine and the wind doesn't blow. Smart grid systems and forward-thinking urban planning are contributing to the realization of eco-friendly, smart cities. Artificial intelligence (AI) and machine learning (ML) continue their pervasive influence across industries. Engineers are harnessing the

Humanity's thirst for exploration knows no bounds, and engineers and scientists are taking us further into space than ever before. Ambitious projects are underway to establish a human presence on Mars and explore the far reaches of our solar system. These endeavors require not only visionary thinking but also cutting-edge engineering. Engineers are developing spacecraft with advanced



“Engineering stands as a beacon of human ingenuity, driving innovation and progress. Each year, engineers worldwide collaborate to confront global challenges, enhance our quality of life, and lay the foundation for a sustainable future”

power of AI and ML to optimize manufacturing processes, enhance automation, and make data-driven decisions that drive efficiency and innovation. Autonomous vehicles are on the cusp of becoming a common sight on our roads, revolutionizing transportation. The applications of AI and ML extend into healthcare, where they enable personalized treatments, disease prediction, and drug discovery, ushering in an era of precision medicine.

Quantum computing, often regarded as the holy grail of computation, holds the potential to solve complex problems that have remained unsolvable by classical computers. Engineers are diligently working to harness the unique properties of quantum bits, or qubits, to exponentially increase computational power. This technology promises to revolutionize fields like cryptography, where it can render current encryption methods obsolete, and accelerate drug discovery by simulating complex molecular interactions with unprecedented accuracy.

Biotechnology has advanced by leaps and bounds, with engineers playing a pivotal role in its progress. Precision medicine, which tailors treatments to individual patients based on their genetics and health profiles, is becoming increasingly common. Gene-editing techniques, such as CRISPR-Cas9, are opening up new possibilities in healthcare and agriculture, offering the potential to cure genetic diseases and develop crops with improved resistance to pests and drought. Sustainable farming practices driven by biotechnology are helping ensure food security for a growing global population, while minimizing environmental impact.

propulsion systems, life support technologies, and resource utilization methods to enable long-duration missions and human colonization of other celestial bodies.

As we commemorate Engineering Day in 2023, it is paramount to honor the dedication and innovation of engineers worldwide. They stand as the architects of our future, continually pushing the boundaries of what is achievable. The innovations highlighted in this comprehensive article represent a mere glimpse into the extraordinary work being undertaken in the fields of engineering and technology. With unwavering commitment and global collaboration, engineers will undoubtedly lead us toward a brighter, more sustainable future that benefits all of humanity.

To conclude, we convey our heartfelt gratitude to the engineers, scientists, and visionaries who tirelessly dedicate themselves to shaping a better tomorrow. Your unwavering commitment and creative brilliance inspire us all and are instrumental in building a more prosperous and sustainable world for generations to come.



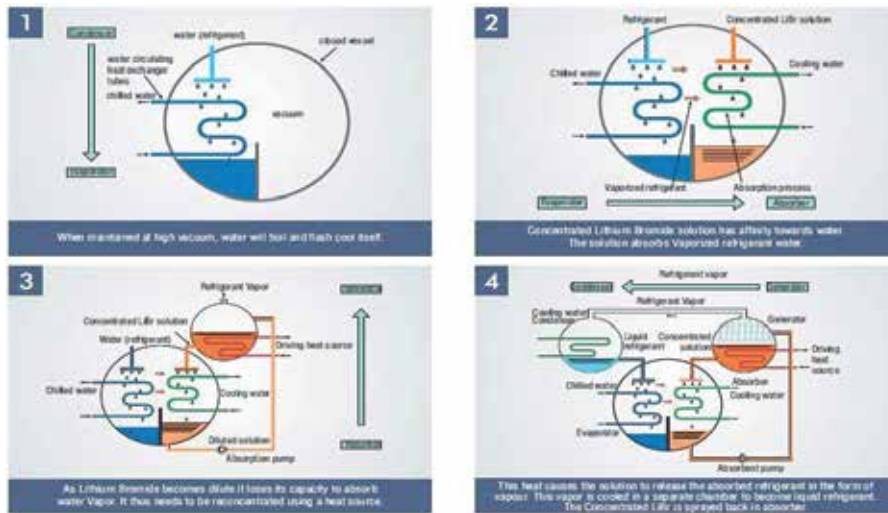
Er. Subrata Kar
FIE(I), C. Eng(I), MBA, MASHRAE, QSAS-CGP™



Samaresh Ganai
Sales Manager – MENA
Thermax Limited, Dubai

VAPOR ABSORPTION COOLING TECHNOLOGY –

Utilization of waste heat / lowcost energy to improve energy efficiency, to reduce electricity consumption, to reduce emission of greenhouse gases and to help achieve sustainability goals.



Introduction:

An absorption refrigeration system uses the heat energy to produce cooling. The most popular form of mechanical refrigeration system runs on the principle of Vapor Compression cycle (VCC) driven by electricity. Although, the Vapor Absorption cooling (VAC) system was invented in the Nineteenth Century, but it could not become popular for various reasons viz. Cost, lower efficiency, difficulty in scalability and so on. However, due to the recent industry focus on decarbonization, energy efficiency, using alternative natural refrigerants to get rid of the greenhouse gas emission, the use of VAC system has been gaining traction for last couple of decades.

Basic Vapor Absorption Cooling Cycle

Vapour Absorption cooling Machine uses water as the refrigerant and Lithium Bromide (LiBr) solution as the absorbent. The process of cooling goes through cyclical stages such as [1]evaporation of refrigerant in evaporator Fig (1), [2]absorption of refrigerant by concentrated LiBr solution in absorber Fig (2), [3]boiling of dilute LiBr solution to generate refrigerant vapour in generator Fig (3)

and [4]condensation of refrigerant vapour in condenser Fig (4).

The refrigeration load is applied at the evaporator. The external driving heat source is applied at the generator to convert the diluted LiBr solution into concentrated LiBr solution again and the cycle continues. The boiling point of water is directly proportional to pressure. At atmospheric pressure

(760 mm Hg) water boils at 100°C. But at a vacuum, say at 6 mm Hg absolute pressure water boils at 3.7°C. To change water from liquid to vapour it has to be heated. The heat, required to change the phase of a liquid to vapour, is called the Latent heat of evaporation.

LiBr is a chemical similar to common salt (NaCl). LiBr is soluble in water. Concentrated LiBr-water solution has a great affinity towards absorbing water vapor and it releases heat (exothermic reaction). More the concentration greater is the affinity to absorb water vapor. Also, less the solution temperature greater is the affinity to absorb water vapour. Further, there is a large difference between vapour pressure of LiBr and water. This means that if we heat the LiBr water solution, the water will vaporise, but the LiBr will

stay in the solution and become concentrated.

Difference between the Vapor absorption Cycle (VAC) and the common Electricity Driven Vapor Compression Cycle (VCC):

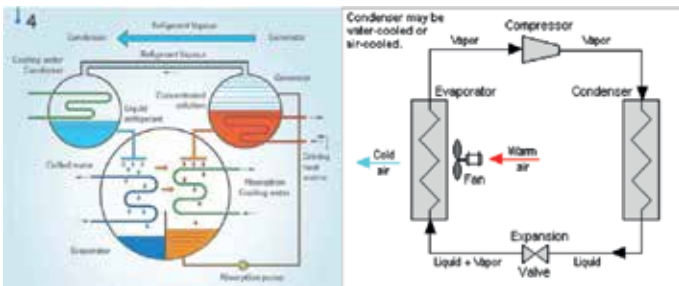


Fig (5)

- a) As evident from the Fig (5) the VAC is heat driven whereas the VCC is electricity driven.
- b) In case of the VAC the compressor (of VCC) is replaced by a generator-absorber assembly.
- c) In case of the VCC the condenser needs to reject the heat (to atmosphere/sink) of (i) refrigeration load and (ii) the work-done by the compressor. But in case of the VAC the condenser needs to reject the heat (to atmosphere/sink) of (i) refrigeration load, (ii) the driving heat of the generator & (iii) the heat of the solution of the absorber due to the exothermic reaction (LiBr absorbing water vapor). Therefore, the heat rejection requirement in condenser is more in case of VAC.
- d) The VCC uses synthetic refrigerants (Like CFC's, HCFC's) often responsible for Greenhouse gas emissions. Whereas VAC uses natural refrigerants e.g. water.

Heat Sources for Absorption Chiller

- Hot water more than 80 deg C
Example : Hot condensate, Process waste heat, Hot water generated in process
- Steam at any pressure
Example : Excess and waste steam; large quantity found in most of the Refineries and many industries.
- Waste vapour
Example : Flush vapour, Fryer Vapour etc
- High temperature Exhaust Gas
Example : Gas/Diesel Engine/Turbine exhaust; Any Exhaust having temperature more than 150 deg C
- Direct firing
Example : LPG, Natural Gas, Bio-gas etc.
- Renewable Heat
Example : Geothermal, Solar Heat, Solar Steam

Why Absorption Chiller :

- Waste heat can be utilised for generating cooling/chilled water instead of electricity
- Most efficient and easiest method to recover heat and reduce CO2 emissions.
- Natural refrigerant used (water), hence no Ozone depletion or global warming potential (Zero-ODP & Zero GWP).
- No moving part, hence, no vibration leading to very long

life and extremely silent operation, practically free of maintenance.

- Major operational cost saving due to drastic reduction of electricity consumption.
- The VAC may well be utilised to harvest the heat generated in the cycle along with the refrigeration achieved. Examples – Vapor Absorption Heat Pump & Vapor Absorption Chiller-Heater. Utilising such a machine, the size of cooling tower may be reduced or completely be avoided.

Application of VAC system across Different Industries:

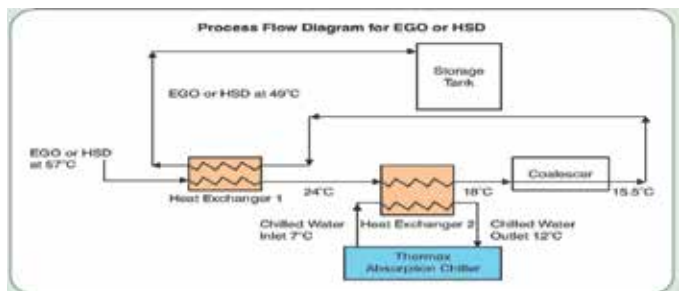
Because of the overwhelming advantages of VAC, the system is extensively used across host of industries as follows:

- | | |
|-----------------------------|--------------------|
| - Refinery & Petrochemicals | - Renewable Energy |
| - Oil & Gas | - Automobiles |
| - Fertilizer | - Rubber |
| - Power Plants | - Textiles |
| - Chemicals | - Pulp & Papers |
| - Paints & Pigments | - Packaging |
| - District Cooling Plant | - Food Processing |
| - District Heating Plant | - Dairy |
| - Hospitals | - Pharmaceuticals |
| - Hotels | - Beverage |
| - Shopping Malls | - Edible Oil |
| - Steel Plants | |

A Few case studies of successful implementation of VAC in different industries:

I) Refinery – Ex. 1: Recovery at Dehazing process

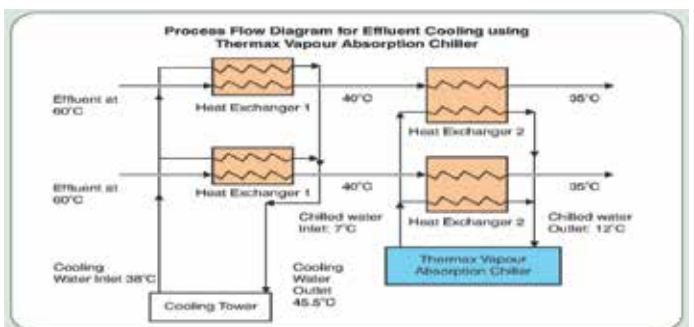
Absorption Chiller aids the electrostatic coalescer of the refinery to reduce moisture content of EGO (Export Quality Gas Oil) and HSD (High Speed Diesel) to improve the quality standard and to achieve the targeted Haze 2.0 Rating.



Reference Installation: KNPC – Mina Abdullah Refinery, Kuwait. Capacity: 500 TR X 2 Nos

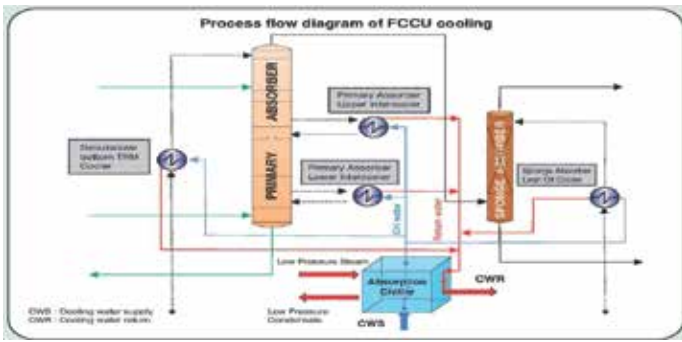
II) Refinery – Ex.– 2: (Recovery at Effluent Treatment)

Absorption Chiller helps to maintain the correct temperature conducive to the bacterial action on the effluent and facilitate sulphide removal.



Reference Installation: KNPC – Mina Abdullah Refinery, Kuwait. Capacity: 853 TR X 2 Nos

III) Refinery – Example – 3: Fluid Catalytic Cracking Unit (FCCU) yield improvement

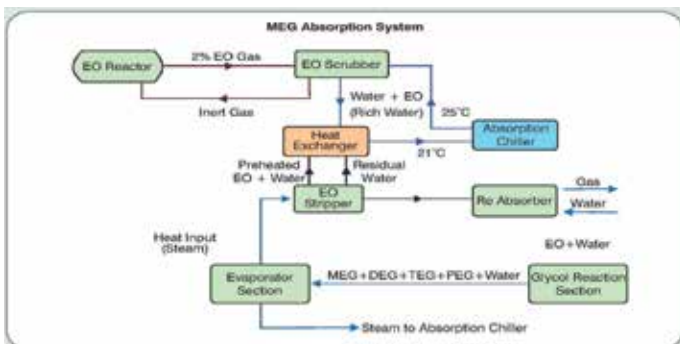


Reference Installation:

1. Oman Refinery (ORPIC), Okan 720TR X 2 Nos.
2. Saudi Aramco Shell Refinery, KSA (SASPEF) 245 TR X 1 No.
3. Reliance Industries Limited, Jamnagar, India 2050 TR X 1 No., 3100 TR X 1 No.

IV) Oil & Gas Example – 1: Mono Ethylene Glycol (MEG) Absorption

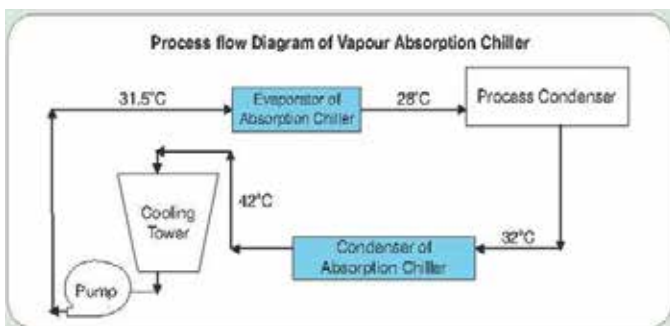
Absorption Chiller is installed in the lean water line returning from stripper section to the scrubber section. This is to drop the return water temperature to cause the overall increase in absorption effect and to help to improve the plant output capacity without changing the existing set-up.



Reference Installation:

1. Yampet, Yambu, KSA: Capacity - 1124 TR X 2 Nos.
2. Sharq Eastern Petrochemical Company, Al-Jubail, KSA: Capacity – 1534 TR X 3 Nos.

V) Industry Example – 1: Capacity Enhancement of Process Heat Exchangers



Reference Installation:

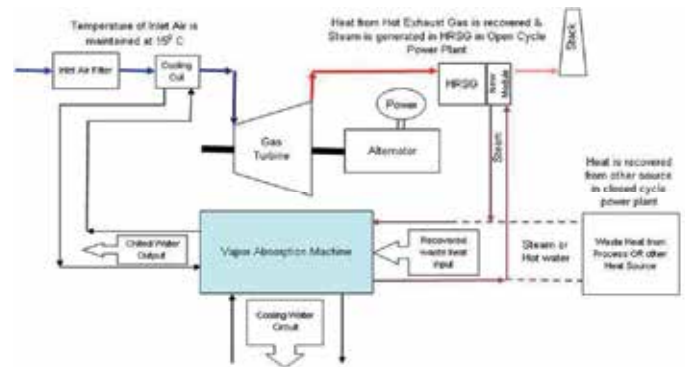
Reliance Industries Limited, Jamnagar, India: Capacity – 2000 TR X 2 Nos.

VI) Industry examples – 2 (Fertiliser, Power Plants, General Industry)

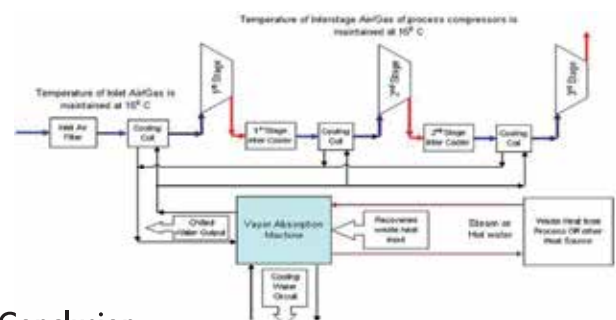
Objective: Optimising temperature levels and maximising efficiency and plant capacity by inlet air cooling of Gas Turbine and Compressors using Vapor Absorption Chiller (VAC) powered by the Exhaust heat of same turbine / compressor.

Principle: Gas Turbines and process compressors take in filtered ambient air and compress it in the compression stages. All turbo machinery are designed as per ISO condition i.e. 15°C/60%RH air intake. The capacity and efficiency of the turbine/compressors gets derated with higher ambient temperature, RH & Atmospheric pressure. With inlet air-cooling - the condition of the air can be maintained at 15°C and as a result the throughput of the turbine/compressor can achieve ISO condition. The recovery of the exhaust heat & running a close loop VAC to cool the inlet air is an extremely energy efficient way to improve the performance of the turbine and compressor.

GAS TURBINE INLET AIR COOLING



COMPRESSOR INLET & STAGE COOLING



Conclusion

It would not be out of place to mention that a Vapour Absorption Chiller fully powered by the solar thermal energy was installed to cool the model miniature stadium in 2009-2010 by the FIFA2022 Bid Committee of Qatar. This was to showcase and emphasize the key focus on sustainability by the bidding Nation for the Greatest Football Tournament. The rest is history!!!

The vapor absorption cooling and its judicious application in Qatar across different industries and commercial construction sector will be a great leap forward towards the sustainability and the same is in complete harmony with the QATAR VISION 2030.



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Er. Ajmal Rajan
B.E. Mechanical Engineer



Fabrication And Testing Of **MAGNESIUM COMPOSITE USING HOT EXTRUSION**

Magnesium composites had an increasing development in the field of Industrial and biomedical applications. The biomedical development of Magnesium composites is concentrated on the mechanical properties, degradation rate and the biosafety to human body. This paper is focused on the biomedical implants of bone plates with biodegradable Magnesium composites. ZK30 Mg alloy metal matrix reinforced with five weight fractions (2,4, 6, 8,10wt.%) of Tri-calcium phosphate (TCP) [Ca, (Po)] have been fabricated using powder metallurgy manufacturing process followed by hot extrusion process for amalgamation.

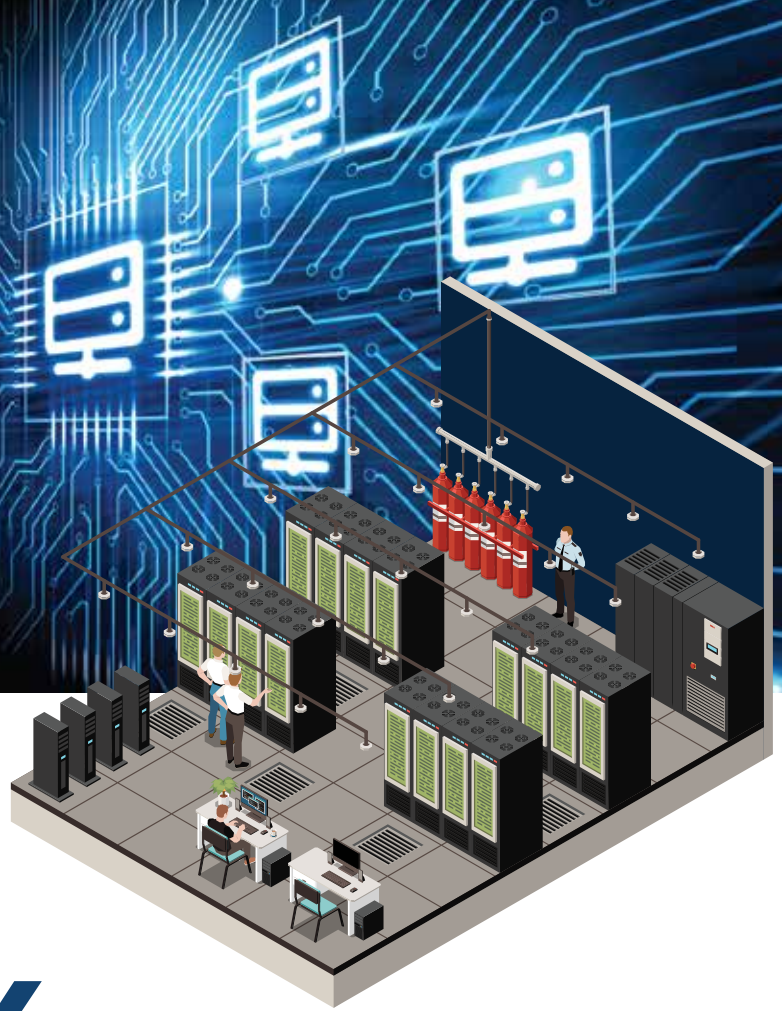
The mechanical properties were investigated using Hardness, Density and Porosity, Tensile and compression tests. The X-ray diffraction (XRD), optical microscopy and scanning electron microscopy (SEM) techniques were used for phase identification, microstructure and surface fracture analysis. The results obtained shows that the increased wt.% of TCP particles diminutions the micro hardness of Mg composites. However, the ZK30 Mg composite possessed higher micro hardness than human cortical bone. The density of Mg composite amended with the addi-

tion of TCP and measurement of porosity outcomes in least percentage. Furthermore, the maximum ultimate tensile strength was possessed by ZK30 Mg alloy while the least was noted for ZK30/10wt%TCP. As a result, increasing wt.% of TOCP particles reduced the ultimate tensile strength, tensile yield strength and elongation of the material. In addition, ZK30/Mg alloy shows a higher ultimate compressive strength.

The optical microscopy specifies the grain sizes of ZK30 Mg composite are refined on addition of TCP particles, although minor amount of agglomerations observed for 6% TCP and 8%TCP moreover clustering increased for 10%TCP The XRD patterns clearly directs the presence of a matrix phase and reinforcement phases and the absence of new crystalline compounds development between ZK30 Mg alloy and TCP particles. The SEM images of tensile specimen displays ductile fracture for ZK30 Mg alloy and brittle fracture for Mg composite whereas the compressive specimen indicates ductile fracture for ZK30 Mg alloy and Mg composites. The composite possesses excellent mechanical properties; thereby it can be used for biomedical implants of Bone plates.



Er. Samir Pawaskar
B.E Electronics,
Cyber Security Expert



DATA EMBASSY

The Indian government has announced in its latest budget that it intends to notify a policy allowing countries and companies to set up "data embassies" in India that provide "diplomatic immunity" from local regulations on national and commercial digital data, senior lawmakers told a local newspaper (*Economic Times*).

The policy could be introduced as part of the upcoming Digital Data Protection Bill, likely to be tabled in March, they said. Legislative approval for "data messaging" could spur greater investment in India in technology infrastructure.

What exactly is a Data Embassy?

A data embassy is a solution traditionally used by nation states to ensure a country's digital continuity, especially with regard to critical databases. It consists of a series of servers that store one country's data and are under that country's jurisdiction while being located in another country. Data embassies are seen as a tool to ensure the digital continuity of a government, i.e. the continuity of critical databases that enable the continuation of governance even in a situation where governance within national borders is no longer possible. Threats that could lead to such a situation include natural disasters, large-scale cyber-attacks and military invasions. In the worst case, a data embassy could enable the government to offer its digital services without having the national territory under its control. This makes data embassies particularly attractive for countries that have already digitized their main databases and are close to the threat vectors mentioned above.

Need for a Data Embassy:

In today's digital age, data is one of the most valuable assets a company or country can possess. And as more and more companies digitize their operations, data is seemingly becoming more powerful. We have seen how data has been used to manipulate people en masse (*Cambridge Analytics case).

As a result, governments are becoming more sensitive and sometimes paranoid, leading to concerns about data sovereignty.

Data sovereignty is the principle that a country has ultimate control over its own data. This

basis of bilateral agreements modeled on the wording of the Vienna Conventions. These bilateral agreements usually also need to be ratified by the partner countries' parliaments.

A successful implementation of this concept is Estonia, which has established a data embassy in Luxembourg.

How to choose the right data embassy?

Below are some important considerations for selecting the right data embassy:

1. Location: the physical location of the data embassy should be in a country with which you have signed the required legal instrument and



includes both the physical infrastructure in which the data is stored and the laws and regulations that govern its use.

On the flip side, as the world becomes more interconnected and the need for resilience increases, countries are simultaneously seeing a need for "data embassies" to protect their digital assets and ensure resilience.

What is the biggest challenge about Data Embassy?

Academic research initially considered using the 1963 Vienna Convention on Consular Relations or the 1961 Vienna Convention on Diplomatic Relations to ensure data protection and inviolability, but found that these conventions would require significant changes.

In the absence of international precedent, data embassies have been established only on the

which can assure you of data sovereignty.

2. Services: Make sure the country where you plan to host your data offers the services and infrastructure you need.

3. Costs: make sure the costs and value for money are right so you can create a compelling business case.

To wrap up:

The need for Data embassies points to a huge gap in the market that could be leveraged by a country like India, which has built huge data centers over the years, has excellent and low-cost network connectivity, and has affordable yet competitive skills. With a progressive and supportive legal landscape, this could become a huge business opportunity. The initiative could also help strengthen the country's cyber diplomacy.

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Past Hon. Secretary, IEI Qatar Chapter
Senior Engineer(Protection Design & System Analysis), Kahramaa

FUTURISTIC SUBSTATION PROTECTION

Introduction

We are living in a continuously changing world driven by continuous technical evolution. Electrical Substation play a major role in building a reliable power network. The evolution in the field of information technology, computer, communication technology and renewable energy together with the motive for cost optimization, less space availability, minimum maintenance requirement, minimizing air conditioning requirements and carbon footprint, etc. has made tremendous developments in power system and substation as a whole and specially in the field of Protection, Automation and Control of Substation.

Power System Protection Basics and Evolution

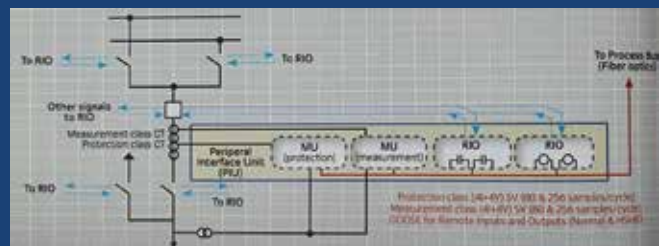
Electrical Protection System in a substation protect and safeguard substation equipments from its damage and accident, and due to that also protect the power system from collapsing and maintain its stability to a greater extent. Protection system provide security to power system as a whole and its role is critical to isolate the system from fault in abnormal operation/scenarios and in normal scenario no action other than internally measuring and comparing the voltage and current of the connected power system.

The equipment which directly handles power system voltage and current are called primary equipment of the power system and primary equipment normally protected in a substation are Power Transformers, Reactors, Capacitors, Over Head Line, Cables, inter connecting Bus Bars, Breakers, Switches, etc. Electrical Protection Relays are used to protect these equipments. Protection relays basically receive system parameters like current and voltage, and act based on its intended function like over current protection, over voltage protection, under voltage protection, over frequency protection, under frequency protection, earth fault protection, distance protection, differential protection, etc. As protection relays cannot directly handle/receive high level of voltage and current which are stepped down by instrument transformers to standard low magnitude values before giving to relays. Potential Transformers(VT) is used to step down high voltage to standards low voltage(110V) and Current Transformer(CT) is used to step down high current to standards low current(1A or 5A).

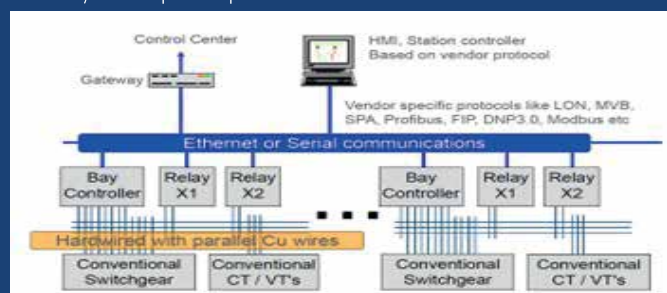
Protection relay senses the current or voltage or both in the primary equipment through the instrument transformers, and it act according to its intended application. Electromagnetic relays used in early era was acting based on the mechanical force developed out of electromagnetic force and when it crosses the pre-determined(set) force it will activate and cause opening of Breakers which will open and interrupt the fault circuit/equipment. In modern numerical era, the relays process the sensed current or voltage or both and compare with the set values/criteria for the intended application and will issue command for opening of

Breakers which will open faulty circuit/equipment and clear the fault. Protection in power system has been subject to several technological advancements. Electro Mechanical Relays which are basic and single function relays were developed in 1900's; Static Electronic Relays which are analog, solid state, multifunctional relays were developed in 1960's; Numerical Relays with Microprocessor Generation-1 which are digital, multifunctional, self-checking, serial communicating(SCADA) were developed in 1980's; Numerical Relays with Microprocessor Generation-2 which are powerful multifunctional, self-checking, ethernet communicating(-substation networking), data historian were developed in 2000's. Numerical Relays are Intelligent Electronic Devices(IED).

IEC 61850 Standard and SPACS:



IEC 61850 is an international standard that defines communication protocols to provide communication between different equipment located in a substation, such as protection, control, and measurement equipment. It proposes a Process Bus communication network between process level equipment and bay level Intelligent Electronic Devices (IEDs) used for power systems protection and control. It defines a data model and the communication services for the interaction with and between elements of a substation such as feeders, breakers, protection devices etc. This standard is a collection of addresses, product development, performance, compatibility, and related topics in order to ensure product compatibility and environmental safety. The goal of the IEC 61850 standard is to control, measure, and monitor all networking roles and automation IEDs (intelligent electronic devices) within power plants and substations



Typical IEC 61850 based Substation Protection Automation and Control System(SPACS)

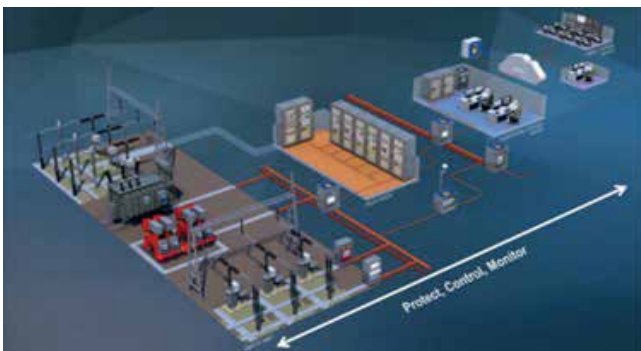
A typical Substation Protection Automation and Control System (SPACS) with IEC 61850 standard protocol will have a Fiber Optic Cable connected IEC 61850 station bus to which bay level IEDs and station level HMIs, Gateway computers, Workstations, Engineering PCs, etc. will be connected. IEC 61850 defines an architecture for meeting the needs of electrical substation automation. The IEC 61850 supports the time stamp feature.

The IEC 61850 objective is to facilitate the interoperability (between devices and systems), ease of configuration (allocation of functions to devices), long term stability (layered, object-model based design), and reliability (lossless network architectures) to replace wire communications. IEC 61850 defines a fast and reliable point to multi point message exchange procedure that can be used to replace copper wiring using in the data exchange between the cabinets in a substation. These messages are called GOOSE – Generic Object Oriented Substation Event. There are 4 basic IEC 61850 messages types: i) Sampled Values (SV) messages; ii) PTP/S- NTP (Precision Time Protocol/ Synchronous Network Time Protocol) messages; iii) GOOSE (Generic Object Oriented Substation Event) messages; and iv) MMS (Manufacturing Message Specification) messages.

Digital Substation

In digital substation the primary equipments are embedded with digital sensors and these sensors are connected to Merging Units (MU) or IEDs which are capable to receive signals via Fiber Optic Cable (FOC) from these sensors and form a Primary Equipment Process Bus replacing bulk quantity of copper control wires. GOOSE messaging can be used for signaling, alarm, interlocking, etc. Instead of conventional copper wired CTs/VTs digital CTs/VTs can be used which provide more flexibility and safety to protection. As FOC networking is used the use of copper control cable is reduced drastically which save lot of material cost. Digital substations enhance substation protection, control and monitoring.

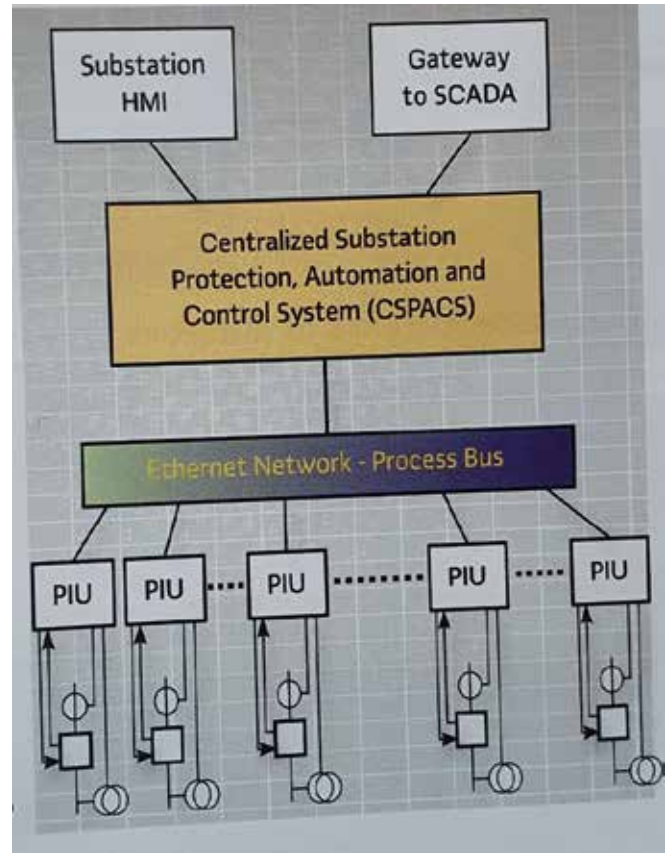
The Digital substation design concept provides an extremely compact solution with many benefits, like cost effective, less maintenance cost, reduction of carbon footprint, higher safety, high resiliency, easier renovation and extension, increased availability and reliability, IEC 61850 Standardization and Interoperability.



Centralized Substation PACS (CSPACS)

The concept of Centralized Protection and Control is not new, but the advancement in Computer Technology, IT and international standard have made it a feasible alternative for modern substations. Centralized Substation Protection Automation and Control System (CSPACS) in principle is the integration of all protection functions of several IEDs and control system into a central computer, and the computer perform the required algorithm of protection function and issue trip and alarm signals to the respective devices. With development of IEC 61850, resulting in sampled values based on analog interfaces and GOOSE based switchgear monitoring and control, we can take the advantage of fiber optic

communications between the devices providing the interface to the substation primary equipment and the CSPACS. IEC 61850 is the standard we can consider as the glue that allow us to combine the advantage of advanced computer and communication technologies into sophisticated protection automation and controls system. The availability of powerful industrial computers and real time



operating systems are creating an environment supporting the next step in the evolution of digital substations with Centralized Substation Protection Automation and Control System. The IEDs such as protection relays, bay control units, etc. are integrated into a single powerful computer and communicate directly with the process equipments through Process Interface Units (PIU). The computer is fed with inputs like digital sampled analog measurements of voltage, current, etc., and digital status of various primary equipment, and the computer processes the inputs and take a decision based on the different protection functional algorithms such as differential relay protection, distance relay protection, current protection, voltage protection, frequency protection, etc. implemented in the computer software, and send digital information to trip the concerned breaker and clear the fault.

The high level of functional integration achieved by centralized system definitely improves the efficiency of the protection and control system. The CSPACS can be deployed in several different architectures depending on the other solutions and components used and overall solution requirements. The main expected benefits from the solution are related to increased flexibility and performance and reduced overall lifecycle cost. Centralized Protection concept can be utilized for both Transmission Substations and Distribution Substations. Digital Substations and CSPACS are becoming a reality in many countries around the world and are being accepted as the standard for future substations for many major utilities.



Er. Mohammed Shamsuddin
Civil Engineer



WET AND DRY UTILITY PLANNING DURING SITE DEVELOPMENT

Wet and dry utility planning is a crucial part of site development. As it implies, the process involves the design and installation of various systems that provide water, gas, electricity, and other core services to whatever's being developed on the land.

Coordinating these utilities is critical in ensuring they both meet code and align with the progress of the overall site plan. This can include identifying the location of utility lines and infrastructure, coordinating with utility companies, and designing systems to minimize the environmental impact of their installation.

Here's a quick breakdown of wet and dry utility planning, and what goes into the process before the utilities themselves go into the site.

Wet vs. Dry Utilities

"Wet" and "dry" are terms used to describe two types of utilities. As you might imagine, they're so named based on the resource they deal with:

- Wet utilities are systems that involve the use of water, such as plumbing, irrigation and stormwater management. These systems are used to bring water into a building, distribute it throughout the building, and then collect and dispose of wastewater. Examples of wet utility systems include potable water supply, sanitary sewer and storm sewer systems.
- Dry utilities include electrical, telecommunications and natural gas systems. These systems bring power, communication, and fuel into a building, distribute it throughout and dispose of waste. Examples of dry

utility systems include electrical power, natural gas, telephone, and cable.

It's important to have consideration and coordination between these systems during the construction and development process to avoid conflicts and ensure the appropriate function of the final product.

Extensive Consideration for Wet Utilities

Wet utility planning is a critical aspect of site development and construction. It's an extensive process to guarantee that the systems are safely and correctly laid in place. Here is a brief overview of the steps involved in installing wet utility systems:

1. Conduct a site assessment to identify the location of existing utility lines and infrastructure, as well as any environmental or site-specific considerations that may impact the design of the systems.
2. Design of the wet utility system typically includes developing detailed maps and specifications for the systems, including the location of water supply and sewage lines, the size and capacity of the systems, and any necessary connections to existing utility lines. The design must also consider any local, state, or federal codes and regulations that apply to wet utility systems.
3. Monitor the installation of the wet utility systems. Close observation is crucial to verify it's done correctly and meets the design's specifications and requirements. This can include testing the systems and regular inspections to check that they're functioning correctly.

Site Logistics for Dry Utilities

Dry utility planning is straightforward compared to wet utility planning. That said, coordination among the different utilities is key, as they all share the same underground space and need to be placed in a way that won't interfere with each other's function. This is where the expertise of a professional engineer or a dry utility specialist comes in to inspect that the systems are designed and installed properly, and are up to code. Here is what's involved in dry utility planning and installation:

- Conduct a site assessment.
- Design the systems.
- Obtain permits and approvals.
- Coordinate with other utilities
- Install the dry utility lines and structures.
- Test and inspect all systems to verify that they work properly.
- Commission of ownership (when turned over to the property owner or developer)

Utility Planning is Essential to Site Development

One of the main reasons why utility planning is so critical is that it must be done early in the development process, as the location and design of the utility systems can have a major

impact on the layout and design of the site.

For example, the location of water and sewage lines can impact the location of buildings and other structures, and the design of the electrical and natural gas systems can affect the energy efficiency of the development.

Additionally, utility planning also includes locating existing utilities that might be part of the site already, as seen in redevelopments or broken lots. This is vital to make sure that the new development does not interfere with existing utility systems and that installers can adequately integrate the existing systems into the new construction site.

Utilities Planning Requires a Concerted Approach

Dry utility planning is a critical aspect of site development, as it lays the foundation for the rest of the project. It's essential for the functioning of any building or development. A project manager must organize all involved parties in the coordination and execution of this process.

A joint approach to utilities is important because it helps to confirm that all the relevant stakeholders are working together towards a common goal and that the utility systems have thoughtful design and installation. This approach also helps minimize the development's environmental impact by designing practical water and sewage systems and properly managing stormwater, among other important considerations.



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HVAC System Design



Er. Sujay Kalankat
Mechanical Engineer



Introduction

This technical writing deals with the HVAC system design, installation proposal as well as MEP engineering services as a predictive maintenance plan, which I recommended for the Mechanical and Electrical Plant rooms (including the Fire pump room, Chiller plant room-critical units and the overall cooling system upgrade on electrical substation such as Transformer, switchgears and telecom rooms) and also, the MEP services support to our incumbent tenant for their client Qatar Gas (North Oil field expansion project) facility in our high Rise building.

Technical details of work

I commenced the work in this high rise project by preparing the condition survey and technical assessment for all the major equipment's of MEP systems in the tower as a predictive and proactive maintenance analysis that would augment uptime and lower the maintenance cost which would eventually enhance the life cycle of the equipment's and avoid catastrophic failures. This survey documents were the baseline of works to be monitored and managed systematically in the facility. During my preliminary survey, one of the major items I listed in the report was about the cooling system which was missing in the Fire Pump room and domestic pump room as well as the upgrading of the existing AC units in transformer, switchgears and data center rooms. Simultaneously, I was closely working with McDermott team (Tenant) to give engineering and technical support on their new facility in the tower to complete the MEP services (for their client-Qatar Gas) and their commercial license approval from the authority. I was implementing proactive maintenance system rather than going with the reactive and corrective maintenance (with unplanned repair) that result in many weeks of downtime and affects the seamless operation of the building.

In pertinent to the Fire pump room, it was obvious from the as-built drawings and site conditions that the design consultant and main contractor has missed the cooling system inside this large spacious L-shaped plant room (having 3sets of Fire

pumps feeding Low and high zone sprinkler system as well as mid zone Fire hydrants, landing valves, Fire Hose Reel and breeching inlets) especially considering the extreme hot and humid weather conditions in this part of the world. Therefore, I have planned to have an effective Hvac system to be installed in order to distribute the air flow equally across all the equipment's in the room space and to nullify the heat generated by various units (which comprises 9no.s of pumps in total and it's corresponding Pump controllers, MCC units for ventilation fans such as Exhaust Fans, Stair Pressurization Fan, Fresh Air Fan, Smoke Extract Fan's) in this technical room during the intense summer conditions. I had given the technical advice to my building management team and raised this concern to have the best feasible solution to tackle all the related problems.

The initial plan was to find any possibility of installing fan coil unit (FCU) but to proceed with FCU, it requires ceiling space which is limited due to the existing fire service lines, valves and accessories for low and high zone for both Sprinkler and wet risers, PRV lines, domestic water supply lines (including the electrical trunking and cable trays passing on the high level) which reduces the space in the soffit to install the FCU and ducted units.

As the pump room comprises 3sets of Pumps (that is 3No.s of standby-diesel pump (end suction centrifugal pumps), main fire pump as horizontal split case-(electrical Pumps) and sprinkler pressure maintenance pumps (that is vertical

multistage jockey pumps]] and its accessories as per zone wise division feeding to different locations in the building. The heat gain touched to a temperature of 48.5 deg.celsius in the peak condition's which is undesirable and beyond the allowable limit for fire Pumps and pump controllers as per manufacture recommendations and NFPA standards. Moreover, the skin temperature of the Pump Controllers and MCC were reaching a high alert range. As there are plenty of cables and wiring goes inside the control panel, this would get damaged when exposed continuously to high temperature in the future. We had earlier instance of our diesel pump under maintenance with the internal check by the specialist service provider for Fire pumps, wherein it was identified that the Piston head, piston liners and Speed sensor tube got melted. Also, the exhaust manifold and turbofan compressor were getting overheated (reaching beyond 607 deg. Celsius). In addition to this, the cylinder had crack outside and connecting rod got bent.

Therefore, in this scenario, if we keep the equipment's left with no cooling system in the room, it shall adversely affect the operating conditions of the diesel engine and centrifugal pump in near future. Likewise, we had situation in domestic pump room where there is no cooling system available for the installed equipment's [having 3 sets of booster pump (serving the Tower, ancillary technical building and the adjacent fitness center) and 1 set of Transfer booster pump to the overhead tank at 42nd floor]. Another instance, even the newly installed Pressure vessel diaphragm damaged, the flange bulged and crack on this new unit because of the high temperature prevailing inside the room due to the lack of cooling and ventilation system.

Thus it was advisable to have the feasible and viable HVAC system to be installed by considering the design parameters and site requirements in both of the above plant rooms to protect the units from high temperature. On the contrary, in the electrical substations such as transformer room, switchgear rooms, telecom and data center rooms, the condition report has been made for each of the AC units as technical analysis to record the existing issues and in accordance with the priority and as proactive maintenance, upgrading the system is planned to execute the work.

Application of engineering knowledge and skills:

The technical survey was prepared considering the retrospective events and I collected data and statistics from the management and staffs who worked with the building for past several years to infer the accurate information about the malfunctions experienced previously as an expert advice from the team. I also contacted the preceding FM team to know the additional details about the building systems and frequent issues they had faced during their tenure.

The most conspicuous one stems from the fact that since the inception of the Tower, it is quite obvious that there was no up-grades and revamping of the then critical and lifesaving systems, thus I had the plan to improve the operative effectiveness of units installed in the plant rooms and thus avoiding unplanned repair works. I made a detailed condition survey with technical report for all individual technical rooms separately which comprised electrical substation (including the chiller yard). In the process, the list of critical equipment's along with the serving area and conditions of each rooms are clearly observed and documented.

Conclusion:

I held meeting with our management and explained the findings with the technical reports where I listed out in depth evaluation corresponding to the site conditions. The main

issues observed in various plant rooms were compressor overheating and fan motor issue at irrigation pump room, the entire coil section got corroded and damaged for Ac units in MV room (serving the chillers), PCB (printed circuit board) systems are not repairable at electrical room (rooftop area), the evaporator fins are corroded and copper coils are defective in basement UPS room. As some of the replacement are beyond economic repair, the new units has to be bought and installed to replace all the defective equipment's. In principal, the solution I made was to install the floor standing Ac's in fire pump rooms considering the criteria such as technical aspects, space constraints and site conditions. This was accepted by the building owners when I detailed the technical issues and the future of the building where there will be constant change of use occurs with different capacity of occupants and visitors utilizing the building services on daily basis.

In 2no.s of fire pump rooms at building basement, the strategic position were chosen to fix the indoor unit to have evenly distributed supply air that would face the pump controllers, MCC (motor control center) and other units so that all the areas of the room will have accurate amount of cooling throughout with proper heat transfer and ventilation rate in place. The supplier was asked to carry out the HVAC Air balancing and



further testing and commissioning of the system. Some of the units were arranged for the troubleshooting with the specialist contractors to check the condition and got the expert advice from them. For data centers and telecom rooms, advanced floor standing AC were installed so as to safeguard the server cabinets and network racks of all the existing tenants (including the As-built servers of the tower).

There were engine overhauling activities happening by the 3rd party contractor. I could relate to the thermal engineering concepts while working in IC engine overhauling tasks. I got to know technical details from the senior technicians from QIBS & IGTC team during their condition monitoring and overhauling works. Also, I enhanced my conceptual comprehension on the turbo machinery systems, thermodynamic and heat & mass transfer application such as compressors, centrifugal pumps, Heat exchangers namely, evaporator (heat absorbing) and condenser (heat rejection), TEV (thermal expansion valve)-high pressure high temp liquid to low pressure and low temperature liquid conversion process. I learned Computational fluid dynamics methods related to the car park ventilation fans performance test. While assisting the consultant and Civil defense (AHJ), I prepared on above concepts and in the process, I got to know on various technical calculations and testing methodology. Also, A comprehensive comparative analysis on various brand of Floor standing ac with advanced technologies and features were carried out.

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Er. Nabeel Muhammad
Biochemical Engineer

Biodiesel from Waste Vegetable Oil

A Study on Production and Performance

Abstract - Biodiesel production is an initiative that uses waste vegetable oil (WVO) from the college food services to produce a clean-burning. The primary aim of this project is to avoid the reuse of vegetable oil which is a carcinogen and to produce biodiesel which will power the vehicles. Creating biodiesel from waste oil makes use of existing waste oil and also reducing the consumption of non-renewable petroleum diesel. Biodiesel use improves air quality by producing a drastically lower amount of soot, diesel particulate matter, carbon monoxide and other elements that are produced by petroleum diesel. During this process, WVO is mixed with a methanol and KOH solution. The lye used is and it acts as a catalyst for the reaction. The biodiesel reactor is charged with these ingredients and the reaction parameters are set, i.e., 650C and 200 rpm agitation speed. The biodiesel produced is checked for its quality and sent for running generator or vehicles.

I. INTRODUCTION

Bio-diesel is one of the most promising alternate fuel. It is produced from vegetable oil using fairly simple chemistry. Pure vegetable oil works well as a fuel for Diesel engines itself. However, vegetable oil is inherently viscous and cannot be burned efficiently at ambient temperatures in modern over-the-road vehicles. Conversion to Biodiesel has many advantages as it readily mixes with petroleum diesel fuel in any ratio, can be used in modern diesel engines with little or no modification, also restores lubricity of low-sulfur diesel fuel by mixing as little as 1% biodiesel. Bio diesel reduces the emissions of Sulfur dioxide by 100%, Soot emissions by 40-60%, Carbon monoxide by 10-50%, Hydrocarbons by 10-50%, Nitrous oxide by 5-10%, depending on engine tuning and the age of the engine. Therefore it is advisable to produce biodiesel from low cost materials like waste vegetable oil.

II. METHODOLOGY

A. Optimization of process parameters

1. Determination of reaction time

Filled the reactor vessel with 1.5L of oil. Heated the oil in the vessel to appropriate temperature. Poured 330 ml of methoxide mixture (330ml methanol+3.75g NaOH) into the reactor vessel. Collected samples from the reactor at regular intervals of time. Amount of the biodiesel produced is noted till it becomes constant. Time to get the constant weight is noted.

2. Optimization of reaction temperature

By fixing the amount of catalyst and reaction time from the previous experiments, found the optimum temperature for the reaction

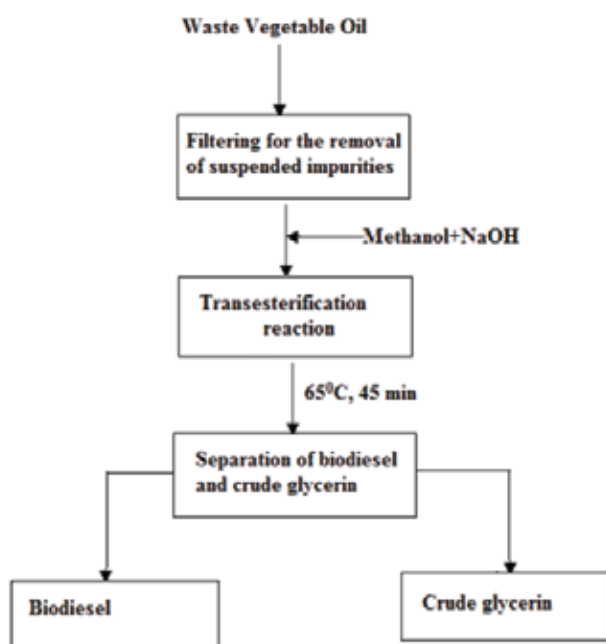
3. Optimization of agitation speed

Agitation is an important parameter in the biodiesel production. It ensures the proper mixing the reactants. Moreover, optimizing the agitation rate helps to reduce the power consumption. In this study, the parameters catalyst concentration, reaction time and temperature are kept constant.

4. Optimization of catalyst requirement

The amount of catalyst required plays a vital role in the biodiesel production, inadequate catalyst makes the reaction very slow and too much of it causes the oil to saponify. Therefore, an optimum amount of catalyst has to be taken to carry out a biodiesel reaction. In this study, graded amount of NaOH (by weight) were taken to determine the optimum amount.

B. Process flow chart

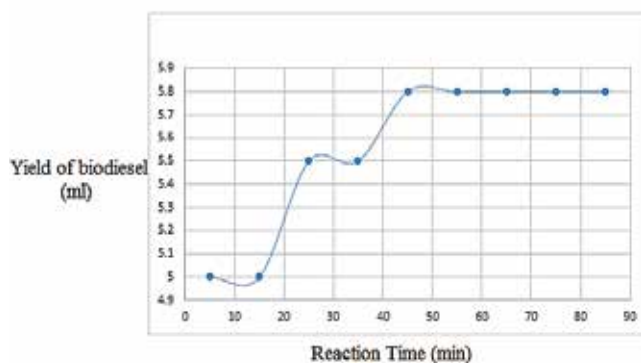


C. Analysis of the biodiesel sample

The biodiesel thus produced is tested for its quality. The parameters affecting the quality of biodiesel analysed are Colour, pH, Density, Viscosity, Flash and Fire point. Also the performance of biodiesel blends (2:3, 2:6 and 2:8) were compared with that of petroleum diesel. Load test on low speed single cylinder diesel engine is being carried out.

III. RESULTS AND DISCUSSION

The NaOH at different concentration were tested for yield. From the it is evident that maximum yield occurred at 0.5g/1000ml and after 1.5g/1000ml the reaction drastically reduces, hence the optimum catalyst concentration is 0.5g/1000ml of oil.



OPTIMUM PROCESS PARAMETERS	
PARAMETER	VALUE
Reaction time	45 min
Reaction Temp	65°C
Agitator speed	200 rpm
Catalyst conc.	0.5g/1000ml

PROPERTIES OF BIODIESEL	
PROPERTY	OBSERVATION
Colour	Golden yellow
pH	7
Density & Viscosity	0.8713g/cc & 7.023 cp
Flash Point & Fire Point	140°C & 150°C

IV. CONCLUSION

Biodiesel can be used as an alternate fuel in diesel engines either blended with petroleum diesel or in pure form. The high flash and fire point (1400C and 1500C respectively) results in poor combustion of fuel in the engines. The shortcomings of biodiesel can be overcome by blending biodiesel with petroleum diesel. The blended biodiesel has greater efficiency compared to diesel. The biodiesel blend 2:8 has a mechanical efficiency of 78% while the petroleum diesel has only 69% efficiency. Thus, blend in the ratio 2:8 drastically increases the engine performance.

Seminar & Panel Discussion Oct 2022

Automate Securely



The Institution of Engineers (India)
(Established 1900, Incorporated by Royal Charter 1995)
Qatar Chapter

SEMINAR & PANEL DISCUSSION

TOPIC:
AUTOMATE SECURELY

In Collaboration with



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04 Qatar Tribune
Sunday, October 30, 2022

Nation

Seminar and panel discussion focuses on secure automation

TRIBUNE NEWS NETWORK
QNA



With industries in Qatar moving towards automation with Artificial Intelligence (AI) and Internet of Things (IoT), a seminar on the challenges and solutions for Industry 4.0 initiative for both Information Technology (IT) as well as operational technology (OT) was organised.

The seminar was held by Institution of Engineers (India) Qatar Chapter in coordination with Vistas Global WLL and its subsidiary companies Expina IT Solutions and New Era Controls. The seminar was followed by a panel discussion on 'Automate Securely' at Hyatt Regency Oryx Doha.

The seminar had presentations from industry leaders ahead of the panel discussion. The event commenced with a welcome speech by Saliha bin Ibrahim KM, chairman of The Institution of Engineers (India) Qatar Chapter. It was inaugurated by Vistasp Sarda, head of Automation and MES, Qatar Aluminium Company. The presentations were made by senior management from VISTAS Global, Expina IT Solutions, New Era Controls, American Bureau of Shipping Group-USA,

The seminar was organised by Institution of Engineers (India) Qatar Chapter in coordination with Vistas Global WLL and its subsidiary companies Expina IT Solutions and New Era Controls.

The presentations brought to the audience cutting edge technologies and real time solutions for the IT and OT security in cyber age. The key take away is that these solutions are now available in Qatar through Vistas Global and its partners.

The panel discussion was attended by Jaber Mohammed Al Ajji, Head of IT Operations, Katana, Ningshin Dey, Expert on Automation and Cybersecurity, Jan Brownson, Global Head, Industrial Cybersecurity at ABB Group, Mohammed Al Halwani, Chief Technical Officer, Cisco Qatar, Subarna MK, Head of the Women's wing of the Institution of Engineers (India) Qatar Chapter was the moderator of the discussion.

covered the audience with solutions to challenges for Qatar industries and risk related to automation and cyber security. The eminent panelists also answered questions from the audience related to specific concerns or problems from their areas of operations.

Abdul Sathar, former Chairman of the Institution of Engineers (India) Qatar Chapter inducted the new members. Dr. Mahboob Ahmed, honorary treasurer of the Institution of Engineers (India) Qatar chapter proposed the vote of thanks.

The Institution of Engineers (India) was established in 1900 and incorporated by Royal Charter in 1935. From humble beginnings, it has grown to be the

world with more than 60,000 members. Qatar Chapter is one of the most active and successful overseas chapters of the Institution.

Vistas Global, part of HBK Group of companies, is a large business process management & system integrator in Qatar. Established in 2006, it has served Qatari customers in both technology & operations. Through partnerships with industry leading solution providers, it has been supporting operational technology organisations in their automation & security requirements. Expina IT Solutions, a subsidiary of Vistas Global, provides end-to-end enterprise grade computing infrastructure





Parker Russell
Chartered Accountants



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Er. Mohammed Zachariah
BE Chemical Engineer



Transforming Chemical Engineering: The Role of Artificial Intelligence

Artificial Intelligence (AI) has become a transformative force across various industries, and chemical engineering is no exception. With its ability to process vast amounts of data, optimise processes, and accelerate research and development, AI is reshaping the landscape of chemical engineering. In this article, we will explore how AI is revolutionising the field and its potential applications, from process optimisation to drug discovery.

Process Optimisation

One of the primary applications of AI in chemical engineering is process optimisation. Traditionally, chemical processes have been optimised through manual experimentation and trial-and-error approaches. However, AI-powered systems can analyse real-time data from sensors and make instantaneous adjustments to maintain optimal conditions. This not only increases efficiency but also reduces energy consumption and waste production, leading to significant cost savings for chemical manufacturers.

Machine learning algorithms can also predict equipment failures and recommend maintenance schedules, preventing costly downtime and ensuring the safety of personnel. These predictive maintenance systems analyse historical data and use it to forecast when equipment is likely to fail, allowing for timely interventions.

Drug Discovery and Molecular Design

AI is making significant strides in drug discovery and molecular design, accelerating the development of pharmaceuticals and other chemicals. By analysing vast databases of chemical compounds and biological data, AI algorithms can identify potential drug candidates with a higher success rate than traditional methods. This not only saves time and resources but also has the potential to bring life-saving drugs to market faster.

Webinar October 2023

IEI & Telegu Forum-Cost Management

TELUGU ENGINEERS FORUM-QATAR

SPEAKER

BALASUBRAMANIAM PARAMANANTHAM

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Cost Engineers: Who Are They and What Do They Do? What is cost engineering and who are the people we call cost engineers?
Course and training details.
Career Opportunities.
Question and Answers session.

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TECHNICAL WEBINAR

on

Australian Chartered Engineer Process and Benefits in Qatar

Guest Speaker



Astley Pung
Business Development Manager
Engineers Australia

Presidential Address



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IEI, Qatar Chapter

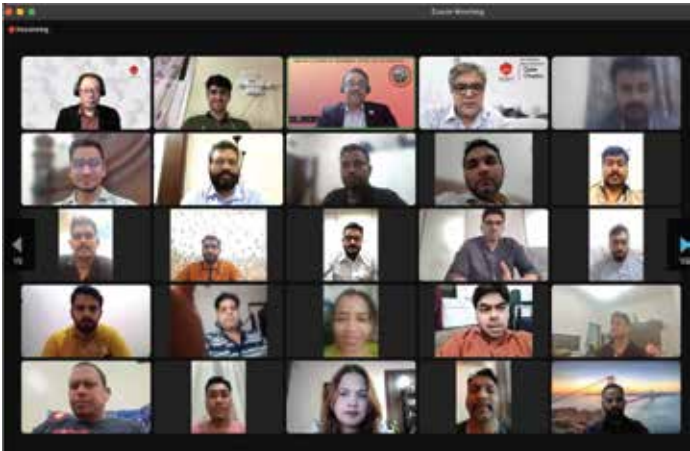
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07:00PM (Qatar)

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Er. Nazeeb Salim
Electrical Engineer



IMPORTANCE OF **LIFE SAFETY & FIRE ALARM SYSTEMS**

Life safety is a critical aspect of engineering that focuses on protecting individuals from potential hazards and ensuring their well-being in various environments. In a world where safety is paramount, it is crucial that we prioritize the well-being of individuals and take proactive measures to protect lives and property from the devastating effects of fires. Fire alarm systems play a crucial role in safeguarding lives and property by detecting and alerting occupants about potential fire incidents.

Fires can occur unexpectedly and spread rapidly, leaving little time for escape. However, with the implementation of effective fire alarm systems, we can significantly reduce the risks associated with fires and ensure the safety of occupants in various settings, be it residential, commercial, or industrial.

Fire alarm systems serve as the first line of defense, providing early detection and warning in the event of a fire. These systems consist of smoke detectors, heat detectors, fire alarms, and emergency notification devices. When a fire is detected, the alarm system immediately alerts occupants, allowing them to evacuate the premises swiftly and safely.

One of the key benefits of a well-designed fire alarm system is its ability to provide early warning. By detecting smoke or heat at the earliest stages, the system can initiate evacuation procedures and alert emergency services promptly. This early response can make a significant difference in saving lives and minimizing property damage. Moreover, modern fire alarm systems are equipped with advanced technologies that enhance their effectiveness.

These include features such as integrated voice evacuation systems, which provide clear and concise instructions to occupants during an emergency. Additionally, some systems can be integrated with other safety systems, such as sprinklers and emergency lighting, creating a comprehensive safety network.

However, it is important to note that the installation of a fire alarm system is just the first step. Regular maintenance, testing, and inspections are crucial to ensure their continued functionality. Fire alarm systems should be inspected by qualified professionals to identify any potential issues and ensure compliance with safety standards.

The advancements in fire alarm systems have significantly improved their effectiveness in detecting and responding to fire incidents. From intelligent systems to wireless technology and integration with building management systems, these innovations enhance safety, efficiency, and overall emergency management. By staying updated with the latest developments in fire alarm systems, engineers and building owners can ensure the highest level of protection for occupants and property.

In conclusion, life safety and fire alarm systems are essential components of any building or establishment. They provide early detection, warning, and evacuation guidance, ultimately saving lives and minimizing property damage. By investing in these systems and prioritizing their maintenance, we can create safer environments for ourselves, our loved ones, and our communities.



Er. Sudhyasatya Banerjee

BE - Electrical
MBA - Total Quality Management



HOSHIN KANRI

Your strategy; in a LEAN way!!

Hoshin Kanri is a lean tool of method for ensuring that a company's strategic goals drive progress and action at every level within that company. This method eliminates the waste that comes from inconsistent directions and poor communication.

Introduction:

Hoshin Kanri is a lean tool of method for ensuring that a company's strategic goals drive progress and action at every level within that company. This method eliminates the waste that comes from inconsistent directions and poor communication. In some organization this is also simply termed as Policy Deployment, however the framing and monitoring are carried out in a structured way using this tool, to understand the present status and future implementation plan of policies or strategies. Hoshin Kanri is termed as a visual strategic management tool or technique that was developed by Professor Yoji Akao in Japan in the 1950s. This is a Japanese terminology, which aptly means "compass management". The individual words "hoshin" and "kanri" mean direction and administration, respectively.

Some of the well-known organization like Toyota, HP, Xerox etc. extensively uses this tool for business planning initiatives. Toyota has used Hoshin Kanri since the 1960s. The company's continuous success clearly illustrates that this approach leads to positive results.

The Technique:

Hoshin Kanri is a lean tool of method for ensuring that Hoshin Kanri follow a Think, Plan, Implement, and Review process, which is similar to PDCA (Plan Do Check & Act) cycle. The cyclical process is a way to plan for the future, not just to react to what is happening now. There are 7 steps to be followed as an organization intends to embrace Hoshin Kanri:





Er. Satheeshwaran Dharmar
B. Tech, PMP, CESC, CFAITMS, CEng (I), MIE.

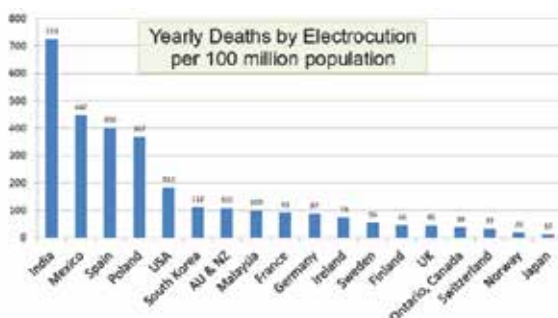
Electrical Safety in India:

Analyzing Challenges, Alarming Trends, and the Imperative for Stringent Standards Implementation.

1. Introduction:

As India's infrastructure expands and reliance on electrical power grows, electrical accidents pose a significant and escalating threat to public safety. Understanding the diverse aspects and consequences of these incidents, from electrocutions to fires caused by electrical system, is crucial. This article delves into sobering statistics and offers insights to prevent such incidents, aiming to empower a safer future for all.

2. The Global Landscape of Electrical Accidents:



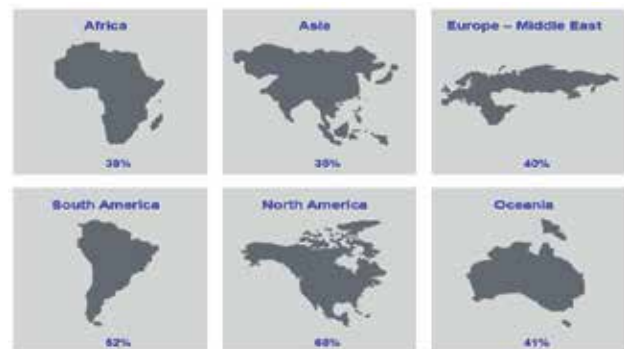
As per FESIA, Japan, India has the highest rate of electrical accidents.

	Source	Year
India	NCRB	Average 2009-2013
Mexico	INEGI	Average 2003-2007
Spain	FENIE	Average 2000s
Poland	SEP	Average 2002-2011
USA	NSC	Average 1991-1993
South Korea	KESCO	Average 2007-2011
AU & NZ	ERAG	Average 2000-2009
Malaysia	ST	Average 2002-2010
France	INSERM	Average 2006-2010
Germany	VDE	Average 1999-2008
Ireland	HSA	Average 1995-2012
Sweden	NESB	Average 2002-2011
Finland	TUKES	Average 2003-2012
UK (low voltage installation only)	ESC	2010
Ontario, Canada	ESA	Average 2008-2012
Switzerland	ESTI	Average 2003-2012
Norway	DSB	Average 2007-2011
Japan	METI	Average 2007-2011

2.1 World Electrical Safety Barometer.

Home electricity is generally safe, if used in the appropriate manner, but most countries lack the standards, regulations, and education to achieve this. The result is an unnecessary risk for electrically induced fires and electrocution. The Electrical Safety Barometer measures the gap between reality and best practice and advises policymakers on how to improve. Higher scores

are better. India's Electrical safety score is 16%, lower than the Asia's average of 35%.



Source: FISUEL, France.

2.2 Electrical Accidents in Qatar: Statistics.

Qatar has adopted several stringent electrical safety regulations in recent years, but more data from recent years is required to analyze their impact.

Causes of Fire Break	Jan	Feb	Mar	April	May	Total
Smoking	0	0	0	0	0	0
Malpractices of Children	0	0	0	0	0	0
Electric	9	6	7	4	2	28
Gas Leak	0	0	0	0	0	0
High Temperature	0	0	1	1	0	2
Intentional Fire	0	0	0	0	0	0
Spark Scattering	0	0	0	0	0	0
Left for Fire Expert for Investigation	1	0	3	1	2	7
Criminal Offence	0	0	1	0	0	1
Unknown Reasons	32	59	67	75	17	250
Other Causes	1	0	0	2	0	3
Total	43	65	79	83	21	291

According to Qatar Civil defense, Electrical accidents also accounted for 9.6% of total fire accidents in Qatar between January 2010 and May 2010.

Death Caused By Exposure To Electric Current, Radiation And Extreme Ambient Air Temperature And Pressure			
Year	Non Qataris	Qataris	Total
2021	11	0	11
2020	10	1	11

Source: Qatar Planning and Statistics Authority.

3. Electrical Accidents in India: Statistics.

3.1 Human Electrocutation: Rising Trends.

India bears the unfortunate distinction of having the highest death rate due to electrocution, as reported by The Forum of Electrical Safety Inspection Associations in Japan. The gravity of this issue becomes even more apparent when examining data from The Indian National Crime Records Bureau (NCRB), which reveals that between 2012 and 2021, over 113,000 individuals in India lost their lives due to fatal electric shocks. This alarming statistic translates to nearly 11,000 deaths annually or a staggering 30 fatalities every day.

Electrocution Deaths In India		
Year	Deaths	% Of Total Accidental Deaths
2021	12529	3.20%
2020	13446	3.70%
2019	13432	3.30%
2018	12154	3.00%
2017	12004	3.10%
2016	11126	2.70%
2015	9986	2.50%
2014	9606	2.10%
2013	10218	2.60%
2012	8750	2.20%
TOTAL	113251	2.84% (AVERAGE)

Source: National Crime Records Bureau, India.

Electrocution deaths in India have been on the rise, with a notable increase from 8,750 in 2012 to 13,446 in 2020, a surge of 54%. Although there was a slight decline to 12,529 in 2021, the overall trend remains worrisome. Similarly, the percentage of electrocution-related deaths relative to total accidental deaths rose from 2.20% in 2012 to 3.70% in 2020, with a slight dip in 2021, possibly attributed to COVID-related factors.

According to the Central Electricity Authority - Annual Electrical Accident Statistics, contact with live electric wire/equipment is the major reason for the Fatal and non-fatal electrical accidents.

Rain increases the risk of electrocution deaths by exposing live wires and making electrical infrastructure more hazardous.

Reasons For Human Electrical Accidents 2015-16		
Accident type	Type	No.
Snapping of conductors	Fatal	870
	Non-fatal	292
Accidental contact with live electric wire/equipment	Fatal	2,141
	Non-fatal	1,295
Violation/Neglect of safety measures/Lack of supervision	Fatal	362
	Non-fatal	581
Defective appliances/apparatus/tools	Fatal	642
	Non-fatal	95
Inadequate/ Lack of maintenance	Fatal	94
	Non-fatal	37
Unauthorized work	Fatal	781
	Non-fatal	237
Any other reasons	Fatal	918
	Non-fatal	707

Source: Central Electricity Authority, India.

3.2 Wildlife Electrocutation: A Tragic Consequence

Electrocution is not limited to humans; it also impacts wildlife. Data from the Wildlife Protection Society of India (WPSI) reveals that between 2010 and 2020, approximately 1,300 wild animals fell victim to deliberate and accidental electrocution across the country. This tragic toll included over 500 elephants, 220 flamingos, 150 leopards, and 46 tigers. The use of 11-kilovolt overhead lines crisscrossing through forests and high-tension wires for rural electrification poses a severe threat to wild animals, as they often perish upon contact with these wires. Other reasons for wildlife electrocution include deliberate electrocution, poaching, and the use of illegal fences to protect crops.

3.3 Electrical Fires: A Burning Issue

Deaths Due To Short Circuit Fire			
Year	No. of Cases	Persons Injured	Persons Died
2021	1808	144	1657
2020	1943	121	1812
2019	2183	208	1990
2018	1970	253	1719
2017	1886	80	1736
TOTAL	9790	806	8914

Source: National Crime Records Bureau, India.

Apart from electrocutions, electrical short circuits contribute significantly to accidental deaths in India. According to the National Crime Records Bureau (NCRB), in 2021, electrical

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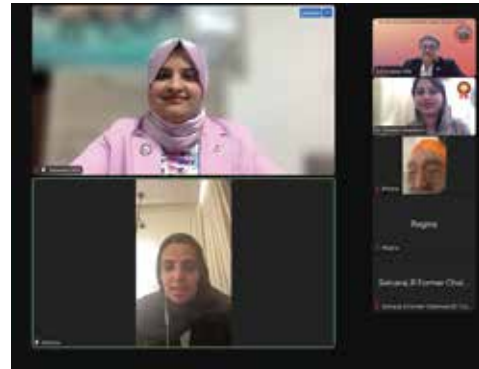
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President - Institution of Engineers India Women's Wing
Head, Heart & Hands in Leadership

Chief Guest
Ms Munera Al Dosari
CEO Startlink Qatar

Speaker
Katie Wapondora
Founder and Managing Partner of QI and ELLE
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short circuits were responsible for 21% (1808 cases) of the total 8491 accidental fires.

4. Safety Measures to Prevent Electrical Accidents:

To prevent electrical accidents, it requires a comprehensive approach encompassing technical and managerial measures, government-led safety initiatives, heightened safety emphasis by distribution companies, and the strict enforcement of electrical and fire safety regulations. Equally important is the dissemination of awareness among both electricity consumers and employees of distribution companies.

4.1 Importance of Stringent Implementation of Standards and Regulations:

The adherence to electrical safety standards holds immense importance. By analyzing the safety score report of India from FISUEL, France, it is evident that India scores a perfect 10 out of 10 in the availability of standards and rules criteria. However, there are several other crucial criteria, such as the role of utilities, consumer education, regulation implementation, initial verification, periodic inspection, inspection report, inspection for existing installations, labeling, and certification, where India falls short. This lack of fulfillment in these areas is the primary reason for the low score. Therefore, the main issue lies in the proper implementation of these standards. To ensure safer practices and minimize the risk of accidents, it is crucial to comply with both national and international electrical safety standards. Adhering to these standards ensures that electrical installations meet specific safety requirements. Some of the national and international electrical safety standards are,

- IS732:2019 – Indian Code of practice for electrical wiring installations, Rev4.
- Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023
- SP 30 - National electrical code of India 2023,

- SP 7: 2016 National Building Code of India.
- IS – 3043 Code of practice for Earthing.
- IEC 60364 - International standard on electrical installations of buildings.
- BS 7671 –Requirements for Electrical Installations, UK.
- NFPA 70E - Standard for Electrical Safety in the Workplace.

4.2 Electrical Safety Audit & Maintenance:

Electrical safety audits and maintenance are crucial for preventing electrical accidents. Audits identify hazards, assess risks, and recommend corrective measures. Maintenance implements corrective measures, keeps systems up to date, and ensures emergency preparedness. Electrical safety Audits and maintenance also support continuous improvement in electrical safety practices.

5. Conclusion:

Enhancing electrical safety is a collective endeavor requiring vigilance, regular inspections and maintenance. A commitment to workplace safety, Public awareness, and adherence to national and international standards will lead us toward a future where electrical accidents and fires become rare occurrences.

6. References

- *National Crime Records Bureau - annual ADSI reports.*
- *Central Electricity Authority - Annual Electrical Accident Statistics.*
- *The Forum of Electrical Safety Inspection Associations (FESIA), Japan.*
- *Wildlife Protection Society of India, publication dated 5 Oct 2020.*
- *International Federation for the safety of users of electricity (FISUEL), France.*



Er. V.S.R. Chandra Sekhar

Member of Institute of Engineer (MIE)
Chartered Engineer(IEI)

BE VIGILANT **BE SMART** **BE CYBER**

Cybersecurity refers to any technology, measure, or practice for preventing cyberattacks or mitigating their impact. It aims to protect individuals' and organizations' systems, applications, computing devices, sensitive data, and financial assets against a wide range of threats, from simple computer viruses to sophisticated ransomware attacks.

Cybersecurity is crucial in today's digital world as cyberattacks have the potential to disrupt, damage, or destroy businesses. The average global cost of a data breach in 2023 was USD 4.45 million. Cybersecurity strategies leverage advanced analytics, artificial intelligence, and automation to fight cyber threats more effectively and minimize the impact of cyberattacks. Cybersecurity is the practice of defending computers, servers, mobile devices, electronic systems, networks, IOTs, and data from malicious attacks. It is a broad field that can be divided into several categories, including network security, application security, information security, operational security, disaster recovery, business continuity, and end-user education.

Cyber security in daily life:

Cybersecurity is a practice of protecting systems, networks, and programs from digital attacks. These cyberattacks are usually aimed at accessing, changing, or destroying sensitive information; extorting money from users via ransomware; or interrupting normal business processes. It is important to practice good cyber hygiene in our daily lives to protect ourselves and our digital assets.

Tips to maximize cybersecurity in everyday life:

1. Secure your Wi-Fi network: Protect your home Wi-Fi network by setting a strong password and avoiding sharing it with others.
2. Enable security settings: Turn on all security settings built into your devices, such as firewalls and virus-detection software. Keep these software up to date to ensure you have the latest protection.
3. Password-protect sensitive files: Files containing sensitive personal or account data, password-protect them to prevent unauthorized access.

4. Practice good cyber hygiene: Learn about personal cybersecurity best practices and internet hygiene to stay safe online.
5. Stay informed: Keep up with the latest cybersecurity news and trends to stay aware of potential threats and how to protect yourself.

Cyber Security in financial sector:

Cybersecurity is a critical concern for financial sector as Financial institutions handle large volumes of sensitive financial data, making them attractive targets for cybercriminals. A survey conducted by Deloitte examined how financial services firms

all industries still have much to do to protect their information assets against threats and attacks. The dangers are swiftly growing in number and severity.

Find below some industries that need stronger cybersecurity measures:

1. Energy and Utilities: This industry includes businesses that supply essential services such as water, sewage, electricity, dams, and natural gas.
2. Healthcare: The healthcare industry deals with sensitive patient data and medical records, making it a prime target for cyberattacks.
3. Government: Government agencies store vast amounts of sensitive information, including citizen data and national security secrets.



measure success with cybersecurity and found that organizations work within a broad spectrum of cybersecurity strategies, structures, and budget priorities. Finance departments play an important role in cybersecurity. They bring deep knowledge of regulatory compliance, which helps organizations navigate domestic and international privacy and security regulations. By keeping finance departments in the cybersecurity loop, organizations can reduce their risk and respond quickly to threats

Retail Market: Retailers handle customer payment information and personal data, making them attractive targets for cybercriminals.

Cybersecurity in Industrial Infrastructure:

Cybersecurity is a critical concern for organizations across various industries. A survey conducted by McKinsey in 2021 assessed the cybersecurity maturity level of more than 100 companies and institutions in different sectors. The results revealed that while some organizations in the banking and healthcare industries have made fair progress, most organizations in

4. Manufacturing: The manufacturing industry is becoming increasingly digitized with the rise of Industry 4.0 (increasing automation, employment of smart machines, smart factories, etc.) making it vulnerable to cyber threats.

5. Construction: The construction industry relies heavily on digital systems for project management, design, and communication.

6. Marketing and Media: Marketing and media companies handle large amounts of customer data and intellectual property which makes vulnerable to cyber threats.

It's important for organizations in these industries to prioritize cybersecurity measures to protect their information assets and maintain the trust of their customers.

Common cybersecurity risks:

Cybersecurity risks vary across different industries and some common cybersecurity risks as follows:

1. **Malware:** Malware is a common form of security

threat that installs itself on a target system, causing unusual behaviour such as denying access to programs, deleting files, stealing information, and spreading itself to other systems.

2. Password Theft: Unauthorized third parties may steal or guess passwords, gaining access to sensitive information.

3. Traffic Interception: Also known as “eavesdropping,” traffic interception occurs when a third party intercepts information sent between a user and a host.

4. Phishing Attacks: Phishing attacks involve tricking individuals into revealing sensitive information by posing as a trustworthy entity.

5. Ransomware: Ransomware is a type of malware that encrypts files on a victim’s system and demands a ransom for their release.

6. Social Engineering: Social engineering involves manipulating individuals to gain unauthorized access to systems or sensitive information.

7. Insider Threats: Insider threats refer to security risks posed by individuals within an organization who have authorized access to systems and data.

8. Data Breaches: Data breaches involve unauthorized access to sensitive data, potentially leading to identity theft, financial loss, or reputational damage.

9. IoT Vulnerabilities: Internet of Things (IoT) devices can introduce security vulnerabilities if not properly secured.

10. Supply Chain Attacks: Supply chain attacks exploit vulnerabilities in the supply chain to compromise systems or introduce malicious software.

3. Implement encryption: Encrypt sensitive data both at rest and in transit. Encryption helps protect data even if it falls into the wrong hands.

4. Keep software up-to-date: Regularly update software, including operating systems, applications, and security patches. Outdated software may contain vulnerabilities that can be exploited by cybercriminals.

5. Monitor network activity: Implement robust network monitoring tools to detect any unusual or suspicious activity. Promptly investigate and respond to any potential security incidents.

6. Backup data regularly: Regularly backup critical data and store backups in a secure location. This can help mitigate the impact of a data breach or other catastrophic events.

7. Establish incident response plans: Develop and test incident response plans to ensure a swift and effective response in the event of a data breach. This includes identifying key stakeholders, defining roles and responsibilities, and establishing communication channels.

8. Conduct regular security assessments: Regularly assess your organization’s security posture through vulnerability assessments and penetration testing. Identify and address any vulnerabilities or weaknesses before they can be exploited.

9. Stay informed: Keep up-to-date with the latest cybersecurity threats and trends. Subscribe to relevant security alerts and advisories from trusted sources to stay informed about emerging threats. Government agencies store vast

How can organizations prevent data breaches?

Now its time to remember old saying “Prevention is better than cure” - Data breaches can have severe consequences for organizations, both financially and in terms of reputation. Find below some best practices to help prevent data breaches:

1. Restrict access: Limit access to sensitive data to only those who need it. Implement strong access controls, including multi-factor authentication, to ensure that only authorized individuals can access critical systems and information.

2. Train employees: Educate employees about cybersecurity best practices, such as creating strong passwords, recognizing phishing attempts, and reporting suspicious activities. Regular training sessions can help raise awareness and reduce the risk of human error.



Remember that cybersecurity is an ongoing effort that requires continuous monitoring, adaptation, and improvement. By implementing these best practices, organizations can significantly reduce the risk of data breaches.



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B.Tech Information Technology



Technological advances and their effects in engineering.



One of the most obvious impacts of technology on engineering is the increased use of software tools and applications.

Technology is constantly evolving and transforming the world around us and have a significant impact on the field of engineering, both in terms of opportunities and challenges. Engineers are at the forefront of this change, as they design, create, and implement innovative solutions to various problems and challenges. On one hand, new technologies enable engineers to design, build, and operate more efficiently, safely, and sustainably. For example, artificial intelligence, robotics, nanotechnology, biotechnology, and renewable energy are some of the emerging areas that offer innovative solutions to various engineering problems. On the other hand, technological advancements also pose ethical, social, environmental, and economic issues that engineers need to consider and address. For instance, how to ensure the reliability, security, and accountability of complex systems? How to balance the benefits and risks of new technologies? How to promote the public interest and social justice in engineering practice? These are some of the questions that require engineers to adopt a holistic and responsible approach to their work.

One of the most obvious impacts of technology on engineering is the increased use of software tools and applications. Engineers can now use software to perform complex calculations, simulations, analyses, and designs, as well as to communicate, collaborate, and manage projects. Software can also automate some of the tasks that engineers used to do manually, such as data collection, processing, and reporting. This can improve efficiency, accuracy, and productivity, as well as reduce costs and errors. However, software also requires engineers to learn new skills and keep up with the latest updates and developments. Engineers need to be proficient in various software platforms and languages, as well as understand the underlying principles and algorithms. Moreover, software can sometimes fail or malfunction, which can lead to serious consequences if not detected and corrected in time. Therefore, engineers need to be vigilant and cautious when using software, and always verify and validate their results. Another impact of technology on engineering is the

ences, and networks. Technology has also enabled engineers to showcase their work and achievements to a wider audience through online portfolios, blogs, social media platforms, etc. This can enhance their visibility and reputation, as well as create new opportunities for learning and career development. However, technology also exposes engineers to more competition from other engineers around the world who may have similar or better qualifications, skills, or experiences. Engineers need to constantly update their knowledge and skills to stay relevant and competitive in the global market. Engineers also need to be aware of the cultural differences and expectations of their clients or employers from different countries or regions. Engineers need to respect diversity and adapt their work style accordingly.

In engineering, technology plays a vital role in creating innovative solutions, improving efficiency and quality, and enhancing safety and sustainability. Following are some

6 . *Technology has made it easier for engineers to access information, resources, markets, and customers from anywhere in the world.*



emergence of new fields and disciplines. Technology has enabled engineers to explore new domains and applications, such as biotechnology, nanotechnology, robotics, artificial intelligence, renewable energy, and more. These fields offer exciting opportunities for innovation and creativity, as well as for solving some of the most pressing issues facing humanity and the environment. However, these fields also pose new challenges and ethical dilemmas for engineers. Engineers need to consider the social, environmental, and economic implications of their work, as well as the potential risks and benefits for themselves and others. Engineers also need to collaborate with other professionals from different backgrounds and disciplines, such as scientists, doctors, lawyers, policymakers, and more. This requires engineers to have a broad knowledge base and a multidisciplinary perspective, as well as strong communication and interpersonal skills.

A third impact of technology on engineering is the increased competition and globalization. Technology has made it easier for engineers to access information, resources, markets, and customers from anywhere in the world. Engineers can now work remotely or in different locations, as well as participate in online courses, webinars, confer-

technological advancements that have impacted engineering in recent years and how they have changed the way engineers work and solve problems.

One of the most significant technological advancements in engineering is the use of artificial intelligence (AI) and machine learning (ML). AI and ML are branches of computer science that enable machines to perform tasks that normally require human intelligence, such as reasoning, learning, decision making, and problem solving. AI and ML can help engineers in various ways, such as:

- Designing and optimizing complex systems and processes using data analysis, simulation, and optimization techniques.
- Automating repetitive and tedious tasks, such as data entry, documentation, testing, and quality control.
- Enhancing human capabilities, such as augmenting creativity, intuition, and collaboration.
- Improving safety and reliability, such as detecting faults, anomalies, and risks, and providing recommendations and solutions.

Another technological advancement that has influenced engineering is the use of additive manufacturing (AM), also

known as 3D printing. AM is a process that creates physical objects by depositing layers of material on top of each other, following a digital model. AM can offer several benefits for engineers, such as:

- Enabling rapid prototyping and testing of new ideas and concepts.
- Reducing material waste and costs by using only the required amount of material.
- Creating complex and customized shapes and structures that are difficult or impossible to produce by conventional methods.
- Enhancing functionality and performance by integrating multiple components and functions into a single part.

A third technological advancement that has affected engineering is the use of the Internet of Things (IoT). IoT is a network of interconnected devices that can collect, exchange, and process data. IoT can enable engineers to monitor, control, and optimize systems and processes remotely and in real time. IoT can also provide engineers with valuable insights and feedback that can help them improve their designs and operations. Some examples of IoT applications in engineering are:

- Smart buildings that can adjust lighting, temperature, ventilation, security, and energy consumption according to occupancy, weather, and user preferences.
- Smart grids that can balance power supply and

demand, integrate renewable energy sources, detect faults, and prevent blackouts.

- Smart transportation that can optimize traffic flow, reduce congestion, enhance safety, and provide navigation and entertainment services.

These are just some of the technological advancements that have shaped engineering in the 21st century. Technology is constantly evolving and creating new opportunities and challenges for engineers. Engineers need to keep up with the latest trends and developments in technology and adapt their skills and knowledge accordingly. Technology can help engineers achieve their goals of creating innovative solutions that can improve the quality of life for people and the planet.

In conclusion, technology has a significant impact on engineering profession in various ways. Technology can provide many benefits for engineers such as improved efficiency, productivity, and creativity, as well as new fields and opportunities. However, technology also poses some challenges and risks for engineers such as increased complexity, competition, and ethical issues. Engineers need to embrace technology and use it wisely and responsibly, as well as develop their skill and competencies to cope with the changing demands and expectations of the engineering profession.

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The Unsung Heroes:

Mechanical Engineers and the Battle Against Carbon Emissions

The global challenge of reducing carbon emissions and combating climate change has never been more critical than the current situation. Industries around the world are under increasing pressure to find sustainable solutions to lower their environmental footprint. Amidst this urgent call for action, mechanical engineers have emerged as the unsung heroes, driving innovation and leading the charge toward a greener, more sustainable future. In this article, we shall explore the pivotal role of mechanical engineers in industry and their contributions to the reduction of carbon emissions.

The Mechanical Engineer's Arsenal:

Energy Efficiency and Optimization: Mechanical engineers are experts in optimizing industrial processes and systems to reduce energy consumption. They meticulously analyze the efficiency of machinery, HVAC systems, and manufacturing processes. By identifying inefficiencies and implementing innovative solutions, they maximize the use of renewable energy sources.

Sustainable Materials and Design: Selecting sustainable materials and designing products for reduced environmental impact is a core responsibility of mechanical engineers. They work tirelessly on developing lightweight materials, recyclable components, and eco-friendly manufacturing processes. Sustainable product design extends the life cycle of products and reduces waste, contributing significantly to carbon emission reduction.

Renewable Energy Integration: Mechanical engineers are at the forefront of integrating renewable energy sources such as wind, solar, and hydroelectric power into industrial processes. They design systems that efficiently harness, store, and distribute clean energy. By facilitating the adoption of renewables, they help industries shift away from fossil fuels and reduce their carbon footprint.

Carbon Capture and Sequestration (CCS): The development of CCS technologies is another area where mechanical engineers shine. They design and maintain equipment for capturing carbon emissions from industrial processes and power plants. Ensuring the safe and effective storage of captured carbon is a crucial step toward a low-carbon future.

Transportation and Vehicle Efficiency: Mechanical engineers are instrumental in revolutionizing transportation. They design fuel-efficient and electric vehicles, optimize engine performance, reduce vehicle weight, and improve aerodynamics. Their innovations are driving the shift towards cleaner modes of transportation, significantly reducing emissions from the transportation sector.

Sustainable Supply Chains: Optimizing supply chain logistics is yet another vital role played by mechanical engineers. They analyze data, employ modeling techniques, and develop eco-friendly solutions for transportation and distribution. By making supply chains more efficient, they help reduce emissions associated with the movement of goods.

Impact on Industry:

Cost Reduction and Profitability: Through energy-efficient processes and sustainable design, mechanical engineers help industries reduce operational costs. These cost savings translate into increased profitability, making sustainability a win-win proposition for both businesses and the environment.

Regulatory Compliance: Mechanical engineers ensure that industries meet and exceed environmental regulations. By staying up-to-date with changing standards and implementing best practices, they help businesses avoid penalties and reputational damage.

Innovation and Competitiveness: Companies that embrace sustainable practices gain a competitive edge in the market. They attract environmentally conscious consumers and investors, fostering growth and long-term success.

Conclusion:

In an era defined by the imperative to reduce carbon emissions and confront the existential threat of climate change, mechanical engineers stand as formidable champions on the frontlines of this global battle. Their specialized knowledge and innovative approaches in fields such as energy efficiency, sustainable design, and the seamless integration of renewable energy sources are nothing short of transformative. Their contributions resonate across industries worldwide, resonating with far-reaching implications.

Mechanical engineers do not merely play a pivotal role in the mitigation of carbon emissions; they are architects of a more sustainable and prosperous



future for our planet. Their work transcends the realm of mere problem-solving; it encapsulates a profound commitment to reimagining the way our society functions. By devising more energy-efficient systems and pioneering sustainable technologies, they lead us towards a world where economic growth and ecological preservation can coexist harmoniously.

In essence, mechanical engineers represent not only the vanguard of innovation but also the guardians of our planet's future. Their contributions extend far beyond their technical expertise; they embody a shared commitment to a world where environmental stewardship and economic prosperity go hand in hand. As we navigate the complex challenges of our time, it is the work of mechanical engineers that offers us a path forward—a path that leads to a more sustainable, equitable, and resilient future for all.

Together, we form an interconnected chain in the battle against climate change. It is through our combined commitment and collaborative endeavors that we can aspire to create a more sustainable and resilient world for current and future generations.

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