

DECEMBER 2023

VIEWPOINT

www.ceai.org.in

OFFICIAL QUARTERLY MAGAZINE OF CEAI

CONSULTANCY FOR THE INDUSTRIAL SECTOR



CEAI
Consulting Engineers
Association of India
Creating Value Ethically

Over **60** Years
Service to Consulting Engineers



Intertek

ISO 9001:2015



www.stc.co.in

BUILDING URBAN LIFELINES WITH MASTERY

Established in the year 1976, Shah Technical Consultants works towards the objective of providing professional services in the field of urban infrastructure specialising in the water and waste water sectors. With projects both in India and overseas, STC is today a widely recognised and trusted name in infrastructure consulting.

OUR SECTORS



Sewerage



Water supply



Storm water



Tourism infrastructure



Solid waste



Roads and bridges



SHAH TECHNICAL CONSULTANTS PVT. LTD.

Mumbai

#407, Raheja Centre,
Nariman Point, Mumbai – 400 021.
+91 22 22871061 | stc@stc.co.in

Chennai

Old No. 43/2, New No. 24/8,
Vijayaraghava Road (Adjacent to Andhra Club),
T. Nagar, Chennai – 600 017.
+91 44 28150573 | stc.chennai@stc.co.in

Jaipur

#32, Lions Colony, Opp. Morani Motors,
Sitabari Tonk Road, Jaipur – 302 018.
+91 141 2552981 | stcjaipur@stc.co.in

VIEWPOINT

OFFICIAL QUARTERLY MAGAZINE OF CEAI

www.ceai.org.in

CONTENTS

Art#	Article Title & Authors	Pg#
i	Message From Chief Editor	v
ii	Message From Guest Editor	vii
iii	Greetings From the President	ix
	<i>Articles</i>	
1	Consultancy in the Industrial Sector after COP28 - Pradeep Chaturvedi	1
2	Consultancy for the Industrial Sector - Satish Narayan Diwakar & Arshi Bhutani	6
3	Consultancy for the Industrial Manufacturing Sector - Jayaprakash K & Arjun K P	13
4	Cement Industry: Power Generation from Waste Heat - Surinder Kumar Kaul	18
5	Emerging Technology Trends in Cement Industry - Jagdeep Verma & Dinesh Satija	24
6	Climate Change - Challenges and Opportunities - Arvinder S Brara	30
7	A Journey Across Six Generations of Civil Engineers in India - Vijay Kumar Dhingra	35
	CEAI News	42
	Other News, Views, Notes	49
	Tech Quiz	51

Editorial Board Members

Mr. A P Mull,
Chief Editor

Mr. R S Sharma
Ex officio
Mr. Girish Mishra

Dr. Rajashekhar R Malur
Mr. Pradeep Chaturvedi
Mr. Navneet Sharma

Ms. Neha Jain
Mr. S K Peter
Mr. Sourav Daspatnaik

About CEAI

Consulting Engineers Association of India (CEAI) is the apex body of consulting engineers in India having membership of organisations as well as individuals. The membership represents large, medium and small consultancy companies/organisations both in the private and public sector and eminent individual consultants. EPC organisations are also members of CEAI since they have planning and design engineers, apart from construction management consultants.

CEAI is the Member Association, of the International Federation of Consulting Engineers, commonly known as FIDIC, the acronym for Fédération Internationale Des Ingénieurs-Conseils, representing the Consulting Engineering Fraternity in India. FIDIC has membership of more than 100 Member Association of various countries and is headquartered in Geneva.

CEAI was incorporated in 1996, with the merger of two leading national associations Association of Consulting Engineers (India) {ACE(I)}, incorporated in 1960 and National Association of Consulting Engineers {NACE}, incorporated in 1976. Thus, CEAI has, behind it six decades of accumulated knowledge and experience.

- CEAI promotes the interest and works to enhance the status of the consulting engineering profession in India
- CEAI advocates global networking and co-operation
- CEAI's activities include:
 - Quality development of Consultants.
 - Productivity enhancement.
 - Promotion of ethical practices.
 - Facilitation and interaction with government and other authorities/ bodies to streamline and improve the system of engagement of consultants.
- Regional Centres in Jaipur, Bengaluru, Kolkata and Mumbai to broad base activities.

Aims & Objectives

- Promote the professional interest and establish the rights and privileges of the status of consulting engineering profession in India
- Represent the consulting engineering profession within India and abroad. Connect the members locally and globally.
- Disseminate among the members information on all matters pertaining to engineering, especially knowledge and information related to consulting engineering profession by way of holding Conferences, Seminars, Courses, Workshops, Field/ Site Visits, etc. and thus assist in Continuing Education for the Professional Development of Members.
- Act as the principal champion for consulting engineering profession through constantly informing and educating the public and lawmakers about key engineering issues and making it possible to have the voice of the profession heard by the policy makers.
- Promote adoption of equitable forms of contracts and other documents used in consulting engineering practice.

Vision

- To represent, promote and enhance the status of consulting engineers in India as an honoured and dignified profession for nation building and propagate Indian engineering consultancy globally.

Mission

- Promote interests of the consulting engineering profession nationally and internationally.
- Promote sustainable, safe and sound engineering practices.
- Upgrade engineering knowledge and skill.
- Propagate code of professional ethics, safety, health and environment.

Values

- Commitment with tenacity to high ethical values, integrity, professionalism and achieving technical excellence and inclusive development.

Code OF Ethics

- CEAI has adopted a Code of Ethics, to which all members must abide. It is not just for the quality of the jobs they work on, but for the safety and well-being of the public at large.
- CEAI is the profession's most respected voice on the practice of ethical engineering.
- The code specifies the responsibilities of Consulting Engineers towards the society as well as the profession, to refrain from performing services unless competent to do so, to act in the legitimate interest of client, to be impartial, to maintain ethical relations with other consultants.



Take Off
with
INDIA

Join CEAI

The Apex Body of Consulting Engineers

Over 60 YEARS

Of Service to the Profession

CEAI - Your Partner To Create Your Future

CEAI

- *promotes the interest and works to enhance the status of the Consulting Engineering profession in India*
- *advocates global networking and co-operation*
- *helps to keep in touch with the latest professional updates – technical, regulatory, legal, financial, health & safety, environmental, etc.*
- *provides excellent opportunity to present papers in seminars and technical lectures organised from time to time*
- *aids in skill development through regular training programmes including training on FIDIC Conditions of Contract and sharing of the legal issues based on the Indian context*
- *takes-up various issues confronting the profession with government and other authorities from time to time with the objective of making the conditions of engagement on a fair and equitable basis so that Consulting Engineers can function in the best interest of the country*
- *promotes the cause of Women Engineers with a view to ensure rightful places for them in the engineering consultancy arena*
- *helps to develop Young Engineers to be the Future Leaders*

JOIN Now & Grow



Message from Chief Editor

Dear Fellow Consulting Engineers & Readers,

Another year has gone by and the country has progressed despite all the trials and tribulations that it had to face. Investments in Industrial and Manufacturing Projects of all sizes have risen, with many States interacting with the industrialists and investors – both Indian as well as Foreign and providing facilities for setting up plants. Work on the Industrial and the Economic Corridors are also going on in full swing, which coupled with the projects for highways, railways, waterways, water ports and airports will give a big boost to the economy. It is these industries that will provide employment to the youth of the country. The key sectors that are growing fast are the automotive, engineering, chemicals, pharmaceutical and consumer durables. The digital transformation has been a key factor as India progresses towards Industry 4.0.

While an Industrialist or Investor may propose an idea and provide the investment, it is the Consulting Engineers who make those aspirations fructify by planning and designing it, having it constructed and then making it operational. The relationship between the Industrialist or Investor and the Consulting Engineer needs to be open and transparent since the latter is virtually an extended arm of the former. The Industrialist or Investor must spell out their business plan (objectives) and aspirations in a lucid and unambiguous manner. It will be from that that the Consulting Engineer prepares the reports to take the project forward.

With the long-awaited thrust on IT hardware and digitalization by the Government of India new plants are being set up to make the country a manufacturing hub for the sector. The new facilities must be based on long term plans and have the flexibility to be tweaked to meet the kaleidoscopic nature of the IT hardware industry.

Site selection is an extremely crucial step for setting up an industry and for the IT ones, the vagaries of nature must be kept in mind, since they are very sensitive to ground motion and structure sway. Electrical power is essential for all industries hence high-quality power needs to be available from sustainable sources. The same goes for the industrial water requirements. Transportation requirements – for raw materials and the finished goods mandate all weather road connectivity. All these must be assured 24x7.

All that sounds very encouraging and is to be done considering the plan and the moves to meet the commitments at COP28 for achieving Net Zero. That would inter alia ensure sustainability and climate change requirements. Recycling construction debris, the so termed waste material and clubbing them with the use of material that is sourced from regeneratable raw materials would go a long long way to achieving the targets.

The design of structures, plant and machinery, their parts and appurtenances all need to be relooked at so that their “adaptability” or “reusability” for some other project is considered and duly incorporated at the initial stages. It is there that digitalization with the current foray into AI can be of immense use. It could throw up alternatives within

some set parameters and list their pros and cons. Thereafter, based on the selection criteria a suitable alternative could be suggested.

As has been stressed all along in these columns, it is the Scientists and Engineers who are the King pins. It is they who need to be in the forefront and lead the country, neigh the world, to a better future.

Engineers constitute the largest number of professionals yet the matter is not receiving the attention it deserves. There is no central record of the number of engineers in the country and how they are engaged. An engineering degree and internship for some minimum period under a qualified engineer need to be the criteria for acknowledging that a person could be deemed to be an engineer. That brings one back to the matter of legislation for the profession of engineering which has been pending for a very long time. The Government of India must address this on an emergency basis so that consulting engineers from India can have a national registration body and be professionally recognized to work in other countries.

For the Good of the Nation
Engineers Must Work
Ethically & Be Forward Thinking

Wishing Everyone
A Very Happy, Bright & Prosperous
NEW YEAR

Happy Reading & Learning

A.P. Mull

A P Mull



Message from Guest Editor

Energy Transition and Digitalisation are key developments that have brought in major changes and are changing the scene of industrialization in the country. They have also transformed engineering consulting services over the past decades and will continue to do so. The changes are resulting from the sustainability needs in a wholesome manner in policies and regulations, market and investments, collaborations amongst governments, new age materials and manufacturing, competencies and skills, and they impact the overall project life cycle right from planning and concepts to implementation and further on to operating regimes, maintenance and decommissioning. Sustainability is key to survival, and while significant progress has happened in reducing carbon emissions, a lot more needs to be done to realise the set goals to achieve Net Zero. Industries such as transportation, power, metals, and cement are some of the key contributors to global warming and providing consulting services to these in view of energy transition and digitalisation need attention. This issue of View Point aims to throw some light on these developments.

The actions taken around innovation and technological advancement will significantly shape our future. Engineers have an important role to play in creating the Net-Zero future. Renewable Energy has caused significant changes to the energy and electricity value chains in the past decade, and it is expected that green hydrogen and derivatives will replicate the same in the current decade. While decarbonization of electricity generation will continue, the decarbonization of industrial sectors, transportation, chemicals and metals will mature and continue over the next two and five decades as developed and developing economies aim to achieve their Net-Zero targets. Therefore, sustainability, circular economy, energy transition, and digitalisation will be the focus in the forthcoming decades and beyond.

The Manufacturing sector has received renewed focus from the Government of India. Production Linked Incentive (PLI) schemes for manufacturing of solar cells, battery manufacturing, semiconductor manufacturing, etc. are already in place. That has brought in significant investments in these industrial sectors.

While the available potential of floating solar, roof top solar, and offshore wind are still to be tapped significantly, there has been a renewed focus on nuclear as a clean energy source across the globe. The challenges of long gestation periods for project maturity in this sector has now brought in an innovation of small modular reactors that are expected to reduce the project lifecycles through standardization and modularization. The Government of India is expected to initiate privatization of this sector.

The Green Hydrogen economy is gaining momentum and technology maturity as well as cost competitiveness will drive its future direction. While using green hydrogen for power generation may not make commercial sense, it can be used for energy storage and off-grid applications. The transportation sector is going through a metamorphosis with the advent of battery electric vehicles mostly for two wheelers and passenger cars. Fuel cell electric vehicles are expected to be the solution for vehicles with higher payloads and longer driving ranges.

Green Hydrogen can also be utilized for heating in built environments and as a source of energy in process industries, including hydrocarbons, chemicals, and metals. It is commonly used as an industrial feedstock in refineries, as well as in ammonia, methanol production and metal industries. The Chemicals and Hydrocarbons sector that emits 16% of the total emissions, is witnessing a shift towards renewable energy sources to generate green synthetic fuels and chemicals for heating purposes in residential and industrial areas.

Metal production is responsible for over 10% of carbon emissions. In the Iron and Steel industry, the traditional Blast Furnace – Basic Oxygen Furnace (BF-BOF) route is being replaced by the Direct Reduced Iron – Electric Arc Furnace (DRI-EAF) route. The production of non-ferrous metals such as aluminum, zinc, and copper require considerable amount of energy and the need for these metals is growing multi-fold due to demand for the manufacturing of solar cells, batteries, energy storages, electric vehicles, etc. The current focus on energy efficiency measures need to shift to electrification of manufacturing processes in the non-ferrous metal industries.

Industry 4.0 applications in industrial and process engineering are resulting in their transformation through smart process plants, smart grids, smart utilities, smart mobility, smart cities, and smart infrastructure. Industry is slowly maturing from asset digital twin to process twin that can provide control on overall asset performance. Digital disruptions and trends are reshaping the industrial engineering industries with a focus on smart asset performance management.

Engineering consulting services also need a similar shift in competencies and skills as energy transition and new technologies emerge. For example, the skills needed to design a renewable power plant vary widely vis-à-vis traditional fossil fuel power plants; floating foundations and undersea cabling design competencies are needed for an offshore wind farm and process skills with chemistry background are needed for battery manufacturing plant design. Developing technology, competency, and solutions pertaining to waste recycling is essential for sustainability. Further, multi-disciplinary and inter-disciplinary skills provide advantage to a plant engineer. Plant engineering and design are performed using an integrated 3D platform; and using AR/VR tools, one can walk-through a digital plant before physical construction. Operators can be trained on a digital asset prior to operating the plant. Enhancing competencies in program management is necessary for timely completion of projects.

“It is not the strongest of the species that survives, nor the most intelligent. It is the one that is the most adaptable to change”, said Charles Darwin. Alvin Toffler stated, “The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn”. Both are relevant to a plant engineering professional today more than ever.

The *Bhagwat Gita* also exhorts everyone **to Awake and Arise**.

Let’s follow those advices and mould ourselves along those lines to transform ourselves and our Nation.

***Wish You And Your Families, Good Tidings And
A Happy New Year***



Dr. Rajashekhar Malur
Senior Vice President and Head
Plant Engineering & Design Businesses
TATA Consulting Engineers Limited



Greetings from President

Dear Colleagues, Friends and Members,

We at CEAI

Wish Each and Everyone of You, Your Near & Dear Ones, Colleagues and Friends

**A VERY BRIGHT, HAPPY
&
PROSPEROUS NEW YEAR**

For Sustainable Development and Growth of the Nation, CEAI advocates that All Adopt and Abide by CEAI's Code of Ethics. The Trust and Goodwill that will Build will be phenomenal and take the Nation to greater heights of Achievement and A Better Standard of Living.

2023 has been an eventful year with many training programmes, seminars, workshops, technical talks, webinars, etc. meetings with officials and authorities for the benefit and furtherance of the profession and its practitioners.

Indian scientists and engineers have demonstrated by virtue of their achievements in Space and Nuclear sectors that they can perform newer and challenging tasks that come their way. We at CEAI strive to take the association to greater heights and make consulting engineers from India as the most preferred for a project anywhere globally.

Industrialisation has helped to provide jobs to a very large number and digitalization is helping to that albeit in a different form. The younger generation is there to take up the challenge and tide over it.

CEAI beckons all engineers to be a member and be a part of India's journey of growth.

Let us all work together to take the engineering consultancy profession to greater heights.

Rama Shanker Sharma

CODE OF ETHICS

December 2023

PREAMBLE

Engineering consultancy services make significant contributions to the economic growth and sustainable development of the nation, and in safeguarding health, safety, welfare, and happiness of the society.

For the nation and the society to derive maximum benefits from engineering services, it is essential that, in addition to being of high technical standards, the services provided are of the highest universally accepted moral and ethical standards.

With a view to achieve the stated objective the Consulting Engineers Association of India (CEAI) has framed a “Code of Ethics” which is mandatory for all members of the Association to adopt and abide by.

This Code presupposes that every member of CEAI is a law abiding, truthful, honest, fair and just citizen of the society. In addition, the member must follow the directives of the Code in his/her professional practice.

THE CODE

Each CEAI Member shall:

Responsibility to Society	1	Ensure that he/she shall be ethically and socially responsible, and his/her professional services safeguard and enhance the health, happiness and safety of the society.
	2	Ensure he/she, in his/her profession upholds the principles of environmentally sustainable development and considers climate change in decision-making with appropriate knowledge and training, and also informs clients about the need for its inclusion.
	3	Treat all persons fairly and encourage equitable participation without regard to religion, race, caste, gender, descent, place of birth, or residence, so that everybody works with honesty, integrity, and mutual trust and respect in a transparent manner.
Responsibility to Profession	4	At all times, uphold the dignity, standing and reputation of the profession.
	5	At all times, provide services: (a) in accordance with the principle of ‘Duty of Care’, implying the obligation to take reasonable steps to avoid foreseeable harm to another person, group, or their property and society; (b) to meet and fulfill the requirements as agreed with the client as per the Design Brief of the client, or as required by the employer as per the employment contract, and give feedback for any changed context; and, (c) to ensure that the said services utilise appropriate technology, and be fit for the design life of the product or facility and for its intended purpose and use.
	6	Always be responsible and accountable for all the professional services provided under his/her responsible charge, including using validated and legal algorithms and software.
	7	Refrain from: (a) expressing in public an opinion on a professional topic unless he/she is sufficiently informed on the facts relating to the topic and he/she is competent to comment on it; (b) making public statements which are not in an objective and truthful manner; (c) casting any aspersions of an unjust or malicious nature; and, (d) performing any service beyond his/her competency.
	8	Imbibe, inculcate and emphasise the Code of Ethics periodically and internally within the organisation and also for oneself.

	9	Maintain knowledge and skills at levels consistent with developments in technology, legislation and management, and apply due skill, care and diligence in the services rendered to the client or employer.
	10	Continue professional development and advancement throughout his/her career.
Integrity	11	Act, without prejudice to the rights of other stakeholders, in the legitimate interests of the client or employer, and perform professional services with integrity and faithfulness.
	12	Act with fairness and justice towards his/her client or employer, and towards vendors, contractors, and other professionals in all matters pertaining to contracts relating to his/her professional services.
	13	Refrain from: (a) indulging or being or getting involved in any activity which in any manner seeks to affect or in any way influence the client or employer with regard to the selection of or the compensation for professional services; and/or affect or influence the impartial judgement of the professional himself/herself; and, (b) participating in any shape or form in the process of giving, promising or taking money, gift, or favour which may influence the judgment or conduct of a person in a position of trust or authority.
	14	Inform: (a) the concerned client or employer organisation's management first, of any unethical or unsafe act or situation; known or learnt by him/her in the course of his/her work or in any other work within his/her competency; and (b) the appropriate authorities, if the client or employer organisation's management is unable or unwilling to address the unethical or unsafe act or situation referred to in (a) above
	15	Facilitate in ensuring legal compliance by client or employer, contractors, vendors and others.
	16	(a) Refrain from utilising any data, information, computer hardware or software in his/her work that might infringe upon any Intellectual Property Rights, without obtaining proper legal clearance; and (b) Use all the data, business plans or strategies, and any other sensitive or confidential documents or materials, whether from the client or employer, or internal to the organisation, in a responsible manner, so that their confidentiality and security are not compromised.
	17	Promote an ethical culture in the organisation based on shared values, beliefs and norms such as trust, honesty, integrity, fairness, confidentiality and accountability, and actively adopt them to uphold professional ethics, and make decisions that are above reproach.
Impartiality	18	Be free of prejudice and personal preferences, in his/her professional advice and judgement.
	19	Refrain from accepting an assignment for services which prejudices his/her independent judgement.
	20	Inform the client or employer of any potential conflict of interest that exists or might arise in the performance of an assignment.

	21	Promote the concept of quality based services to encourage fair competition
	22	Cooperate fully with any legitimately constituted investigative body appointed or setup for inquiry into the administration of any contract where the professional is involved.
Relations with Other Consultants	23	Refrain from directly or indirectly injuring/damaging or attempting to injure/damage the professional reputation or practice or prospects of another fellow professional, except when the fellow professional is incompetent or has violated ethical norms.
	24	Refrain from associating in work with a professional whose methods of practice do not conform to the ethical practices as laid down in this Code.
	25	Refrain from: (a) trying to supplant another professional in any particular assignment; and (b) intervening in work of any kind which to his/her knowledge has already been entrusted to another professional, except when appointed as a Reviewer by the client or employer.
	26	Refrain from taking over the services being provided by another professional unless the client or employer formally appoints the professional to take over the ongoing assignment, after legally terminating the previous contract, and legally indemnifies the appointed professional against any deficiencies and losses already incurred or liable to be incurred due to the errors of omission and commission by the previous professional.
Relation with Clients	27	(a) Refrain from disclosing confidential information concerning the assignment, any technical process or any related matter, of the client or employer without the client's or employer's consent. (b) making comments in public/ social media regarding the work being done for the client.
	28	Publicity material as well as any paper/ article developed, written and published by the professional regarding the project to be as per the contract and the scope of work therein.
	29	Amicably attempt to resolve any issue with the client.
Relation with Employees	30	Provide opportunities for the professional development and advancement to other professionals in his/her employment or control, aimed to foster a culture where people are motivated, engaged, valued and can learn, develop, and grow.

01

Consultancy in the Industrial Sector after COP28



Pradeep Chaturvedi
Vice President
Institute of Directors

COP28 – the Climate Change discussions had global leaders, including the business leaders, engaged in finding practical and cost-effective ways of reaching a low-carbon pathway. Beyond stocktaking, the conference discussed how various countries would move forward towards a Pact that would keep the environment safe, even if Net-Zero is not attained by 2050. Net-Zero is a concept which is pursued by different countries in different ways. It does not necessarily confirm that Net-Zero by individual countries would be attained only through a low carbon pathway for internal activities, but can also be attained by purchasing carbon credits from elsewhere. The transition is not going to be easy and the headwinds such as surging inflation, rising energy cost, and an ongoing war in Europe have brought greater challenges to the journey. In the context of a turbulent macro-economic environment and fractious government negotiations it is clear that the transition has to deliver not just net-zero ambitions, but also energy security, resilience, and affordability. It is less obvious that some of the critical targets that deliver a 1.5°C temperature outcome would be reached, which calls for a focus on adaptation. Whether the focus is on carbon reduction, removal, or adaptation, the time to act is **NOW**.

Future Does Not Belong to ‘Either’ ‘Or’ but only to ‘And’

While there is ongoing debate about whether enough

was achieved at COP28, the private sector leaders showed-up with a mindset of “let’s get it done”, even if precise measurement and outcome are not yet exactly clear. Consultancy organizations were a part of that dialogue. While COP26 highlighted that Net-Zero is a core principle for business, the global leaders, and delegates to the recent COP28 were geared up to face the challenge. The leaders did not shy away from the new challenges and came together to defend their collaboration on innovative solutions. For example, the members of the World Business Council for Sustainable Development’s “Partnership for Carbon Transparency” shared the results of pilot projects where companies across product value chains successfully exchanged standardized product level emissions data to address Scope 3 emissions. Such tools and cross business collaboration allow companies to accelerate decarbonization at scale by identifying, tracking, and reducing emissions.

Finding the balance between energy security and emission reductions has never been more difficult. Leaders were struggling to be more resilient in their approach. For example, does solving the energy crisis today come at the expense of achieving a Net-Zero pathway? Or does investment in renewable energy mean the abandonment of existing energy infrastructure. Possibly the best response does not lie in ‘either’ but in ‘and’ – that is maintaining focus on the long term

while adjusting in the face of present conditions, rather than opting for one or the other. That approach allows leaders to shape strategies around resilience now to tap value-creating business tomorrow as the world continues to move toward Net-Zero in the long run. For example, diversifying the current energy supply with renewable, green hydrogen, and green power can promote national energy security and economic competitiveness. Augmenting existing methods of carbon-intensive production with additional enabling technologies – such as carbon capture, direct air capture, and hydrogen fuel blends – can lower carbon intensity while transforming existing systems into cleaner alternatives. If done well, pursuing these opportunities should create a virtuous cycle for economies among affordability, decarbonization, energy security, job creation and resilience.

The transition would require innovation across green technologies; from carbon capture and storage and carbon removals to sustainable fuels and sustainable agriculture. The new low emissions asset class that is forming can have attractive returns if its investors provide support beyond money, and also lend their expertise and guidance. Navigating the Net-Zero transition while building energy resilience would entail a significant shift in demand, capital allocation, cost, and jobs – likely the greatest in current times. An estimate shows that the cumulative capital spending on physical assets for the Net-Zero transition such as technology, infrastructure, and natural resources – would need to increase by US \$ 3.5 trillion annually upto 2050. That investment would bring growth opportunities, as decarbonization creates efficiencies and opens markets for low emission products and services.

Global Goal on Adaptation (GGA)

The deliberations and the text on Global Goal on Adaptation (GGA), is one of the key deliverables that seeks to adopt a framework encouraging countries to achieve 7 specific nationally determined targets by 2030. Seeking as much attention to adaptation as is being given to mitigation (emissions reduction) the 7 targets under GGA include action focussing on food and

water security, climate resilient infrastructure, health, eco-system, poverty reduction and cultural heritage for enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change.

Though India has already been taking several adaptation measures as part of its national plan on climate change, the country would need Rs. 57 lakh crores for adaptation alone in the “business as usual” scenario till 2030 over the 2023-24 base year. The country’s climate action is, currently, largely financed by domestic resources as climate finance flows from developed countries are falling far short of what is needed to mitigate and adapt to climate change.

Many of the climate technologies leading to achieving deep decarbonisation already exist. The challenge now is accelerating scale-up and cost breakthroughs. 90% of greenhouse gas abatement that is needed could come from technologies that are proven. However, to limit global warming to 1.5°C, those technologies need to scale exponentially by 2030. Annual deployment of wind, solar, batteries, green hydrogen, and carbon capture need to grow annually at 25%, 19%, 55%, and 41% respectively, continuing and accelerating high growth rates from recent years. That requires further rapid cost reduction to ensure commercial viability of green technologies.

The surging demand for zero-carbon technology, materials, and services creates opportunities for companies to build new green businesses. An expert estimate indicates that by 2030, the demand for green technologies could generate upto US \$ 12 trillion in yearly revenues.

Critical factors of building successful green business include leading with game changing ambition, securing a cross advantage by identifying and then ruthlessly delivering the minimum compressible cost for the technology, and proactively creating a business ecosystem. Companies that can innovate and scale green businesses can generate significant value while contributing to the Net-Zero transition.

Proposed Initiatives in Critical Roles of Climate Technologies in Achieving 1.5°C Rise Only

Several announcements and initiatives have provided a signal of intent on the critical roles of climate technologies in achieving 1.5°C and on the need to rapidly scale. They are:

- a) **Renewable Energy:** 118 governments committed to tripling renewables and doubling the growth of energy efficiency by 2030, and to including relevant targets in their upcoming NDCs in 2025. By 2030 the addressable market for electric cars could be US \$ 1.5 trillion – a figure which could be even larger after this announcement.
- b) **Zero-Emission Vehicles:** A consortium of governments, industry and investors agreed to spearhead the lighthouse project, focussing particularly on global deployment of zero-emissions buses. In addition to producing carbon emissions, buses are a major source of urban air pollution, which has a large impact on health and economic growth, particularly in emerging markets. The zero-emission bus market is anticipated to grow rapidly. The electric bus market, for example, could grow by 20% per year till 2030.
- c) **Cooling:** The Global Cooling Pledge, signed by over 60 countries, is aimed at reducing emissions from cooling by 68% by 2050. The pledge could further accelerate the green cooling market, which was already anticipated to grow by 10% annually till 2030, and includes technologies such as natural reference, like ammonia, water, or air as well as new more energy-efficient coolers.
- d) **Build Environment:** A coalition of countries signed the Green Public Procurement Pledge, committing to drive demand for low-emissions steel, cement, and concrete through public procurement. The green building materials market could triple globally to almost US \$ 1 trillion by 2030 but requires scaling of technologies such as hydrogen-based steel making and low carbon cement production.

- e) **Hydrogen:** 39 countries endorsed the UAE Hydrogen Declaration of intent, a Global Hydrogen Certification standard which could help to unlock and accelerate trade in hydrogen. The Green Hydrogen projects that have been announced could increase hydrogen supply globally by almost 40 times in 2030 hence globally consistent standards are critical to enabling the trade.
- f) **Green Shipping:** A significant announcement was made on new green shipping corridors, which are routes exclusively using alternative fuels. A blueprint for green corridor, the expansion of which could drive maritime alternatives – fuel production, port construction, and green logistic growth. Green maritime fuels are already anticipated to grow by over 50% per year till 2036.

Knowledge Sharing the Key to Green Business Growth

Knowledge sharing and collaboration across ecosystems combine with enhanced innovation as a major unlock for green business builders. At COP28, governments, companies, and philanthropists announced the following platforms, coalitions, and other initiatives to support and build the green business ecosystem:

- **Innovation Networks and Platforms:** The ‘Innovate for Climate Tech Platform’, which focused on the Global South, would provide financing for companies that provide products, services, or technologies that can help accelerate decarbonization. That could help accelerate venture capital (VC) investment in historically underserved emerging markets. For example, although venture capital in Africa continues to grow, it represents just 1% of the global flow volume.
- **Capability Building:** COP28 collaborated on the ‘GBB100 Program’, which supported over 150 green-technology startups and scale-ups through hands-on coaching sessions and workshops. That collaboration supported more than 150 companies from 6 continents across 14 technology verticals.

- **Sector Innovation and Collaboration:** Several sector-focused innovation networks were launched at COP28, aiming to foster collaboration and cooperation across value chains and sectors. The Industrial Transition Accelerator (ITA) encourages collaboration to scale decarbonization projects in hard-to-abate sectors like steel, aluminium, energy, and aviation. The newly launched Supercharging Battery Storage initiative, co-led by Australia and the European Commissions, aims to improve international cooperation for accelerated development and deployment of battery technologies.

Climate Technologies have a Scaling Problem

The participants discussed if climate technologies have a scaling problem or an invention problem – and how to get past them. The opinions expressed were:

- Climate technologies have a ‘scaling’ problem not an ‘invention’ problem. The technologies are there but the amount of capital needed to deliver the acceleration is colossal. Reaching Net-Zero emissions requires an estimated US \$ 9.2 trillion of annual investment in physical assets. Much of the investment would come with returns by 2030, upto US \$ 12 trillion in value could be locked to create net-zero technologies, goods, and services.
- Companies cannot achieve R&D as needed on a massive scale; hence an incredible amount of government intervention is needed to set the right regulations and get capital at the right cost.
- It is crucial to differentiate oneself. It is important, as a scale-up, to be able to differentiate oneself from others. Having technical knowledge would be a huge competitive advantage.
- Entrepreneurs and investors would be needed to make hyper-scaling a reality. The market is seeing an uptick in funding, with 300 US \$ 10 billion companies, 1000 unicorns, and 10 US \$ 50 billion funds this trend needs to continue; investors need to be seen as entrepreneurs. The climate imperative requires both the entrepreneurs and investors to make this a reality and hence one needs to be unapologetic about the opportunity for profitable growth.

- Investment would have to move to green projects. Hydrogen, for example, needs traditional project finance support. It is always difficult to get insurance, especially in places that are climate sensitive.

The outcome of the COP28 is also indicative of the fact that the required funding to meet the Net-Zero target would not be coming only from multilateral development banks, international aid agencies and sovereign funds or commercial banks. Private industry would have to come forward in a big way to provide financial support for future growth to achieve Net-Zero as early as possible, even if it is not 2050.

Significance of Resilience

Resilience is the ability to not only recover quickly from a crisis but to bounce back better – and even thrive. It is now generally accepted that learning skills to recover from adversity is one of the most important personal development journeys. Resilience is more than just the ability to recover quickly. In business, resilience means dealing with adversity and shocks, and continuously adapting for growth. Truly, resilient organizations do not just bounce back better; they actually thrive in hostile environments. The characteristics observed of resilient companies are:

- Many organizations have been working diligently on resilience throughout the Covid pandemic and the recent geopolitical turmoil. They had to shift their business equation and supply chains and manage the same efficiently.
- 2/3rd of companies in response to a survey indicated that resilience is central to their organizations’ strategic progress, and that the most important resilience areas are digitalisation, technology, project management, finance, and operations.
- Foresight capabilities (scenario planning and stress testing) is the core area sighted for improvement.
- Risk functions and executive teams play a much

larger role than strategy teams in building resilient organizations.

- 75% of risk managers believe that improving risk culture and strengthening integration of resilience into the strategy process are most important.

Future Actions for the Consulting Companies in the Industrial Sector

In the post COP28 scenario the consulting companies would have to re-strategize their operations. Some of the characteristics of the future growth of the industry would include the following:

- Every action would be covered by a low carbon development route, and also decarbonizing the core assets. ESG would have to be embedded along the total value chain, one global mining company embarked on a journey that would lead to large reductions in both capital and operating expenditures.
- Data and analytics for the manufacturing sector would have to be derisked.
- Companies would have to assure of the solutions based on data and analytics that they can look up to with great confidence.
- Next generation scenario planning
- Anticipating the future growth patterns and thrust areas.

- Turning crisis into a growth opportunity.
- The consulting companies would have to bring out the opportunities for the clients in clear terms. Just highlighting the risk would not be sufficient. They would have to prepare their clients for a head-start on disruptions. An early warning system would have to be created so that the clients can have a better understanding and planning of legal and market risk.

Conclusions

The future for successful consultancy in the industrial sector would call for resilient and agile working of the consultancy companies. They would have to upgrade their policy, approach, and working environment to incorporate and embed all the new emerging scenarios after COP28. They would really have to own the risks of the results of the consultancy advice; and would have to share the results of the outcome of the operations till the end of the project. They cannot just submit reports and vanish. Risk would have to be shared.

It is extremely necessary to develop skills on policy framing, including economic and financial macro and micro level approaches, understanding of emerging technologies and developing new skills and upscaling the existing skills to get maximum advantage from the future opportunities and not be lost in the risks.



Satish Narayan Diwakar
Senior General Manager



Arshi Bhutani
General Manager

Tata Consulting Engineers Limited

Abstract

Climate Change, Sustainability, Digitalisation, and Socio-economic turbulence - enhanced by the pandemic of 2020-2021 are telling on the industrial sectors worldwide right across the board. They are influencing decisions vis-à-vis recasting development plans for the various sectors. All that is also reflecting on the consulting industry which is having to operate in a fluid business landscape.

Conventional management and operation practices are becoming obsolete due to the turbulence in the quickly shifting corporate environment, highlighting the necessity of flexibility and agility for effective management. Business plans must be increasingly flexible and able to change with the times. During the pandemic, “Digital Technology” grew rapidly, and it will continue to play an essential role in all operations going forward. Those developments have given businesses great opportunity to increase their efficiency and competitiveness, but they have also presented challenges in terms of having to keep up with the rapidly changing technology and developments. The pandemic has forced attention on the need for adaptability at an individual, organisation and industry level. Consulting firms must realign their strategies to overcome these ongoing changes in the business environment if they are to survive and prevail in the competition in the years to

come. The need of the hour for the consulting firms is to quickly adapt to “digitalization” and make decisions on projections that are data-driven to meet business needs, customer requirements and address global concerns. For that the consulting firms need to build capabilities in technological prowess coupled with strategic planning, and, project and asset management.

Engineers play a vital role in addressing basic human needs from building facilities to providing clean and potable water, energy, irrigation systems, housing, workplaces, constructing resilient infrastructure and responding to disasters. In providing all these, sustainable engineering principles need to be built-in at an early stage as they have a cascading social impact and they can save time and money. By incorporating them in the concept, planning and design stage it makes the value chain future proof by reducing the risks or threats and maximize the opportunities in this ever-changing world.

Introduction

Over the Years, the Indian consulting industry has grown substantially in size as well as in its service offerings that are commensurate with the key business trends. In addition, the demand for specialist consulting services is in demand in India, which has opened the opportunity for many consultants to help customers with expertise and domain knowledge base and resources in providing

“Sustainable Solutions”. The “Key Business Trends” that will significantly impact the business landscape are shown in Figure-1

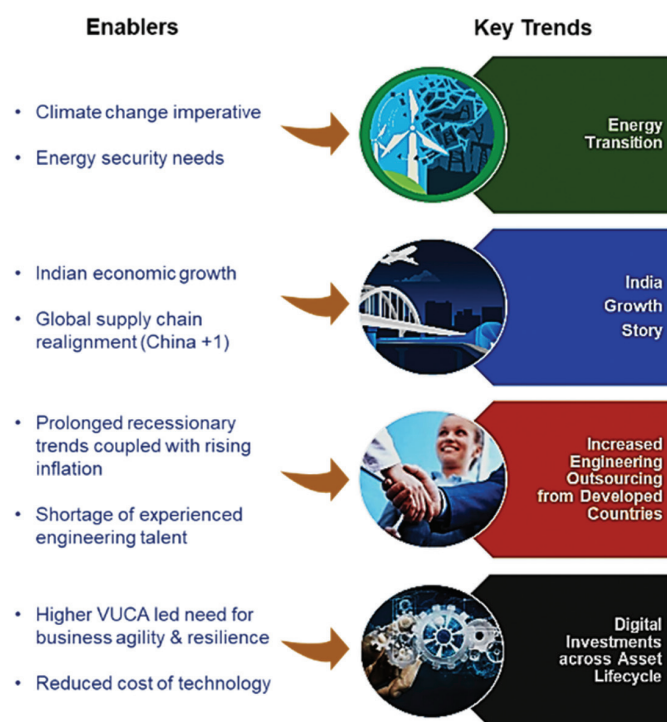


Figure-1: Key Business Trends in coming years
(<https://www.mordorintelligence.com/industry-reports/engineering-services-market>)

The engineering services market size in India was pegged at close to USD 65 billion in 2023. It is expected to reach USD 89 billion by 2028, growing at a CAGR of 6.35% during the period 2023-2028. The consulting services is growing in India due to the digital transformation and the growth of industries such as chemicals, petrochemicals, and pharmaceuticals. Besides infrastructure development is also taking place on a large scale. Indian consulting firms are also realigning business strategy and processes in such a way that helps them to make data driven decisions, to build technological landscape (strategic and project management capabilities) commensurate with the key business trends mentioned earlier. Energy transition and digital landscape across asset lifecycles would be a big “differentiator” in times to come. Any consulting firm that responds to changing business trends by adapting newer strategies will be a game changer in the future.

In the dynamic industrial landscape of India, engineering consulting services stand as a crucial pillar of progress, providing businesses with the expertise and guidance essential for sustained growth and success. These services encompass a comprehensive range of activities, spanning from project feasibility studies to engineering design and development, project management and execution, procurement and supply chain management, quality assurance and testing, and environmental impact assessment and mitigation, and asset management

Consulting for the Industrial Sector: An Analysis

The significance of engineering consulting services in India’s industrial sector extends far beyond mere technical support. These services serve as catalysts for innovation, efficiency, and sustainability, empowering businesses to optimize their operations, enhance productivity, and minimize environmental impact. Consulting firms bring to the table a wealth of specialized knowledge, cutting-edge technologies, and proven methodologies, enabling businesses to navigate the complexities of industrial projects effectively.

Consultants have proven experience with a wide set of clients in a broad range of industries. That brings in the differentiation of having consultants in the Industrial sector. Customers get the advantage of differentiation, value addition, adapting with upcoming technology changes and most important sustainability. Engineering consultants help clients to access a wealth of knowledge and experience to achieve their goals and overcome obstacles they may face.

Engineering consulting services can also provide cost-effective solutions for complex projects and help clients navigate the ever-changing regulatory landscape. With a focus on sustainability and innovation, engineering consulting firms are well-equipped to help clients meet their objectives while minimizing their impact on the environment.

The significance of consultants for the industrial sector and their contribution during the various stages of a project are elaborated below:

a) Project Feasibility Studies and Market Research

Conducting comprehensive assessments to evaluate the viability of proposed industrial projects. Identifying potential market opportunities, assessing the competitive landscape, and providing clients with valuable insights to make informed decisions. This crucial step helps clients minimize risks and maximize the likelihood of success of a project.

b) Engineering Design and Development

Planning the layouts and carrying out detailed technical designs, drawings, specifications, and blueprints for industrial projects – the machinery, plant & equipment, and the structures to house/locate them. Their expertise ensures that designs are not only functional and efficient but also adhere to the safety and environmental standards. Such a comprehensive approach ensures that the projects are built to the prescribed standards, thus minimizing potential hazards and environmental impact.

c) Project Management and Execution

Overseeing the entire project lifecycle, from planning and budgeting to execution and completion. They manage timelines, quality standards, safety and environmental requirements, and budget, thus ensuring that projects are delivered to the prescribed standards. Their proactive approach minimizes disruptions, delays, and other issues, ensuring the smooth execution of complex industrial projects.

d) Procurement and Supply Chain Management:

Optimizing the procurement processes, sourcing, and acquiring the necessary materials, equipment, and services for the projects. They leverage the extensive networks of contractors, suppliers, vendors, and use their data base and expertise to negotiate acceptable terms, ensuring timely delivery of essential resources and appropriate procurement costs. This streamlined approach ensures that projects have the necessary resources to proceed efficiently.

e) Quality Assurance and Testing

Implementing rigorous quality control measures to ensure that products, processes, and industrial facilities meet the required standards of quality, safety, and performance. They conduct inspections, testing, and audits to identify and address potential defects or non-conformities. This commitment to quality safeguards the reputation of the client and minimizes product failures or safety incidents.

f) Environmental Impact Assessment and Mitigation

Identifying and assessing the potential environmental impact of the projects. They develop strategies to minimize or mitigate the environmental damage and ensure compliance with environmental regulations, protecting both the environment and the client's business from potential liabilities. This proactive approach promotes sustainable practices and demonstrates a business's commitment to environmental responsibility.

g) Data-driven Decision Making (Data Excellence)

Leveraging data analytics to gain deeper insights into project performance, identifying potential risks, streamlined decision-making, and improving resource allocation. They collect and analyze data from various sources, such as sensors, equipment, and project management systems, to gain real-time insights and make informed decisions that enhance project efficiency and minimize risks. This data-driven approach enables consultants to provide clients with actionable insights that support strategic decision-making.

Adapting to Changing Needs

The engineering consulting industry in India is undergoing a dynamic transformation, driven by technological advancements, evolving industry needs, and a growing emphasis on sustainability and the effects of climate change. These trends are shaping the future of engineering consulting services and creating new opportunities for businesses to embrace innovation and enhance their operations.

Digital Transformation (Digital Investment across Asset lifecycle)

“Digital India” is a flagship program of the Government of India that aims to transform the country to a knowledge economy with a digitally empowered society. The vision is to provide “Digital Infrastructure” as a utility to each citizen, governance and services on demand and digital empowerment of every citizen.

Data excellence is the bedrock of all improvements and innovations. Organizations today are increasingly relying on Data & Analytics to gain a competitive advantage and surge ahead.

Consulting firms are embracing digital technologies, such as Artificial Intelligence (AI), Building Information Modelling (BIM), and Machine Learning (ML), to enhance the service offerings, improve project outcomes, and gain a competitive edge. These technologies enable consultants to create virtual models of projects, optimize designs, analyse data, and predict potential risks, leading to more efficient and successful projects.

Digital advancements and trends are reshaping the Indian engineering consulting firms with a focus on smart asset performance management. Digitalisation, standardisation, automation and most importantly collaboration are becoming the driving force for growth in India. The future would be more digitally integrated and collaborative.

At the enterprise level, digitalisation would enable several plants to be remotely operated from a command-and-control centre, leveraging knowledge and best practices from one another.

The Power industry is going through a green revolution and power is no longer a one-way value chain from producer to transmitter to distributor to consumer – with solar roof tops and battery electric vehicles, the consumer is also a prosumer. Smart grids are enabling identification and islanding of sources of failures and reduction in aggregate technical and commercial losses. Digital Asset Management of water utilities enable identification of

points of water leakage and pilferage thereby reducing non-revenue water.

The pandemic pushed the growth of “Digital Technology”, and made it play an essential role in company operations. In the future that would increase with the development of Cloud Computing, Mobile, AI/ Machine Learning, IIoT, big data, and digital engagements, etc. - technologies and platforms that have advanced and are maturing in recent years. These developments have given businesses a great opportunity to increase their efficiency and competitiveness.

The shift to remote and virtual working is increasing the demand for cloud-based services. For engineering consulting firms dealing with multi-disciplinary projects, “Concurrent engineering” on a 3D platform (3D Modelling) is possible only with cloud-based systems, with many consulting firms increasingly adopting cloud over traditional IT models to streamline operations and enable flexibility in their business. Coordination between different physical locations –within a city, country and in different geographies is possible with cloud based services.

Contribution to Sustainable World

There is a growing demand for sustainable engineering solutions that minimize environmental impact, promote resource efficiency, and contribute to a circular economy. Consultants are responding to this demand by developing sustainable design strategies, implementing energy-efficient technologies, and promoting waste reduction practices. Reuse of demolition and construction waste materials are also gaining ground. The focus on sustainability aligns with India’s commitment to reducing its carbon footprint and promoting environmentally responsible practices.

The global Environmental, Social, and Governance (ESG) advisory market is one of the fastest-growing consultancy sectors, currently worth \$14B and forecast to grow around 13% per annum due to increased pressure on business organisations to reduce the carbon footprint.

The outcome of the Conference of the Parties (COP27) summit will lead to newer laws and regulations that would require businesses to reduce their own carbon footprint and help others to reduce by providing innovative engineering solutions. It is expected that there would be more focus on building up required competencies faster in energy transition through either training on the changing scope of environmental rules, laws, and regulations so that clients can be serviced better in the changing environmental regulatory landscape. The Management and the Engineering consulting firms from all over the world, who had attended the COP26 summit, are advocating regarding the ESG strategies through white papers and gearing up themselves in providing sustainable solutions in energy transition to private and public sector clients.

Figure-2 shows some of the pathways to adopt ESG measures which can be incorporated suitably in a business.



Figure-2: Integrated Solutions for Energy Transition

Balance between the three dimensions of Sustainability: The Economic, The Social And The Environmental

‘Sustainability’ and ‘Sustainable Development’ are intertwined and difficult to be separated.

Future development strategies should be based on the balanced integration of the economic, social, and environmental dimensions of sustainable development. These strategies should encourage the allocation of resources and investments that maximize synergies and minimize trade-offs among the goals of economic growth, inclusive social progress, and environmental protection for all present and future stakeholders in society.

The challenge of developing practical frameworks for the characterization of sustainability that are

theoretically grounded results from the laxity of the three-pillar paradigm and sustainability’s theoretical foundations.

The inherently political implications of sustainability can often be overlooked. It is imperative to exercise caution to prevent replicating models without giving due consideration to their theoretical foundation and the ingrained ideologies they include. Lastly, it is important to keep in mind that sustainability has complicated and varied historical roots, which means it is still ontologically open and context specific. As a result, any rigorous operationalization of sustainability must include a clear explanation of its meaning.

End User Expectations

The end user is different from the customer. For an engineering consultant, the customer is mostly the manufacturer/ producer. The product owner or end user is different. The expectation of the end user is also intelligently captured by the engineering consultants in the design phase itself so that the eco -friendly devices and the energy efficient systems are inbuilt in the design phase.

Getting Future Ready

To be Future Ready requires adapting to the changes that are occurring and keeping abreast of and deploying technology for functioning in a sustainable world. The engineering services sector is expected to grow due to many factors, including globalization, a diverse and strong economy, a skilled workforce, a rise in government initiative and infrastructure investment.

To meet this growing demand for engineering services, the consulting firms need to integrate technology into their work processes seamlessly as the future will be shaped by knowledge, technology, and sustainability.

The digital technologies such as IIoT, AI, Cloud Computing, etc. are also driving the engineering service sector. These technologies support real-time decision making by data gathering, processing, and analyzing in large volumes. Engineering services are also undergoing transformation due to new technologies that are coming

into the market. Consulting firms must adopt the relevant technological innovations supported by digital platforms to remain competitive. According to Deltek's research, 25% of architectural and engineering businesses globally are already digitally advanced and the rest would be expected to join the digitalization advancement in the coming decade.

Figure-3 illustrates the steps to be future ready as an engineering consultant in the industrial sector.

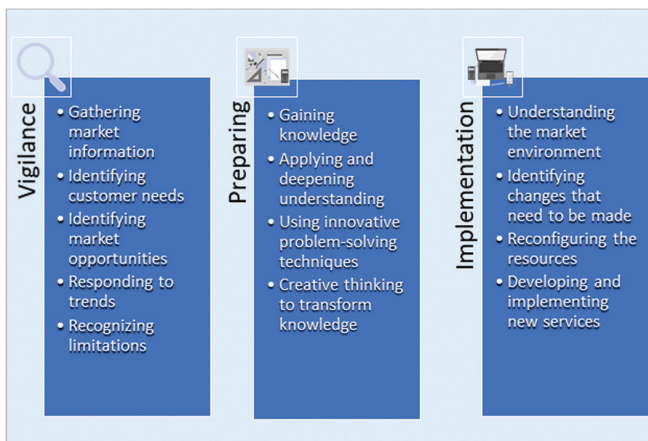


Figure 3: Steps for Future Readiness

Vigilance: Identify, interpret, and take advantage of opportunities. Study the market trends and new technologies to identify and grab opportunities. Anticipating changes and emerging technologies is vital for adapting to a changing business environment.

Preparing: The organization's capabilities can be improved by using knowledge in four steps i.e., acquire the knowledge, applying the acquired knowledge, using creative and innovative techniques to transform knowledge, and using the transformed knowledge to pursue new initiatives and opportunities.

Implementing: It describes the capacity to efficiently allocate resources and carry out tasks to produce new operational capabilities. It entails allocating the proper resources to the right tasks, selecting the best candidate for the position, identifying resources and tasks that complement one another, and directing everyone toward a single objective.

Implementation is the process of quickly and effectively adapting to changes in the market by analyzing the situation and determining what needs to be changed, rearranging resources to allow the business to meet these changes, and creating and launching new goods and services that can capitalize on these changes.

The consulting services industry is experiencing a profound metamorphosis as a result of notable disruptions brought about by technical advancements, creative product development, and changes in business models. These disruptions are mostly caused by the rapid uptake of digital solutions that utilize data-driven methodologies. Furthermore, there is a growing need for environmentally friendly and sustainable construction projects from regulators and customers. This has led to the creation of new industry standards that are more harmonized and prepared for the future.

Summary

The future of engineering consulting services in India is promising, driven by India's rapid industrialization, infrastructure development, and growing demand for expertise in areas such as sustainability and digital transformation.

Engineering consulting services play a pivotal role in shaping India's development and growth which encompass the industrial landscape by providing businesses with the expertise, guidance, and innovative solutions necessary to navigate the complexities of industrial projects, enhance efficiency, resource optimization, embrace sustainable practices and achieve sustainable growth across diverse sectors.

Today's organizations are very complex. The degree of complexity is manifested in multiple dimensions like business models, geographies, business functions, business processes, technology landscape, product & services, partner eco-system, customer engagement channels and so on. However, complexity may be a naturally induced phenomenon since growing business will grow in complexity. It is thus important for the consulting organizations not to eliminate complexity,

rather they should address “complicatedness” attached with the different dimensions. Rationalized products and services, leaner business processes and rationalized applications/ systems would reduce business “complicatedness” manifold and would improve manageability and as such ease of technology adoption.

References

1. Three pillars of sustainability: in search of conceptual origins | Sustainability Science; www.springer.com
2. K Jayaprakash & D S Latha: Digital Transformation in Engineering Sector –Challenges Digital Transformation in Engineering Sector –Challenges and Trending Perspective; ViewPoint - December 2020, Quarterly Magazine of CEAI
3. Sustainability | Free Full-Text | Sustainable Economic Sectors in Indonesia and Brunei Darussalam; www.mdpi.com
4. The 3 Pillars of Corporate Sustainability; www.investopedia.com
5. What Is Value Added Engineering and How Does It Benefit Product Development? - Pacific Research Laboratories; www.pacific-research.com
6. Engineering Services Outsourcing Market Size Report, 2030; www.grandviewresearch.com
7. Engineering Services Market - Size, Trends & Industry Overview; www.mordorintelligence.com
8. Consulting Industry In India: Prospects & Challenges; www.consultantsreview.com
9. The evolution of consulting, engineering and architecture services in 2021; www.unit4.com
10. 5 key trends for the consulting industry in 2023 - InfoDesk

Consultancy for the Industrial Manufacturing Sector



Jayaprakash K
Head- Plant Engineering



Arjun K P
Senior Design Engineer

Barak & Brazos LLP

Preamble

Consultancy in the Industrial sector offers industry specific advice for specific areas or products to businesses. That may also include assisting the industries to enable them to streamline and optimize operations and add a new product. Depending on the type of engagement, Consultancies often power play analogous to business partners with focus on growing business thereby enabling them to achieve their short- and long-term goals.

The current industrial survival and growth trends forces businesses to work towards maximizing profit whilst delivering good quality products to consumers with zero defects. That approach satisfies the customer and makes an unsigned contract between the customers and the manufacturer.

India's manufacturing sector has potential to touch US\$ 1 trillion by 2025. The Industrial sector potential accounts for 25 to 30% of the country's GDP with a potential to create about 90 million domestic jobs by 2025. In general, the present business scenario for the Indian manufacturing sector and the associated consultancy business continues to remain positive alongside with increased share in the Global market.

Introduction

The Industrial sector comprises an enormous cluster

of industries engaged in Food, Chemical, Pharma, Mechanical or physical transformation of substance, material, or items; components into customised consumer or Industrial product, and so on thus enabling an improved quality of life.

Delivering a quality product with minimal cost of production and maximum profitability is one of the challenges that industries face in India. To address these challenges and contribute to the economy by manufacturing a quality product, the sector needs consultants to contribute to the overall industrial development and growth.

Need & Purpose

The role of manufacturing industry consultancy involves design assistance and implementation to augment, streamline and optimise operations and add a new product or portfolio based on the requirement. Companies, after the pandemic, have modified their operating models and working norms at every level and are seeking solutions to safeguard the workforce and improve their performance while ensuring their transformation and long-term sustainability.

Benefits & Roadmap

Consulting for the manufacturing process, benefits the client since the consultant focus on:

- Delivering competitive advantageous products,
- Continuously monitoring the progress towards excellence,
- Deploying the best manufacturing processes,
- Developing a level of maturity with the ability to achieve national and international level of recognitions, and
- Continuous sustained improvement and thrust on empowerment to ensure active involvement of personnel.

Consultancy services offer strategic advice by providing knowledgeable and objective suggestions in relevant domains. Knowledge is imparted by experienced personnel to clients based on experience of similar conditions and requirements, all based on the latest technology trends.

The Consultants advice helps to streamline the overall business development and provides expert opinion for the right direction that guide the client to make informed decisions. Partnering with a reputed consultant enhances the reputation of the company too. The partnering also helps to build credentials and trust with clients, suppliers, and stakeholders with establishment of intended cost-effective, custom-made products using the right technology using innovative approaches.

Initial, Planning & Implementation Phases

a) Initial Phase

In the early phase, consultants and clients work together to examine, and understand the client’s existing manufacturing processes and the upgradation requirements. After that review and discussions, the consultant give their recommendation.

b) Planning Phase

Action Plans are developed by the consultants based on the client’s time schedule for implementation. The Action Plans also provide the various steps and responsible resources with guided timelines to achieve the objective.

c) Implementation Phase

Consultants work together with clients to effectively implement the Action Plans in a collaborative manner. The major aim is to translate the strategy decided into executable plans/ methods. To ensure a productive outcome, clients must take ownership and implement effectively and efficiently. Consultants should support the client during the implementation phase, with regular interaction with all stakeholders.

The Key points to be taken care of during the implementation phase include:

- Maintenance of momentum during change in project/ organisation. The client and the consultant should jointly remind all concerned of the benefits that would accrue after the change; the senior management must join and demonstrate their support for the change. Finally, the transition phase needs to be managed to sustain the momentum.
- Monitoring the implementation and periodic evaluation.
- Another important point while working with the client is to be aware of and understand the requirement, said, and unsaid of the client leadership.
- Manage conflicts and work with personnel who are difficult to work with.
- Interpersonal skills as required to make relationships and projects a success.
- Supplementing the efforts by involving Experts, partnering with the company staff to drive and sustain the execution, ensuring positive changes which lasts permanently in the system.

Implementation experts along with capability building experts and team leaders can manage the transition and deliver for creating a balanced sustainable infrastructure. Design engineering consultancy services for products are fast moving to special products and special purpose machinery sectors.

Steps Involved in Industrial Manufacturing Consulting Sector

Phase – 1- Diagnose

Phase - 2 - Design

Phase - 3 - Delivery

a) **Diagnose with Assessment of Execution**

Industry specific experts work together with available capabilities and work to diagnose a company's correct state and evaluate their readiness/ preparedness to execute a strategy/ design for a product. During the diagnosis, assessments of gaps in capabilities and skill required to achieve transformational change required are analysed to understand the product requirement and plan the essential transformational changes.

b) **Design with Planning**

The team of experts work together to design a transformational portfolio and the implementation plan. Experts ensure that the plan is built with execution in mind, like all should work and align with the top team to achieve the required product.

c) **Implementation and Sustain**

Industrial engineering consulting is essential for all businesses since it goes to improve efficiency and the quality of products/ services, and helps the development of the required infrastructure needed for the manufacturing processes. In a nutshell, an industrial engineering consultant can assist a business leap to the next higher level and achieve business goals.

Generative AI

Now a days Generative Artificial Intelligence is playing a key role in the manufacturing industry and is essential considering the advances in industrial automation.

The advantages of Generative AI in Consultancy services are as follows.

a) **Improved Data Analysis:**

Generative AI can assist by analysing large quan-

tum of data and identify/ discover correlations, hidden patterns, forecasts, and trends. They are used to identify new opportunities, improve decision-making, and mitigate various risks.

b) **Automated Tasks:**

Generative AI can automate many of the tasks that are currently performed by consultants, such as data entry, analysis, and report writing. That can free up consultants to focus on more strategic and creative work.

c) **Focused Insights:**

It can generate personalized effective insights for each client, based on the specific needs and circumstances of the company. These enable company executives to make better decisions and achieve their targets/ goals early.

d) **Improved Communications & Interaction:**

This is essential so that consultants can communicate more effectively with the clients' personnel. It is achieved by generating reports, presentations, and other documents to suit the client's needs and requirements.

e) **Enhanced Creativity:**

It can guide consultants to generate new ideas and solutions to their problems. It will especially help in a complex and uncertain situation.

Typical Case Study Design Consultancy

Today, business environments require flexibility and speed. Design consultants are ready to support the clients who are facing the need to frequently change/ upgrade their product to stay relevant and to gain a competitive advantage for their product. That is achieved by implementing new and latest technologies and delivering in record time.

Each change requires time and effort to permeate in the organization. That is where the Design consultant plays an important role in the development of upgradation or a new product. Multi-faceted support is provided by the consultants, and they can deliver in the required time to

reach the goal that had been set. A typical case of a design consultancy in the manufacturing industry is given below.

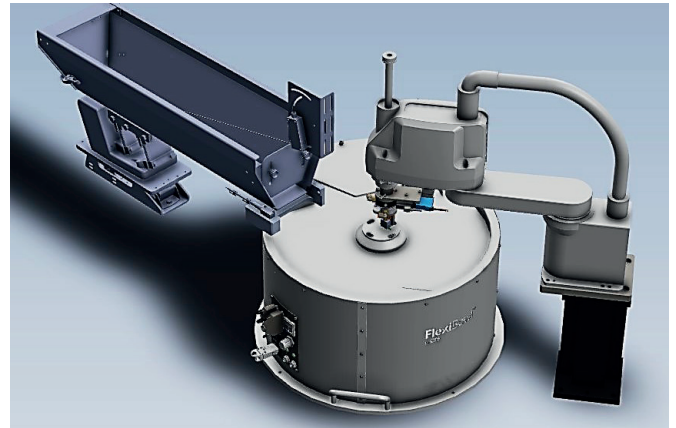
Automated Inspection Machine

Scope: Engineering and design consultancy of an automated inspection machine to inspect and sort deflector pins/ pivot pins.

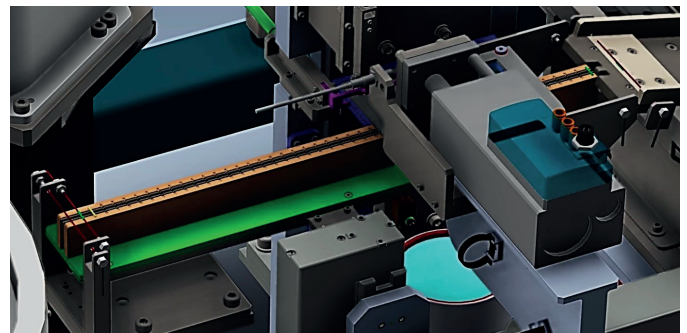
Concept: The Client’s requirement - To conceptualize a system that picks, inspects, and sorts deflector pins and pivot pins of different types. The operator loads the hopper (Flex bowl bulk feeder) with the pins which will in turn feed the bowl feeder (Flex bowl feeder).

Design: The bulk feeder to feature a disc that can rotate 60 degrees forward, while rotating from the picking area to the hopper dropping area in three steps. The histogram output from the C-Vision camera above the picking area is stored in the FIFO register. The status of the last register turns the hopper on/off.

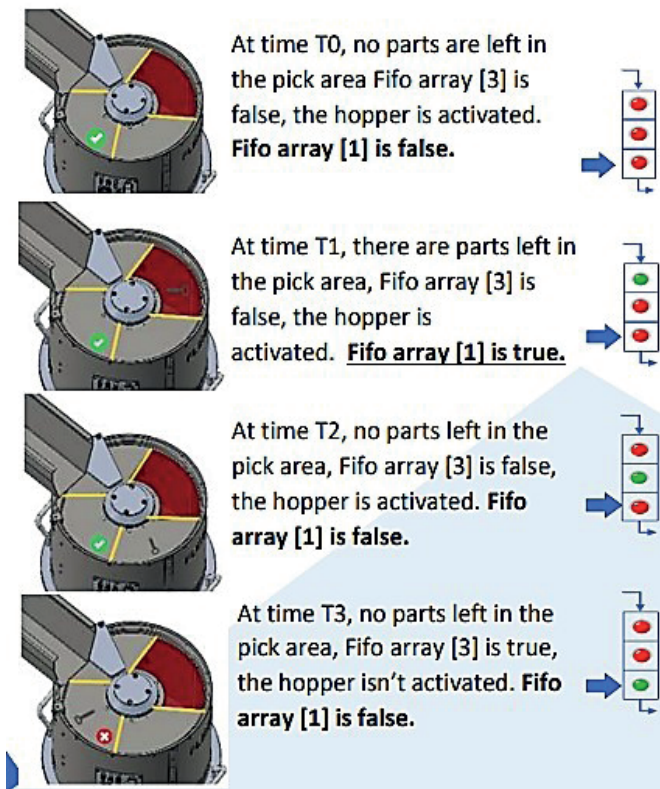
Implementation Phase: After the conceptual design, 3D design models were developed and reviewed. Fabrication drawings were generated for implementation.



Flexi bowl Bulk Feeder, Bowl Feeder, and the Scara Robot



Automated Inspection Station



Reference: 07_Handbook-FlexiBowl from flexibowl.com

The entire system is designed and simulated before handing over the 3 D design for prototype model for manufacture.

Advantage of having design consultants in this case include “First time right” implementation saving time and rework thus generation of revenue for the client is without loss of time.

Conclusions

Industrial consulting services help businesses to look forward and beyond for optimization of existing business plans. The specialists engineering consultants provide insights for improving business operations and optimizing utilisation of inhouse resources and thus deliver enormous value in the long run.

Another advantage is access to skilled specialist(s) with knowledge of Market trends and capabilities that facilitate running the business successfully. The Consultancy's views and advice are generally external to the existing manufacturing setup and thus brings in new perspectives that is useful when dealing with challenging situations or making difficult decisions for an organisation. Consultants have experience of working on many projects for different companies and would have seen a wide range of business issues. They use that experience to advantage when looking at what has gone wrong in the past for other companies and then assist them to develop the best

strategic plan with an unbiased opinion to achieve their business objectives.

Acknowledgement

The authors are thankful to Barak & Brazos LLP for permitting to submit this article/ paper.

Barak & Brazos LLP is a premiere Engineering and Design Services firm of dedicated talent pool with core engineering skills offering Engineering and Design services for Plant Design Engineering, Product Design Engineering, and Infrastructure Engineering.

MANUFACTURING SECTOR IN INDIA INDUSTRY REPORT

INTRODUCTION

Manufacturing is emerging as an integral pillar in the country's economic growth, thanks to the performance of key sectors like automotive, engineering, chemicals, pharmaceuticals, and consumer durables. The Indian manufacturing industry generated 16-17% of India's GDP pre-pandemic and is projected to be one of the fastest growing sectors.

The machine tool industry was literally the nuts and bolts of the manufacturing industry in India. Today, technology has stimulated innovation with digital transformation a key aspect in gaining an edge in this highly competitive market.

Technology has today encouraged creativity, with digital transformation being a critical element in gaining an advantage in this increasingly competitive industry. The Indian manufacturing sector is steadily moving toward more automated and process-driven manufacturing, which is projected to improve efficiency and enhance productivity.

India has the capacity to export goods worth US\$ 1 trillion by 2030 and is on the road to becoming a major global manufacturing hub.

With 17% of the nation's GDP and over 27.3 million workers, the manufacturing sector plays a significant role in the Indian economy. Through the implementation of different programmes and policies, the Indian government hopes to have 25% of the economy's output come from manufacturing by 2025.

India now has the physical and digital infrastructure to raise the share of the manufacturing sector in the economy and make a realistic bid to be an important player in global supply chains.

Source: <https://www.ibef.org/industry/manufacturing-sector-india#>





Surinder Kumar Kaul
Group Director
Holtec Consulting Private Limited

Introduction

For a more responsible production there is need for greater awareness for conservation of energy and utilization of untapped waste heat for generation of power in the Cement industry

Power Generation from Waste Heat

Waste Heat Recovery (WHR) system in a Cement plant is one of the major areas of Energy Conservation thereby generating Green power and reducing CO₂ emission. The benefit of the technology is straight and clear. As the energy cost is dynamic, installation of WHR plants has become more and more cost effective. Reduction of CO₂ emission gives an immense additional advantage for environmental protection and conservation of precious fossil fuel.

The Cement industry is energy intensive and the third largest energy consumer after power and steel industries. A Cement plant needs both electrical as well as thermal energy for its operation. The thermal energy is used mainly during the burning process, while the electrical energy is used for material crushing, grinding, material handling as well as in clinkerisation. Cement plants thus incur considerable cost to meet energy demands as a part of the manufacturing cost.

While energy efficiency had been a top priority in the cement industry, the adoption of Waste Heat Recovery (WHR) systems has taken the lead in the last 10 to 12

years and all major industry players have installed or are in process of installing WHR Power plants.

There is a large potential across the cement industry to recover the waste heat and generate power thereby increasing the profitability of the plant operation.

- Nearly 35% of heat is lost primarily from the preheater and the cooler waste gases. That energy can be tapped by installing a Waste Heat Recovery Power Plant (WHRPP).
- The capacity of the WHRPP is influenced by the moisture content present in the raw material and fuel (coal). Even after considering the heat for drying-off, around 25 to 40 kwh of energy/ton of clinker can be generated.
- The WHRPP generation capacity is based on the production capacity of a Cement plant and can meet 25 to 35% of the Cement plant's power demand. The cement plant capacity and power generation from WHRPP are given in Table-1.

Table-1: Capacity of Cement Plant vs Power Generation from WHRPP

Capacity of Cement Plant (TPD)	5,000	6,000	8,000	10,000	12,000
Power Generation from WHR (MW)	6.0 - 8.5	7.0 - 10.0	10.0 - 14	12.5 - 16.0	14.0 - 17.0

From Table-1, it is clear that a huge potential exists for green power generation in Cement plants with a Plant Load Factor of over 94%.

To put things in perspective and appreciation a brief description of the Cement manufacturing process and Waste Heat Recovery is given below.

Cement Manufacturing Process

Clinker, an intermediate product in the cement manufacturing process, is produced by burning finely ground raw materials (mainly limestone and clay or shale). These materials are fused into new mineralogical phases when heated to around 1450°C (flame temperature around 2500°C) in a rotary kiln. The burnt product is called clinker. The clinker is then ground into a fine powder with small quantities of gypsum and other materials to make cement. Ordinary Portland Cement (OPC) generally contains at least 95 % clinker while for Pozzolana Portland Cement (PPC) it is 65%.

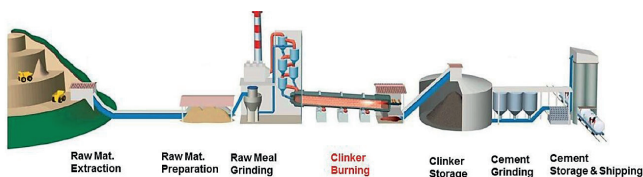


Figure-1: Main Steps in Manufacture of Cement

Cement Manufacturing Plant

The raw material (lime and clay) is burnt to clinker using a fossil fuel and Waste derived fuel fired in a Kiln and Calciner. The raw material is preheated using a suspension pre-heater. The hot clinker leaving the kiln is cooled down from 1450°C to ~120°C in a grate type air cooler. The main steps are shown in Figure-1.

A typical dry clinker kiln requires approximately 700-740 Kcal/kg of clinker thermal input. 55% of that energy is used for clinker formation (de-carbonization of limestone and fusing of the clinker mineral). The main thermal exit flows are from the two gas streams - the kiln and the cooler. Out of above balance of 45%, 8 to 10% heat from the kiln exit is used for drying the raw materials and fuel drying, 8-9% goes in radiation

losses, 2 to 3% is carried by the clinker. The residual heat of 22 – 24% can be used for low temperature power generation.

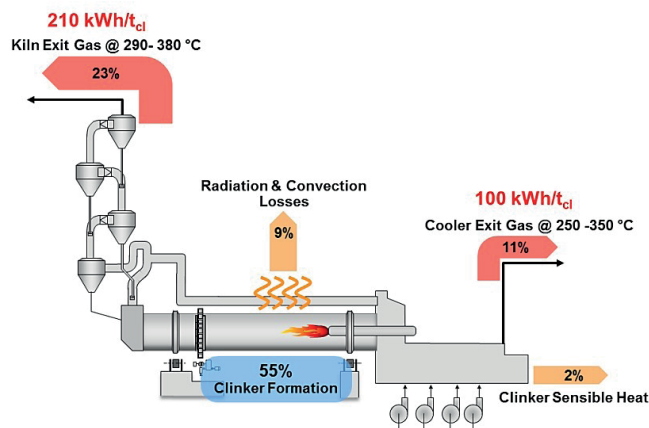


Figure-2: Waste Heat Sources from Cement Clinkerisation Plant

Waste Heat to Power Generation Technologies

The waste heat is available from the Preheater exit and Clinker Cooler for power generation. Generating power from waste heat typically involves using the waste heat to create mechanical energy that drives an electric generator. When considering power generation options for waste heat recovery, an important factor to keep in mind is the thermodynamic limitations of power generation at different temperatures. The efficiency of power generation is heavily dependent on the selection of the thermodynamic cycle based on the input flue gas parameters.

Two different thermal conversion technologies are available for recovery of the cement waste heat as follows:

- Organic Rankine Cycle
- Steam Rankine Cycle

Organic Rankine Cycle

Instead of using water as the working fluid, the Organic Rankine Cycle (ORC) uses hydro chlorofluorocarbon (HCFC) or hydrocarbons, which have lower boiling point and higher vapor pressure. Suitable waste heat

temperature for the ORC is 150° to 360°C.

Although Research had started in 1924, it was the oil crisis in the 1970s that led to a spurt of research around the world.

Salient Features of ORC

- Organic fluid has low evaporation temperature and pressure compared to water.
- Thermal oil and organic fluid are used as working fluid.
- Dry organic fluid is used and hence no superheat is required.
- The system is designed for low temperature and pressure hence no specialised O&M is required.
- Since thermal oil is used it can be hazardous in case of any leakage. Thus, special safety precautions for leakage are to be considered.
- Organic fluid has higher density compared to water; therefore a special turbine is used.
- The selection of the organic fluid is very important and it depends on the temperature of the heat source.
- In the ORC system, the cycle system requires a heat source exchange system, and the self-consumption is relatively high as well as the backpressure operation.
- Cost of installation is high compared to a Steam Rankine WHRPP.

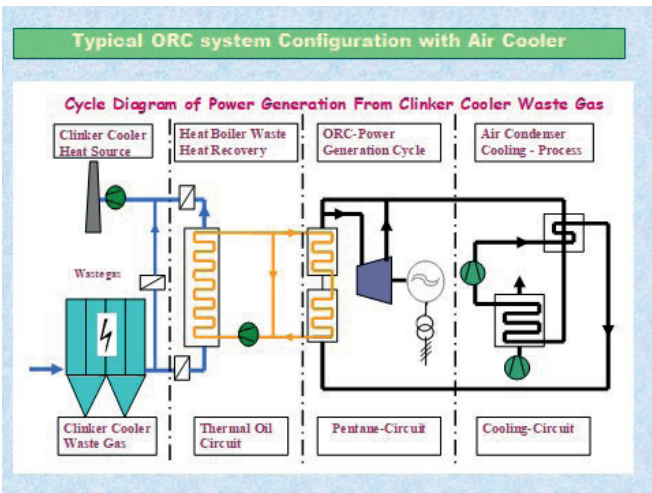


Figure-3: Typical ORC System Configuration with Air Cooler

Steam Rankine Cycle

The most commonly used Rankine Cycle system for waste heat recovery power generation uses water as the working fluid and involves generating steam in a waste heat boiler, which then drives a steam turbine. In a Steam waste heat recovery’s steam cycle, the working fluid water is first pumped to elevated pressure before entering a waste heat recovery boiler.

The water is vaporized into high-pressure steam by the hot exhaust gases from the process and then expanded to lower temperature and pressure in a turbine, generating mechanical power that drives an electric generator. The low-pressure steam is then exhausted to a condenser at vacuum conditions, where the expanded vapor is condensed to low-pressure liquid and returned to the feed-water pump and boiler.

Steam cycles are by far the one most commonly used Waste Heat Recovery systems and generally reflect the following:

- Based on proven technologies and generally simple to operate.
- Widely available from a variety of suppliers world wide.

The Steam Rankine cycle is further classified as Single and Dual pressure. In case of the dual pressure, two pressure circuits - High Pressure and Low Pressure are provided. The Low-Pressure circuit extracts the Low

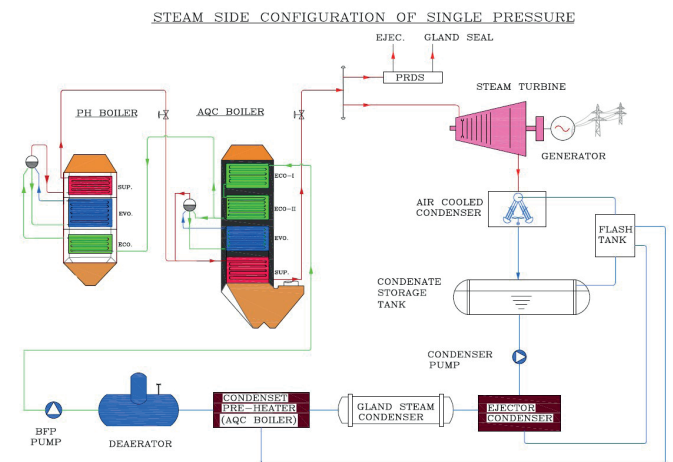


Figure-4: Single Pressure System

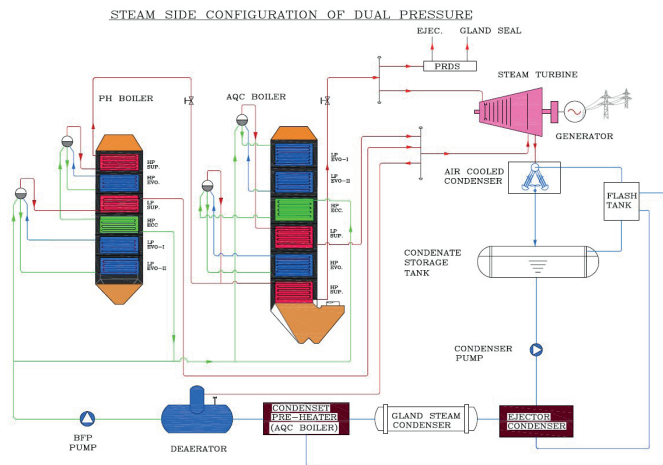


Figure-5: Dual Pressure System

Heat of the flue gas and the same is used for injection to the steam turbine.

The typical Process Steam Cycle, Single and Dual Pressures are shown in Figures-4 and 5.

Salient Points of Steam Rankine Cycle

- Water as a fluid is cheap and widely available and installation is simple.
- Direct heating and evaporation is possible, since only water is used.
- Well proven technology.
- To utilise maximum waste heat by using a Dual Pressure Circuit.

98% of the WHR based Power Plants supplied in the industry due to techno commercial consideration employ the Steam Rankine Steam Cycle. The normal configuration of the WHR power plant in Cement industry is shown in Figure-6.

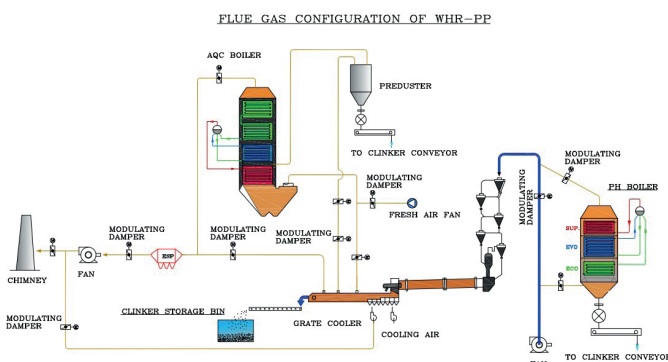


Figure-6: Power Generation from Pre-Heater/ Cooler Exhaust Gases

Major Items To Be Considered for A Cement WHR Based Power Plant

The major items to be considered for a Cement WHR Based Power Plant are:

- 1) Pre heater Boiler
- 2) AQC Boiler
- 3) Alkali/ Chloride Bypass Boiler
- 4) Turbine Generator sets

During the last decade various innovations in technology have been brought out resulting in improvements in performance parameters by 10 to 15% and availability of the system to 97 - 98% of the kiln availability.

Having engineered from concept to commissioning more than 70 waste heat recovery plants in the cement industry from 4.5 MW to 36 MW in India and abroad from 2010 onwards has in the process seen some innovative designs adopted to improve the overall efficiencies and reliability of the WHR Power Plant.

Some of the salient introductions during the process are:

- 1) Finalization of the Process parameters of the Cement plant after determining the necessary heat balance of the Cement plant under operating and potential capacity.
- 2) Two tapping designs for the AQC boiler wherein tap-1 is adjacent to null point and heat utilized at inlet of super-heater and balance heat from cooler at inlet of the evaporator.
- 3) Hot air recirculation system wherein also hot air from the boiler is re-circulated back in the cooler thereby increasing mid tap temperature from the AQC boiler.
- 4) Superheating of the pre heater steam in the AQC boiler.
- 5) Design of the alkali/ chloride Bypass Boiler considering characteristics and composition of the gas and the gas temperature.
- 6) Design of turbine for higher band of temperature variation to take care of any disturbance in the Cement plant.

- 7) Optimization of flue gas velocity through the boiler and ducting.
- 8) Design of the refractories for the AQC boiler, ducting, and pre-duster for minimum shell temperature for longer life.
- 9) Selection of proper metallurgy and arrangement of pressure part and critical boiler component especially dampers, hammering system and dust disposal system.
- 10) Optimization of the turbine back pressure

Technical Features of A WHR Power Plant

Pre Heater Boiler

- Preheater boiler is envisaged to extract the waste heat available from the preheater outlet.
- The PH boiler is a water tube, single drum, top supported, natural/ forced circulation, vertical/horizontal gas flow, and outdoor boiler. The boiler's pressure parts viz. Economizer, Evaporator, Super Heater, etc. are at various elevations of the boiler.

- Due to high concentration and sticky nature of the preheater dust bare/ plain tubes are provided for all sections of the pressure part. The dust accumulated on the heat transfer surfaces of the PH boiler is removed and dropped into the bottom hoppers by a rapping mechanism. Hammers mounted on a rotating shaft drop (by gravity) and strike anvils (solid shaft) that are attached to the pressure part inside the boiler casing. An effective sealing system is provided to minimize false air ingress to the PH boiler through the gap between the striking shaft and the casing sleeve of the rapping system.
- Since major plants are in the process of utilizing alternative fuel, for calciner firing, have a large content of alkali/chlorides, hence an alkali/chloride bypass is essential for reliable operation of the pyro section of the Cement plant The bypass gases are also tapped for power generation although the bypass dust has its own challenges. Thus, designing the boiler necessitates due care.
- Extra care has to be taken to ensure that the bypass dust does not stick on the boiler tubes hence collecting hoppers and special measures for dust dislodging are to be provided.



Pre heater Boiler

AQC Boiler



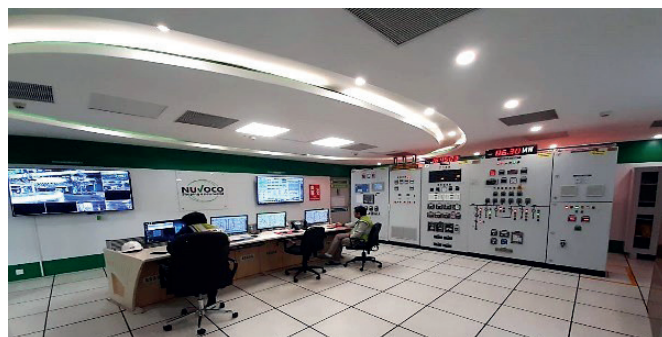
AQC Boiler



Alkali/ Chlorides Bypass Boiler

- The AQC boiler is meant to extract the heat available after the -null point of the clinker i.e., after using the heat for the secondary and the tertiary air requirement of the Cement plant.
- To two tapping design including hot air recirculation is being considered to improve overall efficiency.
- Considering the highly erosive nature of the clinker dust from the cooler, a pre-duster either of the integral or of the cyclonic type is to be installed before the AQC boiler to remove higher size clinker grain. That enhances the life of the boiler tubes against erosion.

For a Waste Heat Recovery based power plant the condensing type steam turbine of dual pressure, multi-stage, impulse single cylinder turbine is envisaged. The turbine is designed to operate under large variation of steam temperature due to disturbance in the process gas parameters in the Cement plant. The complete operation of WHR Power Plant is from the Central Control Room.



Control Room



Turbine Generator

Conclusions

WHR power plants have become a necessity considering the very high cost of power from a Utility grid or a Captive power plant. Almost 30 to 35% of the Electrical energy requirement of a Cement plant can be met by a WHR Power Plant thereby making its installation techno commercially lucrative. WHR Power generation contributes to energy conservation and reduction of CO₂ emission.

The technology has also become very reliable and proven with reliability over 95%. There is a strong potential for taking the same forward to the remaining Cement plants across India and the globe. The WHR power plants operating with old and inefficient technology need to be upgraded to improve their performance.

The Government should incentivise by offering tax benefits to the Industry in all sectors and make installation of a WHRPP mandatory for operating, under construction and new Cement, Steel and Coke Oven plants.

Emerging Technology Trends In Cement Industry



Jagdeep Verma
Head of Business Consulting



Dinesh Satija
Head of Process Engineering

Holtec Consulting Private Limited, Gurgaon

The cement industry, like many others, is constantly evolving and adapting to emerging technological trends to improve efficiency, reduce environmental impact and enhance product quality. The major steps initiated in that direction are: adopting modern energy efficient technologies and waste heat recovery based power generation and renewable energy sources, utilizing waste as alternate fuel to lower impact on fossil fuels and increased manufacture of blended cements.

This article delves into some of the emerging technology trends to shape the future of the cement industry.

Sustainable Practices

The cement industry is increasingly adopting sustainable practices to reduce waste, conserve natural resources, and promote social responsibility which are essential to reduce the environmental impact of the industry known for its significant energy consumption and carbon dioxide emissions. The key sustainable practices adopted in the manufacture of cement are:

a) Energy Efficiency and Process Optimization

- Modern cement plants equipped with advanced automation systems & continuous Emission Monitoring Systems (CEMS) are being increasingly adopted.

With several design innovations, based on computational fluid dynamics (CFD) studies for reducing the overall pressure drop in preheater system to as low as ~300 mmWC offers tremendous electrical and thermal energy efficiency improvement opportunities.

- Adapting to latest generation coolers for new plants by design and retrofitting the existing conventional reciprocating coolers, offers significant potential for electrical and thermal energy saving in the Cement industry. The total heat loss of latest generation clinker coolers are reported to have <100 kcal/ kg clinker with recuperation efficiency in the range of 75-78%.

Hot Air Recirculation (HAR) circuit is also being installed in the cooler for maximising Waste Heat Recovery potential.

- Highly energy efficient grinding technologies like High Pressure Grinding Rolls (HPGR), Vertical Roller Mills (VRMs) and Ball Mill with Roll Press (BMRP) for raw materials, fuel & cement grinding requirements.

Selection of the type of grinding technology depends mostly on the material characteristics, capacity requirements, energy efficiency goals, layout & space considerations, and

investment and on-going operating costs. Several improvements made in design and operation of mills and other equipment in the grinding circuits resulted in reduced energy consumption and improved reliability.

b) Alternative Fuels & Raw Materials

Another significant advancement in cement manufacturing technology is the use of alternative fuels and raw materials. The cement industry is one of the largest consumers of energy globally and is responsible for a significant portion of greenhouse gas emissions.

- The use of alternative fuels, such as waste materials, biomass, and municipal solid waste, can reduce the dependence on fossil fuels, reduce greenhouse gas emissions, and improve energy efficiency.
- The use of alternative fuels has been made possible by advancements in technology, including the development of specialized equipment for handling and processing these fuels. For example, rotary kilns can be modified to handle different types of fuels, and preheaters can be designed to optimize the combustion of alternative fuels.
- The use of alternative fuels also has economic benefits of reducing the overall cost of energy and providing opportunities for waste reduction, recycling, reducing the reliance on fossil fuels and mitigating the environmental impact of cement production.
- Cement production traditionally relies on limestone as a primary raw material. The industry explores various alternative raw materials, such as industrial by-products and wastes. This includes materials like fly ash, blast furnace slag, and other such materials, which can partially or completely replace traditional raw materials.

c) Circular Economy Practices

Adopting circular economy principles involves minimizing waste generation and maximizing the reuse and recycling of alternative cementitious materials.

Alternative cementitious materials refer to substances that can be used as partial or complete replacements for traditional Portland cement in concrete production. These materials offer the potential to reduce the environmental impact of concrete production, improve performance characteristics, and utilize industrial by-products or waste materials effectively.

These materials include use of geopolymers, fly ash, ground granulated blast furnace slag (GGBS), calcined clays, rice husk and metakaolin which have the potential to reduce the carbon footprint of concrete. Additionally, the recycling of concrete through processes like crushing and reusing as recycled concrete aggregate supports a circular economy approach.

d) Carbon Capture, Utilization, and Storage (CCUS)

- Carbon capture, utilization, and storage (CCUS) is another emerging technology that has significant potential to reduce greenhouse gas emissions from cement production. CCUS technology captures CO₂ emissions from cement production and stores them underground or uses them in other industrial processes.
- A greener, more efficient plant is thus further enabled by innovation advances such as scaling of carbon capture, utilization, and storage technologies. In terms of scalability, CCUS is probably the most advanced option. Using this technology, cement players capture emitted CO₂ and can either pursue carbon-cured concrete (one of the few already available utilization options that locks in CO₂ in the end product) or store carbon in former oil and gas fields.

e) **Water Conservation and Recycling**

Sustainable water management practices are crucial in cement manufacturing. They include optimizing water usage in the production process, adopting use of closed-loop systems, water recycling and reuse systems, and implementing technologies to minimize water consumption. Efficient water management contributes to environmental sustainability and helps in addressing water scarcity issues.

f) **Green Building Certifications and Sustainable Product Development**

Cement manufacturers are actively pursuing green building certifications such as LEED (Leadership in Energy and Environmental Design) or BREEAM (Building Research Establishment Environmental Assessment Method). The certifications recognize environmentally sustainable construction practices and products. Cement producers are also investing in the development of sustainable cement and concrete formulations with lower carbon footprints and improved performance.

Adopting these sustainable practices in cement manufacture is not only essential for reducing the environmental impact but also aligns with global efforts to achieve a more sustainable and low-carbon future.

Digitalization and Automation

One of the significant advancements in cement manufacturing technology is digitalization and automation. Smart sensors and Internet of Things (IoT) devices are being extensively used to monitor and optimize the performance of equipment and processes. There are several ways in which these technologies are applied:

a) **Real-Time Monitoring and Control**

Smart sensors placed throughout the cement manufacturing process collect real-time data on various parameters such as temperature, pressure, humidity, and chemical composition. The data is

then transmitted to a central system through IoT connectivity. Plant operators can monitor and control the production process remotely and make adjustments as needed to optimize efficiency.

b) **Predictive Maintenance**

Smart sensors can monitor the condition of machinery and equipment in real-time. By analyzing data trends, IoT-enabled systems can predict when equipment is likely to fail or require maintenance. That allows for proactive maintenance scheduling, reducing unplanned downtime and extending the lifespan of machinery.

c) **Energy Efficiency Optimization**

The energy consumption at different stages of cement production is tracked through sensors. By integrating IoT, manufacturers can analyze the data to identify areas for energy efficiency improvements.

d) **Quality Control and Process Optimization**

The quality of raw materials and the final product are continuously monitored through smart sensors. IoT integration enables real-time analysis and adjustments to the production process, to ensure consistent product quality.

e) **Environmental Monitoring and Emission Reduction**

IoT-enabled sensors can monitor emissions and environmental conditions in and around the cement plant. The data helps in ensuring compliance with environmental regulations and enables the implementation of strategies to minimize the environmental impact of the manufacturing process.

f) **Supply Chain Visibility**

IoT integration extends beyond the plant to the entire supply chain. Sensors can monitor the transportation and storage of raw materials and finished products. The visibility helps in optimizing logistics, reducing delays, and ensuring that the right materials are available when needed.

g) Data Analytics for Decision-Making

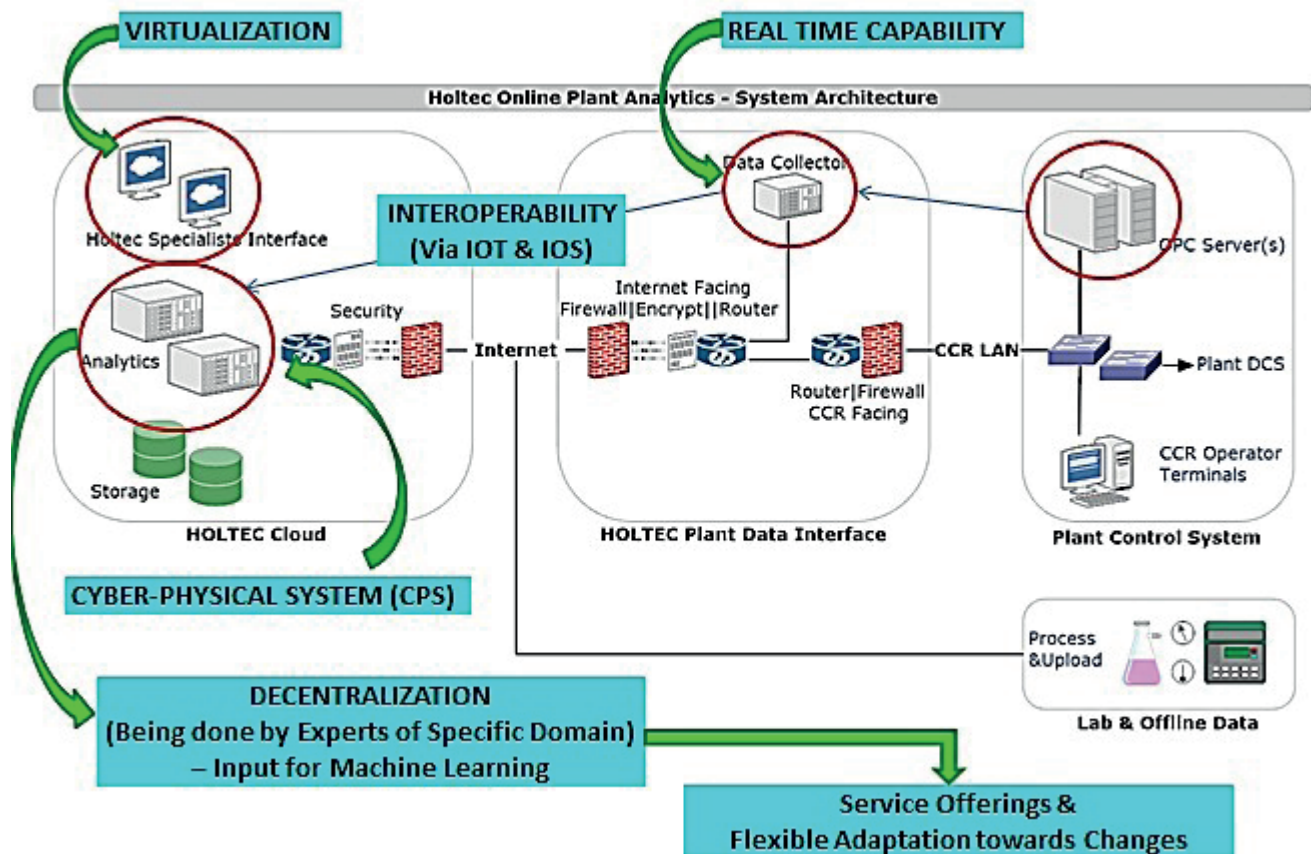
The vast amount of data collected by smart sensors is analyzed using advanced analytics and machine learning algorithms. The data-driven approach provides insights into trends, patterns, and potential areas for improvement, aiding decision-making at various levels within the organization.

h) Remote Diagnostics and Troubleshooting

IoT-enabled sensors allow for remote diagnostics of equipment issues. Plant operators and maintenance teams can troubleshoot problems and even perform some maintenance tasks remotely, reducing the need for on-site interventions and minimizing downtime.

To ensure sustainable & continual improvement in the existing operation, and to extract the latent potential available within the infrastructure, a state-of-the-art Industrial Big-Data service 'Online Plant Analytics' (OPA) has been developed in-house, to support Cement Plants Operations & Maintenance teams on a continuous basis. Thus, a consulting engineering organisation through the OPA is playing an instrumental role in helping the clients teams realizing their performance aspirations and partnering them in effecting continuous improvement in the areas of:

- Operational Performance Improvement
- Productivity Enhancement
- Energy Conservation &
- Improvement in Reliability & Availability



OPA System Architecture

The predictive modelling of **OPA** has proven to be beneficial for the following:

- Advance prediction of Time-lag parameters for initiating proactive actions.
- Reduce variability in operation as well as product quality.
- Identifying the impact of each stage of manufacturing to the final product.
- Learning the Best operating practices from the Data generated over time.
- Machine-guided interference to achieve optimum performance.

Integration of Renewable Energy in Cement Manufacture

The cement manufacturing process is known for its significant energy consumption and carbon dioxide emissions. Integrating renewable energy into cement production is crucial for reducing the environmental impact and increasing sustainability. The several ways in which renewable energy is being utilized in cement manufacture are:

a) On-site Renewable Energy Generation

Solar Power: Solar power is a clean and sustainable source that contributes to reducing reliance on grid electricity. Installing solar panels on the rooftops of cement plants or on adjacent unused land and floating solar panels on exhausted mine pits are increasingly used to generate electricity to meet a portion of the energy needs.

Wind Power: Wind power is another renewable source that is being used to supplement the energy requirements of cement manufacturing processes. Wind turbines are installed on-site to harness wind energy and generate electricity, wherever feasible.

b) Power Purchase Agreements (PPAs) with Renewable Energy Providers:

Cement manufacturers can enter into power purchase agreements with renewable energy providers.

This involves buying electricity generated from renewable sources, such as solar or wind farms. PPAs can offer a reliable and often cost-effective way to source renewable energy.

Green Hydrogen

Green hydrogen is likely to gain traction as a potential fuel for the cement industry. Companies are actively working on cost-effective solutions, with the promise of making green hydrogen readily available in the near future.

Green hydrogen is produced through a process called electrolysis, where water (H₂O) is split into hydrogen (H₂) and oxygen (O₂) using electricity. The electricity used in this process is generated from renewable energy sources, such as solar, wind, or hydropower. That ensures that the hydrogen produced is considered “green” or environmentally friendly.

CEMEX, a leading cement company, has successfully deployed hydrogen-based technology in its cement plants to reduce CO₂ emissions. After a successful trial in Spain in 2019, all CEMEX cement plants in Europe now use hydrogen as part of their fuel mix. The company is also moving quickly to extend this technology to the rest of its global operations, including Mexico, the USA, South & Central America, Africa, and Asia.

Sustainable Supply Chain Management

Technologies such as blockchain, RFID, and other tracking systems are being extensively used to enhance transparency and traceability by tracking the origin and journey of products and materials in the cement supply chain.

Electric Cement Kilns

Electric cement kilns are likely to emerge as a promising solution for reducing the carbon footprint of cement production. These kilns utilize electricity from renewable sources to generate the high temperatures required for clinker production. Pioneering companies like Coolbrook and VTT have made significant strides in developing and commercializing their electric kiln

technology. Coolbrook's collaboration with industry giants like Cemex and UltraTech for its Roto Dynamic Heater ("RDH") technology signifies a promising step towards sustainable clinker manufacturing.

Solar Reactor Technology

The Swiss firm Synhelion and Cemex have made substantial progress in using concentrated solar radiation to produce clinker. While challenges remain, such as storing solar energy for night-time use, a multi-source approach, combining solar, wind, grid, captive, waste heat recovery (WHR), and hydropower where possible, promises a balanced solution for the power needs.

Conclusions

The cement industry has made significant advancements in manufacturing technology over the years, resulting in improved efficiency, increased quality, and reduced

environmental impact. Emerging technologies, such as digitalization, automation, integration of Renewable Energy, usage of alternative fuels, CCUS, sustainable practices, etc. offer significant potential for further improvements in efficiency, sustainability, and social responsibility.

Cement manufacturers are compelled to adapt to these trends in order to remain competitive, foster sustainability, and contribute to the development of a more resilient built environment.

However, the adoption of these emerging technologies will require significant investment and collaboration between industry, researchers, and policymakers. Overcoming technical challenges and carefully considering the economic and environmental impacts will be critical in ensuring the long-term sustainability of the industry.



EY's report underscores Generative AI's (GenAI) potential to inject US\$ 1.2 - 1.5 trillion into India's GDP over seven years, with an additional US\$ 359-438 billion expected in 2029-30. Key sectors like business services, finance, education, retail, and healthcare are poised to drive 69% of GenAI's impact.

Technology Consulting Leader at EY India, Mr. Mahesh Makhija, notes the swift adoption of an AI-first approach for enhanced customer engagement and increased productivity. Despite optimism, the report stresses the need for India to intensify efforts, especially in government involvement. The study reveals that 75% of businesses have low to moderate readiness for GenAI benefits, with 52% citing a skills gap and 42% unclear use cases as challenges. The report calls for strategic initiatives to bridge gaps and propel India into the era of Generative AI for sustained economic growth.

Disclaimer: This information has been collected through secondary research and IBEF is not responsible for any errors in the same.



Arvinder S Brara

Chairman, Environment & Sustainability Committee, CEAI
 CMD, Mantec Consultants Pvt. Ltd.
 Founder of www.greenpledges.com

Challenges

Climate Change is the defining issue of the present time and the current generation is at a defining moment. From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale. Without drastic action today, adapting to these impacts in the future will be more difficult and costly.

The Human Fingerprint on Greenhouse Gases

Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. However, since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas.

Burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures.

There are some basic well-established scientific links:

- The concentration of GHGs in the earth's atmosphere is directly linked to the average global temperature on Earth;

- The concentration has been rising steadily, and mean global temperatures along with it, since the time of the Industrial Revolution;
- The most abundant GHG, accounting for about two-thirds of GHGs, carbon dioxide (CO₂), is largely the product of burning fossil fuels.

The new Emissions Gas Report by the UN Environment Programme finds that there has been progress since the Paris Agreement was signed in 2015. Greenhouse gas emissions in 2030, based on policies in place, were projected to increase by 16 percent at the time of the agreement's adoption. Today, the projected increase is 3 per cent. However, the predicted 2030 greenhouse gas emissions still must fall by 28 per cent for the Paris Agreement 2°C pathway and 42 per cent for the 1.5°C pathway.

Climate-Driven Food and Water Insecurity is Expected to Grow

Global warming of 1.1°C above pre-industrial levels has been caused by over a century of burning fossil fuels and unequal, unsustainable energy and land use. That has led to an increase in the frequency and intensity of extreme weather events, which have caused dangerous impacts on nature and people worldwide.

Each increment of warming results in rapidly escalating hazards, such as more intense heatwaves, heavier rain-

fall, and other weather extremes that increase risks for human health and ecosystems. Climate-driven food and water insecurity is expected to increase with increased warming. When these risks combine with other adverse events, such as pandemics or conflicts, they become even more difficult to manage.

To close the gap between existing adaptation and what is needed, accelerated action to adapt to climate change is essential in this decade. Keeping warming to 1.5°C above pre-industrial levels requires deep, rapid, and sustained greenhouse gas emissions reductions in all sectors. Emissions should be decreasing by now and will need to be cut by almost half by 2030 if warming is to be limited to 1.5°C.

The UN Intergovernmental Panel on Climate Change (IPCC)

The Intergovernmental Panel on Climate Change (IPCC) was set up by the World Meteorological Organization (WMO) and United Nations Environment to provide an objective source of scientific information.

Sixth Assessment Report

According to the Synthesis Report of the IPCC's Sixth Assessment Report, there are multiple, feasible, and effective options to reduce greenhouse gas emissions and adapt to human-caused climate change, and they are available now. The IPCC **proposes adopting a "climate-resilient development"** that involves integrating measures to adapt to climate change with actions to reduce or avoid greenhouse gas emissions in ways that provide wider benefits.

For instance, access to clean energy and technologies can improve health, especially for women and children. Low-carbon electrification, walking, cycling, and public transport can enhance air quality, improve health, employment opportunities, and deliver equity. Economic benefits for people's health from air quality improvements alone would be roughly the same, or possibly even larger than the costs of reducing or avoiding emissions.

Climate-resilient development becomes progressively

more challenging with every increment of warming. Therefore, **the choices made in the next few years will play a critical role in deciding the future of our planet and the generations to come.**

To be effective, these choices need to be rooted in the diverse values, worldviews, and knowledge, including scientific knowledge, indigenous knowledge, and local knowledge. The approach will facilitate climate-resilient development and allow locally appropriate, socially acceptable solutions.

What is known, based on the IPCC reports, is:

- It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere, and biosphere have occurred.
- The scale of recent changes across the climate system as a whole – and the present state of many aspects of the climate system – are unprecedented over many centuries to many thousands of years.
- Approximately 3.3 to 3.6 billion people live in contexts that are highly vulnerable to climate change.
- Vulnerability of ecosystems and people to climate change differs substantially among and within regions.
- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks, compared to remaining below 1.5°C.

Global Warming of 1.5°C

In October 2018 the IPCC issued a special report on the impacts of global warming of 1.5°C, finding that limiting global warming to 1.5°C would require rapid, far-reaching and unprecedented changes in all aspects of society. With clear benefits to people and natural ecosystems, the report found that limiting global warming to 1.5°C compared to 2°C could go hand in hand with ensuring a more sustainable and equitable society. While previous estimates focused on estimating the damage if average temperatures were to rise by 2°C,

this report shows that many of the adverse impacts of climate change will come at the 1.5°C mark.

The report also highlights a number of climate change impacts that could be avoided by limiting global warming to 1.5°C compared to 2°C, or more. For instance, by 2100, global sea level rise would be 10 cm lower with global warming of 1.5°C compared with 2°C. The likelihood of an Arctic Ocean free of sea ice in summer would be once per century with global warming of 1.5°C, compared with at least once per decade with 2°C. Coral reefs would decline by 70-90 percent with global warming of 1.5°C, whereas virtually all (> 99 percent) would be lost with 2°C.

The report finds that limiting global warming to 1.5°C would require “rapid and far-reaching” transitions in land, energy, industry, buildings, transport, and cities. Global net human-caused emissions of carbon dioxide (CO₂) would need to fall by about 45 percent from 2010 levels by 2030, reaching ‘net zero’ around 2050. This means that any remaining emissions would need to be balanced by removing CO₂ from the air.

United Nations Legal Instruments - United Nations Framework Convention on Climate Change

The UN family is at the forefront of the effort to save the planet. In 1992, its “Earth Summit” produced the United Nations Framework Convention on Climate Change (UNFCCC) as a first step in addressing the climate change problem. Today, it has near-universal membership. The 197 countries that have ratified the Convention are Parties to the Convention. The ultimate aim of the Convention is to prevent “dangerous” human interference with the climate system.

Kyoto Protocol

By 1995, countries launched negotiations to strengthen the global response to climate change, and, two years later, adopted the Kyoto Protocol. The Kyoto Protocol legally binds developed country Parties to emission reduction targets. The Protocol’s first commitment period started in 2008 and ended in 2012. The second com-

mitment period began on 1 January 2013 and ended in 2020. There are now 198 Parties to the Convention and 192 Parties to the Kyoto Protocol

Paris Agreement

At the 21st Conference of the Parties in Paris in 2015, Parties to the UNFCCC reached a landmark agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future. The Paris Agreement builds upon the Convention and – for the first time – brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort.

The Paris Agreement’s central aim is to strengthen the global response to the threat of climate change by keeping the global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.

On Earth Day, 22 April 2016, 175 world leaders signed the Paris Agreement at United Nations Headquarters in New York. That was by far the largest number of countries ever to sign an international agreement on a single day. There are now 194 countries that have ratified the Paris Agreement.

Nobel Peace Prize

In 2007, the Nobel Peace Prize was awarded jointly to former United States Vice-President Al Gore and the IPCC “for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such changes challenges.”

Opportunities

Efforts to mitigate and adapt to climate change also produce opportunities for organizations through, for example, resource efficiency and cost savings, the adoption of low-emission energy sources, the

development of new products and services, access to new markets, maximizing new policies that subsidize efficiencies and clean energy, and building resilience along the supply chain. Climate-related opportunities

will vary depending on the region, market, and industry in which an organization operates. Table-1 describes the five opportunity categories from TCFD (Task Force on Climate Related Financial Disclosures).

Table-1: Climate-Related Opportunities

Category	Opportunities
Resource Efficiency	There is growing evidence and examples of organizations that have successfully reduced operating costs by improving efficiency across their production and distribution processes, buildings, machinery/ appliances, and transport/ mobility—in particular in relation to energy efficiency but also including broader materials, water, and waste management. Such actions can result in direct cost savings to organizations’ operations over the medium to long term and contribute to the global efforts to curb emissions. Innovation in technology is assisting this transition; such innovation includes developing efficient heating solutions and circular economy solutions, making advances in LED lighting technology and industrial motor technology, retrofitting buildings, employing geothermal power, offering water usage and treatment solutions, and developing electric vehicles.
Energy Source	According to the International Energy Agency (IEA), countries will need to transition a major percentage of their energy generation to low emission alternatives such as wind, solar, wave, tidal, hydro, geothermal, nuclear, biofuels, and carbon capture and storage to meet global emission-reduction goals. Investments in renewable energy capacity are exceeding investments in fossil fuel generation. The trend toward decentralized clean energy sources, rapidly declining costs, improved storage capabilities, and subsequent global adoption of these technologies are significant. Organizations that shift their energy usage toward low emission energy sources could potentially save on annual energy costs.
Products and Services	Organizations that innovate and develop new low-emission products and services may improve their competitive position and capitalize on shifting consumer and producer preferences. Some examples include consumer goods and services that place greater emphasis on a product’s carbon footprint in its marketing and labeling (e.g., travel, food, beverage and consumer staples, mobility, printing, fashion, and recycling services) and producer goods that place emphasis on reducing emissions (e.g., adoption of energy-efficiency measures along the supply chain).
Markets	Organizations that pro-actively seek opportunities in new markets or types of assets may be able to diversify their activities and better position themselves for the transition to a lower-carbon economy. In particular, opportunities exist for organizations to access new markets through collaboration with governments, development banks, small-scale local entrepreneurs, and community groups in developed and developing countries as they work to shift to a lower-carbon economy. New opportunities can also be captured through underwriting or financing green bonds and infrastructure (e.g., low-emission energy production, energy efficiency, grid connectivity, or transport networks).
Resilience	The concept of climate resilience involves organizations developing adaptive capacity to respond to climate change to better manage the associated risks and seize opportunities, including the ability to respond to transition risks and physical risks. Opportunities include improving efficiency, designing new production processes, and developing new products. Opportunities related to resilience may be especially relevant for organizations with long-lived fixed assets or extensive supply or distribution networks; those that depend critically on utility and infrastructure networks or natural resources in their value chain; and those that may require longer-term financing and investment.

Conclusions

All habitants on this earth need to play a role as individuals to meet the challenges posed by Climate Change and also benefit from the opportunities the challenges present. All must pledge to support the efforts to improve and preserve the Environment and reduce activities, nay, cut off all those that result in Climate Change by going to www.greenpledges.com so one can contribute to meet the challenges as an individual in the

interest of the present and future generations.

References

1. UN Climate Action
2. IPCC Sixth Assessment Report
3. COP28
4. Climate Ambition Summit 2023
5. Sustainable Development Goal 13: Climate Action



The screenshot shows a news article from IBEF (India Brand Equity Foundation) dated December 27, 2023. The article title is 'India is 15th in the top 25 AI nations but has the 'greatest upward potential!'. The main text discusses India's ranking among the top 25 Artificial Intelligence nations, highlighting its 'greatest upward potential' as identified by Tufts University's Fletcher School. It mentions that the United States leads, followed by China, UK, Japan, and Germany. India's position is ahead of countries like Brazil, Argentina, Mexico, Turkey, and Thailand. The article also notes India's status as the second-fastest-growing data pool and the world's largest pool of mobile data, which is a crucial foundation for advancing AI capabilities. Mr. Bhaskar Chakrovorti, Dean of Global Business at the Fletcher School, is cited as the researcher who analyzed AI development based on four key drivers: rapid accumulation of data through broadband consumption, regulations governing data access, capital considerations (talent, investments, diversity in AI talent), and innovation indicators like patent applications and citations. The article concludes by stating that India's positioning in the dynamic AI landscape reflects its current standing and promising trajectory with strategic steering and responsible data utilisation.

<https://www.ibef.org/news/india-is-15th-in-the-top-25-ai-nations-but-has-the-greatest-upward-potential>

A Journey Across Six Generations of Civil Engineers in India



Vijay Kumar Dhingra
Principal Consultant and Adviser
Cetus Consulting Solutions Private Limited.

Introduction

In the late 1950s, during my childhood, I witnessed my father's dedicated role as a Divisional Accountant in the Engineering Division overseen by an Executive Engineer in the Northern Zone office of the Indian Railways. At the tender age of four to five, I lacked an understanding of the intricacies of how things work, leave alone engineering design and construction, yet vivid memories linger of my father's bustling days while supporting the Divisional Engineer in his capacity as the Accountant.

His workdays were far from conventional, devoid of fixed office hours, primarily due to a contractual dispute that had propelled the railways into arbitration. That legal challenge consumed a substantial portion of his time, necessitating his assistance to the Department and late-night briefings with the lawyer who was available only during odd hours. My father, known for his meticulousness and unwavering work ethics, mirrored the dedication of the series of Divisional Engineers under whom he served.

His passion for the profession was palpable, and he held a deep appreciation for Civil Engineering. That sentiment was not merely professional; it was personal. In the subsequent paragraphs, we delve into the reasons behind his profound affinity for Civil Engineering,

shedding light on the roots of his devotion to the field. In this narrative, we will explore the defining characteristics of six generations of Civil Engineers in India and trace the transformative journey that has unfolded over time.

I would like to clarify that the observations shared here are solely derived from my personal experiences, and I do not intend any derogatory implications towards anyone. As a fellow Civil Engineer, I hold a profound appreciation for the intricacies and significance of this esteemed profession.

Post Independence and into 1950s

In the immediate aftermath of gaining independence and extending into the late 1950s and early 1960s, a fervent era of Nation Building emerged in India. During that period, engineers operated with a remarkable degree of freedom, driven more by a results-oriented mindset than a rigid adherence to procedures. The Engineering Officers of that epoch were notable for their strict discipline and practical, field-oriented approach.

Despite the prevalence of unscrupulousness within engineering departments even in the pre-independence era, it is noteworthy that the structures constructed during that time have proven to be exceptionally resilient over the years.

1950s and 60s Positive, Helpful, and Work Oriented Approach

Engineers of that era demonstrated remarkable initiative, drive, and resourcefulness when confronted with challenges in their work. Drawing from my personal experience as the son of a Divisional Accountant in an engineering division, I vividly recall a situation that exemplifies those qualities.

Facing a two-year wait for the allotment of Railway Accommodation, and with no immediate prospect of securing a Government Quarter, our family was confronted with the possibility of renting a residence far from the project site in Old Delhi. However, the need for my father's presence near the office, due to the absence of fixed working hours, posed a logistical challenge. As a stroke of ingenuity, the Executive Engineer in Charge devised a unique solution. He constructed a temporary living quarter using discarded railway sleepers, coated with mud plaster, and topped with a roof safeguarded by mud fusca and tarpaulin. That makeshift accommodation was established on a vacant piece of land under his jurisdiction. We resided in that innovative living space, assisted by an office boy who aided my mother with household chores and marketing before and after office hours. In appreciation of his services, we provided him with food, clothing, and accommodation as compensation. That experience exemplifies the resourcefulness and the problem-solving skills that characterized the engineers of that time.

Initiative for Experimentation and Innovation

The following account sheds light on the fearlessness of Engineering Officers in the past when it came to embracing experimentation and innovation. Nearly a year after settling into our improvised accommodation, my father shared an intriguing development with me: the project office was planning to relocate an existing railway quarter of a station master, which was situated in the path of a railway track, by a few hundred feet instead of resorting to demolition.

As a curious child, I yearned to witness this remarkable

undertaking, yet I was denied permission due to the inherent risks involved. Nevertheless, the experiment unfolded successfully under the astute guidance of the Executive Engineer. He meticulously designed the requisite shoring and scaffolding using locally available scrap, orchestrating the seamless movement of the building to its intended location without incurring any damage.

That anecdote stands as a testament to the dynamic, confident, knowledgeable, and initiative-driven nature of engineers from yesteryears, particularly within the realm of Civil Engineering.

Era that Produced Legends in Civil Engineering

The commendable contributions of numerous engineers from bygone eras are truly noteworthy. Civil Engineering has been graced by legends such as Dr. A. N. Khosla, who not only excelled in his engineering endeavours but also served as the Governor of Orissa, now Odisha. Dr. K. L. Rao, another luminary in the field, held the esteemed position of Minister for Irrigation and Power in the cabinet. Shri Kanwar Sen left an indelible mark with his visionary Rajasthan Canal Project.

Among the other distinguished minds in the realm of Civil Engineering, we find ace designers like former faculty members of the University of Roorkee - Prof. O.P. Jain, and Professor Jaikrishna, both of whom significantly contributed to the discipline. Those luminaries represent a select few among the many who have shaped the landscape of Civil Engineering with their exemplary work.

Independence of Expression and Meticulous Record Keeping

A notable aspect that I deeply admire about the veterans in Civil Engineering was their commitment to flawless documentation and meticulous record-keeping. Allow me to share an illuminating incident from my own experiences. During my tenure at the Water and Power Consultancy Services (India) Limited, now WAPCOS Limited, we engaged a consultancy led by a retired

Director from the Central Water and Power Research Station in Pune to evaluate the dam safety issues of Vihar Lake, constructed in 1860. That undertaking necessitated delving into the historical records and drawings of the project.

Initially, the Department hesitated, claiming the unavailability of those crucial records. However, after a thorough search, they were discovered in an old almirah. What stood out was the precision with which the differences of opinion between the Engineer-in-Charge and Professor Rankine were documented. The Engineer-in-Charge, acknowledging the stature of Professor Rankine, faithfully recorded the resolution of their disagreement. That incident reflects a bygone era where there seemed to be a genuine freedom of expression and independence in professional matters. It prompts contemplation on whether such freedom to document professional disagreements would be received with the same spirit by seniors in our present vibrant democracy.

Similarly, during my pursuit of a Master's degree at the University of Roorkee (now Indian Institute of Technology Roorkee), we were informed that the designs and drawings of the Cautley Aqueduct, completed in 1830, were still available. That starkly contrasts with contemporary challenges faced by engineers, where the as-built conditions often deviate from the initial design due to unforeseen field conditions. Internal details can also differ from what was conceived on the drawing board. Access to such information becomes crucial during structural reviews for assessing efficacy and safety, but regrettably, it is often challenging to obtain. That prompts contemplation on why we have not gleaned this invaluable practice from the engineers of the bygone era.

Following the era characterized by initiative, drive, and professional pride, I found myself working alongside the subsequent generation of engineers. While technically adept, that cohort did not quite match the initiative and drive of their predecessors. Unlike the earlier generation, which took pride in being Nation builders, the succeeding generation appeared somewhat confined by routine. While their knowledge and intellect were unquestionable, the once-vibrant initiative seemed to have waned.

The culture of fearlessly recording opinions had noticeably receded into the background. Decisions, once propelled by a proactive work-oriented approach, now leaned more towards procedural adherence. There existed no shortage of competence, yet the dynamism and assertiveness that characterized the earlier generation had taken a back seat.

The Civil Engineers of Seventies in India

In 1972, during my stint as an engineering student trainee, I experienced a defining moment on the first day of my training at an Indian Railways site. A new Executive Engineer, succeeding his 'daring' predecessor known for 'commission-driven' decisions, surprised us with an unannounced inspection. Arriving during the lunch break, he inquired about my observations since the morning. I proceeded to show him a stack of deformed bricks passed as 'Class A,' a 'dry' soak pit designated for soaking bricks, a shuttering riddled with holes meant for a portico, and, to top it off, a recently constructed wall without the proper staggering of joints.

The Executive Engineer meticulously recorded those observations in the Site Order Book and promptly ordered the demolition and reconstruction of the walls at the contractor's expense. Unhappy with that directive, the contractor facilitated my transfer to another site, where a multi-storey building was under construction by a different contractor a few hundred meters away. My new responsibility was to assess the quality of materials on-site.

Upon reviewing the Indian Railways specifications, I discovered that the maximum allowable clay content in sand for concrete mix preparation was 4 percent, significantly lower than the Central Public Works Department (CPWD) specifications of that era and generally acceptable limit of 8 percent. Upon inspecting the Badarpur sand supplied by the vendor, I found the clay content to be higher than the permissible limit and recommended washing it before use. The instructions were promptly followed; jute bags were transformed into flat sheets and placed on a spare bamboo platform, which labourers used as a step to sit and work. Several labourers were reassigned to carry out this task,

allowing the excess, red-coloured clay to drain away after washing.

Word of that practice reached the previous contractor, who visited the site and humorously commented, “This red-coloured wash is the blood of the contractor.” However, after a few days, the Engineer-in-Charge explained to me that a compromise needed to be made at the site, either accepting the available sand in the market while ensuring that the clay content was not excessively high or facing a time overrun in the project. Subsequently, my influence at the site diminished, and I began delving into other aspects of constructing a multi-storey building.

Mid Seventies to late Eighties

A year after graduating, I had joined the Civil Engineering faculty of my engineering college as an Associate Lecturer. However, my father harboured the desire for me to prepare for and join the Engineering Services as a Class I Officer—a highly esteemed path for Civil Engineers during those times. In pursuit of that goal, I diligently prepared for the Engineering Services Examination and successfully passed it, securing a position in the Central Water Commission (CWC) from September 1975 onward.

I humbly attribute all my professional learning, academic qualifications, and the development of my specialization in the field of hydrology and water resources to the experiences gained at the Central Water Commission. That department not only provided a conducive environment for learning but also granted me the opportunity to pursue my Masters in Hydrology and receive training in mathematical modelling under a United Nations Development Programme (UNDP)-assisted program in the USA. Out of my thirteen years of service in the Central Water Commission, nearly two years were dedicated to training and acquiring higher qualifications.

While I made contributions during my tenure, the lack of exposure to fieldwork and the extended gestation periods of projects were notable challenges. Particularly during the Eighties, the development of water resources appeared financially burdensome, and water resources

management had not yet gained momentum. In that scenario, it became evident that the careers of many engineers in the CWC might not witness the realization of their planned projects on the ground, offering tangible benefits to society. The sluggish pace of government initiatives proved frustrating, leading me to ponder why the government recruited the country’s top talent only to underutilize them.

Motivated by a desire for more impactful work, I decided to explore opportunities with Water and Power Consultancy Services (India) Limited, now WAPCOS Limited. As consultants, I anticipated that they might offer a more dynamic and varied workload, with the potential for assignments to materialize effectively.

During my tenure at CWC, I encountered a mix of officers - some incredibly supportive, while others presented obstacles at every turn, as one might expect in any career. Most adhered to routine, but a select few became invaluable mentors from whom I gleaned significant insights.

Field Engineers-Attaining Annual Financial Target-a Priority

During one of my assignments in WAPCOS, I visited a dam project where I had prepared the Reservoir Operation Manual and Flood Forecasting Scheme. To my dismay, I found the dam filled to its full capacity, yet not a single inch of the canal had been constructed. Expressing my concern to the Executive Engineer In-Charge, I highlighted what seemed to me a shocking waste of taxpayer money. The Executive Engineer responded, “Sir, my posting here is about to end, and land acquisition is a major headache. I have met my financial targets, and my superiors are content. Let someone else worry about the canal.” That was the prevalent situation in numerous water resources development projects under construction at that time.

Issues such as time and cost overruns were pervasive, arising from factors like insufficient funds, procedural delays, contractor litigations, and public disputes during the land acquisition process. Writing manuals without a

clear timeline for their implementation proved to be a frustrating experience.

However, amid those challenges, the opportunity to integrate WAPCOS into computerized operations emerged as a bright spot. I developed custom-made computer programs and worked with software, marking a significant step forward. I credit WAPCOS for equipping me with valuable insights into consultancy project management and enhancing my understanding of these complex endeavours.

Engineers of the 1990s - Experience with Recruitment

In the early nineties, I assumed the responsibility of recruiting Civil Engineers for WAPCOS, a time when the organization lacked established rules for such processes. Eager to introduce transparency, I proposed a comprehensive approach, outlining a written test followed by a personality test for those who cleared the initial written examination. The approved weightage for both tests aimed at ensuring a fair evaluation.

Contrary to the prevailing trend of objective-type tests, I opted for a more traditional format, featuring elaborate numerical and descriptive questions. My rationale was grounded in the belief that a consultancy company demands not only robust technical knowledge but also effective reporting skills, aspects that could not be adequately assessed through objective testing. That departure caught most applicants off guard, resulting in subpar performances for many, except a few who navigated the challenges successfully.

Following the personality test, the Managing Director introduced another change - requiring those who passed the examination and personality test to deliver a presentation before their final selection. That unexpected twist presented its own set of challenges, yet we successfully recruited a group of trainees. A similar rigorous process was applied in the selection of computer programmers.

To my surprise, after the recruitment of some computer programmers, a very senior officer questioned the

regional distribution of selected candidates, asking, “How have you selected so many south Indians while you are a north Indian?” In response, I maintained a straightforward stance, stating, “I have solely assessed their computer programming skills, nothing else.” However, that approach, while focusing on merit, led to a degree of unpopularity among certain administrators within the company.

The quality of Civil Engineers selected in the 1990s appeared satisfactory, yet a lingering sentiment persisted: *‘yeh dill mange more’*—a desire for even better candidates.

Saying No - The Jellyfish Way

When it came to envisioning the trajectory of a consultancy company specializing in water and power assignments, my vision diverged somewhat from the management’s perspective. In those days, my inclination was towards cultivating more specialized skills, particularly in mathematical modelling, elevating the quality control of our reports, and consolidating our foundational strengths. However, the Government’s criterion for evaluating management performance seemed tethered to the company’s turnover.

The most straightforward route for a Public Sector Unit (PSU) to boost turnover was ‘diversification’ into various areas, often involving engaging retired consultants to undertake projects. In that process my proposals to build on the basic capacities of the company and making them a house of excellence met a cold response. Whenever I proposed acquiring expensive yet valuable software that could set the company apart or enhance the quality control of reporting, it was met with a barrage of ten questions. Answering those questions only led to another set of ten queries, creating a back-and-forth matter of queries and responses, reminiscent of a ping pong game with a highly skilled defensive player. That continued until I felt a sense of frustration, realizing it was likely a futile exercise. I facetiously nicknamed that boss of mine a ‘Jelly Fish,’ recognizing it as a subtle way of expressing disapproval or a polite refusal.

The Wonderworld of WAPCOS Clients of Nineties

A vivid episode from my past memory involves a stormwater drainage consultancy project. In a bid to secure it, I assigned one of my sharpest juniors to meticulously document and photograph all bottlenecks and potential stagnation points in the cities relevant to the project (GPS technology had not yet become widespread). Our proposal, crafted based on that comprehensive assessment, ingeniously outperformed the submission from a well-known multinational company, favoured by the Project Management Unit (PMU).

Despite the Technical Evaluation Team favouring our proposal, the PMU hesitated to retract any prior commitments made to their favourites. To impede our progress, they called us for negotiation meetings on three separate occasions, only to cancel each meeting, wasting the time of our senior management and ourselves. Undeterred, we persisted. On the fourth attempt, a meeting finally took place, but to our surprise, they began discussing another project not on the agenda—one that I had no knowledge of. Before I could express my surprise, our Managing Director discreetly pressed my hand and passed me a note that read, “We are getting a project. We are not giving up Storm Water Drainage; they will have to give it to us.” In that crucial moment, drawing on acting skills cultivated during my school days participating in dramatics, I concealed any hint of surprise. True to the MD’s intuition, our perseverance paid off, and they had no choice but to award us the stormwater drainage project. That type of project management approach by clients would have been unimaginable to engineers and bureaucrats of previous generations.

The Joy of Doing Small Things that Bring Smile on the Face of the Poor

In pursuit of seeing the tangible benefits of my engineering efforts quickly impacting society, I sought a position with the Royal Danish Embassy for management of their bilaterally assisted projects in the water sector. At that time, the Embassy was actively engaged in providing bilateral assistance to the Government of India for water

supply and sanitation schemes, emphasizing a demand-driven and participatory approach. Over the course of seven and a half years with the Danish International Development Agency (DANIDA), I had the privilege of leading teams that implemented those projects. I consider myself fortunate to have played a pivotal role in bringing smiles to the faces of thousands of villagers. That was achieved by rehabilitating and enhancing defunct schemes, encouraging Gram Panchayats to take ownership of assets, involving communities in quality control, and jointly managing schemes with engineers and sociologists.

The work extended to the construction of thousands of twin-pit latrines, and their intended use was actively promoted through continuous education efforts within the villages. Throughout that period, DANIDA functioned as facilitators and trainers, working alongside Gram Panchayats. Additionally, I was engaged in watershed projects in the Koraput and Malkangiri districts of Odisha, where we designed interventions that empowered farmers to maintain the structures independently. Witnessing farmers from non-project areas replicate our work was particularly satisfying.

After seven and a half years, I made the decision to resign from DANIDA due to their plan to phase out of India in the next three or four years. I transitioned to consultancy with a desire for new challenges and opportunities.

The collaboration with sociologists, water quality experts, engineers, and other professionals at DANIDA was marked by their commitment and dedication. In one instance, when informed that pipes with BIS marks in the field did not meet satisfactory standards, I opted for a pragmatic approach. Instead of initiating a bureaucratic letter war with the concerned State Government, I issued advice on behalf of the Embassy suggesting that shortlisted companies preferably have both ISO and BIS accreditation. This simple step worked remarkably well, leading to the disqualification of undesirable suppliers.

Working with Danes and expatriates serving as advisers to DANIDA-supported projects was a valuable experience. That exposure allowed me to operate in a multidisciplinary and multicultural environment, a crucial aspect for my professional development.

In summary, my decision to part ways with DANIDA was rooted in their strategic decision to exit India, and the prospect of winding up a program that we had collectively nurtured as a team did not align with my vision for professional fulfilment and excitement.

Recruiting Engineers in late 2000s Private Sector

In the 2000s, as I transitioned to the private sector, I found myself somewhat detached from computer programming and modelling. Instead of relearning those skills, I opted to rely on my younger colleagues for technical execution while contributing to the result by way of advice and discussions based on common sense and experience. My involvement extended to reporting, project management, and business development.

Observing the younger generation, I noted that some were involved in the using analysis models without a deep understanding of the underlying physics or practical considerations. Notably, a few were not qualified as Civil Engineers and hence faced challenges comprehending the configurations of structures. That period marked the IT age, where everyone sought diversification into software. Civil Engineering graduates, traditionally inclined towards construction, were being lured by major construction companies like Larsen & Toubro

(L&T) and Heavy Engineering Corporation (HEC), Ranchi. Consequently, in consultancy, we often had to be content with individuals qualified as agricultural engineers or those genuinely interested in mathematics and modelling. The lure of higher salaries in the IT sector also meant that compromises had to be made.

During my stint in the private sector and interaction with engineers of the 2000s, the Managing Director urged me to participate in campus recruitment at a university offering an integrated M.Tech in Water Resources. Initially hesitant, I complied with his insistence and found a little surprise in the outcomes. Interestingly, the toppers fared poorly in the interview, while those in the middle order performed slightly better, yet not good enough to be recruited. Following the interviews, I took the opportunity to connect with their professors over dinner, offering unsolicited advice on effective teaching and examination techniques.

Conclusions

In conclusion, although our country is undoubtedly in need of digitalization and IT advancements, there is still a considerable distance to cover before realizing its complete infrastructural potential.

In my perspective, there is an urgent necessity to foster a new generation of individuals with the right attitude and dedication to their profession for the comprehensive and integrated development of our nation. I express a longing for the return of the professional attitude and pride that characterized the 1950s and 60s, coupled with the integration of modern models and technology.

CEAI NEWS

ANNUAL GENERAL MEETING OF CEAI

The *27th Annual General Meeting* of the Members of the Consulting Engineers Association of India was held on Friday, 22nd December 2023, at CEAI Centre, New Delhi.

The decisions taken were:

1. Minutes of the 26th Annual General Meeting held on 24th December 2022 were confirmed.
2. Adopted the Annual Report of the Association for the Financial Year ended 31st March 2023.
3. Passed the Audited Accounts of the Association for the Financial Year ended 31st March 2023.
4. Appointed Auditors for the Financial year 2023-2024.



AGM in Progress

WEBINAR ON “ENGINEERING SUSTAINABILITY & REHABILITATION OF BRIDGES AND STRUCTURES”

CEAI’s Future Leader Forum organised a webinar on 17th October 2023 on “**Engineering Sustainability & Rehabilitation of Bridges and Structures**” which was presented by Mr. Amitabha Ghoshal, Past President CEAI.



Mr. Amitabha Ghoshal spoke of the changeover from an Agricultural society to an Industrial economy, and now to a Service-oriented economy which has brought in rapid urbanization. India’s urban population which was 26 percent with a base number of 400 million at the time of Independence is now nearer to 40 percent of the present population of 1350 million – a staggering rise of more than five times!! Transport infrastructures are the worst sufferers with space shrinking rapidly, thus making grade-separated structures as the only solution.

The grade-separated structures are valuable assets for the city and merit careful preservation and care. In the urban setting, a structure that is subject to heavy traffic load, 24/7, is not easy to inspect and investigate with testing tools, and to repair. Inaccessibility to vulnerable areas like the expansion joints in the deck, the supporting bearings which are located on the top of load-bearing piers, and the underside of the deck, are a big challenge.

Mr. Ghoshal highlighted the role of Engineers who can contribute to the sustainability of structures by introducing proper maintenance practices and by undertaking rehabilitation and retrofitting. The construction sector contributes 12.8% of the total carbon footprint and therefore the engineers can contribute significantly by extending the life of the structures, thereby helping in the conservation of the earth’s limited resources. With the

presentation of three interesting case studies in which he had been involved, he explained how with effective Repair, Rehabilitation, and Retrofitting, engineers could increase the working life of structures that had been due for replacement.

The webinar was very well appreciated by the participants.

Link: <https://youtube.com/live/nybSGeIMM?feature=share>

MEETING CALLED BY ADB ON 28TH NOVEMBER 2023

The Asian Development Bank held consultations with representatives of Contractors and Consultants for adopting a sustainable procurement system for funding projects. The meeting was attended by the representatives of NHBF, HCC, Gammon India Ltd, TCE, ICT and CEAI. Mr. R S Sharma President and Mr J V L Narayana, Vice President attended the meeting on behalf of CEAI. ADB was informed that for better project management, CEAI would provide training on the FIDIC Conditions of Contract, Dispute Management, and Contract Management.



CLIMATE CHANGE AND SUSTAINABILITY - CHALLENGES & OPPORTUNITIES

CEAI organized a webinar on **Climate Change and Sustainability – Challenges and Opportunities** on 12th December 2023. Presentations were made by Mr. Kishan Kalra, Past President, AIMA and Mr. Ashish Rakheja, Managing Partner of AEON Integrated Building Design Consultant LLP.

The speakers shared their views on the reasons for global warming and climate change. One of the main challenges was to reduce greenhouse gas emissions, which are the main drivers of global warming. Greenhouse gas emissions come from various sources, such as fossil fuels, agriculture, industry, and deforestation. Reducing emissions requires a shift to low-carbon energy sources, such as renewable energy, nuclear power, and carbon capture and storage. Most of the global carbon emissions would be generated by buildings and construction industry.



Link: <https://youtu.be/M6DphvzEtxo>

TRAINING ON IT ENABLED PROJECT MANAGEMENT (ITEPM)

CEAI organised a training on **“IT Enabled Project Management (ITePM)”** from 14th to 16th December 2023 at CEAI Centre, New Delhi.



The training was conducted by Mr Puneet Aggarwal, Chief Executive Officer and Mr Chander Mohan Saini, Consultant-



Project Management Practice, 7 dot 2 IT Consulting.

The topics covered were:

- Fundamentals of Project Management
- Handson Training on MS Project on:
 - Developing a Time Network Plan of the Project, coupled with an easy understanding of Work Break-down Structure, Task Dependencies, etc.
 - Critical Path Analysis
 - Viewing, Updating & Monitoring of the Project
 - Reporting of the actual scenario in comparison with baselines
- Controlling different Projects at Enterprise level with Cross Linking in multi-Projects
- Customization of Reports with some important reporting fields which otherwise are not available in-built in the software
- Governance of the Project with Tracking/Monitoring
- Resource Management (Men, Machines & Materials)
- Cost Management
- Procurement Management
- HR Management



MULTIPLE FACETS OF CABLE SUPPORTED INFRASTRUCTURE

A live Multi-Disciplinary Technical Event titled *“Multiple Facets of Cable Supported Infrastructure”*



Chairman E & NE Zone, Shri Das Patnaik addressing the audience

was held by the Eastern and North-Eastern Region Centre of CEAI together with the Eastern Zone of IAStructE and the Mechanical Engineering Division of West Bengal State Centre of Institution of Engineers (India) on Friday 15-12-2023 from 2:30 pm onwards till 8:00 pm in Kolkata.

The event was dedicated to the memory of Sri Mahendra Raj, a doyen of the Engineering profession. The three associations joined hands to make the event a landmark gathering of technocrats, after the long drought of physical events due to the pandemic. A core committee was formed with representatives from the three organizations and they worked hard to make the event a reality within a fortnight from the date the decision was made to organize the event.



Shri Amitabha Ghoshal paying tribute to Er. Mahendra Raj

The theme of the event acquires significance given the rapid increase in number of Cable Supported Bridges in different states of India, after the completion of the Vidyasagar Setu in Kolkata and the Worli Bandra Sea Link in Mumbai. Many of those bridges are being built by city corporations and municipalities because of the aesthetic appeal of such structures. Emphasis in the event was placed on the challenges faced in building such structures and the need for regular maintenance and inspection of the structures considering the vulnerability of the cables to distress due to the environmental exposure. The event also covered the increasing usage of Cable cars and Ropeways in urban areas to counter the problems of surface traffic in congested neighbourhoods.

The Inaugural Session started with the Welcome Speech by Shri Sandip Deb, Council Member of IEI, who encouraged the holding of large technical events by combined efforts of multiple like-minded



Event partners: On left-Shri Anirban Datta, IEI and on right Shri Anirban Sengupta, IAStructE making their presentations

organizations. Addresses were delivered by Sri Sourav Das Patnaik, Chairman of the East and Northern Region Centre of CEAI, and Shri Anirban Sengupta, Vice President of IAStructE.

Shri Amitabha Ghoshal, Past President of CEAI, briefed regarding the deliberations that would be held and their significance. He also eloquently portrayed the life and achievements of Shri Mahendra Raj, a doyen among Engineers, whose contribution went beyond carrying out structural analysis of unusual structures conceived by leading Architects like Le Corbusier, Charles Correa, Louis Kahn, etc., and included the formation of the Indian Association of Structural Engineers (IAStructE) and strengthening of the Consulting Engineering Association of India (CEAI).

Six organizations from the related industry joined as sponsors and with their financial participation registration fee was waived for the participants. The participants who numbered over 150 came from consultancy organizations, the construction industry, manufacturers, and academia. The delegates showed a lot of enthusiasm and there was lively interaction throughout the program. What was remarkable was that the average age of the participants was less than 40 years, with many young engineers joining the event.



A large audience stayed on till the end of the deliberations

For the first session deliberating on Cable Supported Bridges, the topics covered design challenges, construction aspects, sustainability issues, and need for effective health monitoring.

The second session dealt with appurtenances for such bridges and methodology for continuous monitoring of the bridges to ensure safe design life.

The third session covered other cable-supported infrastructures like ropeways and cable cars and their increased use in urban centers.

The duration of the event extended beyond the planned closure time of 7 pm by almost an hour but even at that late hour a large number of participants stayed on till the end.

The takes from the event were:

- There is a strong demand from engineering professionals, especially the younger ones for more such live events on interesting engineering problems where they can interact with the speakers and other senior engineers.
- The industry is ready to participate in such events and is also prepared to offer financial support if the demand is not for large sums.
- The industry is keen to participate in the technical deliberations and is ready to depute speakers if they are allowed to highlight their capabilities and achievements.

FIDIC ASIA PACIFIC ANNUAL CONFERENCE 2023

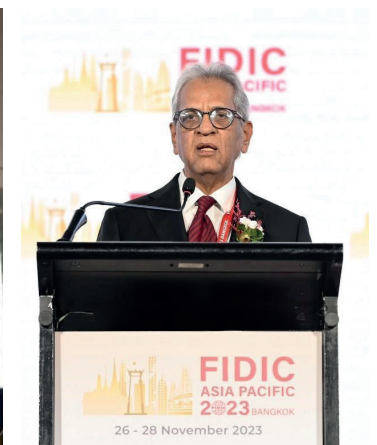
FIDIC Asia Pacific (FAP) organised its Annual

Conference 2023 at Bangkok from 26th to 28th November 2023. It was hosted by the Consulting Engineers Association of Thailand. The theme of the conference was “*Engineering towards Net Zero*”.

FIDIC ASIA PACIFIC AWARDS

FIDIC Asia Pacific (FAP) announced 2023 award winners and distributed the awards during the annual conference on 27th November 2023 at Bangkok. The awards presented to CEAI and CEAI Members were:

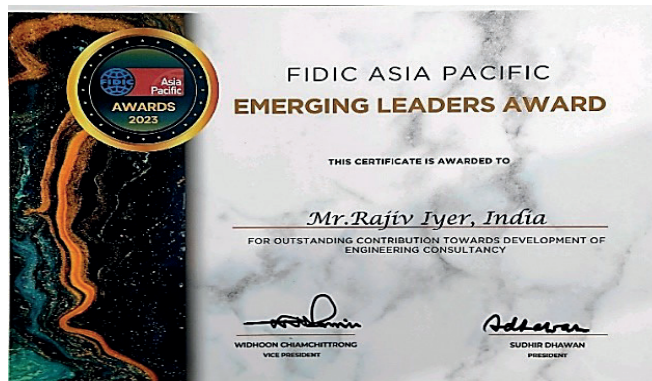
- FIDIC Asia Pacific Envoy Award of Excellence**
Mr. Amitabha Ghoshal, Life Member of CEAI
For Outstanding Contribution Towards the Development of ASPAC.
- FIDIC Asia Pacific Powerhouse Award**
Consulting Engineers Association of India
For Excellent Support Services Towards the Activities of ASPAC.
- FIDIC Asia Pacific Emerging Leaders Award**
 - Mr. Rajiv Iyer, Individual Member
For Outstanding Contribution in Providing Services Towards Project Development



Mr. Sudhir Dhawan, President FAP, addressing the participants

Commendation Certificate

2. Mr. Naman Anand of M/s Legacy Law Offices, India



Forthcoming Events

SEMINAR ON “QUALITY OF DPR AND CONSTRUCTION OF HIGHWAY PROJECTS”

CEAI is organizing a Seminar on “*Quality of DPR and Construction of Highway Projects*” on 9th and 10th January 2024 at Hotel Le Meridien, New Delhi. The Government of India as well as State governments have and are making large investments for upgrading the existing road network and constructing new roads to enhance the mobility of goods and passengers in the country. For every project a Detailed Project Report (DPR) is prepared by the Consultants and thereafter work is executed through various modes by the Contractors/ Concessionaires under the supervision of Consultants.

The quality of the DPR, the designs and the construction are and have been questioned for some time by the stakeholders since a DPR reportedly is not upto the mark. That can adversely affect the implementation of the scheme and design and therefore the execution and the quality of work. Failures of pavements and structures have also been reported and these incidents have been on the increase in the recent past. There is, thus, an urgent and dire need to improve the quality of the DPR and all the activities that go into preparing it and thereafter the design and construction for the project.

CEAI’s aim is to uphold the dignity and integrity of the profession for which CEAI’s focus has been propounding that the quality of engineering services be delivered in a professional and ethical manner. CEAI is and has been seriously concerned about the reported quality of DPR and the Construction, since

Consultants are closely involved in both the phases.

The seminar is aimed at apprising all the current scenario, the actions taken or being taken by the respective stakeholders, the best practices, worldwide, innovative materials, plant & equipment, the technologies, the failures, and the lessons learnt. The steps taken and proposed with a view to improve the quality of the roads will also be discussed.

Hon'ble Union Minister of Road Transport and Highways has kindly consented to inaugurate the Seminar.

For more details about the Seminar, contact CEAI Secretariat at ceai.ceai@gmail.com

Registration link: https://docs.google.com/forms/d/e/1FAIpQLScr70TrBnwh2BgRk8e6uBowQEzGoL1c5Q7xodjFnbX2T8p5A/viewform?usp=pp_url

**Be A Part of the Thrust on Quality
&
Project India's Image as A Leader in
Engineering**

WORKSHOP ON “AI, VR & AR FOR ENGINEERING PROJECTS”

CEAI Academy and CEAI-Western Region Centre have organized a unique daylong workshop on 20th January 2024 at IMC, Mumbai, in which the participants will get an opportunity to experience themselves the use of AI, VR/ AR in Engineering Projects.

AI and its use in many spheres have been making headlines in the past few months since many of its deployment affect even the common man. Legislation to regulate its use is in the offing. However, for the workshop the theme will be its use in engineering. AI for a Project is useful right from the planning stage, and maybe in times to come from the conceptualization itself.

For VR/ AR the presentation will cover as to how they enable virtual visualization and walkthrough to get a better appreciation of what is being planned and designed. The Project Teams of all the stakeholders

would thus be fully aware of what the end product would be and can also include as to how the facility would be maintained to provide the functions for which it was intended.

All these advances in digital technology will go to speed up and improve decision making apart from enabling excellent interface, eliminating interferences, minimising design/ construction errors and enabling better online on time coordination.

SEATS ARE LIMITED SO REGISTER EARLY

Early Bird Discount upto 10th January 2024

Link to fill Registration Form online: <https://forms.gle/Qj2GqgwPLAEAqnFT7>

Learn, Experience & Be Ahead in The Real Time Run

SEMINAR ON “QUALITY OF DESIGN AND CONSTRUCTION FOR SUSTAINABLE INFRASTRUCTURE”

India aspires to be a global engineering hub with a quantum jump in its export of engineering goods and services. That calls for a high degree of excellence in the quality of its engineering projects. With India's achievements and the stupendous success of its Space missions, there has been a growing clamour for the engineering fraternity to achieve similar levels of excellence in project engineering in all sectors to meet prescribed standards and client expectations.

Various challenges that have arisen in recent years have resulted in increased stipulation for proficiency at every stage of the engineering projects, to examine and overcome various impediments, and address them by interacting with policymakers, executing agencies, experts in design and procurement, construction management and contractors, so that the built project meets the specified requirements and functions for its design service life albeit with regular and proper maintenance – with emphasis on the obligations of an engineer vis-à-vis regulations, codes and standards, the contractual commitments and the standard of care of an

engineer.

In response to the above clarion call, the CEAI Ethics & Quality Committee has organised a seminar on **“Quality of Design and Construction for Sustainable Infrastructure”** on 18th & 19th April 2024 at Le Meridien, New Delhi.

The Seminar thus aims to showcase best practices and solutions adopted to meet the highest standards of Quality along with Sustainable Development goals.

Be Aware and Abreast of the 5 W’s and 1 H Why? What? Who? When? Where? & How?

For Sustainable Development

VIEWPOINT

The theme for the March 2024 issue of CEAI’s quarterly magazine **“ViewPoint”** is **“Consultancy for Start-Up and MSME”**.

There are a large number of consulting engineering organisations who are in the MSME category and added to those are the small Start-Up units comprising a few individuals from various disciplines of engineering. Many are doing creditable work which oft go unnoticed; they include those in niche areas and/ or high-end engineering. Other developing countries also need them.

Professionals are invited to share case studies of their achievements, how they addressed the challenges faced, practical issues experienced and the solutions to those, etc. in the various disciplines of engineering. Photographs, charts, diagrams, drawings, etc. would benefit readers for a better appreciation of the issues encountered and the manner in which they were addressed.

The themes for the balance issues for the term 2023-

2024 are:

1. June 2024 – Affordable Housing
2. September 2024 – Energy Transition
3. December 2024 – Recycling & Reuse of Building Materials in Construction Industry

The articles for an issue need to reach CEAI at least 3 weeks prior to the end of the month of the ViewPoint issue. Articles need to be in Times New Roman 12 with single line spacing with before and after 6 pt and normal margin, on A4 size. A recent clear and bright passport size photograph of the author(s) is to be sent along with the article. For details of formatting please refer to **“Format for Articles for CEAI Viewpoint”** on CEAI’s website, under **‘Publications’**.

Advertisement in ViewPoint

ViewPoint is circulated to all CEAI Members, FIDIC, Ministries of the Government of India, Ministries of the State Governments, Administrations of Union Territories, Public & Private Sector Undertakings, Construction Firms, Contractors, Consultants, Foreign Missions and Funding Institutions in India and other organisations related to or dealing with the engineering profession. Thus, all stakeholders partnering development and progress are its readers.

Catch the Customers Eye
Get Wide Exposure → **VIEWPOINT**
Improve Visibility

Support from CEAI members and stakeholders are sought for increasing the number of advertisements, so that ViewPoint gains in its stature as a unique Technical Publication for the fraternity and the public at large to spread information of how Consulting Engineers are helping society for improving the quality of life and doing so sustainably.

The rates for advertisements in *VIEWPOINT* are given below:

Item	Rate Per issue* (Rs)	Discounted rate at 10% for 2 consecutive issues* (Rs)	Discounted rate at 20% for 4 consecutive issues* (Rs)
Back Cover	25,000.00	45,000.00	80,000.00
Inside Front Cover**	18,000.00	32,400.00	57,600.00
Inside Back Cover**	18,000.00	32,400.00	57,600.00
Full Page (Colour)	12,000.00	21,600.00	38,400.00
Full Page (Colour), if a specific page position is required.	14,000.00	25,200.00	44,800.00
Full Page (B&W) (such advertisements will be taken up for printing only when there are 4 or multiple of 4 advertisements for an issue)	8,000.00	14,400.00	25,600.00

Notes: *GST @ 5% or as prescribed will be added to the above rates.

**Inside Front Cover inside back covers booked till June 2024

Tech Quiz

1. **Which is the oldest integrated steel plant in India?**
 - a. Durgapur Steel Plant
 - b. Rourkela Plant
 - c. Bhilai Steel Plant
 - d. TISCO
 - e. Visvesvaraya Iron and Steel Plant
2. **Which state in India has the maximum number of factories?**
 - a. Maharashtra
 - b. Uttar Pradesh
 - c. Gujarat
 - d. Andhra Pradesh
 - e. Tamil Nadu
3. **When was the first petroleum refinery setup in India?**
 - a. Burmah Shell Refinery, Mumbai
 - b. Digboi Refinery
 - c. Esso Refinery, Mumbai
 - d. Caltex Refinery, Mumbai
 - e. Kochi Refinery
4. **What is the largest car manufacturing plant capacity in India?**
 - a. Maruti Suzuki Plant, Mannesar, Haryana
 - b. Hyundai India Plant, Chennai, Tamil Nadu
 - c. Tata Motors Plant, Sanand, Gujarat
 - d. Renault-Nissan, Chennai, Tamil Nadu
 - e. Kia Anantapur Plant, Andhra Pradesh
5. **When was a modern steel plant setup begun in India?**

a. 1912	d. 1923
b. 1959	e. 1870
c. 1801	
6. **Which Sector provides sunrise opportunity?**
 - a. Automobile
 - b. Defence Manufacturing
 - c. Chemicals
 - d. Telecom
 - e. Semiconductor
7. **Which sector employs the maximum number of female workers?**
 - a. Construction
 - b. Manufacturing
 - c. Electricity, Water, etc.
 - d. Mining & Quarrying
 - e. Transport, Storage & Communication
8. **Which is not a core industry?**
 - a. Crude Oil
 - b. Fertilizers
 - c. Steel
 - d. Coal
 - e. Pharmaceutical
9. **Which of the core industries witnessed double digit growth in October 2023**
 - a. Fertilizers
 - b. Natural Gas
 - c. Refinery Products
 - d. Cement
 - e. Crude Oil
10. **What is percentage of MSMEs held by women in India?**
 - a. Thirty
 - b. Nineteen
 - c. Twenty five
 - d. Fifteen
 - e. Forty

The first person who mails the correct answers to CEAI info@ceai.org.in will get a congratulatory mail and will be acknowledged by publishing the persons photograph in the next issue.

Contributed by A P Mull

Answers to Tech Quiz September 2023 issue

1. (c), 2. (b), 3. (a), 4. (a), 5. (b), 6. (b), 7. (c), 8. (a), 9. (b), 10. (d)

WE OFFER

FIDIC TRAINING COURSES

- **Module I : Practical Use of FIDIC Conditions of Contract**
- **Module II : Management of Claims and Disputes Resolution**
- **Module IV : Contract Management and Administration**

The investment in infrastructure is growing and would continue to grow at an accelerated rate in the near and distant future across the Globe and especially in developing economy like India. The multilateral financial institutions are pouring in funds and want to be a part of the India growth story. These MDBs invariably use the FIDIC Conditions of Contract which are acclaimed as the Gold Standard of Conditions of Contract Globally.

The FIDIC Conditions of Contract are being used the world over where multi-lateral development banks provide the funding. And in large complex Government projects.

With a number of large and complex projects BOTH on-going and planned in the country, this training course will bring the participant the necessary detailed knowledge and insights as to the claim management and dispute resolution provisions under the FIDIC Conditions of Contract.

It covers the identification of project risks, their allocation, and the various causes of claim which can emerge over a construction contract and the way FIDIC addresses those. It details the way to handle claims – preparation, submission, assessment, determination under FIDIC Contracts, and how disputes are prevented or otherwise resolved.

Certificate

After completion of the training a Certificate will be distributed to the participants.

The comprehensive program on FIDIC Contracts led by accredited trainers

Contact for further query

+91 9871166102

ceai.ceai@gmail.com

Consulting Engineers Association of India
CEAI Centre, OCF Plot No.2, Pocket 9
Sector B, Vasant Kunj, New Delhi
www.ceai.org.in





With best compliments from

Legacy Law Offices LLP

*Serving the construction and engineering
consultancy industry and aiding:*

**PUBLIC PROCUREMENT;
CONTRACT MANAGEMENT; AND
DISPUTE RESOLUTION INCLUDING
ARBITRATION AND LITIGATION.**



DELHI

Legacy House
D-18, Nehru Enclave,
Kalkaji, New Delhi – 110019
(India)
Phone: 011 - 41752507,
41752508

CHANDIGARH

Legacy House
#333, Sector 4,
MDC, Panchkula-134114
(India)
Phone: 0172 - 4801333,
4802333

MUMBAI

Office No. 307, 3rd Floor,
NITCO BIZ- Park, Plot No. C-19,
Road No. 16- U, Wagle Estate,
Thane (West),
Maharashtra- 400604, India

CONTACT US



MS. VANDANA RANDHAWA

Mobile - 7597383993



E - vandana.randhawa@legacylawoffices.com



www.legacylawoffices.com



CEAI Consulting Engineers
Association of India

DL3 CB 244