TCExpresssion

TATA CONSULTING ENGINEERS LIMITED

Volume 58, Issue 1 - September 2020

Reinventing the Next Normal

CONTENTS

EDITOR'S NOTE

Dear Readers,

This edition of TCExpression, Reinventing the Next Normal, explores the transformation of TCE during the COVID Era.

As the world stuggles with the health crisis, we tried to make the most of what we had and continued to serve our customers and deliver projects and timelines while ensuring employee safety & wellbeing.

Wishing our readers a safe, healthy and prosperous Diwali Season.

Happy Reading!
Alpna Singh

REFLECTIONS

I am delighted to launch the issue of TCExpressions during COVID19 times. This edition explores Tata Consulting Engineer's performance during COVID times and highlights the specific steps and measures taken to outperform customer expectations.

Standard Tata Units – a modular engineering solution designed by TCE to quickly scale up hospital facilities is testimony to the capabilities of TCE to innovate in difficult scenarios.

TCE successfully created various "Pride of Nation" projects and played a key role. The customer testimonials centred around our performance during COVID19 will be cherished by all employees.

This edition also shares the vision of our business leaders and aspirations of our employees as well as updates on our Businesses and People and CSR initiatives undertaken during the last six months.

With every challenge comes an opportunity; this is the belief that led us at TCE to try new things and challenge ourselves to perform at our best.

During the pandemic, TCE has exhibited extreme agility and seamlessly moved from working from offices to working from home. The IT team has enhanced the security infrastructure of the company to protect customer data and ensure strict confidentiality.

I am proud to say, that we at TCE have stood by our delivery, hiring and project execution commitments living up to our project standards.

While the world continues to struggle with the pandemic, as the Chairman of the company, I am proud of each of you as employees/stakeholders for taking the adversities in your stride and continuing to perform and meet deadlines.

Hope you enjoy reading this edition.

Ashok Sethi
Chairman, TCE

WINNING TOGETHER

All organisations have processes designed to continually scan the environment to anticipate and deal with changes, both external and internal. Once in a lifetime, though, a Black Swan event occurs, that completely disrupts the fundamentals and shakes the very foundations of such processes.

One such event to hit the world is the COVID19 pandemic. It has been with us for almost a year now, with seven months of lockdown in India, and the world is still reeling under its impact.

For us at TCE, inventing and reinventing ourselves is in our DNA. As engineering consultants, we are always looking for ways to solve issues by creating new solutions or improvising existing ones. When the pandemic hit the world, it triggered this DNA of our company, and we started focusing on how to deliver our projects, serve our customers and simultaneously take care of our employees, in the new environment.

We must remember and remind us that our ability to respond to this crisis was not by chance or sheer luck – we were able to do this because of our strategy and related investments we did in the last few years. Our Rhythm initiative with its focus on digital applications, SAP implementation, adopting Microsoft collaboration tools, retiring old legacy systems, 3D-4D engineering tools, ensuring that all critical processes are entirely digital and online – from proposal to purchase orders to invoicing to hiring, training, reviews etc. I wish to thanks

to each one of you for ensuring sustainability of our business, continuity of our customer projects and being able to perform and deliver on our promises despite the current challenges. We must and consider ourselves extremely fortunate to be able to experience the fruits of our smart work and efforts.

Customer Connect

As the COVID situation worsened, we quickly got together and upgraded our Business Continuity Plan to ensure that we continue to give uninterrupted service to our customers.

We reached out to all our customers, and a series of letters were sent, assuring them of our support.

Excerpt from one such letter, sent in March 2020:
"Our employees at our Delivery Centers are continuing to work on your projects, professionally handling project critical and intellectual property sensitive data and executing project related engineering and design work using advanced

software tools on special high-end hardware desktops and servers. We have enhanced our network security and data protection levels, increased both data storage scope and frequency of project critical data backup, and have taken measures to ensure business continuity. Aligned to our existing work policy, project critical and intellectual property, sensitive activity or work continues to be executed only from within our work premises. We have extensive online communication and collaboration facilities for our employees to communicate with each other and with you and suppliers. We have also communicated to our teams at our customer and project sites to work closely with respective customer anchors and to ensure alignment with prevailing work advisories and local guidelines. We are working tirelessly to help everyone stay safe while at the same time continuing to serve you."

Digitisation

TCE embarked upon its journey towards digitisation of work processes and project deliveries a decade ago. This early start proved to be a boon and allowed us to move to Working from Home quickly.

IT enablement has been done for safe remote working. We have also launched programs to enable online project reviews, including reviews of 3D models, using collaboration tools.

In the engineering consulting space, we were already a leading player working on 3D/4D and other digital tools. We took this a step forward and launched TCE SmartSite™ - an app-based project management tool which makes the site operations paperless to a large extent.

Our Order to Cash process built on SAP continues to deliver results, and for the first time in two decades, we became a debt-free company. Not only is this a remarkable achievement but even more so during such times.

Employee Connect

COVID19 also challenged our employee engagement processes and led us to accelerate our digital employee engagement programs. All our employee processes from recruitment, through induction to training to retirals, are entirely online.

Employee connect, including 2-way communication and group activities, using Teams and Yammer have been increased in both scope and frequency. We have strengthened our online training and learning platforms and programs so that employees keep learning while working remotely. These have included programs to boost mental health.

Industry Charter

We are committed to "Engineering a Better and Sustainable Tomorrow" and have been enhancing our offerings in renewables and sustainable designs. Further, in the years to come, under the Industry Charter created along with TERI and a few other companies, we propose to pursue research and pilot studies jointly in the areas of:

Hydrogen Economy i.e. Study and research on hydrogen based economy with emphasis on green hydrogen production using renewable resources of solar and wind power, biomass, coal bed methane, bio-methane. Use of hydrogen blended with natural gas for energy and heat generation, in Direct Reduction furnace in place of natural gas, in blast furnace for iron making to reduce the use of coal and use of hydrogen fuel cells for energy generation.

Electrification of Everything Ecosystem, or EEE, which includes use of biomass for electricity generation, Microgrids for various campuses like schools, colleges, large housing societies, remote villages and integration of the renewables to national/state grid, Charging infrastructure for BEV and FCEV and integration with renewable power generation, and Manufacture of battery for electric vehicles in India using recycled battery products.

Apart from the above, we are also interested in areas of Bio-based technologies for sustainable generation of chemicals for industrial application and food processing industries, Solid waste collection, handling, management, recycling and waste to energy conversion, Improvement of water distribution networks for reduction of losses using sensors, GIS mapping and host of digital technologies.

Looking back at the last six months, I am proud of how we have evolved to face the challenge and what we have accomplished. TCE is today a more agile and nimbler organisation; ready to bounce back as the situation improves. Our improved processes which have helped future proof the company and will help the company ride through any future challenges.

Author

Amit Sharma - Managing Director
Tata Consulting Engineers Limited (TCE)

STANDARD TATA UNIT

MODULAR HEALTH FACILITY FOR HANDLING COVID19 PATIENTS

To meet the COVID19 challenge requiring urgent strengthening of health infrastructure, Tata Consulting Engineers (TCE) along with its subsidiary Ecofirst designed a 'ready to implement' modular health facility. Each module is equipped with air-conditioning, five beds and one toilet. This ready to use design can be implemented immediately as an extension of an existing hospital or a completely new COVID19 hospital anywhere in India. These modular units put together can expand to any number of beds, are self-sufficient, sustainable, and can be easily repurposed or dismantled in the future.

The design of these modular units incorporates inputs received from medical planners, COVID doctors, virologists, architects, HVAC and ventilation experts. Tata Consulting Engineers shared these designs freely with many implementing or donor agencies for immediate use.

COVID19 (Severe Acute Respiratory Syndrome Coronavirus 2), originated in China, was declared as 'Pandemic' on January 30, 2020, by the World Health Organisation (WHO). The disease, since its first detection in China, has now spread to over 200 countries/territories. As per WHO (as of September 13 2020) the total number of confirmed cases across the world are 2,86,37,952 with total deaths of 9,17,417 people[1].

On January 30, India reported its first case of COVID19 in Kerala, as on September 13, the total cases stood at 48,50,887 with 79,784 deaths[2]. According to the World Health Organisation, India Situation Report 32, India is at the top with maximum number of daily cases of more than 80,000[3].

COVID19 Pandemic has posed unprecedented challenges for families, communities, healthcare systems, government, and organisations in every industry. Although the country is unlocking from the lockdown, the increase in the daily cases is at the peak in India.

As engineers, designers, and consultants, it is our responsibility to flex and evolve, use our expertise to innovate, try new ideas, and collaborate with others to serve communities in such challenging times. Tata Consulting Engineers (TCE) under their Corporate Social Responsibility initiated this design and engineering solution to help government, NGOs and private organisations.

These modular units can be used as:

1. **Quarantine Wards:** where potential positive patients - who may or may not come out as positive after quarantine period - are kept under watch for 14 days. These patients need to be kept separated from each other to avoid the risk of infecting all.

1 https://covid19.who.int/ , Accessed on 14th September 2020
2 https://www.covid19india.org/ , Accessed on 14th September 2020
3 https://www.who.int/docs/default-source/wrindia/situation-report/india-situation-report-32.pdf?sfvrsn=38d85632_2 Accessed on 14th September 2020

2. **Isolation Wards:** All confirmed positive patients who may not require intensive medical attention, but will need regular treatment and care can be kept here.

3. **Intensive Care Units (ICU):** All positive patients, who require ventilator or oxygen support primarily as part of treatment can be stationed here.

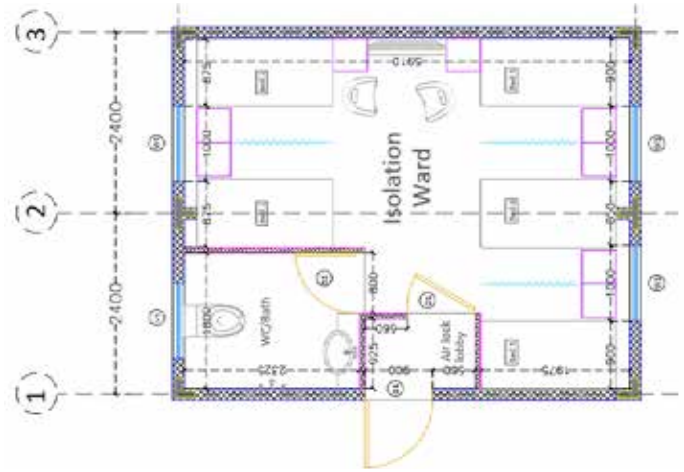
4. **Critical Care Units:** All positive patients with other comorbidities, who may require additional medical care or equipment depending on the individual case can be housed here.

All the above formats have cooling provisions as per human comfort based on climatic conditions, however air handling of different spaces have been designed very carefully to ensure that virus spread from patients under treatment can be contained.

While working on the design solution following essential COVID19 related aspects were considered:

- Modularity of the solution as per available space, size, requirements
- Scalability of the solution depending on need
- Speed and ease of construction/erection
- Weight and robustness of the unit
- Minimal need for specialised/technical labour on site
- Sustainability with the low carbon footprint
- Availability of the material with an alternate supply line
- Post-COVID usability of the unit

The design was envisaged to create the smallest unit which is flexible, modular, prefabricated, ensures rapid deployment, mass manufacturing, minimal site efforts, and scalable solution for creating smaller units that can be erected at places such as Railway Yards, Hospital Vicinity – Parking Lot, Shopping Mall, Residential Colonies, Slums, etc. The material of the unit was designed to be lightweight with high strength to weight ratio and is more comfortable and cheaper to transport. Cost-effectiveness was also an important criterion to make it reach maximum number of people in the country.



Standard Tata Unit

A 30 Sqm. unit known as 'Standard Tata Unit' (STU) accommodates five beds along with one washroom. The design of the unit is such that it can be altered responding to the varying site conditions and end requirements. The same modular unit can be tweaked to be used as separate units/modules as Isolation Wards, Quarantine Wards, and ICUs. These modules can be clustered together to work as full-fledged makeshift medical facilities during the situation of shortage of healthcare facilities. Various construction technologies as well as materials were explored to best suit the unit such that it is easy to transport, zero wet construction, and installation can be done within a day with the help of less-skilled labour.

To enusre that the design delivers the envisaged solution, various industry experts were consulted like Tata Steel design team was consulted on design aspects, Tata Trusts Medical planners as well as Senior Doctors appointed as COVID19 experts by the government were consulted to ensure that the design meets medical requirements. The innovative design of HVAC was finalised in consultation with Voltas.

Final Design Recommendation

- A 16 ft Length x 20 ft Width x 8.5 ft Height unit with a capacity of 5 beds and one common washroom.
- Thermally insulated pre-installed doors and windows.
- Anti-skid flooring.
- The additional facility of Air-lock Lobby at the entrance of the unit.
- Maintain Negative Pressure inside the Isolation ward.
- Maintain an internal ambient temperature of 27-28 degrees.
- Treat extracted air with high temperature and UV to destroy COVID19 virus.

Some Examples of Use

The costing of the STU Isolation Ward has been kept in the range of 12 to 18 lacs depending on various modules, utility, and end requirements, so that it is cost-effective and can be installed in different parts of the country.

The design of STU Isolation and Quarantine wards aims to meet the immediate emergency requirements of various levels of health facilities across cities in the short term and improve the efficiency of existing healthcare infrastructure in long term. Though the STU has been tailored for pandemic use, however, the modularity of designs helps in flexibility to use at any point in time, even after a pandemic. It can be quickly deployed in various cities of the country promptly responding to treat and contain COVID19. Each unit works autonomously and can be expanded to create multiple modular configurations forming larger facilities. The STU is conceived as a ready-to-use solution adapting to the needs and capacity of local healthcare infrastructure.

Authors

Chitranjan Kaushik - Chief Operating Officer
Ecofirst

Aishwarya Agarwal - Senior Architect
Ecofirst

NAVIGATING CORONA CRISIS

Before declaring it as a pandemic on 11 February 2020, the World Health Organization (WHO) had forewarned on 23 January 2020 that COVID19 was much more than just a common cold. Soon enough, the virus turned into a global crisis and has become the challenge of our lifetime, with the world changing dramatically in countering its unprecedented speed, disruption, severity, global scale, and increased risks. It has created a universal agenda for governments to take urgent and proactive measures to protect its communities and economies with public health initiatives and economic stimuli.

Organisations, on the other hand, are busy charting the right course of action in stabilising the business in the near term by responding to changing customer demands and human behaviours or safeguarding and building a future that would be resilient to such black swan events. The need to respond is not expected to end even when the virus' immediate threat, sooner or later, recedes.

With a definite goal to "flatten the curve", we have been jolted with large-scale quarantines, physical distancing, border closings, school and industry closings. Several sectors have been hard hit because of collapse in demand, a second wave of the pandemic and sagging Q2 financial results. Many enterprises have stopped production lines, suspended supply chains, thereby forcing large scale lay-offs. We have seen high volatility in financial markets, an alarming increase in non-performing assets and increasing credit spread in debt markets.

With a general slowdown striking multiple industries, the challenges are multifarious. While revenues of some companies have shrunk by over 75% in a single quarter, we have witnessed a major shift in some business parameters:

- Cash is not just king but extremely critical for survival
- Digital connectivity is now fundamental to business continuity
- Remote working has become the norm and
- Frequent communication with colleagues and investors is imperative for greater transparency

Amidst this uncertainties, robust management, steady and strategic leadership from the finance organisation is critical to address concerns, reduce some of the fears and uncertainty, accelerate action to stabilise the business, protect customers, guide employees, support suppliers and steady financial results, thus positioning the company to thrive when conditions improve.

TCE's Response

This crisis has proved to be an unparalleled catalyst for our employees and partners, to make significant improvements. With no playbook to read from and no multi-variable scenarios to act as precedents, it was time for the TCE leadership to get back to basics and create our playbook using principles of Value-Based Management (VBM). The CFO's organisation is collaborating with the Board, MD and other business leaders to put TCE on a sound financial footing.

TCE's leadership swiftly carved out the following actions:

1. Address our immediate need for liquidity by building a cash-chest
    - Used the "finance lens" to make a clinical journey down the income statement and balance sheet. We realised that an in-depth diagnostic was necessary for the areas of:
        - Revenue, variable costs, semi-fixed costs, interest, taxes and dividends
        - Cash, receivables, payables, non-critical CAPEX and debt
        - Re-evaluating investments to strengthen the balance sheet
        - Choosing higher-yielding projects or most valuable initiatives to shift financial and human resources quickly
    - Introducing financial risk management to a broader audience
    - Turbocharging our management information systems
2. Stitch together a range of scenarios and pursue the one that suits best
    - In line with what marquee consulting firms have been advising, TCE leaders developed three to four integrated scenarios encompassing multiple outcomes with clear trigger points to suggest what financial actions the business will take and when.
3. Stay true to the organisation's core values, vision and mission
    - For a company that believes that its employees are its greatest assets, the customer is the king and partners (vendors, consultants and joint-ventures) are its strength; a knee-jerk reaction was the last thing that TCE would choose to follow. It was time to walk the talk, show our character and not abandon our core values.
4. Leverage core competency and steady the ship at a time when leaders cannot control everything
    - Our competencies and solid analytical framework of project evaluation, value creation and the ability to respond to changing circumstances have been put to the test much more than ever before. So, it was imperative to pay even closer attention to the impact of our decisions on stakeholders, core TCE's values and vision.
5. Rejig the portfolio through strategic planning and M&A
    - As in the military, it was necessary to have a plan-ahead cross-functional team to evolve immediate and long-range strategies;
    - Cultivate extraordinary partnerships so that when others in the ecosystem fail to move fast, we work with partners in new ways, with agility and speed for us to achieve high impact; and
    - During the downturn, pursue small, core business partnership bets that can make meaningful contributions to Total Shareholder Returns (TSR).
6. Focussed and frequent stakeholder communication
    - Upping the rhythm of interactions, transparent communication with colleagues and investors has only ramped up in importance as business conditions, forecasts, and rules of conduct change frequently. For example, implementing a "cash culture" for preserving cash and deploying it vigorously requires organisation-wide communication to understand "why this matters now" and what everyone's specific role is in helping optimise cash.

- It is equally critical, particularly when new information is available about knowns and unknowns, to message proactively with the board, its committees and investors with a focus on actual and projected effects on the company, liquidity situation, actions taken to protect the business, and changes to earlier assurances based on their best understanding of the situation. Net-net, it is essential to demonstrate that leaders are taking fast and resolute action.

- Equally important is a clear plan with the CEO on the cadence of communications with customers, partners, government and industry bodies, so it helps keep stakeholders motivated, decreases distraction, and ease misgivings.

7. Productivity improvement through digitisation, an Achilles' heel for many organisations

    - Accelerate and enable business-critical digital technology, provide agility with enough bandwidth, collaboration tools, remote capability, real-time visibility and business continuity without getting trapped in pilots and experiments. This is a lesson that some companies are learning right now at a very high cost.

8. Prepare for the new normal through reform and reimagination

    - Leadership, with oversight and support of the board, will bring together an ace group of employees to pursue bold and innovative opportunities, productivity initiatives or portfolio shifts that assist customers.

    - Nurture our employees during the disruption by displaying a softer side of personal leadership, passion and empathy during remote work.

    - Reallocate resources with a transformation mindset and enable multiple agile teams with the right structure, process and culture to deliver high value to stakeholders.

    - Evaluate compensation structures across the enterprise

    - Flatten the pyramid, so there are fewer middle managers, rigid hierarchies, approvals, unproductive meetings, thereby leading to less bureaucratic entities, leaner enterprise and more doers with dynamic teams.

20 POINT RESPONSE:

NOT BOWING TO "END-OF-THE-WORLD IS HERE" THINKING

1. Prudent cash management – conserve cash and invest free cash, if any, in short-term, liquid securities;
2. Receivables and payables management - Vigorously pursuing aged debts, tax litigation and interest on tax refunds; Vendors agreed to small deferment of payables;
3. Debt management: Negotiated a marked reduction in bank interest rates and fees;
4. Early realisation of export income such as transferable scrips under Software Export Scheme;
5. Frequent customer interaction and responsiveness;
6. Industry reach/participation in webinars, hosting discussions and national committees;
7. Increased focus on international acquisition, T&M opportunities and new services;
8. Frugality in our expenses and realising every opportunity to save (rent, travel, AMCs, etc.);
9. Honoured every new job offer and did not resort to lay-offs; Compensation structure reviewed for all employees, with no reduction in CTC;
10. More frequent interaction with the Board; Received course correction and other inputs;
11. Employee health, wellness and medical insurance, employee and societal connects;
12. Recast the management team to focus on strategic planning;
13. Instituted strategy team to identify M&A opportunities and new business partnerships;
14. Enhanced digital experience: Leveraged investment in ERP and enhanced project monitoring tools;
15. Innovation and idea boards; Participation in quality improvement programs;
16. Focus on utilisation and productivity of employees and consultants;
17. Wherever possible, project deployment of TCE talent against outsourced resources;
18. Restricted CAPEX allocation to most desirable projects in technology and business integration;
19. Training for floating talent pool; Re-kindled digital learning content for anywhere access; and
20. Strengthen project bid-risk management; Review legal, force majeure and commercial clauses in the agreements.

Conclusion

In the coming days, weeks, and months, as employees are struggling with anxiety about their health, their future, and their loved ones, corporate leadership must not only demonstrate empathy, character, pragmatism, embrace analytically sound decision-making and protect company values, but also bounded optimism that the organisation and its people will find a way through the crisis.

No one knows how long the pandemic will last, but in time, business and daily life will find a new equilibrium. Finance leaders are key to ensuring that their organisations not only set up nerve centres that serve as decision cockpits but also take the reins and guide their ships to calmer waters, so the enterprise thrives in the next normal.

Author

Gurunandan Molahalliker - CFO
Tata Consulting Engineers Limited (TCE)

ECONOMIC GROWTH OUTLOOK

Economic forecasts have been revised multiple times downwards in the last few months. The situation remains highly uncertain and continues to evolve across most countries. With characteristics of the virus and infection not fully understood, the number of cases & fatalities in many large countries are continuing to increase. Some countries even face the risk of a second wave of infection after easing of restrictions and a safe & effective vaccine still turning out to be elusive. Hence, Gross Domestic Product (GDP) growth forecasts, by almost all economic agencies, remain largely negative. In addition, there is a higher-than-usual degree of uncertainty around these forecasts.

The consensus view is that global economies are experiencing the deepest recession since the Great Depression of the 1930s. As per forecasts released by major international agencies, the median GDP forecast for 2020 is in the range of -5%, highlighting a much sharper contraction as compared to previous forecasts, e.g. -3% (IMF) and 2.5% (World Bank).

Some key highlights based on forecast reports of these agencies are:

- Forecasts for 2020 for almost all countries have been cut down, with sharp cuts in France, Italy, Spain, UK, US, India, Brazil, Mexico, Saudi Arabia, Nigeria and South Africa.
- Advanced economies are projected to shrink by 8% in 2020, while EMDE (Emerging Markets & Developing Economies) are expected to contract by 3%.

Source	2019	2020 (f)	2021 (f)
IMF	2.9	-4.9 (Apr forecast was -3.0)	5.4 (Apr forecast was 5.8)
World Bank	2.4	-5.2 (Jan forecast was 2.5)	4.2 (Jan forecast was 2.6)
Fitch Ratings	2.7	-4.6	4.9
OECD	2.7	-6.0* -7.6#	5.2* 2.8#

Forecast Reports, June'20
* Single-hit scenario – second outbreak is avoided
# Double-hit scenario – second outbreak occurs towards the end of 2020

India Outlook

India Growth in Q1 FY'21 reached at a historic low - clearly establishing that India is amidst a crisis, coupled with a recovery that is unlikely in next few months. Indian economy is projected to see a GDP contraction of approx. 5% in FY '21.

India Real GDP %			
Source	2019	2020 (f)	2021 (f)
IMF June 2020	4.2	-4.5 (Apr forecast was 1.9)	6.0 (Apr forecast was 7.4)
World Bank	4.2	3.2 (Jan forecast was 5.8)	3.1 (Jan forecast was 6.1)
Fitch Ratings	4.2	-5.0	8.0
OECD	4.2	-3.7* -7.3#	7.9* 8.1#
Forecast Reports, June'20 * Single-hit scenario – second outbreak is avoided # Double-hit scenario – second outbreak occurs towards the end of 2020			

GVA at Basic Price by Economic Activity (%)					
Sectors	FY 20				FY 21
	Q1	Q2	Q3	Q4	Q1
Agriculture	3.0	3.5	3.6	5.9	3.4
Industry	4.2	0.5	-0.3	-0.6	-38.1
Mining & quarrying	4.7	-1.1	2.2	5.2	-23.3
Manufacturing	3.0	-0.6	-0.8	-1.4	-39.3
Electricity, gas, water supply & other utility services	8.8	3.9	-0.7	4.5	-7.0
Construction	5.2	2.6	0.0	2.2	-50.3
Services	5.5	6.5	5.7	4.4	-20.6
Trade, hotesl, transport, communication & services related to broadcasting	3.5	4.1	4.3	2.6	-47.0
Financial, real estate & professional service	6.0	6.0	3.3	2.4	-5.3
Public administration, defence and other services	7.7	10.9	10.9	10.1	-10.3
Total GVA at Basic Price	4.8	4.3	3.5	3.0	-22.8
GDP	5.2	4.4	4.1	1.1	-21.0

Source: NSO, SBI Research

From the table above:

- Real GDP growth was -23.9% in Q1 FY21 versus 5.2% in Q1 FY '20 (Min. of Statistics and Program Implementation MoSPI, 31Aug '20).
- Core Gross Value Added (GVA) growth (excluding agri & govt. sector) was -29.6 % in Q1FY21 against -22.8% growth for overall GVA. (CARE Ratings, 31Aug'20)
- Construction, Services and Industry (Mining & Manufacturing) are Sectors with a maximum hit in Q1 '21.
- India's Q1 FY '21 trough is deepest amongst peers - One of the most stringent lockdowns enforced by India in the early days of infections to achieve flattening of the curve. Large and increasing no. of reported cases continues to put a serious challenge to achieving growth.

However, with Q1 growth numbers turning out to be worse than expected, the annual forecasts are now getting revised further downwards – in some cases touching -10%. What is worrying is the continued rise in Covid-19 cases (and the recent rapid spread to rural areas), which is hindering a revival in economic activity even in Q2 (and later).

- SBI research (Sept 2020) has revised the FY21 GDP forecast to -10.9% (prev. estimate: -6.8%)
- CARE Ratings projects India GDP to contract by around 6.4-6.5% in FY21 (Aug 31, 2020 report); while ICRA forecast of India GDP growth is -9.5% (CARE Ratings, Aug 2020).

India - Forecast Summary					
FY Strating April	Ann Avg 2015-19	FY 19-20	FY 20-21F	FY 21-22F	FY 22-23F
GDP	6.7	4.2	-5.0	8.0	5.5
Consumer Spending	7.1	5.3	-8.3	9.9	5.4
Fixed Investment	5.9	-2.8	-12.4	8.8	6.5
Net Trade (contribution pp)	-0.3	0.9	-0.5	-0.5	0.1
CPI inflation (end-cal year)	4.7	7.4	3.1	2.7	3.4
Policy Interest Rate (end-cal year)	6.83	5.15	3.5	3.75	4.50
Exchange Rate USD/INR (end cal year)	65.18	76.00	76.00	74.00	73.00

Source: Fitch Rating

- Fitch Ratings has forecast GDP contraction of -5% on account of a sharp decline in both the significant drivers of growth - consumption spending (-8.3%) and Fixed Investment (-12.4%).
- RBI has released and broadly accepted the recommendations by the KV Kamath committee on restructuring loans for borrowers from sectors hit hard by the coronavirus pandemic. The report listed specific financial parameters for 26 sectors, including auto, aviation, construction, hospitality, power, real estate and tourism, among others.

Opportunities in Key Sectors

As per the Mckinsey report of August 2020,

- Manufacturing and Construction sectors could contribute to the highest increase in sector GDP growth relative to the past. Manufacturing has the potential to rise by about 7.5% per year, contributing more than one-fifth of the incremental GDP. Construction could contribute to 25% of the incremental gross jobs.
- Global trends such as digitisation and automation, shifting supply chains, urbanisation, and a greater focus on sustainability, health, and safety are accelerating or assuming a new significance in the wake of the pandemic. For India, these trends could manifest as three growth boosters that become the hallmarks of the post-pandemic economy:
    - **Growth booster 1:** Global hubs serving India and the world
    - **Growth booster 2:** Efficiency engines for India's competitiveness
    - **Growth booster 3:** New ways of living and working
- India would need to raise its competitiveness in high-potential sectors like electronics and capital goods, chemicals, textiles and apparel, auto and auto components, pharmaceuticals and medical devices, which contributed to about 56% of global trade in 2018.
- Other opportunities exist in efficient mining and mineral sufficiency; high–efficiency power distribution, which could reduce power tariffs to commercial and industrial customers by 20-25 %
- Automation of work and Industry 4.0 could bring greater efficiency; for example, about 60% of manufacturing-sector output could leverage predictive maintenance, smart safety management, and product design.
- India could more than triple its renewable energy capacity, from 87 GW to 375 GW, and increase the share of wind and solar energy in power generation from about 7 % to best-in-class 30 %.
- A large number of affordable-housing contracts could enable modern construction methods that can increase productivity and reduce costs.
- Various reform measures could help reduce Commercial and Industrial (C&I) power tariffs by 20-25%. These include a shift to franchising models or privatisation of power distribution companies in the top 100 cities; the introduction of cost-reflective tariffs for C&I customers and direct-benefit transfers for subsidies; and a focus on smart-meter penetration.

Infrastructure

- National Infrastructure Pipeline has proposed that Rs.102 lakh crore would be invested on key infrastructure sectors over the next 5 years.
- Union Budget 2020-21 - Government gave a massive push to the infrastructure sector by hiking the Capex budget by 18.1% to Rs.4.1 lakh crore.
- The fiscal stimulus of Rs.20L crore under 'Atma Nirbhar Bharat Abhiyan' announced by Govt. would provide support in addition to higher allocations in Union Budget for Infrastructure sectors.

Chemicals

Covid-19 crisis presents an excellent opportunity to the Chemical and Pharmaceutical Industry of India.

- In the Chemicals sector, two areas of potential opportunity for India in this sector are:
    - Ramping up exports in select areas, such as speciality chemicals.
    - Building self-sufficiency in petrochemicals to plug the domestic supply shortfall of 52% (by volume) in petrochemical intermediates:
- Pharmaceuticals - Indian pharmaceutical industry aspires to become the world's largest supplier of drugs by 2030. India aims to increase its industry revenue to $120 billion by 2030 from current revenue of $38 billion at a compound annual growth rate (CAGR) of 11-12%.

Author

Rajeev Tanna - Chief Risk Officer
Tata Consulting Engineers Limited (TCE)

The COVID19 pandemic hit the globe quite-hard in both social and business terms. From a business perspective, it required many changes – from the products and services offered to how employees work. The crisis forced companies to close their offices and enable employees to work remotely quickly.

The rush to remote working resulted in multiple challenges for organisations. Given the nature of modern business, most changes had an impact on the IT infrastructure, including operations and support.

IT ENABLED REMOTE WORKING

How Prepared are you?

Converting an entire organisation to a virtual workforce overnight is a herculean task for any IT team. Technology savvy businesses accomplished this relatively painlessly, while the unprepared ones, were left scrambling to catch up quickly.

Right IT infrastructure to allow secure access to the services and information needed to support remote workers is very critical. Thanks to evolving technologies, most employees were already well-versed with the use of email and other collaboration tools to communicate with colleagues and business associates across the world. Many companies were already using virtual collaboration tools like MS Teams, Skype for Business, Zoom, Google Meet, M365, G Suite and other Cloud Computing solutions. However, the necessary IT infrastructure is key to a successful transition, and many fell short in this area.

The three main enablers for remote working are IT Infrastructure at Workplace (or cloud), employee's computing infrastructure at home, and the internet services which connects the employees to their business systems and data. These three together ensure reliability, availability, security, and scalability.

IT Infrastructure @ Work

Work-from-home is the new norm for now. For many organisations, remote working is here to stay even post COVID19. While organisations initially had to clamber to get the workforce up and running, the focus now is shifting to maximisation. Optimising the existing investments and investing in new technology can provide a seamless, secure, and productive experience to employees, regardless of their location.

For organisations that are already on cloud solutions (or are willing to embrace it) for their business, the transition to the current new norm of remote working is smooth. IT teams can ramp-up or scale down the infrastructure resources as per the requirement of the organisation from time to time. Cloud Infrastructure allows organisations to expand horizontally with minimal initial investments. Security envelopes like VPN, MFA, OAuth and like are already available on the cloud from IT security leaders.

Organisations with lighter workloads (Email, Office, Collaboration, etc.) can migrate their Desktop Computers to Virtual Desktop Infrastructure on the cloud and enable remote connectivity. Employees can work on these cloud computers from personal devices

or Thin /Zero clients over a secured network at the comfort of being at home.

Cloud providers like Google, Amazon, Microsoft, VMware, Citrix offer VDI solutions for graphic intensive and compute-intensive heavy workloads. Before making any investments, these solutions need to be tested thoroughly for compatibility, operability, and performance of the envisaged applications.

Many organisations are unwilling to explore cloud solutions at this moment. Legal binding, applications or data that are not cloud-agnostic, security, etc. are few among the extensive list of roadblocks on their cloud journey. An organisation that is on the traditional path may still stay with on-premises solutions while optimising it for the remote workforce. VDI leaders like Citrix, VMware provide on-premises VDI Solutions, to virtualise an organisation's end-user computing for both generic and heavy workloads. This transition from work-place computer to virtualise-computing enhances data security, availability, resource optimisation, power optimisation, easy deployment, better manageability and even physical security. Employees may use Thin/ Zero client or personal computers to connect to these desktop instances in company VDI infrastructure. Migrating to the cloud in future or storing a backup on the cloud, can quickly be attained through this infrastructure. Organisations need to keep in mind that this solution involves massive initial investment for servers, storage, network, and backup viz-a-vis the cloud alternatives.

The primary enterprise security building blocks like DLP, IPS, Firewall, Web Security, Mail Security, WAFS, etc., and other Network Devices, continue to remain. The throughput, capacity, and user licensing of these equipment's need to be revisited and optimised to accommodate more and more users connecting to the business applications (and data) from off-net rather than the local area network (LAN).

An organisation needs to ensure higher, reliable, and redundant internet connectivity to its Datacentres to cater to the bandwidth requirement of the remote users connecting to the Enterprise network.

IT Infrastructure @ Home

Each employee must have access to the technology they need at home, including but not limited to necessary hardware and software best suited for their work profile and a dedicated space to work.

Employees need Collaboration Software, Camera, Head Set, and Mobile Communication Devices. Internet connectivity becomes even more critical for remote working. Dedicated wired internet connectivity will ensure continuous access to your files and applications on the corporate network. Though not reliable, mobile internet can be a backup.

- While interacting with colleagues and other business partners encourage face-to-face interaction over video conferencing or collaboration tools.
- Ensure Safety, ergonomics, security and set expectations that workspace disruptions and background noise cannot interfere with customer experience
- The remote task force needs to take measures to ensure the availability of reliable power input to the above devices using UPS, Inverter, and other power backup solutions to ensure productivity.
- AI-powered virtual assistants like Alexa, Google Home, Apple HomePod should be turned off or stored outside of a dedicated workspace to protect data.

Access controls must be in place to manage each employee's access to the systems needed for their roles. Remote worker's access to office networks, applications, and data should always be on a secured channel. MFA (multi-factor authentication) for critical systems and information access must be implemented.

Authors:

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Tata Consulting Engineers (TCE)

Rajender Singh Negi, Senior Manager - IT
Tata Consulting Engineers (TCE)

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Business Excellence continuously looks at opportunities for improvement and identifies the transformation levers to help a company evolve. Improvement initiatives and transformation programs help implement these initiatives. The ingenuities can be strategic or operational in nature; can involve incremental or breakthrough improvements; can involve changing processes, people mindsets and more; all to embed excellence in everything.

BUSINESS EXCELLENCE DURING COVID19

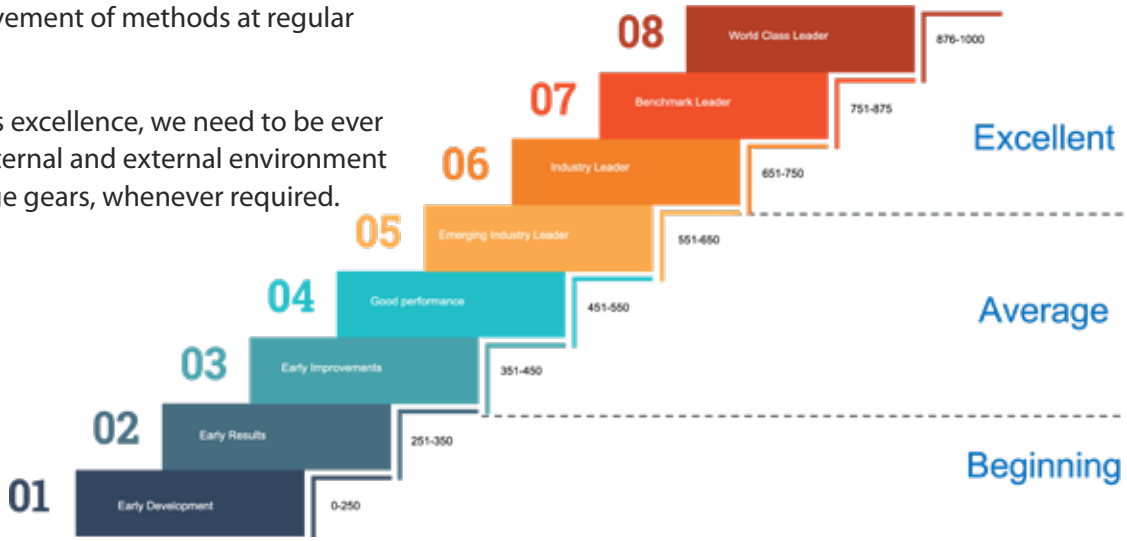
As a Tata Company, we follow a structured process called the Tata Business Excellence Model (TBEM), which is a clone of the Malcolm Baldrige National Quality Award Model.

TBEM is a non-prescriptive model that encourages companies to be process-oriented; the underlying belief being that sound processes will result in desired outcomes. However, TBEM does not advocate rigid processes; on the contrary, it encourages fact-based evaluation and improvement of methods at regular intervals.

In the journey towards excellence, we need to be ever vigilant of both the internal and external environment and be ready to change gears, whenever required.

One such overbearing change that has occurred in recent times is undoubtedly the COVID19 outbreak.

The pandemic gave companies hardly any time to prepare. It has thus checked the resilience and agility of organisations and their ability to change and adapt. TCE's swift response has once again justified the trust bestowed upon us by our Clients, over the last 58 years.



TCE Response

The first thing we did, in mid-March 2020 was to look at our Business Continuity Plan and strengthen it to cope with the unprecedented scale of events. An Executive Management Team, chaired by the MD, was put in place with both members and alternate members. This team prepared a COVID specific Business Continuity Plan (BCP) with a detailed risk analysis and guidelines for all functions – HR, Admin, IT, Legal and Operations.

The Executive Management Team started virtual meetings every morning, which cascaded to the level of Project Managers. Detailed guidelines were issued to protect employees.

1. How to prevent infection
2. Work from home guidelines
3. COVID 19 HR flows and contacts
4. Stay Safe lockdown guidelines

We quickly rolled out procedures to enable Work from Home and facilitate employees with necessary hardware and software. We also organised training programmes on collaborative tools to encourage virtual project reviews as well as protocols to be followed for audio and video meetings, while simultaneously strengthening our network security.

At the same time, we also prepared SOPs to facilitate the safe reopening of both Offices and Sites, including touch-free construction supervision. We also launched a series of communication campaigns for employees to share and learn from each other's lockdown experience, we asked:

1. What have you done differently to be able to work efficiently and effectively from home?
2. What has your Business Unit / Team done differently to ensure productivity and quality while working from home?
3. How do you think we need to change to become an industry benchmark in the current situation?

Employees were encouraged to upload their answers on our internal blog site iThink. It was heartening to see an overwhelming response which was finally shared with the Functional Heads to strengthen the Work From Home (WFH) processes.

Over time, we also realised that our measurements needed tweaking as well. In addition to the standard measures, we needed some new ones. The idea was not only to survive the trying times but to spring back, as soon as the times improved. The lockdown coincided with the financial year. The new Balanced Score Card for Financial Year 2021 is thus a mix of both old and new KPIs.

As we move into the 6th month of the lockdown, we continue to refresh our ways of working and reinvent ourselves in the true spirit of Business Excellence.

Business Excellence Recognition

Companies that cross the 550-point mark in the Tata Business Excellence Model (TBEM) Assessment are recognised as Emerging Industry Leaders. TCE crossed this milestone in last year's TBEM assessment and was recognised with a plaque on 29th July 2020 at the first-ever virtual JRDQV Function on JRD Tata's 116th birth anniversary.

Author

Aditya Kumar Mishra - Head BE
Tata Consulting Engineers Limited (TCE)

SELECT CLIENT TESTIMONIALS

It's been more than a year, TCE got associated in this project and have made tremendous efforts in conceptualising the project. We would like to thank each one of you and your team members for your relentless support and dedication which facilitated us in submitting this very complicated Multi-Utility (First of its kind) bid on time with the highest quality. Despite these tough pandemic (COVID) times, TCE's team efforts to conclude this bid is commendable. Hoping to continue our association into the next phase

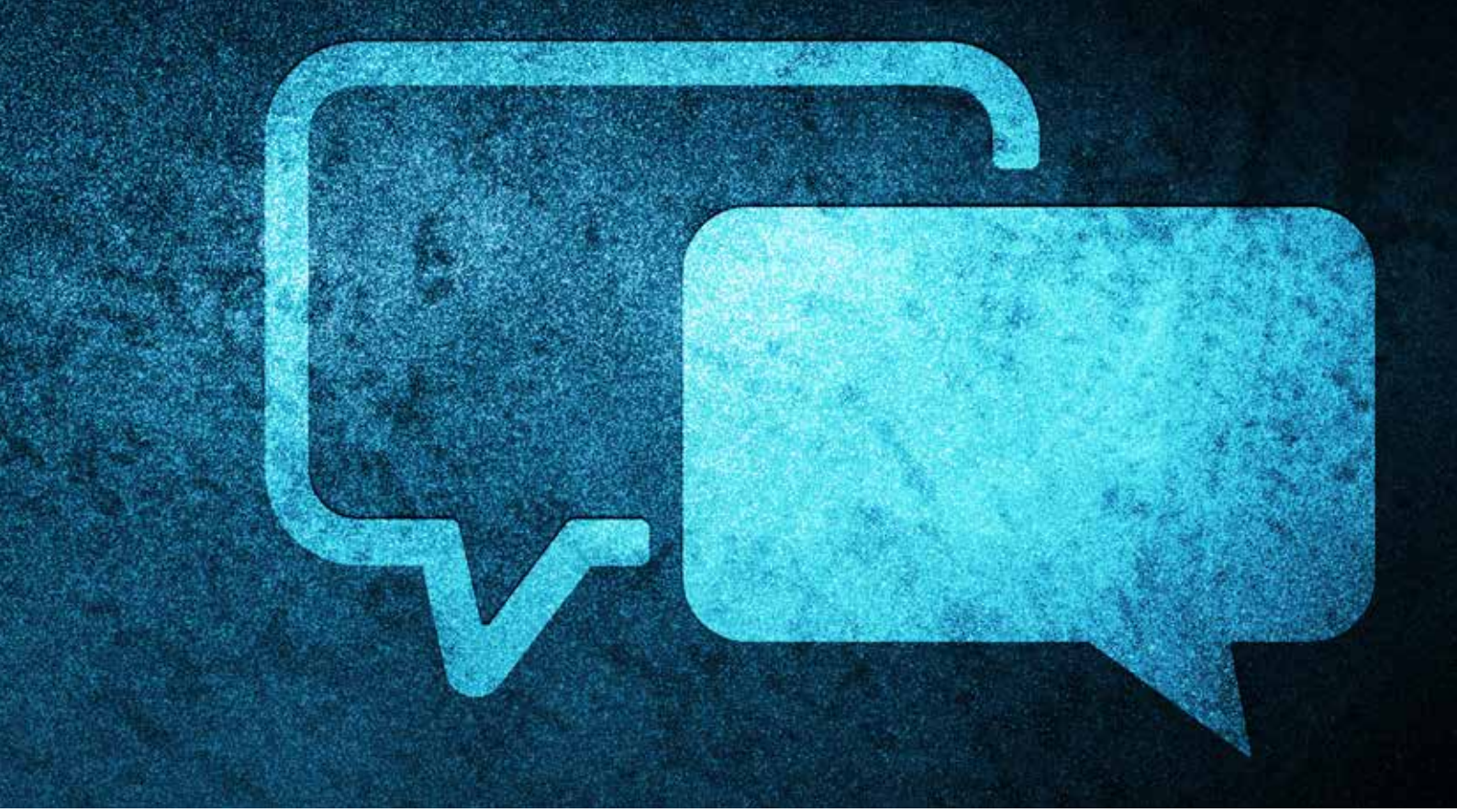
We are a leading industrial and logistics park developer and are working on various projects in India. TCE team is working with us as engineering consultant on all our projects on PAN India basis.A Cost effective and innovative solutions are their strengths which in a way helped us for growth of our business. I also appreciate the efforts put by TCE team on our projects, during pandemic situation like COVID-19 to have minimum impact on our business. I wish TCE team all the best and thank them for their continued support.

We, first of all, are very pleased to give our humble feedback on the TCE-DET's current Work from Home as well as appreciate such supreme and continuing cooperation of TCE in 2020...

... TCE-DET's collaboration after the initiation of Work from Home has not been hampered at all and has been even better in some aspects thanks to Well-set Remote Communication Procedure and Well-trained TCE-DET's engineers...

We hope both parties further cooperate and give efforts to achieve best outcome ever for the rest of the year.

TCE team is working with us as engineering consultant on our logistics park projects on PAN India basis. They are like our partners in our projects. We have established good synergies between our team. Prompt response, flexible approach, involvement of senior management to resolve critical issues, ethical approach, cost effective solutions are some of key parameter on which I would like to give high rating to TCE team. I also appreciate the efforts put by TCE team on our projects, during pandemic situation like COVID-19 to have minimum impact on our business.



The TCE team has demonstrated exemplary patience and professionalism in supporting us and our customers, despite all the constraints, in these challenging times.

We are proud of the team and the support provided by the TCE management. While the challenges mentioned have not gone away, I am quite certain that, we will be able to weather the storm together and emerge stronger, continuing to build on this long-standing partnership.

We appreciate the strong contribution of very good and timely work done by the whole team of Tata Consulting Engineers Ltd assigned for our Indonesian project site. Since COVID 19 spreads, though remote work by Tata team has continued, their performance level is very high even done remotely !!! Further, we very much appreciate decision by Tata Consulting Engineers Ltd that whole team will be remobilised to our site to support works at site under the condition of COVID19. The Tata team has been very dedicated, customer centric and proactive throughout the engagement.

Over recent years, Tata Consulting Engineers (TCE) have come to be a key support service to us and it's integrated asset management approach.

In particular their Professional engineering support services, provided both locally at Port Talbot and offshore from the Kolkata office are both exemplary and expedient.

We would like to appreciate the efforts put by TCE during this difficult time of COVID-19. We would like to thank TCE for their continuous effort without losing efficiency in the support provided through a contract withus. The transition from normal working activity to teleworking during COVID-19 was very seamless and very fast, since the beginning of March 2020, that we did not even realize any disruption in the production of the deliverables. I confirm that the TCE sensitivity to the client-satisfaction is exemplar.

EFFECTIVE COMMUNICATION - KEY TO SUSTAIN THE "NEW NORMAL"

COVID19 brought about many changes globally. Countries around the world took decisions like lockdown, forcing many organisations to look for alternate ways of keeping up the momentum in the business. Companies moved away from the conventional method of working and adopted new ways of working to sustain and move forward.

The initial phase of lockdown involved many dynamics in preparing to work from home. This preparedness was necessary both mentally and physically, especially when it came to the very nature of the business of our consulting organisation. The decade long digitalisation efforts of our company helped us seamlessly sail through this phase.

So, what exactly is the New Normal?

Work from home (WFH), coordinating the complete work using all the available communication tools such as Microsoft Teams, Skype, Microsoft Outlook, WhatsApp, telephonic calls and virtual meetings for discussions is the "New Normal" or the "New way of working". While the new way of working has brought many challenges, we also see several opportunities in value addition-both internal and external, if it is implemented in a well-structured or organised way.

One key attribute that needs most attention during this phase of delivery is effective communication. While the importance of effective communication is well known and practised over the years in ensuring smooth execution of the projects; with the new norm, it has become even more critical. If we have already established ourselves in managing the art of effective communication, we are in the game! If not, we may have to review this attribute carefully and start practising it straightaway. Failure to specialise this art may lead to a roller coaster ride!!

Considering that most of us are involved in a single or multiple projects either working as a team member, specialist engineer, a team lead or a project manager, we need to ask ourselves the following questions -

1. Are all the team members of the project clear regarding the objectives of the project?
2. Are the team members reflecting those objectives in day to day activities?
3. Do we have repeated concerns from the customer on day-to-day activities? How well have we kept our customers informed on our actions?
4. How efficient are we in executing the project?
5. During the team meetings, is it one-way or a two-way communication?

The above questions are typical in nature and can be extended as a long list of questionnaires. Reviewing the above questions would help in consolidating the status of the communication strength of the project team.

On many occasions, I have encountered a situation where-in the project team is confident that they have followed the communication protocols judiciously- they had kept informed both- internal and customers about the updates periodically and they had been maintaining a communication rigour all thru the project cycle but, still there is a lack of clarity from both the sides. This situation at some stage of the project execution can lead to a significant setback. It can be inferred in such conditions that probably the communication is not closed from both sides. During the project initiation phase, an essential communication protocol is set up that provides information about the list of personnel to be notified depending on the focus area (such as project management/technical/administrative/finance/procurement etc.).

Following are some of the primary communication guidelines for different modes of communication, consolidated based on the current & prior project

execution experience. These guidelines if exercised effectively, can bridge a common understanding across several stakeholders and also the team members within the project team-

Email Communication:

- The subject line of the email communication should be in-line with the content of the email
- Content of email should be crisp and clear. If the content of the email is large, it is better to break it up point-wise to help the recipient to absorb the contents easily
- While we review and send our comments/ observations on any attachments, it is essential that we also bring out specific key critical observations in the covering email that needs immediate attention. This will ensure in "keeping the customers informed of critical issues."
- While we provide our comments or bring out any significant differences/inconsistencies from our reviews, the customer will always look forward to any quick recommendations to resolve these inconsistencies. Providing a quick solution will always help in gaining customer's confidence and further leads to customer satisfaction. Hence, we need to go with a solution mindset. It is not necessary that all the issues will be resolved over email communication. But wherever possible, it is recommended
- All email received from the customer/key stakeholders should be acknowledged on the same day of receipt of the email. An email duly acknowledged itself earns more than 50% of customer satisfaction
- Based on the criticality/urgency, the reply time can vary between 1 hour from the receipt of the email to 6-7 hours on the same day. This is a very important step that confirms "We have understood your requirements". Also, it ensures that the communication loop closed
- When the requirements are not clear, it is essential that we get back to the customer immediately seeking more clarification. This is critical because there is a high possibility for potential loss of time if we delay this action.
- If there is a valid reason that one cannot reply to customer's email on the same day and it needed more time to respond, an email stating the same can be sent on the same day. This will give a message to the customer that "we are working on it and we will revert as soon as we are ready".

Virtual Meetings/Discussions (Both Internal & External):

- Preparedness for a meeting is very important to accomplish the desired objectives of the meeting and save everybody's time
- Team meetings or meeting with senior leadership should be followed with a specific agenda. Deviation from the agenda shall be avoided to the extent possible unless otherwise there is an urgency
- One should respect the time allocated for the meeting. Based on the agenda, the convener should be able to estimate the time of completion and accordingly assign the time for the meeting. This will help all the other participants to plan their work accordingly. The convener should keep a watch on time and should take the responsibility to close the meeting within the stipulated time
- The responsibility of the convener is not only to deliver the updates in the team meetings. Equally important is that they should be able to listen to the concerns raised by the participants. Two-way communication must be ensured in all team meetings to close the communication loop. The convener must ensure that two-way communication is established in the team meeting
- On certain occasions, it is observed that discussions on one single topic do not get closed for an extended period. The convener should be able to carefully analyse such situations and decide to take up such discussions separately on a one-to-one basis with that team member. It is not wise to waste other team member's time at the cost of one specific topic
- The project team should plan for meetings with their team leads/team on a regular basis. Projects which have just initiated may require frequent meetings as compared to a matured project.
- During customer meetings, one way to get a confirmation that our understanding is correct is by acknowledging them. It is called a three-way communication. In a three-way communication, the sender orally states his message, the receiver recognises the sender and repeats the message in paraphrased manner; and the sender acknowledges the receiver's reply.

Organisations that have a talent pool with rich experience and required technical skills to deliver can fail miserably at times if effective communication is not practised. The current situation demands us to master this art even more.

With the new way of working already in existence, effective oral and written communication across the project stakeholders is critical to sustaining customer satisfaction and in-turn the business. The success of any project also depends on effective communication. Improving communication, maximises the success rate and minimises the risk. An exact communication protocol and adherence to it not only builds trust with the customer but also among the team, resulting in increased productivity, performance and morale.

Added to these benefits, if the project manager maintains effective communication with the key stakeholders, this may mean repeat order from the customer. At the same time, employees who succeed in specialising the art of effective communication with their colleagues, managers and customers will undoubtedly continue to be a valuable asset to the organisation.

Author

Rajarajan Rathina, Deputy General Manager
Tata Consulting Engineers Limited (TCE)

Corporate Governance is the key activity that manages the following four broad areas:

- People Management
- Rules Management
- Process Management
- Procedure Management

The Board should be more active and approachable during crisis (COVID19 is one such crisis). An active board casts responsibility on the Management to act faster on all aspects including relooking at the policies, rules or procedures that need immediate attention/ changes. The role of leaders should also be well defined and they should be empowered to take necessary decisions and actions. The following guidelines were issued by the respective Governments or their legal offices on Lockdown which motivated corporate houses to relook their actions and strategies during lockdown

- The commissioner of labour, Maharashtra asked employers not to terminate services of employees or reduce their wages during the lockdown (Mar 20, 2020)
- The Finance Minister announced several relief measures relating to Statutory and Regulatory compliances across Sectors in view of COVID19 outbreak (24th March 2020)
- MHA order dated 24th March 2020 set the lockdown guidelines along with various other addendums issued thereafter.

As the fiduciary responsibility of the Board the above guidelines were followed by almost all the corporates in India, however the Board of Directors are also responsible for the Sustainability and continuity of business and take tough decisions for survival of the business.

The new normal will allow employees to work from home in the long term, hence the rules pertaining to workmen and their rights & responsibilities will need to be relooked by the respective State and Central government. The employers also have to be ready with their policies and procedures for allowing employees to work from home.

Data protection will be a very crucial factor while allowing work from home as the company's key data or price sensitive information becomes vulnerable. The government needs to come up with New data protection rules of employers and Privacy protection rules of employees.

Author

Sachin Mishra, Head Legal & Company Secretary
Tata Consulting Engineers Limited (TCE)

Sterilisation and Decontamination

An Overview

The world currently reeling under one of the worst pandemic ever known to humankind, COVID19. This deadly virus has infected millions of people, and several hundred thousand people have lost their lives to this outbreak. Countries across the globe have announced lockdowns and social distancing. Citizens are mandated to practise personal hygiene and use personal protective equipment (PPE) like face masks, hand gloves and hazmat suits to fight against the spread of the outbreak. The pandemic is also posing severe challenges in terms of sterilisation and disinfection of medical devices, surgical equipment, lab instruments, utensils, packages, surfaces, personal belongings and sanitisation of people entering malls, hospitals, restaurants etc. to avoid direct or indirect transmission.

Various new technologies have been developed and existing technologies modified to achieve sterilisation and decontamination of items that are used in daily life and to control the spread of such contactable disease-causing micro-organisms. Some of the sterilisation and decontaminations techniques are:

1. Sanitisation chambers/tunnel - spraying sanitisation solution on people passing through.

2. Ultraviolet hand-held device/box/chamber/ room - using UV-C lights for sterilising personal belongings, PPEs, surfaces, packages, rooms, dental implants etc.

3. Hydrogen Peroxide and Vaporised Hydrogen Peroxide chambers and tunnels – Suitable for packages, utensils, medical instruments, personal decontamination etc.

4. Irradiation process - utilised for food, vegetables and medical products.

5. Autoclave, Steam chambers - utilised to sterilise implants, medical instruments etc.

6. Biomedical waste incinerators - employed to burn medical and biomedical waste.

Few technologies are discussed in the following paragraphs;

1.0 Sanitisation Chamber

Sanitisation chamber is one of the essential technologies being used to disinfect the personnel from the deadly microbes. Sanitisation chamber is equipped with sodium hypochlorite sanitiser containers, and when triggered through sensors, a mist of sodium hypochlorite is created to disinfect the persons passing through it. The prescribed quantity of the Sodium hypochlorite solution is mixed with water through the metering pump, and this solution can be sprayed for 20 seconds minimum in order to achieve satisfactory sanitation. The chamber can also be fitted with air curtains so that the stream of high-pressure air can dislodge the microbes from the cloth.

Chamber can be provided with the sliding glass doors operating based on proximity sensors for touch-free operation. A separate cabin for the operator can be provided for monitoring purposes. Adequate lighting arrangements can be provided inside the chamber for functioning at night. These sanitisation chambers are placed at the entrance of sensitive places including hospitals, malls, railway stations, airports, banks, housing complexes, office buildings etc. to disinfect the personnel and avoid the spread of contagious diseases.

Price Range: INR 25000/- to 1.5 lakhs

2.0 Ultraviolet Light Sterilisation

Ultraviolet spectrum with a wavelength of around 252 to 254 nanometres (UV-C) has excellent germicidal capabilities. In many industries, surface disinfection is carried out without the use of chemicals, and this critical disinfection is achieved through UV light sterilisation, which provides a safe, effective solution. In the food industry, UV lamps are used for irradiation. Ultraviolet light (UV-C) sterilisation neutralises viruses, bacteria, yeast and fungi within seconds by damaging the DNA of the micro-organisms.

UV light sterilisation effectively sterilises the space without using any of the harmful chemicals. UV technology is used for disinfecting the areas from fungi, bacteria, viruses, dust mites and spores from transmitting as these micro-organisms are inactivated. UV technology is proving its importance in hospitals and other setups, where it is integrated into air conditioning systems to sterilise micro-organisms that

spread disease and contaminants which cause severe respiratory issues. UV lamps to eliminate hazardous or toxic chemicals that are produced in some of the food/pharma industries and eliminate Volatile Organic Chemicals.

Applications include baggage in airports, packaging materials at warehouses and malls, conveying equipment like belts in airports, roller conveyors in stations, shipper boxes, packages and containers, surfaces, countertops to destroy mould and bacteria.

Price Range: INR 10000/- to 1.5 lakhs. The price depends on the specifications and size of the chamber.

3.0 Sterilisation by Hydrogen Peroxide

Sterilisation of surfaces can be achieved by hydrogen peroxide (H_2O_2) cloud or low-temperature plasma which is produced by a strong electrical field. Hydrogen peroxide plasma is formed directly in the sterilisation chamber. During hydrogen peroxide gas plasma sterilisation process, the air from the chamber is removed by applying vacuum after placing the surfaces to be sterilised like medical devices and surgical instruments. Before starting each sterilisation cycle, the operator inserts the self-contained cassette of the solution of 58% of hydrogen peroxide and water, and this solution is injected into an outer chamber. The solution is then vaporised and allowed to diffuse throughout the sterilisation chamber, enveloping the items required to be sterilised. An electromagnetic field is created by applying radiofrequency energy initiates the generation of gas cloud or plasma. At the end of the sterilisation cycle, the electromagnetic field is turned off, and the reactive hydrogen peroxide is converted into water vapour and oxygen. The sterilisation chamber is re-pressurised, and the air passed through an activated charcoal filter to remove any residual hydrogen peroxide.

Advantages of low-temperature hydrogen peroxide gas plasma system are;

- Low-temperature hydrogen peroxide gas plasma sterilisation process offers lesser risk to the users and the environment as compared to other chemical sterilisation processes.
- As per OSHA regulations, exposure to hydrogen peroxide has been limited to one (1) ppm in eight (8) hours.
- Destroys a broad spectrum of micro-organisms, including vegetative bacteria, mycobacterium, yeast, fungi, and viruses, as well as highly resistant aerobic and anaerobic bacterial spores.
- No release of toxic residues as Hydrogen peroxide is broken down into water and oxygen.
- Inventory of expensive surgical instruments can be minimised as the process has a shorter sterilisation cycle time (about one hour) and ensures all patients will receive a germ-free device each time.
- Wide range of medical and surgical instruments can be sterilised by this technique and has significantly lower harmful effects on metal surfaces as compared to steam sterilisation. Increases the longevity of the surgical instruments and reduces replacement costs of these instruments.
- Hydrogen Peroxide sterilisation process does not require any special installations. Only a power socket is required, and the system is ready to be installed. The operation theatres can also be fitted with H_2O_2 sterilisation system in order to facilitate quicker sterilisation of instruments required for the procedures.
- The process is easy to follow, and hence training on preparation of items for sterilisation process such as instrument pre-cleaning, loading, unloading, assembling, and packaging can be cost-effective.
- Self-contained ampoules of hydrogen peroxide are used that eliminates exposure to the chemical.

Major disadvantages of this technology include;

- Inability in the sterilisation of linens and other cellulose-containing materials, as the hydrogen peroxide, reacts with the organic material found in these items.
- As this technology relies upon diffusion, materials such as powders and liquids cannot be sterilised.

Price Range – INR 25000 - 2.0 Lakhs.

4.0 Vaporised Hydrogen Peroxide (HPV or VHP)

Hydrogen peroxide solutions are being used as a chemical sterilant for many years. One of the methods of generating VHP is, hydrogen peroxide of 30%–35% concentration from a disposable cartridge is passed through a heated vaporiser and then is pulled through a vacuum system into a sterilisation chamber. In a second, a flow-through approach, where VHP is carried into the sterilisation chamber or space by a carrier gas (air) either in a slightly negative pressure (vacuum) or slightly positive pressure.

Applications of VHP technology include vacuum systems for industrial sterilisation of medical devices and atmospheric systems for decontaminating large and small areas, such as laboratory workstations, isolation and pass-through rooms, and even aircraft interiors. VHP offers several appealing features that include lower cycle time for decontamination of 30–45 minutes, low temperature, environmentally safe by-products (water, oxygen), better compatibility with materials, easier operation, installation and monitoring. VHP has serious limitations as it cannot process cellulose, on the exposure of VHP makes nylon brittle, and VHP penetration capabilities are lesser compared to that of Ethylene Oxide.

The VHP process cycle consists of three distinctive phases;

- Preconditioning
- Decontamination
- Post-Conditioning

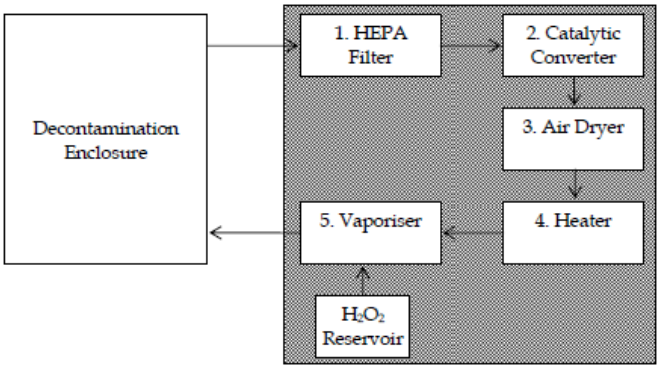
In the preconditioning phase, the chamber is dehumidified to ensure a successful process. In addition, this phase lowers the number of particulates on the package or surface to be decontaminated.

Post–Conditioning VHP gas from a chamber is removed by an efficient catalyst breaking VHP gas into water and oxygen. The door can be opened when VHP concentration within acceptable/safe level inside the chamber.

The unit is controlled by Programmable Logic Controller (PLC) and Human Machine Interface (HMI). PLC has capabilities of configuring various parameters to accommodate different loads. Following are salient features of VHP;

- It is a unique process for reducing particulates on various packages
- Has shorter cycle time with satisfactory decontamination throughout the chamber.
- It is an independent system, easy to install and validate.
- Consumes very low hydrogen peroxide
- Extensive risk analysis is carried out to ensure operator safety

Schematic of VHP Process



Source: Establishment of a Vaporous Hydrogen-Peroxide Bio-Decontamination Capability by Andrew M. Mcanoy, Michelle Sait and Sue Pantelidiis

5.0 Radiation Processing of Food & Medical Products

Gamma radiation processing as compared to other sterilisation methods like sterilisation of health care products using either Ethylene Oxide or wet steam as a sterilant has many advantages. Some of the advantages include;

- As gamma rays are powerful and penetrate right through the package and products, products of any shape can be sterilised.
- Plastic medical devices that are sensitive to heat

and other pharmaceutical equipment/products can be sterilised without causing damage as it is a cold process.

- Offers better packaging flexibility since the packages can be filled or packed individually in sealed bags and then the package is sterilised.
- As the sterilisation process is carried out after final packaging, the product's sterility is retained until the package is damaged.
- It is a continuous, fully automated process with a single parameter to be controlled, the time of exposure. Steam sterilisation and Ethylene Oxide apart from being batch processes; require more than one parameter to be controlled.
- The treated product can be used immediately.
- A very precise and reproducible treatment process.

Radiation sterilisation using gamma rays is an efficient and convenient technique in achieving high levels of sterility in medical supplies. Sealed food and medical products in cardboard cartons, steel or aluminium boxes can be exposed to a dosage of 25 kiloGray as a minimum in order to achieve better results. Exposure of products manufactured as per Good Manufacturing Practices (GMP), to a minimum radiation dose of 25 kGy ensures sterility assurance level (SAL) of around 10^{-6}. This dose provides higher safety factor, and when the product has a low initial microbial count ($<10^3$ CFU per unit), the probability of microbial survival rate of less than one in one million can be ensured.

Gamma radiation has proved its effectiveness in the inactivation of micro-organisms. Finished products must be handled as less as practicably possible during manufacturing in order to reduce the count of micro-organisms to the lowest possible. Premises, where gamma radiation is used, shall be clean and dry, properly ventilated with cleaner air, and the materials selected are suitable to withstand regular and thorough cleaning.

6.0 Autoclaves

Autoclaves are used in sterilising the equipment, instruments or packages that can withstand the temperature range. Air is removed from the chamber by means of vacuum pumps to create a low-pressure. Moist heat, in the form of pure steam, has better heat transfer capabilities and is more effective in destroying micro-organisms and spores as compared to dry heat. That is the reason for removing trapped air so that the steam is not diluted by air.

Moist heat at a lower temperature can destroy contaminants as effectively as much higher temperatures of dry heat, allowing fragile materials such as clothing to be sterilised.

Steam is pushed into the autoclave chamber at 100 – 200 kPa (1-2 bar(g)), pressure and at around 121^{0}C for fifteen (15) minutes, though this may be adjusted depending on requirements. Sterilisation cycles of 134^{0}C for three (3) minutes are also common. With 100% dry steam, as the heat transfer is less efficient, the sterilisation effect is also less. For better effect Steam with 97% dryness is utilised in autoclaves to derive benefits of high temperature and pressure of dry steam, and enhanced heat transfer capability of wet steam.

Modern autoclaves are suitable for sterilising almost any object that can survive the high temperatures and pressures of the cleaning process. Some types of plastics cannot be sterilised using an autoclave. Autoclaves are available in a variety of sizes, from small tabletop instruments to large chambers.

Price Range – INR 1.0 Lakhs to 10.0 Lakhs

7.0 Biomedical Waste Incinerators

Biomedical waste is generated while performing procedures and treatment on patients in hospitals, diagnosis in laboratories and in R & D facilities during research activities or in the production and testing of biological and medical sources in hospital, clinic, research institute etc. It contains infectious micro-organisms, viruses etc.

Biomedical waste incineration processes in which combustion of waste in the presence of oxygen in a controlled way destroys or transforms it into less

hazardous, less bulky or more controllable constituents.

Biomedical waste incineration process destroys almost all organic waste toxicity, and waste volume is reduced by 95-98%. This type of treatment uses high-temperature oxidation under controlled condition to degrade a substance into products that generally induce CO_2, H_2O vapours, SO_2, HCl and Ash. These incinerators can be diesel or gas-fired.

The incineration plant is designed for disposal of Biomedical waste and includes the site and the entire incineration lines, waste reception, storage, on-site pre-treatment facilities, waste, fuel and air supply system, treatment of exhaust gases, on-site facilities for treatment or storage of wastewater, stack, devices and system for controlling incineration operations, recording and monitoring devices.

Price Range – INR 2.0 Lakhs to 22.0 Lakhs

8.0 Selection of Technologies

There are various sterilisation and decontamination technologies available in the industry. One needs to employ the best-suited technology for the intended service to achieve optimum, cost-effective and safer methods of decontamination. Not many people understand the finer aspects of these technologies and install without proper due-diligence, leading to ineffective processes. The price range also greatly varies depending on the size and technical specifications.

During initial days of lockdown, for personal decontamination, a lot of companies have rolled out sterilisation chambers using sodium hypochlorite and sanitiser spraying. Later, the ministry of health and family welfare came up with an advisory against the spraying of disinfectants on people. It also went on to say spraying strong chemicals on an individual may cause skin and eye irritation and may lead to a false sense of disinfection and safety.

In view of the above, it is recommended to carry out a proper study of various technologies to suit specific requirements of sterilisation, decontamination and disinfection. Tata Consulting Engineers has the experience and expertise of providing the right specifications for a particular application and support in the implementation of the best technology for a specific application.

9.0 Summary

The world is slowly limping back to normalcy in due course of time, lockdowns are partially being released, and hence it is imperative that various industries employ proper methods of sterilisation and decontamination processes. Since there are so many technologies and suppliers are available, a detailed and careful study needs to be undertaken to select the appropriate technology for ensuring the effectiveness of the process.

Tata Consulting Engineers is a renowned consulting firm offering comprehensive solutions in the food and pharmaceutical industry and has been engineering hospitals stadium, museum projects over five decades. In case of any sterilisation and decontamination requirements for hospitals, airports, malls, warehouses, railway stations etc., TCE can be approached for offering services related to product-specific sterilisation and decontamination solution.

Author

Shireesh S Swami, Senior General Manager
Tata Consulting Engineers Limited (TCE)

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PLANT DESIGN AND ENGINEERING CLUSTER

The Cluster serves energy, natural resource and process industries, which is dynamic, diverse, and global in scale. Comprehensive and creative solutions keeping pace with changing environment are the key demands of survival. The industry will need to defend itself from these disruptors at a time when it is experiencing diminishing returns (despite widespread cost efficiencies and increasing automation) and increasing investor and activist scrutiny.

Evolving energy demand, customer preference, upcoming environmental regulations and aggressive pricing strategies are transforming the industry outlook. While uncertainty is there on the outcome of the implementation of emerging technologies, this is opening up opportunities to Rethink and Rebound in the era of disruptive Green Initiatives and Convergence of Industrial Automation with Information technology. Climate change and low carbon future are impacting the growth of all businesses in the cluster.

Technology disruptions affecting these businesses include Green Manufacturing, Green Chemicals, Hydrogen Economy, Electrification of Everything, Renewables, Electric Vehicles, Energy Storage, Distributed Generation, Distributed Manufacturing, Modularisation, Smart Grids and Smart Plants, Smart Infrastructure, Asset Performance Management, Industry 4.0, Digitalisation, Environmental Norms, Sustainability and much synergy can be achieved by having a structure that will aid collaboration of the business units in the cluster – that will enable the growth of the cluster.

The Cluster along with the BUs is continuously self-assessing itself in this dynamic environment of uncertainty with focus on employee engagement, productivity improvement, sales strategy, competency enhancement and embracing smart tools & technologies to improve on the Business As Usual (BAU). Specific Initiatives have been taken to expand on the business adjacencies, leveraging our core competency, thrust towards Climate Change and vision to serve the Value Chain across Mine – Manufacture – Deliver – Consume – Recycle.

Various Technology advances are leading to new businesses related to Decarbonisation, product differentiation, optimum resource utilisation and Circular Economy. Energy transition (green initiatives) across process sectors are evolving – Electrification, Renewables, Hybrid generation and Energy

Storage. New opportunities are there in productivity / efficiency improvements linked with Low Touch Economy while Customers are now preferring Solution Providers / Implementation Partners above Advisory services in these areas. The Cluster is keeping a close watch on the emerging technologies and is adopting a partnership-based approach to harness these opportunities.

From a Customer perspective – this cluster serves several accounts that are specific to Sectors as well as multiple accounts that are common across sectors – SABIC, Vedanta, Tata Accounts etc. to name a few. Energy transition towards Renewable Power and Asset Management are having specific Cluster focus to be distributed across various sectors. Cross-selling becomes organic to our Sales Force, more so with the support from IMG.

The cluster also wants to drive talent development across common disciplines and services through the creation of joint teams across the cluster – this will not only enhance the competency of individuals but also enable synergy amongst the sectors. Engineers would want to hone their skills by taking up challenges – to develop depth and breadth, and this cluster can provide an opportunity for the same. Key learning from DECs, Key Accounts, Strategic Accounts should be shared at Cluster and organisational level breaking barriers of sectors and businesses. With the new dynamics and disruptions, the learnings can be extended with a focus on:

1. Commodities of Future
2. Fuel to Chemicals (FTC)
3. Advance Production Technologies & Clean Technologies
4. Renewable Energy Generation and Smart Grids – Energy Transition
5. Sustainability
6. Digital Transformation

Author

Tapan Choudhury - President, Plant Design & Engineering Cluster
Tata Consulting Engineers Limited (TCE)

TATA CONSULTING ENGINEERS PARTNERS INDIA AND PARTICIPATING COUNTRIES ON THE INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR PROJECT

ITER (International Thermonuclear Experimental Reactor) is an international fusion reactor being constructed under the collaborative efforts of seven participating countries, including India. This experimental and collaborative research aims to create sustainable energy for the world by harnessing nuclear fusion to solve the world's energy requirements. ITER nuclear fusion research and engineering megaproject is the world's largest magnetic confinement plasma physics experiment.

In the initial years, ITER-India entrusted Tata Consulting Engineers (TCE) the responsibility of detailed engineering for the project for the cooling water system. TCE was a part of the conceptual design phase and preliminary design phase which formed the foundation for their final design.

Currently 50+ TCE engineers from different specialisations are working at site to help ITER deliver the engineering work packages to the construction team for erection.

TCE is involved in updating the stress re-analysis and support re-qualification to confirm the piping qualifies with three times higher spectrum. The main challenge was to qualify the system of already procured piping and already constructed embedded plates at the site. The margin for changes was almost negligible. TCE successfully qualified the system and its corresponding supports with the Euro Codes.

TCE is also supporting ITER through offshore projects being executed by delivery teams in India. One such recent engagement was on the preparation of the engineering work packages for the mechanical and piping installations of heat rejection systems and the component cooling water system, involving re-qualification and 3D modeling of piping in the cooling water system building in AVEVA E3D as per Euro codes.

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RENEWABLE ENERGY IN INDIA
A REALITY CHECK AND WAY FORWARD

Sustainable Development Goals are planned for countries to prosper economically and to ensure that the planet is protected. Seventeen goals[1] were set encompassing various facets of the development of countries to ensure prosperity. These goals are on poverty and hunger eradication, quality education, affordable and clean energy, clean water and sanitation, good health and wellbeing of citizens, decent work and economic growth, innovation and infrastructure, industry, gender equality, reduced inequalities, responsible consumption and production, sustainable cities and communities, life on land, life below water, climate action, peace, justice and strong institutions and partnering for the goals.

The climate action and decarbonisation have brought focus on the importance of renewable energy, and there has been a global shift in the energy mix over the past decade across the continents. All over the globe, countries have been investing in renewable power, and this article describes the overall scenario with a focus on India's aspirations and challenges to achieve the renewable energy targets specifically with respect to Solar and Wind power capacity additions.

Global Scenario

There is a significant shift in the energy mix in power generation across the globe with renewable power offsetting coal while natural gas, hydro and nuclear being almost flat. It is expected that by 2040, renewables will be the primary source of energy. Renewable push is being witnessed across Asia Pacific, Middle East and Latin American countries as well. During 2019, about 200GW of Renewable Energy has been added across the globe. The generation capacity has been increasing although the investments have flattened out due to lowering of the prices. During the last decade, about 2.7T USD was spent on renewables, and it is expected that about 1T USD will be spent during 2020-2030[2].

In 2019, five countries generated more than 30% renewable power and Denmark led the way at 60% with the other four being Uruguay, Ireland, Germany, and Portugal [2]. One important aspect to be noted in these countries is that the Variable Renewable Power (VRE) is dominated by the wind, and solar is only a small piece of the energy mix. In India, as of now, the wind and solar installed capacity are approximately the same even though the plan is for Solar capacity to be twice that of wind by 2030. Globally, 28% of total electricity generated comes from renewables, and as per MNRE, India has 86.3GW of Renewable installed capacity out of 368.7GW (as of January 2020).

1 https://www.un.org/sustainabledevelopment/ United Nations Organization

2 Renewable 2020 Global Status Report – Annual Report by REN21 Renewable Energy Policy Network for the 21st Century, June 2020

Indian Context – Aspirations

India began its renewable journey on a strong footing and enhanced its target to achieve 450GW RE capacity by 2030 from originally planned 175GW by 2022. It aspires to have 60% of the total installed capacity through clean energy sources[3]. With 60GW of planned hydro capacity, it plans to have 510GW of renewable generation capacity by 2030.

Table 1 indicates the current status (as of June 30 2020) of renewable energy in India and the anticipated capacity additions till 2022.

RES Category	Target IC as on 31-03-2022	RES Installed as on 30-06-2020	Committed RES Capacity addition in 2020-22
Solar	1,00,000	35,122	64,878*
Wind	60,000	37,830	22,170
Biomass	10,000	10,029	(29)
Small Hydro	5,000	4,688	312
Total	1,75,000	87,669	87,331

* includes 40GW ground-mounted and rest rooftop

Table 1: Status as of June 2020 and Planned Capacity Additions (in MW) of Renewable Power in India[4]

National Infrastructure Pipeline, unveiled by Finance Minister in February 2020[5], reinforces India's commitment to renewable energy once again. The government intends to spend 9.3 lakh crores on renewable power capacity additions by 2025. Figure 1 indicates the planned expenditure over the next five years, implementing agency and the project status. 100% of implementation of renewable projects is by Private Developers, and this is the right step taken by the government with its philosophy of minimum government and maximum governance. However, 81% of these projects are still at the conceptual stage, with only 3% in the implementation phase.

Renewable Targets – Performance and Challenges

Despite good performance initially, the capacity additions over the last four years have not kept pace with the ambitious targets set. During the year 2019-2020, the set target of 11.8GW was 24% lower than the previous year and the lowest in the last four years and still, the target capacity addition has not been met.

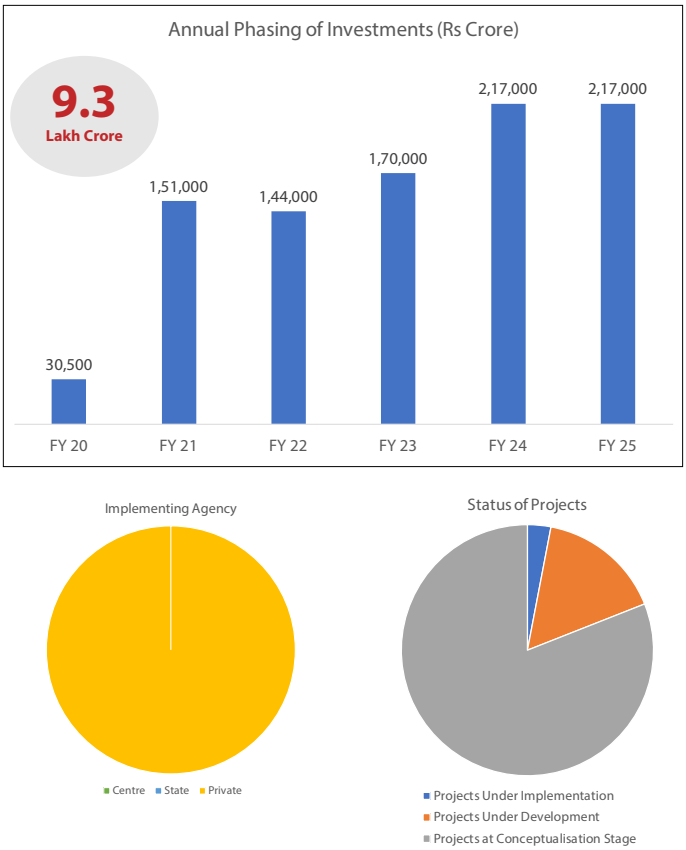

Figure 1: Proposed Phasing of Expenditure, Implementing Agency and Status of Projects as per National Infrastructure Plan for Renewable Energy[5]

Among the states, Karnataka and Tamil Nadu are the only two states that have achieved their targets. As of March 31 2020, India has installed solar and wind power generation capacities of 34.6GW and 37.6GW respectively. The target is to achieve installed capacities of 100GW solar and 60GW wind by 2022. The current pandemic situation of the country may impact the capacity addition much more than in previous years. The private investors need to have the wherewithal to go ahead with the investments for the renewable sector to grow.

There are challenges with the cash flow, and banking & financial institutions may be wary of lending amid mounting NPAs. Investment decisions are delayed across sectors as there is much uncertainty in the market. Amidst these negative sentiments, the power consumption in August 2020 has reached the levels of August 2019 and going forward things should get better.Bulk of the panels and equipment supply for India is from China and due to shutdown of solar manufacturing units in China, the first quarter of 2020 saw $151M of imports as compared to $650M in 2019. Only 53% of targeted solar capacity addition happened during January – March 2020, i.e., 989MW against scheduled commissioning of 1864MW and this trend is expected to further go down during Q2 and Q3 of the

3 https://www.financialexpress.com/industry/india-to-have-60-renewable-energy-by-2030-power-minister-rk-singh/2031205/ News Article, July 21, 2020

4 https://mnre.gov.in/the-ministry/physical-progress Ministry of New and Renewable Energy, Government of India, July 2020

5 National Infrastructure Pipeline, Report of the Task Force, Department of Economic Affairs, Ministry of Finance, Government of India, February 2020

calendar year 2020[6]. The government proposed 20% ~25% additional excise duty on Chinese imports which is not yet implemented and the DGTR (Director General of Trade Remedies) has recommended the extension of already existing safeguard duty implemented in 2018 by another 12 months from July 2020[7].

India has to commission 65GW in the next two years (to achieve the solar target of 100GW by 2022). Today, India has only 3GW of manufacturing facilities for solar cells, which is not enough to meet even 5% of the proposed targets. It will not be possible to meet the target of 2022 without imports from China (70% of total solar cells are produced in China) or other countries.

Another added factor is the current geopolitical situation with China. The situation is under control, but the continuance of border skirmishes brings in uncertainty that has the potential to impact the progress on the planned projects. With the onset of winter, things may turn out for the better.

Land acquisition issues continue to plague both solar and wind projects, and a look at the top achiever states indicate that success depends on the interest states have taken to assist developers in this crucial area. Power evacuation is also one of the reasons for delays as the transmission infrastructure may not be available at the location of wind and solar projects. Land acquisition and power evacuation need to be taken care of by the states.

In some rare cases, there have been instances where PPAs have been cancelled for delays due to land acquisition and instances where agreed PPAs have not been honoured due to change in government. Some of the states have also defaulted on payments to be made to the generators for the utilised power. DISCOMs have recorded outstanding to the tune of Rs 62.19 Billion to renewable generators[8].

Such actions will have a negative impact on the overall investment environment. Policy continuity and stability is to be assured to developers for the stiff targets to be realised.

Way Forward

The recent award of solar projects included the development of domestic manufacturing facilities of solar cells. This focus on Aatma-nirbharta is a step in the right direction to reduce over-dependence on China. Adani and ReNew Power intend to set up solar cell manufacturing facilities of 2GW each. The government is promoting module/cell manufacturing in India by offering incentives and subsidies along with plans for the development of manufacturing hubs. Much needed thrust is being provided to build local manufacturing facilities from a long-term perspective.

States need to plan for more and more solar parks and provide land in their control or assist in land acquisition or provide additional time in case of delays due to land acquisition by the developers. GW Scale solar and wind parks through which these issues are addressed by the governments will help the growth. Gujarat cleared the long-pending proposal of 41.5GW solar and wind park in Kutch district through allotment of 60,000 hectares of land[9].

Floating solar plants appear to gather steam recently, but the vast potential remains untapped. A report[10] by TERI estimates the floating solar potential based on 18000 sq km of reservoirs in India as 280GW. As the technology is imported, the costs are stated to be prohibitive; however, the tariffs quoted in recent bids have been competitive with a difference of 5p to 15p per unit generated with respect to ground-mounted solar. This is one area where indigenous designs are needed. A country that is capable of giant strides in space and nuclear technologies can come up with indigenous and economical solutions for floating solar.

Rooftop solar potential in India is also largely under-utilised. India today has about 3GW of installed rooftop solar against an estimated potential of 43GW. Complex approval processes, the default in bill settlements and unreasonable delays in disbursement of subsidy are the major distractors for rooftop solar in many states. Rooftop solar policies vary across each state and change frequently.

India should work towards having a semblance of uniformity in rooftop policies across the country and provide benefits to the infrastructure owners for rooftop installations. Further, the policies need to be stable for longer durations of time.

The focus worldwide is on sustainability and energy-neutral infrastructure. Every large community, such as colonies of public sector undertakings, gated communities, university campuses, hospital facilities, hotel complexes, industrial campuses, software parks, etc., must plan and work towards achieving energy

6 COVID19 – Impact on Indian Renewables, Bridge to India, May 2020

7 India Set to Extend Levy of Safeguard Duty on Solar Imports by Another Year, Mercom India – Clean Energy News & Insights, July 2020

8 DISCOMs' Outstanding Payments to Renewable Generators Rise to Rs 62.19 Billion, Mercom India, https://mercomindia.com/discom-outstanding-payments-renewable-generators/, March 2020

9 Now 60000 Hectares Land Allotment for Kutch Hybrid Energy Park, Times of India, https://timesofindia.indiatimes.com/city/ahmedabad/gujarat-now-60k-ha-land-allotment-for-kutch-hybrid-energy-park/articleshow/78028021.cms, September 2020

10 Floating Solar Photovoltaic (FSPV): A Third Pillar to Solar PV Sector? Report by The Energy Research Institute (TERI), February 2018

neutrality by having rooftop installations in addition to focusing on sustainability through the adoption of active and passive technologies for energy efficiency, water conservation and zero waste generation.

Offshore wind generation in India is also an area that will emerge in the coming years. The coasts of Gujarat and Tamil Nadu have a potential of 70GW of offshore wind power. The Ministry of Power recently has signed a five-year MOU with the Danish Energy Agency focusing on the electricity market, energy modelling and planning, grid integration of renewables and power system flexibility[11]. Denmark has the largest installation of offshore wind turbines, and this partnership may focus on realising India's potential in this area. ONGC and NTPC have signed an MOU to set up a Joint Venture for the renewable energy business, including offshore wind, that is set to explore asset creation in India and overseas[12].

System integration and hybridisation of VRE are expected to draw much attention going forward. Till the actual VRE generation reaches 25% levels, it is unlikely to have a major impact on the grid. From the current 9% levels in the VRE currently generated, it may reach 30% ~35% by 2030 provided planned renewable capacity addition to the extent of 50~60% of total installed capacity happens.

Steps are being taken to ensure flexible power available from thermal plants. According to a recent study by TERI[13], a peaking response of 500MW to 700MW per minute will be needed by 2030. Coal-fired plants need to plan for fast start capability (which is quite common for gas-fired units).

SECI released a recent tender[14] on the selection of renewable power developers for supplying 5GW of RTC (Round-the-Clock) power from renewable energy projects complemented with power from thermal power from coal-fired plants under tariff-based competitive bidding. MNRE has already released guidelines for RTC Power[15]. This is likely to provide impetus to renewable power generation and ensure better utilisation of under-utilised coal-fired plants.

Other than RTC Power described above, a combination of solar, wind and battery energy storage system (BESS) is also another hybrid model that is getting attention though at a much smaller scale. BESS is cost-prohibitive at present but is likely to become competitive in the next 3 to 5 years. Digitisation and power system flexibility would be the focus areas for RTC and hybrid power. All future tenders issued by SECI are expected to be hybrids.

Of late, Pumped Storage Projects (PSPs) are receiving a lot of attention from several states. Even though they may not be considered renewables, PSPs have advantages of quick starts as well as meeting flexible power requirements required for VRE.

The government launched Green Term Ahead Market (GTAM) that allows buyers and sellers to trade without the botheration of long term PPAs. The problem of curtailments is also expected to be reduced, and surplus power can be sold by the generators recovering their costs of generation[16]. Open access to RE Power, real-time energy market, distributed generation and encouraging solarisation of agricultural feeders are some of the schemes that are expected to provide the impetus.

Despite not meeting the planned aggressive targets, the progress made by India in meeting its renewable energy commitments is commendable. The government has made its intentions clear by making several reforms in the electricity sector in general and renewable power in particular. Other than implementation challenges, the pandemic may negatively impact the growth of renewable power capacity addition in the near-term. However, in the long term, India's transition to clean energy is expected to accelerate. The government is confident of exceeding the RE target as per Prime Minister's message at the World Solar Technology Summit organised by the International Solar Alliance (ISA) held on September 08, 2020.

Author

Rajashekhar R Malur - Head Power Business
Tata Consulting Engineers Limited (TCE)

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12 ONGC, NTPC sign MOU to set up joint venture for renewable energy business, Mint, https://www.livemint.com/industry/energy/ongc-ntpc-sign-mou-to-set-up-joint-venture-for-renewable-energy-business-11590121871028.html, May 2020

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14 Request for Selection Document for Selection of RE Power Developers for Supply of 5000 MW of Round-the-Clock (RTC) Power from Grid-Connected Renewable Energy (RE) Power Projects, complemented with Power from Coal based Thermal Power Projects in India under Tariff-based Competitive Bidding, Solar Energy Corporation of India (SECI), March 2020

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16 R K Singh Launches Green Term Ahead Market, Economic Times, https://energy.economictimes.indiatimes.com/news/renewable/r-k-singh-launches-green-term-ahead-market/77881975, September 2020

TATA CONSULTING ENGINEERS PROVIDES CONSULTING ENGINEERING SERVICES FOR NPCIL'S FIRST INDIGENOUS 2X700 MWE PRESSURISED HEAVY WATER REACTOR AT KAKRAPAR, GUJARAT

The Kakrapar Atomic Power Plant located at Kakrapar, near Surat, in Gujarat, is the first indigenously designed and built pressurised heavy water reactor (PHWR) unit of 700MWe capacity. Tata Consulting Engineers (TCE) worked very closely with NPCIL on the project and provided consulting engineering services for:

- Detailed engineering including preparation of process and instrumentation diagrams (P&IDs), specifications, datasheets, piping layouts, HVAC layouts, earthing and lighting diagrams, tray layouts, elementary and wiring diagrams, and instrument specification sheets.
- Development of an integrated 3D model which included the entire reactor system, along with safety systems, utilities and secondary cycle.
- Complete engineering and 3D modelling of BOTIP (balance of turbine island package) for the nuclear reactor.
- Development of first mobile fuel transfer machine for the 700MWe PHWR.
- This was the first time such an integrated 3D engineering was performed for an indigenous nuclear power plant. TCE is proud to be associated with the design engineering of the unit.

The Challenges

TCE took up the challenge of detailed engineering and 3D modelling of KAPP 3 and 4 (Kakrapar Atomic Power Project), the first 2 X 700MWe PHWR type nuclear power plant for NPCIL. It was for the first time in the Indian nuclear industry that the 3D model of the entire plant was developed concurrently during the engineering of the plant. The significant challenges faced were:

- The 700MWe nuclear reactor was to be an upgrade of the existing 540MWe reactor (which was also designed by TCE in 2001).
- The plant layout, building locations and structures were completely different as compared to the earlier plants.
- 3D modelling was at a nascent stage, and this was the first time that the technology was being used for a nuclear power plant in India.

TCE was elated with the challenge and took up the 3D modelling and detailed design engineering of the unit. It technically involved engineering the plant from scratch as the new plant was an upgrade of an existing plant for which 3D modelling had not been performed when it was engineered many years earlier.

The 3D Detailed Engineering

The work started with the preparation of P&IDs, specifications, datasheets, piping layouts, HVAC layouts, earthing diagrams, lighting diagrams and cable tray layouts, elementary drawings, wiring diagrams, instrument specification sheets, etc.

The complete engineering information was then transformed into a 3D model. As 3D technology was new to NPCIL, TCE worked with NPCIL on the concepts of integrated 3D engineering which helped extract information to build an intelligent 3D model.

As a first step, the development of a 3D model involved preparation of 400+ intelligent P&IDs; completing this step helped NPCIL prepare a preliminary estimate of material requirement.

As the next step, 3D modelling was done of the concrete and steel structures, embedded parts, platforms, equipment, piping, cable trays, HVAC, etc. Construction deliverables like equipment layouts, piping isometric, piping layouts, HVAC layouts, cable trays layouts, support drawings and MTOs were extracted from the 3D model.

Balance of Turbine Island Package

TCE also provided engineering and procurement assistance services for BOTIP.

TCE completed the design and engineering including design basis reports, concept notes, piping designs, optimisation studies, process engineering, development and finalisation of control and logic requirements, and construction drawings for piping, civil, electrical, HVAC, and C&I engineering.

TCE also provided 3D modelling and engineering of the complete turbine building, including all systems inside the turbine building in an integrated engineering environment. All deliverables were generated for erection purpose from the Integrated engineering environment.

The Mobile Fuel Transfer Machine

TCE also developed the conceptual design and complete detailed engineering of a new concept of on power mobile fuel transfer machine located inside the fuel transfer room. It involved developing and designing a remotely operated machine for storage of new fuel bundles, loading of new fuel bundles into fuelling machine head, receiving spent fuel bundles from fuelling machine head and storage of the spent fuel bundles.

Other Important Components

Tray loading machine (TLM) - The TLM was provided in the water-filled tray loading bay for loading of the spent fuel bundles in the spent fuel storage tray.

Portable sealing gate (PSG) - A PSG was provided to seal the rectangular opening in the wall between the tray loading bay and spent fuel storage bay.

Summary

TCE is proud to proclaim that it is carrying forward the torch lit by beloved JRD Tata with Homi J Bhabha in making available atomic power for civilian purposes in India. Since the inception of nuclear power in India, there are now 22 nuclear power plants in operation, generating 6,255MWe power and seven are under construction and projected to generate another 4,824MWe energy. TCE has partnered with NPCIL on 85 percent of these plants and has been associated with the Department of Atomic Energy since 1968.

TCE is a pioneer in nuclear power plant engineering in India and has been the consulting engineering partners for NPCIL right from the initial 220MWe plants to the 500MWe ones and now the 700MWe plants. TCE is presently engineering the Gorakhpur Units 1 and 2 which form the basis for the ten reactors planned in a fleet mode as announced by the Government of India in 2017.

TCE is happy and proud to share that India's first 700MW indigenous nuclear plant — KAPP Unit 3 at Kakrapar — achieved criticality on July 22, 2020. demonstrating India's progress towards long-term energy security.

Author

Alpna Singh, Corporate Communication
Tata Consulting Engineers (TCE)

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FEW PROJECT

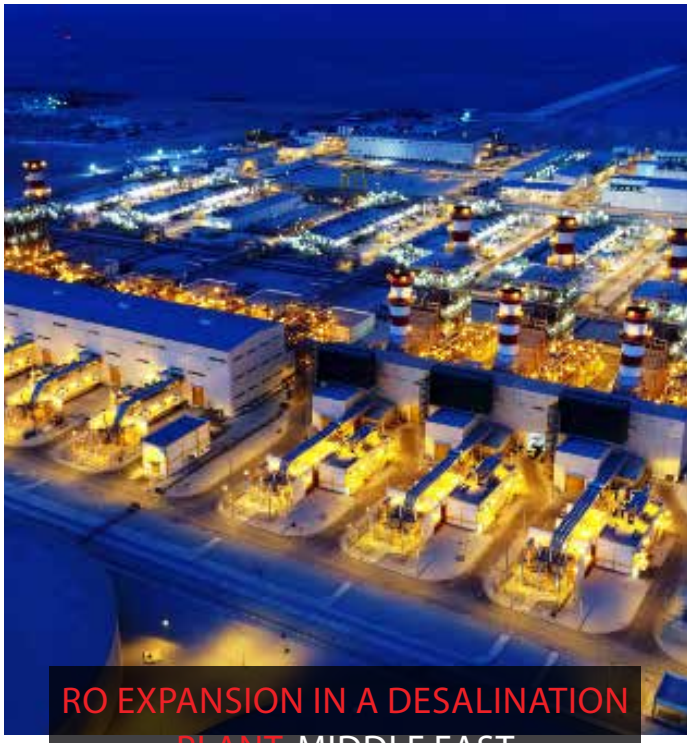
POWER AUGMENTATION PROJECT NIGERIA

The client is the world's largest manufacturer of polyester, Africa's second-largest producer of polyolefins, and a global manufacturer of spun yarns.

The power plant at the complex comprised of 4 x 33 MW Frame-6 Gas Turbines. In the absence of grid support, and to meet uninterrupted power requirement; 4 GTGs operated on part load to prevent even load shedding in case of tripping of a GTG and no standby.

To mitigate the operating constraint and to achieve necessary adequate redundancy in operation, the addition of 1 no. GTG (GTG-5) of 42 MW (at ISO condition) was proposed at the newly identified location inside the plant boundary. Expansion of the new GTG-5 provided the flexibility of having 1 No. GTGs in standby mode. 4 No. GTG would operate on part load to meet the required load of 86 MW.

TCE carried out basic and detailed engineering, procurement assistance, vendor documentation review, electrical system study, transformer energisation study etc.



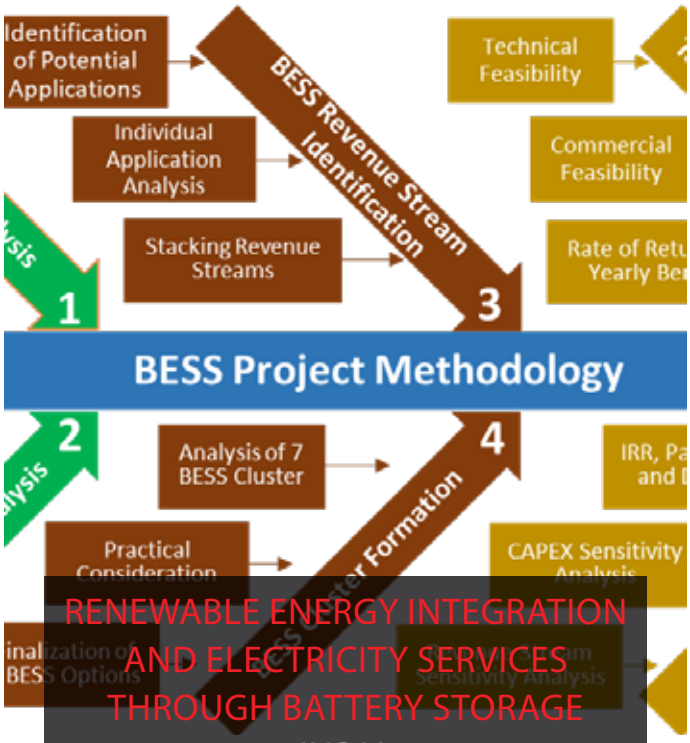
RO EXPANSION IN A DESALINATION PLANT, MIDDLE EAST

The client is a key part of Qatar's National Vision 2030. The project supports strategic goals of creating infrastructure to support economic development.

The power plant is supplying 2520 MW of electricity and 136 MIGD of which 60MIGD is produced through reverse osmosis technology, while 76.5MIGD is produced using multiple-stage flash technology. The Reverse Osmosis (RO) Expansion Plant consists of 13 numbers 1st pass and 5 numbers 2nd pass RO units producing a total 61.45 MIGD water. Out of which two RO unit are redundant for 1st Pass, and one RO unit is redundant for 2nd Pass; Plant also consist of seawater supply facilities including on-site hypochlorite production for disinfection of seawater; seawater return facilities; common pre-treatment facilities for RO units, including dissolved air flotation (DAF) plant and Disk Filters (DF) and ultrafiltration (UF) plant with chemical dosing and other appurtenant systems.

TCE was the Engineering Consultant for the new RO Expansion Project including development of power distribution scheme, development of design criteria for electrical, instrumentation and control system etc.

HIGHLIGHTS



RENEWABLE ENERGY INTEGRATION AND ELECTRICITY SERVICES THROUGH BATTERY STORAGE

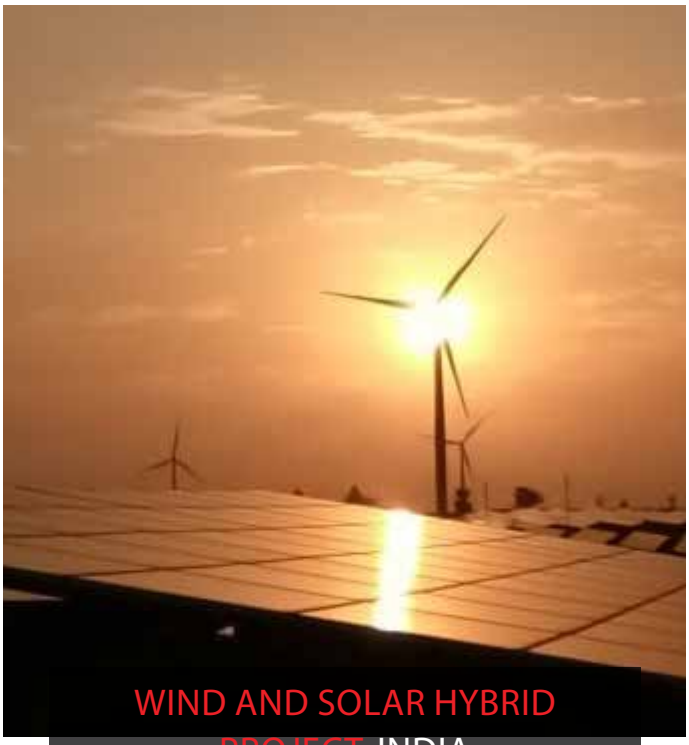
INDIA

The client is a power distribution giant. World Bank project.

Globally, the Battery Energy Storage System (BESS) option is considered as a preferred solution to overcome high variability in energy with large scale penetration of renewable energy generation and environment-friendly electric vehicles. Distribution utilities are facing more significant challenges in terms of heavy penalties levied for maintaining grid discipline and considerable investments to cater to the ever-increasing demand. BESS can be used to manage peak demand, avoid penalties from grid regulators and identify the potential for CAPEX deferment in the urban environment.

TCE developed a systematic approach and methodology based on advanced data analysis and complex simulations for optimal BESS selection in Distribution Environment.

Benefits of BESS are multifold, it enables effective management of renewable power, meet peak demand, optimise assets and reduce penalties. BESS size of 50MW/100 MWh is suggested for the client.



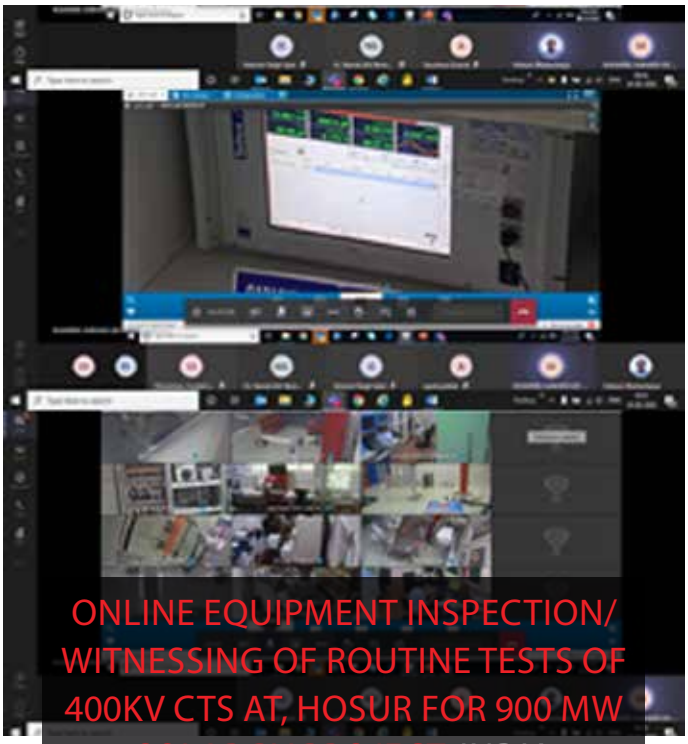
WIND AND SOLAR HYBRID PROJECT, INDIA

The client had an existing asset of 50 MW wind plant with plant operational Capacity Utilisation Factor (CUF) of about 28%. To enhance the overall utilisation rate of Balance of the plant (BOP), a Solar PV plant of suitable capacity was proposed to be installed near the wind asset. India's first wind-solar hybrid plant was planned to utilise the same dispatch equipment and compliment the wind generation during poor generation hours.

The DC energy produced by the plant is about 37018 kWp, while the AC output is about 28875 kW. Such power is capable of lighting around 3600 homes. The annual energy production is 63387 MWh, an equivalent of 60851 tonnes of CO_2 emission can be reduced. Thus, providing an eco-friendly option of energy generation

TCE supported the client in finalising the capacity of solar installation. Estimated the generation profile of solar and predicted the overall generation profile for Wind and Solar hybrid project by superimposing historical generation curve of wind with solar estimated generation curve. Reviewed the concept, design and calculations related to solar PV project and also review the engineering documents from the EPC.

FEW PROJECT HIGHLIGHTS

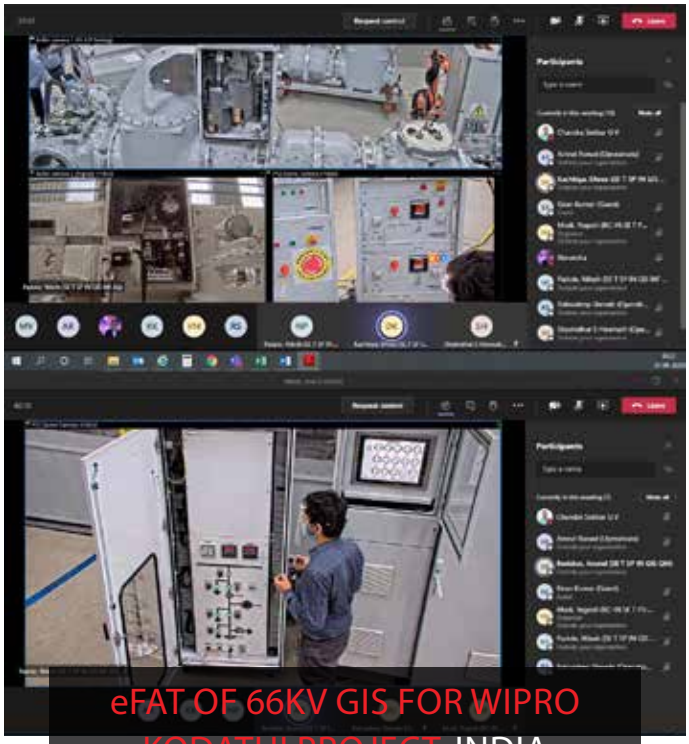


ONLINE EQUIPMENT INSPECTION/ WITNESSING OF ROUTINE TESTS OF 400KV CTS AT, HOSUR FOR 900 MW SOLAR PV PROJECT, INDIA

In view of the on-going COVID19 pandemic, TCE proposed online MS Teams inspection/witnessing of routine tests of 400KV CTs, Hosur for 900 MW Solar PV Project, Bikaner. The client agreed with the proposal. This approach has been adopted by TCE for the first time.

The inspection was carried online in a structured manner. Video demonstration of the inspection approach by the Vendor. Tour of the complete EHV testing hall for ensuring the proper shielding. Checking the validity of calibration chart of the test equipment. Inspection name plate ratings, serial number of all CTs and QAP requirement. Equipment visual inspection, dimension checking and Test connections. Witnessing of test results on monitor/ meters and equipment condition after the test. Recording on tests results

TCE has vast experience in onsite inspection of equipment, highly skilled resources and in-depth understanding of equipment specification, which helped carry out online equipment inspection effectively with the scheduled time and to the satisfaction of the customer. TCE has given high confidence to the customer, and the customers extended the online inspection service offering for the remaining CTs, and the same can be extended to other switchyard equipment. An online inspection will reduce the travel time and expenses and is a cost-effective way of carrying out an inspection. Going forward, even post-COVID19, TCE is preparing guidelines and process for online assessment so that online inspection can be a standard offering to our customers.



eFAT OF 66KV GIS FOR WIPRO KODATHI PROJECT, INDIA

TCE is associated for Detail Engineering Consulting Services for Electrical works of 66kV Gas Insulated Substation (GIS) for a Project in Bangalore. During pandemic situation, conducting & witnessing of Factory Acceptance Test (FAT) of electrical equipment is a major challenge.

TCE suggested an online FAT (eFAT) option since it is a challenge to travel to the vendor place due to the current situation. Discussions were held with the vendors for the readiness in performing the eFAT. A short mock eFAT was conducted prior to the final one in order to check facilities and visibility at the vendor place.

TCE team participated along with customer and Contractor. All the tests were carried out as per Approved Quality plan by the Vendor. Due to usage of high end cameras and also facility of zoom in/out options, visualisation of test readings was easily done from remote sitting in our home. Endurance test for the breakers as part of this eFAT was virtually observed. Local Control Cabinet (LCC) was also offered as a part of eFAT by Siemens. Functional test related to LCC was conducted. eFAT was successfully completed as per the schedule. This is first of its kind online inspection carried out which has given value added service to the customer without travel and other expenses. This experience has proved the viability and significance of the eFAT during this pandemic condition and TCE can continue to support in other projects.

CHEMICAL REACTION TO COVID

The new financial year started in the most challenging situation due to the strict lockdown declared by Government to contain the spread of COVID19 pandemic, and we were faced with the challenge to continue to support our clients and honour our commitments for scheduled deliveries. This was an unprecedented situation with no past reference or case study to rely upon. Engineering work requires a lot of collaboration, and we had never done that without physically sitting together. It was a do or die situation.

We are proud of our teams including the exceptional support provided by our IT and Admin teams to quickly plan and execute shifting of IT hardware to the residences of our personnel and to enable them to connect to our servers in office following the strictest IP and Data Protection protocols. This was very important as we deal with some of the most confidential and valuable IP information and data related to our clients. Within one week of lockdown, we were able to enable almost 40% of our workforce to work from home, and within three weeks, almost 100% of people were enabled.

People had to quickly adjust to a new way of working, sitting remotely at different locations and collaborating with their colleagues using technology. Microsoft Teams suddenly became the primary medium of communication. Reviews started happening electronically using screen share and other technological tools. New protocols had to be prepared and perfected.

We are proud of our employees who rose to the occasion and adjusted to this new way of life. They all quickly adopted the new norms, and contributed to normalising our operations, respecting our commitments to clients and ensuring that the quality was not impacted. It was incredibly challenging as people had to take care of their domestic chores also while ensuring delivery commitments. This prompted people to device new flexible ways of working. Some even faced connectivity issues due to network congestion and devised their methods to ensure delivery schedule by using the network at night and early morning when bandwidth is less loaded.

With the agility and flexibility shown by our teams, we were able to ensure near-normal operations within two weeks and ensured that Clients' projects were minimally impacted. We received appreciations both from our domestic as well as international clients for quickly normalising our operations.

We also appreciate the cooperation of our clients concerning this new way of remote working. Project Progress Review Meetings, Engineering Review Meetings, 3D Model Review Meetings, HAZOP reviews etc. all are now happening virtually with the client using the latest available technology for collaboration.

Our sales team was also faced with the same challenge to maintain contacts with prospective clients, and they have also admirably adopted the use of remote technology to remain in touch with our clients, to present our proposals, discussions, clarifications or negotiations in virtual meeting mode.

Virtual Induction of New Joiners:

We honoured all the appointment letters issued and made arrangements for virtual joining of new employees remotely from their homes. They were IT enabled by our IT Department with all data protection policies etc. and their Induction Training was also conducted virtually. Each one of them has been fully integrated into our team and is actively contributing to operations.

Business Outlook

COVID Pandemic has significantly impacted decision making at Clients end, resulting in a delay in award of several projects for which we had submitted bids. With our clients also gradually shifting to work from home and some office operations, the situation is slowly improving, and we expect good order flow in the coming quarters.

Anti-China sentiments globally and the realisation of risk in concentrating manufacturing in one country or region is likely to present more opportunities to Indian Manufacturers to set up manufacturing units in India.

Meanwhile, we continued to provide services to our existing clients and received appreciation from them for our agility and ability to quickly stabilise work from home.

Even during these trying circumstances, we provided EPCM services to Shell Retail for their Retail Outlet program, and TCE is proud to have completed 12 Retail outlets and commissioned 7 of them.

Some good practices improvise and implemented during this situation:

Challenging situations always also provide opportunities for innovative thinking and improvisation. Our teams also implemented some excellent practices to mitigate the limitations and challenges faced due to remote working and no physical interaction.
Some of the noteworthy practices strengthened/ started were:

1. **Project Management:**

    - Daily Updates from each of the Discipline Leads in the form of Email listing the activities performed during the day.

- Daily online timesheet filling on onedrive for better visibility and tracking of work of individual team members and its analysis.
- Regular management updates on each Saturday about progress of previous week.

2. Resource Planning:

- Each team member was receiving "Weekly Tasks to perform list broken down day-wise" by each Sunday evening for the coming week.
- Daily activity list issued to each of the Team Members by respective DLs and reviewed at the end of the day as part of monitoring and review exercise.

3. Performance Management & Employee Engagement:

- Performance Appraisal – Each of the Discipline Lead, Key Account Manager and PMO team is provided with their respective KRAs, and each of them must fill in the achievement by the end of the month and forward the same to HoD. Performance Appraisal for the 15 senior team members is now on monthly performance from July Onwards.
- Quarterly Performance Feedback provided offline to all team members on one to one basis.
- Skip level interactions by BUH and HoD with employees in BU – both individually and in a group
- Select 10 number of E4, E5 level employees have fortnightly interaction with HoD
- Every E6, E7 level employee has dedicated 45minute one to one interaction with HoD each month to discuss both short term and long term activities and action plans, including improvement areas..

4. Quality Assurance & Virtual Review Process of Critical deliverables:

- WRENCH – BD and Project Engineers (PE) have started capturing/logging the number of errors in the system. Earlier it was done only by DHs. This is helping us in carrying out root cause analysis and planning mitigation measures.
- Technical Audit Procedure for HCBU deliverables – We have initiated the process of technical Audit over and above the mandatory Quality Procedure Audit carried out / mandated by QMS.
- Captured Lessons Learnt for all the ongoing projects is cascaded during the Project PICM and Discipline CoC meetings.
- Completed Virtual HAZOP of NFASL project and received appreciation from the client.
- Successfully conducted Virtual PDMS Model Review of a few large international clients.
- Detailed Yearly training calendar is prepared and is tracked each week to ensure compliance. 4 external faculty members have conducted training sessions so far this FY.

5. Operational Management:

- Daily Sync-Up call with the Senior team members of HCBU, where the following is discussed:
  - Daily Planned Accrual vs Achieved.
  - Tracking of Accrual, Billing & Collection on a daily and weekly basis, same has yielded results in reducing our LWC.
  - Discipline Updates.
- Delivery - Sales formal sync up call every fortnight.
- Analysis of the Weekly Timesheets

Author

Manoj Kumar - Head - HCBU
Tata Consulting Engineers Limited (TCE)

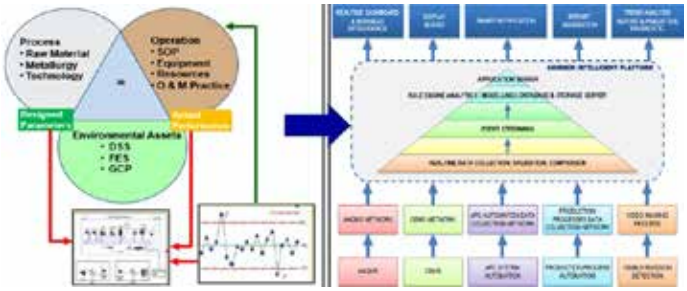
ADVANCE SOURCE IDENTIFICATION

The client presently owns and operates a port-based integrated iron and steel plant of template capacity 5 million tons of strip products per annum at Port Talbot, Wales in the UK. The plant is an old installation. The manufacturing process route is a conventional one-coke-making with by-product gas recovery, sintering, iron making in the blast furnace, BOS with continuous casting and finally rolling to strips. The handling of bulk quantities of solid raw material, size reduction, and, pyro-metallurgical process operations led to significant particulate dust emissions in the air.

The ageing of the dust pollution control facilities of the plant and its inadequacies in some areas has posed growing difficulties in managing the ambient air quality in respect of particulate specks of dust of size 10 microns (PM10) and above. Deterioration of air quality in the Port Talbot area due to steel plant operation has been reported in several public documents, news items, reports of WHO, and, DEFRA on AQMA under AURN.

Considering the need of improvement of ambient air quality in the Port Talbot area, an action-oriented composite plan was undertaken and several remedial measures were initiated to combat particulate dust emissions. Given the above, an idea for an integrated intelligent common platform for Air Quality Management System (AQMS) was conceived. It was also opined to have an IIoT based solution as an option for the same.

A shop wise list of significant process and APC parameters affecting dust pollution was prepared. TCE also prepared the list of critical parameters and Cause & Effect (C&E) diagram impacting air pollution for a standard integrated steel plant. This Desktop Study discussed a programme for verification of Port Talbot Works specific critical process and APC parameters causing dust emissions for interfacing with AQMS, and gap analysis.



Conclusion from the Desktop Study

1. Thorough auditing of all the monitoring instruments covering weather station, AAQMS and CEMS as owned by Port Talbot Works.
2. Review of the present location of Air Quality Monitoring Stations in respect of GLC isopleths.
3. The authenticity of emission data, both from process stacks and diffuse emissions from area and line sources input to the model.
4. Additional monitoring stations in some areas within the plant.
5. Portable air pollution measurement stations and that may be mobile van or placement of Directional Dust Gauge stations at strategic locations.

INFRA CLUSTER

BUILDING A BETTER TOMORROW TODAY

For any nation, Infrastructure development is critical for economic development. Improvements in infrastructure directly help the other sectors of the economy also. Investment in infrastructure sector drives the future growth for a developing country. TCE is a leading engineering consultant in the Infrastructure business. Being a Tata Group company, TCE contributes significantly in Nation-Building undertaking Pioneering works in Water, Waste Management, Distributed Development/ Megacities Master Planning, Horizontal/ Vertical Development, Ecology, Environment and Flood management.

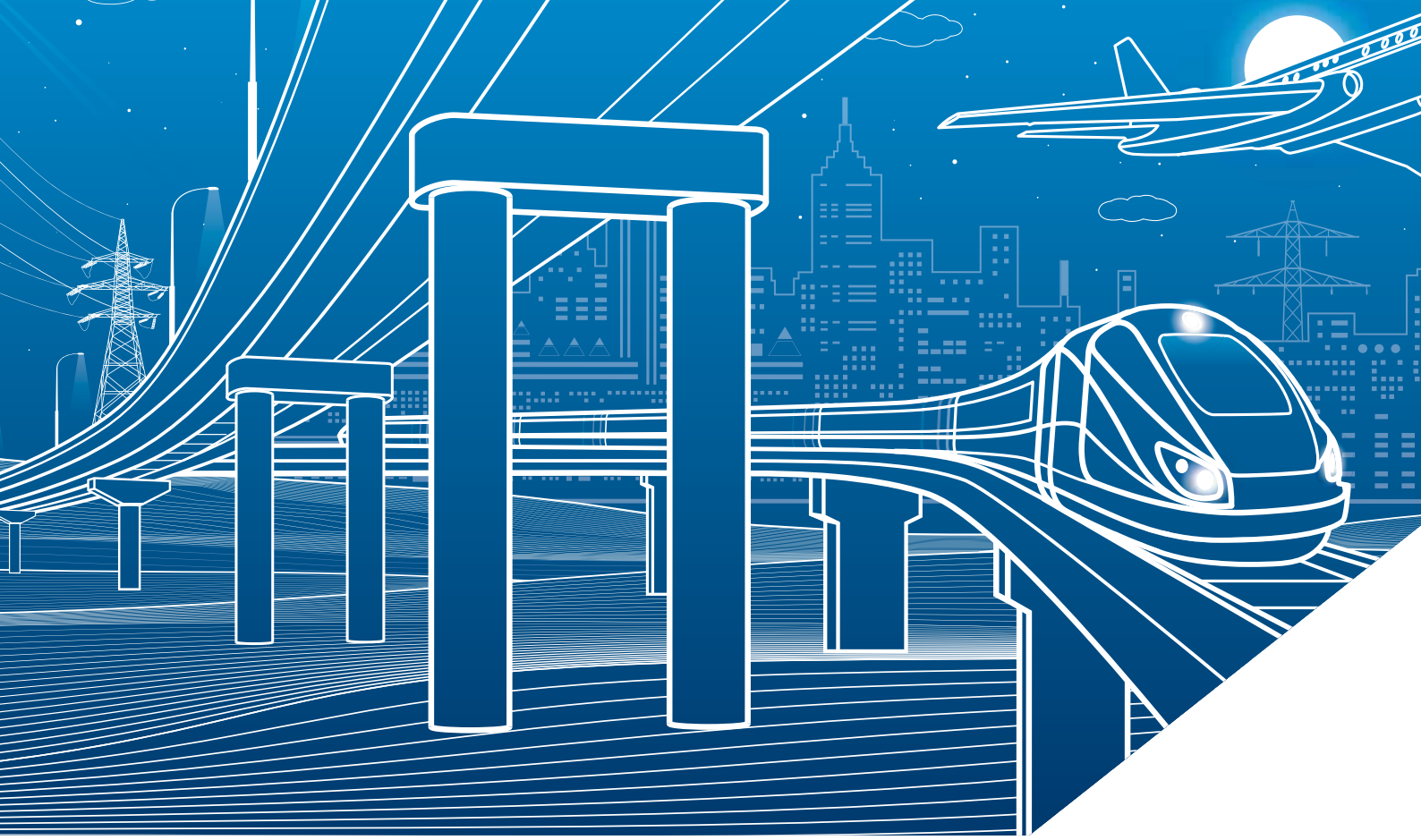
Aligned with the Group Philosophy and to build synergy and provide integrated, holistic solutions to our clients, we decided to regroup TCE as three clusters viz. Infra, Plant Engineering and Digital. The Infrastructure cluster comprises the Infrastructure Business Unit, Project Management Consultancy Business Unit and the Eco-first.

Infrastructure Business Unit (IBU) is a part of the nation's everyday life. We strive to improve the quality of life of the ordinary person working in sectors such as Water & Wastewater Management, Built environment and Transportation. We provide consultancy from concept to commissioning working with government and local bodies, public and private sector organisations, and international funding institutions. Working with these agencies calls for a high level of documentation and standards, which speaks about our proficiency in this area and has helped us become a partner of choice for various prestigious customers and consortium partners.

We offer integrated Project management consultancy services through the Project Management Consultancy Business Unit (PMCBU). We look at project management and construction management solutions in totality, integrating with engineering and procurement skills. PMCBU provides the much-needed transparency, ethics and values bundled with structure and professionalism, the market requires. PMC BU is present in all the four zones of India and has a sizeable presence abroad with a strong presence in Africa

At Ecofirst, we provide a comprehensive and holistic Integrated Design solutions across the project lifecycle. We specialise in creating sustainable designs and responsible development solutions by seamless integration of Architecture, Engineering & Environmental Technology.

The Infra cluster accounts for 40-45% of the total strength of TCE with a rich experience in Built Environment, Water & Wastewater, Ports and Harbours and Project Management with customised digital solutions Pan India and across the globe.



Future Growth

We see enormous opportunities for the Infra cluster by focusing on merging sectors, a combination of partnerships, increasing international penetration, digitalisation of our services and strengthening presence in our existing sectors.

Transportation

We aim to provide concept to commissioning services in all areas of transportation, with a focus on last-mile connectivity. There is massive growth in the domestic market predominantly in Metro and to a certain extent in ports. The tier 2 and 3 cities are being upgraded, and metro investments are in the range of 40 billion USD or Rs 280000 cr. Infra Cluster needs to capitalise this growth and have strong partnerships/JV to spearhead the growth story. Similarly, in Ports, we already have strong partnerships with Western firms and hope to strengthen this further to charter better offerings to our customers.

International Penetration

At present Infra BU is one of the leading players in the domestic market. We intend to extend our services to International markets which will also ease out enormous pressure currently seen by the business on Margins and working capital. We are planning to increase international penetration in water and building segment which will open opportunities to offer our enriched experience to international projects.

Partnerships

The sector has, over the years, scaled its operations and customer base through a collaborative approach, partnering with other strong players and international organisations. A consortium-based approach has helped the sector gain market share in new and emerging projects.

Digitalisation

We enable engineering transformation with 3D, 4D, 5D enabled Digital & Advanced Technologies. We have digitalised our PMC services where all the critical parameters of Safety, Quality, Schedules, Drawings, Documentation are available on a real-time basis through our smart App "SmartSITE". The construction site engineer can now provide inputs on all the project parameters using the TCE SmartSite app, helping faster and high-quality deliverable to clients. We believe that this will create a differentiator for TCE and facilitate us to stay ahead of the competition.

Author

K Ramesh - President, Infra Cluster
Tata Consulting Engineers Limited (TCE)

DESIGNING CITIES FOR THE YOUNGEST CITIZENS

Designing Cities for the Youngest Citizens

If you could experience the city from 95 cm - the height of a 3-year- old - what would you change?

Urban95, an initiative by Bernard van Leer Foundation seeks to find an answer to this question and aims to design child-friendly cities across the globe. In India - Pune, Bhubaneswar and Udaipur are the three pilot cities to adopt this concept.

Ecofirst Services Limited, a 100% subsidiary of TCE, was appointed as the Technical partners along with Taru Leading Edge to transform Pune into one of the first child-friendly cities of India.

Begun in December 2018, this journey of 2 years is now complete with the implementation of 8 Tactical Urbanism projects and six pilot projects across Pune city. It has effectively demonstrated how to design child-friendly urban public spaces and sensitised the implementers - Pune Municipal Corporation (PMC), urban planner, urban designers and the users (citizens of Pune) to think differently, i.e. from 95cm- the height of a 3-year-old.

A new concept for all, it required learning while delivering to make it a successful endeavour. For this the Urban95 Technical Team (Ecofirst Services Limited and Taru leading edge) diligently followed a systematic and methodical approach, ensuring rapid and time-bound delivery. These efforts helped the client to formulate a model methodology which can be adopted by other cities to transform themselves into child-friendly cities tomorrow.

At the initial stage, a city-level baseline assessment was conducted to identify existing issues faced by the Infants, Toddlers and their Caregivers (ITC) and potential areas of interventions. Further, an in-depth review of existing planning and policy documents (2 plans,6 policies, 2 special programs and the PMC budget) was conducted to incorporate ITC considerations into the Planning Framework of the city. Two Design Guideline documents-(i) Pune Crèche and Day-Care Centre Guidelines and (ii) Urban Design Guidelines for Safe city for ITCs have been formulated by the team and published, which can be used as a ready-reckoner for Pune and other cities to guide implementation of Child-friendly designs.

Nature based Play park at NIBM, Pune

Combating with the on-ground challenges of lack of data, multiple coordination between departments and the multiplicity of project tasks, the Urban95 technical team determinedly juggled, to materialise this concept into reality.

Project Highlights

The design of the interventions was focused on Holistic Early Childhood Development and Child Psychology. It aimed at making the urban environment Safe, Accessible, Green, Playful and Inclusive for Infant, Toddlers and their Caregivers. They were divided into five urban components, Neighbourhoods, Streets, Green Open Spaces, Social infrastructure and Urban services. Below are the highlights and achievements in each of these objectives and features.

Walkable and mixed-use Neighbourhoods

ITCs have a shorter range of mobility (i.e. up to 600m). Hence, it was recommended to cluster a mix of ITC daily destinations such as schools, parks, clinics, convenient shopping, etc. together within 10-15 minutes of walking distances in all neighbourhoods in Pune through a provision in on-going plans, policies and Town Planning Schemes.

Creating Safe Streets

The first public space that young children encounter outside their homes is the street. Hence, recommendations were given in the Comprehensive Mobility Plan and other mobility policies of Pune. Through tactical urbanism project, a playful, safe crossing for young children at Shivarkar garden was demonstrated with the active participation of Punekars. Vithal Shivarkar Road was redesigned as a pilot to showcase the design of ITC friendly street elements.

Green Open Spaces

Several policy and planning recommendations were given to ensure access to quality green open space from every home in Pune. Through tactical urbanism project, sensory play elements for ITC's in Lonkar Park, Kondhwa were demonstrated while two pilot projects were executed to showcase the importance of nature-based play in Early Childhood Development.

Social Infrastructure

Pune lacks good quality social infrastructure facilities for young children and needs to be equitably distributed across the city. Hence, recommendations were given in the Development Plan and other concerned regulations. While through tactical and pilot projects ITC friendly waiting as well as play areas were designed in Sonawane Maternity Hospital, PMC Crèche and Aundh Model Balwadi school.

Future Sustenance of the Initiative

A new position of Chief Child Development Officer was proposed in the present institutional structure of PMC for effective cross-sectoral collaborations and to ensure incorporation of ITC design principles in suitable policies/projects/programs. Also, a separate budget

for ITC related projects was proposed in the upcoming annual budget of PMC. Child-specific materials have been included in the present Schedule of rate (SOR) items of PMC.

Inclusivity and Capacity Building

During the project, several stakeholder consultations, as well as amplifier workshops, were conducted to get inputs and buy-in from the PMC officials at every step. Also, four training workshops were conducted for urban practitioners and PMC officials for knowledge dissemination. Two Peer to Peer city workshops were attended for cross-learning among the Technical teams of 3 cities- Pune, Bhubaneswar and Udaipur.

Conclusion

Pune city is at its infant stage, learning, adapting and transforming itself into becoming one of the first child-friendly cities in India. Ecofirst is proud to be a part of this "first" and is determined to continue this journey towards making other cities child and family-friendly. We are looking forward to adopting this concept in our on-going work on Silvassa Smart City. A good start in the life of the youngest urban residents is one of the best investments a city can make. Let us, as urban consultants do our bit to ensure the provision of a healthy childhood for the youngest citizens- our next generation.

Before	After
	
	
	

FEW PROJECT

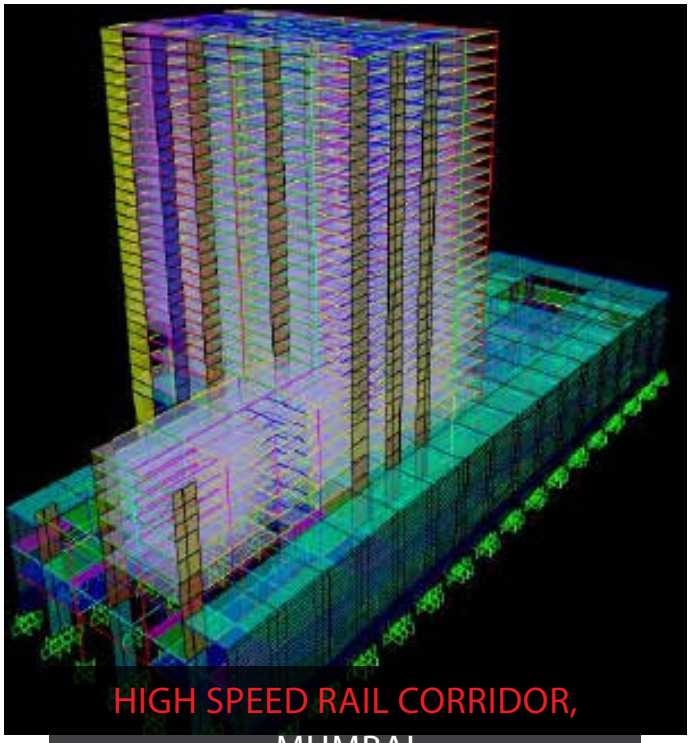
DESIGN & PROJECT MGMT OF CAMPUS BUILDING, BANGALORE

The client proposes to construct a new world-class building in their campus to house four interdisciplinary centres.

The plot area of approx. 4-acres located on the Northside of the campus. The built-up area is 2,00,000 sq.ft. The building comprises of Lower ground Floor + Ground Floor + 5 Floors. The overall height of the building is 32m. Other infrastructure facilities include utility building, connecting roads, landscaping, external services, etc. The building shall meet the sustainable features with the target of GRIHA five-star rating. The overall duration of the project is 24 months.

The campus would foster fundamental & translational research, address specific Grand Challenges of national relevance, facilitate breakthrough inventions and discoveries, and the translation of these to society, Steer innovative academic program, Build strong collaborations with various stakeholders.

TCE is the Design and Project Management Consultant for Construction of the Building including development of onsite infrastructure within Campus.



HIGH SPEED RAIL CORRIDOR, MUMBAI

The client has earmarked 50.31 Ha area for the proposed, International Financial Services Centre (IFSC) and High Speed Rail (HSR) corridor.

The IFSC buildings are proposed to be constructed over Underground HSR Station. Integration of the HSR station and IFSC is essential for the successful implementation of both these prestigious projects.

Structural analysis and design are carried out following the provisions contained in IS and other relevant codes. Different layout configurations for building above the station were considered for analysis. Various framing options like RCC column frame, PT slab with a wider beam, structural RC walls with structural slab were considered for preliminary analysis.

TCE is currently working on completion of Good for construction drawings. Complete HSR station is developed on REVIT model, and all the Good for construction drawings are made on REVIT platform.

TCE has been appointed for Detailed Structural Design of the proposed HSR Station and preliminary design of IFSC buildings planned above the HSR station.

HIGHLIGHTS

MSME TECHNOLOGY CENTRE RAJASTHAN

The Bhiwadi MSME TechnologyCentre in Alwar District of Rajasthan was inaugurated virtually by Hon'ble Union Minister, MSME, Road Transport and Highways Shri Nitin Gadkari on 31st August 2020.

The Ministry of MSME, through the Development Commissioner (MSME), is implementing Technology Centre Systems Program (TCSP) to establish 15 new Technology Centers (TC) and upgrade the 18 existing TCs.

TCE is the Project Management Consultant (PMC) for the project.

1500TH MILESTONE HANDOVER OF NANDGHAR PROJECT, NDIA

The Nandghars progressively Handed Over for Operations - 1500th Milestone Handover in Varanasi inaugurated by Madam Smriti Zubin Irani, Minister for Women and Child Development.

TCE is associated with this project as Program Management Partner for last 3 Yrs and entrusted with role as technology selection, engineering, procurement, site selection and project management.

FEW PROJECT

REVIVAL/REFURBISHMENT OF WATER SUPPLY SCHEME PHASE I BANGALORE

TCE was give the scope to Review the Design (Process, Hydraulics, PIDs, Civil, Electro-mechanical and ICA Works. Supervise the Construction. Inspect Equipment's at the Factory Premises. Monitor Trial Run and Commissioning Services and Assist the client In Certifying the Contractor's Work

Best Practice, Innovation and Value Addition

- High Rate Lamella Clarifier (Plate settler) & Granular Activated Carbon Filtration Process was proposed FIRST TIME in Bangalore for a large capacity Water Treatment Plant (WTP) of 110MLD.
- Ozone Treatment System for 110MLD capacity for the WTP FIRST of its kind in Bangalore and one of the largest plant in India.
- Existing Water treatment plant structures were demolished upto the Raft Bottom and filled with plum concrete for Construction of new Structures.
- Hydraulic Dredging with Bio-remediation is proposed for the T G Halli reservoir to remove the pollutants from the reservoir bed thereby wastage of huge amount of reservoir water is avoided.
- Adopted Trenchless Technology for laying of pipe at major road crossings within the city with CCTV surveillance proposed at all the sites to monitor the construction.
- STP with Disc Filter for Tertiary Treatment is proposed at the upstream of reservoir to prevent sewage entry to the reservoir by inception and diversion.

PROJECT MONITORING OF 150 MLD CAPACITY STP BANGALORE

The Sewage Treatment Plant (STP) projects is for 150 MLD capacity using conventional Activated Sludge Process (ASP) with Biological Nutrient Removal (BNR) (Nitrification, De-Nitrification & Phosphorus removal) with Disc Filtration to meet $BOD_{5.}$ It required Recycling and Reuse of Wastewater to Irrigation Tanks using State of Art Treatment Technology arranged in Limited Space with complete SCADA and Automation.

The scope of TCE included Review of Design (Process, Hydraulics, PIDs, Civil, Electro-mechanical and ICA Works. Construction Supervision. Inspection of Equipment's at the Factory Premises. Monitoring of Trial Run and Commissioning Services and Assist client In Certifying the Contractor's Work.

Best Practice, Innovation and Value Addition

- Introduction of Vortex Grit Chamber to enhance Grit Removal Efficiency.
- Existing Sludge digester demolished up to the Raft Bottom and filled with lean Concrete for Construction of new Structures.
- Sequential Construction of Process Units without disturbing the Operation of existing STPs.
- Construction of Anaerobic Sludge Digester having a large diameter of 25.0 m and having a height of 13.0 m.
- Construction of 150 MLD Capacity STP in minimal space.
- Diversion and treating the Sludge from Existing 248 MLD STP to accommodate the new Structures.

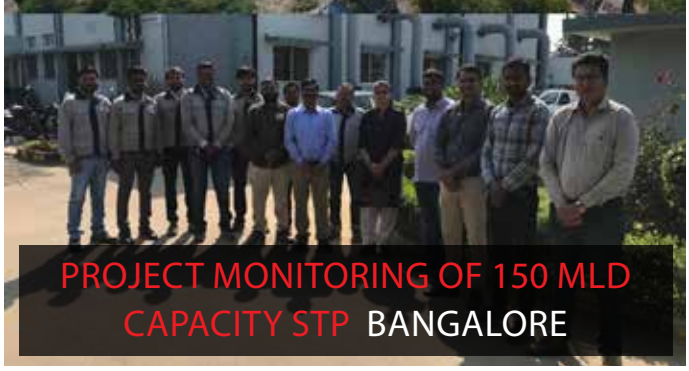
HIGHLIGHTS

WATER SUPPLY AND SEWERAGE PROJECT, PHASE 3 BANGALORE

The Project covers augmentation of 775 MLD drinking water supply to Bangalore city and Wastewater management, benefitting about 1.1 crore people. Requiring a WTP of 775 MLD - 100 km away from Bangalore city, Three stages of Clear water pumping stations and RCC Clear water reservoirs (64 ML, 32 ML and 32 ML) with Electro-mechanical, Automation & SCADA works at three locations.

Best Practice, Innovation and Value Addition

- Design and PMC for one of the biggest water treatment plants of capacity 775 MLD with high rate plate / tube settlers, filtration with 20% bed expansion. This will increase the additional output of treated water by 80 MLD, thereby generates additional revenue for the customer.
- MIS/IoT with CCTV surveillance proposed at Nodal office to monitor the construction activities on day to day basis
- Adopted Trenchless Technology for laying of pipe at Railway, NH and major crossings within the city
- Two (2) no of RCC pipe bridges avoided in this project resulting in savings worth crs.
- At one location accommodating 50 ML capacity GLR was challenging due to highly undulated terrain with rock outcrops, having elevation difference of 15 m.
- Electrical equipment (HT & LT Panels, DG, cable) sizes in STP'S (14 no) optimised



PROJECT MONITORING OF 150 MLD CAPACITY STP BANGALORE

The 60 MLD Sewage Treatment Plant (STP) located at Vadaj, Ahmedabad won the Elets Water Innovation Award under the Innovation in Water Resource Management by an Urban Local Body (ULB) category.

The plant is based on Sequencing Batch Reactor (SBR) technology consisting of primary treatment unit and secondary treatment including sludge digestion with mechanical sludge dewatering facility and chlorination system.

Tata Consulting Engineers (TCE) is the Design Consultant and Project Management Consultant (PMC) for the project is also the Design Consultant for the Ahmedabad Smart City.

Q&A - PORT SECTOR COVID19 IMPACT

Q1. What policy or other measures is the government considering taking in the near future/During COVID times?

The Ministry of Shipping (MoS) was quick to respond to the changed requirements. They advised shipping lines not to impose any container detention charge on export and import shipments of containerised cargo or any other new or additional charge. Indian ports were also advised that no penalties, demurrage charges, ground rent beyond the free period, storage charges, additional anchorage charges or berth hire charges should be levied on any port user.

Further, the ministry stated that the minimum guaranteed throughput obligations would be computed for the year under consideration, without considering the lockdown period.

The Central Board of Indirect Taxes and Customs also issued guidelines to reduce the impact of the pandemic. Key among these were clearance of goods based on understanding (not bond) and acceptance of electronic country of origin certificates instead of physical certificates, electronic communication of PDF-based final electronic out-of-charge certificate and copy of the bill of entry, and issuance of eGate pass to reduce the interface between customs authorities and importers/customs brokers.

Q2. What are the suggestions/ideas/recommendations for faster development in the sector (during and post Covid-19)?

- Impact of COVID19 will result in accelerating the moves towards Digitisation
- Blockchain technology is being used to make the process of documentation more secure
- Optimising networks and routines of cargo, along with controlling the monitoring of fleet activity allows the enhancement of vessel management systems
- Digital transformations in the maritime freight market are set to reach $38.4 billion on digitalisation techniques in the next 28 years. The compound annual growth rate of the industry is predicted to be about 10% from the year 2019 to 2027, mainly due to information technology developments (Source: Transparency Market Research)

Present Govt. Initiatives in Digitisation

- Replacement of manual forms by web-based e-forms
- Introduction of Direct Port Delivery, Direct port Entry
- Installation of container scanners, and Radio Frequency Identification (RFID)-based systems for gate automation
- Paperless transactions, Digitisation of land records
- Automation of issuance of delivery orders
- Single-window interface for facilitating trade (SWIFT)
- Integration of more seaports with port community systems (PCS)

Q3. What are the key issues impeding faster development of the sector?

Needs & Requirement of Port Sector Development

- To Improve Indian Ports performance and capacity at par with best international ports. Proactive Policy initiatives for Port Operation Enhancement
- To promote Coastal Shipping helping decongesting roads and environment friendly

- New /Upgradation of existing Roads & Rails for improving last-mile connectivity.
- Development of Deep Draft Ports & Upgrading existing ports by capital dredging to accommodate bigger vessels.
- To reduce logistics cost and facilitate export-oriented manufacturing by reducing time and variability and also the suitability of the ocean mode of transportation for imports of raw materials/exports of finished products.
- Digitisation of Ports

Q4. How should the government address these issues and what specific measures it should take?

Planning for New Efficient State of the Art Greenfield Mega Ports (4-6 in total with a capacity of at least 200 MTPA each), 4 in the East Coast and 2 in the West Coast with a comprehensive/competitive dredging and offshore reclamation policy- being the major cost component for Green Port Development

Manufacturing led development around Mega Ports.

- Indian Ports to act as Trans-shipment hub ports for neighbouring countries as Bangladesh etc
- Shift Exim Oriented industries near the land bank of new/ more efficient Mega Port.
- Development of industrial and maritime clusters along with Port-based industrial cities. Airports in a triangular fashion to ensure holistic growth and expansion of all three entities without any conflict for other ports; development around industrial clusters
- Old Major Ports around cities as Kolkata, Mumbai to be converted into only clean cargo port/cruise ports. Bulk/ Break Bulk Cargo to be generally avoided
- Inefficient Minor Port handling less than 0-5 MTPA to be closed Phase-wise and all existing Ports are handling more than 20 MTPA to be digitised/smart/sustainable with seamless/elevated connectivity to avoid city congestions around it.

Governance Model

- Development of National Port Planning Authority comprising of experts from areas of Shipping, Ports, Private Ports, Logistics and Consultants etc. with a primary focus on efficiency of ports and /shipyards, Maritime clusters, Port-based cities and avoid duplication of investments in Ports/Shipyards/maritime sector by Central/Major Ports and State/Private Ports and Shipyard
- The corporatisation of Port Authorities; Direct participation of relevant maritime states; management should shift from centralised to decentralised
- Appropriate legislative and policy changes to expedite the move to the landlord model
- Restructuring of TAMP
- Governance Mechanism of New Maritime clusters

Inland Waterways

Inland waterways to focus on point movement of cargo in small parcels and passenger transportation considering limitation in draft

- Inland Waterways through deepening of rivers at appropriate depths and develop Inland Terminals at Strategic Locations in synergy with road and rail at strategic locations in synergy with ports and rail
- Concessional terms for setting up terminal & cargo handling facilities at suitably connected places
- Focus on north-eastern waterways;
- Fiscal incentives to consignors using inland water transport.

Major Rivers to have independent dedicated River Boards to ensure holistic development of Rivers transport, ensuring water quality and preservation of environmental laws.

Also, Develop a comprehensive plan for Embanking/ Riverbank stabilisation in a phase-wise manner

In order to make India an Attractive Destination for Foreign Investors & niche Contractors to operate in Indian Market, the following may be followed:

- Contract Agreement for Major Projects - FIDIC International Norms to be followed.
- Immediate Dispute Resolution during the currency of Contract shall be provisioned.
- Government Audits shall be scheduled during 50% and 80% stages of project completion for its effectiveness and corrective action if any.
- Single Window Clearances
- Policies to initiate competition among the research organisations, consultants for better delivery. No award of work on Nomination basis creating scope for inefficiency.
- Introduce incentive policy to accelerate work progress and recognition to institutions/organisation/individuals contributing to timely/ahead of scheduled completion of projects.

Respondent

Devdatta Bose, Senior General Manager
Tata Consulting Engineers Limited (TCE)
in a Panel Discussion @ India Infrastructure Forum 2020

DIGITAL TRANSFORMATION IN PROCESS INDUSTRIES - UNIQUE CHALLENGES AND PROPOSED APPROACH

The process industry has been relatively slow in adopting the latest digital technologies when compared with industries such as discrete, logistics, retail. The underlying reason is possibly explained by the following unique characteristics of this industry which also significantly impact their digital transformation approach:

1. Process plants are complex by design, often having anywhere between 50-200 P&IDs with a diverse equipment, control schemes and operating procedures. They are also often bespoke in nature with very few cases where two plants share the same overall configuration
2. Process plant operation is continuous in nature where, unlike discrete, one cannot pull the proverbial 'andon cord' as any plant stoppage has ripple effects beyond the obvious loss of production – wastage of in-process inventory, potential catastrophic failure, adverse effect on asset health
3. Industrial sector overall accounts for ~ 54% of the world's total energy consumption; process industries account for 75% of that. Along with being energy-intensive, process plants are also high in water consumption and GHG emissions
4. Given the toxic, explosive & flammable nature of chemicals that are typically used and the possibility of runaway reactions, process plants have an inherently adverse work environment where safety is of critical importance from both plant and human perspective

It is due to these unique aspects of process industry that typical technological solutions that work very well in other industries are not applicable 'out-of-the-box'. From a digital transformation perspective, this amounts to the following:

A. Need for a Comprehensive Approach

Along with IT-OT convergence, which forms the bedrock of any industrial digital transformation, engineering technology (or ET) plays a crucial role in the process, given the extremely complex nature of assets. Asset digitisation and Asset Information Management (AIM) solutions, that not only allow instant visualisation of plant and access to all relevant information at tag and equipment level but also provide the perfect substrate for mounting all future digital applications/ analytics in a contextual manner, are the need of the day.

B. Importance of Domain Expertise

Digital solutions in process sector need to be deeply embedded in the asset, especially when we talk about advanced Asset Performance Management (APM) solutions where a deep understanding of equipment and system level Failure Mode, Effects & Criticality Analysis (FMECA) and Root Cause Analysis (RCA) for problems is essential to delivering results on the ground.

C. Need for an 'Integrator-Partner' to drive the digital transformation process

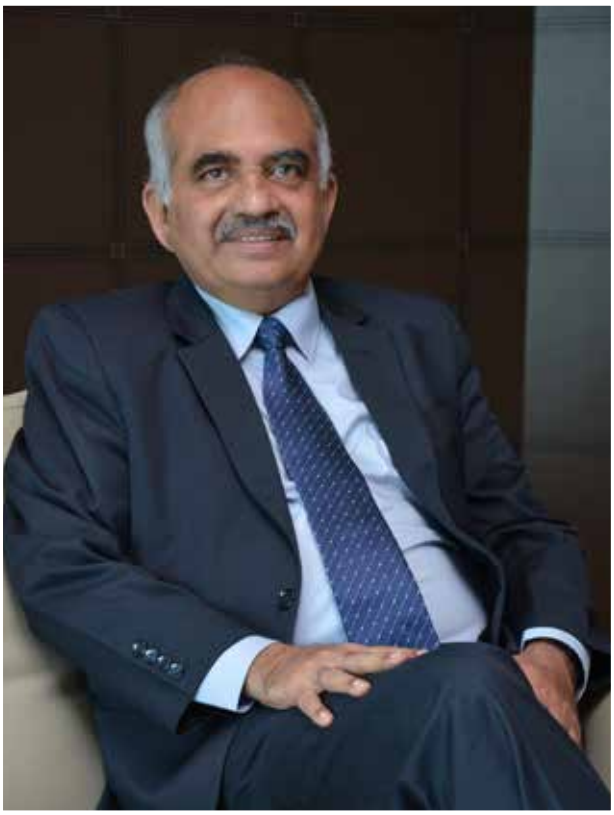
For a process plant owner, it can be extremely challenging to attempt digital transformation as there are a plethora of technologies to choose from and lack of expertise within the organisation. Also, unlike other pureplay business or IT consulting exercises, the idea of a consultant designing a strategy and leaving implementation to the customer does not work at all due to the reasons already stated.
Process Industry needs a long-term partner who can meet the requirements stated in the above two points and is also willing to partner with the client throughout their digital transformation journey –strategy finalisation, solution architecture, technology evaluation and selection, implementation and post-commissioning support

The above three points form the basis of TCE's approach to digital services where it leverages its deep domain expertise across power, oil & gas, petrochemicals, chemicals, metals and mining sectors and partners with technology firms to deliver 'end-to-end' solutions in a "Digital EPC" mode.

I took the opportunity provided by this platform to share with the audience multiple projects, case studies that TCE has delivered in Asset Digitization and Industry 4.0 space. I concluded by sharing a glimpse of the point solutions TCE is developing by essentially productising its domain expertise to make it readily available and deliver enhanced value to its customers in the coming years.

Author

Himanshu Joshi - Head, Strategy and M&A
Tata Consulting Engineers Limited (TCE)



DIGITAL CLUSTER

FUTURE PROOFING TCE

Digital technologies are transforming all industries, redefining business models and creating new opportunities for proactive, innovative and agile organisations. Organisations that enjoy a monopoly or significant market share today can no longer take comfort in their market leadership. In the traditional model of competition, the competitors were identifiable, but in the digital era, the lines of the game are blurred with outsiders becoming competitors (for eg., IT players, Management Consultants, etc., in the field of engineering consultancy).

These new competitors would start offering a unique value proposition by leveraging digital technologies and use new business models to serve customers. That's why business model changes will become one of the essential factors for the viability of many businesses in the future.

Recognising the rapidly changing market dynamics, we decided to form a separate Digital Cluster to give sharper focus on growing digital services and building an innovation culture within the company.

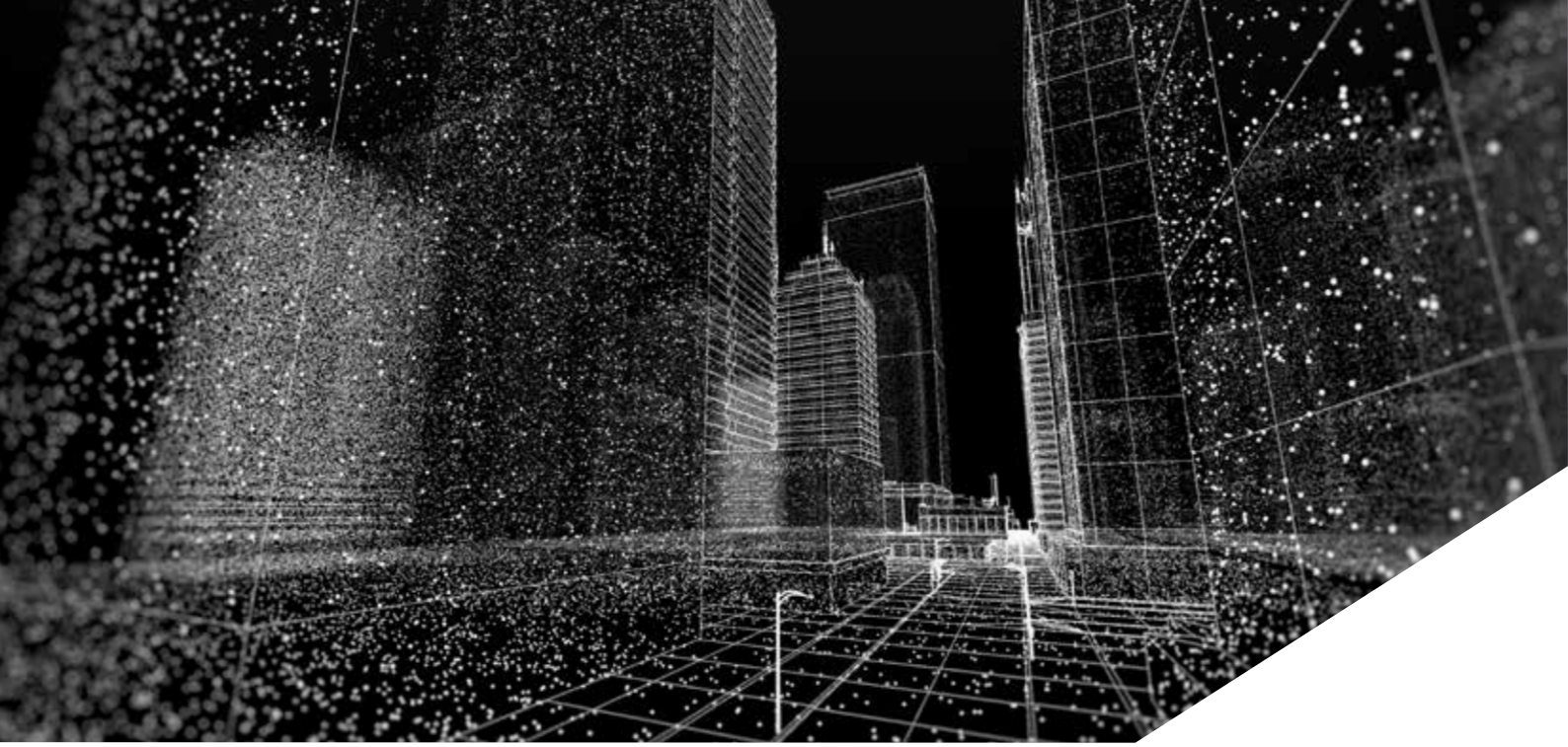
TCE has nearly six decades of experience in providing engineering and project management service to sectors like Power, Water, Hydrocarbon & Chemical, Metal & Mining, Transportation, Urban infrastructure, Buildings, Environment Management and Construction Management. The adoption of digital technologies across the asset lifecycle will bring tremendous value to the customers. Digital Cluster plans to leverage TCE's strong domain expertise in offering differentiated digital services to customers and carve out a dominant position in the market and support future-proof TCE.

Digital cluster comprises three groups - Digital and Advance Technology Business Unit, Technology Group and Corporate IT team. The Digital Cluster also manages the Accelerated Delivery Centre (ADC).

Product Engineering Services

Product Engineering incubated in 1968 has a great legacy supporting India's nuclear, space and astronomy establishments on very critical and complex machine design (one- of- its - kind) and automation projects. In the future increased privatisation of Defence, Space and Railway sector will throw open many opportunities apart from good prospects with government establishments like DRDO, ISRO, BARC, IGCAR, NPCIL. Further, the much talked about 'Make in India' initiative of the Indian government and a likely shift of manufacturing base to India will provide opportunities, especially in the areas of machine localisation.

The vision is to regain the dominant position which we once enjoyed in special purpose machine design, automation and high-end engineering analysis fields and achieve rapid growth.



Asset Digitisation Services

In digitisation field, we secured an early breakthrough and leveraged that to become a market leader in India by establishing a business model that offers high-quality service at a competitive price (utilising ADC) with a critical partnership with technology firms. With the successful implementation of initial projects, our vision is to grow in the domestic and international market and become a leading player. With the penetration of digital technologies in the construction industry, we have identified services like BIM, 4D/5D simulation, digital construction management and digital handover as growth areas. Digital Cluster closely collaborates with the Infra Cluster in developing suitable offerings and providing a complete solution to the customer.

In the area of Industry 4.0, our vision is to think and plan big, start small and proliferate. We will leverage our domain expertise across sectors and partner with leading technology firms to deliver end to end digital solutions to our customers as a 'Partner-Integrator' and in 'Digital EPC' mode. To achieve this, it is imperative to develop a robust partner ecosystem, and we are currently focusing on the same. Apart from these two offerings, we also plan to productise our own unique industry-specific O&M improvement 'Point Solutions' which can generate significant value for our clients. The plan for the current year is to develop ten such point solutions with the support from domain BUs and commercialise some of them.

Technology Organisation

TCE is a knowledge-based organisation, to stay ahead of the curve on the latest knowhows, a technology group was set up in 2014 with the mandate of promoting Technology Excellence, Delivery Excellence, Productivity improvement and Technical branding. This group has Subject Matter Experts (SMEs) assigned to fulfil the charter.

As part of internal efficiency and productivity improvement initiatives, technology group actively supports our automation and productisation programs. We have developed an extensive knowledge depository, and the technology team continuously maintains the knowledge management systems. To remain ahead of the competition, the technology group continues to develop strategies for introducing new service and product offerings to customers by continuously tracking the global megatrends. Opportunities in the latest technology areas are explored and developed by way of strategic academic and industrial collaborations with partners.

The group also promotes a culture of innovation by developing and implementing a formal innovation framework, incubating and commercialising new innovative technology solutions, promoting patenting, strengthening technical branding and advocacy and more extensive Academia and Industry collaboration apart from other established activities.

The digital cluster continues to lay a strong foundation for digital practice and contributes to the rapid growth of the digital business.

Author

S Vidyanand - President Digital Cluster
Tata Consulting Engineers Limited (TCE)

Construction is not only the least digitised industry but also sees almost negligible R&D spending, less than 1% of the revenues, versus 3.5% to 4.5% for the auto and aerospace sectors. Productivity in the construction industry has grown a meagre 6% since 1945 compared to a manifold in agriculture or manufacturing.

Well executed construction and handover are also the gateways to optimised operations during the lifetime of assets. These are now efficiently enabled by digitisation. A Strong Digital Asset Lifecycle Management requires the creation of digitised asset data right from conceptualisation, planning, engineering and construction phase of an asset and seamless handover from construction to operations and maintenance.

Lack of Digitalisation in Construction Industry

There is significant additional value to be made by increasing digitisation in the Construction industry.

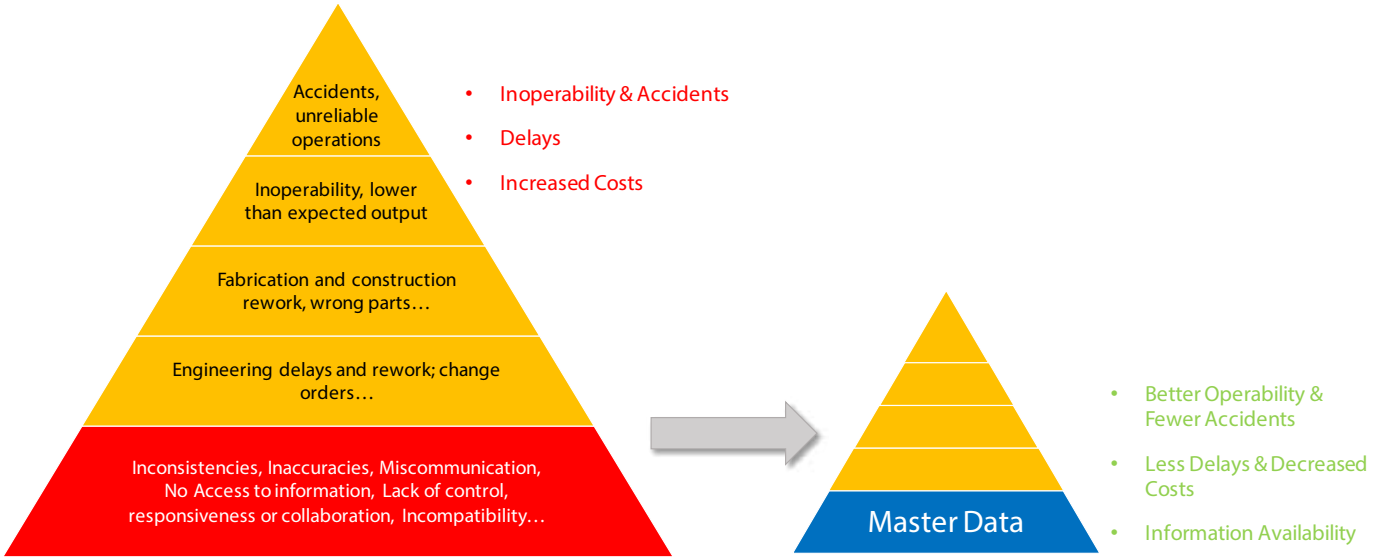
Assets represent such a significant financial investment for an enterprise, knowing what they are, where they are, their condition and performance are essential from both a financial and governance perspective.

Assets play a key role in the production of products, or the delivery of services; hence their performance has a direct and significant impact on the costs and quality of product and the services delivered.

An Asset in the Digital world is represented by various attributes, performance characteristics, and relationship with other assets. This representation of the asset in Digital World is called Master Data of Asset. Reliable, accurate Asset Master Data is key for safer, efficient, and reliable operation of the asset.

In enterprises, Asset Master Data is spread across applications, systems, and departments in various forms and formats and maintained by various stakeholders of the asset. There is a high likelihood that asset data can easily become fragmented, duplicated, and most commonly out of date. When this occurs, correct business and operations decisions are taken based on inaccurate data. Digitisation of Asset Data and management of Digital Asset Data using one centralised application is the key step for accurate business decisions and safer and reliable operation of assets. Integrity, consistency, and comprehensiveness of Asset Master Data are the foundations to strong Digital Asset Management.

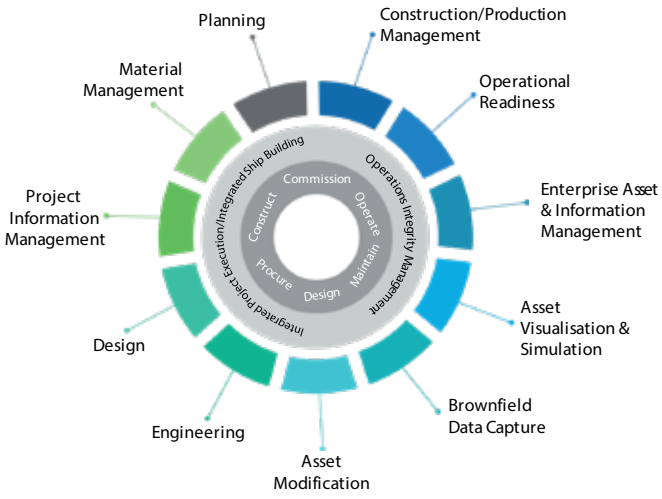
Digital Asset Management directly addresses the root causes that drive increased cost, scedule impacts, potential in-operabilities and accidents



Digital Asset Management addresses challenges of asset management by making information easier to access, reliable, single version of the truth and usable by the broader organisation for making business and operational decisions. Enterprises are also pursuing Digital Asset Management to streamline operational processes.

What is Asset Management?

Systematic process of deploying, operating, maintaining, upgrading and disposing assets cost-effectively.



Implementation of Digital Asset Management

Typical steps to implement Digital Asset Management are:

- **Digitisation of Physical Asset:** Existing physical asset can be digitised using 3D laser scanning (this is just enough for visualisation) and converting to intelligent 3D models (for further engineering and intelligent linking to other assets). For green field plant or facilities, 3D engineering is the best way to create digitise asset.
- **Meta Data Association:** Various asset attributes which characterised the asset should be associated with digitised physical asset.
- **Asset Hierarchy:** Digitised Asset should be interlinked in a manner so as to create hierarchical tree like structure to represent the entire facility or plant.
- **Document Association:** Documents like P&ID, Plans, Sections & Elevations, Operation Manuals, Characteristics Curves, etc. should be associated with digitised asset.
- **Integration with Enterprise systems:** Finally Digital Asset Management should be linked an enterprise system viz. ERP, Building and Plant Maintenance systems to link financial, procurement, maintenance data of digitised asset.
- **MIS and Dashboards:** Good Digital Asset Management system should be able to provide comprehensive reports and dashboard regarding the assets. The reports and dashboard should be configured based on the business needs and for typical use cases of the system.

If implemented well, Digital Asset Management can lead to following benefits:

1. Seamless communication within the organisation,

Typical Digital Asset Management System Landscape

- **Asset register or inventory**
- **Topographic data on the assets, and quantities derived**
- **Asset condition data**
- **Asset capability information**
- **Asset performance service levels, failure rates, etc.**
- **Life expectancy data of equipment and materials**
- **Descriptions of potential interventions for maintenance or renewal, and their costs**
- **Contextual data, such as climate and surroundings**
- **Asset history such as maintenance alternations, renewals and replacements and events such as accidents or other incidents**

2. Single version of truth,
3. Streamlined business processes,
4. Better Project Management,
5. Knowledge Management and reusability,
6. Safer and Reliable Operations, and
7. Foundation for Digital Twin

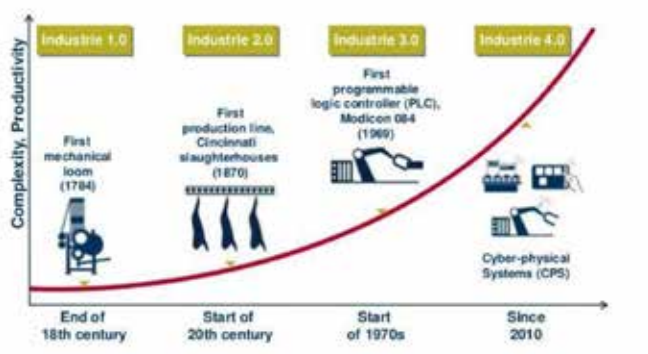
Industry 4.0 and IIoT

With availability of persuasive communication network and cost of computing coming down drastically, cloud computing is becoming the de facto standard. Boundaries between information technology and operation technologies are diminishing leading to evolution of Industry 4.0 and Industrial Internet of Things (IIoT).

The Industrial Internet of Things opens plenty of opportunities in automation, optimization, intelligent manufacturing and smart industry, asset management and industrial control.

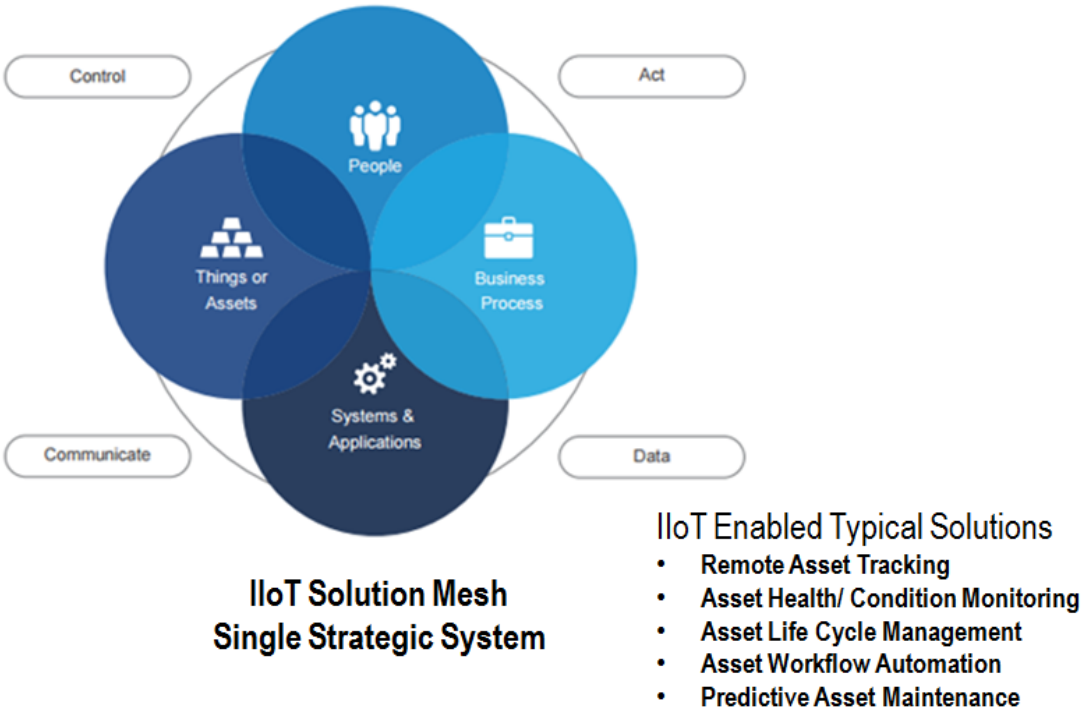
It plays a key role in the overall digital transformation towards a digital supply chain in many parts and value chain components of the large ecosystem. With more and more data and real time analytics, IIOT paves the way for faster and better decision making.

Asset Condition Monitoring, Asset Performance Management, Predictive Asset Maintenance, and Environment Monitoring are some typical applications of Industrial Internet of Things.



Evolution of Industry 4.0

Using machine learning, the IIoT data can be used for training algorithms to spot potential patterns that would indicate a future failure. Such insightful information would previously take weeks to discover and rely on the availability of skilled professionals at every site. The use of real-time data can help those with the right skills monitor more machines in multiple places, thus making decisions on maintenance faster, more reliable, and appropriate. In turn, the efficiency of operations can be speeded up considerably.



Digital Asset Management and IIoT

Digital Twin

A Digital Asset Management system integrated with IIoT platform enables virtual representation of the Actual Physical asset along with its functioning. Such digital representation of asset is identical to physical asset in its characteristics and functioning and is called as 'Digital Twin'. Digital Twin are used to simulate a real life scenario and based on the results, critical business decision can be taken.

Industry Ecosystem

Asset is created when it is conceptualised, however, due to lack of standards, varied contracting conditions, digital capabilities of various project stakeholders, the asset creation process employs limited digitalisation as of now. The Owner of an Asset should insist on a digital way of creation of Asset from Concept to Commissioning and later on in the Operation, Maintenance, and modifications stages using 3D Engineering tools and proper project governance.

The Owner should align contract conditions to insist use of modern 3D tools during engineering and construction stage from all relevant project stakeholders and finally the As-Built digital handover of a project. Digital handover leads way to manage entire an asset digitally thought the life cycle of the asset.

Author

Pravinchandra R Shahu - Head DATBU
Tata Consulting Engineers Limited (TCE)

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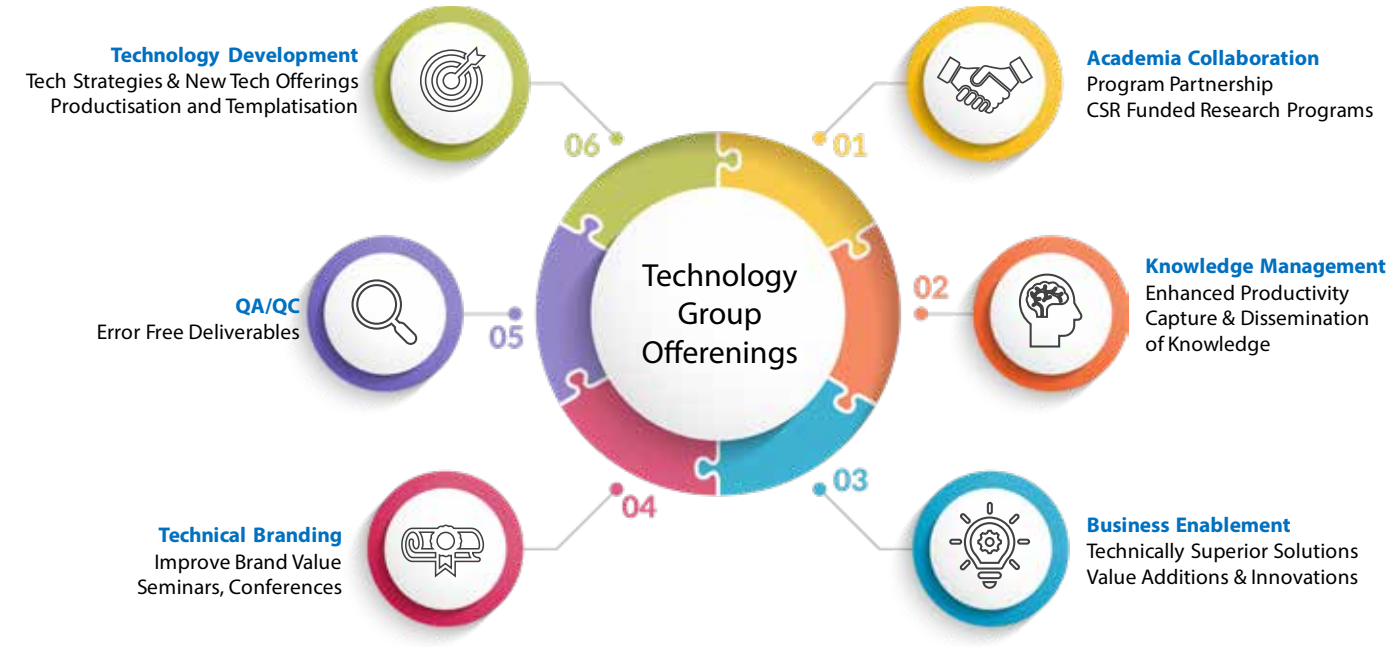
CONTINUOUSLY CREATING KNOWLEDGE

TCE follows a structured approach to achieve technical excellence. New technology development is a continuous process, and it helps TCE expand innovative service offerings to customers. In a way, the technology team is a dedicated taskforce to align the services and products offerings to customers by using the latest and emerging technologies.

The technology group is actively involved in positioning TCE as a technology thought leader. The branding efforts include Publishing technical articles, Publishing whitepapers, Presenting in seminars, Becoming members of statutory bodies, Collaborate with Academia on research



TCE has to its credit no. of articles published in various National and International Journals of repute. Conducting webinars on topics of interest to the industry as well as Academia has been a regular ongoing initiative. The prevailing circumstances due to the pandemic has been a significant boost to webinars, making it a very popular way of communication with the Industry as well as Academia. TCE has been part of several Industrial as well as Academic webinars.

Published Whitepapers

1. **Respect to our Nation Builders – A Comprehensive Solution to the challenges faced by Guest Workers in India**
   This article presents an overview of the condition of the guest workers in India's construction industry highlighting the challenges faced due to the informal and unorganised registration status of these people, the poor living, social and health conditions at worksites. The paper also summarises the proposed recommendations on mitigation measures, including the use of digital interventions.

2. **COVID and Crude - Compounding Challenges. Positive Impact on Nigerian Fertilizer Industry**
   Nigeria is the gas giant of Africa and certainly a leading crude oil producer in the World. With an estimated gas reserve of about 200 tscf (rank#1 in Africa) and production of slightly more than 8 bscf/day, its the largest gas producer in Africa. However, gas-based economy in Nigeria is yet to be fully realized. With its proximity to sizable markets in North America and Latin America, and its rich gas reserves, Nigeria is a dream destination for Nitrogen based fertilizer manufacturing.
   This study explores the impact of current global uncertainties of COVID19, turbulent hydrocarbon sector and overall health of local economy on the budding Nigerian fertilizer industry.

3. **Safer Restart of Process Plant - A Perspective**
   During the first week of May 2020, after the partial lifting of lockdown, two major accidents occurred while restarting the two process plants – a polymer plant and, a paper plant. These accidents highlight the importance of safe restarting procedures after the plants have been shut down for long periods of time. A comprehensive, plant-specific restart procedure must be developed and approved by competent authorities prior to taking up the restart activity.

4. **COVID 19 - Impact on Indian Power Sector - A Perspective**
   COVID19 Impact on Indian Power Sector is a viewpoint that looks at what happens to the strategic goals and action plans in the current highly uncertain COVID19 scenario.

5. **COVID19 - Strategic Risk Management under uncertainty**
   Risk managers prepare their organizations for all types of risks, but very few would have imagined that they would one day be faced with a global pandemic that could strike swiftly with such a broad impact and no predictable end date.

6. **Overcoming Post COVID19 Challenges through Design Alternatives - The Construction Industry**
   The construction industry currently has a high level of human interaction and a low level of digitalisation. Covid19 norms have further impaired the sector with additional challenges of health, safety and physical distancing. This article attempts to describe how design alternatives can help enhance site productivity and project progress in the 'new-normal' work situation through technology infusion.

Technical Publications

1. **Sustainable Materials for Construction *by R L Dinesh, Published in ViewPoint - CEAI June '20***
   Cement, steel, metal, glass, chemicals, wood and other construction material are extensively used in modern-day buildings. Demand for these materials is increasing day by day, resulting in increased energy demand and carbon emissions. This article highlights some alternate/sustainable construction materials useful in the civil engineering and architecture.

2. **Use of New Age Material for Roof of Building Review of Materials and a Case Study *by Manos De, Published in ViewPoint - CEAI June '20***
   Design and selection of suitable material for roofing, the top skin of the building, is a specialised science dominated by consideration of environmental loads like wind, snow, temperature and impact loads. Failure of the roofing causes loss of functionality, building aesthetics and significant loss of value of the property. This article presents a comparative study on the aspects of design and selection of material for re-roofing application in a special area, especially at a great height.

3. **Lighting Management System by V V Barve and P V Shimpi, *Published in ViewPoint - CEAI June '20***
In India, more than 40% of the energy is consumed by Industries, of which 8-10% is for lighting purposes. The article covers the different modes of control like timer control, sensor control, group control, individual control, daylight harvesting and dimming. It also covers different types of dimming, like analogue and digital dimming. A case study of Digital Addressable Lighting Interface (DALI) for an industrial plant is also presented.

4. **Systems for ecological, sustainable, resilient and Socially responsible riverfront development by Pratima Marwah and C R Indumathi, *Published in ViewPoint - CEAI June '20***
Rivers have been the spring points for civilisations and have sustained numerous settlements - villages, towns, cities and mega-cites since human life appeared. As civilisations matured, rivers also served as a connection between the landscapes and communities. They became the means of involving people for bringing in ideas for a creative and sustainable environment-friendly form of living as per the codes that evolved. In this paper, efforts have been made to present a few riverfront development projects briefly explaining the salient features of the projects and the sustainable materials adopted.

5. **Hydrogen economy offers low-emissions fuel to combat air pollution by Dr S Sakthivel, *Published in Gas Processing & LNG, USA, July '20***
The air quality indexes (AQIs) and particulate matter (PM concentrations in many fast-developing countries and regions are climbing high levels that are considered too hazardous for public health and environment. The AQI of New Delhi, India, is recently assessed above 300 (severe) and PM2.5, PM10 concentrations also reached extremely hazardous levels. The reasons for these rising air pollution levels include wind-spread burning of agricultural waste, rising vehicular emissions and diesel generator usage etc. This article focuses on the use of hydrogen fuel as a substitute to help reduce air pollution in fast-developing regions, such as India. At present, hydrogen production systems are heavily dependent on fossil fuels. These systems must switch to renewable fuels to make hydrogen a 100% clean fuel source. Increased investments in renewable energy-based resources will improve air quality and energy security.

Webinars

1. D Geethalakshmi presented on ***E Mobility & Green Mobility*** in a virtual conference organised by The Institution of Green Engineers (IGEN) and Institution of Engineers. The global automotive industry is on the verge of disruption. There is an increased market share of electric vehicles globally in recent years due to policy support from Government authorities and commitments from the automobile industry for the development of EVs. Key technology enhancements that lead to lower battery price reduced charging time and improved driving range will contribute to an accelerated growth of Battery Electric Vehicles (BVs).

2. Business Continuity is of paramount importance at all times. Today, with the ongoing crisis, we understand this more than ever. Consulting Engineers Association of India in association with Tata Consulting Engineers presented "***Enabling Remote Working for Engineering Consulting Organizations***" by Dr Rajashekhar R Malur and Mr Pravinchandra R Shahu

3. ***Transition Pathways to a High Share of Renewables in the Indian Power Sector by 2030 organised by TERI CBS- By Rajashekhar R Malur***
Around the world, power systems have been undergoing rapid change, on the back of technological innovation and the right mix of policy interventions to drive CO2 emissions reductions, thus facilitating dialogues between the decision-makers at the country level, in stretching their institutional capabilities for going 'net zero' by 2050. TERI's aims to accelerate the zero-carbon power transition in India through deploying business voices in support of power policy reform that enables increased corporate RE procurement.

4. Electricity demand is likely to increase with the growth of BVs and thereby impacts the distribution grid. The pattern of load demand due to EVs is such that the grid is going to witness morning and evening peaks during the weekdays. Introduction of smart charging strategies assists in BV charging process by avoiding simultaneous peak loads. Department of Electrical Engineering, PSG College of Engineering - Coimbatore, organised a faculty development program on the ***New Technology Developments***. Presentation on EV Grid Interface and Smart Charging was given by D Geethalakshmi

5. Plant Engineering design is a multi-disciplinary activity where engineers from multiple disciplines play an essential role to design and develop the manufacturing process using inherently safer design techniques. Plant Design engineers are responsible for various activities from conceptualising the process to carrying out the development of BFDs, PFDs and detailed P&IDs using the concepts of mass and energy balances, sizing and costing of the process equipment, evaluation and optimisation of the candidate design for manufacturing a product. Process safety is an inherent part of process design which includes personal safety, plant and equipment safety and environmental safety. Department of Chemical Engineering organised a ***Master Class on Industrial Practice of Process Engineering and HAZOP Methodology***. The Master Sessions were conducted by Atul Choudhari and Dr. S. Sakthivel.

6. Various factors are driving the future technologies like smart sensors, communication data storage, analytics & diagnostics, artificial intelligence and cybersecurity, which are bringing digital transformation in the process Industry.

   With various advancements in the communication sector, remote monitoring is in trend in Process & Power plants. K Jayaprakash conducted a session to I&C students of Dayanand Sagar College of Engineering on the Topic "***Measurement sensor landscape and Industrial remote automation trends***". Few case studies and examples capturing the importance of these technologies in post COVID19 scenario with the concept of Remote Monitoring for Operation were presented. It was a lecture covering the ***Present and Future Developments in Sensor Technology used in Process/Power plants along with Digital Technology Implementation and Benefits.***

4th edition of CII National Energy Efficiency Circle Competition in June '20

CII, BEE and UNIDO organised 4th edition of CII National Energy Efficiency Circle Competition in June 2020 through Virtual Platform. The theme for the 4th edition was "Compete, Innovate and Rebound to Sustain". The competition brings together best in class energy managers of the country to compete and share best practices from their respective organisations. This event involved 400+ participants; 100+ organisations; 160+ Technical Case Study were presented

Some of the participating sectors included Refinery, Auto & Ancillary, Food, Chemical, Pharma, Agro, Metals, Power Plants, ESCO, Cement, Glass. TCE's subject matter expert Mr Bharat Yadav was on the Jury Panels for the fourth time in a row.

Advocacy and Associations

Knowledge gained by industry practices becomes a valuable input to the development of Standards and Codes. Bureau of Indian Standards (BIS) is a vital body which develops design standards. 58 TCE Engineers are on various BIS technical committees. They are involved in the standardisation process that includes revalidation of existing standards every five years, development of New Standards and adoption of International Standards. Engineers from TCE take part in the process of drafting of the new codes and standards, review of the draft codes during circulation stage, and voting on adoption of international standards considering the applicability of the technology in Indian context and harmony with similar international practices. The members also take part in the code committee meetings to develop consensus on the draft codes, discuss the current industrial practices and the relevance of the code specifications for providing a solution to business, society and government. TCE Engineers are also members of prestigious Institutions such as CEAI, CII, IEI etc.

Sustainable Campus Initiatives

The main objective of the Sustainable campus initiatives is to achieve sustainable goals in the campus. The sustainable global goals focused as part of the study are: i) Provide Affordable and Clean Energy ii) Provide Clean Water and Sanitation iii) Optimisation of energy consumption and production iv) Reduction of Carbon Emission and support on climate action.

As part of this Initiative, two feasibility studies were carried out at two campuses in India.

1. One Sustainable campus study included Green Energy Initiatives, Energy Management, Water & Waste Management and Smart Technologies.

2. The Second microgrid Implementation feasibility study at the campus explored options to:

   - Provide uninterrupted and reliable power
   - Operate on Island mode during grid disturbances
   - Reduce the consumption from the grid
   - Maximise the consumption from Solar Power
   - Offset DG operations and incur fuel savings
   - Reduce carbon footprint with less GHG emissions
   - Perform peak saving of the contracted demand.

Knowledge Sharing

Knowledge sharing is fundamental to a team's collective growth. Virtual platforms not only have become essential means of working in the current circumstances but also offer excellent connectivity to many people at the same time becoming a platform to learn and share. Virtual Technology lecture series was introduced as a part of the future fit sessions to address technical training needs and to enhance the learnings within the organisation. Domain experts conducted the sessions on a wide range of trending

and interesting topics. Since lockdown, 15 such sessions were conducted with unique attendance of 145+ participants.

P R I D E- Project Innovations In Design Engineering

TCE has executed projects in almost all industrial sectors and has built various state of the art plants and facilities demonstrating its rich experience and unique capabilities. All projects follow best in class engineering practices leading to many 'First of its Kind' applications. The PRIDE poster session allows showcasing and sharing of achievements in building value to our customers, with our TCE colleagues and help create a sense of pride at being part of such a unique team.

At TCE, the customer is at the centre of what we do. We understand that customer value is dependent on three factors – Quality, Cost and Timelines. We take pride in what we deliver and strive to exceed customer goals.

The poster sessions aim to meet the following objectives:

1. Highlight the value additions aligned to Customer Goals
2. Create a vibrant and collaborative environment that thrives on creativity, conceptualisation, value engineering and optimal design & engineering.
3. Share the best engineering practices, expertise and strengths.
4. Recognise projects and projects teams on
   - Customer value through service quality, schedule adherence and cost reduction
   - Customer feedback and customer testimonials
   - Unique and innovative features, First of its kind (in India/world) design/application
   - Recognitions/Laurels earned in the form of awards, letters of appreciation etc.

The first virtual knowledge-sharing e-Pride session was conducted during the lockdown, and we look forward to continuing such sessions in the future.

Sustainability

Tata Sustainability Month is celebrated every year in the month of June. The theme this year was centred on 'Biodiversity' to help bring focus on a concern that is both urgent and existential and to highlight the interdependence of humans and the webs of life, in which they exist.

Given the current challenges and prevailing social distancing norms because of the pandemic, digital platforms were leveraged to organise various engagement activities and interactive sessions to trigger conversations on the environment and reiterate the urgent need to enable a sustainable tomorrow.

Renovation of TMTC Pune Campus by Ecofirst/TCE was selected for showcasing on an "interactive map" and as part of a "coffee table book" - TSM 2020 campaign.

Value Engineering & Innovation

Value Additions enhance a product or service before offering to customers. In TCE way of working, Value Addition is a critical part of the project solution. Value additions aim to improve the design, enhance safety, save CAPEX/OPEX, reduce the period of construction and to improve constructability, aesthetics, environmental compliances, among others.

Value engineering workshops conducted during the project execution for the critical design components.

Value engineering is carried out at the early design stage to capture the largest possible impact with the minimum disruption in the value creation process.

Industry Interaction

Tata Consulting Engineers (TCE) gave a presentation to Central Water Commission (CWC) with regard to its activities in water sector and briefed them about our involvement in studies and engineering of Water Resources Projects, Inter basin transfer of water, Irrigation, Flood management, River development & rejuvenation and construction of large tunnels for water transfer. Some of the recent projects of national importance are:

- Blue Consultancy for Flood management and Inland Water ways for Amaravathi Capital City of AP
- Project Management Consultancy for National Mission for Clean Ganga-Namami Gange project across five states
- Project Management Consultancy for Municipal Corporation of Greater Mumbai for many large tunnels ranging in size from 2.2 m to 4.0 m for transfer of water.

TCE's Power Business Team briefed about our involvement in all types of projects such as Run-of-River Projects, Dam Toe, Canal Drop, Pumped Storage, Rehabilitation/RMU totalling more than 21 GW of installed capacity worldwide. TCE is one of the few consultants empanelled with CERC in India and are involved in several landmark projects in India and abroad. A few are as under:

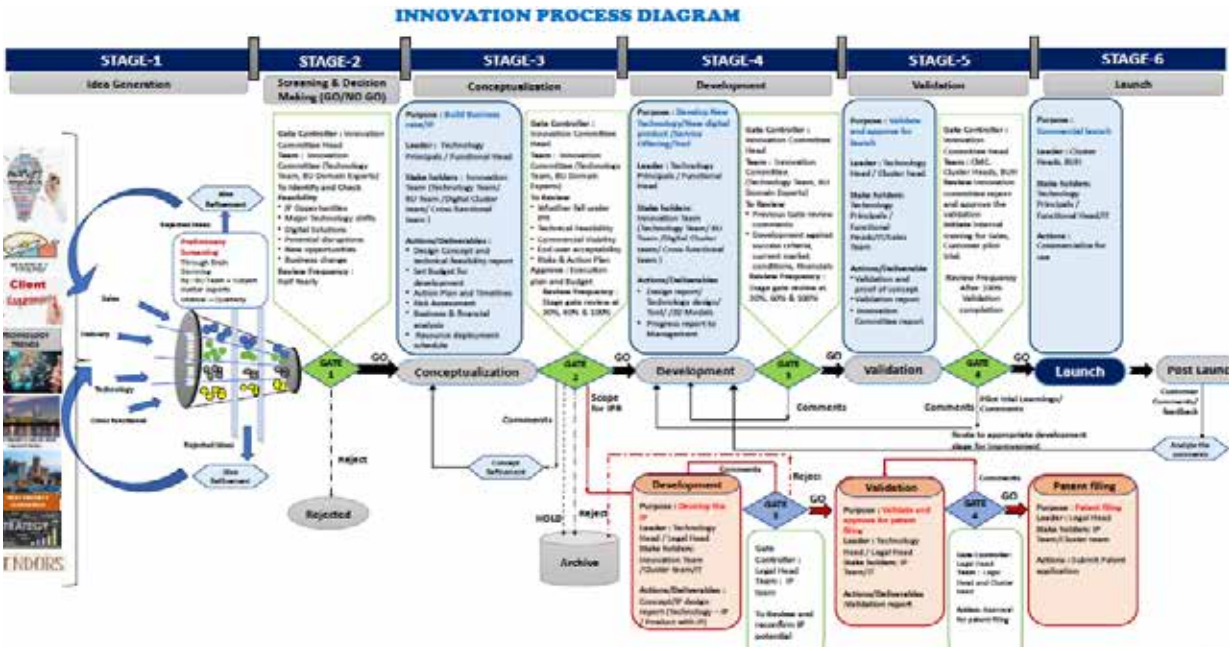
- Pinnapuram PSP*(1680 MW) – Owner's Engineer for one of the World's largest Integrated Renewable Energy with Storage Project (IRESP)
- Ghatghar PSP (250 MW) – First time adoption of Roller Compacted Concrete (RCC) technology and Stepped Spillway for a high dam in India
- Shrinagar HEP (330 MW) – Concept to Commissioning services
- Select International projects –BatokaGorge HEP* (2400 MW), Ingula PSP (1332 MW), North Kariba (360 MW) &ItezhiTezhi (120 MW), Upper Karnali* (900 MW)

The presentation was made by TCE to look into the possibility of private sector working with CWC for overall water resources development in the country.

The Innovation Framework

The success of any organisation depends upon the ability to develop and launch new products & services relevant to the market on a sustainable basis. TCE's mission is "To provide Technically Excellent and Innovative Solutions for adding value for all stakeholders and operate globally as professional consulting engineers".

Innovation processes are focused towards creating and maximising value to the business, revenue generation through IP, differentiated value-added services and to create market disruption to stay ahead of the competition. The stage-gate innovation framework helps promote innovation culture in the company. The framework developed by TCE is set up with a detailed project plan and clear objectives and deliverables that are monitored and reviewed.



2020 MARCH:
THE ROLLER COASTER RIDE BEGINS!

When offices went for a lockdown, we did not know what hit us. The urgency of the immediate situation is what drove all our actions in the short term. Employee health and safety took centre-stage and continues to be the spotlight when it comes to many actions related to the workforce.

As HR when I think about the last five months, some of the thoughts that come to my mind revolve around:

1. The infinite capacity of the human mind to adapt and adopt.
2. The effortless breaking down of barriers, both at a mental and physical level that one got to see.
3. The seamless acceptance of contradictions – what was just not possible became the new way of working.
4. The ability of not only surviving the present but still daring to dream of creating a future.
5. And the mantra became to grow, grow, grow – emotionally, personally, professionally, and for the organisation.

Office space which provided an excellent platform for social interaction while serving the primary purpose of running a successful and profitable business was a piece that got abruptly removed from the equation, like the proverbial carpet being pulled from under your feet! At the same time, as the pandemic continued to rage, it was the organisation an employee looked up to - for succour, guidance and direction – the authorities, the government being entities too remote to be in the reckoning. It became amply clear that HR had to step up its game, and this is how we went about doing so at TCE.

TCE, profoundly conscious and aligned to the Tata ethos, stepped forward to assuage employee fears, educate employees and to provide support as employees themselves or their near and dear ones bore the brunt of the virus. Various communications were published on ways and means to prevent COVID infection, managing COVID symptoms, getting medical assistance, SOPs at construction sites / DCs, and work from home guidelines. Keeping health and safety aspects of employees and families in mind, we leveraged relations with health insurance agencies to offer competitive top-up health insurance plans and Corona Kavach policy.

A drive was conducted to understand employee's situations, software/hardware

requirements and immediate support were provided wherever needed in terms of shifting of desktops to homes and ensuring systems access while always keeping the customer deliverable in mind. TCE had always driven its business in a collaborative manner – face to face meetings with project teams, clients, colleagues along with business enabling functions at a close call. Employees were used to having personal interactions. Suddenly all such interactions/ meetings/ tea break conversations even Townhall and DC communications became virtual. Everyone was impacted irrespective of their roles and responsibilities.

In the past five months of working from home, TCE has undergone a transformation in the way of working, especially as the use of technology and connecting with people became seamless. Managers and Team Leads built effective ways of communicating with their team members who were spread out and, in many cases, far away in their native places.

At TCE, in several areas, HR accelerated what we were already doing. This became especially evident with respect to the digitalisation journey that TCE had already embarked upon – Virtual on Boarding, digital learning platform and all digitalised HR process be it related to training or performance management made life very simple and the transition to remote working delightfully smooth. There is an enhanced focus on the development of talent through programs related to leadership journeys – with the mode of delivery becoming virtual but equally effective.

We continue to seize opportunities to synthesise and transform. As we evolve, the need of the hour is to offer person-centric employee experiences. The workplace has moved into homes. We love the challenges we face to be able to provide rich employee experience to the millennials, to the working parents and continue to invest in technology leading to better employee engagement. We want to listen deeply to our employees.

HR is playing a significant role in driving innovation as a culture, thereby helping business offer differentiated solutions to win at the market place. In tandem with the business, we move towards being the First Movers and spot opportunities.

It would suffice to say that the hybrid model of Working From Home and from offices is here to stay. This is coupled with a great appetite of employees to upskill themselves. HR at TCE is geared not to go back to normal but to define the way forward to something bigger and better than before.

Author

Kalpana Jaishankar - CHRO and Head CSR
Tata Consulting Engineers Limited (TCE)

PURPOSEFUL ENGAGEMENT

As we progressed into a WFH model to combat COVID19 pandemic, we had some more significant challenges at hand – "Need for the right business plans/models" and "Engaged employees to get through these challenging times". We knew that we needed to be prepared for a marathon, as this pandemic was not going anywhere in a hurry.

Communication - A key to Employee Engagement

We did not want our employees groping in the dark during these uncertain times, and hence we embarked on this journey of Enhanced Employee Engagement. We started by connecting with our people from the grassroots level-across BU's and locations, domestic and international -checking on their health and wellness and for better understanding of their challenges. The employees were glad and overwhelmed to be connected to the HR Leadership at the organisation and BU level through these calls, which helped keep them engaged, motivated and reassured that the organisation was with then during these unprecedented times. We built on our legacy of Care and Compassion so synonymous with a Tata company.

While being compassionate, we also focussed on sharing meaningful business updates with our people.

Business Leaders starting from the Team Leads, BU Leadership to the top leadership including our MD continued communicating with all our employees, continually updating them on the team performance, BU performance, the overall health of our business and on new strategies ensuring that our company is moving forward.

Immediately following the lockdown we held a "DC e-Townhall" across all the Delivery Centres (DCs) in April 2020 educating employees on the Do's and Don'ts wrt the pandemic and lockdown, Guidelines on Work from Home & TCE's COVID Response and BCP (Business Continuity Plans). We followed this up by conducting a Live townhall session chaired by our MD, Mr Amit Sharma, where employees from across the globe participated.

These measures certainly enhanced our employee engagement quotient, as all our employees were now fully equipped with all information related to business and TCE's future aspirations, ensuring they continue to be aligned to TCE's goals and Vision, Mission & Values. Employee Engagement Through Employee Well Being:

"Healthy Mind resides in a Healthy Body"

As the proverb suggests, we engaged our people through a series of Yoga Masterclass sessions on Breathing Techniques under Wellness HQ, placing a thrust on the mental and physical wellbeing of our people. The idea was to engage with our people, communicating the significance of healthy mind/body and support them to fight this pandemic with full strength.

Employee Engagement through Recognition:

In order to keep the employee morale high during this pandemic we launched Virtual Kudos program in April 2020 to facilitate recognition of team members using the virtual mode. Peer-to-Peer recognition program #ThankYouBuddy.

"SocialSphere', a dedicated channel on Yammer, provided the easy accessibility, fun and online platform to drive peer recognition. The program saw 139 employee recognition posts and participation of 567 employees since the launch on 22nd May 2020.

e-PRIDE Poster session, a knowledge sharing platform was held on 12th June 2020. This programme recognises best practices employed by participating teams. The session celebrated the innovation and value addition by the winning teams and saw a participation of 118 employees over MS Teams.

Rang De TCE - Art Competition

This art competition is a hunt for our in-house painting maestro. Entries were invited from employees on "Delivering Aspirations, Achieving Scale Theme" Winners were announced on JRD Tata's 116th birth anniversary on 29th July 2020. They were felicitated by our MD, Mr Amit Sharma, in an online ceremony with the participants and the Senior Leadership Team. This year we received 23 entries from across the DC's and a panel of 4 Jury members help select the winners. The Winning artworks will adorn the e-Birthday Card for the year.

Virtual Fun @ Work: Time to Unwind

Fun while Working From Home became a modified form of Fun@Work!. We created Delivery Centre wise, Virtual DC Break Out rooms to keep the Virtual Fun @ Work going. Known popularly as Gamers Gallery (Mumbai), Attaglatta (Bangalore), Chit-Chat-Play (Delhi), Power Players Café (Pune), Addabites (Kolkatta) and Jammin' Junction (Jamshedpur) these forums saw active participation from employees.

Breakout rooms our "recharge rooms" intended to act as de-stress zones helped boost employee engagement and productivity during the lockdown. It is being used to host various brain-boosting games, virtual retreats and activities such as Lumosity Combats, Bol Baby Bol, e-Tambola, eScavenger Hunt, Truth & Lie etc.

We celebrated Independence Day with a difference. The theme for our event was United Colors of India. This was a fun-filled event comprising of a quiz, Song / Dance and other performances. The event was one of a kind, and it was heartening to see the entire TCE as one family joining in for this employee engagement activity along with their family members.

With 1574 employees joining in various employee engagement activity during COVID times, this was redefined Employee Engagement at TCE.

Happiness Week:

On the journey of having more engaged and happy employees, we conducted "Happiness Week" from 24th August to 28th August 2020 wherein 800+ appreciation drops were shared on Yammer. The campaign was spread over for five days, and every day there was a unique theme for the drops. The recognition drops were uploaded on Yammer and receiver's name was tagged to the drop. It was quite satisfying to see employees appreciating one another and creating moments that mattered.

DIGITAL ONBOARDING

The nationwide lockdown due to the global pandemic led to the world doing things differently. It was evident that the old ways will not hold good and new ways of going about work is here to stay. The HR processes within Tata Consulting Engineers Limited (TCE) also went through a digital facelift to become smarter, accessible and measurable. TCE honoured all the offers rolled out which required onboarding of new hires.

The HR team quickly geared up to onboard the new hires, virtually, through the available IT Infrastructure. The first task was to connect with all the new hires and provide reassurance regarding their employment with TCE. The team then collect information on the new hires like current location, the time required for them to join, availability of laptop or desktops, internet connection and their confirmed interest to join TCE. Information captured was analysed to decide on onboarding dates and batches.

The first set of new hires were onboarded on March 24, 2020. Since then, during the lockdown period, we have welcomed more than 50 new hires in our organisation. The basic premise of the digital onboarding rests on three building blocks - feel integrated, feel equipped, feel connected, including 4 phases (Pre-joining, First Day, First Week and First Month) with specific milestones. The process ensures new hires are engaged right from the moment the offer is received.

The Pre-joining Phase

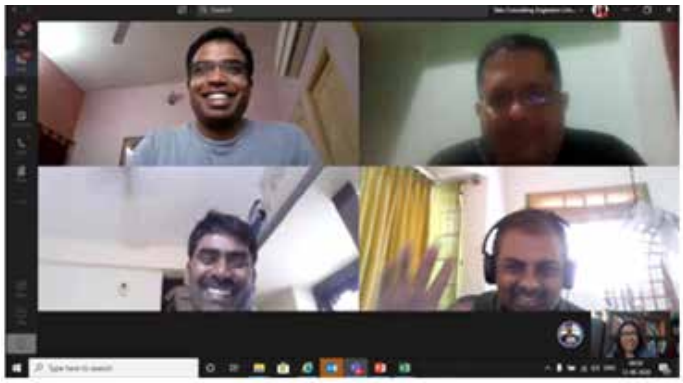
The entry point and connect for the new hire is through 'Talboard', the online portal. TalBoard is the recruitment & onboarding application, which automates the entire talent acquisition and onboarding process. The application integrates sourcing, candidate relationship management, candidate screening, interview management analytics, pre and post joining formalities, and helps manage the entire hiring and onboarding process more intuitively and efficiently.

The joining kit has now been digitised, and duly filled-in joining forms are submitted by the new hires before the date of joining in Talboard.

At this gateway, the first HR Connect between the new hire and the TCE HR takes place; this is the phase that fosters connection. Email communication is sent to the new hire two weeks before the date of joining, encapsulating information on the Induction Process, Buddy Details, Role of Buddy, Check-in Details, etc. This ensures smooth onboarding on Day 1.

The First Day Phase

The first day begins with the Welcome Note on virtual



joining, copied to the respective Business Unit and Delivery Center. This is followed by virtual interaction through MS Teams Video Call; the new hire is welcomed by the HR Team, Reporting Manager, and the Buddy.

Two days prior to the joining date, all systems of attendees are checked for a smooth welcome. On this day, virtual induction is conducted with the objective of new hire engagement and connect. The new hire is oriented to the Tata Legacy, TCE Values, Tata Code of Conduct, a brief on TCE, SMILe and Skillport, i.e. the Learning Management Systems (LMS) as an orientation to the systems and processes required to perform their duties. The new hire is made to Feel Connected to the team, including HR, Manager, Buddy, and other enabling Teams.

The First Week Phase

This phase is more like handholding the new hires to help start interactions with other members of the team. A planned interaction takes place with the Senior Team, Business Orientation, knowing the team, detailed handholding to various platforms in TCE like timesheet, attendance and the LMS.

Mandatory e-learning programs are assigned through the Learning Management System – SMILe. These are programs that orient a new joiner to the Tata Code of Conduct and TCE Way of Working. During this phase, support is provided to ensure, the new hire Feels Integrated into the system. The connect is established through MS Teams platform.

The First Month Phase

Experience entails support being provided to the new hire to Learn the Ins & Outs of the New Job. Learning is ensured through various virtual project meetings, work is allocated, roles and responsibilities are discussed, and KRAs are assigned. The new hire is oriented to submit the KRAs in the online platform 'PRISM'.

The mandatory e-learning programs are expected to be completed within 30 days of joining. We have a segment of foundation programs focusing on building an ethical business culture like Tata Code of Conduct (TCoC), Prevention of Sexual Harassment (POSH), Anti-Bribery and Anti-Corruption (ABAC) Policy, Anti-Money Laundering (AML) Policy, Gift & Hospitality (G&H) Policy and the Whistle-Blower (WB) Policy, which are mandatory for each new hire to complete and are tied-up with their confirmation assessments. These programs are delivered online through our LMS. Further, this culture is reinforced by re-orienting all employees through refresher programs, FAQs, and TCoC awareness posters on the intranet.

By the end of the First Month, the new hire is completely equipped to perform his tasks.

Tomorrow is Today, Future is Now!

The onboarding process which was initially coined as "In-Touch" has now reincarnated as "In-Touch 2.0" keeping in tandem with the digitisation journey.

- The first-ever In-Touch 2.0 Virtual Onboarding program was held in April 2020.
- All employee touchpoints from manager connect, buddy interaction to detailed orientation sessions on 15 induction modules were held live virtually.
- Senior subject matter experts connected over Microsoft Teams to orient new hires on TCE's business, systems and processes.
- InTouch 2.0 program has been further enhanced and now will be conducted online through e-learning programs. From Sept FY 21 onwards, all new hires will get inducted in TCE through e-learning programs as part of the pre and post onboarding program.
- Social learning- All new hires can interact with their fellow new hire on the collaborative platform, share insights on the sessions, and learn together.
- Real-time faculty connect- Learners can directly connect with in-house faculty to clarify doubts based on the session.

Digital Onboarding at TCE paves the path of a journey towards employee engagement at TCE!

PROMOTING A LEARNING CULTURE

At TCE, we are perpetually creating new and better ways to develop our employees and equip them with the right set of skills and mindset to fuel their career growth. We leverage multiple modalities to enable learning opportunities, including virtual learning, classroom training, webinars, instructor-led programs, books, podcasts, and curated learning journeys.

Technology Integration for Accessible Learning

In FY21, we embarked on a differentiated learning paradigm by leveraging technology to ensure that learning is not impeded in times of social distancing. The new-normal brought with it an excellent opportunity to prepare our teams to work remotely and deliver efficient results using various 3D engineering and other digital tools. This meant the need to devise a digitised learning solution to enable our employees to remotely access content from a vast array of resources under one umbrella. Thus, we launched Qlik2Learn- a specially curated remote learning platform to help our employees invest their time in learning as they work from home.

Qlik2learn provides easy-to-navigate, on-demand access to a host of resources including live learning events, e-learning programs, videos, open-source programs and blogs. Live Learning Events are hosted using Microsoft Teams, delivered by Subject Matter Experts and these Live sessions are made interactive by incorporating live Q&A sessions.

Qlik2Learn is the one-stop-shop for various learning needs including but not limited to:

- FutureFit - Technology Lecture Series, 3D Tools Training, Productivity optimisation tools etc.
- Softskills Masterkey - Leadership Skills, Managing Virtual Working and various other Soft-skills.
- WellnessHQ - Employee Wellness, Health Campaigns, Resources to manage Stress & Anxiety

Over 20 virtual training sessions have been conducted so far as part of the Technology Lecture series covering Live Learning Events on myriad topics which include Reviews using various 3D Tools, Productisation, EV, Storage systems for Refined Petroleum Products and Smart Lighting Systems. The programs have seen the participation of 1000+ employees across TCE, and more programs are slotted to be announced in the series for the next quarter.

Further, over 14 e-learning programs were provided to employees through Softskills Masterkey, focusing on managing self, maximising productivity, developing personal accountability, becoming successful collaborators, leading and managing Virtual teams and leading teams through change. Over 500 employees have developed their skills by completing various programs hosted through this initiative.

As part of WellnessHQ, various online masterclasses on Mindfulness and Physical wellbeing were conducted.

4 Mindfulness program in association with Group HR were delivered by Art of Living. Online Yoga Class and E-learning programs on managing stress were also provided to the employees.

Competency Development and Career Progression Training

At TCE, employees at all levels of our organisation are empowered to drive their individual career development and progression. This year we launched TCE's very own Technical Competency Framework & a Structured Career Framework. These frameworks will help us promote continuous development by aligning our employees' career aspirations with our organisational goals. The Technical Competency framework has been integrated with the performance management process. To equip the team leads to have effective career conversations with their team members, we partnered with an external facilitator to conduct a series of workshops.

Two instructor-led classroom sessions and six virtual programs were conducted on Building Capabilities of Team Leads on Assessing Technical Competencies and having Performance Conversations. Participants experienced a new system of immersive learning through case study reviews, group discussions, online polling, whiteboarding and engaging dialogues. A total of 153 Team Leads/BU Training Managers/the HR Team were trained on Understanding Competencies, Assessing Competencies and effectively Conducting Career Conversations. Technical Competency Feedback was embedded in FY 20 performance assessment exercise where 103 Team Leads for the first time have reviewed capabilities of 1590 employees and provided developmental feedback in the PMS exercise.

Aligning Learning Offerings with Changing Workplace Dynamics

We are cognizant of our role in helping our workforce improve their emotional and mental stamina as we navigate a course through this extraordinary global challenge presented by the COVID-19 pandemic.

We have taken a holistic approach to address the various stressors brought about in the face of isolation, balancing work commitments and other challenges that surface in the wake of the new workplace, that is, home. A number of learning interventions were designed and launched to enable our employees with the right set of skills in their arsenal to tackle these challenging circumstances.

We partnered with an external counsellor to organise a webinar, "The Stress Effect- Social Distancing", on exploring the art and science behind managing stress in times of social distancing keeping in mind the psychosocial considerations of this new working environment. The program was specially curated for the employees in the junior to middle management and saw participation from 60+ employees from various Business Units.

As we move into the next phase of recovery, we have adopted a proactive strategy to continuously support our leaders in building long-term resilience to enable a significant transformation for themselves, their team and the organisation at large. We recognise the importance of having a cerebrally agile and productive leadership team during these times and the role that wellbeing plays for the same. As such, we undertook a massive drive to take the leadership team across TCE through a virtual wellness program on Breathing Techniques in partnership with Prana Shakti. The program covered empirically tested techniques to improve sustained attention and cortisol levels.

Developing Effective Leaders

LEAP (Leadership Excellence with Awareness and Practice) is a specially curated, experiential & immersive, Leadership learning Journey, delivered in a high-impact virtual environment. The journey is spread across five months and is aimed at creating the right mindset, enhance the manager-employee relationship, build leadership skills and behaviours that ensure that individual(s), the team(s) and the organisation thrives.

The curriculum of LEAP program is highly integrated and designed to maximise linkages across the four learning tracks of Leading Self, Leading and Growing Team, Leading with Trust and Leading with Influence.

The program offers a unique blend of a high impact virtual classroom, pre-work, simulations, assignments, Peer to peer learning through e-connects, Speed Coaching sessions with a facilitator and Virtual Bite-sized e-learning modules.

The pilot batch covers 38 managers across TCE, and a series of batches are in the pipeline for the coming year.

New-age Virtual Learning Academy

In line with our commitment to provide unhindered access to comprehensive learning solutions to our employees across geographies, we recently launched our Virtual Learning Academy, SMILe-Percipio, powered by the cutting-edge learning technology platform Percipio from Skillsoft.

SMILe-Percipio provides an on-demand, seamless learning experience combining self-paced, virtual classroom and mobile learning options. With a vast plethora of smart learning features, SMILe-Percipio satisfies multiple learning modalities as learners can now choose when, where, and how to learn through curated channels, full-fledged courses, micro-learning videos books, podcasts, webinars and much more.

This advanced learning platform provides one-click access to content with over 500 pre-curated channels mapped to TCE's critical competencies along with a tailored learning experience aligned to the topics of the learner's interest. This state-of-the-art learning academy demonstrates learning impact by showcasing how learning activity supports key business objectives and quantifying program value with out-of-the-box reporting using charts and graphs.

At TCE, we provide opportunities for life-long learning and all our employees are called upon to upgrade their skills in a fast-changing world. Bringing out the best in our people is the hallmark of our development efforts across different levels through the myriad training interventions each year and this ethos will continue to propel our endeavors in the times to come.

TCEndeavour

CARE | SHARE | RESTORE

Under the CSR Brand, TCEndeavour, the company is working on five primary focus areas:

1. Sustainable Livelihood
2. Education
3. Infrastructure
4. Health and Hygiene
5. Research

A photo story of the contibutions of the last six

Water wheels support

Sustainable Livelihood

Solar support for existing water supply

Farm Ponds

Vegetable cultivation

Health & Hygiene

COVID19 Awareness

Infrastructure

Primary school renovation of Khoripada - Before

Distribution of food grains

Primary school renovation of Khoripada - After

Education

Door Step School's

Training & Awareness

Door Step School's

Career Awareness - Computer Course

Tata Volcon held at Taj Mahal Palace, Colaba

Mr Amit Sharma, MD TCE, was invited for a roundtable discussion about the Leadership Perspective on Employee Volunteering within the Tata Group.

Along with Mr Amit Sharma, the CEO's from other group companies were present. Mr Abhishek Sharma, CSR SPOC from Pune, was felicitated with the SPOC hero award for coordinating more than 50 volunteering activities during TVW12, a month long volunteering program held at the group level.

Career Awareness - Fashion Designing Course

Mr Amit Shrarma, Speaking at Tata Volcon

Career Awareness - ITI Course

Mr Abhishek Sharma receiving the SPOC Hero Award

CSR Grants for Research Programs:

As part of CSR, we have engaged with Academia in the following areas:

1. Laboratory Support for Supercritical Carbon Dioxide Thermal Cycle at Inter-disciplinary Centre for Energy Research with IISc Bangalore
2. Large Scale Grid Integration of Renewable Power with IISc Bangalore
3. Digital Twins for Mechanical Components with IIT Bombay

The CSR Team at Tata Volcon

TATA VOLUNTEERING WEEK 13

3108 VOLUNTEERING HOURS | 678 VOLUNTEERS | 51 PROGRAMS | 5450 LIVES TOUCHED | 420 UNITS OF BLOOD DONATED

Activity with Differently-abled children, Bangalore

Swatchata hi Seva, Bangalore

Blood Donation, Bangalore

Cricket Match with underprivileged school students, Bangalore

Wall of Humanity, Jamshedpur

Wall of Humanity, Jamshedpur

Blood Donation, Kolkatta

Yoga exercise with Differently abled kids, Pune

ACTIVITIES WERE CURTAILED DUE TO COVID19

Blood Donation, Mumbai

Blood Donation, Mumbai

'Nesting Campaign for birds', Mumbai

Safety Week Celebration,Construction sites, Pune

Corona Awareness & good health habits, Pune

Best out of waste, Delhi

Eye check-up, Delhi

Motivational session with Lend a Hand India, Pune

TATA CONSULTING ENGINEERS LIMITED

Engineering a Better Tomorrow Since 1962

Corporate Office
Unit No NB 1502 & SB -1501, 15th Foor, Empire Tower, Cloud City Campus, Opposite Reliable Tech Park
Thane Belapur Road Airoli, Navi Mumbai – 400 708
CIN No.: U74210MH1999PLC123010

Registered Office
Matulya Centre 'A', 1st Floor, 249 Senapati Bapat Marg
Lower Parel (West), Mumbai – 400 013

tceconnect@tce.co.in | www.tce.co.in