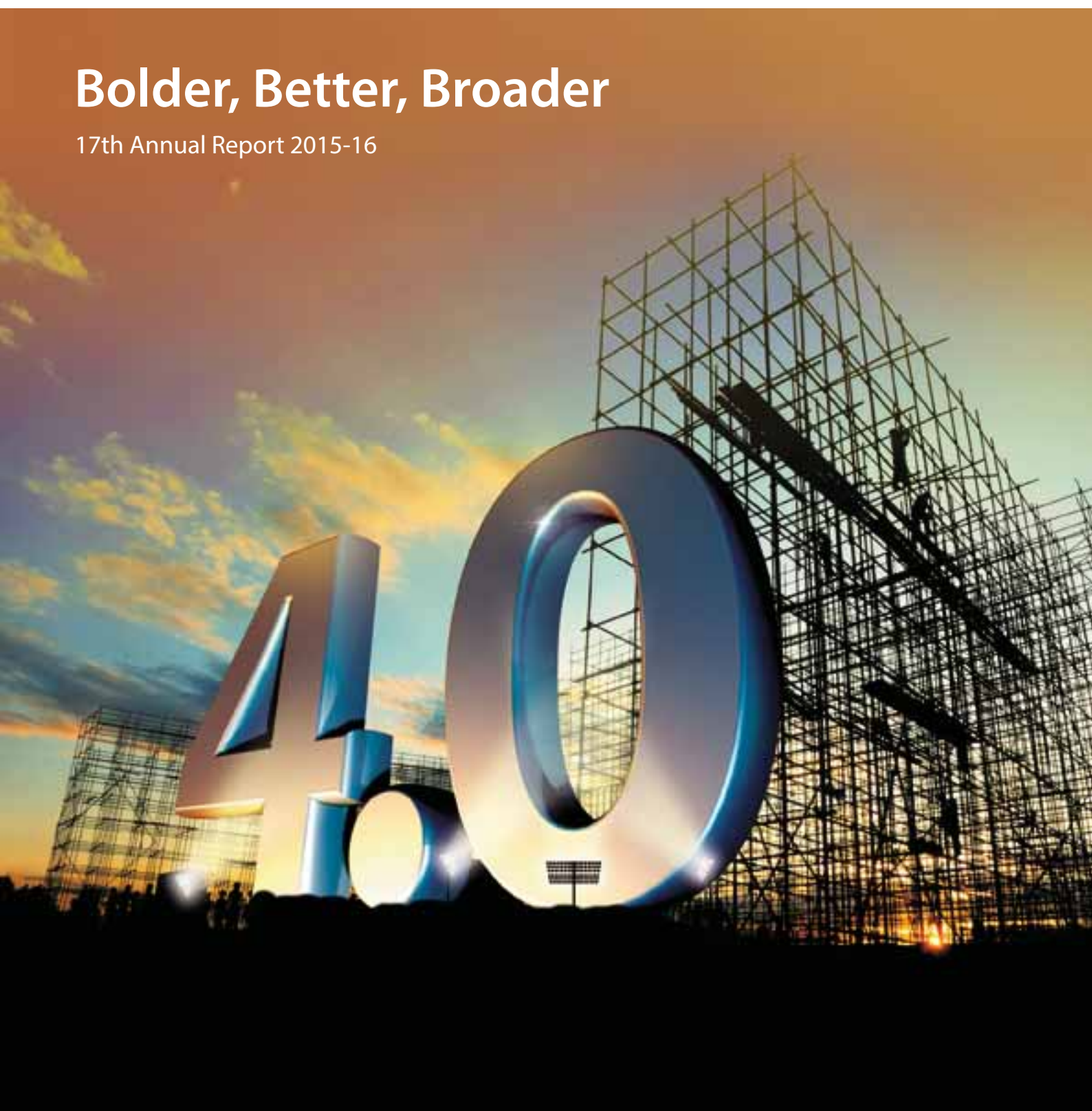




**TATA** CONSULTING ENGINEERS LIMITED

# Bolder, Better, Broader

17th Annual Report 2015-16



### Forward-looking statement

This annual report and other statements – written and oral – that we periodically make, contain forward-looking statements that set out anticipated results based on the management’s plans and assumptions. We have tried wherever possible to identify such statements by using suitable words in connection with any discussion on future performance.

We cannot guarantee that these forward looking statements will be realised, although we believe we have been prudent in our assumptions. The achievement of results is subject to risks, uncertainties and even inaccurate assumptions. Should known or unknown risks or uncertainties materialise, or should underlying assumptions prove inaccurate, actual results could vary materially from those anticipated, estimated or projected.

We undertake no obligation to publicly update any forward-looking statements, whether as a result of new information, future events or otherwise.

## Contents

- ▶ Vision, mission, core values **1**

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- Business structure **2**

---

- Corporate snapshot **4**

---

- Board of Directors **6**

---

- Executive Team **7**

---

- Management Messages **8**

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- Business Division **16**

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- Corporate Social Responsibility **52**

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## 4.0

### Bolder, Better, Broader

Every once in a while comes an upheaval when things crash and break completely; then, from the embers, rises a new era. The great financial meltdown brought the established world of business and economy crashing, shifting the power centres to the other side of the globe. Tried and tested business models stand obsolete and driven out of purpose. The dot com crashed only to emerge in an ecommerce avatar, morphing into ‘the cloud’ and ‘the internet of things’. Every aspect of the business world screams to be transformed – for getting bolder, better, broader.

The age of the bot is here. Artificial Intelligence, automation and the ‘internet of things’ mark a new industrial revolution, version 4.0. With the advent of new technology, the way people will work and be engaged is poised to change dramatically. Lines of demarcation - geographical, technical, biological and functional - are getting blurred.

Tata Consulting Engineers Ltd has attempted to stay relevant by adapting to the 4.0 era. It is about being bold enough to take the un-trodden path, to adapt new technology for better services and deliver value far broader than planned.

The theme of this report is all about embracing change to create new footprints in the engineering service industry and stay relevant in the 4.0 era.



### Vision

To be an internationally respected engineering consultant offering comprehensive solutions

### Mission

Provide technically excellent and innovative solutions, for adding value for all stakeholders, and operate globally as professional consulting engineers

### Core values

- ▶ Customer satisfaction and loyalty

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- ▶ Responsibility to society

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- ▶ Organisational and individual growth

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- ▶ Technical excellence with professional ethics

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- ▶ Employee dignity and self respect

## BUSINESS STRUCTURE

### BUSINESS VERTICALS

- Infrastructure
- Built Environment
  - Water, Waste Management & Environment
  - Transport
- Energy
- Thermal, Renewable, Nuclear
- Process
- Steel Metal Mining
  - Chemical

### HORIZONTAL SERVICES

- Information Technology & Advanced Technology
- Project & Construction Management
- Design & Engineering

### CORPORATE SERVICES

- Finance
- Legal & Secretarial
- Corporate HR
- Technology
- Business Excellence
- Risk & Compliance
- Corporate Communications & CSR
- Administration
- Safety

## SERVICES

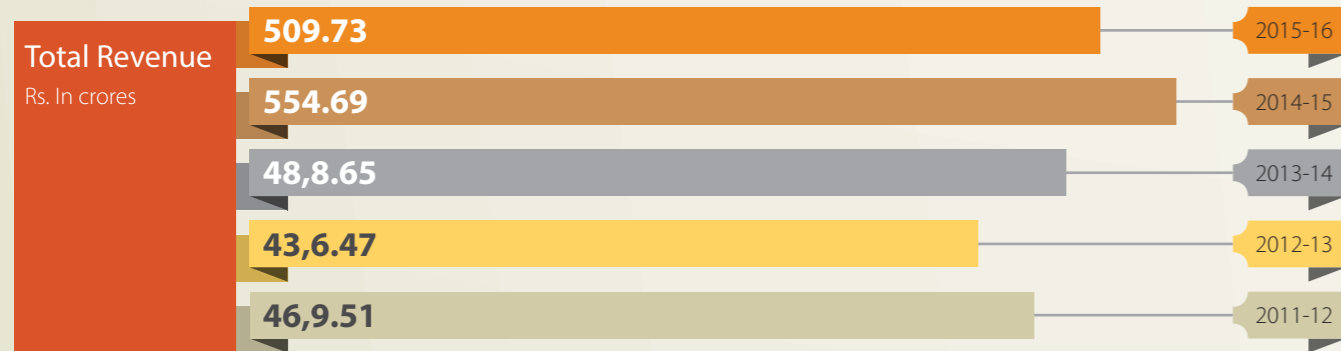
- |                                 |   |
|---------------------------------|---|
| Design engineering              | <ul style="list-style-type: none"> <li>▶ Feasibility studies, Pre-project reports and technical studies</li> <li>▶ Architecture &amp; Master Planning</li> <li>▶ Layout &amp; Transportation Planning</li> <li>▶ Electrical, MEP and Instrumentation</li> <li>▶ Environment and Air Quality Control Services</li> <li>▶ Design &amp; Detailed engineering</li> <li>▶ Utilities &amp; Shared Services</li> <li>▶ Environment impact assessment</li> <li>▶ Sustainability and green technology solutions</li> </ul> |
| Project management              | <ul style="list-style-type: none"> <li>▶ EPCM services, Procurement management, Quality inspection</li> <li>▶ Engineering Program Management and Planning</li> <li>▶ Project management services</li> <li>▶ Quality, Inspection &amp; Equipment management</li> <li>▶ Commissioning support</li> </ul>  |
| Procurement management services | <ul style="list-style-type: none"> <li>▶ Procurement Assistance</li> <li>▶ Quality, Inspection &amp; Equipment management</li> <li>▶ Inquiry/Tender Preparation and Award</li> <li>▶ Procurement Management Services</li> </ul>   |
| PMC                             | <ul style="list-style-type: none"> <li>▶ Project Supervision, Construction project management and commissioning, Safety management</li> </ul>   |
| Advanced Technologies           | <ul style="list-style-type: none"> <li>▶ 3PLM services - Project, Plant &amp; Product Life-cycle Management</li> </ul>  |
| Digital Engineering             | <ul style="list-style-type: none"> <li>▶ Engineering Outsourcing - Product Engineering, Plant Engineering</li> <li>▶ Manufacturing Engineering - Plant Automation &amp; Manufacturing Process Design</li> <li>▶ Digital 3D/4D/5D Design &amp; engineering services</li> <li>▶ BIM, Constructability Analysis and Site Optimisation</li> <li>▶ Asset Lifecycle Management Solution</li> <li>▶ Engineering Simulation and Validation Services</li> </ul>  |

Corporate Snapshot

## Bolder, Better, Broader

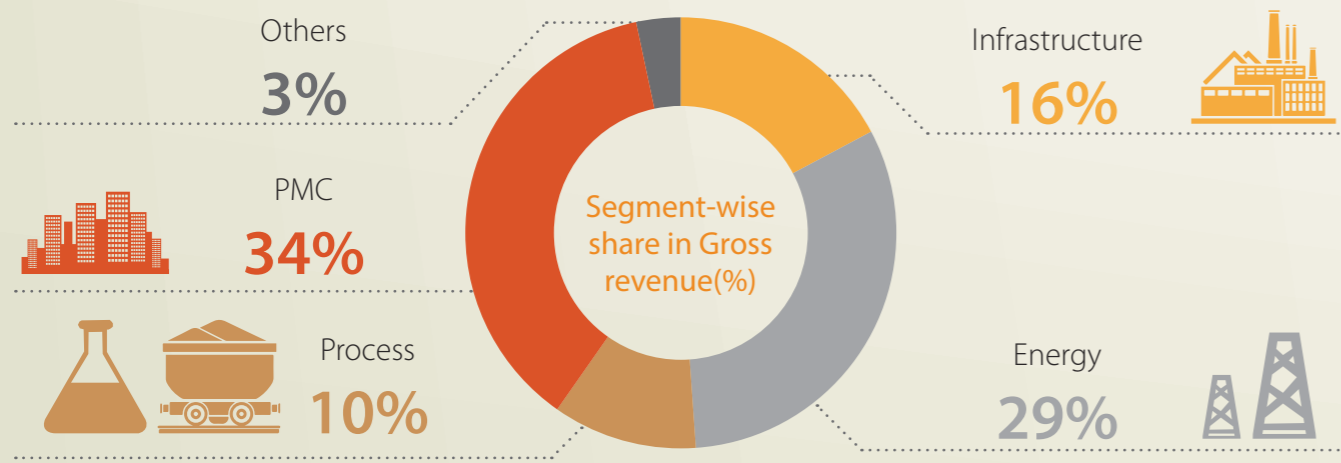
Tata Consulting Engineers has grown from a single sector company to a multi-sector, multi-disciplinary service provider. Through its 62 years of operation, the Company has stayed resilient through cyclical peaks and troughs in the business, over the decades. This was possible on account of the Company's technological inner core and value systems. With every challenge faced, the Company has bounced back, bolder, better and to provide bigger value to customers.

### Turnover



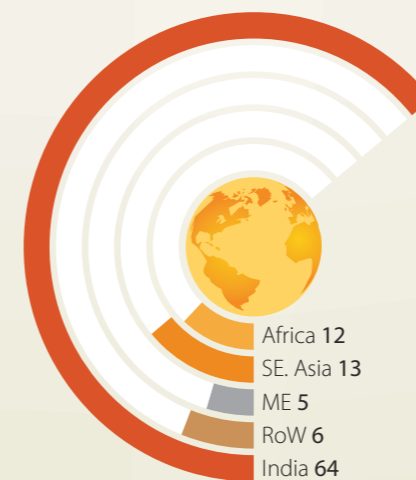
Country-wise projects undertaken (2015-16)

- |               |              |                 |                  |                  |                     |                 |
|---------------|--------------|-----------------|------------------|------------------|---------------------|-----------------|
| 1. Australia  | 6. Ethiopia  | 11. Malaysia    | 16. Oman         | 21. Singapore    | 26. Uganda          | 31. Myanmar     |
| 2. Bangladesh | 7. Finland   | 12. Mauritius   | 17. Portugal     | 22. South Africa | 27. United Kingdom  | 32. Philippines |
| 3. Benin      | 8. Indonesia | 13. Nepal       | 18. Qatar        | 23. South Korea  | 28. USA             |                 |
| 4. Botswana   | 9. Kenya     | 14. Netherlands | 19. Saudi Arabia | 24. Switzerland  | 29. Utd. Arab Emir. |                 |
| 5. China      | 10. Kuwait   | 15. Nigeria     | 20. Senegal      | 25. Turkey       | 30. Zambia          |                 |



30 billion USD (2015-16) TPV\*  
\*TPV - Total Projects Value

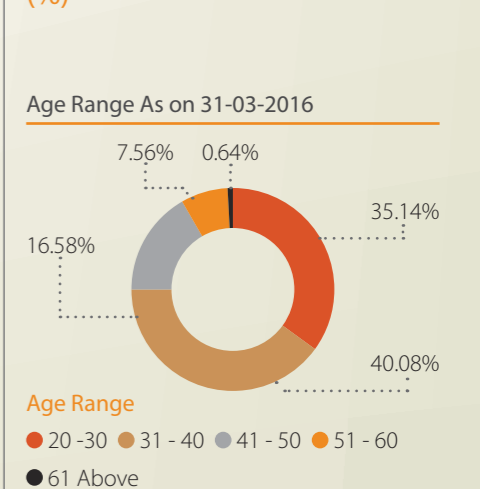
### Region-wise share in revenue (%)



### Employee Demographics (%)

Segment	Employee Demographics (%)	
	Female	Male
Process	17	83
Infrastructure	23	77
Energy	17	83
Construction	1	99
Others(Corporate,etc.)	25	75

### Age diversity profile (%)



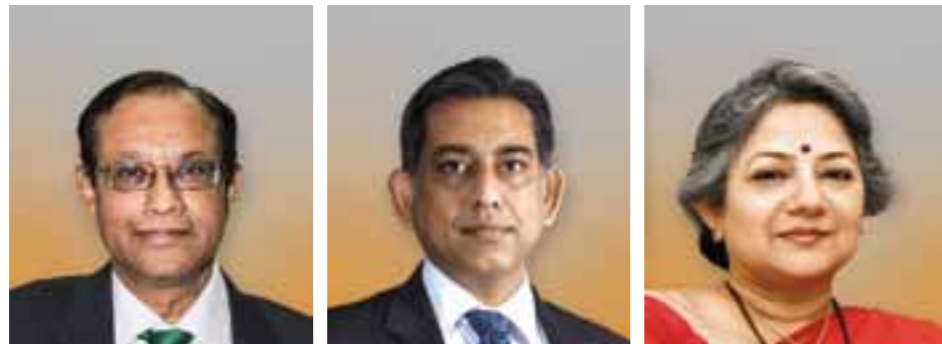
## BOARD OF DIRECTORS



**S Padmanabhan**  
Chairman

**A K Vora**  
Director

**Neera Saggi**  
Independent Director



**Prashant Kumar Ghose**  
Director

**Amit Sharma**  
Managing Director

**Hema Ravichander**  
Director

Mr Prasad Menon, retired as Chairman w.e.f Jan 2016 & Mr J P Haran, retired as MD w.e.f 24 Sept 2015.

### CSR Committee

Neera Saggi (Chairman), A K Vora, S Padmanabhan, Amit Sharma

### Subsidiaries

#### Ecofirst Services Limited

Board of Directors

S Padmanabhan, Chairman

Amit Sharma, Director

Risheshwar Prasad, Additional Director

#### Executive Management



**Chitranjan Kaushik**  
Chief Operating Officer

## EXECUTIVE TEAM



**Amit Sharma**  
Managing Director

**Sachin Dewasthalee**  
Chief Financial Officer

**Sachin Mishra**  
Legal & Company Secretary

**Kalpana Jaishankar**  
Human Resources

**Mahesh Marve**  
Chief Technology Officer



**Shrikant Chandratreya**  
Business Excellence

**K Ramesh**  
Project Management  
Services

**Vidyanand S**  
Energy

**Pravinchandra Shahu**  
Information Technology &  
Advanced Technologies

**Dr. Tapan Choudhury**  
Steel Metals & Mining



**Manoj Kumar**  
Chemical

**MV Soman**  
Corporate Talent Head

**Vikram Bapat**  
Infrastructure

**Pradeep Dhal**  
International Marketing  
Group(MEA)

**Rajat Kaushal**  
International Marketing  
Group(RoW)



## Dear Stakeholders,

The year 2015-16 was a year that heralded change from many fronts for Tata Consulting Engineers (TCE) - on the leadership front and in terms of preparedness to the changing scenarios in the industry. Mr. Prasad Menon retired early 2016 after leading TCE as the Chairman from Feb 2011 to Jan 2016. His tenure as chairman was momentous and has set the direction for the future of TCE. On behalf of TCE, I would like to thank him for his tremendous contribution. I would like to thank Mr. J P Haran, who retired in Sept 2015 after serving the Company for about 42 years and making a significant contribution to TCE. I convey my best wishes to Mr. Amit Sharma, the new Managing Director, in leading TCE through a changing industry landscape.

### Readiness for Industry 4.0

The most recent years are witnessing a spectrum of changes in the design and engineering consultancy world-wide. This is also reflected in the Architectural Engineering and Construction Management space, driving the need to adopt digital technologies to deliver value to customers. Concepts such as modularisation and standardisation are now leading the design and engineering consultancy towards extremely short project cycles and market agility. State-of-the-art engineering design tools



As a knowledge based business, it is pertinent for TCE to strengthen systems to protect intellectual property rights, both for TCE and its customers. This effort has won the trust and faith of TCE's customers and paves the way for increased participation in a collaborative, global environment.



are required to infuse high levels of predictability, optimise costs, deliver value engineering, cut short project cycles and manage asset life cycle. Simulations, resource planning and 4D enabled construction scenario planning, are the mainstay for value creation for global customers today.

Tata Consulting Engineers took several measures to differentiate itself as a state-of-the-art, integrated, engineering solutions provider. The Company's focus in 2015-16 was in the areas of Technology, People and Markets. The investment in new technologies such as 3D-5D suites began in early 2014 and TCE has since, invested to the tune of H 32 crores to upgrade to high-end digital tools. Going forward, the Company will continue to build capabilities in 4.0 technologies for delivering high value to its customers. Providing engineering services on a digital platform using 3D tools, virtual simulation of engineering design and construction planning, reducing the errors and project commissioning time. Digital tools combined with core engineering and value engineering solutions are the key differentiators that are shaping the engineering consulting practice. TCE is well on this journey and will continue on this road.

The adaptation of digital suites has enabled the Company to ramp up its service strategy to package highly customised, client-centric delivery models. The focus on people development was marked by the skilling of a large majority of the workforce to adopt new engineering design tools. The multi-disciplinary pool of fresh graduate engineers was doubled last year and readied to deliver solutions on digital engineering platforms. The Company established relationships with marquee, international clients to offer integrated solutions that encompass various engineering specialties in key segments.

The adaptation of technology in engineering consulting has enabled a

great deal of collaboration among various entities in the value chain. TCE established several partnerships with global EPC companies to offer core engineering solutions. TCE also set up exclusive delivery centres to offer customised services to multi-national clients. With the success of such partnerships in the past year, TCE will continue to drive this strategy with a focused, market-specific approach.

Complementing the technology and people alignment to industry requirements, TCE also streamlined its business processes in line with global industry practices. Several enterprise automation systems have been put in place to bring about operational efficiencies.

### Business Responsibility & Governance

TCE strengthened its governance mechanisms, and business responsibility-focused measures to drive business excellence. The Company is managed by an independent board at the apex level. The risk management framework rolled out last year was further strengthened and driven with increased vigor to address various risks. As a knowledge based business, it is pertinent for TCE to strengthen systems to protect intellectual property rights, both for TCE and its customers. This effort has won the trust and faith of TCE's customers and paves the way for increased participation in a collaborative, global environment. Exclusive engagements in partnership with global players are enabled through delivery centres established in various locations.

In line with the Tata Group fraternity's ethos of giving back to society and conducting business in a sustainable manner, TCE launched several corporate social responsibility programs in alignment with the Group's focus areas and the CSR policy. TCE's programs are centered on four core areas – Education, Infrastructure, Health & Hygiene and Sustainable Livelihood. The initiatives driven were both flagship programs of TCE and joint programs initiated by the Tata Group. The Company also participated in the Tata Group's employee volunteering initiative, with over 33% of its employees volunteering time and services.

### Performance Overview

Challenging macro economic scenarios persisted in the year 2015-16 slowing down growth considerably. The slowdown in China coupled with Oil-\$ dynamics in the Middle East were the two key macro economic trends that impacted the capital investment in plants and infrastructure projects resulting in a demand fallout. Energy, infrastructure, chemical and mining industries were impacted, which are the key areas in which TCE is present. In the domestic markets, capital expenditure, especially in the infrastructure space had not picked up. Thermal power projects have also slowed down owing to delay in feedstock linkages, especially in the coal mining sector. However, the domestic economy indicates signs of a recovery. Several planned mega projects in Water, Urban infrastructure, Smart cities, Energy, etc. are still on the fringes and yet to commence owing to prevailing liquidity crunch. The renewable energy sector in the Indian market shows promise in

2016 with capacity addition of about 70% over the previous year, with possible generation of about 3.7 GW. TCE has a strong presence in all of these sectors, i.e., urban infrastructure, public utilities, energy, including renewable energy. Other areas of infrastructure development being expansion and modernisation of Indian ports are opportunities that TCE is ready to tap. These capital expenditure projects are expected to take off and TCE's prospects look good as the economy gains steam. Order books are expected to pick up pace towards the end of 2016-17.

TCE withstood the tough economic conditions by balancing its focus on both the international and domestic markets. The strategy was to address a mix of capital expenditure projects complemented by OPEX revenue expenditure projects such as asset modernisation and upgrades, dedicated design and engineering delivery centers for international clients, outsourced engineering services for international companies and collaborations with several partners. The Company posted a gross turnover of H 509.73 Crores, in the midst of challenging macro economic conditions. The year ahead shows promise of better growth prospects on the strength of a good order book.

Going forward, TCE will take a more focused approach to sectors and the geography it operates in to leverage its inherent potential. TCE's foray in the Indian markets will be in the design, engineering, master planning and project management consultancy space across sectors such as Infrastructure, Water & Waste Management, Ports, Urban Infrastructure and Smart Cities, Energy (Thermal, Nuclear &

Renewable) segments. The Middle East regions' focus will be on the Buildings, Chemical, Metals & Mining and Power. Africa & S.E. Asia regions market strategy will be to drive opportunities in Power, Mining and Utilities. TCE will continue its collaborative efforts with large EPC players, partnerships with global engineering companies and lending agencies to increase its footprint in other regions of the world. TCE will continue to work with Tata Group companies with whom it has established long term working relationships.

Through the decades, TCE's strength was, and continues to be, the commitment and capabilities of its employees. It is the passion and talent of its workforce that has helped TCE weather several cyclical turns of the economy in the past. TCE acknowledges this and is committed to recruiting and grooming engineering talent. With a diverse, multi-disciplinary talent, TCE's potential to become an internationally renowned engineering consultant is a reality, not too far in the horizon.

On behalf of TCE, I would like to thank all our customers, partners, vendors and employees for the support and faith reposed on us all these years. We will strive to serve all our customers to enable them to achieve success.

Sincerely yours,

**S Padmanabhan**

## Dear Stakeholders,

**T**ata Consulting Engineers (TCE) as an engineering consulting company stands on the threshold of new beginnings – ‘millennial’ engineers, who have grown from the ‘internet’ are moving to the ‘internet of things’ and experienced talents of the ‘industry of things’ are entering the ‘industrial internet of things’. We are witnessing a new era of Industry 4.0 amidst times of volatility and unprecedented socio-political changes world-wide. Investment cycles across core industries are being redefined with a rebalance between capital investments (CAPEX) and operational investments (OPEX). Greenfield capital investments share and compete for the pie with operational improvements, asset sweating and asset life-cycle management. This has opened up a new set of opportunities for TCE to re-package itself and offer solutions across the spectrum by - leveraging its proven decades of experience; tapping into the agility and vibrancy of its millennial talents totally at ease with digital tools, enabled and guided by experienced mentors; providing innovative solutions to meet customer objectives.



### Gearing for Growth

The financial year, 2015-16 marked the preparedness for the next phase of our growth. With the support of our customers and perseverance of our talents, TCE has been able to enhance its international footprints significantly in the last four years.

### Markets & Business portfolio

We are inching towards having a balanced domestic and international market footprint and we are doing this by focussing on the unique requirements of the regions we are present in. In terms of our business portfolio, we are targeting a blend of capital project market, alongside annuity and repeat work on plant modernisation, tapping into the operational spend of our clients in these international markets. We also

created sector specific partnerships and consortium agreements with global EPCM peer firms to provide our clients with solutions that had the best of both worlds - international expertise, Indian ingenuity, with local talent presence - all at a price point that was competitive and within our client budgets. We plan to continue these relationships and strengthen them further.

### Delivery Mechanisms

With Industry 4.0, the advances in information technology are being embraced by traditional brick and mortar industries, manufacturing sector and for infrastructure assets. This will reshape the way new projects are executed and legacy plants and assets are upgraded. The convergence of information technology, engineering and manufacturing with the ‘Industrial Internet of things’ is redefining the traditional capital project and operational sustenance activities of our clients. The trends of big data, cyber physical systems and integrated plants are fast becoming a realistic ask.

We are working on defining our relevance and space in Industry 4.0 by helping our clients in:

- ▶ Creation of smart infrastructure, smart cities, smart grids, smart factories and smart plants
- ▶ Enabling urbanisation in a sustainable and environment friendly manner

Our focus is on domain and industry know-how, 3D-4D engineering and asset life-cycle management through analytics, system engineering, condition monitoring, plant efficiency and controls, sensor based plant/factory intelligence, proactive maintenance and as-required outage management approach.

The rules of this Industry 4.0 haven’t been written yet. We are proactively working with our customers, partners, and peers to define these rules and embrace the possibilities that Industry 4.0 will bring forward to make a better tomorrow!

### Customer Alignment

Globally, we witnessed our customers’ focus on either increased OPEX investments or in their efforts towards opening new markets, controlled or cautious CAPEX investments and a need for leveraging technology to optimise project investments. Our customers are spread across three segments, namely original equipment manufacturers (OEMs), contracting firms (EPC) and plant owners (Owners). The growth challenges they face are not pertaining to economies of scale but due to the volatility that an integrated and inter-dependent ecosystem brings in global world. As a response to the market and competitive dynamics, our clients expect consultants to offer differentiating elements on projects. These are typically (a) value engineering, (b) solutions that bring multi-sector experience and best

practices, (c) an integrated approach to balance the capex and opex cycles for an optimal ‘Total Cost of Ownership of the asset, (d) modular and standardised approach, (e) predictability in terms of project cost and timelines (f) safety from design to construction, (g) awareness and adherence to local and global codes and standards, (h) environmental and regulatory alignment.

The transforming landscape is also reshaping the client and consultant relationships based on governance, transparency, proven track record and competencies. TCE is well poised to meet these expectations. By leveraging best in class digital tools, engineering software and simulation technologies, TCE is helping its customers realise the benefits of modularisation and standardisation. TCE has adopted latest innovations in its respective business streams and enhanced customer relationships. In the last financial year TCE engaged with clients to jointly create new engagement models that blended traditional services and outcome-based value propositions. This allowed the partnership to deliver value engineering and innovative solutions that achieved cost, time and efficiency improvements; it enabled our clients to create their own assets, deliver their projects and products in an optimal and predictable manner. In order to meet our customer expectations we are putting in efforts and investments in reshaping our workforce in international



The engineering consulting industry and Tata Consulting Engineers are both part of the changing environment that is impacted by the way technology is put to use. Industry 4.0 to TCE means not only adapting to these changes but aligning its service model with new permutations and combinations to add value to customers.





exposure, training on program and project management aspects.

### Highlights of 2015-16

The year 2015-16 saw us enhance our international footprint with addition of marquee international clients in our portfolio and scale our footprints across Africa, Middle East, USA, Europe and Korea. We gained traction with our clients in new projects (CAPEX investments) as well as plant sustenance activities (OPEX investments). Despite the industry wide slowdown, approximately 40% of the turnover was from international markets. This was an outcome of a differentiated sales strategy for Middle East and Africa (MEA) and Rest of the World (RoW), each bringing in a specific strategy to bear fruit. The MEA focus was on attracting customers who were asset owners or were positioned as EPC players. The prospects in RoW were equipment manufacturers and technology providers. Our market strategy helped us withstand the pressure due to capital investment slowdown and enabled us to reduce the risk and enhance our client relationships as we came closer to their operations and working. Opening up unique service lines, TCE established dedicated delivery centres to cater to marquee international customers in several key segments. In the domestic markets, TCE took a consortium led approach to participate in the ambitious smart city projects in the country. TCE, with its extensive expertise in urban infrastructure combined with a track record in working on four smart cities, is expected to be part of several of these projects in the coming year. TCE is involved in the master plan for India's first smart port city with a unique

concept of logistics driven economic activity and settlements to support such activities.

Building a vibrant, agile workforce, TCE trained and inducted 300 graduate trainees from premier engineering institutions in the country. The shift to digital delivery mechanism and delivery using high-end digital tools is a continuous journey of innovation, optimisation and learning, and we have progressed well. Presently majority of our project delivery is on digital platforms, through the entire spectrum of the delivery chain. This has enabled a collaborative and virtual work environment where services are being offered in a seamless manner backed by a robust enterprise information technology platform.

Internal tools, processes and system upgrades were completed with financial (SAP), HR, project management, enterprise resource and process systems adopted in the last financial year. We also streamlined our document management and communication systems; internal engineering codes and procedures were migrated to online platforms, thus allowing seamless access across the organisation and project sites. Notable was the upgrade to the knowledge management system, contract management systems and project management systems, for greater operational efficiencies.

### Performance Overview

Prevailing macro-economic conditions such as slowdown in infrastructure investments, adverse growth conditions in the developed markets and slow demand in the emerging markets has put pressure

on margins and business growth. This has severely impacted engineering design consulting firms worldwide which are in consolidation mode. This is further accentuated by the disruptive trends in the way plants are designed and built. The China effect that has stressed the commodity markets and the fluctuations in oil pricing has impacted investments in the power, infrastructure, mining and transportation industry.

FY2015-16 witnessed a slowdown in project investments covering commodities (Steel, Mining), Oil & Gas in international markets and continued stress in the domestic market across power, steel, mining and nuclear, coupled with delayed past projects resulting in impact on the EPCM/Consulting space.

Tata Consulting Engineers saw growth in the Infrastructure, Power, Water and Construction & Project Management businesses. The impact on the commodity markets hit the prospects in Chemical, Steel Metal & Mining segments. In the Infrastructure space, Water, Waste Water and Urban Infrastructure projects have begun to see an influx of new investments.

TCE's revenue share in the Project & Construction management and Energy sector continues to be sizeable, and the growth is primarily due to international market spread. TCEs collaborative efforts across the globe, sustained revenues in this sector. With greater onus on renewable energy sources, several solar and hydro projects took off but the sector still requires the necessary impetus for growth. The Nuclear business, which depends solely on the domestic market, saw some setbacks in projects taking off; however

growth in this sector is expected to pick up in the current financial year.

With assured projects delayed or deferred and stress in the markets, our effective billable utilisation took a hit and our margins were impacted. However, TCE sustained growth in revenues to the tune of H 509.73 crores, on the strength of the previous year's strong order books. Our focussed sales and service strategy yielded positive outcomes with healthy order books for the next financial year. With an aim towards growth the Company took prudent measures, such as office space optimisation, project need based hiring. We also enhanced focus on sales and customer relationships to enhance profitability. The impact of these measures, is expected to reflect in the results of the coming financial year 2016-17.

### Outlook for the future

Going forward, Tata Consulting Engineers will pursue aggressively in the regions of its presence by:

1. Packaging optimal and fit-to-purpose solutions aligned to customers' requirements
2. Focus on quality of service and compliance aided by strong TCE procedures and standards
3. Value engineering and optimal design with a thrust on innovation
4. Focus on technical advancement and adoption with efficient knowledge management
5. Branding, networking to capture mindshare and clinch repeat business
6. Training and skilling of our talents

on state-of-the-art design and engineering tools, program and project management skills, international cultural training and orientation, sales and contract management training with an aim to enhance our customer relationships and connects

7. Adopting 3D-4D engineering for all new projects
8. Incorporating Safety in Design, ensuring safety standards across the delivery chain
9. Adherence to environmental, statutory, code and standards and sustainability norms in our projects
10. Optimisation of our operations by ensuring higher utilisation of space, people and competencies
11. Commitment to a sustainable practice by providing technical solutions that help clients adopt sustainable measures that are environment-friendly. This serves as the Company's overarching Sustainability Goal.

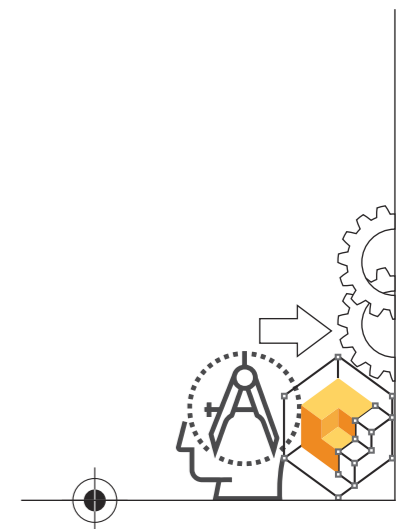
The engineering consulting industry and Tata Consulting Engineers are both part of the changing environment that is impacted by the way technology is put to use. Industry 4.0 to TCE means not only adapting to these changes but aligning its service model with new permutations and combinations to add value to customers. The future of the organisation is its people and TCE will continue to invest in re-skilling them to adapt to prevailing changes.

TCE's role in the engineering ecosystem touches lives of the masses every day – from the water that reaches the people to the cities they live in and the spark of

electricity that lights up their homes every day. TCE continues to stay resilient with innovative ways and means. It is this spirit that has won the confidence and trust of its key customers and partners who have reposed their faith in the Company time and again. Today, the Company is proud to be engaged by clients on several projects approximately valued at 30 billion USD. We thank our customers, partners, associates and employees for their faith in us and we hope to continue on our growth path to be amongst the consulting firms that are making a difference and ensuring that we create a better tomorrow in a sustainable, responsible and professional manner.

Sincerely yours,

**Amit Sharma**



## Engineering 4.0

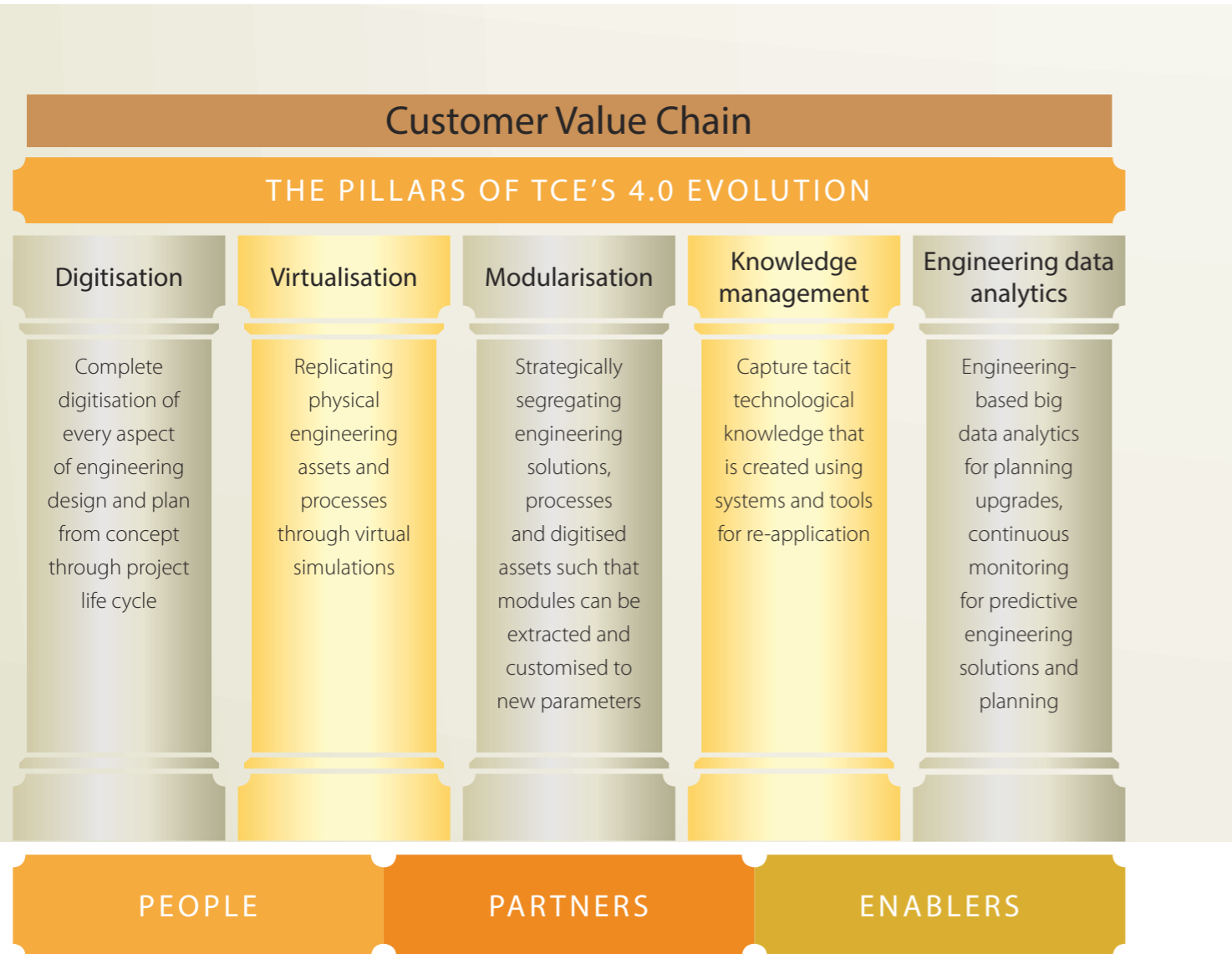
**Bolder.  
Better.  
Broader.**

**D**igital driven changes are giving rise to new business models, new service models and a new collaboration of minds through the internet of people. Tata Consulting Engineers Limited took bold initiatives in adapting to Industry 4.0 principles in the engineering and architectural service business.

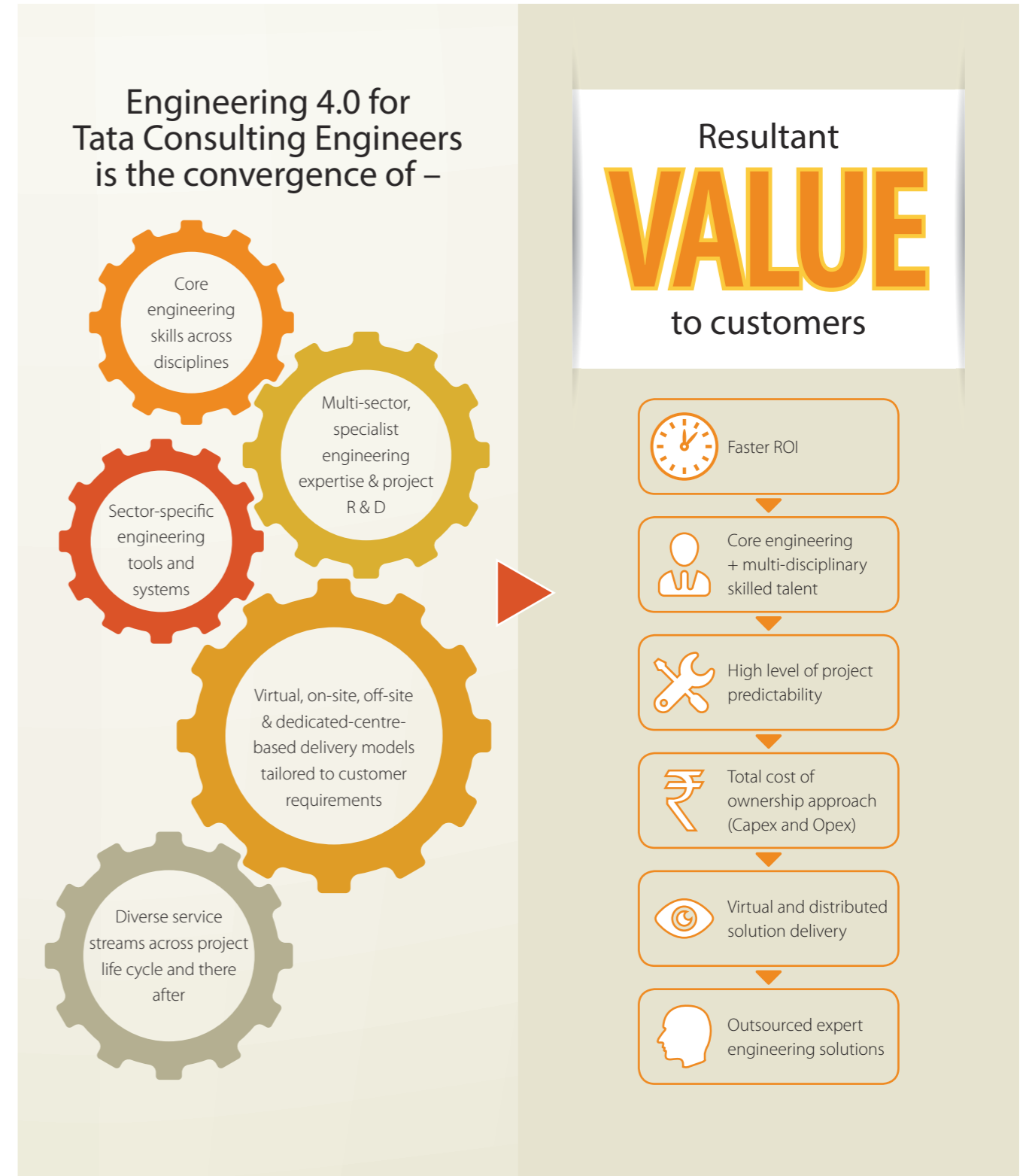
### On the path of 4.0

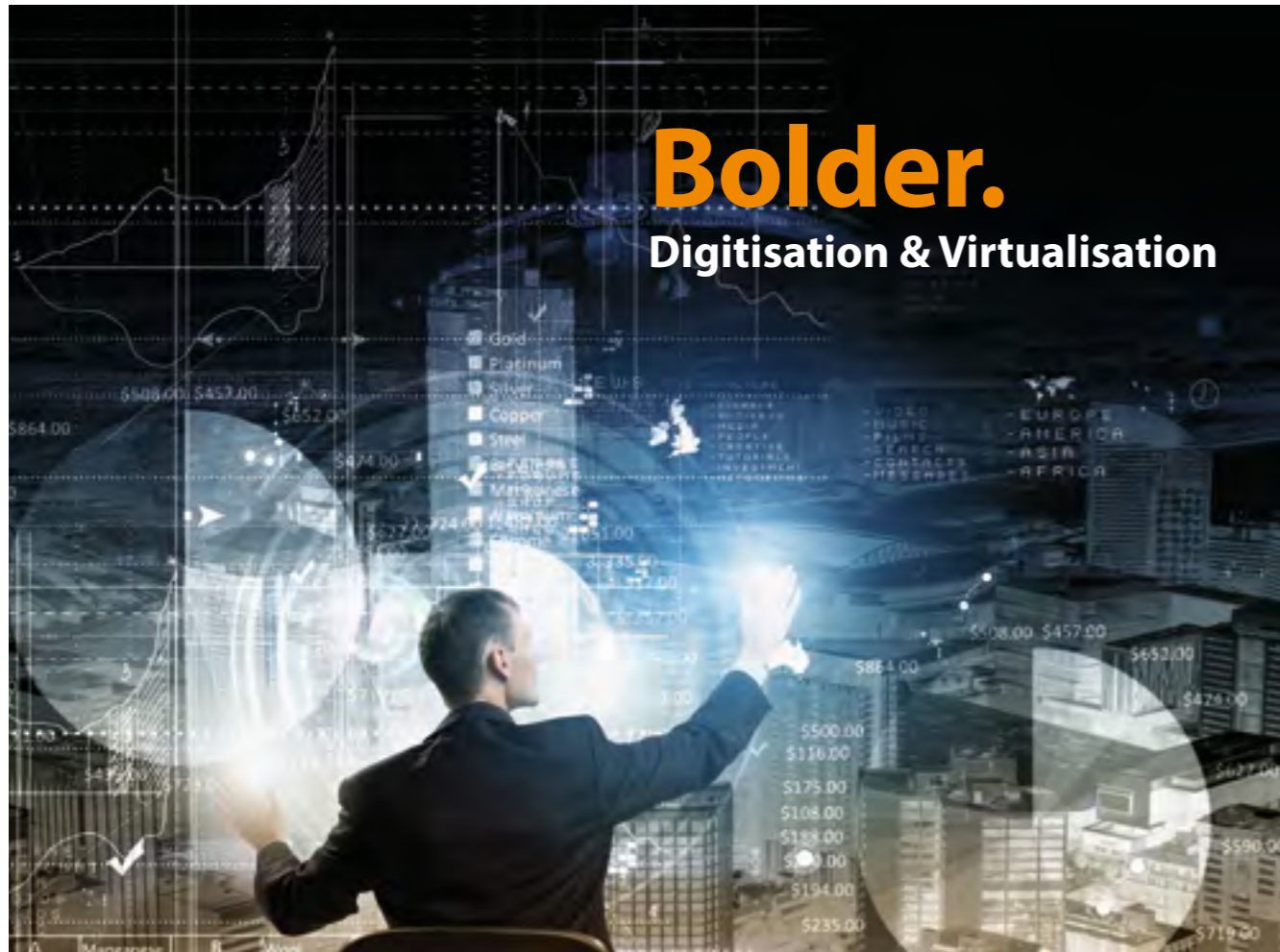
The world presently is talking about the industrial revolution 4.0 which is overhauling the way every industry operates. Even as the talk is on, the walk on the path of 4.0 across industries is happening here and now. Technology interventions, hardware and software that help collaborate seamlessly, artificial intelligence and automation that assist humans with extreme efficiencies, are some of the pillars of industry 4.0. The impact of this as seen today is just the top of the surface. Deep down are endless possibilities that several industries are boldly adopting. Each industry is seen adapting to the interoperability offered by the new age technological machines, devices and gadgets. Making things better are the advancement in cloud-based technologies that provide better efficiencies. The bigger impact of everything going virtual and the resulting ease of collaboration is drastically changing the way people and machines interact.

Tata Consulting Engineers is on the path of the 4.0 evolution process since the last four years and FY 2015-16 was characteristic in establishing the Company as a 4.0 pioneer - Bolder, Bigger & Broader. The pillars of TCE's 4.0 evolution, relevant to the engineering consulting industry has engineering at its core.



These pillars converge to create integrated digital engineering solutions that bring multi-disciplinary skills to a collaborative platform. This was made possible as TCE aligned its service offerings, expertise, systems, processes and people to deliver customers immense value. The value thus delivered uniquely addresses customers' pain points and resulted in adaptability by customers to new service offerings.





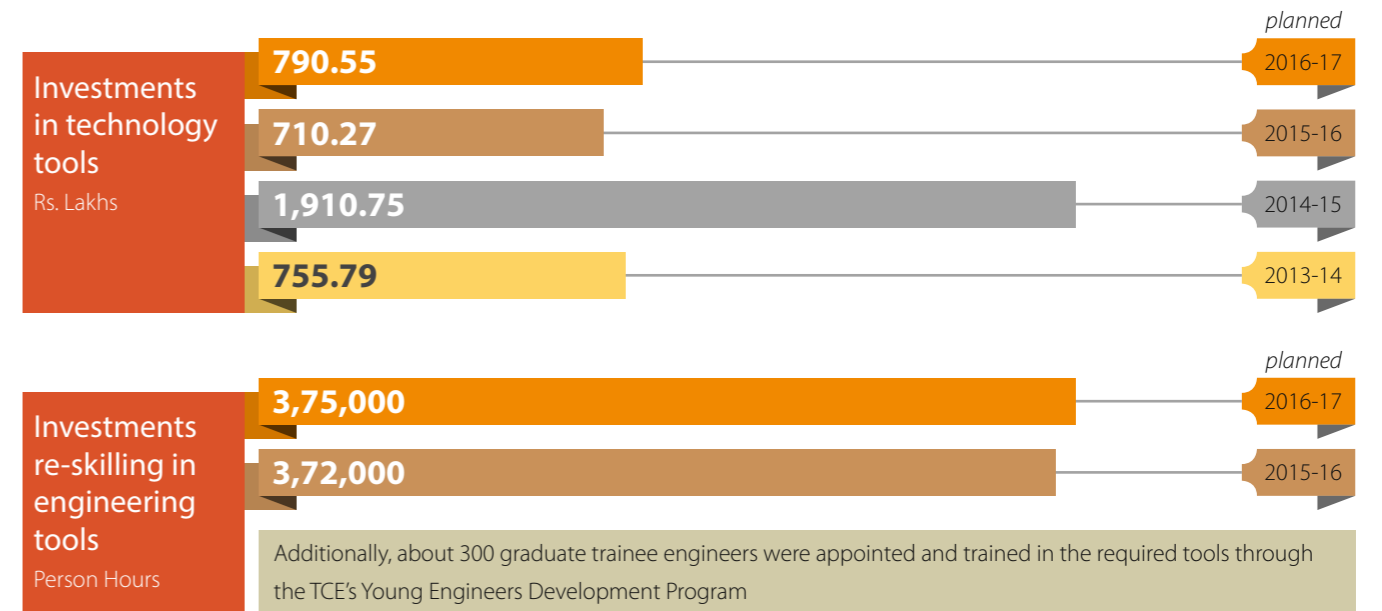
# Bolder.

## Digitisation & Virtualisation

Bolder adaptation of new age applications to deliver engineering services was the hallmark achievement for Tata Consulting Engineers in FY 2015-16. The process of digitisation via vis systems and processes began way back in 2012 when the mantra for TCE was readiness for global markets. TCE adapted digital engineering tools for design engineering and planning. The bolder initiative for TCE was the migration of delivery systems to 100 % digital. This enabled the Company to shift all solutions from concept to project management to 2D, 3D, 4D and 5D tools. This was a

tectonic shift for a 54 year old company as it involved a radical shift in mind set to an engineer at TCE. The convergence of core engineering with digital concepts, knowledge management and data analysis and re-use, is a bold new way services would be delivered in the engineering consulting space. The entire engineering solution delivery was transferred to a virtual space bringing about a great deal of predictability, speed and cost efficiency to the client. Thus, the foray into the international markets with marquee clients and long term engagements, despite

adverse macro economic conditions, took shape in 2015-16. Going forward, this readiness combined with greater adaptation to the 4.0 pillars such as modularisation and engineering big data analysis will set the trend for the years to come.



Tata Consulting Engineers balanced the incorporation of new technology and re-skilling of personnel based on project and client requirements. The challenge was also in the mindset change required at the customers' end to understand and appreciate the value of digitisation and virtuality.



## Key solutions

### Value delivered with digitisation and virtuality

- ▶ Outage management solutions for an international power plant using 4D solutions with predictive modeling.
- ▶ Fast tracking of plant engineering review from three months to one day with real-time simulation presenting 30 to 40 scenario plans using terrain mapping, earth-walk etc. This resulted in accurate predictions in cost and resource planning right at the conception stage.
- ▶ Point cloud structural engineering data creation of entire brownfield plant asset for progressive migration to 3D – 5D for plant upgrade management in real time, with minimum downtime. Data-rich modeling helped with impact assessment in the construction process

resulting in huge cost savings.

- ▶ Urban infrastructure development projects for water management in several large states using digital tools helped map a significant populace in tier II and tier III cities enabling accurate planning for migration of brownfield cities to smart cities and rural infrastructure planning. The future holds the promise of using big data analytics in the structural engineering context for accurate planning in upgrade of townships.

### Modularisation

Plant engineering in Industry 4.0 is all about fast tracking plant engineering and construction processes such that each process is dove-tailed to another and pipelines the business development process to completely eliminate lag time between build and go-to-market. This is enabled with the strategic segregation of standard activities in plant engineering. Once standard elements are modularised, effort is applied to aspects that require customisation. Modularisation reduces commissioning time by close to 50% and

provides similar cost efficiency.

Tata Consulting Engineers successfully completed a pioneering project for a large international client using a digitisation & virtualisation in FY 2015-16. Key value delivered were:

- ▶ Reduction in costs
- ▶ Reduction in site-related iterations
- ▶ Reduction in commissioning by 50%
- ▶ Availability of ready-to use modules specific to the sector for future replication

Going forward, the implication of modularisation for Tata Consulting Engineers is the progression from digitisation and virtualisation to strategic modularisation of the design engineering and PMC process. A customisable library of data rich 3D models specific to each sector is being built which can speed-up delivery schedules for the customers. TCE upgraded to a knowledge management system, 'Wrench' to capture such inherent knowledge to build a repository relevant to the 4.0 era.



## Knowledge Management & Technology 4.0 **Better.**

As a sequel to a digitised and virtualised delivery model, TCE generates a huge amount of data rich models specific to each sector. Tata Consulting Engineers combines a plethora of industry specific tools to provide customers holistic solutions through a digital, integrated engineering model. TCE has multi-disciplinary capabilities to customise these data rich models to customers' unique needs and reduce timelines and cost.

In the year 2015-16, Knowledge management applications were upgraded to include all aspects of project management, knowledge management and engineering design analysis.

Several systems that were implemented or in the final stages of implementation are:



## TCE's technology inputs to clients 2015-16

The technology solutions team, with a cross-functional team of experts, created in 2013, was strengthened to provide value engineering solutions to key projects requiring specialist solutions. Several project specific value additions were captured to build up the knowledge bank.

Value additions provided by dedicated team of technology experts:



### TCE's Strategic Differentiators

- ▶ Skilled People
- ▶ Multi Disciplinary competency
- ▶ Track record spanning 54 years
- ▶ Innovation through value engineering & optimisation
- ▶ Support through the value chain with end-to-end integrated solutions
- ▶ State-of-the-art digital tools & systems
- ▶ Infrastructure back up with processes, systems and standards benchmarked to international standards
- ▶ Business stability with trust built over decades
- ▶ Strong pedigree and value systems
- ▶ High level of compliance, respect to IPR and total integrity



Engineering design & Construction services require a metamorphosis in terms of portfolio of service options available to customers, especially those who are already in the Industry 4.0 era. Manufacturing processes, have increasingly adopted automation and robotics and cloud based data analytics management. Advanced modularisation and standardisation are the key strategies that accelerate delivery schedules, reduce cost and ensure error-free delivery. Tata Consulting Engineers focused on modularisation and standardisation techniques in the design engineering and construction management delivery processes by packaging customised service models.

Yet another challenge in the engineering industry is the slow growth environment, sharply reducing investments in large

capital projects that are, traditionally, the revenue generation point for design engineering and construction management firms.

While core engineering services for large, capital intensive projects continue, the need for 4.0 services relevant to a digitised manufacturing environment is the need of the day. Industry 4.0 is fast adopting a model that combines capital expenditure and operational expenditure on assets. This requires Total Expenditure solutions (TOTEX) where in the industry requires engineering services from concept to commissioning and extends through the asset life cycle. This is pertinent in an environmental and highly cost conscious regime. Furthermore, with digitisation and automation of processes, modularised models and data for assets are available which needs to be put to repeat use for

upgrades and modernisation through customisation.

Tata Consulting Engineers remodeled its service pipeline to enable 'TOTEX' relevant services to customers. The CAPEX model of concept to commissioning is now extended to plant life cycle management solutions. This remodelling of services is especially relevant as Tata Consulting Engineers made a major shift to digital engineering services. This offers long-term value to customers as TCE is available as a consultant from the concept stage to the 'after life' stage of assets. In a digitised environment, environmental compliance upgrades, modernisation and asset retirement solutions also becomes more predictive and cost efficient. Virtual simulation of assets helps in predictive planning of upgrades and modernisation, with minimum downtime of active assets.



What customers want	Accelerate delivery time, reduce cost, increase safety Multi-sector expertise, global + local codes and standards Predictability for extreme efficiency Repeated use of digitised modules Digital engineering analytics and planning through asset life cycle
Why	Shift from CAPEX & OPEX models to TOTEX models, taking a long term, holistic view
How	Asset data generated through digital engineering facilitates cost-effective TOTEX approach Develop a combination of traditional and digital engineering solutions
Action	New Digital Engineering & Advanced Technologies Service Business Unit created Standardisation in systems and processes Knowledge management



## Service models that offer Greater value to customers

- Value through service on digital engineering platforms
- Value through collaborations & partnerships
- Value through Dedicated Engineering Centers (DEC)
- Value through the core engineering and IT-enabled combine

The year 2015-16 was marked by several collaborative efforts in the area of IT tools, technology solutions, geographically distributed delivery solutions, dedicated delivery centres and collaborative combines as a go-to-market strategy.

TCE entered into strategic agreements with leading international engineering IT solutions providers, synergising sector specific engineering tools and core engineering capabilities.

TCE's technology teams tied up with large clients to work on process innovation in areas such as coal beneficiation/ washery, material handling, waste to energy, solar energy programs, etc.

Unique service models were created with a combination of virtual, onsite, offsite service teams comprising multi-disciplinary skills for marquee clients on a long-term basis.

TCE established dedicated engineering centres for large clients for specific sectors. The partnership-based service model serves as an extended arm for large international customers providing them with cost effective, core engineering capabilities. Three centres were established in FY 2015-16 for four international clients.

Collaboration with EPC players in the Korean region continued with several large projects delivered jointly in Africa & Middle East.

Such unique collaborative service offerings helped TCE build its credentials in key international regions and set the foundations for bigger potentialities.

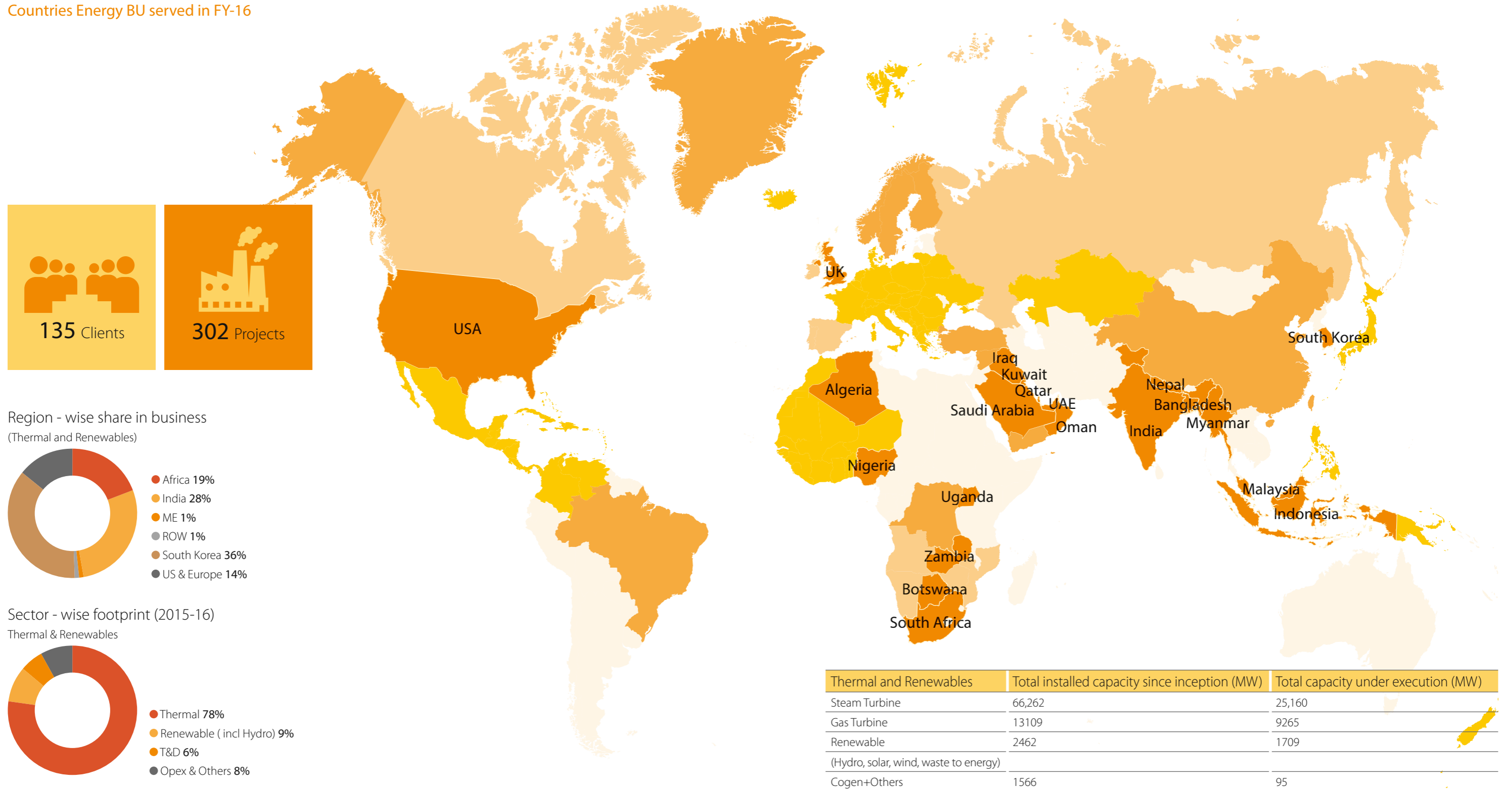
Going forward, moving to a service model that is delivered wholly from a digital platform will enable the creation of big data relevant to the engineering sector. This is expected to serve as the stepping stone for newer service propositions for customers in a world that is marked by regulatory and environmental protectionism.



Thermal  
Renewables  
Nuclear



Countries Energy BU served in FY-16



## Thermal Power

The Power Business Unit of Tata Consulting Engineers has with its depth and scale of experience in the sector, established itself as a front runner in engineering, design and PMC for all types of power generation. The year 2015-16 saw the Energy BUs continued foray into the international markets with collaborative go-to-market business agreements. The tie-up with Korean EPC leaders was expanded with large MNCs partnering with TCE. Presently, TCE jointly delivers projects partnering with almost all leading EPC players in the region.

In 2015-16, TCE worked with other MNCs, especially in the area of modularisation and standardisation projects for simple cycle and combined cycle power plants. By modularisation of plant equipment and system, TCE provided modular engineering solutions that aim to fast-track simple cycle plant operation to 3 months and combined cycle plant operation to 12 months. Ready-to-use 3D engineering solutions based on the modularisation concept, fast-tracks the plant marketing, construction, erection and commissioning cycle. Modularisation approach is initiated right from design, procurement, contracting up to construction of plant equipment and systems. It includes skids, pre-assemblies, entire process equipment such as HRSG, IDCT, pumps, other equipment and pipes & sleepers.

Yet another collaborative model was the establishment of Dedicated Engineering Centres (DEC) to address the unique

needs of customers in the area of power generation, transmission and distribution. Through dedicated engineering services, TCE worked with the clients to help them in their growth story. Thus, long-term client relationships were forged. TCE was won the trust and confidence of international customers through value added services and strong systems to maintain client IPRs. In a cyclical business, involving higher capital expenditure for large scale power projects, such annuity-based businesses helped TCE balance short term and long term business cycles.

TCE took several strides in the Opex sector in thermal power. A major project in this sector was the value additions for a captive power plant in UK. TCE was required to provide solutions to extend the life of the 50-years old plant. Key results achieved included increased power output, increased DM water production, savings in chemicals and improved O&M knowledge of the plant operators. Strengthening its offerings in the opex area, TCE offers solutions for environmental upgrades of power plant efficiency improvement studies, and consulting services for renovation and modernisation of plants.

### Transmission & Distribution

TCE made several technological advancements in the T&D sector with assignments in Ultra HVDC upto 800 kV, FACTS ( STATCOM, FSC and TCSC), smart grids, energy management and SCADA as well as smart metering for smart city projects.

## Renewable Energy

Tata Consulting Engineers Ltd is targeting the international markets in Renewable Energy to provide value engineering services in the sector. The requirement for tapping renewable energy potential and the advanced scope for projects in the Solar PV and Integrated Solar and Combined Cycle (ISCC) area especially in the MEA region provide new opportunities. TCE hopes to take a collaborative approach to serve these regions and provide value added services and optimisation solutions in hydro and solar energy generation.

### Hydro

TCE's successes in the Hydro energy sector in various capacities include - 2400 MW hydro electric project in Zambia/ Zimbabwe, PMC services for one of the largest pumping stations in Asia, projects in Bhutan, Nepal, Uganda, Zambia and several domestic projects in Karnataka, Gujarat, Assam, Arunachal Pradesh and Himachal Pradesh.

### Key Value additions:

- a) 37.6 MW project in Nepal - CAPEX reduction of 3 million USD through optimisation of barrage and De-silting basins designs
- b) A 189 MW plant in Georgia -Overall cost reduction of about 2.5 million USD through suggestions for optimised designs for dam, bridge and water transfer schemes
- c) 118 MW project in Bhutan involved in energy use by 10 % and optimised

designs for HRT & desilting basin designs resulted in CAPEX reduction of 3.6 million USD

### Solar

TCE's solar power generation sector is one that is fast growing and shows potential especially in the context of clean energy commitments. With a greater thrust on clean and renewable energy, the country's solar energy program with its ambitious target of 100 GW by 2021-22, a plethora of opportunities have arisen. On the domestic front, TCE is providing engineering services for an international solar energy leader for generating, more than 100 MW in totality for plants of varying capacities in Telengana and Punjab. TCE is working with leaders in the solar power generation industry and the segment is fast picking up in growth.

During the year 2015-16, TCE met with initial success in the solar energy segment with projects in Morocco and Egypt. Going

forward, TCE plans to drive growth in the overseas market specially in the Solar PV and Integrated Solar and Combined Cycle (ISCC) projects space. This has scope in the overseas markets specially in the Middle East & Africa Region. This demand is due to a conscious move to renewable energy. Emerging economies are rich in renewable resources and combined with funding from international funding agencies, there is a fillip to renewable energy, especially solar energy.

TCE is ready with capabilities in the technologies pertinent to solar power generation such as PV and ISCC, with expertise to provide value added solutions. The Company has also filed for right for patent with respect to floating solar PV, providing a cost effective solution to drive solar power generation through the photovoltaic method. The process provides a cost effective indigenous solution for solar power generation that supports utilisation of water bodies.



## Nuclear Power

Past involvement in Installed capacity:

**4780MWe**

Under Construction:

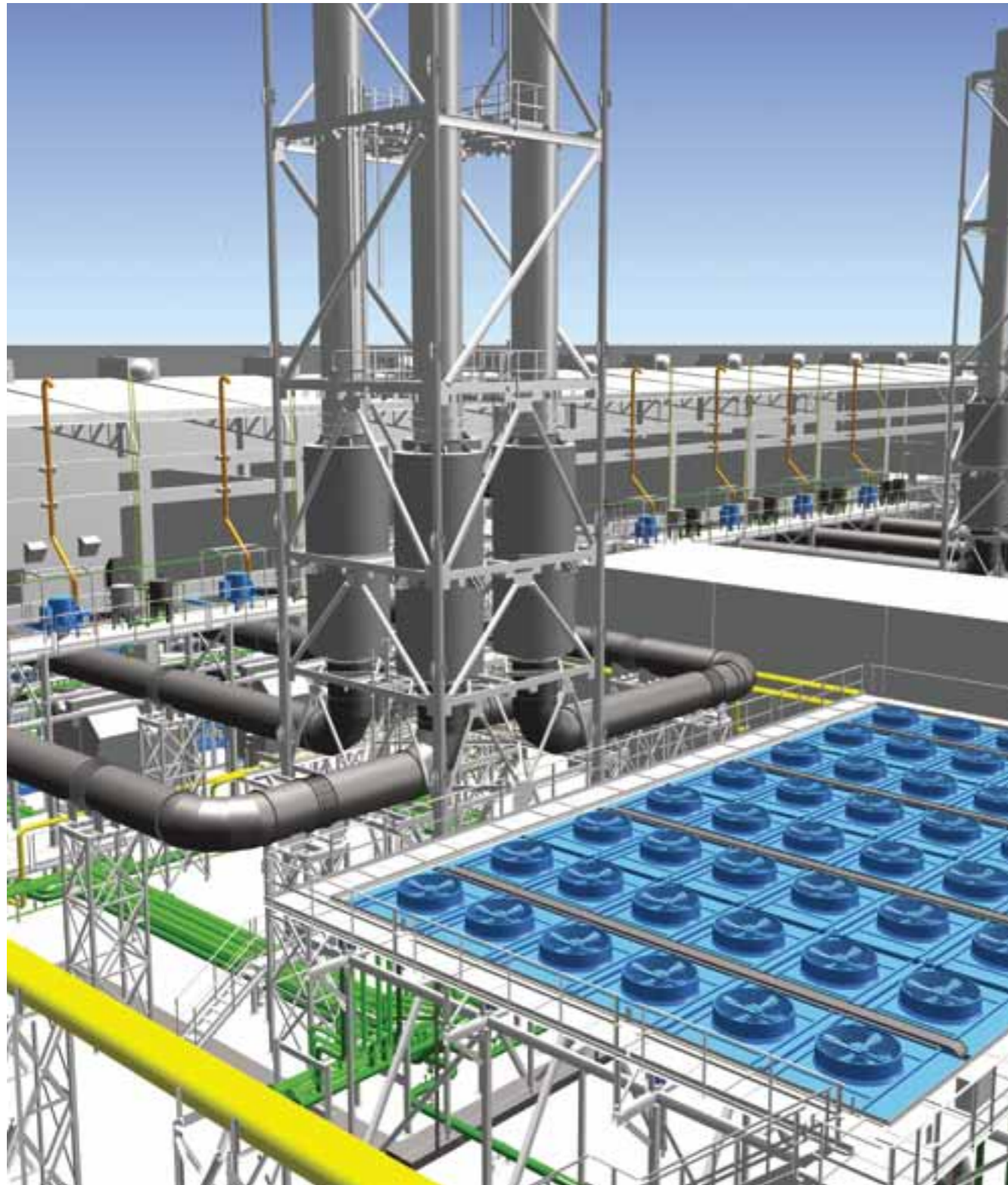
**5300MWe**



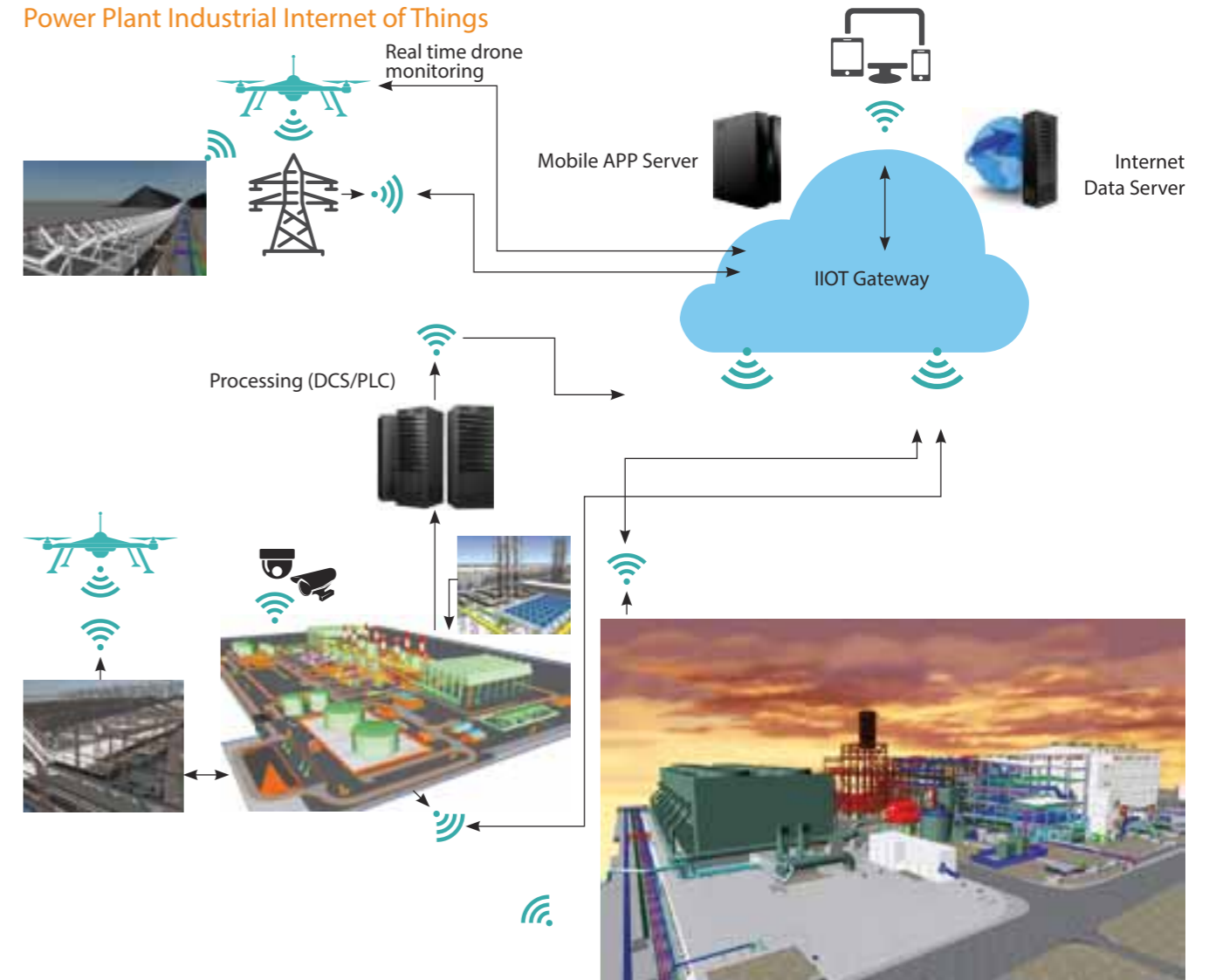
### Areas of expertise

Nuclear Power Plants Research Reactors
Spent Fuel Processing Nuclear Fuel Fabrication
Nuclear Waste Management
Fuelling Machine

The Nuclear Power segment served as a stand-alone business unit offering special services and nuclear power generation services working closely with Government and quasi-government entities. TCE has in the past and in recent times, worked on several prestigious projects that have done the nation proud, the most recent one being the design of the launch pedestal for the GGSLV Mark III. The nuclear power generation sector in India has seen slow progress in recent times. The sector is involved in several critical projects, the current ones being the Kakrapar 3 & 4 units and Rawatbhata 6&7 both with 700 MWe Pressurised Heavy Water Reactors. The Nuclear sector is now structured as part of TCE's Energy Business



### Power Plant Industrial Internet of Things

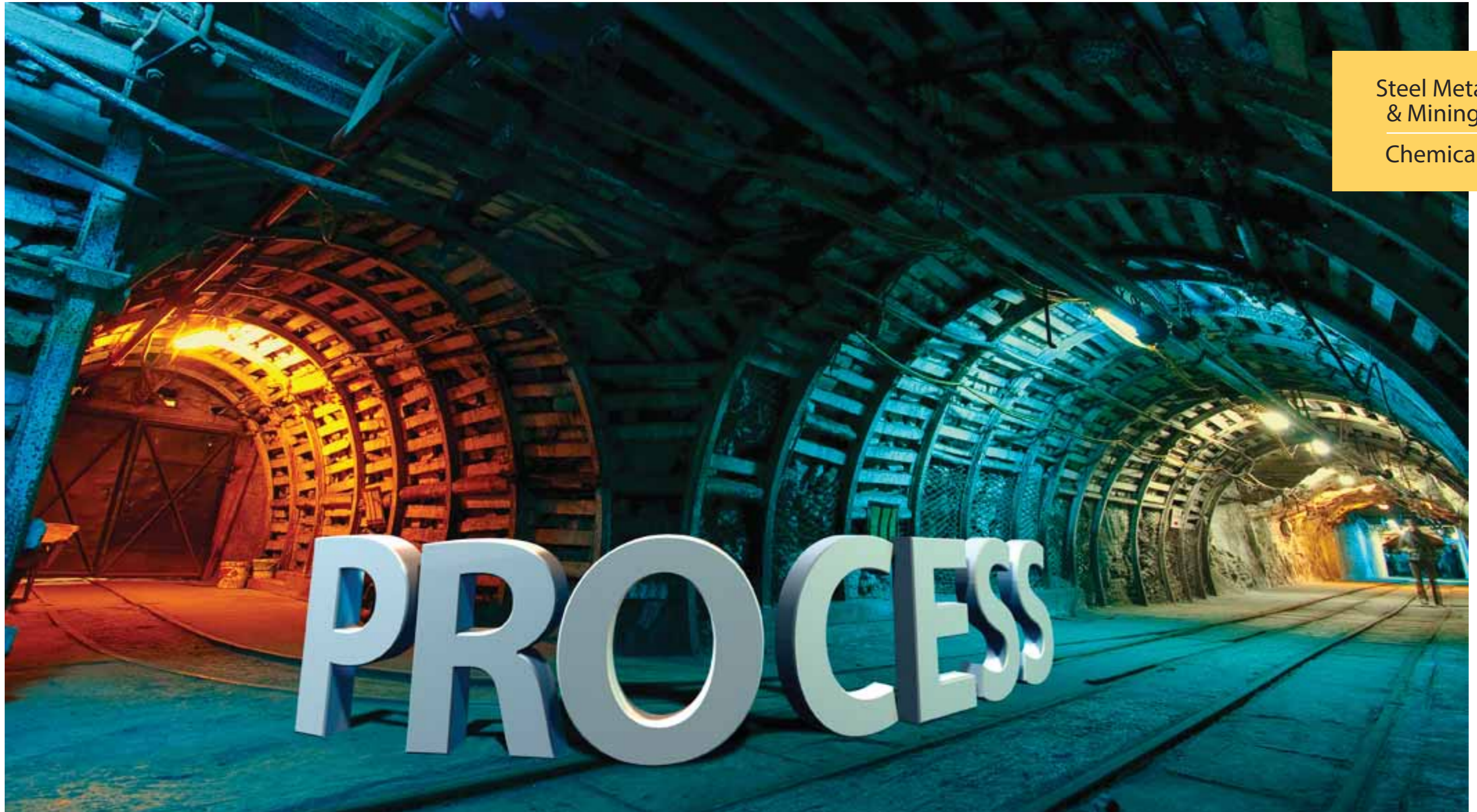


### Engineering Data Analytics

- Real time plant performance data for operational excellence
- Critical equipment health management in real time
- Process deviation alerts eliminating forced outages
- Remote monitoring and diagnostics for resource optimisation
- Optimisation of energy storage facilities for electricity, heat and gas connected to grid

- Live plant Trend analysis based on 'what if' scenarios in a virtual plant environment

- Real time Plant data by Smart sensors
- Power plant industry data across geographies
- Operational and Maintenance History



Steel Metal  
& Mining  
Chemical

## Steel Metal & Mining



Tata Consulting Engineers' Steel Metal & Mining sector has capabilities in steel and mining with proven value additions provided to customers, thus building long term relationships. TCE engaged with two large mining entities in South Africa and in India. TCE provided feasibility studies to establish project viability for the 1st time since the discovery of the mine deposits in 1954, TCE is currently engaged to provide EPCM services for the mine. A key achievement in the year was the mine planning and water management solutions for an international mining client in India. TCE conducted extensive terrain analysis to arrive at a complex solution to overcome the water management challenge for the mine. The solution involved channelisation of a natural water body to manage the mine's water requirements, planning of channels, spillways, and storage dams to secure water for captive needs. The extensive use of mine planning, and geo-modelling tools combined with technical expertise that is

multi-disciplinary in nature helped arrive at such value added solutions. In the mineral sector, a notable project was a 2 MTPA coal beneficiation plant where TCE provided solutions to beneficiate crushed coal to segregate clean coal of desired ash level and rejects. End-to-end solutions combine to provide optimised material handling systems through 3D modelling.

The steel sector also involved complete digital delivery system using 3D to 4D solutions where scenario planning and what-if scenarios were tried and tested for a large scale steel plant. Several value engineering solutions were possible using 4D construction planning and sequencing bringing about huge cost benefits to the client.

The year 2015-16 marked the complete migration to 3D and 4D based solutions delivery for various large scale projects in the steel, mining and minerals segment. Multi-disciplinary 3D models developed in different software platforms are integrated

in as single model to provide holistic solutions across the process and project life cycle in the steel, metal and mining project management. The movement to over 90% digital delivery enabled the business to move into OPEX related projects were the SMM BU, provided value engineering services to bring about cumulative cost savings of about H 108 crores last year. Notable is the upgrade of the air pollution management system for a steel plant with modernisation solutions that helped the client retain and reuse existing assets and optimise the others.

Moving ahead, TCE will leverage its multi-disciplinary capabilities and sector specific knowledge, 3D-5D tools to provide services for OPEX and CAPEX related services to clients.

Cumulative Value engineering cost benefits to customers  
**H 108 crores**

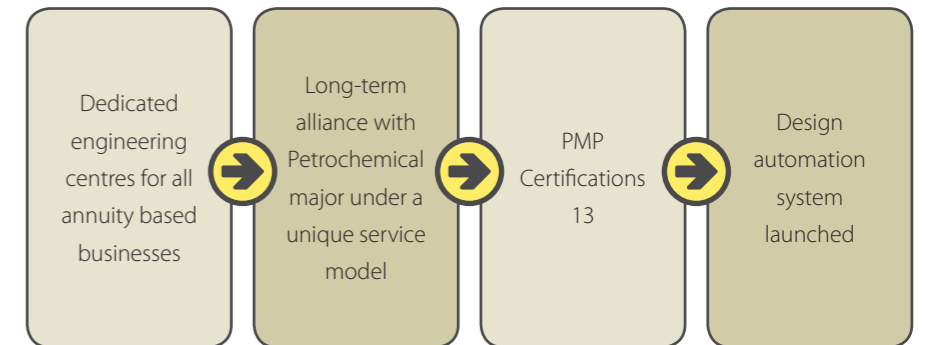
## Chemical



**Focus Areas**  
Midstream ; Refineries  
Downstream: Chemical, Derivatives  
Annuity Businesses: Chemical plant asset management

The Chemical Business Unit re-aligned its processes and systems for greater exposure to delivery in the international markets. A long-term alliance under a unique service model was established with a multi-national petrochemical group in the Middle East. This alliance bodes well for the business as it opens up a plethora of opportunities across the region. TCE's unique combination of a distributed and virtual delivery model and the convergence of multi-disciplinary talents on a common platform makes it the

### Key Highlights



preferred partner by international MNCs. Added to this is the value engineering solutions that translate to huge cost benefits to clients. Going forward, TCE hopes to work along-side more such alliance partners to make their businesses profitable and sustainable.

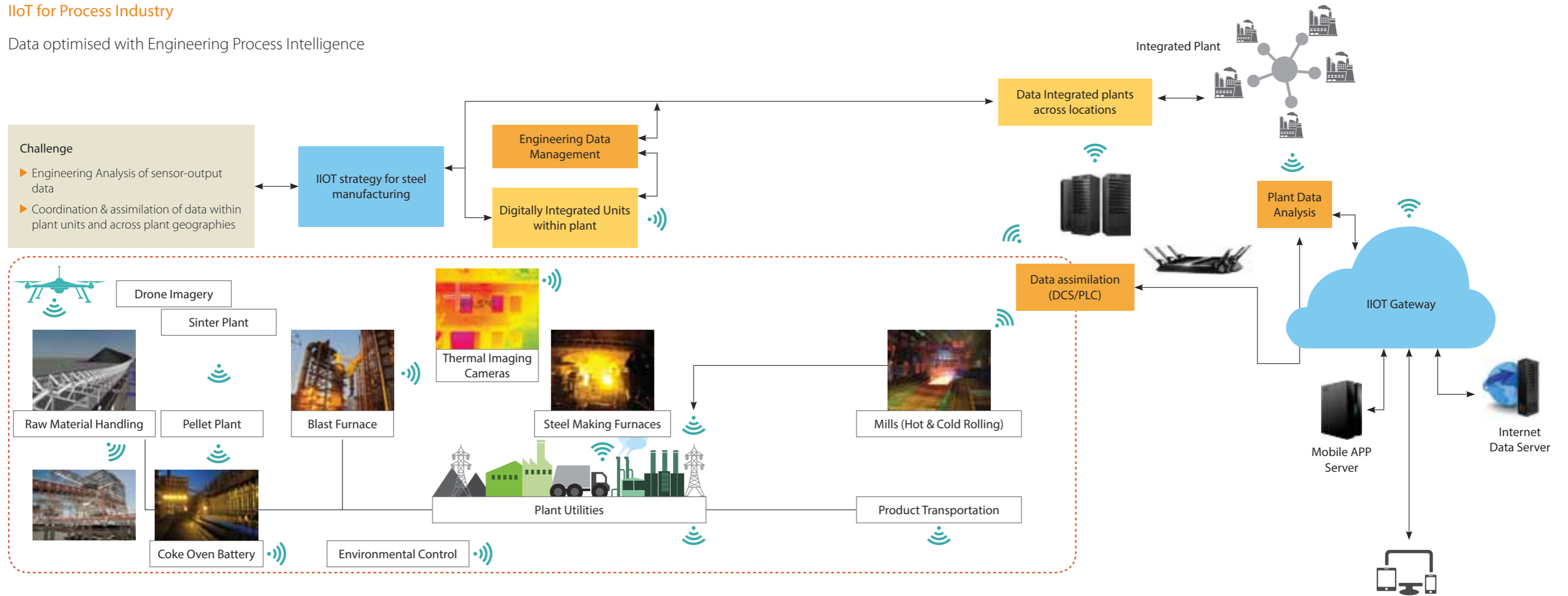
Taking on an internal focus, the year 2015-16 was marked by greater automation of processes and systems for effective project management and error-free design delivery. Training and re-skilling of engineers in new technologies relevant

to the Chemical Business Unit was completed. The introduction of a robust knowledge management system and project governance software was a serious drive to honour TCE's commitment to its international customers and partners. The deployment of high-end digital engineering suites are aimed at providing optimised designs and faster delivery.

The coming year, TCE hopes to ramp up its international presence and build on its distributed delivery model to provide value to customers world-wide.

### IIoT for Process Industry

Data optimised with Engineering Process Intelligence



**Challenge**

- ▶ Engineering Analysis of sensor-output data
- ▶ Coordination & assimilation of data within plant units and across plant geographies

IIoT strategy for steel manufacturing

Engineering Data Management  
Digitally Integrated Units within plant

Data Integrated plants across locations

Plant Data Analysis

Data assimilation (DCS/PLC)

IIoT Gateway

Mobile APP Server

Internet Data Server

**IIoT for the Process Industry (Eg. Steel Plant)**

**Plant unit efficiency**

- ▶ Production process best practice data
- ▶ Standardisation of core operating systems
- ▶ Manage performance of plant asset and fleet efficiency through in-depth trend analysis and malfunction prediction
- ▶ Triggers for sub unit/equipment malfunction
- ▶ Efficiencies from raw material through the transport of finished goods
- ▶ Production planning based on what if, when, how scenarios based on engineering analytics
- ▶ Resource consumption efficiency
- ▶ Efficient stock management
- ▶ Improved quality through reduced human errors

**Integrated Manufacturing Systems**

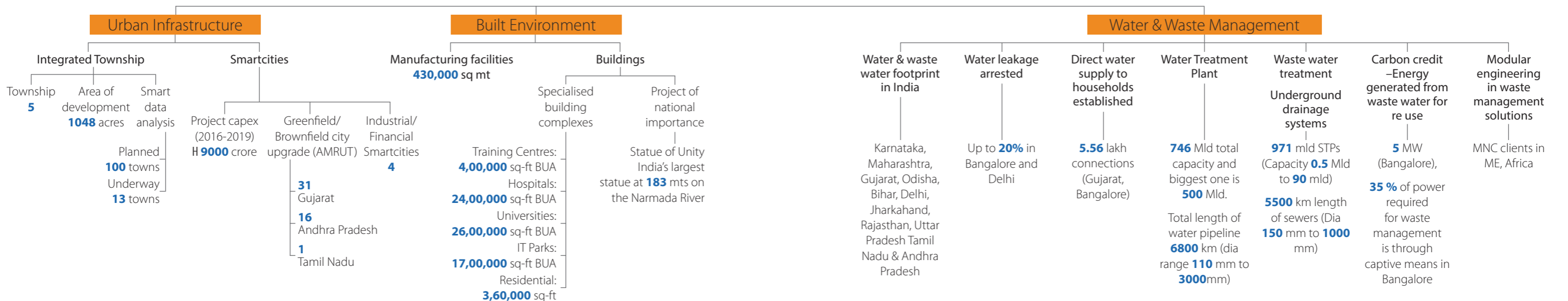
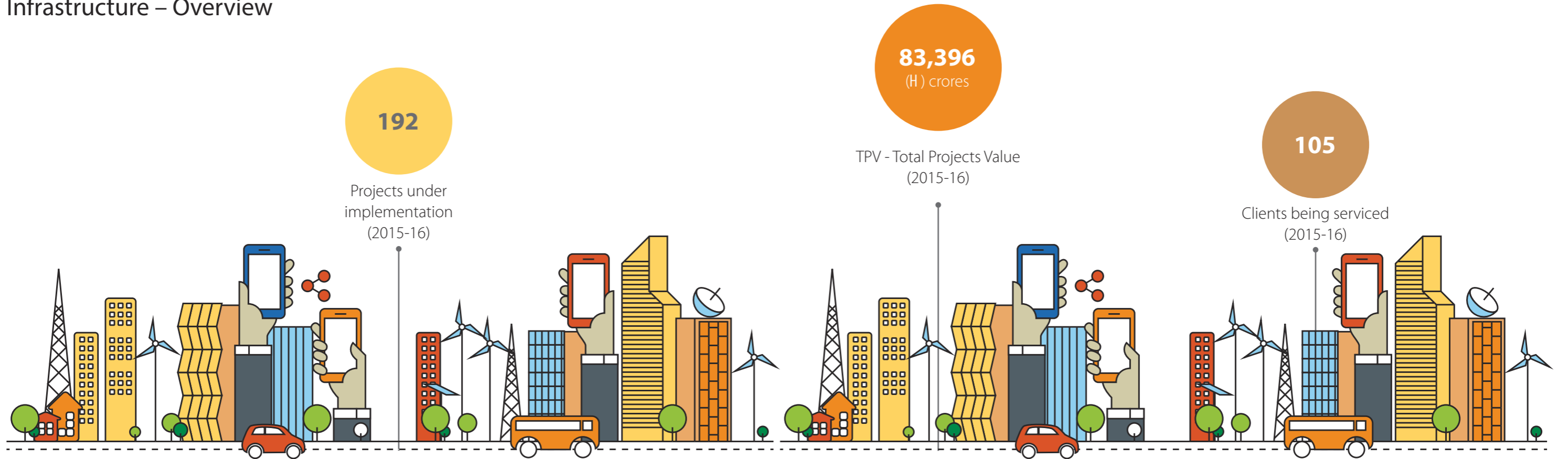
- ▶ Trend analysis for demand & supply balance
- ▶ Accurate production decisions
- ▶ Coordinated operations in all plants across geographies
- ▶ Improved asset utilisation with integration
- ▶ Business decisions derived from intelligent plant data analytics
- ▶ Business decisions made from within a digitally simulated environment based on 'what if' scenario planning

- ▶ Planned production
- ▶ Production efficiency
- ▶ Plant & process efficiency
- ▶ Predictive analysis and triggers for critical business decisions
- ▶ Maintenance synchronisation leading to reduced downtime
- ▶ Spare management planning & scheduling
- ▶ Translating complex data to business intelligence



Built Environment  
Water & Waste Management, Environment  
Transport

## Infrastructure – Overview





## Sectors

### BUILT ENVIRONMENT

Tata Consulting Engineers' Infrastructure Sector was involved in India's urban infrastructure modernisation program. The Indian Government's ambitious 100 smart cities plan is a great opportunity for TCE's Infrastructure Business Unit. TCE is empanelled by the Government as a consultant to create vision documents and blue prints to facilitate the smart city selection process.

TCE applied digital tools and technologies for integrated urban infrastructure planning to drive resource efficiency and environmental sustainability. Urban master-plan were digitally enabled through automation and e-governance by migrating to SCADA system. This enabled city level command and control centers to provide efficient service to citizens. Such integrated automation at design

engineering and planning level helps to use natural resources effectively.

Among the smart techniques for integrated infrastructure planning, TCE used Geographical Information System (GIS) platforms to gather data and integrate them into 3D tools. A key initiative in 2015-16 was the data mapping and analysis for several tier 2 and tier 3 towns in the state of Madhya Pradesh. Satellite images were converted to GIS platforms to create scientific data of entire cities. This one source data point of big data on cities, demographics, terrain, etc paves the way for applying engineering perspectives to predict sewage challenges, water and utilities requirements, optimisation and upgrades of infrastructure in the future.

TCE's Infrastructure Business Unit's Built Environment Sector moved to 100% delivery on high-end digital engineering tools in 2015-16. Digital tools used enabled construction simulation, walkthroughs that resulted in quick decision making, increased efficiency, optimisation, safety & sustainability. Predictability was ensured with less than 5 % variance in some projects such as large IT campuses and building complexes. Concept architecture was adopted in the design and plan for a 1400-bed hospital in Southern India. A 174-bed cancer specialty hospital is adopting industry best 'good practices'. A World-Bank funded project comprising 13 training centres in 13 states across India to serve as a skill-building centre was conceptualised and planned. The project is expected to be completed by 2019.

### TRANSPORT

#### Ports

Key projects in 2015-16	Project Description	Details
Key projects in 2015-16	Port automation & upgrade	Consulting paper on recommendations with a 30 year horizon for a port in Karnataka  Masterplan for port handling facilities with a 10-year horizon in the Western coast of India
	Greenfield port development	Engineering services for captive coal jetty for power plants - 2 Nos PMC for international ship repair facility
	Smart Port cities	2 Smart Port cities in Khandla & Paradip

The Port & Harbour sector of TCE's Infrastructure Business Unit is a nascent sector that is fast picking up with India's ambitious infrastructure development plans. Tata Consulting Engineers is involved in several of the new capex investment projects in the country. Several of these

projects are also based on public-private partnerships and requires TCE to work in a consortium-based set up. Going forward, this sector sees a lot of opportunities in the country. The sector has gained immense credibility with involvement in a first of its kind Smart Port city concept

in India. A shiplift project, second in the country, is planned with facilities for 6000 tonne capacity. With the Indian peninsular expected to get busier, such capacity building is critical to India's growth story.

### WATER, WASTE MANAGEMENT & ENVIRONMENT

The Water & Waste Management sector had a successful year with several large scale projects underway. TCE's water management and distribution solutions have impacted a large populace across the states of Gujarat, Karnataka, Bihar, Jharkhand and Delhi. Several value engineering solutions translated to cost reduction, resource conservation and modernised service delivery in utilities infrastructure.

The water management solution in the city of Bangalore positively impacted about three million people and reduced their water expenses by about 50%. The methane gas generated in the sewage treatment plant was used to generate electricity and for captive consumption, meeting 35% of the total power requirement for the waste treatment facility. Leakages and pilferages were addressed over 300 sq mt with 300,000 connections and 20% of leakage was saved. Facility capacity augmentation in

waste water treatment were undertaken without increasing the footprint. Using advanced digital technology tools, TCE can engineer retrofitting of any treatment plant for augmenting capacities ranging from 30 to 100 % present capacity (depending on conditions) without increasing the footprint.

In Gujarat, state-of-the-art underground drainage systems were planned and water distribution facilities extended to rural habitats. This has a great positive impact on the quality of life for a large area covering 33 districts. The Delhi water supply program involves working with international consultants to augment capacity and efficiency partnering with an international funding agency.

In several other states, the requirement in addressing flash floods and mitigating flooding, design and plan of storm water drainage systems applying international standards are underway. These projects

are typically long gestation assignments extending between 3 to 8 years.

In the year 2015-16, TCE established a Dedicated Engineering Centre to address the unique needs of international MNCs in the water and waste management sector. Engineering services that require multiple disciplines and capabilities were provided using advanced technologies and modularised design concept of water treatment and waste management facilities.

TCE's technical expertise was also relevant for the unique captive needs of a large mining set up in India with high level solutions for managing natural water supply, planning of dams and reservoirs.

With innovative service lines being offered and the highly-skilled, multi-disciplinary talent available, TCE's international footprint increased with dedicated Engineering Service Centres to provide 'Made in India' solutions.

### ENVIRONMENT

EIA NABET(Quality Council of India) accreditation	• 8 sectors • 5 functional areas
Swachh Bharat Mission (Health & Hygiene Program) DPR	• 75 towns • 2100 tonnage handling
Waste to energy proposal	3000Tons per day municipal solid waste

The Environment sector undertook an ambitious waste to energy proposal for management of 3000 tons per day of municipal solid waste. State-of-art planning and technologies are being explored in line with international standards. Environment impact assessment studies were conducted for a canal under Inland Waterways Authority of India, Ministry of Shipping.

TCE was accredited in key sectors and functional areas under NABET. Some of the flagship projects undertaken are EIA and EMPs for smart city and new cities.

The Environment services include - CRZ clearances for coastal zone development, Air pollution controls & risk assessment, environment and social impact assessment studies for wind power projects, etc. Advanced digital technologies are used for risk identification and mitigation in hazardous chemical impact management and other HAZOP solutions. The use of advanced digital tools and data analytics have improved efficiencies and reduced delivery time by a third.



# Project Management Consultancy

TPV - Total Projects Value close to  
**H 18000** crores

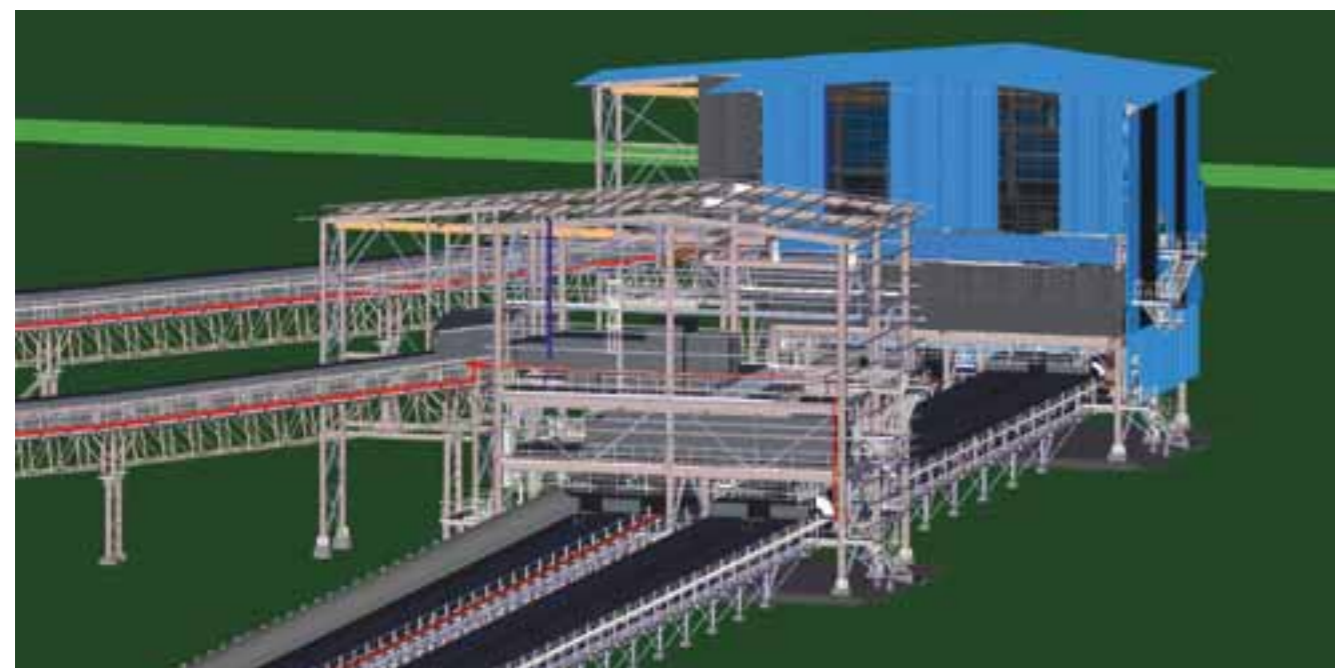
Cumulative benefits of value engineering solutions  
**H 150** crores

Worldwide active projects:  
**122**

Active sites worldwide:  
Zambia, South Africa, Nigeria, Ethiopia, Malaysia, Indonesia, Sharjah, Saudi Arabia, India

### Key Projects underway

PMC Services for



### Services

Project Management - Construction Management, Inspection & expediting, outage management, owner's/lenders engineers, safety audits and supervision, Construction supervision, Construction Simulation.

### Industry served



### Value additions in key project

The Project Management Consultancy (PMC) BU is a service business unit providing project management consultancy and construction management services. The BU provides services for all sectors. This has been possible on the strength of a large pool of multi-disciplinary talent that is easily mobilised. Years of technical expertise in the area and a track record of managing complex projects internationally. Safety practices, adoption of international standards of quality and established business excellence processes are a key differentiators for TCE.

The PMC business unit is presently involved in some of the prestigious projects that create value to society. Currently, the BU is managing mega water supply projects in the states of Gujarat and Bangalore. Also in the line of prestigious assignments is the project management of the country's most prestigious academic institutions and university campuses. The

BU is involved in providing services to several large scale power plants in India and in emerging markets which makes a difference in the quality of life for people. In a country faced with acute power shortage, TCE delivered the projects on time for Zambia's major power plants in Itezhi Tezhi and Maamba. In the renewable sector, PMC BU is executing some of the recent solar power projects across various states and few of them have already been commissioned and supporting the National Green Grid concept.

On the domestic steel and mining sector, PMC BU continues to provide services for a Group company's major green field project in Odisha in addition to various on-going brown field projects. The services provided were amongst the first lot of facilities commissioned in KPO-PH # 1, safely and without any major incident. The PMC BU ensured close to 57 Million Safe Man-hours for the entire project duration. The commissioned projects had several first of its kind achievements.

TCE successfully managed operational optimisation solutions to manage plant shut downs for a major conglomerate in Saudi Arabia enabling successful operations with no downtime. These solutions were delivered in real-time such that the client benefited with restart of the facilities. Moving ahead, TCE's PMC BU will continue to provide clients with more such optimisation services off-shore.

In the industry 4.0 scenario, modularisation is a key process innovation to fast track projects. Keeping abreast of such modularisation concepts in the market, Tata Consulting Engineers' PMC BU is currently working with clients with newer solutions to apply the concept to construction management. With the use of advanced digital tools, 4D construction simulation has benefited clients with predictability in project management. Scenario planning through virtual simulations have already reduced time at the site and moved decision making pertaining to construction right to the digital space. Going forward, TCE will provide solutions to fast track and optimise construction processes by adopting modularisation and standardisation in construction management. Such futuristic solutions also call for re-skilling talent and orientation into remote working. TCE has already put in place the requisite processes and hopes to delve deeper into industry 4.0 consulting and project management.



**CSR Committee**

Ms. Neera Saggi, Chairman  
Mr. S Padmanabhan, Director  
Mr. A K Vora, Director  
Mr. Amit Sharma, Director

**Key Highlights 2015-16**

Corporate Volunteering (Tata Engage)

**1014**  
Persons volunteered

**9212**  
Total person hours on CSR

**69**  
Total No. of programs across locations

CSR Program Milestones in 2015-16		
SUSTAINABLE LIVELIHOOD, HEALTH & HYGIENE		
Khoripada Village Sustainable livelihood program	Demographic survey	347 inhabitants
	Self Help Group Training	30 women
	Farmer Awareness Program	51 persons
	Rainwater Harvesting Tank	Tank repair Drinking water replenishment



EDUCATION		
Child Education	Basic education for children of migratory workers	School van as a mobile classroom
	Training on safety for teachers of migratory workers' children	56 teachers
Computer aided drafting for youngsters	ITI students, marginalised students (Pune, Bangalore, Mumbai)	44 students
Young adults	Career counseling program	120 students



Tata Group Programs		
INFRASTRUCTURE		
Uttarakhand	Rehabilitation Program	Engineering services for Women's weaving centre, Govt. Polytechnic Aanganwadis
Chennai Flood	Rehabilitation Program	Aid for flood victims Surveys for beneficiary mapping



### Flagship programs



#### Khoripada Sustainable Livelihood Program

TCE is involved in the tribal village of Khoripada, Jawhar in Palghar district near Mumbai. This hamlet with 63 families, is starved of water and sustenance post the monsoons. TCE's intervention involved construction of a rainwater harvesting tank to catch and purify rain water, and provide a solution to meet the water needs of the hamlet, post monsoon. Scaling the program

to a longer engagement, TCE is working with MITTRA, to provide holistic sustainable livelihood programs in the village. The year 2015-16 saw the commencement of the program with baseline surveys, farmer orientation and exposure programs for enhancing livelihood schemes, training in governance and maintenance of self-help groups, etc.



#### The School on Wheels Program

The School on Wheels Program is a program to provide basic education to children of migratory workers and prepare them for regular schooling. TCE is engaged with Door Step School, Pune to convert a school van into a classroom and provide schooling to the children of contract workers, construction workers etc living in makeshift tenements. The bus aims to

travel to two or three centres daily to conduct classes for these children. The program targets to enroll young children in municipal schools by providing preparatory education, especially those children who have never had any formal education. Currently, the school van is being made classroom ready with modifications to the chassis.



#### Basic Computer based drafting course

A direct intervention, TCE provides training in basic computer based drafting to young adults to increase their employability. Students enrolled in ITI's the Draftsman stream are provided with computer based

drafting courses in TCE offices. In 2015-16, the programs were conducted in Pune, Bangalore and Mumbai. About 44 students were trained and certificates awarded.

### Goals & Targets for 2016-17

#### SUSTAINABLE LIVELIHOOD, HEALTH & HYGIENE

Khoripada Village Sustainable Livelihood Program, Jawhar	Tree plantations for tree based farming	23
	Floriculture plantation	61 families
	Training	Self help group training, farmer training in crop management
	Support for landless through backyard poultry management	3 families
	Water management	Farm ponds, drip irrigation, repair of check dam

#### EDUCATION

Basic child education	School on Wheels)Class room facility	1 School van, remodeled
	Basic education/enrollment	75 children in 3 tenements
	Training on safety for teachers of migratory workers' children	56-60 teachers
High school students' career orientation	Career counseling for high school students in Municipal schools	1000 students
Young adults skill building	Computer aided drafting for youngsters ITI students, marginalised students	Introduce program in Delhi, Kolkata. Continue in Mumbai, Pune, Bangalore

#### INFRASTRUCTURE

Infrastructure for Khoripada, Jawhar	Water management for sustainable livelihood	Engineering solutions for various projects
Reilef work in Uttarakhand	Rehabilitation in Uttarakhand (Tata Group partnership)	

#### HEALTH & HYGIENE

Swach Bharat Mission	Partner with client for building toilets in rural Gujarat	Project management consultancy for 3000 toilets
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## **TATA** CONSULTING ENGINEERS LIMITED

Engineering a better tomorrow

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