“All complex problems are best handled with conviction, devotion, self-confidence…….”

- An interview with Mr. Rajesh Kumar Srivastava

Mr. R. K. Srivastava is an experienced geologist who has been working as Director (Exploration) of Oil and Natural Gas Corporation Ltd., the leading national oil company of India, an Energy Maharatna, and had held additional charge of Chairman and Managing Director (CMD) from 1st September 2022 till 6th December 2022. He is the non-executive Chairman of ONGC TERI Biotech Limited (OTBL) and Director-In charge, Carbon Management and Sustainability Group (CM&SG) of ONGC. He is holding the charge of Indian Geological Congress (IGC) as President for the tenure 2021 to 2022 and is also a member of research advisory committee of Wadia Institute of Himalayan Geology (WIHG).

He is an alumnus of Lucknow University where he acquired the degree of Master of Science (geology) followed by M. Tech degree in engineering geology from the prestigious Indian Institute of Technology, Kanpur. Pursuing continuous learning Mr. Srivastava has successfully completed the FT non-executive Director Diploma Program in 2022.

Mr. Srivastava, a visionary exploration leader and industry veteran, joined ONGC in 1984 as a Graduate Trainee and has over the years risen in the hierarchy of ONGC by serving in different capacities and key positions, including position of Chief of Exploration and Development Directorate. He is an expert in up-stream
hydrocarbon exploration and development with wide experience in all the gamut of E and P ranging from well-site operations, exploration & development geology, seismic data interpretation to strategizing, planning, implementing and monitoring of exploration programs, field development schemes, etc.

As an acknowledgement of his outstanding contributions, he was awarded the prestigious ‘National Mineral Award’ in 2009. He played a key role in the formulation of ‘Hydrocarbon Vision-2030 for northeast India’ driven by Ministry of Petroleum and Natural Gas, Government of India.

Towards making ONGC one of the best companies in E and P space, Mr. Srivastava has always advocated for a focused approach for expanding exploration, especially looking for new opportunities. Testimony to his continuous strife for excellence in hydrocarbon exploration, two new basins have been added to the hydrocarbon map of India, Bengal Basin as the 8th producing basin of India and Vindhyan Basin, which may soon become the 9th producing basin of India.

When approached for this interview, Mr. Srivastava graciously agreed despite his busy schedule. The following are excerpts from the interview conducted some time at the end of November 2022.

**Q. It is with great expectation the energy hungry nation has bestowed the responsibility of leading exploration endeavours of the energy behemoth to you. How do you see the challenge?**

**A.** Having joined this prestigious organisation as a young geoscientist and working, learning, and rising through the ranks, I feel humbled and privileged to be chosen to lead India’s biggest National Oil Company as Director (Exploration) and entrusted with the additional charge of leading this organisation as Chairman and Managing Director for a brief period. These positions come with great responsibilities towards all the stakeholders of this great organisation. Having served the company for more than three decades in various capacities, I am aware of the expectations and the challenges in meeting the energy requirements of our country. This of course is linked to the ever-increasing gap between domestic oil and gas production and its consumption in the country. During the last decade, ONGC has made concerted efforts to put promising new basins on hydrocarbon map of India through a consolidation process by acquiring additional acreages and aggressive exploration with a view to add additional volumes for production. You must be aware that ONGC has readily responded to the clarion call of reducing import dependency through an ambitious Action Plan to enhance production and reach to a level of 26 MMT of oil and 32.5 BCM of gas by 2024.

**Q. What are major exploration challenges being faced in the different basins in India, and what strategic measures are being adopted to address them?**

**A.** Recent success in the Bengal and Vindhyan basins have been path breaking. ONGC made its second discovery at Bengal Basin recently. We have been aggressively pursuing its exploratory programme in Bengal Basin both in form of acquiring new data and in form of acquisition of new exploration acreages.

In the Vindhyan Basin too, recently ONGC has established commercial success. To chase this success, we have already fast tracked the drilling program through introduction of pad drilling from the existing drill sites to cut short the time of pre-drill activities. We are aggressively pursuing early monetization.
ONGC is also focusing on other category-II and -III basins of India by acquiring acreages through HELP/OALP and planning & executing exploration program in these acreages.

Field growth/delineation of established hydrocarbon pools is ONGC’s key exploration component in older/mature basins to unlock the yet-to-find (YTF) potential of proven plays at reduced risks and to maintain healthy Reserve-to-Production (R/P) ratio.

ONGC’s dedicated efforts to revisit and re-explore the older basins using new technology have started bearing encouraging results as can be seen in recent exploration successes as elucidated below:

- Exploration success in establishing BCS play extension in North Gelki, Assam Shelf
- Maiden commercial hydrocarbon discovery from Permian Kommugudem formation of KG Basin
- Discovery in Devgarh formation in Ratna Field Mumbai Offshore
- Discovery in Daman formation, Tapti Daman Block Mumbai offshore

Notwithstanding smaller discoveries in older basins, shorter cycle time for monetizing commercial discoveries and improved estimation of the risk/reward equation should drive our exploration targeting untapped YTF hydrocarbons in these basins.

I am quite confident and optimistic that these initiatives shall bear fruits for us in the coming days.

Q. To maintain healthy Reserve Replacement Ratio (RRR) ratio, new hydrocarbon prospects are regularly needed to be identified for drilling. How is this challenge being addressed, considering largely mature areas are being operated in by ONGC.

A. Field growth/delineation of established hydrocarbon pools is key exploration component in mature basins to unlock the YTF potential of proven plays at reduced risks and also to maintain the R/P ratio. During FY 2021-22, ONGC has maintained RRR (2P reserves) of more than 1 for the 16th consecutive year; last year it stood at 1.01 from domestic fields. So, we can maintain healthy RRR figure despite all the challenges ONGC is facing.

As we know, the basic building block for generation of prospects is quality seismic data and its integration with other G and G data. Vintage seismic data is being re-processed using advanced technologies wherever improvement is necessary and feasible. Potential areas are also being covered by new seismic data using latest technologies and advance geometries. These actions are helping to sustain the accretion and production in the short term. Consolidation of mature plays through field growth is the integral part of ONGC’s exploration strategy towards YTF realization and targeted conversion of around 1690 MMToE across all basins.

As a medium- and long-term strategy, ONGC is acquiring new acreages across all categories of basins including category-II and category-III and deep/ultra-deep-water areas. ONGC envisages to achieve an acreage holding level of around half-a-million km² by 2024-25 under the accelerated exploration program.
Q. ONGC is credited with the discovery of hydrocarbons in almost all the producing basins of India with many oil fields therein. Some of the aging fields have been on a natural decline now, and reportedly ONGC has been trying to reverse the falling output. What are the efforts undertaken and how successful have these been?

A. Considering that time is of essence, we have embarked upon an accelerated exploration and production program through various initiatives.

On the production front, while legacy fields continue to be the mainstay of our base production, there is significant traction on the development of new fields as well as new schemes for maximizing recovery in mature areas.

ONGC, supported by government’s policy, is strongly pursuing improving recovery from the existing areas. As part of expanding its EOR portfolio under the ER policy, 211 fields of ONGC located in onshore and offshore areas were considered for screening. A total of 33 ER
proposals were submitted, out of which 17 have already been approved. Two fields, Gandhar GS-9 and Gandhar GS-11 are under feasibility study.

ONGC, for the first time, executed a pilot polymer flood project in the heavy oil field of Mehsana. The pilot was successful in achieving all its objectives. The incremental gain is 5,057 m$^3$ in 13 months against FR envisaged 4,960 m$^3$. Commercial scheme for the same has already been submitted and envisages incremental oil gain of 1.79 MMT (~ 5 % over BAU) and recovery of 23.3 % by 2046.

Through various phases of field development schemes and use of advanced technologies, hydrocarbon volumes were reviewed for L-I reservoir in the MH North field and revised upward from oil in-place volume of 10.31 MMT (2004) to 20.86 MMT.

On the exploration front ONGC has embarked upon an accelerated exploration program under which we are committed to drill around 500 exploratory wells besides acquiring 2D/3D seismic data to apprise the new acreages. This endeavour further gets boost supported by government of India’s policy support declaring hitherto inaccessible (No-Go) deep water areas available for exploration. Our international outreach program is expected to bring in major international players participating jointly with us in exploration. Emphasis is being given to bring in best in class technologies to leverage our E and P efforts.

ONGC is cognizant of the role it assumes in the national energy landscape. It has made cumulative core E and P spends of over Rs 1,500 billion over the past five years. As on 01.04.2022, 20 major projects are under implementation with a total projected cost of around Rs 590 billion with envisaged gain of around 85.5 MMTOE.

These are some of the many efforts on the part of ONGC, not only to sustain but also enhance the domestic production.

**Our international outreach program is expected to bring in major international players participating jointly with us in exploration.**

Q. **Back in 2019, ONGC adopted a strategic roadmap called ‘Energy Strategy 2040 (ES-2040)’, wherein a target was set to double its overall oil and gas output, diversify into refining, marketing, and other businesses, as well as make investments into renewable energy sources. Could you please elaborate on the different areas outlined in this roadmap and give us a sense on the progress made so far?**

A. ONGC had adopted Energy Strategy (ES)-2040 as its strategic blueprint for future in 2019. “Energy Transition” and “Future Energy Demand Scenario” were the fundamental drivers of the roadmap and, going along, this transition is going to play an increasingly stronger role in charting out the future policies and strategies. ONGC remains committed to expand and double its production from both domestic and overseas operations by 2040. ONGC is in the
process of sourcing new technologies and international partnerships for harnessing difficult play fields as it remains focussed on shorter business cycles.

Coping up with ES-2040, from the exploration point of view, we are already in the mission mode. In line with the mandate of expanding exploration footprint into less explored/unexplored areas, especially in category-II and III basins, ONGC has already adopted steps to venture into such areas. In furtherance, it has already been brought out that, under Open Acreage Licensing Policy (OALP) bidding process, ONGC has so far been awarded 45 exploration blocks encompassing total area of around 89,807 km², out of which, 54,745 km² (61%) of area is falling in less explored areas of category-II and III basins. This figure itself speaks about the focus and the intensity of exploration activities that the company is contemplating. We have taken steps for induction of advanced exploration techniques - already induced a few AI/ML based technology in addition to induction advanced exploration techniques relating to seismic API. For deep water exploration, we have entered into MoU with reputed global E and P players. Bringing reputed global E and P player in the Indian hydrocarbon industry may be a game changer and will open up a new vista.

In downstream, ONGC is well poised to expand its capacity through the expansion and green-field activities in progress at its subsidiary units. We are also expanding our footprints in City GAS Distribution (CGD) and re-gas through group entities and has presence in 23 geographic areas across 12 states. A 5 MMTPA LNG regasification terminal at Chhara port (Gir, Somnath District) in Gujarat is under implementation. We are progressing well on the path of strategic restructuring of the group businesses with amalgamation of ONGC Mangalore Petrochemicals Limited (OMPL) with Mangalore Refinery and Petrochemicals Limited (MRPL).

In addition, ONGC is also exploring opportunities in the field of renewables. ONGC, which presently possesses 31 MW of installed solar capacity and 153 MW of wind, is trying to accelerate its development of renewable energy projects. In July 2022, ONGC signed a memorandum of understanding with Indian renewable group, Greenko, to create a joint venture that will invest INR 494 bn (US$6.2bn) in renewable energy, green hydrogen, and green ammonia projects in India, aiming to scale up to 10 GW capacity of solar and wind projects.

MoU has also been signed with Equinor to tap opportunities of upstream, midstream, downstream sectors, in the field of renewables and carbon neutrality.

Q. Any ONGC interest in expansion into the petrochemical sector?

A. ONGC’s presence across the value chain and beyond the E and P business is also an effective way to mitigate risk associated with the oil price cycle. ONGC already has its presence in petrochemical sector through its subsidiaries in form of MRPL and OPAL. Taking over of majority stake of Hindustan Petroleum Corporation Limited (HPCL) is also an effort in this direction.
Q. Over the last three decades, the R and D activities have gradually seen a shift from the NOCs to the service companies, who undertake to innovate and introduce new products and offerings. However, NOCs also focus such efforts in-house for addressing solutions to E and P challenges. Could you please tell us about some such notable R and D innovations within ONGC?

A. ONGC, an E and P maharatna company, is facing wide variety of challenges, some of them unique to different basins and fields, and therefore, relies upon specifically designed in house R and D solutions besides sourcing solutions from the industry vendors. Catering to its need on various fronts, ONGC has setup of 12 world class institutes for R and D, technology development and training. Out of these 10 are R and D institutes. All the ONGC institutes are interconnected through a cord under the common umbrella namely COIN (Committee of ONGC institutes), which collectively provides a platform to share knowledge base, identify gaps and overlaps thereby providing an effective R and D network. All the R and D institutes are certified by international organisation for standardization (ISO) and recognised by Department of Scientific and Industrial Research (DSIR, Ministry of science and technology). In this respect I must admit that institutes of the stature of KDMIPE (Keshva Deva Institute of Petroleum Exploration, Dehradun), GEOPIC (Geodata Processing and Interpretation Centre, Dehradun), CEWELL (Centre for Excellence in Well Logging Technology, Vadodara) and IRS (Institute of Reservoir Studies, Ahmedabad) are nerve centres of our E and P efforts. These institutes are regularly interacting with the industry and academia for the induction of new thought processes that will lend value to the entire exploration value chain and value cycle. These institutes are continuously in touch with various reputed E and P players/domain experts for possible induction of new technologies. ONGC collaboration with IITs under the ‘ONGC-Pan IIT Collaborative Research Program’ have resulted in to filing of seven patents, sixty PhDs were registered, and eighty research papers have been published. MOUs are also signed with Wadia Institute of Himalayan Geology, Dehradun, and Banaras Hindu University (BHU), Varanasi for undertaking collaborative projects. Seismic and potential field joint inversion project has been taken-up by BHU to improve sub-basalt imaging for giving impetus to the Mesozoic exploration.
Our Institutes have also developed indigenous software including AI/ML based applications which we use in our activities. Few of them are elucidated below:

- **Seistelligence**: A Python-based artificial intelligence/machine learning application developed indigenously helps in reservoir characterization and reservoir property volumes prediction and deep learning (DL) based techniques. The application is rolled out across ONGC work centers for its wider use.

- **Drona**: To provide a data science platform to perform AI/ML-based techniques, a Modular Data Science Tool, has been developed. In the first phase, this tool is designed to provide lithofacies identification based on well logs. It has been rolled out across ONGC work centers and helped to predict litho-facies in several wells with more than 90% accuracy and significantly faster than conventional approach.

- **Reserves Ultima (Petroleum Resources Management System, PRMS)**: Automated preparation of a highly complex and sought-after report namely Accretion Pattern report for basins and field levels was achieved and integrated with the in-house software to allow Reserve Estimation Group (REC) group to generate the same with just a single click. Field level REC data since 1995 for all fields of ONGC has been successfully migrated to the new PRMS compliant database model. Successfully incorporated business intelligence (BI) visualizations in the in-house developed software. Furthermore, a number of interactive, intuitive and drill through visualizations have been built, such as Field Growth in terms of in-place and EUR, field-wise positions, etc. to have a bird’s eye view.

- **PEBUL Software**: This In-house developed software PEBUL (Production Enhancement by Unloading Liquid) is designed to predict about liquid loading and design of mode of de-
liquification for gas wells. Intellectual Property Right (IPR) has been applied for the software.

- **Oil Field Analyser software**: Software is used for production data analysis for Oil and Gas producing asset. This software can be utilised for any oil and gas producing asset involving multiple sands, multiple areas, and multiple lift modes for efficient monitoring. It is a one stop solution for retrieving data in various meaningful formats, which is very handy to managers for taking decisions. IPR has been applied for the software and planned to be implemented.

**Q. Technology evolution has been taking place at lightning speed since the last decade, which has brought more efficiency in different fields, including our lives. How is ONGC adopting technology advances in exploration and development to increase overall efficiency in these areas?**

**A.** Exploration and production companies are always in need of innovation and technological advancements. ONGC is one of the largest and strongest E and P company in India with in-house service capabilities in all the activity areas of exploration and production of oil and gas and related oil-field services. The state-of-the-art technologies inducted and absorbed over the years such as depth domain processing, stratigraphic inversion, advanced volume-based interpretation tools, stochastic lithofacies modelling using neural network, spectral decomposition, geo-cellular modelling, etc. are a few examples.

An important aspect of ES-2040 is “Digitalisation Initiatives”. The search for hydrocarbons has evolved into highly sophisticated technology where today almost every scientific discipline known is being brought to bear upon the endeavour. Moving towards cloud technology to provide cost and time efficiency is now not a luxury but a necessity at enterprise level. We have introduced ‘One company, One data policy in ONGC’ and “Consolidation of Computing Resources” to achieve these objectives.

ONGC is aggressively pursuing induction of advanced exploration techniques in the entire spectrum of exploration and production. Technology is an enabler for harnessing hydrocarbon potential from the challenging and difficult plays. The following technologies have been inducted in ONGC across different areas:

**Exploration:**

- In the seismic data acquisition front we have inducted advanced seismic data acquisition technology like OBN surveys.
- In the field of data interpretation and reservoir management ONGC has inducted AI/ML based technology like Seisnetics, rezlytics, data physics optimisation survey by M/S Tachyus, USA etc. in its exploration process.

**Production:**

- EOR: low salinity water flood; 1st time in Indian offshore
- Structural integrity management system (SIMS) in collaboration with IIT Madras
- Increasing efficiency of voidage compensation through profile modification.
Interview with Mr. R.K. Srivastava

- Digital oil field for monitoring and control of oil field operations.

**Digital**
- Setting up Digital Centre for Excellence (DCOE)
- Transition to cloud
- SAP S/4 HANA upgradation
- Real Time Data Management and monitoring (RTDMM) for predictive analytics in drilling

**Services**
- Casing while drilling
- Auto Driller
- Managed pressure drilling
- Liner while drilling
- Subsea integrity monitoring system
- HF jobs through mono bore completion.

Q. Around the world there are talks of clean energy transition from fossil fuels, and efforts are also being made by Government of India to meet its climate targets. One of the areas being focused on is to produce and utilize green hydrogen by 2030. What is your take on this, and how do you foresee the role of ONGC in this scenario?

A. Hydrogen will play pivotal role in the low carbon economy in India. India’s total hydrogen demand is expected to touch 11.7 MMT by 2029-30 from the current 6.7 MMT largely focused in the refinery, chemical, petrochemical and fertilizer sectors. Future demand will be driven by greater use across transport, industry, and power.

The natural gas infrastructure could be utilized for the transport of green hydrogen. The natural gas pipeline could easily transport 10% hydrogen injection into the gas grid. The existing industrial or commercial users will be able to use hydrogen blended natural gas without much difficulty.

ONGC is committed to carry out its business in a responsible and sustainable manner and has plans to progressively move towards carbon neutrality by effective carbon management and adding renewable energy capacity.

In India, several initiatives like blending hydrogen with CNG (H-CNG) for use as transportation fuel, formulating National Hydrogen Mission, etc. have taken place to capitalize the hydrogen as green energy. 50 buses in Delhi are plying on blended hydrogen in Compressed Natural Gas (CNG). Oil and Gas PSUs are developing projects for use of hydrogen as a fuel. The aim is...
to develop India into a global hub for the manufacturing of hydrogen and fuel cells’ technologies across the value chain.

With declining costs of technology, notably in renewable power generation, electrolysers and fuel cells, the use of green hydrogen is likely to become cost competitive in industry, transportation, and storage solutions for electricity systems over the next decade. Presently, green hydrogen produced with renewable resources costs anything from $3 to $6.5 per kg. In India, we must set an aggressive target of achieving under $1 per kg within a decade. This will make India the first country globally to achieve $1 per 1 kg in 1 decade – the 1-1-1 target for green hydrogen.

There are various associated challenges, however, I am sure that with the advent of technologies and economies of scale, 1-1-1 target for green hydrogen is achievable for the country.

ONGC is committed to carry out its business in a responsible and sustainable manner and has plans to progressively move towards carbon neutrality by effective carbon management and adding renewable energy capacity.

While we appreciate the magnitude and urgency of the climate change challenge, we also understand our commitment towards energy security of the country and are committed to carrying out our business in a sustainable manner. ONGC has a multipronged strategy to make its green energy portfolio richer and has plans to progressively move towards carbon neutrality by effective carbon management and adding Renewable Energy Capacity. ONGC is India’s leading oil and gas company and has been pursuing green energy agenda through various alternatives and renewable sources of energy. It has set a target of producing a minimum of 10 GW of renewable power by 2040 while continuing its focus on the core E and P business.

ONGC has signed a memorandum of understanding with Indian renewable group Greenko to create a joint venture that will invest INR494 bn (US$6.2bn) in renewable energy, green hydrogen and green ammonia projects in India, We have signed MOU with Solar Energy Corporation of India (SECI). The MoU provides a broad, overarching framework for ONGC and SECI to collaborate and cooperate for undertaking renewable energy projects including solar, wind, solar parks, EV value chain, green hydrogen, storage, etc. R and D efforts are also going on in the direction of hydrogen energy through our ONGC Energy Centre which has already developed laboratory scale model and very soon shall embark upon scaling it to commercial level.

ONGC is also considering India’s first 200-300 MW demonstration wind offshore power project for which feasibility study is being carried out jointly with NTPC Ltd.

Q. Picking up the thread from my previous question, keeping in line with the Prime Minister Modi’s concept of ‘Atmanirbhar Bharat’, what role for ONGC is being envisaged for improving the energy security of the country?

A. In line with Hon’ble Prime Minister’s vision, the entire exploration program of ONGC has been drafted by considering the ways and means to realize the yet-to-find resources. In the short
term till 2024, ONGC would be targeting about 1690 MMtOE of prognosticated resources. Acquisition of acreages being an integral part of strategy, ONGC intends to reach to a level of 5 lakh km$^2$ of acreage holding by 2025. On the journey to bring maximum area under active exploration, ONGC is committed to increase acreage holding across all categories of basins with focus on expanding exploration in unexplored category-II and III basins and deepwater.

Accelerated exploration plan of ONGC envisages:

- 2-fold jump in 3D seismic data acquisition quantum.
- 1.2 times increase in exploratory drilling performance.
- Increase in CAPEX by 150% for exploration compared to last three fiscals with an allocation of approximately INR 310 bn in the next three years.

ONGC has also been employing state-of-the-art technologies in EOR, IOR, redevelopment of fields, drilling of horizontal wells, HP/HT and Managed Pressure Drilling (MPD) technology for enhancing the productivity of producing fields.

ONGC is constantly striving towards early monetisation of discoveries. Its efforts contributed to the upgrading of Bengal and Vindhyan from category III to Category II Basins, of which the former became a category I basin soon after with commercial production of first oil from its Ashokenagar-1 well.

Perseverance of ONGC over the last 25 years, has now paid off – the Vindhyan Basin is close to becoming the ninth producing basin of India. On testing a well in the Son valley sector of Madhya Pradesh produced gas over 62,044 cubic meters/day, thus confirming the production potential of Proterozoic Basin for the first time in India. ONGC is fully geared to consolidate this development. With belief in prospectivity, it has already acquired 5 Blocks under OALP rounds on the same play trend.

ONGC has completely monetized ‘U’ Field of KG-DWN-98/2 project. Though there has been supply chain disruption earlier due to COVID pandemic and now due to Ukraine-Russia crisis, we still are working towards early monetization of rest of the field of KG-DWN-98/2.

Q. **What efforts are being made by ONGC to contribute towards India’s fight on climate change?**

A. As you know, ONGC is one of the world’s largest integrated oil and gas exploration and production (E and P) company and largest in India. Its exploration and production activities spread across more than 400 operational establishments on land and in the high seas.

ONGC has been proactive, and programs were rolled out long back for reducing its emissions to address emerging issues on climate change. Based on the belief “that cannot be measured, cannot be managed” the first GHG accounting was conducted in the year 2010-11, through external consultant, setting the context and future roadmap for emission reductions. ONGC has undertaken some of the land mark initiatives in emission mitigation by utilising the latest technologies like Flare Gas Recovery Units, Waste Heat Recovery units, Tank Vapour Recovery Units, Energy Efficient motors, Retrofitting Equipment for Energy Efficiency, Reduction in Gas
Flaring, LED Lighting Systems, Replacing Natural Gas with compressed air for instrumentation purpose, Casing Head gas recovery in SRP units, Replacement of old hydrocarbon pipelines, Fuel Switching, Paperless office, Green Buildings, Replacement of Diesel Gensets with Gas Generator sets, Micro turbines, Dynamic Gas Blending, Renewable Energy, ONGC Tripura Power Company, Green buildings, etc are all examples of multitudes of initiatives rolled out by ONGC for combating global warming and climate change. The company continues to look for new opportunities to infuse latest technologies in its value chain.

ONGC has so far registered 15 Clean Development Mechanism (CDM) projects with the United Nations Framework Convention on Climate Change (UNFCCC) with an emission reduction potential of 2.1 Million TCO2e/year.

We have considerable investments in wind and solar power generations including over 150 MW of wind turbine generated capacity in Kutch and Jaisalmer districts. With regards to solar, we have ground mounted solar power plants in Hazira, photo voltaic power plants in Rajahmundry and Uran as well as massive roof top power plants at various office buildings. ONGC has set a target of producing a minimum of 10 GW of renewable power by 2040. We have signed a MoU with Solar Energy Corporation of India (SECI) which provides a broad, overarching framework for ONGC and SECI to collaborate and cooperate for undertaking renewable energy projects including solar, wind, solar parks, EV value chain, green hydrogen, storage, etc. For emerging hydrogen space, we have signed a MoU with Greenko, and ZeroC Private Limited, to jointly pursue opportunities in green hydrogen and its other derivatives. In our core E and P operations we have installed facilities such as new gas gen-sets, micro turbines, and gas flaring recovery schemes to reduce flaring of natural gas. We are the first non-American company to be a part of Global Methane Initiative and through this program alone, ONGC could prevent over 20.48 MMSCM of methane gas leakages into the atmosphere. As we all know in the short term the global warming potential for methane, the dominant
component of natural gas, is almost 84 times that of CO$_2$. We are in the process of implementing CO$_2$ based EOR as a CCUS project in Gujarat which has the potential to sequester 5 to 6 million tons of CO$_2$ by 2040. We have cut the carbon emission intensity of our operations by over 12% in last five years (reported in 2021). Overall, we have a portfolio of investments in diverse technologies across all spectra of renewables while at the same time investing heavily in decarbonizing our core E and P operations.

Q. One effective way for reduction of carbon footprint being adopted by many NOCs is the adoption of CCUS. Has ONGC considered its adoption, and if so, how successful has the experience been?

A. We, at ONGC, have always believed that no energy transition can happen without traditional oil and gas companies playing a dominant role. CCUS has been around for decades, and it is oil and gas companies that has led at the forefront of this revolution in making. Until we have the scale of renewables, CCUS is the most compelling technology to decarbonize our energy needs. It becomes all the way more significant in the Indian scenario. As a NOC we have a responsibility to provide reliable and affordable energy, the latter being the key, to our burgeoning middle class and lift our less fortunate populace out of destitution. We are committed to end this sinister cycle of energy poverty. ONGC has signed a MOU with Indian Oil Corporation Ltd., wherein, as a CCU project, we will be utilizing the captured CO$_2$ from their Koyali refinery for EOR project in depleted Gandhar oilfield. This pilot project has the potential to sequester 5 to 6 million tons of CO$_2$ by 2040. A standalone carbon storage project as of now is not economically feasible, so we have included enhanced hydrocarbon recovery as well as provision for blue hydrogen production for sustainable carbon capture.

Another aspect that I would like to highlight is that we need to have a comprehensive national carbon storage assessment of our geological formations for an effective carbon management towards a low carbon future. ONGC, with its vast subsurface experiences in most of the 26 Indian sedimentary basins is advantageously placed to accurately evaluate the carbon storage potentials in depleted oil and gas fields, saline formations and in un-mineable coal seams. As an E and P company, we not only have the technical know-how, but we can also steward the whole carbon storage and utilization operations by sharing our existing surface and subsurface infrastructure. A centralized database will act as a foundation for government and industries for their policies formulation and for future business decisions since a dependable CO$_2$ storage estimate is a prerequisite to ensure successful deployment of CCS technologies.

Q. The oil and gas industry is cyclic and goes through ups and downs (in the price of the barrel) created due to geopolitical situations, or otherwise. In the west the downcycles usually result on occasional downsizing in the companies. What impact does the fluctuation in the price of oil have on ONGC’s performance as a company?

A. Cyclicity of crude oil price is a reality and it is seen in the recent past that its frequency has increased. ONGC, being an integrated energy company across full hydrocarbon value chain, is able to shield itself from volatile crude price cycle to a large extent.
Q. A common perception in some of the multinational oil companies is that a geoscientist’s current training can get him/her a job but may not keep him/her attractive as a productive and efficient employee throughout a decades-long career. How do you cater to such needs within ONGC, i.e., building new skills in the workforce to address complex challenges?

Employees are the cornerstone of ONGC’s growth and value creation. ONGC’s HR Vision is to build and nurture a world class human capital for leadership in energy business, by continuously innovating and adopting best-in-class HR practices to support business leaders through engaged, empowered, and enthused employees. Our talent management strategy is focused on building an optimal and competent workforce to meet business needs and is centered around workforce planning and talent acquisition, performance management, learning and development, career growth, succession planning, leadership development, and extending best of employee facilities, welfare benefits and work environment.

Capacity building of the workforce is a priority area, with dedicated institutes taking care of the learning and development needs of our employees to effectively meet the challenges of E and P industry. ONGC has tie-ups with several national and international institutions, agencies and business schools for capacity building of its energy professionals. Learning Management System (LMS) is one of the landmark initiatives undertaken by ONGC in recent times. A pioneer project under the Government’s Digital India Initiative, LMS portal brings competency-based learning to all ONGCians, to enable self-paced learning, continual learning through learning pathways, world class trainings, up-to-date content and assessment-based progress. With this, ONGC has become the first PSE to onboard Learning Management System in 2022 under Mission Karmayogi launched by Hon’ble Prime Minister. ONGC has in place strategic
development interventions across executive levels, to build and nurture a continual pipeline of energy leaders.

(At Jaisalmer War Memorial, 2021)

Q. The present exploration and development scenario in the industry has changed quite a bit over the last two decades, as we have almost moved away from the conventional oil and gas production, more so in the western world. Our industry is now focused on deep-water settings, subsalt plays, sub-basalt plays, shale resources, gas hydrates, geothermal energy, and the like. Could you tell us about the efforts that ONGC may have made in exploring some of the relevant unconventional resources, and how those efforts are panning out?

A. ONGC has been an active contributor on gas hydrates exploratory research under National Gas Hydrate Program (NGHP) of Govt. of India. ONGC, as a Consortium Member of National Gas Hydrate Program of GOI has played a significant role in G&G studies for the identification of sites for NGHP-01 and NGHP R and D Expedition-02. Based on the results of NGHP-02 and subsequent studies and review by international experts, KG Offshore area (DW) has been found suitable for pilot production test. Various studies like sand control measures, well design, reservoir, and production simulation modelling as prerequisite for the pilot production have been completed. ONGC would undertake pilot production test in deep waters for gas hydrate. In March 2021, ONGC had signed an MoU with initial validity of five years with Skolkovo Institute of Science and Technology (Skoltech), Moscow for collaborative studies to establish
Interview with Mr. R.K. Srivastava

cooperation in the gas hydrate research and technology applicable to Indian basins. ONGC has also signed an MOU with IOC R and D for development of nanoparticles as kinetic inhibitors in the dissociation of gas from gas hydrates under reservoir conditions.

As part of concerted exploration efforts for basement play, a total of 12 wells were drilled, which included 3 wells in Mumbai Offshore, 2 wells in Assam Shelf and 7 wells in Western Onshore (WON) Basin. Out of these, three wells in Mumbai Offshore and two wells in WON proved oil bearing and one well proved gas bearing in Mumbai Offshore. In addition, testing of six wells drilled in the previous financial year also gave encouraging results for basement play.

High pressure- High Temperature (HP-HT) and Tight reservoirs have been an exploration and development challenge for ONGC. ONGC is striving hard in the field of HP-HT due to bore hole complications, fluid design, high-cost drilling technology including HP-HT cementing, well construction and other reservoir engineering issues. In ONGC operated areas, HP-HT regime is encountered in areas like Periyakudi, Bhuvanagiri in Cauvery Onland, Kottalanka, Nagyalanka, Bantumilli South and Malleswaram in KG Onland. Yanam in KG Shallow offshore. Certain areas in Western Offshore were also classified as HP-HT reservoirs. Additionally, high pressure regime is often encountered in certain areas of Assam Arakan Fold Belt.

During recent campaign of high-tonnage hydro-fracturing (HF) in Malleswaram field, significant gain in oil production could be achieved.

ONGC has been operating in 4 CBM blocks (Jharia, Bokaro and North Karanpura in Jharkhand and Raniganj in West Bengal) where exploration activities have been completed. Developmental activities are at an advanced stage in three of these blocks viz. Bokaro, Jharia and North Karanpura.

Geothermal for Carbon Neutral Ladakh is the first step to putting India on the Geothermal World Map. The MoU for the same was signed with the Ladakh Autonomous Hill Development Council, Leh, in February 2021. Phase-I of the initiative will involve exploratory cum production drilling of wells up to 1000 m depth and the setting up of a Pilot Plant of up to 1 MW power capacity. The drilling operation is in progress.

As mentioned earlier also, ONGC is again venturing into high-risk high-gain ultra-deep water exploration in east and west coast of India. For this we have already acquired deep/ultra-deep acreages under OALP in Cauvery, Andaman, and Mahanadi basin. We have also identified few more in Kerala Konkan basin, Saurashtra offshore. Efforts are also on to bring in experienced partners for exploration of deep and ultra-deep-water fields of east and west coast basins for professional societies help in bridging the gap between academia and industry by bringing them to same platform. It creates a synergy and flow of knowledge from both sides.

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possible technology, risk and skill sharing. Significant progress has been made in this regard with global majors like Exxon Mobil, Chevron and TotalEnergies. ONGC also invited EOIs for various E and activities for deep/ultra-deep water areas of KG Basins.

Q. According to you, how does being a member of a professional society influence a geoscientist’s career? What is your take on habitual reading and writing of articles in a professional society journal especially for the young geoscientists?

A. Professional societies help in bridging the gap between academia and industry by bringing them to same platform. It creates a synergy and flow of knowledge from both sides. It also gives geoscientists an exposure to best of both worlds. In India, professional associations like Society of Petroleum Geophysicists (SPG) and Association of Petroleum Geologists (APG) are doing tremendous work through their biennial conferences, continuing education courses and regular lectures. It provides E and P fraternity an excellent platform for deliberation and dissemination of valuable technological ideas and know how.

The industry relies on synergy between subsurface geoscience and engineering teams rather than individual disciplines working in silos. Synergy in interdisciplinary approach will open new opportunities for member education, community, and knowledge sharing that are best positioned to be successfully delivered in a unified organization.

Young geoscientists should always be looking for their skill enhancement. What better way is there than to go through scientific publications by experts and geoscientists across the globe?
Q. Your current role as Director (Exploration) with additional charge of C&MD of India’s leading national oil company must be very demanding. What do you do to destress yourself, and maintain a work- personal life balance?

A. You don’t start preparing yourself for the responsibilities when they are entrusted to you. The key “mantra” is a continuous process of self-development. Even though the role that I am in is highly demanding, but it is also very satisfying and energizing once you see the fruits of actions taken by you. I am fortunate to be supported by over twenty-seven thousand strong and competent manpower of ONGC that makes my job much easier, though challenging.

Another very important aspect is time management, which helps me manage the work-personal life balance. I am fond of listening to music and reading poetries/Shayaries/Ghazals. My newfound passion for golf also helps me keep going.

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Q. What message would you like to give to India’s geoscientific community across disciplines through this interview?

A. I believe all journeys start with a small first step. All complex problems are best handled with conviction, devotion, self-confidence, and belief in the collective wisdom. We need to pool as
many innovative ideas as we can. It is not enough to rest on our past laurels and allow complacency to creep-in.

My simple message to young geoscientists is to remain committed, clearly understand their roles and responsibilities and prepare to face the challenges of energy transition and evolving business paradigm through continuous learning and skill enhancement. There are innumerable opportunities available for geoscientific communities which they should responsibly discharge and contribute to building our nation.

The image is taken near Corbyn’s Cove in south Andaman where the Oligocene-aged sandstone-shale turbidites are best exposed. These exposures were deposited in deep sea environment with alternating bands of sandstone and shale commonly known as Andaman Flysch. (Image courtesy of Ritesh M. Joshi)