Mounting and persistent pollution problems will lead to steady growth in India’s fragmented environmental technologies market. The overall environmental technologies market in India, including goods and services, is valued at USD 16.3 billion (2016). India ranks third overall in the 2016 Top Markets Study (TMS), with a Composite Environmental Technologies Score of 31.7. India ranks second for water, with a score of 16.3; sixth for air pollution control; and seventh for waste and recycling markets, with scores of 12.8 and 2.7, respectively.

State of the Environmental Regime

India’s complex environmental regulation is hinged on five major pieces of legislation, including the Environment (Protection) Act, 1986; Forest (Conservation) Act, 1980; Wildlife (Protection) Act, 1972; the Water (Prevention and Control of Pollution) Act, 1974; and the Air (Prevention and Control of Pollution) Act, 1981.

The regime is steadily improving as evidenced by the Environmental Business Journal-OECD Environmental Stringency Survey, which ranks environmental regimes on a scale from 1 to 7 (with 1 being lax and 7 being the most stringent), which scored India a 3.6 in 2012, a 1.2 point improvement from its 2005 score of 2.4. India’s ranking on the World Economic Forum’s 2011 Index for Regulatory Stringency of 48th globally, with a score of 3.88 (on a similar scale to that of EBJ-OECD), was consistent with the EBJ-OECD ranking in the same survey for enforcement of 54th globally, with a score of just 3.50, reinforcing the assessment of moderate regulatory stringency coupled with moderate enforcement.

The Ministry of Environment, Forest and Climate Change (MoEFCC) is India’s federal agency responsible for implementation and oversight of environmental laws. Enforcement, however, is delegated to the state level through State Pollution Control Boards (SPCBs) or Pollution Control Committees (PCCs) in the seven union territories who ultimately answer to state government heads rather than the federal authority. This delegation of enforcement to state governments has served to decentralize enforcement practices and contributes to fragmentation and incongruent application of rules across provinces, lack of transparency in regulations and practices, poor implementation of regulations, weak regulatory compliance and corrupt practices in some areas. India's environmental laws have proved challenging to enforce because regulators lack the resources to address issues of asymmetric information and assert authority. Government agencies that enforce India's environmental laws have 200 to 300 technical staff, who monitor at least 50,000 plants and factories.
There is also concern among Indian civil society that the Modi government may hinder development of an effective environmental enforcement regime by abolishing environmental approvals for select industries and proposing that government regulators rely on industry to monitor and report its own effluent and emissions. Since becoming Prime Minister of India on May 26th, 2014, Prime Minister Narendra Modi expressed his commitment to economic development and growth. Some experts view this commitment as an attempt to dismantle laws for protecting the environment. On August 29, 2014, Prime Minister Narendra Modi organized a high level committee within the MoEFCC to review and amend important Indian environmental laws: the Environmental (Protection) Act (1986), Forest (Conservation) Act (1980), Wildlife (Protection) Act (1972), the Water (Prevention and Control of Pollution Act) (1974), and the Air (Prevention and Control of Pollution) Act (1981). One of the committee’s recommendations is eliminating the role of independent pollution regulators, thereby trusting industries to police themselves. Many experts expressed concern about the process used by the committee and its recommendations, including whether they indicate that the Modi administration is opposed to enhancing environmental protection.

Market Barriers

The following barriers have been identified by the Environmental Technologies Trade Advisory Committee (ETTAC), the U.S. Department of Commerce’s Office of Energy and Environmental Industries (OEEI), and the Commercial Service India as the most problematic for environmental technologies companies attempting to export to or work in India:

1. **High Tariffs**
   India has relatively high tariffs for environmental technologies, particularly in the area of monitoring and instrumentation. High import taxes also diminish the price competitiveness of higher quality, and thus pricier, U.S. environmental technologies.

2. **Fragmentation of the Market Across Regions**
   Environmental technology markets in India are highly fragmented across the country, and it is difficult to find a representative or distributor that can truly provide national sales coverage. Companies that succeed in India must expend additional resources to develop export strategies on a region-by-region basis.

3. **Transparency and Price Sensitivity in Tenders**
   Transparency in how tenders are bid is an ongoing issue in India that is further complicated by regional fragmentation. Tenders are also plagued by a lowest bidder mentality with little assessment of cost/quality trade-offs.

4. **Corrupt Practices in Tenders**
   U.S. companies have reported that public tenders are rife with institutional corruption that negates U.S. companies’ ability to compete.

5. **Rolling Back Environmental Compliance Rules**
   Poor enforcement of environmental rules has been an ongoing struggle in India. The Modi government proposal of “the concept of utmost good faith” hinges on voluntary disclosure and monitoring of pollution control by Indian businesses. If this proposal becomes law, the market for industrial environmental technology will likely erode, along with the environmental compliance incentives that an active enforcement regime enables.

6. **Limited Sophistication of Local Partners**
   Local partners are tacitly, if not formally, required in tenders, and many national players in the Indian water market are new to the water technology sector and may have no prior experience developing and implementing water projects, creating additional management burdens for U.S.
companies entering into joint venture relationships.

Market Opportunities

Air Pollution Control

Air Quality Monitoring

The Central Pollution Control Board is responsible for operating India’s 342 monitoring stations under the National Air Quality Monitoring Programme (NAMP). In April 2015, the Indian government launched the country’s first Air Quality Index (AQI). The AQI will cover 10 cities initially and eventually will be expanded to more than 60 cities. Each city will have six to seven continuous monitoring stations with AQI display boards, and the data will be made available to the public via an online portal on a daily basis. The Indian government has sought adoption of science-based air pollution control strategies in Indian cities to establish baseline data on ambient air quality and pollution sources. This information will be used to define cost-effective source reduction opportunities and investments, assist policymakers in evaluating health and economic impacts of various air pollution control approaches, and foster accountability for air quality improvements. This initiative will build Indian capacity in assessing and predicting future emissions inventories, developing effective and efficient control strategies, and assessing health benefits of various air pollution control approaches. Particular emphasis has been placed on monitoring and control technologies relevant to coal-fired power plants and petroleum refining operations. India’s expanding network of air monitoring stations provides opportunities for relevant U.S. technology providers.

Key Technologies in Demand:
- Fenceline monitoring equipment
- Continuous emissions monitoring equipment
- Ambient air quality monitoring equipment
- Source emission measurement technologies
- Dry sorbent injection technologies
- Flue gas desulfurization equipment
- Activated carbon injection technologies
- Inspection, adjustment, maintenance and repair services
- Selective catalytic reduction technologies
- Selective non-catalytic reduction controls
- Urea to ammonia reagent systems

Air Pollution Control

Coal is India’s primary energy source, accounting for more than 70 percent of energy generation in the power sector. Most of the country’s hard coal, however, is of poor quality, with low to medium heat values and high ash content, contributing to decreased efficiency in power generation and higher local emissions. With low quality coal and more than 85 percent of India’s coal-fired power plants currently employing subcritical technology, the average efficiency for the generating fleet is less than 35 percent. The resulting unreliable electricity supply, together with high end-use tariffs, has led energy-intensive consumers, such as the steel, cement, chemicals, sugar, fertilizer and textile industries, to produce a significant portion of their own electricity. Wealthier households also typically employ back-up diesel generators, contributing to worsening local air pollution, particularly from particulate matter.

The government’s “Make in India” initiative aims to increase India’s manufacturing as a percentage of GDP to 25 percent by 2022. The program was launched in 2014 and targets a number of key sectors, including mining, oil and gas, power generation, pharmaceuticals, chemicals and construction. Expansion of infrastructure – including energy infrastructure – to support a build-up of the country’s manufacturing base will require increased inputs from energy-intensive, coal consuming sectors such as cement and steel, which are substantial contributors to air pollution. If India is to meet its Nationally Determined Contribution (NDC) commitment under the December 2015 Paris Climate Agreement to reduce the emissions intensity of its economy by 33 to 35 percent as compared with 2005 by 2030, emitting facilities will require emissions control technology.

The government also has identified 17 high polluting industry sectors in need of greater oversight and air pollution control measures. These include aluminum smelting, pharmaceuticals manufacturing, chlor-alkali/caustic soda, cement (200 tons per day (TPD) and above), copper smelting, dyes and dye intermediate, fermentation (distillery), fertilizer, integrated iron and steel, leather processing including tanneries, oil refinery, pesticide formulation and manufacturing, pulp and paper (30 tons per day (TPD) and above), petrochemical, sugar, thermal power plants, and zinc smelting. As the development of new rules for these industries evolves and are enforced,
opportunities in control technologies will continue to develop.

Key Technologies in Demand:
- Wet and dry scrubbers
- Bag houses
- Filters
- Flue Gas Desulphurization
- Selective catalytic reduction technologies
- Selective non-catalytic reduction controls
- Urea to ammonia reagent systems

Waste Management and Recycling

Solid Waste Management and Recycling

Waste management and recycling is underdeveloped in India. The country generates about 55 million tons of municipal solid waste (MSW) per year, the vast majority of which remains untreated. Formal and industrial recycling processes are fairly limited, as a widespread informal recycling industry provides income to many of India’s poorest households. The government has allocated approximately USD 1.11 billion for solid waste management projects in urban areas, which is about one-third of the total estimated amount of investment needed to manage the country’s MSW, according to the U.S. Commercial Service in Kolkata.

In June of 2015, the MoEFCC published new draft Solid Waste Management Rules for public comment. The draft rules cover waste separation, collection, transportation, processing, storage and disposal, with an emphasis on source reduction. Also included are criteria specified for solid waste treatment facilities, landfills (siting, closure and environmental monitoring), waste-to-energy (WtE), composting and construction and demolition (C&D) waste. Standards are set forward for composition of compost, treated leachates and emissions from MSW incineration, as well. The final version of the rules went into effect in March 2016. If enforced, the new rules should lead to opportunities for U.S. waste management equipment and service companies.

Key Technologies and Services in Demand:
- Waste handling equipment
- Waste treatment technologies
- Brownfield site remediation design and equipment
- Soil contamination testing and monitoring equipment

Recycling of Discarded Electronics

The Indian MoEFCC implemented the E-Waste Management and Handling Rules in 2011 and a revision as the E-Waste (Management) Rules in 2015. These directives outline responsibilities of electronics producers, discarded electronics collection centers, recyclers and other relevant entities to limit environmental and health issues potentially created by improperly discarded/recycled electronic equipment. The 2011 law seeks to establish a formal electronics recycling framework to promote safe handling of discarded electronics and growth in related economic activities nationally. The 2015 revision expands producers' responsibility under an Extended Producer Responsibility (EPR) program, including setting up Producers Responsibility Organizations (PRO) and e-waste exchange.

According to Environment Minister Prakash Javadekar, the new 2015 rules will place “absolute responsibility” on the producer to manage all aspects of e-waste, from generation to safe disposal. The increase in Indian demand for equipment and recycling services presents opportunities to U.S. companies with experience in providing equipment or services used in safely and efficiently recovering valuable materials from discarded electronics.

Key Technologies in Demand:
- Waste handling equipment
- Waste treatment technologies
- Brownfield site remediation design and equipment
- Soil contamination testing and monitoring equipment

Hazardous and Medical Waste Management

Continued economic and industrial development in India has led to increased focus on properly managing resulting hazardous wastes. In 2008, the Indian government implemented the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, outlining the responsibilities of various entities relevant to disposal, collection and treatment of hazardous wastes. Additionally, increased access to healthcare in India has created an estimated USD 80 billion industry in 2012 with an expectation to reach USD 280 billion by 2020, the wastes of which require effective management.
Key Technologies in Demand:

- Waste handling equipment
- Waste treatment technologies
- Brownfield site remediation design and equipment
- Soil contamination testing and monitoring equipment

**Water and Wastewater Treatment**

The Indian water and wastewater sector has high ambitions to develop comprehensive public and private water and wastewater treatment and distribution infrastructure. As of January 2016, India has 68 water treatment and transmission, desalination and industrial reuse projects in its tendering pipeline for 2016 with a cumulative estimated value of USD 6.5 billion. Realizing implementation at this level will require unprecedented levels of investment in public infrastructure as well as new financial vehicles that make water, wastewater and reuse projects profitable endeavors. The Indian Planning Commission’s Expert Committee Report on Indian Urban Infrastructure and Services underscores this point, estimating that USD 126 billion of capital investment is required over the next 20 years to meet India’s basic potable water and sanitation needs. In real terms, this means that capital expenditure on water and wastewater infrastructure is poised to grow 83 percent from 2015 to 2020, reaching an annual run rate of USD 16 billion by 2020.

**Municipal Water and Wastewater Treatment and Plant Development**

Growth in the municipal water and wastewater treatment sector is being driven by shortfalls in drinking water and sanitation access, growing concerns over surface water pollution and efficiency demands related to overall water scarcity in India, and it will continue to translate into a robust water and wastewater treatment market in India. While 94 percent of Indians have access to clean drinking water, just under 40 percent of the population has access to sanitary wastewater systems, a disparity that emphasizes the dire need for wastewater treatment systems in particular. The Government of India estimates installed wastewater treatment capacity currently at less than 20 percent of need. Plans to introduce wastewater tariffs and combine them with drinking water tariffs, if implemented, will lead to steady and robust infrastructure growth over the next five years. The emphasis on improving wastewater treatment is reflected in the segment’s expected growth curve of 15.3 percent CAGR between 2015 and 2020. Global Water Intelligence estimates that the value of the wastewater treatment segment will reach USD 6.78 billion in 2020, more than doubling its 2015 value of USD 3.3 billion.

Correspondingly, the drinking water treatment and supply segment will grow at a slower clip, reaching USD 9.4 billion in 2020 from a 2015 base of USD 5.5 billion. The Planning Commission estimates that USD 126 billion of capital investment is required over the next 20 years to meet India’s basic potable water and sanitation needs. In the short run, lack of consumer confidence in municipal sources of drinking water will continue to fuel a robust point-of-use water technology market in India.

Major tenders expected for municipal wastewater treatment and water supply projects include the Ahmedabad City 24X7 water supply project in Gujarat estimated to worth USD 364 million, the Kochi water supply project in Kerala worth an estimated USD 300 million, the Malad wastewater treatment plant in Mumbai estimated to be worth USD 296 million, the Bandra series of wastewater treatment plants also in Mumbai worth an estimated USD 289 million, and the Bangalore water supply extension with an estimated value of USD 271 million.

The Government of India’s *Approach to the Twelfth Five-Year Plan* states that currently only 30 percent of total sewage generated is treated before being released into surface waters, creating substantial pollution and public health problems. The Approach sets a goal of zero discharge of untreated sewage into rivers. This goal has been translated into a series of recently announced municipal reuse projects, including the Hyderabad recycling plants in Andhra Pradesh, with an estimated tender value USD 453 million. The project calls for the construction of a series of municipal treatment plants that will supply treated effluent that is currently released into local rivers directly to industrial and agricultural users.

The Jawaharlal Nehru National Urban Renewal Mission (JNNURM), formerly the largest source of financing for municipal water and wastewater projects, has been replaced by the Modi government’s Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and, to a lesser extent, the Smart Cities Initiative. AMRUT combined with the Smart Cities Initiative could yield
substantial investments in water and wastewater infrastructure depending on the forthcoming project allocation. AMRUT has budgeted USD 7.7 billion across 500 towns and cities while USD 7.4 billion has been budgeted across 100 cities for smart infrastructure initiatives.23

In the short-term, the state of Bihar plans to develop a series of 112 water, sewerage and storm water drainage projects for tendering of Public Private Partnership (PPP) finance models.24 This plan is confluent with the Modi government’s recently announced model for funding the National Mission for Clean Ganga, which seeks to entice investors by relying on a “hybrid annuity-based PPP model” where the central government will finance 40 percent of the capital costs for facility construction followed by a release of remaining funds in annuity-style payments subsequent to commissioning.25 Under the national program, this model will be employed for approximately 20 municipalities.26

Technologies and Services in Demand:
- Engineering, procurement and construction services
- Operations services
- Advanced Filtration
- Membrane filtration
- Waste to energy technology
- Anaerobic digestion
- Nitrification
- Biological denitrification
- Monitoring equipment
- Testing equipment

Municipal Water Efficiency

Energy consumption and water loss issues plague Indian municipalities. The Government of India estimates that between 50 to 70 percent of water supply finances go to electricity to pump water, while reported non-revenue water is 30 to 50 percent (with actual non-revenue water likely to be greater than reported). The National Action Plan for Climate Change states a goal of improved management that will increase water use efficiency by 20 percent during the Five-Year Plan period. Coupled with other investments in infrastructure and the vast national build-out of water treatment facilities, the demand for water efficiency technologies will rise rapidly in the coming years.

Technologies and Services in Demand:
- Monitoring technology
- Leak resistant transmission systems

Industrial Process and Wastewater Treatment and Reuse

Industrial process and wastewater is a rapidly growing segment of the Indian water market, estimated to reach USD 2 billion of revenues by 202027 and expected to grow 20 to 25 percent per year.28 The market for process water is driven by process demand and influent quality (surface water meets 41 percent of industrial demand),29 while the market for wastewater and reuse is driven more by the relative scarcity of water than strict effluent guidelines provided by the government. This point is underscored by the fact that although encouraged in official planning, industrial reuse is not articulated in any state or national regulation.30

Weak regulations and enforcement of industrial effluent is expanding the scope of pollutants and increasing treatment complexity and burden on municipalities. Tightened regulations and enforcement are expected during the 12th Five-Year Plan as well as new incentives to induce industrial water reuse. Plans to implement a tariff system for industrial effluent that penalizes low treatment quality and provides industrial credits for water reuse is a key pillar of the New National Water Policy. Consistently, the Modi government has recommended that heavily polluting industries embrace zero liquid discharge to avoid effluent release into surface sources entirely. High water consuming industries, such as power generation, oil and gas refining, petrochemical production, pharmaceuticals, and steel, are already implementing reuse strategies in order to meet locally imposed freshwater limits and overall issues with scarcity.

There are emerging opportunities in the "new industrial cities" for improved wastewater management. The preeminent opportunity is the Delhi-Mumbai Industrial Corridor (DMIC). The DMIC plans to establish seven new industrial cities with forthcoming water and wastewater capital investments estimated to be worth USD 90 billion. DMIC will provide a series of Engineering, Procurement, Construction (EPC) and Build, Own, Operate, Transfer (BOOT) contracts for water supply networks, drainage schemes and effluent treatment plans.31
Primary industries that exhibit demand for treatment technologies include power plants, oil and gas extraction and refining, food and beverage, pharmaceuticals, textiles, steel and aluminum production, and mining. These industries favor high-end treatment technologies and those that meet high international standards for quality and technical efficacy.

Technologies and Services in Demand:
- Engineering and construction services
- Water reuse equipment and services (process specific)
- Advanced filtration
- Membrane filtration
- Reverse osmosis
- UV disinfection
- Anaerobic digestion
- Nitrification
- Biological denitrification
- Membrane bioreactor systems

**Groundwater Maintenance and Recharge**

India is withdrawing groundwater resources at a faster rate than recharge occurs. The Government of India plans in the 12th Five Year Plan phase to introduce a legal shift of ground water resource ownership from property owners to a federally managed commons. In the short-term, the government plans to rectify shortages by creating a comprehensive groundwater monitoring system and groundwater recharge projects. This will translate into demand for groundwater mapping services to assess current resources, monitoring technology and early phase recharge demonstration projects.

Technologies and Services in Demand:
- Hydrological mapping services
- Monitoring equipment
- Groundwater recharge technology

**Environmental Engineering and Consulting**

The construction market in India is expected to grow twice as China’s leading up to 2030, while India’s urban population is projected to grow by 165 million by 2030. India is also expected to become the world’s third largest construction market by 2021. If bound to requirements for environmental impact assessments, this coming boon of construction activity could correspondingly grow India’s environmental engineering and consulting exponentially.

Technologies and Services in Demand:
- Environmental impact assessment

**ETWG Agency Initiatives and Programs**

**U.S. Environmental Solutions Toolkit**

The Toolkit compiles the U.S. Environmental Protection Agency’s (U.S. EPA) environmental regulations, related underlying research and a list of U.S. companies that provide technologies necessary to implement similar environmental regulatory actions abroad. The Toolkit is used by U.S. EPA officials and environmental consultants as a reference tool within bilateral activities that focus on addressing environmental concerns.

**Power-Gen International Buyer Program**

Power-Gen, one of the leading U.S. power generation equipment and services trade shows, has partnered with the U.S. Department of Commerce’s International Buyer Program to encourage foreign participation in the show. This platform is leveraged to discuss policies and exchange technical information regarding power plant emissions control with Indian participants and to foster business relationships between Indian end-users and U.S. emissions control providers.

**WasteExpo International Buyer Program**

WasteExpo, one of the leading U.S. waste management trade shows, has partnered with the U.S. Department of Commerce’s International Buyer Program to encourage foreign participation in the show. This platform was leveraged to exchange relevant technical information with Indian participants and to introduce Indian buyers to U.S. waste management technology providers.

**Water Environment Federation Technical Exhibition and Conference (WEFTEC) International Buyer Program**

The U.S. Department of Commerce, through its International Buyer Program, leads a delegation of Indian officials and business representatives to WEFTEC to explore relevant U.S. technologies and work with U.S. exporters on approaches to water resource management.
MDCP Assisted Development of Drinking Water Standards

Through the International Trade Administration’s Market Development Cooperation Program (MDCP), the American Water Works Association (AWWA) is implementing a program to help Indian utilities develop and meeting AWWA standards for drinking water treatment.

Market Contacts and Program References

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http://www.moud.gov.in

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