

# AGNI Mission: Leveraging Technology and Innovation for Clean Water

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Universal availability and accessibility of clean drinking water needs to be accorded top priority by governments and policymakers. In the Indian context, significant steps like the Jal Jeevan Mission have been taken in the recent past. However, the challenge of clean drinking water for all continues to persist especially in rural areas. Going ahead there is a need to extensively leverage emerging technology and innovative solutions to ensure provisioning of clean water for large swathes of Indian population. In this quest, Government of India's AGNI Mission based on its past achievements, is set to play a pivotal role in facilitating high impact, affordable, scalable, and sustainable technological solutions along with relevant stakeholders for clean water provisioning across rural and urban areas, inclusive of geographically difficult and remote locations of the country. This will undoubtedly transform lives for millions of Indians.

**C**lean water is a necessary resource that sustains human life and fuels socio-economic processes. Hence, it is an essential pre-requisite for sustainable development. The inclusion of Goal 6 on Clean Water and Sanitation in the Sustainable Development Goals 2030 fortifies the same. Clean water has both intrinsic and instrumental importance. Intrinsically, clean water is an end in itself as it is vital for life. Instrumentally, the lack of availability or access to clean water imposes a significant burden on public health with ultimate negative consequences on multidimensional poverty, human development, and economic growth.

In the Indian context, the clean water problem comprises two parts. First, lack of an improved source of drinking water within household premises and second, lack of adoption of proper drinking water treatment facilities. According to the latest National Family Health Survey (NFHS – 5), about 99 percent and 95 percent of urban and rural households respectively have access to an improved source of drinking water<sup>1</sup>, a promising statistic. However, the improved source of drinking water is 'piped into dwelling/yard/plot' only for 54 percent of the urban and a meagre 23 percent of rural households. Hence, a significant percentage



of Indian households both rural and urban, lack an improved source of drinking water within the household premises. Further, NFHS-5 data suggests that 58 percent of Indian households do not treat water prior to drinking. With respect to treatment as well rural areas are trailing. While 44 percent of urban households do not treat their water, corresponding statistic for rural India stands at 66 percent. Additionally, while 44 percent of urban households use an appropriate treatment method<sup>2</sup>, in rural areas this figure stands at only about 21 percent. Thus, official estimates categorically highlight that availability of and

<sup>1</sup>According to NFHS-5, improved sources of drinking water include – piped water, public taps, standpipes, tube wells, boreholes, protected dug wells and springs, rainwater, tanker truck, cart with small tank, bottled water, and community RO plants

<sup>2</sup>Appropriate water treatment methods include boiling, adding bleach/chlorine tablets, filtering, electronic purifying, and solar disinfection (Source: NFHS – 5)

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access to clean drinking water, particularly in rural India, is a challenge that poses a significant public health as well as a socio-economic development burden. As per estimates about 21 percent of communicable diseases in India are water related translating into a loss of 73 million days of labour imposing an estimated economic cost of USD 600 million annually. Hence, it becomes imperative for governments and policymakers to pay immediate and adequate attention to the clean drinking water challenge that afflicts a significant percentage of Indian population, primarily in the rural hinterlands.

In this regard, the untiring efforts of the Government of India need to be lauded. In 2019, the Government formed the Ministry of Jal Shakti by merging the earlier two ministries of – Water Resources, Rural Development and Ganga Rejuvenation, and Drinking Water and Sanitation to address India's water problems holistically and comprehensively. Additionally, the government has taken proactive cognisance of the clean drinking water issue. An institutional mechanism in the form of the Jal Jeevan Mission (JJM) was created to ensure provisioning of safe and adequate drinking water via providing individual Functional Household Tap Connections by 2024 to all rural Indian households. At the launch of the Mission on August 15, 2019, only 17 percent of rural Indian households had a tap water connection. However, in just a matter of three years this percentage has significantly increased to 50 percent<sup>3</sup>.

Additionally, besides development of rural piped water supply infrastructure, undertaking technological interventions to improve water quality is an important component of the JJM. Adoption of technical solutions and innovations can play a pivotal role in providing rural Indian households with clean drinking water. They can help overcome barriers such as inhospitable geographies, groundwater contamination, in-situ geogenic contamination. Technology and innovation solutions help nations and communities to do more and achieve better outcomes with limited resources. Hence, their deployment in the water segment especially in the Indian context

<sup>3</sup><https://ejalshakti.gov.in/jjmreport/JJMIndia.aspx>

becomes crucial as the country houses 18 percent of the world's population with just 4 percent of its water resources. Further, climate change is set to exacerbate India's existing water stress.

At this juncture it becomes critical to highlight the transformational role that AGNli Mission (Accelerating Growth of New India's Innovations), a flagship Programme under the Office of the Principal Scientific Adviser (PSA), Government of India is playing in facilitating adoption of technologies and innovations for clean water.

### AGNli Mission

AGNli is one of the nine missions under the Prime Minister's Science, Technology, and Innovation Advisory Council, working under the aegis of the Office of the PSA and executed at Invest India, the National Investment Promotion and Facilitation Agency. The AGNli Mission focuses on helping to capture the value of Indian technology: assisting Indian innovation, engage key national priorities designated by the Office, in domains ranging from human development through ecological sustainability to public safety. AGNli's approach focuses on the following:

1. ***Bridging the Gap between Innovators and Adopters:*** AGNli helps resolve the mismatch between innovations and adopter needs. AGNli partners with agencies and organisations – understanding their strategic, policy, and programmatic priorities at leadership tier, and their operations in the field; surfacing and identifying pain-points which, if resolved, would help adopters achieve their own internal priorities. Around these pain-points, AGNli formulates operational scenarios that these agencies themselves would recognise: describing 'a day in the life' of enduring that pain-point, both for field officers and leadership. To detail these, the AGNli team will run professional mixed-method research initiatives, combining quantitative surveys with ethnographic research techniques.

This allows AGNli executives to understand, as closely as possible, what the world looks

like through their partners' eyes. Then, against these operational scenarios, AGNli outlines technology stacks, comprising Indian innovation (e.g., from Indian technology startups) that can resolve these pain-points. AGNli innovation teams reach out across innovator networks to identify these Indian technologies. Field technology showcases facilitated by AGNli help innovators understand the needs of the adopter better and also allows the later to experience technology solutions first hand.

- 2. *Creating a Scalable Impact:*** AGNli helps Indian technologists and innovators engage major adopters – and their networks. For example, in rural livelihood domains, AGNli will partner with women's Self-Help or Common Service Centre groups – which are part of communities scaled nationwide across rural India. This ensures that innovations are presented to a larger network, thus, creating an ecosystem for enabling impact at scale with a built-in feedback mechanism.

Robust dissemination channels are must for successful innovation diffusion. As a programme of the Office of the PSA, AGNli is therefore able to translate its role into institutional engagement that maximises the beneficial impact of Indian innovation, for Indian citizens. AGNli institutional partnerships establish channels that help to better understand community needs, to build relevant technology use cases, and to facilitate end-user adoption.

- 3. *Empowering the Bottom of the Pyramid:*** A primary AGNli aim is to ensure that Government's guiding principle of Antyodaya – that the poor, marginalised, and those left behind – are engaged to the maximum possible extent, with the capacity Indian technology can create. AGNli seeks, in its partnerships, to ensure that grassroots and field-level insights are prioritised in AGNli operational scenarios, and technology stack development. AGNli's tasking often focuses on ensuring Indian emerging technology and innovation solutions are targeted at grassroots economic

and human development outcomes.

- 4. *Supporting the Competitiveness and Capturing the Value of Indian Technology.*** AGNli has refined its technological focus. This includes engaging Indian innovation in the domains of artificial intelligence, quantum computing, robotics, cyber-physical, materials, and energy. By connecting pain-points to, and defining operational scenarios for, Indian innovators: AGNli offers insight into opportunity for Indian innovation to evolve solutions and scale.

With respect to clean water, AGNli is playing a significant role by way of mapping rural pain points, building India's clean water technology ecosystem, and collaborating with stakeholders to facilitate high technology interventions. The Mission's roles and activities in each are elaborated below.

### Mapping Rural Pain Points

Evidence-based technology intervention forms the core of AGNli's work. Primary surveys, field-visits, focus group discussions (FGDs), and key informant interviews are utilised to gauge rural pain points, technology preferences, and barriers to technology adoption.

In the context of clean water, AGNli executed a primary survey among 2,142 Village Level Entrepreneurs (VLEs)<sup>4</sup> from Bihar, Chhattisgarh, and Madhya Pradesh to understand water, sanitation, and hygiene (WASH) challenges. Additionally, the survey probed on impact of COVID on the existing challenges, and the VLEs technology preferences. Findings indicate that 93 percent of the surveyed VLEs perceived 'access to clean drinking water' as an important challenge and 93 percent VLEs also felt that the same has been aggravated by the pandemic. On the brighter side, 95 percent of the surveyed VLEs opined that technology that 'improves water quality' can be an effective technology solution for resolving WASH challenges. Further, 96 percent VLEs stated that for them the priority features of technology solutions would be 'low maintenance cost', 'simple and easy to use', and 'environment friendly'. Moreover,

<sup>4</sup>VLEs are the operators of the Common Service Centres under the Ministry of Electronics and Information Technology, distributed equitably across rural India.



FGD conducted with a sub-sample of surveyed respondents highlighted access and availability challenges pertaining to clean potable water and the health repercussions of the same.

### **Building India's Clean Water Technology Ecosystem**

AGNli extensively interacts and collaborates with innovators and technology providers to address India's pressing clean water challenges. The clean water management ecosystem in India is at a growth stage wherein increasing resources are being infused to develop sustainable, low-cost, and cutting-edge technologies. These clean water specific technologies and innovations developed by both startups and public R&D labs, many of which are also a part of AGNli's portfolio, are targeted towards improving availability as well as quality of water to ease challenges faced by Indian citizens.

### **Improving Water Availability**

Innovative technology solutions like Atmospheric Water Generators (AWGs) are alternatives that can help make affordable clean water available to Indian citizens. AWGs essentially extract water from humid ambient air and convert the same into potable water. These

are decentralised, economical and environment friendly systems that generate clean water through a multi-stage filtration process and then mineralise the same before dispensing. Such systems developed by indigenous startups are available in various sizes and have capacity to process 30 to 2,000 litres of water/day. Recently such solutions have gained traction and have been installed in public spaces such as the Secunderabad railway station in Telangana<sup>5</sup> by the Indian Railways and schools in Uttarakhand<sup>6</sup> to ensure availability of improved quality water. Additionally, as noted above a major clean water availability challenge in India is lack of clean drinking water within the household premises. In this context, there are indigenous solutions available that enable doorstep delivery of safe drinking water through remote supervision and control through GPRS connectivity in real time. Such solutions have been deployed across locations in Gujarat, Maharashtra, Uttar Pradesh, and Delhi. Last but not the least, leveraging technology and innovations for restoration of water bodies is another sustainable method for improving water availability. Water bodies become the first victim of water pollution. Rapid urbanisation and industrialisation are the major causes of depletion of water bodies as they become dumping ground for industrial effluent, garbage, and silt. Technological solutions can help

<sup>5</sup> <https://inc42.com/buzz/secunderabad-railway-station-gets-indias-first-water-from-air-system/>.

<sup>6</sup> <https://timesofindia.indiatimes.com/city/dehradun/scientists-install-atmospheric-water-generator-units-in-15-schools-in-uttarakhand-to-tackle-water-supply-issues/articleshow/91841997.cms>

restore these water bodies and reverse the effects of pollution. Such innovations utilise artificial intelligence based electromagnetic mapping technology that enables them to predict presence of perennial water sources with high accuracy (90 percent and above) and develop the source within 100-120 days.

### Improving Water Quality

Availability of water is half the battle won. The other half is to ensure that the available water is free of contaminants and fit for human consumption as otherwise it has severe repercussions for human health. In the context of water quality, innovative technology solutions can be broadly classified into two categories:

- **Filtration solutions:** The Indian innovation ecosystem provides various sustainable water filtration and membrane-based cost-effective technologies for treating water. Indian startups have developed patented water purifier technologies to produce clean potable water. Meanwhile, from the public R&D ecosystem, the Council of Scientific and Industrial Research (CSIR)- Central Salt and Marine Chemicals Research Institute, Bhavnagar has developed an indigenous hollow-fiber membrane technology that provides sustainable cost-effective process with nearly 100 percent water recovery to treat water containing suspended particles, pathogens, and other harmful microorganisms. Similarly, CSIR- Indian Institute of Toxicology Research, Lucknow has developed *Oneer* an innovative water technology that eliminates pathogens such as virus, bacteria, fungi, protozoa, and cyst to provide safe drinking water to communities as per national and international standards prescribed for potable water. The community level model is of 450 LPH (liters per hour) capacity and can be scaled up to 5,000 to 1 lakh liters per day.
- **Monitoring solutions:** Water monitoring systems essentially utilise sophisticated tools such as IoT that enables low-cost, low-power, and real time monitoring of water quantity (water levels, flow, soil moisture, and rainfall

intensity) and quality (pH, conductivity, turbidity, dissolved oxygen, trace metals, and microorganisms). Additionally, advance sensors, and data analytics systems also help in efficient monitoring of drinking water quality in a cost-effective manner. Platform solutions also address water monitoring concerns by generating information such as groundwater levels, quality, and quantity, calculate daily water footprints among other things.

### Collaborating for Clean Water

AGNli collaborates with various stakeholders to fulfill India's clean water needs. These stakeholders include non-profit organisations, government departments, ministries, and corporates among others. Below are some of the major water engagements that have been led by AGNli.

#### 1. Quenching Eastern India's thirst

Metallic groundwater contamination is a major problem in the Ganga-Brahmaputra plains of India. As a result, a large section of the Indian population that resides in these fertile river basins faces severe drinking water quality challenges. In this context, AGNli collaborated with Aga Khan Foundation<sup>7</sup> in December 2018 to conduct a technology scouting exercise for identification of affordable water filtration technologies to be deployed by the Foundation in selected sites in Eastern India. AGNli recommended water purification technologies developed by Bhabha Atomic Research Centre (BARC). These technologies addressed issues related to arsenic, iron, and multi-contaminants. AGNli helped facilitate the engagement between the Foundation and BARC. Through AGNli Mission's support, Aga Khan Foundation entered into a licensing agreement with BARC for deployment of these solutions at selected sites.

#### 2. Strengthening Grassroots Networks

MeitY's CSC network with its strong on-ground presence can play a pivotal role in facilitating adoption of clean water technologies to rural remote areas of the country. To this end,

<sup>7</sup>[kdn.org/our-agencies/aga-khan-foundation](http://kdn.org/our-agencies/aga-khan-foundation)

AGNli collaborated with CSC in February 2021 to organise a technology showcase for VLEs of Uttar Pradesh. The theme for the showcase was affordable and sustainable solutions for water purification and portability. A total of five startups and public R&D institutes presented their solutions to the VLEs. These solutions ranged from water filtration technologies to water portability solutions. Multiple engagements were facilitated between the VLEs and innovators for deploying these solutions in remote areas of Uttar Pradesh.

### 3. Partnering with Global Stakeholders

WaterAid<sup>8</sup>, a multinational NGO works towards empowering local communities and ensures delivery of right innovations and technologies in pursuit of clean water and sanitation for all. In pursuance of these objectives in India, WaterAid partnered with AGNli to organise a virtual technology showcase in early November 2021. Two clean water technology specific startups from AGNli's portfolio that are associated with development of AWGs were shortlisted by WaterAid to present their solutions. These startups interacted with the WaterAid India team to understand the applicability of these solutions in different sites identified by the NGO.

### Conclusion

Lack of clean water poses a significant human development challenge that can severely compromise the capabilities of large swathes of Indian population in contributing positively towards the country's economic growth and development. Taking cognisance of the same the Government of India has taken concrete steps like the JJM to resolve India's clean water challenges. Assisting the Government of India in this quest, AGNli will continue to work to facilitate high impact water related interventions, to leverage affordable, scalable, sustainable, and universal technology and innovation solutions to ensure provisioning of clean water to Indian citizens, both rural and urban inclusive of those residing in geographically difficult and remote locations. Going ahead, AGNli's focus would be to utilise indigenous innovations and technologies to – (a) ease the water related challenges accentuated by climate change events to ensure ecological

sustainability and climate resilience across rural and urban India; (b) provide for the primary sector's water needs to help improve agricultural outcomes and India's food and nutritional security. This emanates from the fact that water, primarily groundwater is a critical input for agriculture; and (c) and last but not the least, cater to urban India's rising water demands. As per estimates, India's urban population is expected to add another 416 million people to its urban areas by 2050<sup>9</sup>. This rapid pace of urbanisation calls for immediate and better utilisation of technology solutions to meet India's water requirements effectively and efficiently. Thus, AGNli remains committed to help India achieve its climate related goals, better public health outcomes, improve agricultural and industrial output, and propel the country towards timely achievement of SDG 6 as well as overall better socio-economic and human development outcomes.

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<sup>8</sup><https://www.wateraid.org/in/>

<sup>9</sup><https://www.un.org/development/desa/publications/2018-revision-of-world-urbanization-prospects.html>