STRENGTHENING COMMUNITY PARTICIPATION IN WATER MANAGEMENT: A STUDY ON THE SATHYA SAI NATIONAL DRINKING WATER MISSION

The *Sri Sathya Sai National Drinking Water Mission* has installed 108 water purification systems in as many villages spanning the six states of Andhra Pradesh, Telangana, Odisha, Gujarat, Tamil Nadu and Karnataka. With the first plant installed in 2006, the Mission, also known as the *Sri Sathya Sai Prema-Amrutadhaara*, has over the years enabled the uninterrupted supply of pure drinking water to over 40,000 families (over 2,00,000 users) in areas of chronic water distress. Most of the installations are in Andhra Pradesh (68) and Telangana (24). Fluoride contamination of drinking water is extremely high in several districts of these states leading to extreme burden on health of the residents. The design, planning and implementation of the Systems was carried out by the Sathya Sai Technology Group under the aegis of the Sri Sathya Sai Seva Organisations and supported by the Sri Sathya Sai Central Trust, Puttaparthi.

This study aims to describe the Drinking Water Mission, set it in the larger context of water as a key sustainable development goal and, highlight some of the design facets of the project that have led to its continuing success (as evidenced by the uninterrupted functioning of the purification plants). Finally, an analysis of economic benefits of the water purification plants based on direct and indirect coping costs that would have been incurred by 2,00,000+ users in the 108 villages in the absence of the purified water supply has been presented. This study emphasises the scale, scope, output and outcomes of the Water Purification Systems Project in greater detail as the Sri Sathya Sai Seva Organisations propose to expand this project as one of its flagship initiatives for community wellbeing leading to the centenary year celebrations of Sri Sathya Sai Baba in 2025.

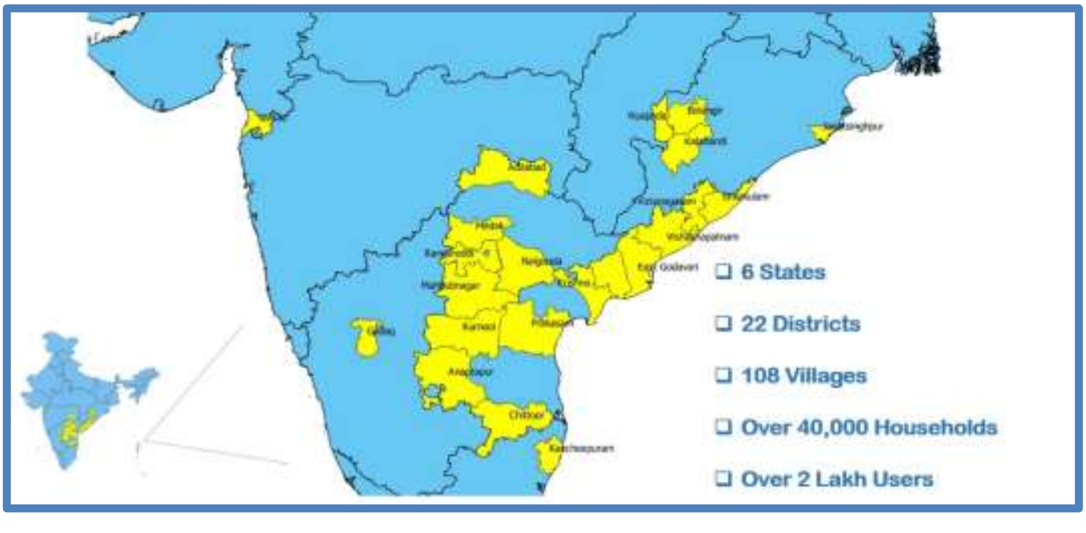

Figure 1: Location of Water Purification Plants in Six States of India

Other Initiatives Under the Mission

The Sathya Sai National Drinking Water Mission has three other similar initiatives to provide drinking water in areas of high need. While the rest of this research note focuses on the 108 water purification plants, a brief description of the two major initiatives is presented here.

In Paderu, Visakhapatnam District of Andhra Pradesh, the Mission has provided drinking water to 350 villages across 10 Mandals, which account for a population of 4,40,585. Another 40 projects are under construction in May 2020. The terrain is hilly and difficult to reach. The project lays pipelines through the hilly terrains to supply water from the natural springs and rivulets to the tribal settlements. It also provides storage facilities at the settlements. Transporting water through pipelines to the settlements has made a tremendous difference to the tribal population. Post the project, the tribal people do not have to trudge through the difficult terrain to fetch water. Women are also saved from the danger of snake and scorpion bites since they do not need to undertake long walks to fetch water.

Figure 2: Project Implementation in Paderu Mandal, Visakhapatnam District

The Sathya Sai Premadhara Project initiated by Sathya Sai Seva Organisationa, Kerala in 2018-2019 has installed 119 water filtration units. These provide pure drinking water every day to nearly 1,65,000 citizens in 14 districts. The Premadhara units provide both hot and warm water after purification. The units are being established at public places, especially for floating population covering Bus Stations, Taluk Hospitals, Primary Health Centers and Government Schools in Kerala with approval of the State Government. Each unit is attached with the local Sathya Sai Seva Samithi and the

Service Coordinator is responsible for the day-to-day and smooth functioning of the unit. The drinking water is provided free of cost to all the citizens. The Kerala Sathya Sai Organization has spent over ₹23,00,000 on the installation of the water filtration and dispensing units. These provide access to pure drinking water to over 6 crore people annually.

Figure 3: Water Filtration Units installed in Schools and Old Age Homes in Kerala

The Sri Sathya Sai Seva Organisations, Odisha have taken up several projects under the banner of 'Sri Sathya Sai Nirmal Jhar' to provide clean drinking water to the poor and needy. One of the flagship initiatives involves over 60 cool drinking water projects at a cost of around ₹ 1,00,000 per project including civil works. Each project provides for an overhead tank and submersible pump to make it a self-sufficient unit. The completed facility is then handed over to the public at large. In the state capital Bhubaneswar itself, there are 18 such projects installed at different prominent places. With approval of the local authorities, these units have been established at public places, especially for floating population covering Bus Stations, Vending Zones, Autorickshaw and Taxi Stands, Major Chowks, Multi-Religious Places, Government and Private School Premises, Government Hospitals across 20 districts of Odisha. During summer months, nearly 1,80,000 people benefit from the cool drinking water facility on a daily basis. During the rest of the year, there are 1,20,000 daily beneficiaries. Thus, at an expense of about ₹50 lakhs, over 5 crore people are provided access to cool and pure drinking water. In summer, when the mercury in the state breaks the threshold of 45-degree Celsius, the

Seva Dals also arrange cool water in earthen pots in more than 100 such Jal Seva locations across the state. During the three summer months every year from 8 am to 4 pm, about 1,000 beneficiaries are served with cool water or energising drinks on a daily basis. During the quarter, nearly 120,000 people are served in concurrence with local authorities.

Figure 4: Drinking Water Plants at public places in Odisha

I. Sri Sathya Sai Drinking Water Mission: Context

The United Nations' Sustainable Development Goal number 6 (SDG-6) targets *availability and sustained management of water and sanitation for all by the year 2030*. Scarcity of water is not a new concern in most of the developing world – well before the SDGs, and the Millennium Development Goals (MDGs) even, non-availability of clean water to large numbers of people was a major threat stalking the masses. For decades, government bodies and to some extent non-government agencies in the development sector have been searching for and implementing solutions to mitigate the difficulties faced by citizens, especially the vast rural population, and to provide water security.

Goal 6 therefore continues to be a significant one whose urgency cannot be highlighted enough because availability of clean water can have a tremendous multidimensional and positive impact on many other SDGs – whether livelihoods, health, education, gender inequalities, hunger or poverty. According to the World Health Organization

(WHO), more than 200 crore people globally have limited access to clean water in their homes. Nearly 80 percent of them lives in rural areas.

With its burgeoning population, India bears much of the burden arising out of such a water crisis. More than 60 percent of India's irrigated agriculture and 85 percent of drinking water supplies are dependent on groundwater. Of the available groundwater, it is estimated that more than 90 percent gets used up for agriculture, and only the remainder is available for drinking and domestic use.

There are four parameters of critical importance with respect to groundwater for drinking: ***availability, access, quality and affordability***. Severe depletion of aquifer levels, over drawing of water due to irrigation as well as domestic needs, climate change, low rainfall and drought in many areas of the country – all lead to unavailability of water for drinking and domestic use. Where water availability is low, access to water is a challenge – women may have to walk farther out to fetch water for domestic use, especially in rural areas. The coping cost of poor access is high: more time and physical strength is spent on fetching water. Time spent on fetching water (or, waiting for water to be released) means less time spent on livelihoods and income generating activities. Children may be pulled out of school so that they can help fetch water. Health and wellbeing of women and children is also at peril due to the long distances travelled to fetch water when the access is poor.

Even when there is availability of water, and access is reasonable, quality of water maybe highly compromised. Contamination of ground water could be due to discharge of toxic effluents, salinity, pollutants like fertilizers and pesticides, and discharge of untreated sewage. The presence of arsenic, nitrates, excess fluoride can also lead to highly toxic and unpotable water. Fluoride levels of up to 1.0 mg/L are considered safe for consumption while up to 1.5 mg/L maybe considered 'permissible'. Any concentration of fluoride in water above these levels leads to often severe disabilities and chronic health conditions. The impact of consuming contaminated water is a heavy health burden both due to the short term waterborne illnesses like cholera and gastroenteritis, as well as chronic and irreversible musculoskeletal disorders (seen in areas of fluoride levels >3 mg/L in water, for example).

One solution to procuring drinkable water is of course the open market where ostensibly purified water is sold in bottles and cans. The market is replete with many such companies that sell bottled water. However, from a development perspective, it is known that buying water at market rates is a huge burden for much of India's population – whether urban or rural, but especially rural. Buying water is a recurring expense, and where water distress already leads to economic distress, buying water for daily consumption is an added burden. As a result, the worsening water crisis in India may well turn out to be the biggest impediment to development and prosperity for our citizens in both urban and rural areas. Rather than leaving it to the open market therefore, it is imperative that all efforts – whether Government, non-Government or philanthropic – focus on providing drinking water solutions that do not push the citizens into further vulnerability and socio-economic stress.

It is in this context of multidimensional vulnerability of our fellow citizens to water scarcity that the emphasis in SDG-6 of not just providing water, but on "availability and *sustained management of water* [..] for all by 2030" became vital. The Sri Sathya Sai Water Purification initiative described in this note is a good case study that addresses the drinking water scenario on all the four aforementioned parameters. More importantly, the case study highlights best practices on sustained management of drinking water resources and systems.

II. Sri Sathya Sai Water Purification Systems: An Overview

Sri Sathya Sai Technology Team's mission has been to 'reach out to the remote and far-off rural locations and provide simple and affordable techno solutions to some of the long-standing problems faced by them'. With this in mind, the team conducted extensive research across India to study and document how technology can be used to create pathways for reducing poverty and vulnerability in rural areas. Among the many issues they found, one for example, was the effect of excess Fluoride, high level of TDS (Total Dissolved Solids) and, bacterial and physical contaminants in drinking water in the villages in India. In the Nalagonda District of Telangana, for example, the team documented severe deformities and concomitant health issues in high numbers among the residents of villages.

Since only the available groundwater or surface water in a location, however contaminated, can be used for drinking water purposes, it was clear that water purification is the only way to solve the problem. However, the solution had to be scientific and data based. The team collected scores of samples for testing and built a database on the type of contaminants that needed to be treated. They studied various water purification systems and the pros and cons of each system in relation to the pollutants and toxins that had to be removed from the water. The Technology team was also particular that unlike the commercial vendors who strip the water of all minerals (so that the water tastes better), it was imperative that some minerals that are beneficial to the human body be left in the water after purification. The purified water also had to meet BIS/WHO standards. With these objectives, the Sri Sathya Sai National Drinking Water Mission was born, with the first installation of a purification plant completed in 2006.

Unlike the massive water supply projects implemented earlier by the Sathya Sai Central Trust that benefited nearly 1.5 crore people in three states of India, and which saw water being piped hundreds of kilometres to its destination, the focus of this National Drinking Water Mission is on using the available ground water or surface water in the location where the village population resided and collected its water for domestic use. Therefore, the availability parameter had to be met before a village could be chosen for installation of a purification plant / system. The actual design of the system therefore focuses on access, quality and affordability.

Design of the Water Purification Plant / System:

Based on its extensive research across regions, the Technology group found various technologies available to bring down Fluoride contents and contaminations in water to safe limits:

1. Use of activated alumina as a medium for purification
2. Use of Alum for clarification
3. Reverse Osmosis method
4. Use of Charcoal and bone powder and chemical reagents.
5. Ion exchange reactions/UF Filtration
6. Solar Distillation
7. Air Liquefaction

From their study of each these methods and visits to sites of existing operating plants, the team concluded that the most effective method is the use of activated Alumina as medium in locations where there is only high fluoride and, the TDS (Total Dissolved Solids) are lower than say 350 ppm (parts per million, also measured as mg/l). However, in places where there are higher TDS levels - such as 500 to 3000 ppm, the Reverse Osmosis (RO) system is ideal. Although expensive, and the wastage of water is higher during the process, an RO system is more efficient in eliminating toxins to the desired levels. Retaining essential minerals during the process can be done by controlling feed pressures and flow rates. So, the RO system is the chosen method in the 108 installations across the states.

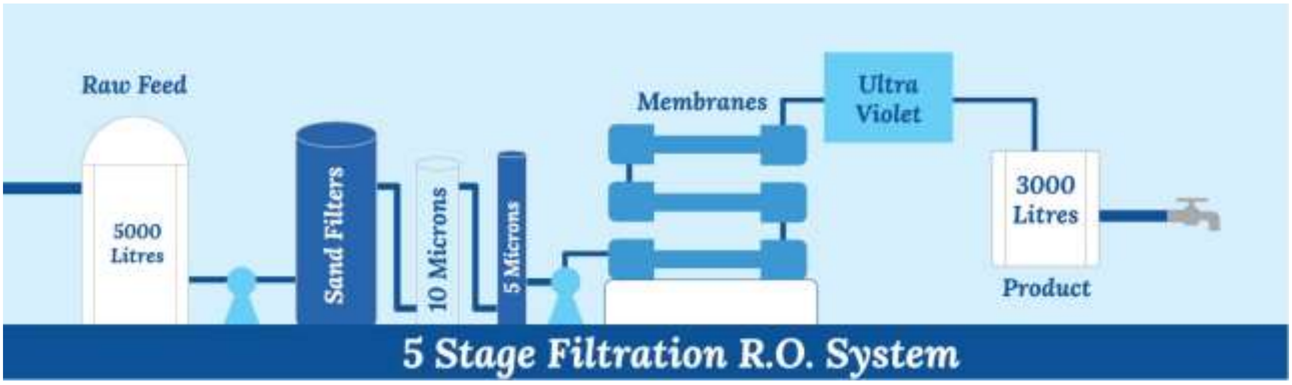

Figure 5: Filtration Process Used at the Water Purification Plants

Buy-In from Citizens

There is a critical item on the checklist for the Technology Team in choosing villages for the installation of the RO system: awareness had to be created in the village first on the importance of consuming pure and safe drinking water. The Technology groups along with the Sri Sathya Sai Village Integrated Programme volunteers first took up the activity of awareness building among the villagers. Only then, they were able to assess the readiness of the villagers to buy in to the idea of the RO system. This is an important step because, the Sri Sathya Sai Drinking Water Mission does not see the villagers as mere beneficiaries of the 'project'. Instead, they are the primary stakeholders who will have ownership of every stage of the process – from the building of the RO plant to the operations (including maintenance, distribution of water and maintaining finances).

Needs and Resource Assessment

The field team then collects samples and sends them for analysis at a lab. This is an important step to determine the level and types of contamination of the local groundwater source. On evaluating the lab report, the Technology team then determines the type and capacity of the purification system, which is normally calculated on the basis of 5 liters of water per person per day.

Meanwhile, the following needs have to be assessed so that the purification system can be installed in the selected village:

- Note the time when Single and 3-Phase power supply is available and enquire about voltage fluctuations.
- Map the number of water sources in the village. Make sure they are sufficient and reliable.
- Check for the availability of any old building room of size – 12x10 or 12x14 feet. If no such structure exists, find a suitable site for constructing a room. Try and use existing infrastructure to limit costs.
- The plant itself should be in the middle of the village, convenient for all.
- Involve the villagers in doing both small and big tasks for the plant. Make them feel the plant is their own.
- Identify responsible and active elders and youth of the village. Involve them at every step of the process.

The Technology team prepares a comprehensive report on the viability of the plant at that village, as well as a budget for implementation. The actual implementation involves resource inputs from the Sri Sathya Sai State Trusts as well as the Central Trust.

Physical Infrastructure and Cost

The Water Purification Systems are designed to cater to the needs of approximately 2,000 residents on a daily basis. This would involve purifying water at the rate of 1,000 litres per hour, resulting in 10,000 litres of pure drinking water per day (at a rate of 5 litres per person). This assumes that electricity is available for ten hours per day to run the plant. The plant and equipment including electrical and civil works costs about ₹ 5 lakhs. Maintenance costs amount to approximately ₹ 450 rupees per day. This includes operator's salary, electricity charges and, replacement of cartridges, membranes and other paraphernalia involved in the RO system.

Figure 6: A Drinking Water Collection Center

Nominal Cost to the User

The design of the Water Purification System ensures that the plant has to be self-sustainable. Each household in the village that opts to use water from the purification plant is given a membership card and a Jerry Can / container. The membership card can be topped up each month for ₹ 60. This amount provides 20 litres of water per day for a nominal cost of ₹ 2 resulting in a cost of just 10 paise per litre! If at least 80 to 90 percent of the village signs up for the service, the system is able to generate enough resources to pay for the costs of running the plant, as well as some money saved as a welfare fund to serve the needy in the village as and when required. The Technology Team reports that in some villages, the welfare fund has accumulated to the amounts of a few lakh rupees.

This funding model has resulted in smooth running of the Water Purification Systems since funds to pay the electricity bills, spare parts and operator salaries are available from the user fee deposits. There is no external funding required to keep the plants running. Villagers are also aware that the user fees are important to keep the plant operational.

Village Committee

The Technology Team helps with the setting up of a village committee. The village committee is solely responsible for the operation, maintenance and financial record keeping of the Water Purification System. The committee comprises two men, two women and youth members, and are chosen by the villagers themselves. A bank account is opened with the village name / committee name. A person from the village is employed to take care of the complete operations of the plant on a day-to-day basis.

Once the plant is installed by the Technology group and is declared functional, the group and the Sri Sathya Sai Organisations cease to have a role in the operation and maintenance of the System. The village committee is completely empowered to undertake all activities related to the functioning of the plant. Audits of the functioning are conducted occasionally by the Technology Group, to ensure that the systems are running smoothly and as planned.

III. Key Takeaways and Learnings

1. **Affordable Access:** Drinking water cannot be a market commodity for a majority of the population. It is possible to provide safe, purified drinking water at a nominal cost, where the intent is only for the cost of operations and maintenance to be covered, with a little left over for local village welfare activities. The coping costs of accessing safe drinking water are so high, that the intent of any initiative should be to mitigate the coping costs and improve the quality of life for the population. With the drinking water plant offering purified water at 8 to 10 paise per litre (price may vary slightly depending on number of users / subscribers), one can see the magnitude of difference with market vendors that charge ₹ 10 to 15 per litre. In some cases, where subsidized water is sold at ₹ 2 per litre, it is still 20 times higher than the cost of water at the purification plants. Of the 8 to 10 paise per litre charged by the water purification plant, only 5 paise per litre is required for production and maintenance. The remaining amount is collected for given back to the villagers for depositing in the village welfare fund.

2. **Community Participation:** Community participation in managing water sources is critical to its success. There have been instances of agencies – whether government or non-government – providing infrastructure for delivery of water including water

purification units. Often, the upkeep of the infrastructure, the provision of funds required to keep the unit operational, and ownership of responsibility to keep the plant functional are areas where the bottlenecks appear and hinder the longevity of the resource. As the World Bank observed*, "Although significant progress was made on increasing access by rural communities to water supply over the past decade, many systems are no longer operating properly due to poor maintenance, contamination or depletion of water source. Officials acknowledge that the traditional approach of 'build-neglect-rebuild' is unsustainable, inefficient and largely responsible for the poor performance of an estimated $500 billion dollars' worth of assets in water resources and irrigation infrastructure."*

The Sathya Sai Water Purification System under its Drinking Water Mission therefore is unique in its approach to the management of such water purification units. Critical to the continuous functioning of the plants is the management structure. The Sathya Sai Seva Organisation was clear from the beginning that it would have to be community managed process and not a top-down or an external agency driven process. The Organisation was not going to manage the unit; the villagers would have to take it up. The project team helped the villagers by setting up a framework for management of the water purification plant. Guidelines were laid down for the formation of a village committee to oversee the operations of the plant. Such decentralized and participatory mechanisms enhance transparency, create stakeholder ownership and provide sustained, self-managed water resource systems.

3. **Beyond Transactional Activity**: Mr Chinnappa, one of the Village Committee members from Pamdurthi in Ananatapur District described how the supply of water is not just a transactional activity. One has to practice the spirit with which the enterprise was set up: "This is a sacred unit set up by the Sathya Sai Organisation. We have to run it knowing the intent with which it was set up […] Sometimes villagers come and say they didn't bring their card. How can we deprive them of water and say, 'no card, no water'? We have to figure out a solution. So, we now have a cash box where they can deposit a rupee [if they don't have their card with them; a rupee being the daily charge for 12 litres of water per household]. This way they get the water they need, and we can oblige by having the cash box as an alternative." Villagers therefore innovate on practices as required to ensure that the users are served. This is not to say that problems may not arise. When they do, the village committee has to take care of them through debate and consensus building.

4. **Community Development:** The building housing the Water Purification System can become a multi-activity center for the village. It can serve as a community hall, library, dispensary, Bhajan center or any other use for common good in the village.

Thus, the Water Center becomes more than just about water – it helps in providing a unifying platform for village activities.

5. **Improved Health and Wellbeing:** Significantly, women and children are spared the everyday burden of fetching potable drinking water from a distance. This frees up their time and has a positive impact on their health. The quality of the purified drinking water adds to the health and wellbeing of the residents. Villagers have reported that visits to the doctors have come down significantly. This was reported by Mr Chinnappa of Pamdurthi village as well. He compared the visits to the doctor in his village with those of a neighbouring village and mentioned that the visits to the RMP were much lower in his village now due to the better quality of water. In fact, he observed that when folks leave for work in the fields or any other errand outside the house, they carry drinking water with them now because they are so used to the good quality and taste of the water available in their own village. Earlier they would drink water from the borewell.

6. **Self-Sustaining System:** The water purification plants have been running uninterrupted since they started operations. Sustained management of the resource involves complete buy-in from the community, management by the users / stakeholders through a village committee, and a financial model where the plant pays for its own operations and maintenance through nominal user fees.

IV. Tangible Costs and Benefits

Unavailable, inaccessible or poor quality / contaminated water leads to high costs for citizens through lost livelihoods, ill health, and concomitant economic losses. It follows therefore that there will be significant economic and other intangible benefits when purified drinking water is provided at a nominal cost, with minimum infrastructure and a user-fee model that is self-sustaining. The water sector and studies by eminent multi-lateral agencies is replete with data on coping costs – where citizens incur costs to cope with the inadequate and unclean water available. Coping costs can be direct – such as the money spent to buy water or installing borewells and water tanks; or, they can be indirect coping costs – such as time spent to fetch water, loss of wages due to ill health or care giving.

Waterborne illnesses (such as diarrhoea, enteric fever and viral hepatitis) often result in high coping costs for the residents. High mortality of children under 5, absenteeism in schools, malnutrition and continuing ill health are some of the other significant losses that are more complex to monetize.

Since Andhra Pradesh and Telangana States account for 85 percent of the Sathya Sai Water Purification Plants (and historically have had high incidence of waterborne illnesses like diarrhoea, enteric fever and viral hepatitis), government and research data from the two states has been used to demonstrate coping costs, and cost-benefit analysis that demonstrates the mammoth benefits of water purification systems that are self-sustaining and can provide uninterrupted purified drinking water to citizens.

The following indicators have been used in this analysis:

- Women's wage losses due to (a) waterborne and concomitant illnesses, (b) caregiving due to other family members' waterborne illnesses, (c) water fetching duties
- Men's wage losses due to waterborne illnesses
- Cost of buying water (a conservative estimate of 10 percent of the households as buying water has been taken)
- Cost of health care

Coping Costs

If purified drinking water was not available through the water purification plant, the following coping costs would have been incurred by members of the 40,000 households in 108 villages:

1. Cost of Buying Water: A conservative estimate that only 10 percent of the villagers would buy water in the absence of the water purification plant has been taken. Rest of the villagers may use other low-cost filtration or purification methods. This number is therefore indicative and would go up if higher number of village households were to buy drinking water.

The Sathya Sai Technology Group reported that in some villages that were closer to the main road and therefore had better access, households could buy water from a vendor for ₹ 2 per litre. This has been taken as the benchmark, although it is possible that households would have paid even higher prices if they bought bottled water.

i. Cost of buying water at 20 litres per day x ₹ 2 per litre x 365 days (4,000 households): **₹ 5.8 crores**
ii. Cost of buying water at the Sathya Sai Water Purification Plant: 12 months x ₹ 60 per month = ₹ 720 (annually). 720 x 4,000 households = ₹ **28.8 Lakhs**
iii. Subtracting #ii from #i above: Net spending on drinking water: ₹ **5.5 crores**

At the water purification plant, villagers spend only 5 percent of the money they would otherwise have spent on commercially bought drinking water.

Since the assumption above is that 10 percent may already have been buying water prior to the water purification plant, the rest of the calculations for coping costs will take into account only 90 percent of the households (i.e. 36,000 households).

2. Women's Wages: Assuming one adult woman member per household who is a worker (either in agriculture, MGNREGA or similar work), at a wage rate of ₹ 160 per day, and 180 workdays per year, the following savings result:

i. Loss of wages due to illnesses (waterborne and concomitant illnesses): **₹ 6.9 crores annually**.
ii. Loss of women's wages due to caregiving (other household members – children, elderly, others – being ill with waterborne and other illnesses): **₹ 15.6 crores annually**.
iii. Loss of women's wages due to water fetching duties: **₹ 15.6 crores annually**
(This study assumes one working woman per household, although the Andhra Pradesh Government reports 1.6 women per household registered under the MGNREGA scheme. If we consider 1.6 working women per household, the wage loss could be ₹ **24.96 crores**).

Total loss of women's wages (i+ii+iii): ₹ **38 crores**

3. Men's Wages: Based on incidence data, and 10 sick days (with 60 percent attributed to waterborne illnesses), and assuming one adult working male member per household, the loss of men's wages due to illnesses is **₹ 3.5 crores.**

4. Cost of health care: Assuming 60 percent of health expenditure is due to waterborne illnesses (shown in research) and ₹ 1,000 per household as a conservative estimate of rural health care costs, we assign 600 per household for annual healthcare costs related to waterborne illnesses, the annual health care costs are **₹ 2.2 crores.**

Total Coping Costs (Direct and Indirect): Adding the costs from all the categories above (1-4), the total annual coping costs of consuming impure water and / or buying drinking water are: **₹ 49.2 crores**

Note: Detailed calculations for the figures provided above are in Appendix I. Sources of data used in the calculations are in Appendix II. The data and analysis have been done using published figures by the World Bank, Asian Development Bank, UNICEF, and the Central and State Government of India. For sake of simplicity, no discounting, compounding or indexation has been incorporated in the analysis.

V. Intangible Costs and Benefits

As described earlier, this analysis does not include other important and intangible costs that are complex and difficult to monetize. Yet, they could negatively impact the beneficiary community without access to pure drinking water. These include:

- Number of school absentee days due to waterborne illnesses
- Number of <5 infant mortality cases averted
- Number of childhood days saved by removing the need to fetch water
- Impact of childhood illnesses in the long term

- Number of adult years added to lifespans by preventing deaths due to diarrhoea, enteric fever and viral hepatitis

VI. Cost-Benefit Analysis

The 108 water purification plants were set up at an approximate cost of ₹ 5 lakhs per plant. This includes physical infrastructure – the building, electrical and civil works and, the machinery / materials required for the plant. The user fee of ₹ 60 per month per household is sufficient to cover all expenses related to the operations of the plant.

The one-time investment of ₹ 5.4 crores on 108 water purification plants by the Sri Sathya Sai Seva Organisations, and a user-fee of ₹ 720 per year per household therefore prevents the incurring of coping costs to the tune of ₹ 49.2 crores per year for the 40,000 households (over 2,00,000 beneficiaries). This does not include other important intangible social and economic benefits. <u>Over the potential 15-year lifecycle of the 108 water purification systems, the coping costs averted would be ₹738 crores.</u>

Moreover, the gains experienced by the households in the 108 villages are much more than just the monetary numbers outlined above. For example, the time gained due to fewer sick days for the entire household, the savings in caregiving days and work days will all together add nearly a 100 days to the household members' lives each year to do other activities – whether economic, social, physical or spiritual. Children can play more, learn more; adults can spend more time in family, leisure or productive activities. Such gains are invaluable.

VII. Conclusion

The Water Purification Systems set up by the Sri Sathya Sai National Drinking Water Mission in 108 villages highlight the need for an open, transparent, robust design of such initiatives where sustainability of the resource is built in, villagers are not mere 'beneficiaries' but are users who pay a nominal fee for the service and, the longevity of the resource is significant. Such a model is amenable to scale up in many more villages demonstrating high returns on investment, as long as the villagers agree to abide by the financial, infrastructural and operational model that has seen a successful running of all the 108 plants over the years since their installation.

Sharing his vision for 2025, Sri Nimish Pandya, All India President, Sri Sathya Sai Seva Organisations, underscored the potential of such decentralised water purification projects in rural and tribal areas in benefitting lakhs of individuals who are deprived of access to pure and safe drinking water. The Sathya Sai Organisations plan to expand the number of projects over the next five years through collaborative endeavours.

Appendix I: Detailed Analysis of Select Economic Benefits of the Sathya Sai Water Purification Systems

S. No.	Coping Activity	Amount (₹)	Notes
I	**Cost of Buying Water**		**Assumption: Of the 40,000 households, if even 10% of the households buy drinking water (due to poor quality of water available)**
1.1	Buying water at ₹ 2 per litre from a vendor	**5,84,00,000**	**4,000 households x 20 litres per day x ₹ 2 per litre x 365 days** (The amount of ₹ 2 is mentioned by the Sathya Sai Tech Team. Cost maybe higher and therefore this amount could be larger)
1.2	Water from the Sathya Sai Water Purification Plant	**29,20,000**	**4,000 households x ₹ 2 x 365 days** (Households end up paying 5% of the cost of what they would otherwise spend on drinking water during the year)
Total I	**Cost of Buying Water**	**5,54,80,000**	
For II to IV below, only 90% of the households (i.e. 36,000) are taken into account for calculating coping costs. This is because the 10% who are estimated to have bought drinking water would not have incurred the coping costs calculated below.			
II	**Women - Wage Loss**		Calculated at ₹ 160 per day wage rate for one woman per household*
2.1	15 Sick Days		36,000 households - 1 adult woman - 180 days of work
2.2	Waterborne Illnesses	**5,18,40,000**	WHO estimates that 60% of sick days are due to waterborne illnesses. Hence total wages lost would be: **36,000 x 9 sick days x ₹ 160 per day**
2.3	Other Illnesses	**1,72,80,000**	20% concomitant illnesses (like back ache, exhaustion, posture problems due to carrying water every day) Hence total wages lost would be: **36,000 x 3 sick days x ₹ 160 per day**
2.4	Wages lost due to fetching water	**15,55,20,000**	UNICEF estimates equivalent of 27 days of wage loss due to fetching water (Our study assumes one working woman per household, although MNREGA for Andhra Pradesh reports 1.6 women per household registered as workers under their scheme) Hence total wages lost would be: **36,000 x 27 days x ₹ 160 per day**

2.5	Wage loss due to caregiving (sick children, elderly, other family, medical visits)	**15,55,20,000**	Caregiving for three family members at 9 days of water borne illnesses per person (children, elderly, etc.) = 27 days of caregiving days per year. Hence total wages lost would be: **36,000 x 27 days x ₹ 160 per day**
Total II	**Total Women's Wage Loss**	**38,01,60,000**	(At one woman worker per household in 36,000 households)
III	**Men - Wage Loss**		One adult working male per household in 36,000 households
3	10 Sick days		Calculated at ₹ 160 wage rate per day*
3.1	Waterborne Illnesses	**3,45,60,000**	WHO estimates that 60% of sick days are due to waterborne illnesses. Hence total wages lost would be: **36,000 x 6 sick days x ₹ 160 per day**
Total III	**Total Men's Wage Loss**	**3,45,60,000**	
*Based on minimum wage list published by Governments of Andhra Pradesh and Telangana for MGNREGA and Agricultural Labour			
IV	**Cost of Healthcare**		Andhra Pradesh has highest incidence of waterborne illnesses such as diarrhoea, enteric fever and viral hepatitis.
4.1	Medical Visits and Medicines	**2,16,00,000**	Since rural households maybe served by a public health center, or a low-cost local doctor (compared to urban areas, a conservative estimate of ₹1,000 per household per year is used here for calculating health care costs). Prevalence of waterborne illnesses requiring treatment is taken at 60%. Hence total costs would be: **36,000 households x ₹600 per household**
Total IV	**Total Cost of Healthcare**	**2,16,00,000**	
V	**Sum of I - IV**		
5.1	**Total Coping Costs (Direct and Indirect)**	**49,18,00,000**	Annual Costs incurred if the Sathya Sai Water Purification Plant was not supplying water to the 40,000 households in 108 villages.

Appendix II: Notes on Sources of Data

- Wage data published by the Governments of Andhra Pradesh and Telangana for agriculture labour and Mahatma Gandhi National Rural Employment Scheme (MGNREGA) peg the daily wage rate at approximately ₹ 160 per day (varies over time, and hence an average rate has been taken).
  http://www.nrega.ap.gov.in/Nregs/SSR_eng.do
  https://labour.telangana.gov.in/content/minimumWages/Maximum_Minimum_wage_in_Part_I_Part_II_wef_01042015.pdf

- WHO has estimated that about 60 percent of the loss in work day is due to waterborne illnesses. An annual average of 10 sick days and 15 for women have been reported. We take into account 60 percent of these days as workday loss due to waterborne illnesses.

- Sources of data on sick days, loss of wages and health care costs are from:

  - Reports by ADB: (https://www.aiib.org/en/projects/approved/2018/_download/india-andhra/urban-water-project.pdf and https://www.adb.org/sites/default/files/linked-documents/48434-002-sd-16.pdf)
  - A study titled "Social Cost-Benefit Analysis of Improved Water Quality in Rural Areas: An Exploratory Study in Coastal AP" by V Ratna Reddy, M Kullappa and D Mohan Rao in the Journal of Social and Economic Research (June 2008)

- UNICEF has estimated that women lose the equivalent of 27 days of work due to water fetching duties. https://www.unicef.org/india/what-we-do/clean-drinking-water

<u>Research, Analysis and Documentation</u>

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