

## Best Practices Award in Construction of Sustainable, Innovative and Smart Buildings

Low investment cost

### Title of the Best Practice / Research

Water WISE Buildings and Industries

### The Location of Best Practice Implementation

Country Singapore

City Singapore

Project Website [www.ecosoftt.org](http://www.ecosoftt.org)

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### The Category Applied for

Best Practices Award in Construction of Sustainable, Innovative and Smart Buildings

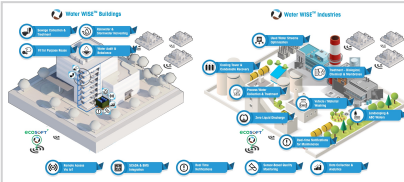
### Focus Area

Low investment cost

### Project Summary

Water Smart Buildings and Industries is a technology-driven project developed by ECOSOFTT to drastically reduce fresh water consumption in commercial buildings, factories, homes and townships. It emphasises the integrated management and maximising the use of all water sources available, including rainwater, piped water, surface water and wastewater. This drastically reduces the wastages in the conventional "once through" municipal water system, which has been the dominant model for urban development for over 100 years. This innovative solution is applicable in advanced urban areas by reducing the load on municipal systems. At the same time, it is a viable option for off-grid areas in developing countries. Over 50 projects have been successfully completed across 5 countries, with excellent technical outcomes, proven financial viability and high social acceptance. The innovative solution has influenced the setting of policies and standards, paving the way for even faster adoption.

### Project logo or Main Photo



### Type of submission

Organization

Name of the Organization ECOSOFTT

Location Of Organization Singapore

City/Town,Postal Code 139952

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Type of Organization	ECOSOFTT
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## Partners in Executing the Practice

Name	Organization Type	Other Organization	Address	Contact	Support Type
Enterprise Singapore	Central Government		230 Victoria Street #10-00, Bugis Junction Office Tower, Singapore 188024	Ru De CHEN CHEN_Ru_De@enterprisesg.gov.sg +65 64334560	Financial Support
PUB, Singapore's National Water Agency	Central Government		80 Toh Guan Rd East, Singapore 608575	Geoffrey Stephens Geoffrey_STEPHENS@pub.gov.sg +65 97416448	Technical Support
JTC Corporation	Central Government		The JTC Summit, 8 Jurong Town Hall Road, Singapore 609434	Dr. Loh Wai Soong LOH_Wai_Soong@jtc.gov.sg +65 6883 3788	Technical Support

## Financial Profile

Annual Budget	Partner Name	Year	Contribution Amount	Support Type
520000.00	Innovation Grant by JTC and Enterprise Singapore, ECOSOFTT Contribution	2016	270000.00	Technical advice. Showcase and promotion to water industry leaders during the World Cities Summit and Singapore International Water Week held in July
500000.00	Sales income from external customers	2017	0.00	
700000.00	Sales income from external customers	2018	0.00	
800000.00	Sales income from external customers. Grants	2019	35000.00	Technical validation. Setting new standards

## Level of Activity

International
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## Key Dates

Date	Significance
2015-04-01	Project Initiation
2016-04-01	Pilot Completion
2016-07-01	Showcase to global scientific and technical community during Singapore International Water Week
2018-12-01	Issuance of New Technical Standards in Singapore
2020-01-01	Successful completion of 50 projects in 5 countries

## Scope and Criteria

**The project is expected to include smart, innovative solutions, technologies, and intelligence techniques in design and execution, with a strong manifestation of related infrastructure aspects.**

Water WISE Buildings and Industries is a set of solutions which enable water sustainability through total management of the water cycle for townships, homes, commercial buildings and industries. With the solution, buildings and industries can use every drop of water more than once, taking in less piped water and reducing wastewater discharge into the sewer network. As an example, recycling 50% of wastewater increases the supply of water by 100%. To quote the PUB, Singapore's National Water Agency: "Reuse is not unnatural - it's what nature does. Reuse is copying nature and using technology to make it happen faster." This approach greatly multiplies the water resources available for domestic and productive economic uses. With this solution, buildings and industries can become totally water secure and reduce their water cost. The technology solution set includes Water Source Protection, Drinking Water Treatment, Water Conservation, Wastewater Recycling, Internet of Things, SMART Controls and Data Analytics which can be implemented in a modular manner that eliminates dependence on municipal systems. Whether urban, rural or peri-urban settings, the platform has proven to be a viable and economic model by the following: • Recycle all wastewater streams present in buildings and industries using low energy and high water recovery technologies; • Embrace rainwater harvesting, a low cost source of water from the natural water cycle; • Better optimise water from different sources and use non-potable water for non-potable purposes; • Deploy Smart Controls to monitor and manage water usage that can be integrated with Building Management Systems; • Engage users and sharing responsibilities in managing water from source to source, at source. As a result, Water WISE Buildings and Industries dramatically improves water security, improves quality of life and alleviates the constraints to economic development, all critical in a water-scarce world.

**The project is expected to adopt effective and efficient approaches for significantly reduce life-cycle emissions of buildings, while adopting carbon-neutral construction through design, materials, technology, and practices.**

In modern cities, water needs are mostly met by municipal potable water sources, used once mostly for non-potable applications (such as in toilet flushing, washing, cooling towers) and discharged into the sewer systems where they exist. It should be noted that potable water has high embedded energy and high carbon consumption, especially in regions such as the Gulf where it is largely obtained through desalination. Using potable water for non-potable purposes means that we are incurring significant embedded financial and environmental costs, even if these costs are not fully reflected in water tariffs. Outside metropolitan city centres, access to clean water is often a challenge. The resulting wastewater is mostly discharged into open areas untreated or semi-treated. This causes pollution and wastage of a valuable resource – wastewater which can be reused. Instead of using potable water for non-potable needs, a switch towards using fit for purpose water for the majority of our water consumption can reap significant savings in terms of these “hidden” carbon footprint of water. Water recycled and kept within buildings and estates can be used efficiently for cooling, landscaping and urban farming. This will greatly reduce heat effect in buildings and the energy to cooling buildings. For example, a green roof or rooftop farm can reduce building temperature by 2 to 4 degrees Celsius and may offset up to 10% of food related carbon emissions. Water WISE Buildings and Industries at appropriate scales lessen the load on the water networks where they exist. They can operate without the existence of a centralised municipal system with a water grid. This drastically reduces the wastages commonly seen in the conventional “once through, use and throw” water system. As a result, such an approach has the potential to be adopted on a massive level to bring reliable services to masses in water scarce countries, conserve water resources and maintain an ecological balance.

**The project is expected to show Innovation, new business and operational models of the construction sector, which enable sustainable production and consumption of the built environment.**

Water WISE Buildings and Industries are not dependent on any single technology. Instead, they offer a platform where technology innovators can collaborate to create integrated solutions. Nevertheless, the treatment technologies to be deployed need to meet a set of criteria to maximize user benefits and environmental impact. The positive impact to construction include the following: 1. Small footprint of system minimizes real estate cost 2. Blending of Green (landscape) and Blue (water) features into building environment adds value to the property 3. Lower infrastructure costs to build water network/grid, which represents 70% of cost of water system which has to be paid upfront, This minimise financing and land access constraints 4. Low energy consumption and operating costs 5. Low use of chemicals through stable biological process for safer handling 6. Facilitates closing of water, energy, material and nutrient resource loops at local level 7. No odour, creating pleasant environment 8. Reliable performance for ease of operations and maintenance, including It should be emphasized that the technologies selected are not static, but constantly evolving to incorporate viable and new technologies to meet changing user needs. As such, Water WISE Buildings and Industries can be seen as an “open-source” platform. The projects have proven building-level water management to be Technically Feasible, Socially Acceptable and Financially Viable. Depending on the water sources, tariffs structure and local costs, recycling may be viable at different scales. In many cases, managing recycling at an estate level could provide more flexibility in storage options and excess water from one building can be sent for use in another building that consumes more water. In such a framework, the end users become active partners and collaborators with service providers and utilities in the management of water from source to source, at source.

**The project is expected to promote utilization of local materials, financial and technical assistance, for supporting least developed countries, in building sustainable and resilient buildings.**

Despite heavy investments, large “centralised” municipal water infrastructure solutions, where they exist are unable to cope with increasing demand. Over 5 billion of people in the world still do not have access to adequate water supply and wastewater networks. Municipal water infrastructure has proven to be difficult to implement. Rapid and widespread urbanization makes it difficult to connect users. In some cases, it is not even technically and financially viable. Most municipalities in developing countries cannot afford expensive, complex infrastructure investments. A World Bank report found that a whopping 89% in Low Income countries have water tariffs that cannot cover even basic operations and maintenance (O&M) costs. The “decentralised” and “integrated” management of water and wastewater on the other hand has the following advantages: ? It eliminates the high capital and operating expenditure. ? It multiplies water resources through recycling, which is critical in water scarce regions. ? It can be deployed by itself or in conjunction with existing centralised water or wastewater systems to enhance a community’s water resilience and security. ? It encourages active participation from consumers and empower users to manage various water sources including recycled water to meet their water needs sustainably. Depending on the water needs and financial situation, users can choose to implement the parts of the paradigm that they most urgently require. Use of materials can be customised to maximise local purchases. Construction or installation can also be performed by local manpower. It is thus a viable and attractive alternative to provides adequate services to billions of people living in least developed countries.

**The project is expected to include solid waste and waste water management planning and measures.**

In human settlements, fresh water, materials and resources are almost entirely used once, contaminated and discarded. In some advanced cities, the resulting used water and materials are sent to centralised wastewater and incineration plants. However, many developing areas have either overloaded municipal water and waste infrastructure, or no municipal infrastructure altogether. In such cases, untreated used water and material are often discharged into open areas, polluting land and water sources. In either case, there is much room to reduce cost and improve sustainability by closing the resource loops at point of use. A low cost, modular and replicable approach to close the water, carbon and nutrient loops is critical. Water WISE Buildings and Industries can be enhanced with additional modules to produce clean energy, recycle discarded materials and recover nutrients for food production. The platform encompasses the following: ? Recover and reuse used water (up to 95% of fresh water intake) for indoor farming, toilet flushing, cooling and other non-potable applications ? Convert biodegradable and non-biodegradable solid waste to generate energy especially for cooling and heating. This is done through the form of a small scale Waste to Energy Plant on-site that meets environmental discharge (air emission) standards ? Extract nutrients from used water and waste to grow food that enhances food security. This is done through Biological reactors such as the Aerobic Biofilter without Sludge, another innovation by ECOSOFTT ? Integrate solar and other renewable energy to power the infrastructure The vision of the future Buildings and Industries is one that is able to maintain a reliable water supply and a highly reduced level of waste at the lowest cost and environmental impact. The aim is Net Zero Water, Net Zero Carbon and Zero Waste through technology innovation and user involvement.

**The project is expected to help in increasing the climate change resilience of the built environment, with emphasis on greenery, gardens and sustainable buildings approaches and techniques and revitalization of the biodiversity in the built environment.**

Climate change increases the challenge of water management. The frequency and severity of flooding and droughts will increase, exacerbating already significant water challenges. Water WISE Buildings and Industries increase climate resilience through an integrated water system to: ? diversify supply to increase security, ? reduce impact of floods, ? safeguard scarce water resources and maximise availability, ? reduce carbon footprint of water, The key aspects include the following: ? Capture every drop of rain on roofs and ground surfaces. ? Reuse water endlessly. Reuse is drought resistant by increasing water availability. At the same time, turning used water into clean water requires less energy than turning seawater into drinking water. This reduces the carbon footprint of water drastically. ? Combine the need for storm water drainage with open space for recreation and wildlife habitat through rain gardens and man-made lakes. Other than preventing floods, this method mimics natural hydrological processes and bring the attractiveness of water to building users. This creates Active Beautiful Clean (ABC) Waters ? With abundant water available, it is possible to create greenery either on the ground or in the sky through high-rise gardens. This adds space for recreation and gathering. A layer of plants on a roof or wall can reduce the amount of heat that penetrates a building by 70%. This reduces the need for air-conditioning, which is one of the largest users of electricity in tropical regions and the Gulf. ? Excess water can also be used for farming whether in urban, per-urban or rural areas. This mitigates the potential disruption of food supply due to climate change. Water WISE Buildings and Industries projects thus create communities of gardens and waters. Beyond monetary value, communities can now get much closer to water, appreciate its beauty and learn to treasure it more.

**The project is expected to decrease density of the built environment, and the resources connected to it, through digital and augmented reality solutions as an example by ways such as: dynamic use, flexible use, configuration, and shared uses of buildings and their surroundings.**

Water WISE Buildings lead to “Liveable Density”, which focuses on creating a high quality of life in urban settings. Water and wastewater treatment infrastructure need not be dull structures or ugly machines. We have integrated water management features into the built environment including: ? attractive rain gardens that prevent floods ? water fountains using recycled water ? wastewater biological reactors that become visitor attractions Innovative design can reduce that feeling of density by creating the illusion of space using green, blue (water) and eco-friendly elements. Liveable Density means that we prioritise these facilities for occupant and community recreation. At the same time, employing Water WISE solutions in rural areas at a significant scale contribute to lower urban density. In many developing countries, rural population migrate to cities to seek better livelihoods. Many thus live in unorganised slums or unauthorised settlements with poor water and sanitary conditions. Inevitably, they lead to overloading of urban infrastructure including water systems and increase the difficulty of infrastructure development. Providing access to water in conjunction with sanitation, health, education and livelihood opportunities in rural areas would lead to better lives for villagers. It would reduce the need for villagers to migrate to urban areas and reduce urban density.

**The project is expected to ensure high level of security and justice in mixed-use and mixed-ownership models through legal experimentations and regulatory innovation empowerment**

The issue with water equity or justice is “How do we make sure that all people have safe, affordable access to water? Water is shared by different users – rich and poor - within a catchment. It can be contaminated from a variety of sources, including industrial discharges, domestic wastewater, and polluted farm runoff. Attempts to get more than one’s fair share of this shared resource or avoid common costs will result in winners and losers. The burden of being the loser can impact negatively on people’s livelihoods and on ecosystem health, which can result in discontent, and potentially conflict. Often the losers are marginalised communities, disempowered individuals or groups, and the natural environment. Water WISE Buildings and Industries brings about greater water security for all users and stakeholders. This applies for those living in wealthier areas with the ability pay for water, and those in poorer areas with less ability to pay. In the case of industries and wealthy urban communities, we improve water security and reduce cost of water. In an example of a housing estate in North India with 5,000 residents, we implemented a system to enable 500,000 litres of sewage to be. This reduces the cost of water by 90%, prevents over-extraction of the catchment and eliminates pollution to nearby areas. Our social enterprise model channels capital and technology to serve poor communities to attain security and justice goals. We help such communities gain access to 24x7 clean water, sanitation facilities and replenish water sources. With replication, the end result is harmonious co-existence and fairness.

**The project is expected to include creation of new data-driven, digital services and respective new business models for better living conditions, while supporting ownership of personal data and transparency policies, codes of conduct and solutions.**

Until recently, water engineering has largely been isolated from IoT and Data Analytics technologies. By integrating the three, there is a now huge opportunity to radically improve the way water is managed. A digitally-enabled Water WISE Buildings and Industries project maintains a reliable and secure water supply at the lowest cost and environmental impact. It employs technology and use information to deliver essential services more efficiently, improve environmental sustainability and engage stakeholders collaboratively through: 1. Increased use of digital information mgt technology to improve reliability and efficiency of the water system, with full cyber-security 2. Dynamic optimisation of operations and water resources to meet demand for different water applications with varying quality requirements 3. Incorporation of demand response and energy-efficiency approaches for planning and optimization 4. Deployment of IoT and mobile technologies for metering, quality monitoring and communications concerning operational status and automation of plants, human and environmental conditions 5. Development of predictive analytics functions to reduce water consumption, reduce downtime of equipment and unpleasant user experiences 6. Provision of timely information, control and optimisation options to building managers so as to enable Water SMART management practices This involves new processes for the end-to-end management of every drop of water in its different forms as a resource. Facility Managers in the future will increasingly be upgraded to become Water Managers responsible for: • Planning production of water from wastewater and rainwater • Monitoring consumption of water in different points within the estate • Marketing recycled water to tenants and users • Ensuring the water is available to users at the right time and cost Such a transformational has the potential to radically improve quality, cost and environmental p

**The project is expected to include technological solutions, and digitization in order to increase the quality of life and efficient use of natural, economic resources, and digital participatory methods for people to influence their living environments.**

Water management enabled by information provides the necessary ingredients for effective water management and optimisation. At the heart of the system is a Water SMART Control System, powered by a Data Analytics engine. The system enables the collection, analysis and reporting of information to actively reduce the use of high quality freshwater and thus water cost. The information needs of Water SMART Control System provide the critical basis to identify and add meters and sensors. The wireless sensor network comprises of numerous tiny battery-powered, spatially distributed and autonomous sensors to monitor physical (e.g. water flow rate) or environmental conditions (e.g. temperature, water quality). The network of sensors will provide batch data in hourly, daily or other frequency of transmission to a centralised data lake. This data is ingested into the various software components for the forecasting, optimization, monitoring and other Water SMART Control functions. The comprehensive analytic solution provides advanced modeling capability for predictive models, supply and demand forecasting, fault prediction, and optimisation for every step in the Water SMART Controls management process. The analytic solutions enables the facility manager, data modeler and business manager the unique ability to build better descriptive and predictive models and generate insightful predictive forecasting models.

**The project is expected to address post disaster management by comprehensive plans and disaster risk reduction and resilience.**

Water WISE Buildings and Industries help water systems manage shocks and secure a reliable service supply to their users in the following risk events: ? droughts ? flood ? power cuts ? contamination ? terrorist attacks The platform is more resilient to climate variations, due to greater self-sufficiency through generating multiple sources of water on site. At the same time, it mitigates the impact of flooding (excess water), through hydrological modelling, water detention tanks, ponds and rain gardens.. Increased access to data and technology can also help strengthen planning and operation processes to better target resources and improve operational continuity. To manage the risks of disruption of overloading and equipment failures, the following measures would be incorporated: ? Continually assessing the system performance against the designed standards ? Instil maintenance procedures to reduce vulnerability and improve resilience ? Involve users for active demand management

## Narative

**Innovative, leap-frogging, and affordable technological advancement use.**

The predominant model for water supply and sanitation system involves treating all water is treated to drinking quality standard and transported via water pipes to buildings and industries. The water is to be used once and the resultant wastewater is collected, transported via sewage pipes to central treatment facilities. The cost of such systems, especially the piping networks have proven to be uneconomical, especially for developing countries and places facing budget constraints. Water WISE Buildings and Industries offers a new paradigm that largely eliminates the need for complex piping networks, which make up 70% of conventional system costs. It is also highly modular, where users can choose to implement the parts of the paradigm that they most urgently require. The emphasis on on-site recycling multiplies water supply through principles of circular economy. As a result, the platform becomes an economically and environmentally sustainable model for billions of people.

### Introduces a positive cultural change

Water WISE Buildings and Industries represent a paradigm shifts from conventional water management approach based on a Centralised model to a more sustainable Decentralised model. While the Decentralised model has been available for some time, it was seen as a “low end” or “interim” solution long waiting for Centralised solutions. However, our platform has provided economical, low maintenance and compact technologies have enabled Decentralized model to become a viable alternative to complement or meet gaps in Centralized plants and networks. In the next phase, knowledge-sharing, development of standards, deployment of appropriate technologies and engagement of users will spur mass adoption and massive cultural changes. ECOSOFTT has emerged as a pioneering enterprise that is shaping the future of water by Inspiring young minds and influencing policy-makers through advocacy and model projects.

### Positive outcomes on sustainable development at either economic, environmental and social level

Water is an essential resource for the production of economic goods and services. It is no coincidence that many industries are located near water sources. In some cases, deteriorating water availability is threatening the growth and survival of industries. Water WISE Buildings and Industries provides a set of solutions to increase water availability, reduce cost of water and eliminate pollution caused by discharge of industrial wastewater. As an example, we have worked on projects to recycling industrial wastewater for cooling towers and back in production uses. At an appropriate scale, this Closed-Loop system has proven to be cheaper and more robust for the industries. At the same time, it safeguards the shared water resource so other water users in the catchment also benefit. As a result, water conservation measures at the major industrial user creates positive social and environmental impact, while safeguarding its own economic interests.

### Favors least developed human settlements, promotes gender equality and social inclusion

With 50% of global population living in rural areas, rural water management will have a major impact and will affect urban water management directly and through linkages in the food chain. We have applied principles of the platform successfully in rural communities. In such cases, we help people gain access to 24x7 clean water, sanitation facilities and replenish water sources. As an example, we transformed the condition of a 200 person village in Central India where women had to walk 4km every day to fetch water and defecate in the open. Through our community-led transformation programme, we mobilised the community to build infrastructure for themselves. Eventually, they gained access to safe drinking water at , toilets & bathing rooms, wastewater recovery system for irrigation and ground water recharge with financial sustainability mechanisms. It was estimated that every dollar invested in ECOSOFTT's Social Impact programme generates 10 dollars of economic and social returns

### Aims to Improve quality of life in either developing or developed countries/communities

With 50% of global population living in under-developed rural areas, rural water management will have impact overall water management directly and through linkages in the food chain. We have applied the principles of the Water WISE platform successfully in rural communities. Our Community Led Transformation for Water and Sanitation is based on the condition of 100% inclusion - No family or unit is left out. In such cases, we help people gain access to 24x7 clean water, sanitation facilities and replenish water sources. As an example, we transformed the condition of a 200 person village in Central India where women had to walk 4km every day to fetch water and defecate in the open. Through our community-led transformation programme, we mobilised the community to build infrastructure for themselves with financial sustainability mechanisms. It was estimated that every dollar invested in ECOSOFTT's Social Impact programme generates 10 dollars of economic and social returns.

### Demonstrates potential for transferability, adaptability, and replicability, including partnership models

Our mission is to benefit multiple water stakeholders simultaneously, through collaboration with corporates, educational institutions, government, NGOs and other stakeholders for the benefit of communities on the principles of creating shared value. The following evidence demonstrates the maturity and impact of our solutions developed in partnership with others : 1. Population Served - Our technologies have been employed in 50 projects that serve over 250,000 people who now gain access to total water sustainability 2. Aggregate Volume - 8 Million Litres of Water Treated and Recycled Per Day 3. Rural Underprivileged Uplifted Over 2,000 persons living at the Bottom of Pyramid gained 24x7 access to Clean Water at 70 litres/person/day, dedicated Sanitation facilities, Wastewater Recovery systems and improved Livelihood 4. Students Engaged on Water Issues- Our AQUA Water Education programme has engaged 60,000 global citizens through classroom experiences and applied learning

### Improving the ecological footprint.

We have a bold vision for success and social impact through movement creation and collaboration comprising. Our long term targets are as follows: • Treat 1 trillion litres of wastewater per day • Protect 1,000 rivers, lakes and water bodies for future generations • Enable 1 million entrepreneurs for water, wastewater and environmental services • Complete 10,000 community-led transformation programmes for water, sanitation and livelihoods • Engage 10 million students across the world Our goal is an ABC World – ACTIVE economy, BEAUTIFUL society and CLEAN water.

## Personal Attachments

Document Name	Document Summary	Attachment
Organization website		<a href="#">External link</a>
ECOSOFTT Business Profile	Water WISE Solutions and Project Samples	ECOSOFTT COMPANY PROFILE_PROJECT DETAILS.pdf
Water WISE Buildings and Industries	Solution and sample projects	Water WISE Buildings and Industries.pdf

## Project Attachments

Document Name	Document Summary	Attachment
Project Logo		Water WISE Buildings & Industries lo res.jpg
Water Practice & Technology - IWA Publishing	A description of the solutions published in an international journal of the International Water Association (IWA)	IWA -Water Practice & Technology.pdf
Factsheets of Completed Projects		PROJECT FACT SHEETS_FEB 2020.pdf
Rural Water & Sanitation		<a href="#">Video link</a>
Project website		<a href="#">External link</a>

## Other Attachments

Document Name	Document Summary	Attachment
Selected Media Coverage		Media Coverage Selected copy.pdf
FICCI India Water Awards	The Poseidon, an ECOSOFTT innovation received the First Prize in Water Technology Innovation from FICCI, the apex business chamber in India	FICCI_Water-Compendium-2017.pdf