Water Security

Key Element for Integration of Sustainable Development Goals and the Climate Change Agenda

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Key messages

- *Water is one of the enablers for achieving the Sustainable Development Goals (SDGs) and the Paris Climate Agreement goals, especially on adaption. However, global water resources are under increasing pressure due to the growing gap between water supply and demand, wasteful use of water, anthropogenic water pollution, lack of integration in sectoral planning and climate change impacts on the hydrological cycle.*
- *As essential to the goals of these two global agreements, water can be a useful connector to integrate implementation of the SDGs and the climate change agenda. For this purpose, water and climate change policy makers need to work closely to better understand climate change impacts on water resources and to make sure that country adaptation action plans incorporate water sector development priorities.*
- *A great amount of knowledge on both water quantity and quality management has already been generated and is available for informing policy actions. A challenge is to translate this knowledge into action. An enabling environment needs to be created for the translation of useful knowledge to country actions that supports knowledge sharing and capacity building, the strengthening of regulations, the integration of sectoral priorities and the mobilisation of all possible financial resources.*

Bijon Kumer Mitra
Pham Ngoc Bao
Tetsuo Kuyama
Binaya Raj Shivakoti
Henry Scheyvens

1. Introduction: Will we have enough water for sustainable development?

Water is essential for the survival of living beings, meaning that it is impossible to ignore the increasing insecurities in the water sector associated with climate change impacts on water resources and the growing pressures on this finite resource associated with population growth and rapid urbanisation and industrialisation. Water scarcity is located at the top of global risks to societal development (WEF, 2015). Despite impressive achievements on the water targets of the Millennium Development Goals (MDGs), water security remains a challenge for many countries. More than half a billion people still do not have access to improved drinking water and nearly 2.5 billion people are still using unimproved sanitation facilities (WWAP, 2015). Unimproved drinking water and poor sanitation lead to huge health and economic tolls; in some countries the estimated economic losses are equivalent to as much as 7% of gross domestic product (GDP) (Hutton and Chase, 2016). The World Water Development Report-5 warned that the world would face a 40% water shortfall in the next 15 years, if current water usage trends (i.e. unregulated excessive water withdrawal and inefficient water use) do not change (WWAP, 2015). Unsustainable development pathways and the failure of water governance both negatively affect water availability and water quality.

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Institute for Global Environmental Strategies

Climate change will make the situation worse in many areas.

Water is an integral part of the Sustainable Development Goals (SDGs) and the global climate change agenda, as set out in the Paris Agreement on climate change. Unless major reforms are undertaken to increase water use efficiency and water governance, water security cannot be achieved. The absence of water security will jeopardise all efforts to achieve global development and climate change goals and targets.

Shocking facts

- *Less than 1% of the world's fresh water is readily accessible for use*[1]
- *1 in 10 people lack access to safe drinking water*[2]
- *1 in 3 people lack access to improved sanitation*[2]
- *40% water shortfall by the next 15 years*[2]
- *Over 80 % of wastewater is directly discharged to environment*[2]

[1]OECD, 2013; [2]WWAP, 2015

2. Water in the SDGs and Paris Climate Agreement

The importance of water for sustainable development is clearly acknowledged in SDG 6 on water and sanitation as well as a number of other goals and targets. SDG 3 (health), SDG 11 (cities), and SDG 12 (consumption and production) all contain specific water-related targets (Figure 1) . Water also underpins the success of many other SDGs. Managing water sustainably contributes to the sustainable production of food (SDG 2) and energy security (SDG 7). Moreover, proper water management also strengthens resilience and adaptive capacity to climate-related hazards and natural disasters (SDG 13). Sustainable water resource management is also important to the Paris Climate Agreement, though the critical links between climate change and water do not receive much attention in the Agreement. In many areas, climate change is projected to increase the frequency of climate-induced droughts or flooding, lead to seasonal changes in rainfall, and result in the deterioration of water quality as a result of salt water intrusion (associated with sea level rise). Unsurprisingly, many key climate change adaptation measures are related to the water sector, such as flood protection works, building infrastructure to improve water retention capacity, expanding the area of land under irrigated farming, and introducing technologies to improve water use efficiency.

Climate change mitigation efforts are also important for the water sector. If mitigation efforts are successful, they will reduce climate change impacts on water resources. However, the mitigation measures themselves could also influence water use, depending on technology choice. For instance, if the efforts to limit global warming to 2°C rely on technologies that sequester atmospheric carbon dioxide (e.g. growing biofuel crops) and that store emitted carbon from the combustion of fuels (carbon capture and storage technology), as both technologies use large amounts of water, this would exacerbate the existing water shortage. Therefore, measures are needed that minimise trade-offs and maximise synergies between the Paris Climate Agreement and SDG 6. If the trade-offs are not properly managed, the SDG water goal and other goals will be put at risk, and climate change adaption and mitigation efforts may also be undermined.

3. Generating evidence-based knowledge towards water security

A number of common challenges for sustainable water resource management have been identified around the world. These challenges include increasing demand for water, climate change uncertainties, uni-sectoral planning approaches, reliance on single water sources, and ecosystems degradation. The Institute for Global Environmental Strategies (IGES) is working together with research partners at the forefront of several initiatives to generate evidence-based knowledge on solutions to deal with these water challenges. Drawing on these research projects, several strategies and recommendations for sustainable water resource management are elaborated below.

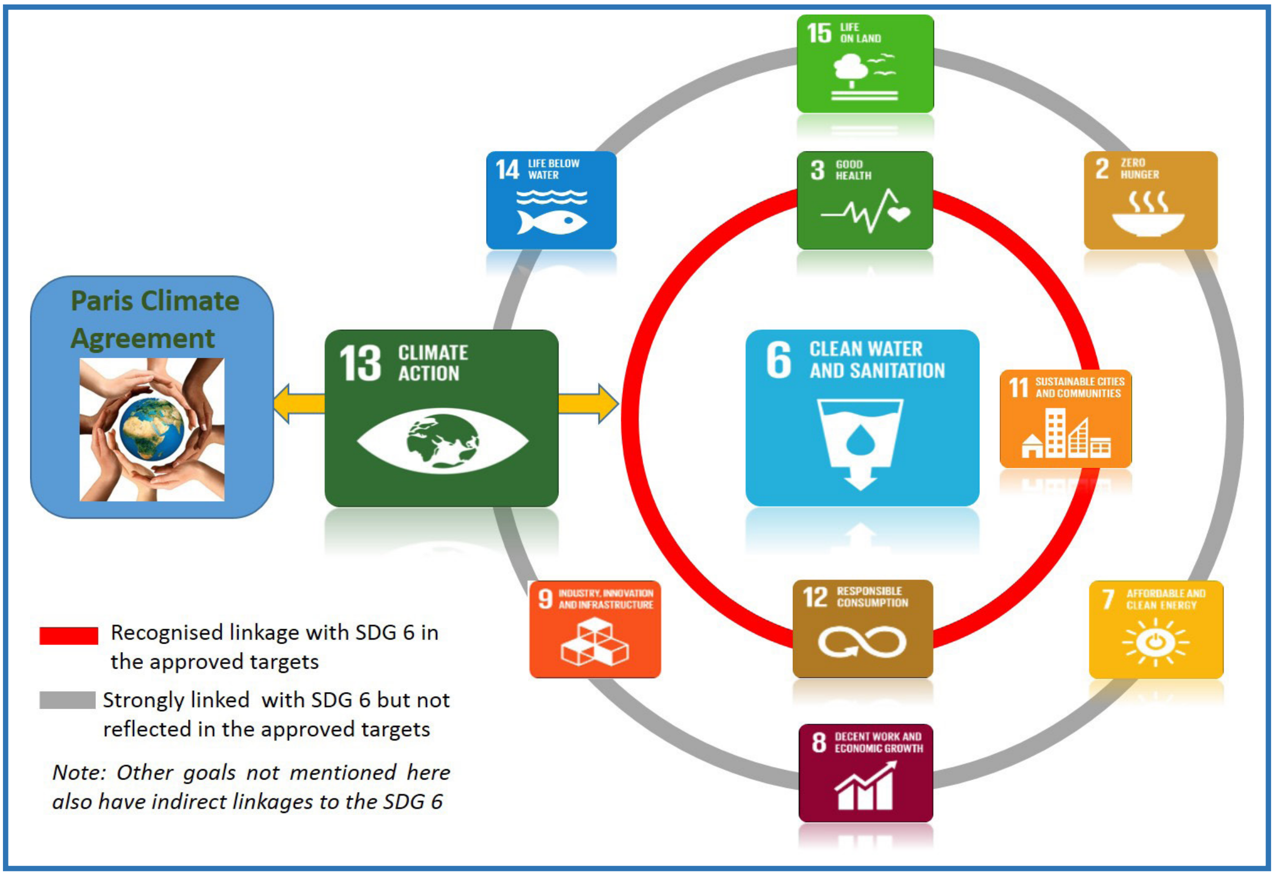

Figure 1. Inter-linkage between SDGs and Paris Climate Agreement

Nexus approach for sustainable water management

Conventional sectoral-based planning cannot ensure sustainable use of water; rather, it tends to result in competition among water users. Recognising this problem, IGES launched a research programme to explore the nexus between water, energy and climate, and to find ways to transcend traditional sectoral boundaries. The findings of this study indicate that water, energy, and climate are inextricably linked. Table 1 shows that energy technology choices greatly influence both water demand and carbon emissions. Some carbon mitigation technologies such as carbon capture and storage (CCS) and concentrated solar power (CSP) have negative correlations with water use efficiency, meaning that they can exacerbate existing water shortages in water-stressed countries such as India and China. This study argued that sectoral interests should be well balanced when decisions over mitigation technologies and resource allocation and development are made.

Table 1. Impact of energy technology choices on water use and carbon mitigation

Energy technology	Water use	CO_2 emission
Coal	High	High
Coal + CCS	Very high	Low
Gas	Medium	Medium
Gas + CCS	High	Low
Solar (photo-voltaic)	Negligible	Negligible
Solar (CSP)	High	Negligible

Source: IGES, 2013; DOE, 2006

Decentralised wastewater management

Wastewater management is a major challenge for sustainable development. It is intrinsically linked with safe water supply, human health and environmental risks. Inadequate sewerage network coverage and lack of sewage treatment facilities are major challenges for wastewater treatment in many developing countries. Large-scale and conventional centralised wastewater treatment systems with advanced technologies have often failed in developing countries because of weak institutions, high costs, and lack of both financial and human resources to manage and maintain the systems. IGES together with several of its partners is working to promote the decentralised wastewater management approach as a smart alternative for domestic wastewater management in Asia. Decentralised wastewater treatment systems can fill the gap between on-site and centralised sanitation options, as shown in Figure 2 (Bao and Kuyama, 2015).

Conjunctive use of water for climate-resilient agriculture

Typically, water is withdrawn from either surface or underground sources to supply a wide range of users. High dependency on a single water source can result in source depletion and increases vulnerability to climate change. Conversely, conjunctive use of surface water and groundwater builds resilience and adaptive capacity to climate-related hazards. Conjunctive water use is expected to provide several advantages for water management, including (i) reduced pressure on groundwater; (ii) reduced saline water intrusion in coastal areas; (iii) reduced water logging and associated salinisation; and (iv) better control on water allocation and distribution during droughts or floods. In agriculture, conjunctive water use creates flexibility to provide timely irrigation for various crops during critical periods and can prevent crop damage from deficits in rainfall or prolonged droughts. In recent years, many countries have faced severe droughts that caused considerable crop damage. Amongst

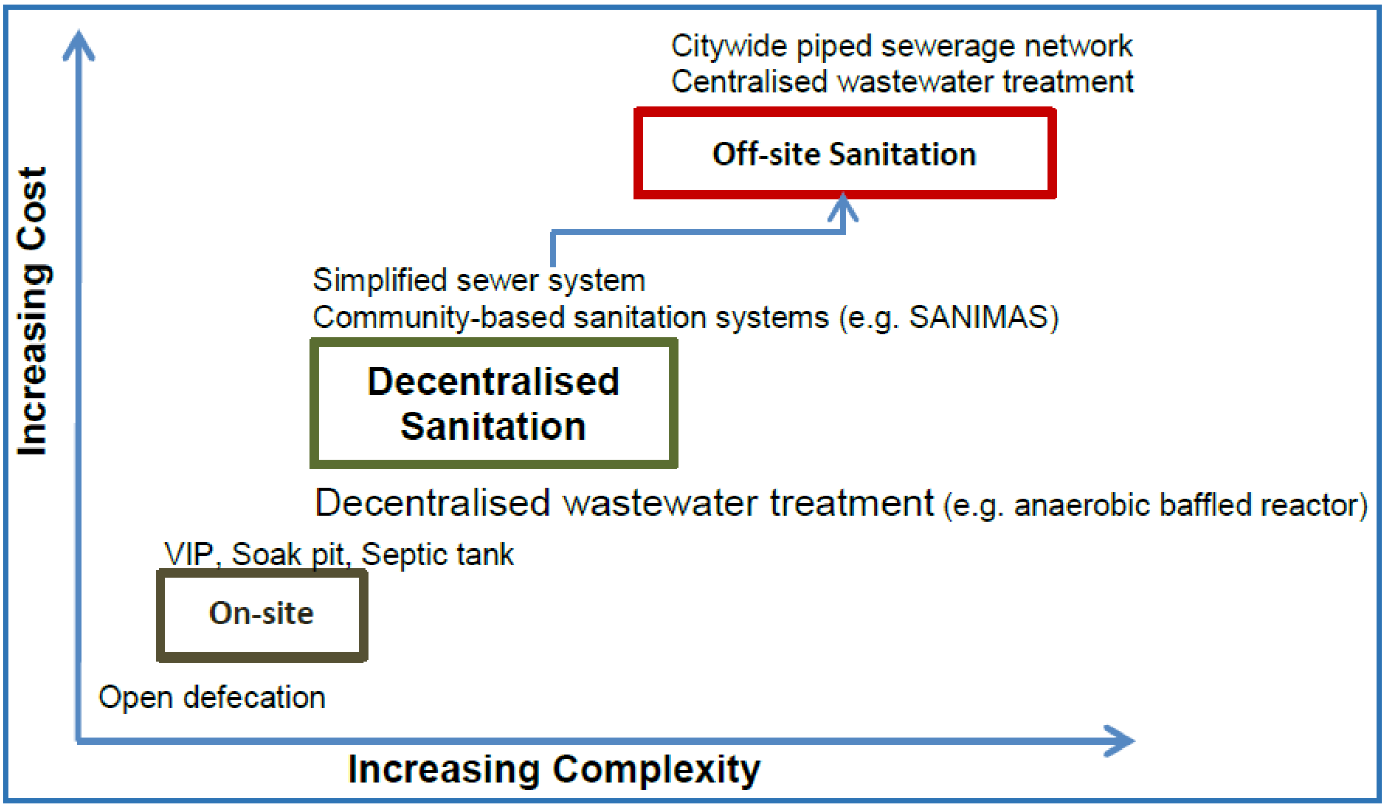

Figure 2. Decentralised sanitation fills the gap between on-site and centralised sanitation options

these, countries in the Lower Mekong are increasingly affected by droughts, including those caused by the latest El Nino event. For low-income countries in the Lower Mekong, such as Lao PDR, climate-induced drought could threaten the agriculture sector and hence the lives of millions of small-holder farmers.

Together with the International Water Management Institute (IWMI), IGES is implementing a project to promote groundwater irrigation as a viable alternative to mitigate droughts and increase food security in Lao PDR. Under this project, IGES is engaged in research and a pilot trial of groundwater irrigation to institutionalise groundwater irrigation in a manner that ensures good governance and sustainable management of groundwater resources.

4. Enabling environment for translating water knowledge to actions

Recognising the importance of water security for sustainable societies, efforts to generate evidence-based knowledge towards sustainable water resource management have increased through various forums involving academia, think tanks, non-profit organisations, and international agencies, etc. But, these efforts only have value when the generated knowledge is translated into actions. How such knowledge can be translated to national and local actions in a continuous cycle of development is a major challenge. This challenge can partly be met by reducing persistent gaps that exist in certain areas of knowledge development, exchange and application. To do so, several measures and interventions are critical to build bridges between knowledge generation and policy actions including (i) generating evidence-based knowledge to address real needs; (ii) knowledge sharing and capacity building; (iii) formulating enabling regulations to make the best use of knowledge; (iv) integrating sectoral interests and (v) securing access to diversified financial sources (Figure 3).

The elements of an enabling environment for bridging knowledge generation and actions are elaborated below through several examples.

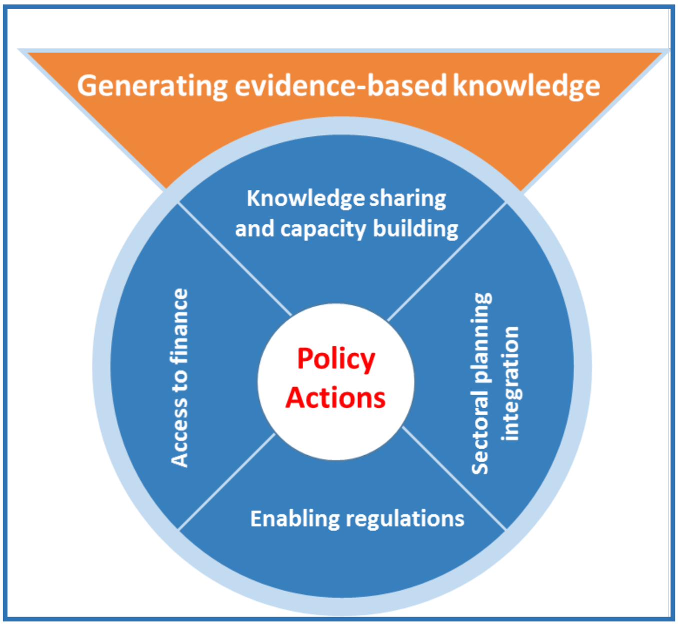

Figure 3. Enabling environment for translating water knowledge to actions

Knowledge sharing and capacity building

Factors that influence the use of evidence-based knowledge in policy making, planning and the implementation of plans include timely access to knowledge, the relationships between the knowledge generators and the end-users of the knowledge, and capacity-building of the knowledge users. Knowledge sharing processes thus need to move away from the traditional concept of knowledge being generated just by “experts” to collaborative approaches to problem identification and solving, and the creation of platforms to transfer know-how.

The Water Environment Partnership in Asia (WEPA), initiated by the Ministry of Environment of Japan (MOEJ) in 2004, is a successful model of a regional knowledge platform. WEPA has brought together 13 member countries – Cambodia, China, South Korea, Indonesia, Lao PDR, Philippines, Malaysia, Myanmar, Sri Lanka, Nepal, Thailand, Vietnam, Japan – with the aim to improve water environmental governance through knowledge accumulation and sharing, capacity building, and the planning and implementation of action programmes in selected member countries. As the Secretariat of the WEPA platform, IGES gathers, organises and analyses regional knowledge on the water environment in a publicly available database, supports capacity building on the water environment and helps member countries to formulate and implement the action programmes.

Figure 4. A step-by-step approach for designing activity framework of WEPA

Enabling regulations

Regulatory frameworks for water management and use can be strengthened by employing evidence-based knowledge on water risks that has been generated. IGES has been studying the water-energy nexus in India, and this study highlighted the need for new regulation to control the use of water by thermal power plants as a coolant. The IGES study estimated that existing thermal power plants use about 15 billion cubic metres per year for cooling. This study highlighted the importance of a new regulation concerning greenhouse gas emissions and water use in thermal power plants (TPP), noting that the regulation will contribute to India's water security.

The Central Energy Authority of India (CEA) released guidelines for water use in TPP (3.6 m^3/MWh) in 2012 (CEA, 2012). Further efforts have been made by the Ministry of Environment, Forest and Climate Change (MOEFCC), including notifying the Environmental (Protection) Amendment Rules 2015, which reduce the water use limit even further, from 3.6 m^3/MWh to 2.5 m^3/MWh for new thermal power plants to be installed after January 2017 (MOEFCC, 2015). Enforcement of the MOEFCC new regulation on water use in thermal power generation (2.5m^3/MWh) will reduce water use for thermal power generation by 30% as compared to the CEA guideline (3.6 m^3/MWh) (Figure 5).

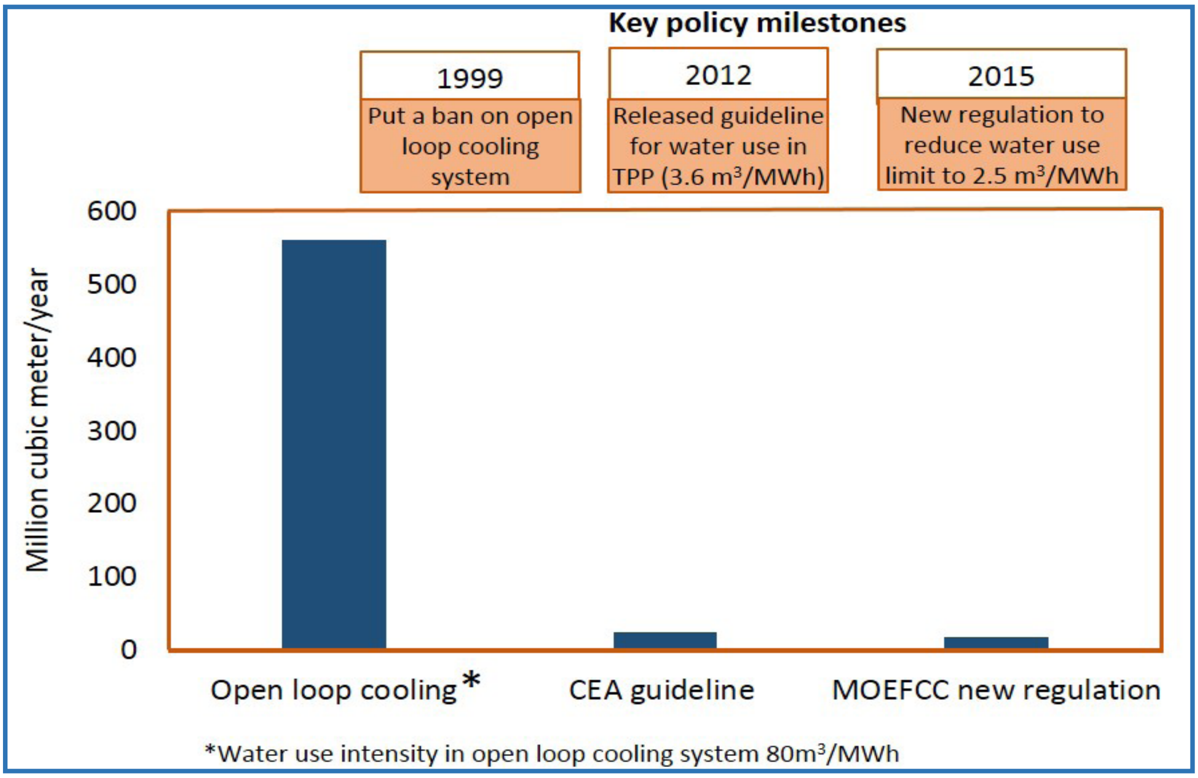

Figure 5. Key policy milestone and potential impact on water use of a 1000 MW coal power plant (Source: prepared by authors)

Integration of sectoral planning

Water is a multi-sector interest. One of the main challenges to sustainable water management is to maintain a proper balance among the interests of the various water users. Cross-sectoral partnerships around water must be up-scaled if the world is to avoid a 40% water shortfall in the next 15 years.

There are some good models of cross-sector water collaboration that provide win-win outcomes for the water users. The IGES water-energy nexus study in India describes one such model of sectoral collaboration on water, where the municipal wastewater of Delhi is used for the cooling of a thermal power plant. The Pragati CCGT power plant and the Delhi Jal Board decided on a collaborative agreement under which the power plant authority covers the operation and maintenance cost of the wastewater treatment plant in exchange for free intake of 20 million litres of treated wastewater. The model provides a greater opportunity to plan integrated water and energy infrastructure for the future. It has many co-benefits. Benefits to the power plant include: (i) provides a reliable and continuous water supply, which is particularly important in the dry season; (ii) helps to obtain environmental clearance and (iii) potentially avoids conflict with other water users. The model has also introduced a cost and responsibility sharing mechanism that reduces the burden on the wastewater management authority, and contributes to environmental conservation by reducing demand for freshwater and improving the water environment.

Securing finance for water security

For sustainable water resource management, new interventions, both hard and soft, depending on the nature of water constraints and livelihood contexts, are needed. Implementing water interventions to achieve sustainable development and build climate-resilient societies will require substantial investment. One World Bank study reported that meeting SDG targets 6.1 (By 2030, achieve universal and equitable access to safe and affordable drinking water for all) and 6.2 (By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations) will require around US$114 billion in financing per year. The breakdown of this is: safe water – US$37.6 billion; basic sanitation – US$19.5 billion; safe faecal waste management – US$49 billion, and hygiene – US$2.0 billion (Hutton and Varughese, 2016). To ensure sufficient finance throughout the cycle of knowledge generation to implementation, both traditional and non-traditional financial sources will be needed. Traditional sources include government budgets, public banks and international financial institutions. Non-traditional sources include pension funds, insurance companies, sovereign wealth funds,

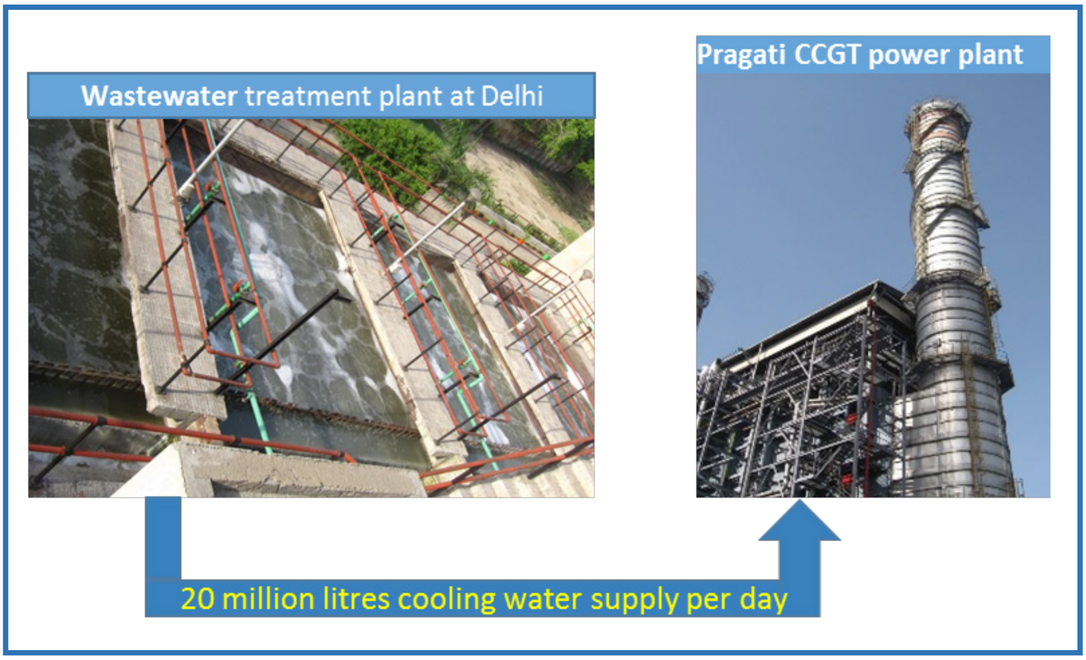

Figure 6. Treated municipal wastewater used for power plant cooling in Delhi, India

private companies, microfinance agencies, climate funds and green bonds.

5. Conclusion

Water security is essential to human survival and well-being. This makes the current over-exploitation of natural water resources and degradation of natural water systems top global developmental and environmental priorities. If we fail to make major improvements in the management of water resources, water security will not be achieved, placing at risk many of the SDGs and the global climate change agenda. These improvements are only possible when all actors and all sectors work together for better understating of the issues and to agree on solutions. Water security will require coordination of SDG and climate change actions at country level. Water security cannot be achieved if these agendas are pursued separately. The process of coordination needs to be supported by the generation of evidence-based knowledge and enabling conditions to translate knowledge to actions. The enabling conditions include platforms and processes to bring knowledge to the attention of policy and decision makers, strengthened legal and regulatory frameworks that provide appropriate controls and incentives, the integration of sectoral planning for equitable management of trade-offs and the realisation of synergies across sectors, and mobilising the necessary financial resources from both traditional and non-traditional sources.

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Institute for Global Environmental Strategies (IGES)
Natural Resources and Ecosystem Services Area
2108-11 Kamiyamaguchi, Hayama, Kanagawa, 240-0115, Japan
Tel: 046-855-3700 Fax: 046-855-3709
E-mail: nre-info@iges.or.jp
www.iges.or.jp