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Urban Water Security in Asia-Pacific

Promoting Demand Management Strategies

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Robert Brears

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Executive Summary

In Asia-Pacific, urban centres will face water insecurity as a result of climate change and the impacts of urbanisation. To achieve urban water security in the Asia-Pacific region, water managers can use a variety of demand management tools to alter the attitudes and behaviours of individuals and society towards water resources. In Europe, urban water security is affected by droughts and scarcity. The European Commission has stated that demand management should come first and that alternative supply options are only considered once the potential for water efficiency has been exhausted. In order to achieve urban water security in the Asia-Pacific region, existing institutional frameworks between Europe and Asia-Pacific can be used to exchange best practices and lessons learnt from European urban centres implementing demand management strategies.

Policy Recommendations

- Urban water managers in the Asia-Pacific region can use demand management strategies and instruments to achieve water security by changing people's culture, attitudes and practices towards water resources and reducing consumption patterns.
- European best practices and lessons learnt in urban water demand management could be transferred from Europe to Asia-Pacific. The European Commission's Flagship Initiative to achieve a resource-efficient Europe provides a suitable cooperation mechanism. In addition to calling for a change in consumers' behaviour towards resources in general and the sustainable use of water, this Initiative promotes international cooperation on resource efficiency.
- Several European institutions and platforms could be used to exchange best practices and lessons learnt in urban water demand management, including the European Commission's Joint Research Centre, the European Union Water Initiative, and Horizon 2020. This transfer can occur at the EU, EU member state, and city levels through numerous existing cooperation frameworks. Nevertheless, the transfer of knowledge does not have to be one-way: With Europe facing water insecurity in the future and a significant number of cities already over-exploiting their groundwater resources, there is the potential transfer of best practices and lessons learnt in urban demand management from Asia-Pacific to Europe.

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1. Introduction

The Asia-Pacific region is one of the most rapidly urbanising regions in the world. Currently, seven of the world's mega-cities (cities with populations of 10 million or more) are located in Asia-Pacific. However, by 2025 there will be 21 mega-cities in the region. With three out of four Asia-Pacific countries already experiencing water scarcity, urban centres in the region will face water insecurity as a result of climate change and the various impacts of urbanisation.

Traditionally, urban water managers facing increased demand and variable levels of supply have relied on large-scale, supply-side infrastructural projects such as dams and reservoirs to meet increased demand for water (supply-side management). However, these projects are costly in both environmental and economic terms. Environmental costs include disruptions of waterways that support aquatic ecosystems. Economic costs stem from a reliance on more distant water supplies, often of inferior quality, which not only increases the costs of transportation but also the cost of treatment. In addition, since the vast majority of water resources in Asia-Pacific are transboundary, supply-side projects can create political tensions because they rely on water crossing both intra- and inter-state administrative and political boundaries.

This policy paper explores how demand management can be used to achieve urban water security, and how best practices and lessons learnt in Europe can be transferred to the Asia-Pacific region through numerous platforms for cooperation.

2. Challenges to Urban Water Security in Asia-Pacific

Water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being and socio-economic development; ensuring protection against water-borne pollution and water-related disasters; and for preserving ecosystems in a climate of peace and political stability (United Nations, 2013). In other words, water insecurity is the inability of a population to access good quality water of sufficient quantity necessary for sustaining livelihoods, human well-being and socio-economic development.

In the Asia-Pacific region, cities are at risk of water insecurity as a result of climate change and the various impacts of urbanisation. The Asia-Pacific region suffers disproportionately from natural disasters. 90% of all people affected by natural disasters between 2001 and 2010 reside in the Asia-Pacific region. Climate change is likely to decrease water security in the Asia-Pacific region, with increases in the frequency and magnitude of floods and droughts. In particular, flooding will decrease the availability of good quality water through contamination of surface and groundwater supplies, while droughts decrease the quantity of water available and increase demand for water for cooling and drinking. Climate change is projected to impact on urban water security in the following ways:

- **Precipitation and storm events:** Storm events (flooding) wash pollutants from urban areas into surface water bodies, as well as contaminate ground water supplies.
- **Heat-island effects:** Air temperatures in urban areas compared to surrounding rural areas are 3.5 to 4 degrees Celsius higher. The result is an increase in demand for water for cooling and drinking.
- **Heat waves and droughts:** During heat waves and droughts, demand for water increases (drinking water and water for cooling). In addition, higher temperatures mean algal levels increase, which degrades the quality of water resources and leads to increased treatment costs and energy use in the treatment process.
- **Sea-level rise and coastal flooding:** Globally, cities are mainly concentrated in coastal zones, leaving a large portion of the world's urban population exposed to the risk of sea-level rise and intensifying storm-surges, which contaminate groundwater supplies and damage water infrastructure.

Moreover, the Asia-Pacific region is one of the most rapidly urbanising regions in the world, with urban populations growing at 2.3% per annum compared to the global average of 2%. Currently, there are 10 mega-cities in the region (cities with 10 million or more residents). This will increase to 15 by 2025 leading to significantly increased demand for water resources. In addition, water quality is threatened by land-use changes that degrade ecosystems, as well as increased pollution.

Patterns of urbanisation are projected to impact water security in a number of ways:

- **Increase in population:** Rapid population growth has increased demand for water for both domestic and non-domestic use, frequently leading to over-exploitation of water resources. This results in excessive withdrawals and water scarcity.
- **Land-use change:** Urbanisation (urban sprawl or encroachment into river basin catchment areas) lowers the availability of good quality water of sufficient quantity through direct (point source) pollution (industrial, domestic wastewater) and indirect (non-point source) pollution (pathogens, organic and inorganic).
- **Degradation of ecosystems:** Over-exploitation of ground and surface water degrades ecosystems and their services (e.g. reduced ability to purify water etc.).
- **Competition:** Over-exploitation can lead to inter-sectoral, inter-regional and even international competition over scarce water resources.

For all of these reasons, the Asia-Pacific reason will be characterised by growing water scarcity over the coming decades, and policymakers will need to make full use of demand management techniques to mitigate these challenges.

3. Demand Management to Achieve Urban Water Security

Demand management involves better use of existing water supplies before plans are made to further increase supply. In particular, demand management promotes water conservation, during times of both normal conditions and uncertainty, through changes in practices, cultures and people's attitudes towards water resources (Savenije and van der Zaag, 2002). In addition to the environmental benefits of preserving ecosystems and their habitats, demand management is cost-effective compared to supply-side management because it allows the better allocation of scarce financial resources, which would otherwise be required to build expensive dams, water transfer schemes from one river basin to another, and desalination plants (Global Water Partnership, 2012).

Urban water security can be increased through demand management techniques by: (i) reducing loss and misuse in various water sectors (intra-sector efficiency); (ii) optimising water use by ensuring reasonable allocation between various users (cross-sectoral efficiency) while taking into account the supply needs of downstream ecosystems and other water users and uses; (iii) facilitating major financial and infrastructural savings for cities by minimising the need to meet increasing demand with new water supplies; and (iv) reducing the stress on water resources by reducing or halting unsustainable exploitation of water resources.

Demand management involves communicating ideas, norms and innovations for water conservation across individuals and society, the purpose being to change

people's culture, attitudes and practices towards urban water resources and reduce consumption patterns to achieve water security (Global Water Partnership, 2012, Muller, 2007). Urban water managers can use two types of demand management strategies to modify attitudes and behaviour towards water:

- Antecedent strategies attempt to influence the determinants of target behaviour prior to the performance of the behaviour.
- Consequential strategies attempt to influence the determinants of target behaviour after the performance of the behaviour. This assumes that feedback, both positive and negative, of the consequences of that behaviour, will influence the likelihood of the behaviour happening or not happening in the future (Maheepala et al., 2010, Molle and Berkoff, 2009, Gifford et al., 2011).

Using these two strategies, urban water managers can use two types of demand management instruments to achieve urban water security: (i) communication and information instruments, and (ii) regulatory instruments.

3.1 Communication and Information Instruments

Communication and information instruments encourage a water-orientated society. In particular, communication and information tools aim to change behaviour through public awareness campaigns around the need to conserve scarce water resources.

Public education: Urban water managers can promote water conservation in schools to increase young people's knowledge of the water cycle and encourage the sustainable use of scarce water resources. To do so, water managers can use a variety of strategies, including school presentations, and distribution of water conservation information and materials that can be used in school curriculum. Meanwhile, water managers can use public education to persuade individuals and communities to conserve water resources. In particular, water managers can influence individual's attitudes and behaviours towards water resources by increasing their knowledge and awareness of environmental problems associated with water scarcity (Steg and Vlek, 2009, Najjar and Collier, 2011, Policy Research Institute, 2005).

There are multiple tools and formats that water managers can use to increase environmental awareness and water conservation, including (i) public information such as television commercials, newspaper articles and advertisements, internet and social media campaigns; (ii) public events such as conservation workshops, public exhibitions; and (iii) information included in water utility bills, such as leaflets on water conservation tips.

Competition between users: Urban water managers can also increase participation rates in water conservation programmes by promoting competition among individuals and communities to achieve specific water consumption targets. Examples of competitions include eliciting commitments to water savings targets and promoting competition through the water utility bill. Regarding elicitation of commitments, urban water managers can obtain verbal or written commitments from individuals and communities in order to achieve specific water saving targets. Competitions can then be held to compare individuals' or communities' water

savings with one another and offer winners recognition or prizes for their water-saving achievements (Georgia Environmental Protection Division Watershed Protection Branch, 2007, Patchen, 2010). The water bill can also be used as a tool for competition between water users; for example, water bills can show a household's water consumption compared to the average household in the neighbourhood, city, province or state (Georgia Environmental Protection Division Watershed Protection Branch, 2007, Patchen, 2010).

3.2 Regulatory instruments

Regulatory instruments are frequently used in the management of water and involve setting allocation and water-use limits. In addition, regulatory instruments are used to provide incentives for all water users to conserve water and use it efficiently.

Conservation ordinances: Temporary urban water conservation ordinances and regulations restrict certain types of water use during specified times and/or restrict the level of water use to a specified amount. Examples of water-use regulations include (i) restrictions on non-essential water uses, e.g. watering lawns, washing cars, filling swimming pools, washing driveways; (ii) restrictions on commercial use, e.g. car washes, hotels and other large consumers of water; and (iii) bans on using water of drinking quality for cooling purposes.

Permanent urban water conservation ordinances and regulations include amendments to building codes or ordinances requiring the installation of water meters and water-saving devices, e.g. low-flow toilets, showerheads and faucets in all newly constructed or renovated homes and offices (Michelsen et al., 1999, OECD, 2011, Pennsylvania State University, 2010). For example, plumbing codes can be used to ensure new homes and offices meet the maximum water-use standards for plumbing fixtures such as toilets, urinals, faucets and showers.

Water pricing: In urban water resource management, economic theory suggests that demand for water should behave like any other goods: as price increases, water use decreases. Water managers can use a variety of different price structures, all of which send different conservation signals to individuals and communities. A flat rate is essentially a fixed charge for water usage regardless of the volume used, where typically the size of the charge is related to the customer's property value. A volumetric rate is a charge based on the volume used at a constant rate, e.g. $1 per cubic metre of water used. An increasing block tariff rate contains different prices for two or more pre-specified quantities (blocks) of water, with the price increasing with each successive block. A two-part tariff system involves a fixed and a variable component. In the fixed component, water users pay one amount independently of consumption and cover infrastructural and administrative costs of supplying water. Meanwhile, the variable amount is based on the quantity of water consumed and covers the costs of providing water as well as encouraging conservation.

Subsidies and rebates: Economic instruments such as subsidies (incentives) or rebates are used to modify an individual's behaviour in a predictable, cost-effective way, i.e. reducing wastage and lowering water consumption by providing, for example, subsidies for newer, more water-efficient toilets (Global Water Partnership, 2012, Policy Research Institute, 2005, Savenije and van der Zaag, 2002, OECD, 2012).

Product labelling and retrofit programmes: Urban water managers can promote water conservation product labelling schemes as well as managing retrofits of water-using devices such as taps, showers and toilets. The labelling of household appliances according to their degree of water efficiency is important in reducing household water consumption by eliminating unsustainable products from the market, provided the labelling scheme is clear and comprehensible and identifies both the private and public benefits of conserving water. Nevertheless, people are more likely to respond to eco-labels if the environmental benefits closely match personal benefits, such as reduced water bills.

Retrofit programmes involve the distribution and installation of replacement devices to physically reduce water use in homes and offices. The most common retrofits are toilet retrofits, involving customers having their older toilets replaced with newer low-/dual-flush toilets, and the distributing of showerheads and faucet aerators (devices that when inserted into taps reduce the flow of water) to households and offices (Georgia Environmental Protection Division Watershed Protection Branch, 2007, Roach et al., 2004, Michelsen et al., 1999, Pennsylvania State University, 2010).

4. Europe's Policy Response to Urban Water

In 2003, Europe was affected by widespread droughts affecting over 100 million people, a third of the EU territory, with a cost of at least 80 billion euros. In response, the EU Council of Ministers asked the European Commission to address the challenges of water scarcity and drought. The European Commission in 2007 issued the 'Communication on water scarcity and droughts in the European Union'. The Communication Paper laid down a water hierarchy in which water demand management should come first, and alternative supply options are only considered once the potential for water efficiency has been exhausted. The Communication Paper listed several policy options needed to manage water in a way that addresses water security, including putting a price on water, allocating water-related funding more efficiently, fostering water-efficient technologies and practices, and fostering the emergence of a water-saving culture in Europe.

Since the release of the Commission's Communication, droughts in 2011 and 2012 affected large parts of Southern, Western and even Northern Europe, with rainfall as low as 40% of normal levels. Meanwhile, by 2030 the number of river basins in Europe affected by water insecurity will increase by 50%. Regarding water use, around 20-40% of Europe's available water resources are being wasted. With water consumption in Europe projected to increase by 16% in 2030 and 60% of European cities currently over-exploiting their groundwater resources, urban water managers need to implement these demand management policy options to achieve urban water security (European Commission, 2002).

Under the EU's "Europe 2020" strategy for smart, sustainable and inclusive growth, the Flagship Initiative for achieving a resource-efficient Europe aims to create a framework for policies that support Europe's shift towards a resource-efficient and

low-carbon economy. This will help Europe fight climate change and limit the environmental impacts of resource use. To achieve this shift, the Flagship Initiative calls for a change in behaviour of consumers towards resources. The Flagship Initiative calls for a water policy that makes water-saving measures and increasing water efficiency a priority in order to ensure that water is available in sufficient quantities, is of appropriate quality, is used sustainably and with minimum resource input, and is ultimately returned to the environment with acceptable quality.

5. Promoting Collaboration between the EU and Asia-Pacific

Building on growing international awareness of the strategic importance of avoiding risks to the supply of resources, including water, the Europe 2020 Flagship Initiative identifies cooperation with key partners to address resource efficiency issues internationally as a key priority. The strategy highlights how concerted action on a global level can help mitigate the rise in global demand for resources, and calls for international cooperation to promote the exchange of skills, technology and best practices.

As part of this Flagship Initiative, the EU can transfer to the Asia-Pacific region best practices and lessons learnt concerning how European cities have used demand management instruments to implement the Communication paper's policy options to achieve urban water security: pricing water, allocating water-related funding more efficiently, fostering water-efficient technologies and practices and fostering the emergence of a water-saving culture to achieve urban water security. In particular, by utilising European-wide initiatives, the EU can transfer to the Asia-Pacific region best practices and lessons learnt in demand management through numerous existing institutional frameworks for cooperation between the two regions, including at the EU, EU member state and EU member state city levels.

EU-ASEAN Partnership: The Bandar Seri Begawan Plan for Action to Strengthen the ASEAN-EU Enhanced Partnership (2013-2017) serves as a vehicle to strengthen the ASEAN-EU Partnership on addressing regional and global challenges of shared concern. With regard to water resource management, the Plan of Action calls for promoting public awareness and partnership to enhance integrated water resource management.

State-to-State: At the State-to-State level, the project funded by the German Federal Ministry for Education and Research and executed by the UFZ, TU Dresden and Dresden Sewerage and Drainage Company IWAS (Internationale Wasserforschungs-Allianz Sachsen, Water Research Alliance Saxony) has been initiated in partnership with Vietnam with the aim of modernising the country's water sector.

State-to-State and City: At the State-to-City level, the German Federal Ministry for Economic Cooperation and Development (BMZ) has commissioned the 'Integrated

Resources Management in Asia Cities: The Urban Nexus' project with 10 Asian cities in China, Indonesia, Mongolia, Philippines, Thailand and Vietnam.

City-to-City: At the city level, Berlin's water utility (Berliner Wasserbetriebe) has a management contract with Kathmandu's water utility (Kathmandu Upatyaka Khanepaini Limited) to enhance the capacity of Kathmandu's water managers.

Three existing initiatives could play a particularly important role in facilitating the transfer of best practices and lessons learnt in demand management from Europe to Asia-Pacific on urban water demand management.

European Commission Joint Research Centre: These best practices and lessons learnt in demand management can be transferred through the Joint Research Centre, the European Commission's in-house science service, which addresses key societal challenges on a European and global scale. The JRC supports water policies by assessing water quality, predicting climate change impacts on water resources, assessing future water needs in the economy, studying water governance in developing countries, mapping water resources and carrying out analysis of how new technologies can be implemented for increasing water efficiency and reuse.

European Union Water Initiative: The European Union Water Initiative was launched in 2002 at the World Summit for Sustainable Development in Johannesburg as a partnership with national governments, donors, the water industry, NGOs and other stakeholders. One of the key goals of the Initiative is to improve the efficiency and effectiveness of water management through dialogue and coordination to strengthen cooperation through promoting river basin approaches in national and transboundary waters.

Horizon 2020: Horizon 2020 is the largest EU Research and Innovation programme in Europe's history with nearly 80 billion euros of funding available over seven years (2014-2020). The purpose of the funding is to promote excellence in science, industrial leadership and the tackling of societal challenges faced by citizens in Europe and elsewhere. Regarding water resources, the challenge will fund research and innovation that seeks to achieve a water-efficient and climate change resilient economy and society. Specifically, Horizon 2020 calls for the strengthening of international cooperation with China and India, through strategic partnership in the field of water. In addition, Horizon 2020 states that the EU should promote its experience in water policy in order to share best practices.

To ensure these best practices and lessons learnt are implemented in the region, the EU can implement the World Bank's methodology on operationalising demand management instruments (Closas et al., 2012). In particular, this methodology contains a set of phases in which water managers can plan, develop and implemena demand management strategy to increase urban water security in Asia-Pacific.Specifically, this methodology involves the following:

- **Engagement:** Capacity building of local, regional and national authorities on demand management, participatory planning between the various stakeholders on demand management strategies.

- **Assessment:** Identification and prioritisation of water and urban issues through qualitative and quantitative assessments.

- **Participatory planning:** Evaluation of possible demand management strategies, consensus on objectives, goals and actions, development of strategic action plans.
- **Implementation and monitoring:** The strategic action plan for demand management is implemented, and progress towards achieving the objectives and goals of the plan are monitored and adjustments made where appropriate.

6. Conclusion

Climate change and rapid urbanisation in Asia-Pacific is threatening urban water security in the region. To achieve water security, urban water managers in the region can use demand management strategies and instruments to change people's culture, attitudes and practices regarding water resources and reduce consumption patterns. The European Commission's Communication Paper provides policy options in demand management to achieve water security, and offers the potential for transferring best practices and lessons learnt in urban water demand management from Europe to Asia-Pacific.

The European Commission's Flagship Initiative for a resource-efficient Europe provides a platform for cooperation. In addition to calling for a change in behaviour of consumers towards resources in general and the sustainable use of water in particular, the Flagship Initiative promotes international cooperation on resource efficiency. In this context, policymakers in the EU and Asia-Pacific countries should take the following steps to promote urban water security:

- Urban water managers in the Asia-Pacific region can use demand management strategies and instruments to achieve water security by changing people's culture, attitudes and practices regarding water resources and reducing consumption patterns.

- European best practices and lessons learnt in urban water demand management could be transferred from Europe to Asia-Pacific. The European Commission's Flagship Initiative to achieve a resource-efficient Europe provides a suitable cooperation mechanism. In addition to calling for a change in behaviour of consumers towards resources in general and the sustainable use of water, this Initiative promotes international cooperation on resource efficiency.

- Several European institutions and platforms could be used to exchange best practices and lessons learnt in urban water demand management, including the European Commission's Joint Research Centre, the European Union Water Initiative, and Horizon 2020. This transfer can occur at the EU, EU member state and city levels through numerous existing cooperation frameworks. Nevertheless, the transfer of knowledge does not have to be one-way: With Europe facing water insecurity in the future and significant numbers of cities already over-exploiting their groundwater resources, there is the potential transfer of best practices and lessons learnt in urban demand management also from Asia-Pacific to Europe.

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