A FRAMEWORK FOR DEVELOPING INDUSTRIAL WATER USE POLICY

INTRODUCTION

Industry has been a key engine of growth in Asia, but fast economic expansion has come at the cost of a surge in water resource use and water pollution. Estimates suggest that the industrial sector of the region will see the largest increase (of 65 percent) in water use by 2030 compared to any other sector in the economy. To address these challenges several countries have updated their water policies or industrial policies since 2004: (Example: Bhutan, China, India, Pakistan, Myanmar and India). Other countries, like Bangladesh, are planning to develop an industrial water use policy, while some other countries are in the process of reviewing their existing water policies.

The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) undertook a project to strengthen national capacities in designing policies for water treatment and use in key industrial sectors in seven countries in the region: Bangladesh, Cambodia, Indonesia, Lao PDR, Myanmar, Pakistan, and Viet Nam. Due to their booming industrialisation, these countries present high-water consumption and...
water pollution potential.

As part of this project, the present document seeks to highlight the practices from 20 countries in terms of addressing water pollution and promoting optimal usage of water in the industrial sector to support policy-makers in developing industrial water use policies. Based on this analysis, the policy brief develops a framework for the development of industrial water use at national level, which is elaborated upon in the later parts of this document. In formulation of this framework, it also tries to address some of the challenges identified during the regional workshop and should be read in conjunction with the lessons from China.

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A Framework for Industrial Water Use Policy

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I. PREAMBLE

This first part introduces the current situation and challenges relative to water policy and the importance of embedding water policies in national agendas

a) Current situation and challenges

This section stresses the need to assess the current situation and discusses systems mapping as a tool to do so.

When it comes to industrial water, there is no one-size-fits-all policy. Effective policies must take into account the risks and leverage the opportunities specific to each country, including available water sources, trends in usage from industrial sector and envisaged changes in economic structure. For instance, the Burmese water policy emphasizes ‘population growth, urbanization and industry use’ as ‘serious challenges to water security’ (1.11). Here, taking stock of the current situation is equally as important as projecting an ideal situation. To trigger positive change, policies should lie on ambitious aspirations.

The first step in developing policy should be prioritization of issues — including an assessment of main polluting industries — and a mapping of domestic water capacities. Such systematic account of major polluting industries allowed the Philippines to strategically target pulp and paper, furniture, construction and the plastic industry in its plan to green the manufacturing industry. This step will help establish the sectoral breakdown and the sizing of the industrial sector. Assessing the size is just as important as identifying the main sectors as small family-ran manufactures may call for different policy tools than large industries.

Given the holistic nature of water systems, the design of an industrial water policy should also be preceded by a system mapping. This thinking exercise locates the boundaries and nodes of a system, increasing concern for all stakeholders, structures and their connections. System mapping provides an understanding of interlinked challenges and opportunities. In that sense, it is a tool to establish inclusive and just policies. At the same time, charting the leverage points (sections of the water cycle that are directly affected by policies) and inter-related themes helps to ensure that critical related issues are given due consideration in the policy document. In the context of water policies, system mapping can help systematize basin-wide approaches. For example, in the past application of systems mapping in the case of targets related to SDG 6 has revealed indirect links with issues SDG 3 (on human health and well-being), on other SDG 6 targets, as well as on SDG 11 (on cities and human settlements), on SDG 14 (on sustainable use of oceans, seas and marine resources) and on SDG 15 (on sustainable use of terrestrial ecosystems). Understanding these inter-linkages in the national context will be critical in developing holistic policies.

b) Link with existing policies and national agendas

This section emphasizes the importance of embedding water policies in national plans.

The industrial water use policy should be aligned with existing water policies, strategies and country’s overall industrial strategy. Successfully
shifting towards a more sustainable industrial water use requires inscribing water policies in a broader transformation of economic structures and supply chains. System mapping at the policy level could be helpful to actively identifying the ties, trade-offs and synergies of policies. System mapping can clear the way for integrated policies by identifying the variety of legal frameworks effective in a given location. Competing legislation should be identified early on to avoid conflicting legislations and ensure that the policy comes into effect. Water policies increasingly recognize the need for holistic approaches. For instance, China’s Water Ten policy II explicitly aims to the “transformation and updating of economic structure” while innovative water policies are included in broader strategies to green the economy (Philippines 1, Malaysia - Executive summary). These efforts to holistically transform industrial water use are said to be inscribed in a larger “theory of change”. At the same time, this section needs to clearly articulate the value addition made by this policy in the context of existing policies.

II. PRINCIPLES

This part presents some of the critical principles that may underpin the industrial water use policy

Underpinning principles provide the framework on which concrete measures can later be built. The following section highlights three principles commonly cited in existing water policies that are relevant to industrial use. While the following might help ignite reflections on policy principles, such decisions should ultimately be based on national circumstances.

a) Water as a public good

Several South East Asian countries recognize water as a public good (Vietnam, Lao PDR 6)¹⁰, a status that translates into concrete policies such as the introduction of water exploitation fees (Vietnam, 65)¹¹. The public good framework is a safeguard against the privatization of water and a commitment to equalizing access to water sources. Example: “Water resources are owned by the national community, which the government centrally and uniformly manages for the whole country” (Lao PDR, 6). This principle then provides basis for limiting over exploitation of water resources by any particular sector.

b) Polluter-pays principle

More common still is the polluter-pays principle, which generally dictates that those who produce pollution should bear the cost of managing it. Applying the polluter-pays principle to water requires allocating clear responsibilities for wastewater management and holding polluters accountable. In practice, this is achieved through price-based or quota-based mechanisms. Price-based mechanisms take the form of pollution taxes, where the price of pollution is determined by the rate of the tax for polluting emissions. Quota-based mechanisms, often referred to as ‘cap-and-trade’, set a limit on the maximum level of emissions for a given time period and distribute limits or allowances for each pollutant among firms that produce emissions¹².

While nearly all the countries of this policy review have made this principle explicit in their water policies, legal interpretations of this principle vary across countries. In India, it means that “absolute liability of harm to the environment extends not only to compensate the victims of pollution, but also to the cost of restoring environmental degradation”¹³, whereas the French Charter for the Environment simply sees it as requiring that everyone contributes to “the making good of any damage he or she may have caused to the environment”¹⁴.
c) Integrated Water Resource Management (IWRM)

Integrated Water Resource Management (IWRM) is another widespread principle underpinning water policies. IWRM was born from the realization that a fragmented approach to water management is inadequate to deal with the growing global water stress and the interconnected nature of water cycles. IWRM seeks to “coordinate the development and management of water resources in order to maximize economic and social welfare”.

The principle of IWRM should be at the centre of industrial water use policy for two reasons. First, upstream integration is crucial to ensure that industrial activities are not limited by water access. Second, downstream integration is an essential process to protect the right of downstream users to clean and sufficient water. IWRM is cited in many water policies (India 9.2., Pakistan 3.5, Malaysia 7.2, Australia 24.iv, Myanmar 2.h, Bhutan 6.2.4, Algeria I.4, Zimbabwe 6.3), with concrete implications in the design of water programs, including:

- Taking basin and sub-basin as a unit and not as separate entities to ensure that the interests of upstream and downstream stakeholders are protected against threats like mining or contamination (India 12.4, Pakistan 3.5, Bhutan 6.2.4, Lao 15)
- Greater knowledge exchange. IWRM implies mobilizing and empowering a variety of actors, from industries to research facilities. In its effort to ignite industry change, China has been pushing to bridge scientific and industrial worlds, including by encouraging enterprises to seek professionally certified environmental service companies (P.R.C 33.1).

Including IWRM in industrial water policies is also a pledge to consult stakeholders in all steps of design and implementation. Using IAP2’s Public Participation Spectrum, consulting here means “obtaining public feedback on analysis, alternatives and/or decision” with the expectation that stakeholders will be “informed, listened to, and that their concerns and aspiration will be acknowledged.”

III. POLICIES GOALS AND OBJECTIVES

This section discusses the structure of policy goals and proposes three objectives for industrial water policy

After outlining the theoretical underpinnings of a policy, it is common to highlight policy a policy goal. Policy goals emphasize the values guiding concrete objectives, which may include sustainability (Botswana 1.1.1, Bhutan 2, Maldives Executive Summary, Lao PDR 1, Pakistan 2.1), efficiency (Botswana 1, Bhutan 2, Pakistan 2.2), equity (India, Bhutan 2.2, Botswana Pakistan 2.2), stakeholder participation (Maldives) and the Sustainable Development Goals (Maldives Executive Summary).

Policy goals can be structured as “The National Water Policy is informed/relies on value(s) X”. For instance, article 2.2 of the Bhutan water policy establishes that “water must be used and managed sustainably, efficiently and equitably while recognizing and preserving the environmental, social, cultural and economic value and uses of water”. Statements of this kind are occasionally complemented by specific targets (Pakistan).

In the case of an Industrial water use policy, the goals of industrial water policies can be reflected in concrete objectives at three entry points of the Industrial Water Cycle detailed below. These entry points are:

- **Policy Objective 1**: Water resources development, supply and conservation, which seeks to increase the availability of water for industrial purposes
- **Policy Objective 2**: Water demand and use management, which aims at increasing water use efficiency
- **Policy Objective 3**: Wastewater management, which seeks to limit and eliminate the environmental damage from industrial effluents

The following Industrial Water Cycle diagram breaks...
The Industrial Water Cycle

Water Resources Development
Goal: Increase Available Water

Groundwater
Water body Extraction
Tools: licenses, fees, area regulation

Rainwater Harvesting
Tools: Subsidies, Incentives, Regulations

Desalination
Tools: Subsidies, Research, Incentives

Recycled Water

Water Demand and Use Management
Goal: Increase Water Efficiency

Demand Management
Policy Tools: BAT, Pricing, Water Footprint, Cleaner Production Technologies

Industrial Use

Waste Water Management
Goal: Limit Environmental Damage From Effluents

Treatment Facility
Tools: Industrial Parks, Up-to-date science, Regulations, Zoning, Discharge Standards

Recovered By-products

Discharge

Recycle and Reuse

Source: ESCAP Creation
Policy Objective 1: Water resources development and conservation

This section presents four policy measures to increase water development and conservation.

Water resources development seeks to increase available water. Related strategies increasingly entail programs and activities to protect source and encourage sustainable water sourcing. Regulations may be put in place to protect sources (1), while processes like rainwater harvesting (2), recycling and reuse (3) and in some cases desalination (4) can be incentivized to limit unsustainable water sourcing.

(1) In most places, water was historically abstracted from the groundwater and water bodies. However, because most groundwater sources and fresh water bodies cannot keep pace with exploitation, their use cannot remain unregulated. To address overexploitation through IWRM practices, countries can seek to increase community ownership over wells. Article 41 of Lao's water policy establishes “groundwater user groups in community areas to raise ownership of communities to be responsible for the management, maintenance, monitoring” of “public drilled wells” and preserve sustainable use (Lao PDR 41). Groundwater can also be protected through abstraction regulation. Possible regulations include licenses and fees, area regulation and groundwater recharge programs:

(a) In Pakistan, abstraction is limited by a licensing scheme with a prior environmental assessment: "A study shall be undertaken for enactment of legislation to formally allow and define the use of water abstraction licenses and water rates for industrial use" (Pakistan 15.1).

(b) Such schemes can be complemented by area regulation, with the goal of geographically containing the environmental impact of water abstraction. To preserve vulnerable zones, Pakistan and Lao's have made their extraction permits area specific.

(c) Finally, the damage of overexploitation of groundwater can be reversed by groundwater recharge programs. Kabul’s groundwater levels are being successfully restored by such a program, suggesting promising results for the region as a whole21.

(2) In countries that allow it, rainwater harvesting is often highlighted as a sustainable water source, especially for industrial use (Bhutan 6.1, India 11.4, Pakistan 15.3, Malaysia22 7.4.4.2, Myanmar 12.d, Burundi 70623). When possible, it should be incentivized and adequately regulated. Desire to reap the benefits of rainwater harvesting coupled with awareness of the related challenges is best exemplified by India's water policy: “In industrial areas, rainwater harvesting and de-salinization, wherever techno-economically feasible, should be encouraged to increase availability of utilizable water. Implementation of rainwater harvesting should include scientific monitoring of parameters like hydrogeology, groundwater contamination, pollution and spring discharges” (11.4).

(3) Desalination is another trending technology to develop water resources. Water policies from Myanmar and India point to it as potential solution to increase utilizable water (India 11.4, Myanmar 12.d). However, it poses three serious environmental problems. First, desalination is highly energy intensive and is therefore often paired with substantial greenhouse gas emissions. Second harvesting water from the ocean can result in significant biodiversity loss, as millions of organisms are killed in the process. Third, desalination plants release doubly concentrated salt water that can wreak havoc to marine ecosystems24. For these reasons, desalination should only be considered as a last resort for providing fresh water.

(4) Finally, mechanisms to recycle and reuse need to be systematically recommended to promote industrial uses of greywater (India 11.7, Pakistan 15.3, Philippines 725, Myanmar 7. b, Bhutan 6.1.4, Botswana 8.1.13). Georgia forbids the use of potable water for industrial purposes that do not require potable water (53.2.c). Among the services the green sector of a country's economy is meant to provide, Philippines cites water recycling: “reliable waste water management systems that ensure the efficient treatment and recycling of domestic and
industrial effluents” (Philippines 7). For water reuse to be conducted safely, water policies should either require compliance with the ISO standards TC 282 or develop their own standards on water reuse.

Policy Objective 2: Demand management and water use efficiency

This section presents three policy measures to improve demand management and water use efficiency.

The principle of efficient water use, including for industry, is featured in many water and industrial policies (Pakistan 3.1, India 4.3, Vietnam, Philippines 7, Myanmar 5.b, Bhutan 5.5.1, Maldives 2.2, Botswana 8.1.10). These policies follow growing evidence for the high profitability of increasing water use efficiency. Reducing water use by 20% could have a return on investment exceeding 1,000% over by 2030. Policies try to increase water efficiency through, inter alia, (1) setting water-use efficiency targets (2) technological improvements (3) water pricing and (4) water footprint.

(1) Setting water use efficiency targets: Setting sectoral targets in terms of improvement of water use efficiency over a period can be a useful way to promote resource use efficiency. The water use efficiency can be set in terms of percentage reduction in water intensity (m3 per BDT) annually or over time. For example, India’s water mission targets overall improvement in water use efficiency at least by 20% by 2030.

(2) The pressure on water resources can significantly decrease by improving technologies, meeting up-to-date industry standards and developing best available technique (BAT) to evaluate industries against (Philippines 9.2, Australia 106.c, Maldives 2.2, Botswana 8.1.14).

Policies can speed up the development and spread of technologies to minimize water use and pollution. For instance, China’s Water Ten tasks the Ministry of Science and Technology with engaging the scientific and technological community in the process of development and dissemination of key technologies (P.R.C IV). Among others, this cooperation has resulted in the massive phasing out of outdated equipment in the textile industry.

Best technologies can be furthered championed through BAT schemes. BAT seeks to enforce industrial alignment with a set of best practices. It typically involves the training of experts to examine industry compliance to national standards, and can be strengthened by empowering these experts to fine companies failing to align with BATs. An example of water efficiency BAT taken from the European Commission’s Water Policy states: “In order to reduce the usage of water and the generation of waste water, BAT is to reduce the volume and/or pollutant load of waste water streams, to enhance the reuse of waste water within the production process and to recover and reuse raw material”.

(3) Water pricing is an effective tool to limit industrial water consumption. The spirit of water pricing is well summarized by article 7.1 of India’s water policy, stating “Pricing of water should ensure its efficient use and reward conservation”. China, India, Australia, Bhutan and Zimbabwe have integrated pricing in their strategy to reduce water demand (P.R.C 14.1, India 7, Australia 104.2, Bhutan 6.2.3, Zimbabwe 6.14). To target areas where water scarcity is most critical, pricing can be adjusted to water availability. China has developed a tiered pricing system accounting for water availability on a region-by-region basis, making water most expensive where it is rarest (P.R.C V.14).

China’s example also lays bare some of the challenges associated with water pricing. There, the anticipated reduction in water consumption was long weakened by vast geographical disparities in the prices of water and insufficient punishment mechanism. Additionally, the pricing mechanism was blind to the degree of pollution emitted by industries. When indexed to pollution levels, water pricing could nudge industries towards cleaner production processes. In general, water pricing must be implemented cautiously so price does not stand as an obstacle to essential water uses. Stakeholder consultations are essential in developing such fair
valuations (India 7.1).

Another approach is putting in place catchment specific water markets, as done in Australia. Water markets allow users to sell and buy water entitlements based on their needs, thereby offering financial rewards for efficient water use. At the same time, it is important for the water pricing to keep in mind the environmental capacity of the industrial area and be high enough to promote sustainable rate of water withdrawal.

(4) Lastly, optimizing industrial water use requires an accurate assessment of the water footprint of industries. Several countries have recently put in place capacity building measures to allow water auditing and water accounting studies to become widespread (India 6.1, Myanmar 7.a, Botswana 8.1.10, Philippines).

Policy Objective 3: Wastewater management

This section sheds light on policy measures to enhance the management of industrial effluents

Untreated industrial effluents threaten the environment and are a main cause for water pollution. Water policies can limit the potential damage of industrial effluents by using laws (1) and the polluter-pays principle (2) to regulate wastewater disposal, monitoring water quality (3), clustering pollution sources (4), updating knowledge around pollutants and solutions (5), and integrating stakeholders (6).

(1) The first strategy to limit wastewater pollution is to manage effluents to ensure that wastewater does “not reach the groundwater” (India 8.6, Myanmar 9.f, Lao PDR 31). To that end, policies should seek to limit the production of effluents, control wastewater disposal by industries, and encourage wastewater treatment.

(a) “Zero discharge initiatives” encourage companies to decouple pollution with end-of-pipe solutions by introducing concerns for effluents at the value chain level (Myanmar 12.f, Botswana 8.1.13). By setting a policy-blind focus on discharge reduction, such initiatives allow companies to choose their preferred strategy. In practice, because the treatment of hazardous chemical is so expensive, these initiatives often favor comprehensive strategies and new technologies to avoid producing effluents in the first place. To encourage the adoption of zero-discharge initiatives, reward systems can be put in place. For example, zero-discharge plants could benefit from tax credits.

(b) Depending on countries and regions, industries are required to carry out treatment at the source (Pakistan 15.2, India 11.6) or encouraged to treat water wherever is most cost-effective (Australia 66.3).

(c) Alternatively, wastewater can be regulated through discharge permits, which set a limit of acceptable effluent release for specified pollutants (Georgia 84.3). While this system has helped countries like China build strong and unified database, its implementation can be challenging. Its design is indeed made complicated by the complex mix of pollution sources and industrial sector.

(2) Incentives to manage wastewater are often grounded in the polluter-pays principle or indirect interests

(a) Financial deterrents such as pollution levy can lead to the reduction of pollutant emissions and fund the improvement of water quality. They can deter against illegal wastewater disposal. However, to successfully dissuade polluting behaviours, the pollution levy must be high and strictly enforced. China’s attempt to reduce pollution through discharge fees was undermined by setting fees under the cost of treating wastewater, at a level that removed all incentives to treat water in many industries. As a result, the amended Environmental Protection Law in China gives the local environmental protection bureau to not just issue penalties for violations but also suspend, shut down, or detain the polluting facilities. Under Pakistan’s 2017 policy applies the polluter-pays principle to wastewater disposal: “15.2 Industry shall be required to carry out in-house treatment of their waste water before transfer to municipal sewer as per NEQ standards and the “Polluter Pays” principle shall be strictly enforced.


Existing rules shall be strengthened for effective monitoring/control of pollution as per international standards. The standards of effluent disposal shall be strictly enforced.

(b) Positive financial incentives encouraging wastewater management can also effectively reduce effluent release. The Maldives is exploring this option to improve water quality as provision 4.3 of its water policy seeks to “Promote innovative financial mechanisms and models to develop water and sewerage systems (4.3)”. Similarly, India’s water policy points to mechanisms of this kind to reduce financial barriers to wastewater management: “Subsidies and incentives should be implemented to encourage recovery of industrial pollutants and recycling/reuse, which are otherwise capital intensive” (11.7).

(c) Non-financial incentives: It is important to identify incentives that are enforceable. For example, if the possibility of inspection is too low or the fines are too low, firms might find it easier to pollute and pay the fines if their violation is detected. Governments could work with the industrial associations and other apex bodies to seek possible alternatives to financial sanctions. This could include making membership to industrial associations conditional on environmental compliance. Given that membership in associations can be critical to entice foreign buyers, these measures might be a greater incentive for firms to comply with the regulations.

Similarly, Indonesia’s Programme for Pollution Control, Evaluation, and Rating (PROPER) program capitalizes on companies’ concerns for positive public image to enforce policy compliance. PROPER publicly discloses the environmental performance and sustainability profile of companies, with the hope to foster a virtuous competition for policy compliance. Given the proven record of this system in Indonesia, it may be considered for industrial water use. This could take the form of a sectoral water use performance rating system comparing companies on their water efficiency and their pollutant emissions. Industrial water use policy could aim to set up such an industrial environmental performance rating with a focus on water usage and pollution.

(3) In order to ensure effluents standards are enforced, industrial effluent levels should be monitored on a regular, sudden and independent basis. Research from JPAL in the Indian state of Gujarat stresses the importance of independent monitoring. In an experiment they led, ensuring that environmental monitors are randomly assigned to plants, paid from a common pool, monitored for accuracy and paid bonus for accurate reports reduced by 80% the odds of false reporting, which in turn led to a 28% reduction in pollutant emissions.

Remote sensing technologies can complement this process through automated real-time water data. Such technologies have proved highly effective in monitoring water quality in the Gulf of Finland and in the city of Shaoxing in China. In Shaoxing, sensing technologies are monitoring the effluents of 251 enterprises and keeping the owners and the authorities constantly informed of the pollution levels. This has allowed key stakeholders to react immediately to pollution spikes. The Industrial water use policy could set a goal for increasing automation of pollution monitoring in key industrial sectors or at least set an aim to explore and pilot the feasibility of application of such technologies.

(4) A fourth strategy to optimize industrial wastewater treatment and conduct effective monitoring of effluent disposal is to localize water-hungry and polluting industries. This can be achieved by establishing zoning regulations localizing industries on the basis of fresh and safe water availability and effluent discharge possibilities (Bangladesh 4.8.a). Alternatively, water policies can incentivize industries to join cluster systems called “larger industrial estates” or “industrial parks” (China I.1.3, Pakistan 15.3, Botswana 8.1.6, Thailand Strategy 3). Grouping industries through such policies allows driving the costs of infrastructure — including treatment facilities — and utilities down, thereby making it easier to control mass pollution. Eco-industrial and smart industrial parks, also make it easier to share infrastructure and recover waste. Industrial parks have proved effective structures to incubate industrial symbiosis and circular economies.

(5) Fifthly, policies regarding industrial effluents should seek to keep up with the science and
technology, especially to tackle emergent pollutants. One provision of China's Water Ten policy calls for a periodical assessment of environment and health risks of industry facilities and clusters to ensure new chemicals and pollutants are included in the environmental monitoring radar. To expand the scope of control of water policy, the American Environmental Protection Agencies regularly update wastewater discharge standards on an industry-by-industry basis. These technology-based regulations are intended to ensure that greatest pollutant reductions that are economically achievable for an industry is achieved.

(6) Finally, wastewater management can be optimized by adopting a participatory approach. Building on the IWRM principle, several recent policies stress the importance of cooperation and stakeholder integration in implementing successful wastewater treatment. These include intergovernmental participation in China (IX), upstream-downstream relationship in Bhutan (6.2.4) and Pakistan (3.5), and basin-level planning in Pakistan (5).

Cooperation with private actors can also increase wastewater discharge compliance. Overly ambitious effluent standards sometimes stunt private sector buy-in and suppress efforts to comply. In such cases, dialogue to identify acceptable standards

**IV. POLICY IMPLEMENTATION**

Successful water policy implementation demands a fair assessment of risks through assessment and monitoring; and access to sufficient means of implementation.

a) Assessment and monitoring

_This section expresses the importance of assessing and monitoring water quality and water-related projects_

Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development, taking an IWRM lens to consider inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse. Following this process, the potential impact of industrial developments on water is inscribed in industrial development and water policies. India (6.2), China (Qi and Xin Zhou, 2009), Bhutan (6.4.4) and the Maldives have integrated EIA in their water policies. Industrial water use policy can highlight the need for such EIAs to have a special focus on water sector and prescribe the specific requirements in EIAs from water resource perspective.

There should be continuous assessment and monitoring of the implementation of the policy. The policy document should specify which government agency would be responsible for the monitoring and what mechanism will be adopted for the same.

b) Means of implementation

_This section highlights channels to strengthen the implementation of industrial water policies_

Successfully implementing a sustainable water policy requires large and real-time datasets (1), a technological shift (2), sufficient financing (3), capacities for public and private actors (4), cross-sectoral partnerships (5), appropriate institutional arrangements and accountability (6) and increased stakeholder engagement (7).

(1) **Data:** Accurately monitoring and reporting on water flows, needs and capacities, as well as pollution and effluent levels, is essential to inform decision-making regarding water use and wastewater management. While integrating rainfall, climatic and geological data is crucial to comprehensive evidence-based water policy design (Myanmar 15.d), data transparency is the key to responsive policies. Only by keeping the public informed on water quality can countries harness participatory monitoring. Since adopting strict data transparency measures (P.R.C
China has been able to better prevent and address many water incidents. Large, transparent, real-time, GIS-compatible databases are the cornerstones of responsive and comprehensive water policies. Concerns for strong data are often cited in policy texts (India 14, Malaysia 5.3.2.6, Australia 86.1, Niger, Bhutan 6.2.4, Botswana 6.1.4, Mongolia 7). India’s engagement to strong water data is expressed in article 14.1 of its water policy: “All hydrological data, other than those classified on national security consideration, should be in public domain. However, a periodic review for further declassification of data may be carried out. A National Water Informatics Center should be established to collect, collate and process hydrologic data regularly from all over the country, conduct the preliminary processing, and maintain in open and transparent manner on a GIS platform”. The policy document may outline the overall direction in developing and harnessing such data systems to monitor water use (especially ground water) and pollution levels.

(2) **Technology**: Given the technical dimension of efficient water use, the effectiveness of industrial water policies relies partly on the industry’s ability to adopt best processes and technologies. To enable such transition, considerations for access to financing or other incentives for faster technology adoption are often integrated in water policies. Additionally, water policies should seek to maximize the involvement of the science, technology and innovation community to allow related technologies to flourish. Section IV of China’s Water Ten spells out the key role of the sci-tech sector in creating and disseminating new tools for clean and abundant water

(3) **Financing**: Research for and implementation of water policies requires adequate financing mechanisms. These can be direct or indirect. In direct financing schemes, governments directly provide the financial resources to shift to cleaner water use through green financing programs (Malaysia 9.3.2) or green bonds. Indirect financing on the other hand means nudging actors towards economical strategies such as “efficient and economic use of water” (India 6.4) or the “recovery of industrial pollutants and recycling” (Myanmar 12.g). Direct and indirect financing are predicated on close collaboration with the private sector. As exemplified by article 8.4 of the Maldives’ water policy, financing pervades all phases of the industrial water cycle: “Create financing opportunities for water and sewerage research that includes research on desalination, sewage treatment, wastewater reclamation and reuse, tariff setting etc”

(4) **Capacity development**: As emphasized by water policies across the region, designing water resources management, predicting and meeting future challenges such as demographic growth and climate change cannot be achieved without equipping key actors with the appropriate skills and knowledge (Pakistan 29.2, Australia 98, P.R.C VII, Bhutan 7.1.4, Botswana 10.1.11). It is therefore paramount to encourage research and capacity building of public and private sector actors to deal with industrial water use related challenges and policy implementation. Training and measures like the development of guidelines for water sensitive urban planning are instances of existing capacity building measures (Australia 92). Pollution control system is another area where capacity-building, including of local officials, is critical for implementation of policies. (P.R.C 19.3).

(5) **Partnerships**: To harness the potential of partnerships and cooperation, the implementation strategy of water policies often highlights the interlinkages between policy, practice, science and decision making at various levels (Pakistan 29.3, Bhutan 7.1.2). Partnership for water can take the form of **community inclusion** in water planning and use (India 12.3, Niger 3.2.1), with an emphasis on measures like gender mainstreaming (Myanmar 1.5, Bhutan 6.2.5, Burundi 705). Partnership also entails leveraging the potential for collaboration with the private sector and academia (Philippines 8.10, Ethiopia 2.2.3) in the form of Public Private Partnerships to create solutions such as market enablers for rain harvesting systems (Malaysia 6) or incentivize Corporate Social Responsibility schemes. Policies creating public platforms for collaboration between stakeholders can foster partnerships of this kind.
Institutional arrangement and accountability: Policy coherence is a crucial component of implementation. Water policies should therefore be embedded in a larger national planning and institutional framework. This entails establishing appropriate institutional arrangements to implement the policy. This should build on the systems mapping and stakeholder analysis conducted for the policy formulation. Where applicable, this can involve mechanisms to allow state governments to coordinate water management efforts and settle disputes (India 12, Mongolia 11, 12, 13, 14). Assigning clear institutional and organizational accountability, including of government actors at all levels, of private actors, NGOs and CSOs (P.R.C IX, Maldives), is a necessary prerequisite for strong policy enforcement. China’s Water Ten and associated policy reforms specifies the roles and responsibilities played by the main ministries and local officials, by linking performance evaluations to quality of water, and holds them legally accountable for the water in their jurisdictions.

Stakeholder engagement: A commitment to engage effectively with different stakeholders throughout the policy implementation process is important. One important part of this engagement is awareness raising and keeping the public at large informed about the status of the policy implementation and impact. Awareness campaigns to increase public and industry awareness around the implications of future “business as usual” scenario is instrumental in achieving stakeholder buy-in and transform social norms. Countries like Bhutan and the Maldives (7.4.2, 7.1) have implemented such measures to sensitize users on water-use efficiency. Similarly, public awareness can be enhanced by integrating water management considerations in school curricula (Botswana 1.2.12, Burundi 709). Similar efforts can be pioneered by Government in partnership with industrial associations in improving water use efficiency and limiting water pollution from industries. For example, China established a four-level supervision and inspection team spread amongst districts, towns (streets, development zones), villages (communities), and enterprises. Aside from government officials, citizens also participate in this monitoring system, which adds a more publicly and socially engaged monitoring method. Such kind of monitoring approaches that empowers citizen groups can help create transparency and improve accountability for policy implementation. In planning and assessing the stakeholder engagement, the ESCAP-IAP2 planning and assessment tool will be helpful.

c) Cross-cutting Issues

This section should highlight some of the cross-cutting issues that will impact the implementation of the policy and how these can be addressed

(1) Climate Change: The policy document should address the potential impact that climate change will have on water resource availability and occurrence of extreme weather patterns. These changes can have significant impact on Industrial Water availability and measures to climate proof industrial water sources from impact of climate change could be included. Measures to manage industrial waste water as well as sourcing of water should be climate-proofed. To forecast the implication of climate change on water availability, countries like Pakistan have enshrined climate change modelling in their water policies: “To better understand how rainfall patterns will shift, local climate model should be prepared by pooling computing resources for adopting global climate models to local conditions through regional models” (Pakistan 8.1.10).

(2) Urbanisation and increased water stress: Urbanisation and subsequent increases in the water stress will have implications especially on industries located in urban centres. As a result, the policy might want to include measures through which how pressures from urbanisation and industrialisation can be managed effectively while limiting the potential of any risk of conflicts. To diffuse the conflicting water needs arising from increasing urban population and industrial activities, the government of Nigeria has set out to combat "leakages and losses" and reduce “unaccounted for water” (Nigeria 5.3.16).
(3) Gender equality: Inclusive industrial water policies should account for the disproportionate impact of water issues on women. Given the fact that women bear the brunt of the domestic work worldwide, they are more likely to be affected by water pollution and scarcity. Tasks such as laundry and cooking put women at greater risk of direct contact with polluted effluents. Likewise, water scarcity often forces women to travel greater distances to fetch water. Reflecting such concerns for gender equality regarding water, article 6.2.5 of Bhutan’s water policy stipulates: “Participation of both genders in water resources management decisions shall be encouraged. Therefore, water related programs shall take into consideration the important role of women and men with respect to equal sharing of burden and benefits.”

(4) Social inclusion: concerns for social fairness should be hardcoded in the design of any industrial water policy. Indeed, the poor are often ill-equipped to have their rights to clean water respected, making them more vulnerable to scarcity and effluent pollution. For example, the price of water must be set with concerns for social fairness. To ensure pricing does not prohibit essential water usage, some governments offer subsidies to users who cannot otherwise afford water, as in the case of Zimbabwe – where prohibitive water prices are seen as threats to “national interests” (Zimbabwe 6.14).

CONCLUSION

This policy brief provides a framework for countries to develop an industrial water use policy. While this policy framework discusses a wide range of policy tools for reducing industrial water use and pollution, it should be read as guidance and entry points, not as prescription. It builds on specific experiences from China, a regional knowledge exchange and analysis of policy approaches of about 20 countries. However, national contexts are of paramount importance when designing any water policy package and the framework need to be customised adequately grounded on such contexts.
FOOTNOTES


2. Based on desk research of existing national policies available online in English, Bangladesh would be the first country to develop a separate industrial water use policy. ESCAP collaborated with Water Resources Planning Organization (WARPO) of Bangladesh in organizing a multi-stakeholder workshop to initiate the process of development of this policy. See: https://www.unescap.org/events/workshop-industrial-water-use-policy-bangladesh


4. Australia, Bhutan, Botswana, China, European Union, Ethiopia, Georgia, India, Lao PDR, Malaysia, Maldives, Mongolia, Myanmar, Niger, Nigeria, Pakistan, Philippines, Thailand, United States, Vietnam, Zimbabwe


11. https://mpra.ub.uni-muenchen.de/52996/1/MPRA_paper_52996.pdf


As a result, in 2016 alone 22,730 cases in total were reported, with 44 per cent of cases resulting in the seizure of equipment or facilities. Read more here: [https://www.unescap.org/sites/default/files/Tackling%20Industrial%20Water%20Pollution_Policy%20Brief_2019_1.pdf](https://www.unescap.org/sites/default/files/Tackling%20Industrial%20Water%20Pollution_Policy%20Brief_2019_1.pdf)


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