Technical Committee (TEC)

Taking an integrated approach to improving water efficiency

Do you see a pressing need for a realistic evaluation of water-use efficiency options in your country? Are you wondering exactly how your country can fulfill the "water efficiency" part of the WSSD target on the preparation of Integrated Water Resources Management (IWRM) and Water Efficiency Plans and use these to catalyze further improvements? This brief approaches the question of efficiency from an IWRM perspective, aiming to help policy makers and practitioners develop a strategic and integrated approach to improving efficiency. It builds on the discussion of water efficiency in *Catalyzing Change*, the GWP's handbook for developing IWRM and water efficiency strategies, and emphasizes that efforts to improve efficiency should be directly linked to a country's overall development goals.

Improving water efficiency allows countries to reduce water scarcity and maximize the benefits provided by existing water infrastructure. It also frees up water for other uses and reduces environmental degradation. Efforts to improve water efficiency can therefore contribute directly to the development goals of many countries, especially those that are chronically short of water or the capital to invest in water development.

In 2002, the need to improve water efficiency was recognized and given new impetus by the World Summit on Sustainable Development (WSSD). Article 26 of the WSSD Plan of Implementation, which sets an action target for the preparation of "IWRM and water efficiency plans" by 2005, makes reference to water efficiency in two different ways:

- Art. 26 (a): "… introduce measures to improve the *efficiency of water infrastructure* to reduce losses and increase recycling of water"
- Art. 26 (c): "Improve the efficient use of water resources and *promote their allocation* among competing uses in a way that gives priority to the satisfaction of basic human needs and balances the requirements of preserving or restoring ecosystems and their functions, in particular in fragile environments, with human domestic, industrial and agriculture needs, including safeguarding drinking water quality"

Global Water Partnership

As Article 26 highlights, improving efficiency has multiple aspects. It entails finding ways to maximize the value of water use and allocation decisions within and between sectors for sustainable social and economic development. It involves getting the most not only out of scarce water resources but also out of other natural, human and financial resources. And it relates not only to the efficiency with which water is used, but the efficiency with which it is "produced", i.e. the efficiency of the processes that go into providing water when, where and in the appropriate quantity and quality needed for a particular use.

All this emphasizes the need for a multi-faceted approach that considers wider social issues and values as well as physical and technical concerns. Such an approach should be based on four key inter-related concepts: *technical efficiency, productive efficiency, product-choice efficiency* and *allocative efficiency*. All four are useful in different contexts and are best viewed as different parts of an integrated whole.

"Improving water efficiency requires a multi-faceted approach that considers wider social issues and values as well as physical and technical concerns.

Technical efficiency is the production of as much physical output as possible given a particular level of physical inputs. Engineers were probably the first to use this concept, and for them it implies producing something using the smallest amounts of inputs possible, such as materials and energy. The concept of technical efficiency is relevant both to water as an output, when "producing" usable water supplies (through reservoir construction, water transfers, etc.), and to the use of water as an input, in agriculture, industry and households.

When dealing with the use of water as an input, "technical efficiency" is referred to as "water-use efficiency"[1]. Achieving this requires measures such as recycling and reusing water, improving user practices, and ensuring that water infrastructure functions efficiently. Given the high proportion of water used by the agricultural sector in many countries, the gains from improving water-use efficiency are likely to be greatest in that sector.

Though analysis and decision-making to address water-use efficiency can occur at different levels, they usually occur at a rather local level—when considering the efficiency of a particular irrigation system, for example. However, interventions to improve technical efficiency should also be considered in the context of the water basin as a whole, in order to take into account the water recycling and reuse that occurs within hydrological systems.

Productive efficiency is an economic concept which deals with the need to maximize the value of an output in relation to a specific level of inputs. If a given level of output is produced using least cost methods of production, then the enterprise demonstrates productive efficiency. So, productive efficiency is similar to technical efficiency, except that technical efficiency is concerned with physical production in relation to inputs and outputs, while productive efficiency measures inputs and outputs in terms of their value.

Despite the fact that technical and productive efficiency are similar concepts, their policy and planning implications can be very different. For example, using a technical efficiency framework to examine an urban system with 40% unaccounted-for water (UFW) might suggest ever-more effective strategies for reducing UFW such that the maximum number of households could be served given the input of a particular volume of raw water at the system intake. An (economic) productive efficiency framework, however, would lead us to reduce UFW only to the extent that the benefits of doing so (through increased revenue, public health improvements, etc.) exceeded the costs of achieving that reduction.

Productive efficiency, like technical efficiency, is relevant both to the "production" of usable water supplies and to the use of water as an input. Efficiency in the "production" of usable water is important, given the opportunity costs involved in foregone invest-

[1] Efficiency always implies some sort of process, so "water efficiency" refers not to the efficiency of the water as such but the efficiency of transformation of the use of input water to output water.

ments elsewhere in the economy. For example, this might mean making use of natural aquifers rather than building surface storage to store and supply water of appropriate quality when and where it is needed. When water is an input, improving productive efficiency could mean increasing output or producing a higher value output while using the same or a lesser amount of water, for example, "more crop per drop".

Again, analyses and decision-making concerned with productive efficiency in water use are typically carried out at the local level. But, again, a broader view is needed in order to determine whether or not production is actually efficient. This is because when water is used for specific purposes such as irrigation or municipal water supply, only part of it is actually consumed. The rest remains in the hydrological system and is, in most cases, available for reuse or recycling. Importantly, as this water is recycled through the hydrological system, its efficiency of use increases. Thus, while all parts of a system may display low levels of water use efficiency individually, the system as a whole might be operating at a high level of efficiency.[2]

Importantly, efforts to minimize the amount of water used to produce certain goods or services must take into account issues of environmental sustainability and social equity. But doing this is not always easy, because using water-saving options in one location can adversely affect users in other areas. For example, if a change in a production process leads to less water being available for groundwater recharge, groundwater users may find their water supply declining. The whole issue can be made more difficult by the fact that people do not always agree upon what the "output" is, even within a given system. Outputs related to hygiene, sanitation and recreation, for example, are difficult to define and make efficiency hard to assess. So, like inputs, water-related outputs must be considered in social and environmental as well as economic terms.

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Product-choice efficiency means ensuring that goods and services reflect consumers' preferences and their ability or willingness to pay. In market situations, product-choice efficiency tends to assert itself automatically. However, this almost never happens in the water sector. Instead, users generally get the quality of service and the type of water infrastructure that water-sector professionals decide are appropriate. This leads to distortions, such as the provision of a high-quality service to a small number of users. Ways of overcoming this include widening the range of service and technology options available to users and ensuring that they participate in any decision making related to such options.

Allocative efficiency is an economic concept that relates to the distribution of factors of production (i.e. the resources used to produce particular goods and services) and to the distribution of the goods and services produced within an economy. From a water perspective, the concept covers the allocation of the resources needed for the "production" of water products and services (including services to the environment). It also relates to the allocation of the available water resources among competing "uses" such as agriculture, domestic and industrial water supply, and ecosystem use.

In both cases the allocation is "efficient" when the net benefits gained from the use of water (and other resources) in these various ways are maximized. More generally, allocative efficiency is the efficiency with which a country allocates water and related resources to achieve its sustainable development goals. Typically, decision-making and actions related to allocative efficiency occur at the regional or national level.

Allocative efficiency can be achieved through a range of measures that ensure that water is allocated to the highest value uses, as well as through rigorous cost-benefit assessments. Importantly, when we determine what the "highest value uses" actually are, we

[2] See Seckler et al., 2002.

> “…physical improvements are only part of the answer; maximum gains in efficiency are only made when they are combined with better management practices.

must take into account social and environmental as well as economic concerns. Likewise, costs and benefits need to be assessed in social, environmental, and economic terms. Improving allocative efficiency therefore means examining how water can best be allocated and used to achieve, in a balanced way, a multitude of society's goals. For example, if reducing poverty is an important goal, decision makers need to ask which water policy and allocation measures would contribute most to achieving that target.

In sum, therefore, technical, productive, product-choice and allocative efficiency, though distinct concepts (see Box), are significantly inter-related. All require that we recognize the social and environmental—as well as the economic—value of water. Each concept also has a role to play in ensuring that water is produced, used and allocated in ways that strike the best balance—in terms of the goals of economic efficiency, environmental sustainability, and social equity.

Basic Concepts and Terminology

Technical efficiency: The production of as much physical output as possible using a particular level of physical inputs. When water is an input, "technical efficiency" is referred to as "water-use efficiency".

Productive efficiency: An economic concept that involves maximizing the value of the output that can be produced using a given levels of inputs. The concept is therefore similar to the concept of technical efficiency, except that it measures inputs and outputs in terms of their value rather than the amounts physically used and produced.

Product-choice efficiency: Ensuring that goods and services reflect consumer preferences and their ability or willingness to pay.

Allocative efficiency: The allocation of resources needed for the "production" of water products and services, and the allocation of available water resources among competing uses, so as to maximize the net benefits from their use. In the latter case, allocative efficiency means the efficiency with which a country allocates water and related resources to achieve its sustainable development goals.

Practical solutions and approaches to improve water efficiency

In practice, water efficiency can be improved using many approaches, including investing in physical improvements in infrastructure and technology, fostering changes in user behavior, and developing integrated improvements in water management. These three approaches are described briefly below. The IWRM ToolBox[3] provides additional information.

Improving infrastructure

One way of improving water efficiency is by investing in and improving infrastructure. However, any investment made must take into account a variety of factors, including a country's land, labor and capital endowments, and its ability to maintain the infrastructure it is investing in. Importantly, investment costs should never outweigh the benefits obtained—reducing leakage, for example, is only cost-effective up to a point. Plus, it should be remembered that physical improvements are only part of the answer; maximum gains in efficiency are only made when they are combined with better management practices. Options include investing in water loss reduction systems, strengthening regular maintenance programs, matching water supply to demand, encouraging recycling and reuse, and introducing better land-management practices.

[3] See www.gwpforum.org

Reducing losses as a result of leaks and evaporation include options such as lining irrigation canals and fixing leaks in urban water-supply systems. These methods are used to improve "conveyance efficiency" (the proportion of the water delivered into the system that actually reaches end users). Appropriate irrigation technologies and agronomic practices can also be used to improve "application efficiency"—i.e., to ensure that a greater proportion of the water applied to farmers' fields is actually used by the crop.

However, care should always be taken when implementing interventions that aim to improve conveyance or application efficiencies and so prevent water loss. In areas where a significant percentage of the population does not have good access to water, water lost from the system may have unintended but beneficial uses—leaks from irrigation canals, for example, can recharge groundwater reserves and thus increase water availability to groundwater users. And, it is often the poorest segments of the population (those excluded from the original benefits of infrastructure development) that benefit. In these cases, therefore, it is important to examine what would cost less: providing for these beneficial uses directly or allowing inefficiencies in water transfer to continue.

> " Regular maintenance of infrastructure also helps to maintain water efficiency levels and is more cost-effective than rehabilitation.

Regular maintenance of infrastructure also helps to maintain water efficiency levels and is more cost-effective than rehabilitation. The best ways of ensuring that structures don't fall into disrepair (which results in plummeting water efficiency levels) is to get the users involved in their management and to set water user fees which are high enough to cover the cost of operation and maintenance. It does no good to develop a lot of new water infrastructure if it is not going to be maintained.

Enabling water users and managers to better match supply to demand is critically important when working to ensure that the type and quality of service provided fits the needs of users and their willingness and ability to pay (product-choice efficiency). In irrigation systems, giving the user more control over when and how much water is applied to his or her fields can mean huge gains in yield, which is why groundwater irrigation is typically two to three times more productive than canal-based irrigation.

One option is the use of highly-responsive surface-irrigation systems, which have been made possible by advances in computer technology. However, many lower-cost alternatives are also available, such as the conjunctive use of groundwater and surface water—which involves engineering and management considerations. In the water supply and sanitation sectors, users can be given more control over the service and technology options available to them by ensuring that they participate in decision-making processes and by widening the range of service and technology options available. This can substantially reduce costs.

Efforts to encourage recycling and reuse need to take into account that recycling and reuse already occur to some degree in all hydrological systems. Decision makers should also be aware that, when water becomes scarce due to growing competition or to drought, many users build their own small-scale recycling and reuse structures, by digging ditches to direct household wastewater to backyard gardens for example. Recycling and reuse can be encouraged on a larger scale by separating runoff drainage water from household and municipal wastewater and providing low-cost treatment options. In this way, "grey" and "black" water flows can be used appropriately to provide water for uses that would otherwise compete for freshwater supplies (e.g., irrigation of agricultural fields and public gardens).

Better land-management practices can be used to reduce the rate at which siltation reduces water storage in downstream infrastructure (a storage loss of 1% per year on average). So, for example, farmers can be encouraged to adopt erosion-control practices and to reduce their use of slash-and-burn agriculture by providing them with incentives. Other ways forward include the conservation of upstream forests, the promotion of sustainable forestry (not clear cutting), and the introduction of land-use regulations.

Impacting user behavior

Economic, social change and regulatory instruments can be used to encourage domestic, industrial and agricultural users to use water more efficiently. In many cases, the best approach is to use all three lines of attack at once.

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Economic instruments include the full range of direct and indirect economic incentives (and disincentives) to improve efficiency. Examples include water-pricing systems, water markets, taxes, tariffs, subsidies, and access to markets for goods. However, for economic instruments to be applied successfully, effective administrative, monitoring and enforcement capacities must be in place.

Charging for water can be used to affect people's behavior and so promote conservation and efficient water usage. It can also be used to ensure cost recovery and to measure consumers' willingness to pay for additional investments in water services.[4] Many experts have strongly advocated full-cost water pricing as the only way to ensure sustainable use of the resource. However, while full-cost pricing may be a good long-term aim from the point of view of economic efficiency and environmental sustainability, any efforts to implement it need to be accompanied by measures to ensure that the poor can afford water—especially that required for domestic uses. So, tariff and fee structures must balance the need to encourage efficient water use with the need to ensure that low-income households can afford basic levels of supply.

Water markets improve efficiency by creating incentives for farmers and/or industries to save water and sell off their rights to the portions they do not use. Water markets require well-defined, tradable and enforceable water rights; a strong regulatory framework; and the infrastructure necessary to transfer water from one user to another. They tend to function well in water-scarce basins where large-scale users are engaged in high-value activities. California, for example, successfully established water markets that enabled farmers to sell units of water they did not use to cities during drought years. The farmers improved their water efficiency; the cities got the water they needed. But many countries lack the preconditions necessary for successful water markets.

Taxes can be applied directly to water used by volume, and could also potentially be applied to products involving highly water consumptive or water polluting processes (in which case they can be viewed as a charge that passes the environmental costs on to the consumer in the absence of detailed knowledge on which to base pollution charges). They could also potentially be used to reduce agricultural water pollution, thereby improving efficiency, by increasing the prices of fertilizers and pesticides; in these cases, they can be viewed as a charge for services not taken into account when the market establishes prices for such inputs. However, all of these options need to be considered carefully in relationship to the larger economy.

Subsidies to domestic and agriculture water supply, while commonplace, often do not benefit those most in need. However, given that water use has a public good nature and

[4] TEC Background Paper 4, Integrated Water Resources Management

that externalities are pervasive, removing subsidies may not always be appropriate. In particular, getting rid of subsidies altogether may not be in the interest of poverty reduction. Cross-subsidies, where better-off users in effect pay for poorer ones, can help in bringing affordable domestic water supply to the unserved poor but can distort prices; direct subsidies better communicate water's value to users and managers but may be more difficult to implement. In all cases, subsidies should be carefully targeted, transparent, and regularly re-evaluated.

Social change instruments aim to teach individuals and organizations how to change their behavior and stop wasting water. Water-efficient public behavior can be promoted through such instruments as public information campaigns to inculcate a shared vision of a prosperous and environmentally sustainable future. Such campaigns are especially effective during water shortages. Another powerful way to reach a public audience is the formal education system, which can promote efficient water use with improved teaching materials, teacher training, experiential models and hands-on projects.

A different set of social-change instruments may be needed to change the behavior of public institutions, industry, and the private sector. Water-efficient companies, for example, could be rewarded with "water efficiency" labeling or with positive press for improved water efficiency. Water consumption information (for example comparing domestic to industrial water use) could be widely disseminated. Generally, such strategies are undertaken by government-overseen water management agencies, but they also could be successfully pursued by NGOs or local citizens' groups.

Social-change instruments should work in tandem with economic and regulatory instruments. While these latter interventions may appear more likely to yield immediate impact on water efficiency, when the public grasps the need for saving water it is more likely to accept other interventions. In the short-term, social-change instruments increase the likelihood that other changes will succeed. In the long-term, social-change instruments can build a more water-aware, and therefore more water-efficient, society.

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Regulatory instruments work by directly imposing rules and limits governing water use—unlike economic instruments, which attempt to influence user behaviour indirectly by creating an economic environment in which improving efficiency is in the economic interests of the user. For regulatory instruments to be effective, countries need an appropriate legislative framework and the technical, financial and administrative capacity to enforce regulations.

Standards, limits and guidelines can be used to control the quantity of water withdrawn by users from natural water systems over set time periods. They can also be used to control the quantity, quality, timing and location of discharges into watercourses and to specify that particular technologies should be used to reduce water use or waste loads. Product standards are another example, and can be applied both to water provided for specific uses and to the goods produced (e.g. water efficiency standards).

Standards and other direct regulations can be inflexible, costly to implement and prone to imperfect implementation and evasion, and can also fail to allow users the freedom to employ a range of techniques to conserve water or reduce waste disposal. These defects have been one reason why the use of regulations in combination with market tools and information is being increasingly advocated. But there are many areas where market tools cannot do the job; in these cases, regulatory instruments can help avoid the inefficiencies that occur when individuals are allowed to neglect the external costs of their decisions.

Exploiting opportunities offered by a more integrated approach to management

While sectoral approaches are important, they may result in missing out on some of the most promising opportunities to improve water efficiency—such as improving water productivity in rainfed areas, managing surface and ground water conjunctively, and managing water supplies for multiple uses.

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Improving water productivity in rainfed areas is important given that, while some 2,500km^3 of water is diverted annually for irrigation around the world, some 16,000km^3 is used in rainfed agriculture. Making the use of this water more efficient can reduce the need for new irrigation infrastructure and contribute to the livelihoods and food security of some of the world's poorest people. Improving productivity includes adding more water at critical junctures, in the form of supplemental irrigation, to mitigate the effects of short-term drought.

Conjunctive management of ground and surface water builds on the fact that groundwater systems are two to three times more productive than canal systems on average. In areas where canal systems are underlain by good quality aquifers, there is enormous potential to improve efficiency through managing surface and groundwater together. In Uttar Pradesh, the irrigation agency turned a large unlined irrigation scheme into a massive groundwater recharge scheme. As a result dangerously declining groundwater levels have been reversed, farmers now have enough water for two cropping seasons, and yields and incomes have both increased. Research in India and Pakistan has shown how by taking into consideration groundwater quality in irrigation management, the equity and productivity of schemes can be increased.[5]

Managing water for multiple uses is important because in many countries, people use domestic water supplies for activities such as irrigating home gardens, keeping livestock, fishing, processing crops and running small-scale enterprises. In areas without adequate domestic water supply, they use irrigation water to meet household needs, such as drinking and bathing, as well as to support a range of income-generating activities in addition to crop production. A more integrated, multiple-use approach can therefore maximize the benefits of available water supplies. Such an approach involves assessing the range of water needs in collaboration with end users, examining the water sources available, and matching water supplies to needs based on the quantity, quality and reliability required for various purposes.[6]

[5] See GWP-International Water Management Institute [IWMI] Water Policy Briefing: "Reducing poverty through integrated management of groundwater and surface water", 2006. www.iwmi.org/waterpolicybriefing.

[6] See GWP-IWMI Water Policy Briefing: "Taking a multiple-use approach to meeting the water needs of poor communities brings multiple benefits", 2006.

Pursuing efficiency in the preparation of IWRM strategies and plans

The WSSD Plan of Implementation, which calls for countries to prepare national "IWRM and water efficiency plans" provides an opportunity for countries to take a coherent and strategic approach to improving water efficiency in ways that advance their sustainable development goals. While there is no one blueprint on how to define and choose the most efficient use of water in a society, a strategic approach to improving water efficiency would involve at least four sets of actions:

- developing the information required to make strategic choices;
- improving allocative efficiency at national and regional levels;
- improving technical/productive/product-choice efficiency at local levels;
- linking local to regional and national plans.

Preparing plans to improve allocative and technical efficiency requires *information and assessment*. Developing an effective knowledge base should therefore be a fundamental part of a strategy or plan to move towards more efficient approaches. This entails pulling together the knowledge needed to identify key efficiency challenges and set a baseline for monitoring progress and impacts, and developing systems to feed knowledge into the decision-making process on an on-going basis.[7]

An important first step in improving water-use efficiency is determining where and how water is currently being "spent". Water accounting[8] provides a conceptual framework for envisioning water use in a basin, sub-basin or smaller hydrological system and identifying areas to target for improved efficiency. It looks at how much water is flowing in, how much is flowing out, and how much is being consumed by various processes within the area under scrutiny. It distinguishes between beneficial and non-beneficial depletion—a value judgement that must be determined with stakeholders, taking into account that water can be depleted by evaporation, flows to seas (or other locations where it is not economically recoverable for use), pollution, and incorporation into a product through industrial or agricultural processes. It is useful for getting an overview of water users in a basin, conceptualizing water allocation in the context of multiple uses of water, identifying opportunities to improve water efficiency by reducing non-beneficial depletion and harnessing utilizable outflows, and providing a good base for stakeholder consultations and dialogue across disciplinary lines. It does not provide tools for more exact analysis of the relative value of beneficial uses, nor does it address water quality issues in any detail.

"In developing plans to improve allocative efficiency, there must be close interaction between water professionals and national and local decision-makers.

Improving allocative efficiency at national and regional levels requires the careful consideration of the range of measures discussed in earlier sections, which should generally be addressed in a comprehensive IWRM strategy or plan.

In countries that are chronically water short, a strategic approach to improving allocative efficiency might consider the allocation of water to uses that can generate foreign exchange with which to gain access to "virtual water"—i.e., the water that is embedded in food or other products that need water for their production.[9] Instead of allocating capital and water resources to produce something that can be more efficiently produced elsewhere, trade in virtual water allows water scarce countries to import food and/or other high water consuming products, while exporting low water consuming products and in this way making water available for other purposes.

In developing plans to improve allocative efficiency, there must be close interaction between water professionals and national and local decision-makers. The involvement of

[7] See section on "Creating a knowledge base", *Catalyzing Change*, pp. 29-31.

[8] "Water Accounting for Integrated Water Resources Management", IWMI, 2001.

[9] See "As thick as blood. Water in the Middle East," *The Economist*, December 23, 1995

stakeholders and close communication with affected parties is crucial. It is especially important to understand national and local policies on such matters as food self-sufficiency, rural employment, the legal framework, and the effectiveness of institutions for enforcing laws and managing water resource systems.

“National and regional efforts to improve allocative efficiency and local efforts to improve technical/productive/product-choice efficiency need to be mutually reinforcing.

Improving technical/productive/product-choice efficiency at local levels can help reduce wasteful use of the resource, which represents an opportunity lost as well as the use of water for little economic or social gain. National water efficiency plans should include consideration of how to use available water resources efficiently to help maximize the productivity of other natural, human and capital resources. For example, a country may conclude that maximizing the technical water use efficiency of an irrigation system requires substitution of local technology with expensive imported technology, which could put a strain on foreign exchange and harm local employment. Such a country could explicitly accept a lower level of irrigation efficiency in its overall strategy.

National water efficiency plans should also dwell on the role of national governments in providing incentives for research and development of technically efficient devices, as well as for their promotion and distribution. Prices matter here, since if markets for technically efficient devices are distorted through subsidies or externalities, they will not reflect society's true values and may hinder user adoption.

Clearly, national and regional efforts to improve allocative efficiency and local efforts to improve technical/productive/product-choice efficiency need to be mutually reinforcing. Indeed, moving towards greater efficiency in the use and allocation of water will require coordination of work at many levels. While a strategic approach to improving water efficiency will generally emphasize national action, the end result should be action at lower levels, from the household and community levels on up.[10] In accordance with the Dublin Principles, decisions should always be taken at the lowest appropriate level.

National policies need to provide the appropriate enabling environment for initiatives at other levels. Allocation frameworks should be developed at the national level, leaving the details to be worked out with stakeholder input at lower levels. This is the plan in South Africa, where guidelines will be set at national level while catchment agencies will work out the details. All this highlights the importance of integrating vertically as well as horizontally.

[10] Fourth World Water Forum, "Integrated Water Resources Management: Strengthening Local Action", Thematic Document, Framework Theme 2, Mexico City, March 2006

Key lessons

Taking an IWRM approach to water efficiency requires an integrated set of measures to improve efficiency that are selected strategically in terms of a country's overall development goals. Here are eight lessons for policy makers and practitioners charged with evaluating options and preparing strategies to start moving towards more water efficient solutions:

- Link your water efficiency strategy to your country's sustainable development goals.
- Consider interactions between scales and the prevalence of water recycling and reuse, especially in irrigated agriculture and within water basins.
- Look at opportunities to improve water efficiency that lie outside the water sector, such as land management.
- Take into account social and political realities that may make some options infeasible without taking other steps first.
- Capture the full benefits of improved water productivity at local levels by integrating these with system- and basin-level changes.
- Consider unintended but beneficial uses of water, taking into account that it is the poor who are impacted most by such "externalities".
- Invest in good data collection and management and communication with stakeholders.
- Consider "non-traditional" opportunities to improve efficiency such as conjunctive use of groundwater and surface water or increasing the safe use of wastewater.

Printed by: Columbia University Print Services Production: Red Shift

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This brief was prepared under the direction of the GWP Technical Committee. It draws extensively on various papers and notes prepared at the request of the Technical Committee by Leanne Burney, Sarah Carriger, Jennifer Davis, Henrik Larsen, Peter Rogers and David Seckler; verbal and written comments by Hartmut Bruehl and Judith Rees; and the documents listed in the box on "Information resources".

About the Catalyzing Change Series

The brief is part of a series of policy and technical briefs designed to help countries accelerate their efforts to achieve the action target for the preparation of IWRM and water efficiency strategies and plans set by the 2002 World Summit on Sustainable Development (WSSD) and reinforced by the 2005 World Summit. The series tackles key issues and potential stumbling blocks and attempts to give countries at the beginning of the process the benefit of lessons learned from those further down the path.

The series complements *Catalyzing Change: A Handbook for Developing Integrated Water Resources Management (IWRM) and Water Efficiency Strategies*. The handbook and all associated briefs can be downloaded from www.gwpforum.org or hard copies can be requested from gwp@gwpforum.org.

The briefs in this series are intended to be dynamic rather than static documents. We will continue to update and improve them based on your input. Please send comments and questions to Christie Walkuski at walkuski@iri.columbia.edu.