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POTENTIAL

improving water
management
in Tajikistan



NATIONAL HUMAN
DEVELOPMENT
REPORT 2003



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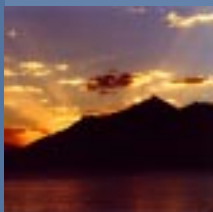




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Foreword

Water is central to human life. We depend on plentiful and sustainable access to it for a wide range of basic human activities, from drinking and cooking to washing, farming and, in Tajikistan, generating electricity. Few other resources occupy so important a place in the table of human needs. And yet water is also dependent on us for its safekeeping and preservation: Central Asia bears witness more graphically than most other regions of the world to the consequences of poor stewardship of this fundamental resource. The relationship between water, its users and the environment is, in short, an intimate one and a fragile one, offering real benefits if prudently and sustainably managed.

For these reasons, water is an exciting theme for any discussion on human development. As this year's National Human Development Report will demonstrate, the linkages between water and basic human imperatives are great and many: reducing poverty, hunger and disease, and advancing education, health and environmental sustainability – all of these are profoundly affected by water and water management, where improvement promises substantial and tangible changes in the quality of life for all of Tajikistan's people.

This is also a timely report as water is currently the focus of much global attention. In 2000, the General Assembly of the United Nations adopted the Millennium Declaration, in which world leaders resolved, inter alia, 'to halve, by the year 2015, the proportion of the world's people who are unable to reach, or to afford, safe drinking water,' and 'to stop the unsustainable exploitation of water resources.' Water resources also featured prominently at the World Summit on Sustainable Development in Johannesburg in 2002. The Plan of Implementation adopted there reiterated the

Millennium Development Goal, set a new target of halving the proportion of people who do not have access to basic sanitation by 2015, and recognised the key role of water in combating poverty, and in the realms of agriculture, energy, health, biodiversity and ecosystems.

This report takes a lead from these global goals and aspirations, recognising the imperative need they express for refocusing the debate on people and human lives. But this report also aims to go beyond the targets, to address some of the issues that are currently hampering development. In anticipation of a healthy public debate, the report aims to ask probing questions about water in Tajikistan. Of particular interest will be the *constraints* currently facing the water sector, as well as the issues of cotton and hydropower – two of Tajikistan's richest opportunities for the future, and two areas where wise water policy will play a key role.

To reaffirm the importance of the International Year of Fresh Water, the Government of Tajikistan, being the originator of the resolution of the UN General Assembly in its 55th Session, is organising an international conference in Dushanbe - the Dushanbe International Fresh Water Forum - from 29 August to 1 September 2003. Envisaged as an accompaniment to the Forum, this year's NHDR is the product of over a year's consultation and collaboration between government, civil society and the international community. While by no means exhaustive, I am confident that its findings and analyses will represent a valuable contribution to the public debate, enhancing policy formation and decision-making in the country. I recommend this publication to the widest possible audience.



Matthew Kahane
UNDP Resident Representative in Tajikistan

Prologue

The modern world is going through an epoch of globalization encompassing practically every sphere of public and human activity. Today the impacts of globalization manifest themselves far and wide – in the economy, in politics, and in the environmental and social spheres. However these impacts are not always clear cut. In some cases the impact is positive, while in others they have an adverse effect on economic development, on raising living standards, or on the environmental balance. In other words, the advance of globalization in its present form is not always beneficial. Its advantages are particularly doubtful in resolving socio-economic and environmental problems in an overwhelming majority of under-developed countries. It is due to the intensification of globalization that the world faces the problem of a constantly expanding gap between rich and poor countries, with the populations of the latter plunging deeper and deeper into poverty. One factor characterizing the extent of poverty amongst peoples and nations is “water stress”, prevalent in most under-developed countries today.

As the UN Deputy Secretary General Ms. Louise Frechette pointed out at the official opening ceremony of the International Year of Freshwater (2003) in New York in December 2002, “water is a fundamental need, both for people and economies. It is a key resource for producing food, improving living standards and ensuring economic growth. Water is also an essential source for the functioning of all ecosystems on Earth.”

Unfortunately many parts of the world already suffer from shortages of water: approximately a sixth of the world’s population does not have access to clean drinking water, while a third has no access to water for household needs. If the current disturbing trends continue, two out of every three people on the planet will be living in countries affected by the water stress. Global climatic changes can further aggravate the problem.

On this basis, we can realistically assert that it will be

impossible to ensure the sustainable development of society without meeting the target, outlined in the Millennium Declaration of September 2000 in New York and confirmed in the final documents of the World Summit on Sustainable Development held in Johannesburg in September 2002, of halving, by 2015, the number of people without access to clean drinking water and adequate sanitation.

We should never forget that shortage of water entails numerous ethical problems. Access to water should be recognized as one of the principal human rights. In any discussion on the privatization of water we should bear in mind that water is a common good belonging to all mankind.

Establishment fair and rational systems of management in water resources means increasing access to water and sanitation for all, as well as reducing the threat of water-related conflicts. It is no secret that at present water very often becomes the cause of political tension in relations between different countries. One of the key goals of the international community in the sphere of water resource management should be conflict prevention. This can only be achieved on the basis of respect for the sovereignty of neighbouring states, and in considering countries’ specific historical, cultural and economic conditions.

Confronting the range of challenges related to water resources and mobilising the political will of all UN member states in resolving these problems is the main goal of the International Year of Freshwater (2003), declared at the UN General Assembly on the initiative of the Republic of Tajikistan.

While possessing the largest water resources in Central Asia, the Republic of Tajikistan has been experiencing difficulties in supplying fresh water to the population in recent years. Here we are not thinking of water shortages as such, but of water’s poor sanitary condition and the long forgotten diseases that this often

brings with it, such as typhoid and hepatitis. Another aspect of the problem is the need to ensure careful use and conservation of water, both in private life and amongst commercial enterprises and organizations.

Currently it is of utmost importance for Tajikistan to create an effective water conservation system by reconstructing existing irrigation networks and canals, using new technologies that can minimize water losses, especially in relation to irrigation of agricultural lands.

We also consider essential the development of a set of measures aimed at protecting water basins from toxic and other wastes disposed by industrial and agricultural enterprises. Naturally in this instance we are simply stating the existing problems. Solving them in the long run will depend on identifying financial resources that are not currently available in the

Republic of Tajikistan. At the same time it should be emphasized that the problem of water use is really a regional one, affecting equally the interests of all Central Asian states. If we take into account the present situation in the Aral Sea Basin, the problem of water use takes on, to a certain extent, a global nature, where solving problems will require participation from international financial institutions as well as investments from the developed countries.

The International Year of Freshwater provides an excellent opportunity for the full implementation of all decisions relating to water and adopted recently at the major UN forums. These will facilitate greater focus on developing effective strategies at all levels (global, regional, subregional and national) for the long term preservation of existing reserves of good quality potable water on the planet, and for their subsequent rational use in the future.



Talbak Nazarov
Minister of Foreign Affairs
Republic of Tajikistan

improving water management in Tajikistan



The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations or UNDP concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries.

Source: UNCT

Tajikistan Factfile

Table A.1: Key data on human development in Tajikistan, 2002

Indicator	Unit
Territory	143,100 km ²
Population density	45.5 people per km ²
Total population	6.506 million
Female	49.9%
Male	50.1%
Urban	1.720 million
Rural	4.787 million
Capital	Dushanbe
Independence Day	9 September 1991
HDI ranking	113 of 175*
HDI (2001)	0.677*
GDP per capita	\$187.90
Life expectancy (2001)	68.3 years*
Education enrolment at all levels (% age 6-23)	58.4 %
Currency	Tajik Somoni (TJS)
Exchange rate, 2002 average (TJS:US\$)	2.76
Share of public budget spent on:	
Health	5.7%
Education	16%
Social protection	13.2%
Exports as % of GDP	66.7%
Economic growth	9.1%
CPI	14.5%
Budget surplus (% of GDP)	0.8%
Consumption basket (01.2002)	TJS 25.62
Average salary	TJS 32.55
Minimal pension	TJS 5
Share of labour force employed in state sector (2001)	28.4%
Share of labour force employed in private sector (2001)	40.7%
Official unemployment rate	2.5%
PRSP estimated unemployment rate	33%
Farms registered	15,463
Number of general schools (grades 1-11)	3684
Number of people per doctor	497
Number of nurses per doctor	1.6
MMR per 100,000 live births	50.6
IMR per 1,000 live births (2000)	36.7**
Fertility rate (2000)	3.9

Sources: State Statistical Committee, *UNDP,

**89 in 2000 MICS

Table A.2: Population by region, 2002

Region	Area ('000 sq km)	Population	Urban	Rural	Density (people/sq km)	
GBAO	64.2	213,200	28,300	184,900	3.3	
Khatlon Oblast	24.8	2,293,000	394,400	1,898,600	92.5	Source:
Sughd Oblast	25.4	1,962,400	509,900	1,452,500	77.3	State
DRD	28.6	1,433,900	183,300	1,250,600	50.1	Statistical
Dushanbe	0.1	604,000	604,000	-	6,040.0	Committee
Tajikistan	143.1	6,506,500	1,719,900	4,786,600	45.5	

Acronyms

AAH	Action Against Hunger	KT	Kurgan Tube
ACTED	Agency for Technical Cooperation and Development	MDGs	Millennium Development Goals
ADB	Asian Development Bank	MICR	Multipal Indicator Cluster Survey, UNICEF
AIDS	Acquired Immuno-Deficiency Syndrome	MIWR	Ministry of Irrigation and Water Resources
AKDN	Aga Khan Development Network	MMR	Infant Mortality Rate
AKF	Aga Khan Foundation	MOE	Ministry of Environment
AKFED	Aga Khan Fund for Economic Development	NCE	National Cotton Exchange
AKHP	Aga Khan Humanities Programme	NGO	Non-Governmental Organisation
CAR	Central Asian Republics	O&M	Operations and Maintenance
CIS	Commonwealth of Independent States	OCHA	UN Office for the Coordination of Humanitarian Affairs
CPI	Consumer Price Index	OSI	Open Society Institute
CSFB	Credit Suisse First Boston	PRSP	Poverty Reduction Strategy Paper, 2002
DVK	Dushanbevodokanal (Dushanbe Water Authority)	RRDP	UNDP Reconstruction, Rehabilitation and Development Programme
DRD	Direct Rule Districts, Tajikistan	RT	Republic of Tajikistan
EEC	Eastern European Countries	SCF-UK	Save the Children Fund UK
ESCAP	UN Economic and Social Commission for Asia and the Pacific	SCO	Swiss Cooperation Office
FAO	UN Food and Agriculture Organisation	SES	Sanitary Epidemiological Station
GAA	German Agro Action	SPECA	UN Special Programme for the Economies of Central Asia
GBAO	Gorno-Badakhshan Autonomous Oblast	TJS	Tajik Somoni (= 100 dirams)
GDP	Gross Domestic Product	TMA	Tajik Municipal Authority (formerly Tajikcommunservice, urban water authority)
GNI	Gross National Income	TSK	Tajikselkhozvodoprovodstroy (rural water authority)
GoT	Government of the Republic of Tajikistan	TWh	Terawatt Hour
GWh	Gigawatt-Hour	UK	United Kingdom
HDI	Human Development Index	UN	United Nations
HIV	Human Immuno-Deficiency Virus	UNAIDS	Joint UN Programme on HIV/AIDS
I&D	Irrigation and Drainage	UNCT	UN Country Team
ICG	International Crisis Group	UNDP	UN Development Programme
ICT	Information and Communications Technology	UNEP	UN Environment Programme
ICWC	Interstate Commission for Water Coordination	UNESCO	UN Educational, Scientific and Cultural Organisation
IDA	International Development Association	UNFPA	UN Population Fund
IEA	International Energy Agency	UNICEF	UN Children's Fund
IFAS	International Fund for Saving the Aral Sea	UNECE	UN Economic Commission for Europe
IFIs	International Financial Institutions	UNIFEM	UN Development Fund for Women
IHA	International Hydropower Association	UNTOP	UN Tajikistan Office of Peace Building
IMF	International Monetary Fund	WB	World Bank
IMR	Infant Mortality Rate	WEHAB	Water (and Sanitation), Energy, Health, Agriculture and Biodiversity
INGO	International Non-Governmental Organisation	WFP	UN World Food Programme
IN-SHP	International Network on Small Hydro Power	WHO	UN World Health Organisation
IWMI	International Water Management Institute	WRI	World Resources Institute
ktoe	Thousand tons of oil equivalent		
KWh	Kilowatt hour		

\$ indicates the United States Dollar in all instances

Table B. I. Conversion table for energy units

	Watt hour	KWh	MWh	GWh	TWh
1 kWh =	1,000	1			
1 MWh =	1,000,000	1,000	1		
1 GWh =	1,000,000,000	1,000,000	1,000	1	
1 TWh =	1,000,000,000,000	1,000,000,000	1,000,000	1,000	1

Executive Summary

Improving water management in Tajikistan is central to advancing development in the country. Water affects almost all spheres of life, from drinking and sanitation to agriculture, energy, industry and the environment. Integrated and sustainable planning in these areas promises great improvements in living standards and domestic incomes for all people in Tajikistan.

Promoting dialogue

Recognising the imperative need for improved water management in the country and the huge potential gains this can offer, this report aims first and foremost to promote the dialogue around issues of water management in Tajikistan. It poses more questions than answers, acknowledging that the detailed assessments and plans that will be necessary for future implementation are beyond the scope of this enquiry. Instead the report asks searching questions about the role of water in Tajikistan, focusing throughout on the impacts and benefits for individuals themselves.

Refocusing on the people

In a post-Soviet environment now in transition to the market economy it is essential to maintain sharp focus on the individual, and on the extent to which all people actually benefit from reform and development. While vast irrigation schemes and hydropower projects once served broader Soviet goals, today's swing to the market economy risks serving narrowly economic ones. Both models have delivered a range of benefits to individuals - high electricity coverage from the Soviet period for instance, and a more dynamic economy today, yet neither has managed to effect the kind of sustainable progress - social, economic and environmental - that Tajikistan needs for a bright future. Reform and increased funding in the water sector are fundamental to making this change: no other sector or service affects so many aspects of national life, and few have as great a potential for effecting real change as water.

Central Asia's water store: Tajikistan's water resources hold huge potential for advancing development in the country

Photo: Pamir Photoalbum, Planeta



Part I: The Potential

The first part of the report assesses the potential of Tajikistan's water resources for advancing development in the country. It considers the impact of improved water management on a range of basic human imperatives: reducing poverty, hunger, and child and maternal mortality, tackling major diseases, and promoting education, gender equality and environmental sustainability. The Millennium Development Goals (MDGs) provide the framework for this assessment, and demonstrate both the wide-ranging impact of water on national life, and the enormous gains to be made in terms of welfare outcomes.

IMPROVING WATER MANAGEMENT CAN IMPACT A WIDE VARIETY OF BASIC HUMAN IMPERATIVES: FROM REDUCING HUNGER AND POVERTY TO ADVANCING EDUCATION AND ENVIRONMENTAL SUSTAINABILITY

The following chapter then considers the vast water resources at Tajikistan's disposal to meet these challenges. While stressing the need for continued regional cooperation in water resource management, Chapter 2 argues for renewed focus on national concerns, on the premise that many of Tajikistan's water challenges can and must be addressed locally.

Part II: Constraints and Impacts

The second part of the report asks the questions: what are the constraints currently facing the water sector, and how are they impacting on the population? Lack of funds, institutional weakness and wasteful consumption

are examined as the main factors hampering progress. Higher and sustained levels of funding for the long-term will be required if significant advances are to be seen in service provision: in water supply and sanitation, spending at the two main water authorities is less than \$0.40 per person per year; meanwhile irrigation and drainage (I&D) systems - the economic lifeblood for 65% of the national workforce - are struggling to remain operational with current spending at less than 10% of 1991 levels. Staff shortages and training gaps in the institutions responsible for water management present further challenges, while excessive consumption rates - in some areas more than ten times Western European levels - will have to change if increased funding or better management are to bring about any serious improvements.

CURRENT CONSTRAINTS: LACK OF FUNDS, INSTITUTIONAL WEAKNESS AND WASTEFUL CONSUMPTION BEHAVIOUR

Continuing the MDG theme from Part I, Part II next considers the impacts of poor water management on Tajikistan today. With just 57% of the population served by piped water, the impacts can be disturbing: nearly 25% of the population takes its water from pools and irrigation canals. With no treatment and a high risk of contamination from improperly disposed sewage or fertilizers, a large part of the population is susceptible to disease: Tajikistan has the highest child mortality rate in the CAR region, at 78 and 93 cases per 1,000 females and males respectively¹. With one UNICEF survey finding 45% of schools had unsafe water supplies, the impacts on non-attendance and drop-out rates are also assessed. In hydropower, insufficient funds and expertise for proper maintenance mean that systems are running at 60-70% efficiency, instead of 90% under normal operating conditions. In irrigation and drainage, on which 80% of the agricultural product depends, the World Bank reports an 18% decrease in the irrigated land area since 1991 as degraded systems fall out of use.*

Part III: Cotton - maximizing water benefits through improved management

Continuing the agricultural theme, Part III examines

Tajikistan's cotton industry. Employing a third of all agricultural workers (over 20% of the national workforce) and representing the country's third largest export, cotton is part of the fabric of life in Tajikistan. Part III therefore asks the question: with the cotton sector operating under the current structures, do farmers receive maximum benefits from Tajikistan's natural competitive advantages of plenty of water and sun? This section reveals a worrying trend of spiralling debt, half-hearted attempts at farm privatisation, and continuing pressure to plant cotton over other crops.

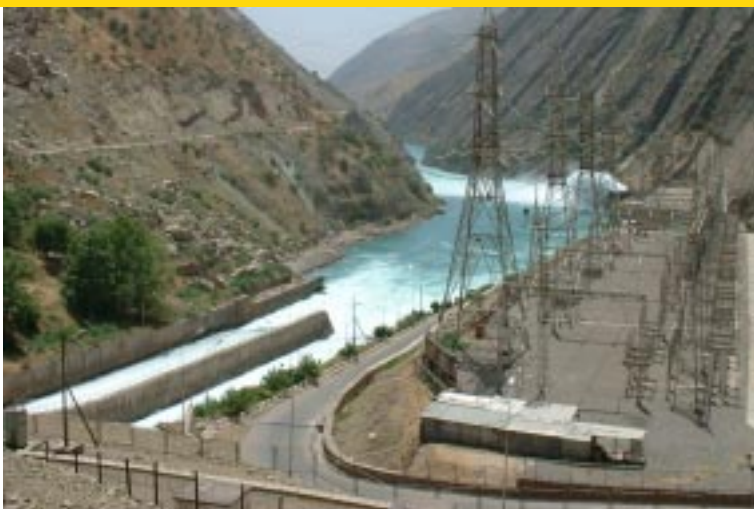
A REFORMED COTTON SECTOR COULD BE A POWERFUL TOOL FOR POVERTY ALLEVIATION

However, mindful of cotton's high export value and corresponding potential for poverty alleviation, this section does not advocate a move away from cotton. Instead it argues for further liberalisation, better market information for farmers, and greater competition amongst cotton ginneries. Unless rural incomes can be increased this way, farmers would be better off redressing the nation's persisting food deficit by switching to grain and vegetable crops. Management at all levels is faced with tough questions for the equitable development of this important agricultural subsector.

Part IV: Hydropower - meeting needs, and addressing issues of effective demand

Part IV aims to ask similarly probing questions in the hydropower sector. Assessing the benefits of electricity for poverty alleviation and some of the dynamics associated with hydropower - regional energy swaps and ageing infrastructure - Part IV examines the prospects for further large-scale hydro developments in Tajikistan. With enough technically exploitable hydro potential to single-handedly power all five Central Asian Republics twice over, the grounds for optimism are considerable. However this section asks the more critical question: is there effective demand for Tajik hydro in the region. All agree that there is a clear need for cheap and clean electricity, but neighbours' willingness to invest in the future is at present lacking. This section examines the prospects for a turnaround in regional commitment to Tajik hydro: with the region's rich stocks of hydrocarbons it concludes that effective

* GoT Resolution #208 of 22 May 2003 notes that only 15,000 hectares of irrigated land have fallen out of use



Baipazinskaya Hydropower Station in Central Tajikistan: safeguarding current generating capacity and restoring efficiency at existing hydro plants must be a first step in redeveloping Tajikistan's hydro sector.

Photo: UNDP

demand will not materialise in the near future. Instead, growing concerns over resource depletion and carbon emissions may in the long-term serve as a catalyst for future development. Until that time, Tajikistan's policymakers and planners should consider other alternatives for increasing power generation, including improving terms of trade for energy imports, and exploring smaller-scale hydro developments.

Part V: Resource allocation

The final part of the report considers water sector's worrying funding gap in greater detail. The section has two overarching objectives: first, to demonstrate how little money is currently being invested in the water sector, the impacts of which have been discussed in preceding sections; and second, to make a first attempt at costing the likely investments needed to improve water systems, based on national and international models.

THE NEED FOR CHEAP AND RENEWABLE HYDROELECTRICITY IS NOT IN DOUBT; NEIGHBOURS' WILLINGNESS AND ABILITY TO PAY FOR IT IS THE REAL QUESTION.

Looking in turn at water supply and sanitation, irrigation and drainage, and hydropower, Part V asks three key questions: 1) What is the actual state of the system, and what are current investments? 2) What are the objectives for any future investments? And 3) What resources are needed to meet those objectives? As already noted above, spending levels in water supply are untenably low: spending ranges from 2.5 dirams (\$0.08) to 3.4 dirams (\$0.11) per cubic metre of water supplied: this compares with average Western European rates of \$1.50 per cubic

metre – well over 100 times more. Tentative costing estimates indicate that halving the number of people without access to piped water could cost upwards of \$200 million to 2015. Such annual spending levels are equivalent to more than 1% of current GDP: this in itself sounds feasible, but it should be remembered that this in a country where public expenditure in 2002 totalled just 16% of GDP. Given these enormous costs (similar for hydropower and I&D systems) there is an imperative need for wise prioritisation in the allocation of funds: decisions will have to be informed by a prudent assessment of what can realistically be achieved, and of what interventions will produce the greatest impact for the greatest number in the shortest time.

Part VI: Conclusion

This closing chapter presents the main findings of the report and makes recommendations for the future. It notes the following:

- that water is central to human development
- that good water costs money, and that higher and sustained levels of funding will be needed for the long term, from both national and international actors
- that institutional capacity must be strengthened, especially in the areas of staff retention and training, and of data collection and presentation, with a particular focus on access to financial information
- that water consumption patterns need changing, with an increase in public awareness and appreciation of water as a limited and shared resource
- that priorities in cotton must be refocused, with increased competition in the ginning process and in the provision of credit and inputs, for increased benefits to farmers
- and that there is an urgent need for a similar debate in hydropower, with a reappraisal of the realistic options for future development of the sector

Following the Conclusion, the Annexes include statistical appendices with comprehensive data on human development indicators in Tajikistan, a bibliography, and a list of useful websites.

Part I

The Potential

One of Tajikistan's greatest assets is water. Wise management of national water resources could prove a powerful tool for improving human welfare and facilitating economic development not only in Tajikistan but in the region more broadly. To fully realize the promise of its natural wealth while simultaneously preserving its assets for the future, Tajikistan must confront substantial challenges. The potential benefits for economic development and human welfare are real and, with careful planning and proper administration, achievable.

Global commitment to the importance of water

The integral roles of environmental sustainability and good management of water resources in promoting economic growth and human development are underscored by the priority placed on these issues in the United Nations Millennium Declaration of 8 September 2000. This established key targets - known as the Millennium Development Goals (MDGs) - for global development to be met by the year 2015. In the Declaration, member states recognized that achieving progress on human development requires a cooperative and collective effort on the part of the international community. Member states also recognized that landlocked nations and countries with economies in transition face special difficulties in their efforts to engage with and benefit from the globalizing world economy. Thus in Tajikistan especially, success in achieving the MDGs, including targets for sustainable water resource management, will require concerted efforts by national authorities, regional partners and international organisations to identify and pursue common interests in the development and stewardship of Tajikistan's water resources.

SUCCESS IN ACHIEVING THE MILLENNIUM DEVELOPMENT GOALS WILL REQUIRE CONCERTED EFFORTS BY NATIONAL AUTHORITIES, REGIONAL PARTNERS AND INTERNATIONAL ORGANISATIONS

This report considers the state of water resource management in Tajikistan today and prospects for tomorrow. In a world ever more conscious of water's central role in improving people's lives, Tajikistan would seem to be well positioned for the future. The question is how practically to translate water resources into real and sustainable improvements in living standards.

Chapter I: The Millennium Development Goals

The Millennium Development Goals represent a series of specific, quantitative targets for education, health, environment, and income poverty aimed at improving the lives of people around the world. Specific targets for the expansion of water provision and sanitation service are of particular concern and relevance to Tajikistan.

Although the MDGs identify water as a specific concern, management of water resources is of particular relevance for achieving other important targets in the Millennium Development Goals. The importance of improving irrigation to facilitate agricultural development and reduce hunger is one obvious connection. Other impacts are less apparent though no less important: providing clean water to schools can help raise school attendance levels; and improving access to water and sanitation is an important

element in efforts to reduce child mortality rates. What are the main linkages between water and the Millennium Development Goals?

Water and poverty

MDG 1 aims to halve by 2015 the proportion of the world's people whose income is less than \$1 dollar a day. In Tajikistan, where 65% of the population depends on agriculture for its livelihood and per capita GDP is \$188 (the lowest in the CAR region), the importance of water as a direct input for increasing crop yields and agricultural incomes is of considerable importance.

MDG 1: HALVE BY 2015 THE PROPORTION OF THE WORLD'S POPULATION WHOSE INCOME IS LESS THAN \$1 A DAY

Around 84% of all water used in Tajikistan is consumed by the agricultural sector, yet only half of this is thought to reach the crops - the rest is lost to evaporation and inefficiencies in the water transport infrastructure.

Water and hunger

MDG 1 also aims to halve by 2015 the proportion of the world's people who suffer from hunger. Despite some improvement in food production (cereal production in 2002 rose 30% over the previous year), Tajikistan still runs a large food deficit: internal grain production accounts for 40% of consumption requirements, with commercial imports making up a further 40%. The World Food Programme provides 10% of requirements, leaving a 10% shortfall of around 100,000 tons of grain.² The government's continued

involvement in cotton (the country's third largest export after aluminium and electricity, representing 11% of exports) diverts considerable irrigation resources away from food production. Consumption of meat and vegetables in the Tajik diet has decreased by 50% since 1991:³ unless and until cotton becomes more profitable for the farmers themselves, many would be better off switching to fruit and vegetables, a crucial move in raising rural incomes and addressing the country's food problem. Part III will consider the question of cotton in more depth, asking the key question, are farmers feeling the full benefits of Tajikistan's rich water resources under the current arrangements in the cotton sector?

Good water management can also help to preserve ecosystems that naturally regulate water flow for food production: in rural areas, for example, where gas and electricity provision is low, deforestation for household fuel leads to reduced water-retention, with increased wash-off diminishing year-round supplies.

Water and education

MDG 2 aims to ensure that, by 2015, children everywhere will be able to complete a full course of primary schooling. Water impacts on education in many ways. Poor or unreliable access to clean water discourages school attendance, particularly among girls.

MDG 2: ENSURE THAT, BY 2015, CHILDREN EVERYWHERE WILL BE ABLE TO COMPLETE A FULL COURSE OF PRIMARY SCHOOLING

Poor quality water leads to poor sanitation and disease, which also lower attendance rates. When children do attend school, poor water access undermines the learning environment.⁴ Survey evidence suggests that lack of access to safe drinking water at school is an important factor in non-attendance.⁵

With 93% of the country covered by mountains, land for farming is scarce: amongst the Central Asian Republics, Tajikistan also has the lowest rate of irrigated land per capita, at 0.12 hectares per capita. Here a farmer can be seen making the most of a mountainside plot.

Photo: Surat Toimastov



Water and gender equality

MDG 3 aims to promote gender equality and empower women. Although the targets attached to this goal relate more to gender equality in education, employment and public administration, significant additional burdens for women can be seen as a result of struggling water management. With largely dilapidated irrigation systems and the resulting decline in agricultural incomes, many rural areas have seen an outflow of male labour. As a result, women assume greater burdens in terms of irrigating and harvesting, in addition to the more traditional gender roles of household chores and caring for children. While this rural reality could act as a catalyst for women to play a greater role in local decision-making, tentative studies show that this is not yet happening: men retain the dominant voice in most communities, while the majority of women interviewed were not members of water user associations (where they existed) and often were not aware of the laws pertaining to water use.⁶

Water, child mortality and maternal mortality

MDGs 4 and 5 aim respectively to reduce by two thirds, between 1990 and 2015, the under-five mortality rate and to reduce by three quarters, between 1990 and 2015, the maternal mortality rate. Improved quantities and quality of domestic water reduce the main morbidity and mortality factor for women and young children. According to the World Health Organisation (WHO), the lack of safe drinking water is the principal cause of 60% of diseases, particularly diarrhoea amongst young children.

MDGS 4 AND 5: REDUCE BY TWO THIRDS, BETWEEN 1990 AND 2015, THE UNDER-FIVE MORTALITY RATE, AND REDUCE BY THREE QUARTERS, BETWEEN 1990 AND 2015, THE MATERNAL MORTALITY RATE

Diarrhoea is a major problem in Tajikistan: in Khatlon Oblast, home to 2.2 million of Tajikistan's inhabitants, 14% of the population suffers from diarrhoeal disease.⁷ Of the three main causes of child mortality in the country - acute respiratory infections, diarrhoea and malnutrition - the latter two are intimately linked to

poor water quality. The first of these three is also indirectly linked to a lack of water: the increase in acute respiratory infections is mainly blamed on indoor pollution, resulting from burning wood or other biomass inside the home. Tajikistan is seeing a reversion to these traditional forms of fuel as hydro-power generation has decreased and electricity shortages have become the norm. The impacts of improved water management on labour burdens (for mothers fetching water) and on food security may also help reduce susceptibility to disease, especially anaemia for mothers, in turn reducing child and maternal mortality.

Water and major diseases

MDG 6 aims by 2015 to have halved and begun to reverse the spread of HIV/AIDS, and the incidence of malaria and other major diseases. Although the reported incidence of HIV/AIDS is still fairly low in Tajikistan,⁸ malaria and other diseases where poor water management is a factor present serious challenges to human development. Malaria was almost eradicated in Tajikistan before independence, but returned in 1992 and, by 2002, there were an estimated 400,000 cases in the country. Better water management can reduce mosquito habitats, while improved food security can again help offset the population's susceptibility to this and other diseases: typhoid is a good example in Tajikistan, and will be discussed at greater length in Part II.

Water and environmental sustainability

MDG 7 aims to halve, by 2015 the proportion of people without sustainable access to safe drinking water. This is the key MDG for this report, based, as it is, on the premise that securing access to safe drinking water will have the corresponding knock-on effects in poverty, hunger, health, education and other key human development indicators. MDG 7 also addresses particular issues of environmental sustainability. Central Asia, home to one of the world's worst water-related ecological disasters, the desiccation of the Aral Sea, is a dramatic example of how unsustainable water use can negatively impact on the environment. Improved water management, including sustainable levels of abstraction

and rational use, particularly for agriculture, are key factors in maintaining ecosystems' integrity.

MDG 7: HALVE, BY 2015 THE PROPORTION OF PEOPLE WITHOUT SUSTAINABLE ACCESS TO SAFE DRINKING WATER

Declining agricultural yields and the abandonment of thousands of hectares of once fertile land are testament to the dangers of poorly regulated water use.

Chapter 2: The Resource

With resources come responsibilities...

Tajikistan possesses unique water resources. With 93% of its territory covered by mountains, Tajikistan contributes more water to the Aral Sea Basin than all the other Central Asian countries combined. The area of glaciers (8% of the country) exceeds that of agricultural croplands (6%). Among CIS countries, Tajikistan is second only to Russia in terms of volume of water resources; and with a population of only 6.5 million, Tajikistan's annual water production of 13,000 cubic metres of water per person per year is among the highest in the world. Given the significance of water for human development described in Chapter 1, these resources give Tajikistan an enormous potential advantage in meeting MDG targets and other development objectives. Since the vast majority of water in Tajikistan originates inside the country, Tajikistan is free of many of the problems that typically face downstream countries, such as industrial pollution, mineralization and higher salinity levels from upstream neighbours. While Tajikistan need not contend with the pollution of other countries, it must still take care not to pollute its own water resources - both for its own sake as well as for the benefit of downstream users in neighbouring states.

... and opportunities

The opportunities that accompany such an abundant resource are plain. Beyond those benefits for human

development outlined in the previous chapter, water in Tajikistan also presents other opportunities: as a potential draw for tourism, as a tool for diplomacy, and as a source of energy. Much of this potential is untapped: international tourism is still in its infancy; efforts at regional cooperation have lagged, and development of hydropower has been hindered by disputes over economic viability, physical security and expected benefits for poverty alleviation. As this report will argue, development of water resources along these lines may bring new opportunities and benefits to the people of Tajikistan.

TAJIKISTAN'S ANNUAL WATER PRODUCTION OF 13,000 CUBIC METRES OF WATER PER PERSON PER YEAR IS AMONG THE HIGHEST IN THE WORLD.

Where does Tajikistan's water come from?

Tajikistan generates around 64 km³ of water each year – approximately 55% of all the water in the Aral Sea Basin. Glaciers and underground water sources provide around 25-50% of yearly flow (depending on glacial melt). Glaciers hold a massive 845 cubic kilometres of water, equivalent to seven times the total annual flow in the Aral Sea Basin. However, the glaciers are retreating at an alarming rate, due in large part to rising annual average temperatures and decreased precipitation over the past twenty years. (See Box IV.3)

There are around 25,000 rivers in Tajikistan, altogether totalling 90,000 km in length, two and half times the circumference of the Earth. Tajikistan is also home to more than 1,300 lakes, holding 46 km³ of water. A little under half of this is fresh water, more than a third - 17 km³ - of which is found in Lake Sarez, formed when an earthquake created a natural dam in 1911.

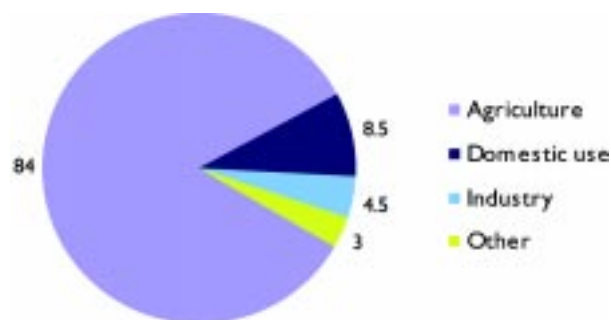
There are nine reservoirs currently operating in Tajikistan. Altogether these hold an extra 15 cubic kilometres of water, in addition to country's lake water. Two of them – Nurek Reservoir on the Vakhsh River and Kairakum Reservoir on the Syr-Daria – are of international significance, as they regulate seasonal

irrigation flows to Kazakhstan, Uzbekistan and Turkmenistan and provide electricity to the region at peak demand times in the early morning and late evening. Over the course of the year, around 13% of annual surface water flow is stored in reservoirs for this purpose. Many in government and elsewhere feel that reservoir capacity should be expanded in order to secure reliable, regulated irrigation flows and increased supplies of cheap hydropower to the whole Central Asian region and beyond. Some of the dynamics surrounding hydropower development are explored further in Part IV of this report, on hydro-power and effective demand.

What is water used for?

With its predominantly agricultural base, 84% of the water in Tajikistan goes to the fields, while 8.5% of consumption is accounted for by drinking water and communal services, 4.5% by industry and 3% by other uses, such as fisheries. These numbers do not capture the entire picture, however: 43% of the population has no access to piped water and nearly 25% of the population uses irrigation channels as its main source of drinking water. The challenge of access to water will be considered in greater detail in Part II on Constraints and Impacts.

Figure I.1: Water uses in Tajikistan



Source: MIWR

Where does the water go?

Central Asia is spread across the Aral Sea Basin, which consists of two main river basins, the Syr-Daria to the north, and the Amu-Daria to the south. As can be seen from Figure I.2, Tajikistan provides more than 55% of

Table I.1: Flow volumes and land area in the Aral Sea Basin

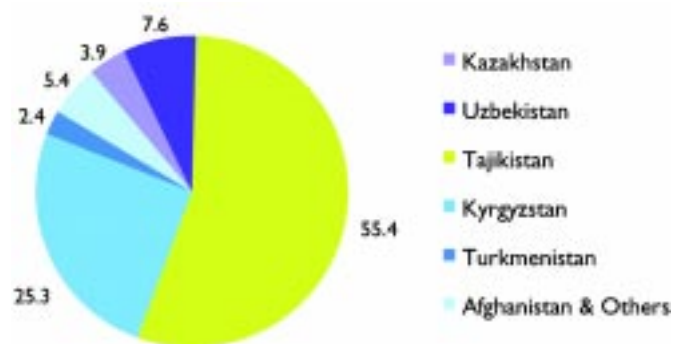
Country	Volume of flow (km ³)	Proportion of basin (%)
Tajikistan	64.0	11.02
Kyrgyzstan	29.3	9.07
Uzbekistan	8.8	31.07
Kazakhstan	4.5	34.46
Turkmenistan	2.8	5.68
Afghanistan	6.2	8.52
Total	115.6	100

Source: World Bank and UN World Water Development Report, 2003.

Note: small proportions of the Aral Sea Basin also lie in China and Pakistan (0.15% and 0.01% of total basin area respectively). Their flow contributions are negligible and are therefore not shown.

the total flow volume in the Aral Sea Basin while occupying just 11% of the total basin area. Table I.1 shows the flow contribution of each country in the Aral Sea Basin, along with the area of the basin that each country occupies. Tajikistan's is by far the largest contribution, while Tajikistan and Kyrgyzstan together account for over 80% of water flows to the region.

Figure I.2: Tajikistan - by far the largest contributor to flow volume in the Aral Sea Basin



Source:

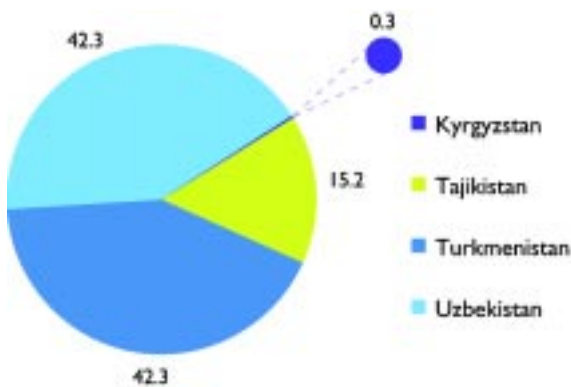
The World Bank, UN World Water Development Report, 2003.

Who is entitled to the water?

During the Soviet era, regions that produced cotton and rice were given priority access to water for irrigation. Under this policy, the largest volumes of water were directed to the downstream republics in the

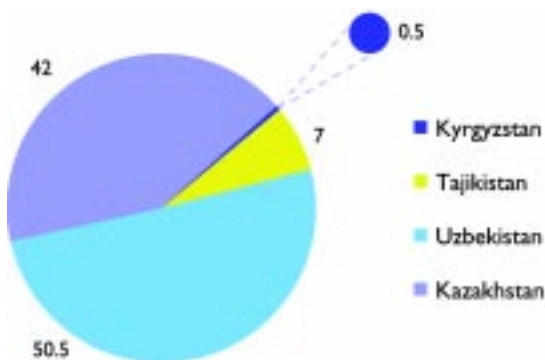
lower reaches of the Amu-Daria and Syr-Daria rivers – Kazakhstan, Uzbekistan and Turkmenistan. Figures 1.3-6 show the flow entitlement, per capita water consumption and the area of irrigated land per head of population for each of the five Central Asian states. Flow volumes are fixed under the Water Strategy for the Aral Sea Basin of 1996. As Tajikistan perceives it, there is a large disparity between the allotted flow volumes and the rightful entitlement of each state to the region’s water resources.

Figure 1.3:
Flow entitlements on the Amu-Daria (%)



Source: MIWR

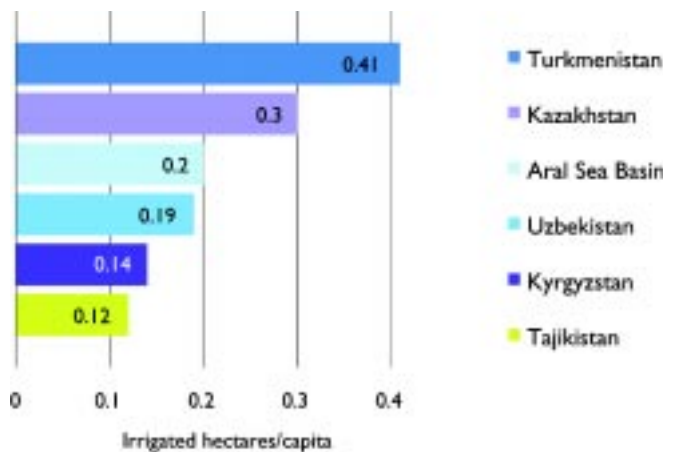
Figure 1.4:
Flow entitlements on the Syr-Daria (%)



Source: MIWR

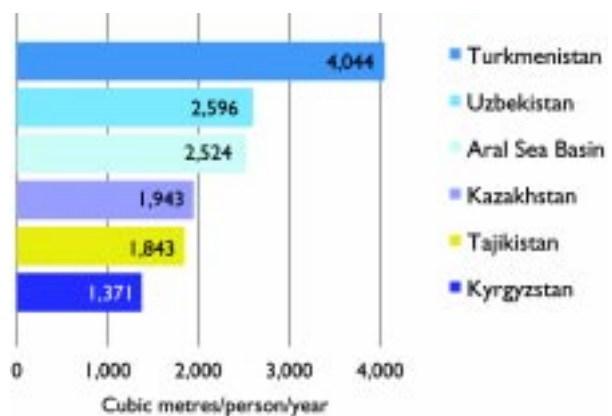
Figure 1.5: Irrigated land per capita in the Central Asian Republics

With 43% of Tajikistan’s irrigated lands planted for cotton in 2001, little space is left for grain and vegetable crops, contributing to the country’s continuing food deficit.



Source: MIWR

Figure 1.6: Per capita water consumption in the Central Asian Republics



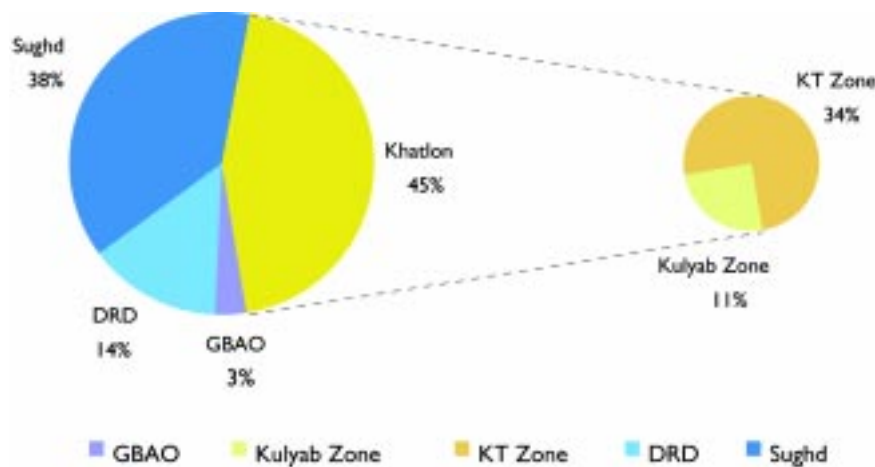
Source: MIWR

Tajikistan’s net flow entitlement is 11%, equal to the basin area the country occupies. Given the continuing food deficit and the unequal distribution of water resources across the country (see Figure 1.7), it is understandable that the Government should wish to expand the irrigable area. This low flow entitlement also limits the amount of water the country can store and use for hydropower (though physical storage space is also

limited, as we shall see later). Although the Tajikistan government points to the regional benefits of reservoir expansion, downstream opposition to further withdrawals is fierce.

Figure I.7: Distribution of irrigated land in Tajikistan.

Khatlon Oblast to the south and Sughd Oblast in the Ferghana Valley account for 83% of irrigated lands in Tajikistan.



Source: MIWR

Conclusion

Although there are substantial constraints on the direction and pace of water development, water in Tajikistan has considerable potential as a means for stimulating economic growth and advancing human development. Water occupies a prominent and important place in much of the thinking about regional relations in Central Asia. Regional cooperation will remain high on the agenda of long-term interests for all Central Asian states, but it is essential that these broader considerations should not eclipse local issues that may have a more direct bearing on national populations and welfare outcomes. Further sections of this report focus on national concerns, on the premise that many of Tajikistan's problems can and must be addressed locally.

Footnotes

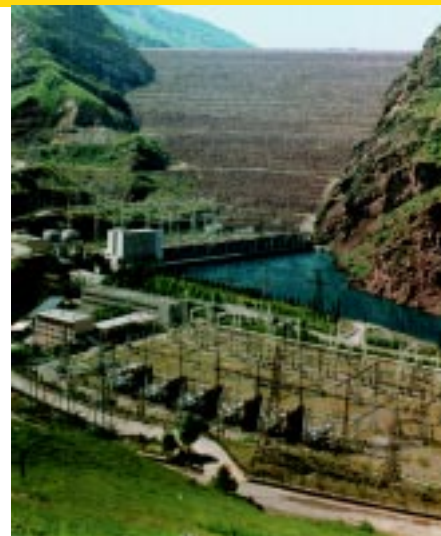
- 1 WHO, 2001
- 2 FAO/WFP: Crop and Food Supply Assessment Mission in Tajikistan, Report, August 2002, page 13.
- 3 World Bank: Towards Accelerated Economic Growth, 2001.
- 4 UNICEF, Ministry of Education: sample survey, August 2002.
- 5 Save the Children UK, UNICEF, RT Ministry of Education: Report on Community Based Education and Management Information System (c-EMIS), Dushanbe 2003.
- 6 UNIFEM: Needs Assessment of Rural Women on Land Tenure Rights in Tajikistan, Dushanbe, 2000.
- 7 Sanitation and Epidemiological Station, Dushanbe, 2001
- 8 There are 75 officially registered cases of HIV/AIDS in Tajikistan, though UNAIDS estimate the true figure may be 20 times this.

Part II

Constraints and Impacts

With the highest dam in the world, Nurek hydropower station produces a quarter of Tajikistan's internally generated electricity. The sector needs \$60 million a year just to cover basic running costs and repairs: since 1991 it has sustained a funding shortfall of around \$20 million a year, putting efficiency, reliability and security at risk.

Photo: Academy of Sciences



Chapter 3: Constraints

Three principal constraints currently hamper improvement in water management in Tajikistan. Two of them, financial limitations and institutional weakness, are common to almost all aspects of public service provision throughout the developing and developed world. The severe deterioration in public water infrastructure points to chronic underinvestment in the water system over the last ten years, while the haphazard response of public authorities, exacerbated by the years of civil war, is symptomatic of a culture of weak institutional capacity and poor inter-agency coordination that must change. A final major constraint is the vast inefficiency not only in the provision but in the consumption of water. Heavily subsidised during the Soviet period, consumption rates in Tajikistan (as in much of the Former Soviet Union) far outstrip those in most developed countries. For any increases in funding or improvements in management to impact positively on water provision in the country, a serious culture change will have to be seen in water allocation and consumption patterns.

Financial limitations

As yet, there has been no comprehensive study of the cost of rehabilitating water systems in Tajikistan. Such an exercise should be conducted as soon as possible to provide national authorities and international donors with a full and accurate assessment of the scope of the problem and likely cost of addressing it. The IMF's Joint Staff Assessment of the 2002 Poverty Reduction Strategy Paper clearly points out the absence of proper costing for many of the PRSP's programmes: unless and until realistic numbers can be provided for the water sector, both government and other actors will remain in the dark as to the scale of the challenge.

As a simple measure of the current level of underinvestment, it is instructive to consider the decrease in spending on water system maintenance since the end of the Soviet Union. According to the Ministry of Irrigation and Water Resources, irrigation in Tajikistan received \$72 million a year for operating and maintenance costs in 1990, while today the sector receives \$6.5

Box II.1: A note on cost comparisons

In order to get a fuller picture of the decline in public services since 1991, this report compares spending levels at the end of the Soviet Union with those of today. However, there are dangers in relying heavily on these cost comparisons: with artificially low tariffs water was treated as an essentially free commodity, distorting comparisons with today's more market oriented sector; dollar comparisons with the Soviet rouble are not always reliable; and the explicit and implicit subsidies of the Soviet period mean that past and present costs cannot always be compared directly. Nonetheless, these figures can serve as useful indicators, and with the above limitations in mind this is the role they will play in this report.

million a year - less than 10% of former levels. Tajikistan's hydropower structures once had an income of \$150 million, returning a \$90 million profit to Moscow after operating and maintenance costs of \$60 million. Since 1991, income and expenditure have fallen to just \$40 million, leaving a worrying \$20 million funding gap every year for ten years, for basic repairs and upkeep.⁹

UNLESS AND UNTIL REALISTIC NUMBERS CAN BE PROVIDED FOR THE WATER SECTOR, BOTH GOVERNMENT AND OTHER ACTORS WILL REMAIN IN THE DARK AS TO THE SCALE OF THE CHALLENGE

At present, funding requirements exceed available resources, public and external, by a considerable margin. Given the size and likely persistence of the financial shortfalls, it is essential to establish priorities for investment in the water system. As yet, mechanisms for prioritization of financing do not exist; it is not clear, then, how investment decisions will be made, whether expenditures that benefit a narrow population such as cotton businesses will be favoured against investments that benefit broader human development, for example; or how to balance competing needs for expansion of water infrastructure and rehabilitation of existing networks. It is imperative to establish good priorities early on. In any case, decisions should be informed by a sober assessment of what can realistically be achieved, and of what interventions will produce the greatest impact for the greatest number in the shortest time.

Questions relating more specifically to the funding of improved water institutions are outlined below, while more difficult questions of financial resource allocation - specifically of costing water, and identifying the priorities to be taken in the sector - will be addressed at greater length in Part V: Resource allocation.

Institutional weakness

Previously, all lines of communication for the ministries involved in water management ran directly to Moscow. Specialised agencies submitted reports and funding requests to the centre, and there was little coordination among ministries at the regional or republic level. Since the break-up of the Soviet Union, this command structure has effectively been decapitated, depriving it

even of the centralist direction that Moscow once provided. Ministries in the republic today are faced with the challenge of coordinating their own policy on the basis of little prior experience.

Two features of the water sector complicate this task: first, water is important to many sectors; it is at once a vital resource (for drinking and sanitation, for example) and a key input for the economy (for irrigation and power generation). At the same time, water can be a threat to the population and to the economy (in flooding and mudslides, and in destroying crops with rain and hail). As a consequence, no single agency can lay claim to exclusive responsibility for water management, and indeed in the apparatus of government there is a bewildering array of ministries and institutions, committees and departments all with partial or overlapping responsibility for the various aspects of water use and management.

WATER: AT ONCE A VITAL RESOURCE AND A POTENTIAL THREAT

The second feature of water management that distinguishes it from some other development challenges is its environmental impact. Few regions of the world have experienced the dangers of water mismanagement more fully than Central Asia. The desiccation of the Aral Sea and the salinization of vast tracts of land across the region serve as a warning of the costs of poor policy-making and the folly of permitting short-sighted economic interests to dominate over longer-term economic, social and environmental considerations. It is to be hoped that with experience of such mistakes in the past, Central Asian states will not make the same mistakes again in the future.

Given Tajikistan's limited experience in coordinating complex water policy, the inherently multi-sectoral nature of water and the intimate and fragile relationship between water and the broader environment, it is not surprising that current institutional and legislative frameworks are struggling to meet the challenge.

Staff retention and training

The personnel base on which the water system depends has been weakened by independence, the civil war and

economic transition. Many of the cadres who filled senior managerial and technical posts were Russian. Even before the break-up of the Soviet Union in 1991 skilled personnel had gradually been leaving Tajikistan. The lack of funds for recruiting and retaining highly qualified staff has had a severe negative impact on key agencies, both in weakening their professional culture and in hampering their performance in the field. With public sector salaries averaging around \$15 per month, incentives and commitment are low, and many employees are forced to seek extra work out of hours, further reducing productivity. Difficult financial circumstances also make the system more susceptible to bribery and corruption.

HOLISTIC, INTEGRATED WATER POLICIES WILL BE
ESSENTIAL FOR SUSTAINABLE WATER USE IN THE FUTURE

Opportunities for training and team-building are almost non-existent, leading to slow adoption of new technical and managerial approaches. Communication with regional offices is haphazard, with some ministries reporting that staff in the field are sometimes unaware of key policy changes. As a result of these personnel constraints, outmoded practices have persisted in spite of the clear need for efficiency-improving reforms.

Specialisation - strength or weakness?

A critical personnel issue concerns the highly specialised technical backgrounds of many professionals in the water sector. One positive feature of the Soviet legacy is the presence of a relatively strong (if much weakened) professional culture able to generate detailed scientific reviews of a quality that would be hard to find in other developing countries. But narrow scientific specialisation comes at a price: there is a real shortage of leaders in the sector with a sound, holistic understanding of the overall water system. With irrigation programmes neglecting drainage, supply systems neglecting sanitation, and end-pipe solutions for industrial waste being favoured over integrated treatment measures, the absence of integrated water policy and management has contributed to Tajikistan's failure to halt some of the unsustainable and damaging practices of the previous era. Some reversals have been seen, but these are owed not to improved policy or management, but to changing macroeconomic realities: the decline in industry has seen an overall

decrease in industrial waste since 1991 for example, while the increasing dependence on agriculture has hastened the rate at which land is retired due to salinization and soil exhaustion. A new generation of policymakers capable of maintaining the high scientific standards of the current generation while also able to see the linkages between disparate water-related sectors and the externalities associated with water use will be essential if Tajikistan is to achieve sustainable water usage for the long term.

Consumption behaviour and ownership

A serious constraint threatening to undermine any improvements in the water system in Tajikistan is the level of water consumption. The World Bank has estimated that water use in Dushanbe may be as high as 1,400 litres per person per day - around ten times the amount in Western Europe.¹⁰ Other figures from the World Bank indicate that in cotton irrigation, twice as much water is used as is necessary, with Tajikistan using around 70% more water than Pakistan (a country hardly known for efficient irrigation). Excessive consumption only increases the strain on systems and institutions struggling to function at all, let alone cope with world-beating consumption figures. For measures to resurrect Tajikistan's ailing water systems to be successful in any way, a serious culture change is needed in consumption - both at home, and in the field.

Why is so much water consumed?

The usual answer to this is that as utility charges in the Soviet Union were particularly low, water, as with gas and electricity, was not used sparingly. As a result a culture of overuse became the norm. Plugs, for instance, are conspicuous by their absence across the former Soviet Union, and Tajikistan is no exception. In irrigation the story is slightly different. Soviet farming manuals still used today list the standard amount of water required for each crop. While these guidelines were easier to follow when irrigation and drainage systems were fully functioning, the margin of error has increased with every year of system degradation. As water counters at headworks have broken down, the tendency in regions where water is available has been to err on the side of plenty. The impacts in terms of waterlogging and salinization have not been as pronounced in Tajikistan as in some of her downstream neighbours, but nonetheless,

Box II.2: Raising public awareness about water - major campaigns in Dushanbe

The Youth Ecological Centre (YEC) is a Dushanbe-based, independent NGO whose stated aim is to encourage students, teachers and scientists to play a more active role in environmental matters. YEC collects, processes and disseminates information on the environment and on civic initiatives and groups in Tajikistan. The YEC Training Centre educates youth and NGOs on facilitation methods, environmental journalism, nature protection and civic and legal matters, amongst other things. Working hand-in-hand with the Training Centre is the YEC Information Centre, which keeps up-to-date information on current social and environmental developments, and has several useful databases. *Tabiat* (Nature) is a monthly bulletin published by their press service that is distributed to government ministries and NGOs in print and electronic versions. Since its inception, YEC has trained over 700 volunteers.

The past few years have seen real growth in public awareness raising campaigns, with several successful conferences, seminars and open discussions being held in and around the capital. Some of the highlights included:

- the International Conference on Water Resources and their Rational Use in Central Asia (9-11 October, 2001) organized by the Academy of Sciences;
- the Fresh Water to Humanity National Conference (25 September, 2002) organized by the Government of Tajikistan in conjunction with the Ministry of the Environment, the Academy of Sciences and the Republican Centre for Farm Privatisation Support;
- the International Seminar on Freshwater Resource Management (1 November, 2002), organised by the UNESCO Division of Water Sciences;
- the Round Table meeting (May 20, 2003) held on the eve of the Dushanbe International Fresh Water Forum;
- and the exhibition 'Water: one resource – many users' which opened on 10 June, 2003, showcasing children's ideas on water from locally-held drawing competitions.

more than 15% of irrigated lands in the country have been salinized, and 2,500 hectares of land continue to be lost every year as a result of overwatering.

Ownership

Hikes in water tariffs are the usual prescription to address over-consumption. Tariffs are imposed for two reasons: first, to cover costs and make the water system financially self-sustaining; second, to discourage excessive consumption by raising the cost of water. Whether household incomes and the economy at large could support higher water tariffs is a source of some debate. The poor are often hit hardest by rising water prices. Although Tajik Municipal Authority (the urban water authority) receives some money (around TJS 150,000 in 2002) to provide services to the poorest consumers, these funds fall short by a wide margin. It is the poor who are most in need of upgraded services, yet it is the same poor who are least able to pay for them.

IT IS THE POOR WHO ARE MOST IN NEED OF UPGRADED SERVICES, YET IT IS THE SAME POOR THAT ARE LEAST ABLE TO PAY FOR THEM

Measures must be taken to increase ownership of water resources. Existing systems cannot support excessive consumption rates, and something must be done to halt a culture where villagers refuse to turn off their taps for the simple reason that their neighbours also refuse. If the resulting empty water tank is not sufficient motivation for water economy, higher tariffs may be the only way forward.

A strong case can also be made for education. Water conservation is not hard to teach; other than a plug and a washbowl, conservation imposes no new expenses on the state or the population; and as compared with the costs of inaction - shortages, cuts in service, overburdened systems and contamination - conservation represents a highly cost-effective, community-level means of addressing the imperative for change in national water use.

Dushanbevodokanal, the authority responsible for providing water to the capital, reports that only 33% of the water it withdraws from rivers and groundwater sources reaches end users. The rest is lost through leaks in worn-out pipes and dilapidated infrastructure.

Photo: Surat Toimastov



Chapter 4:

Impacts on safe drinking water

Access to water

Access to piped water was never 100% in Tajikistan. The mountainous topography of the country presents major physical challenges to extending the water supply network. According to UNICEF, 57% of the population (3.7 million people) is covered at present, including 93% of the urban population and 47% of the rural population.¹¹ Just over 10% (650,000 people) use spring water, 3.7% (235,000 people) use river water, and nearly 25% (1.52 million people) use water from gorges, canals, irrigation ditches or pools. Access to piped water does not mean simply access to safe drinking water. The case of Dushanbe is illustrative: 16% of supplies into the Dushanbe water system are diverted directly from the river into local distribution networks without any treatment.¹² By MOE data, the quality of water treatment is low.

NEARLY A QUARTER OF THE POPULATION USES WATER FROM GORGES, CANALS, IRRIGATION DITCHES AND POOLS

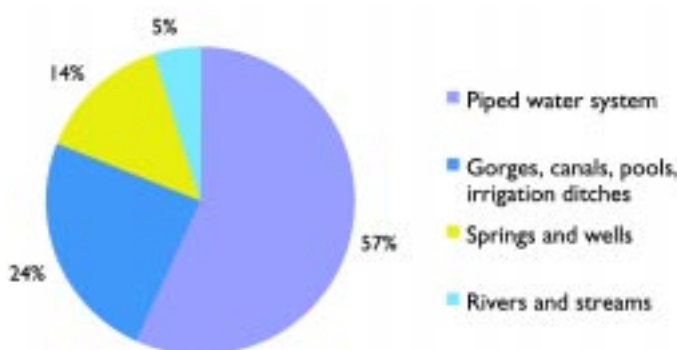
Around 65% of the national supply system - water mains and distribution nets - is dilapidated but still functioning while a third of the system has completely broken down. Again, Dushanbe is illustrative: of a total water system

input of 270 million cubic metres in 1999, the World Bank reports losses in the distribution network of 44 million cubic metres per year, and losses and wastage in apartment blocks of 100 million cubic metres per year - equivalent to a sixth of the total amount of piped water consumed in the country.¹³ Inefficient patterns of usage combined with power shortages mean that water supply is rationed in many areas of the country. With water running for only a few hours at the beginning and end of each day in these areas, supplies are polluted as backpressure draws dirt into worn out pipes. Figures II.1 and II.2 show population statistics by water source and access to piped water across the country.

Safe drinking water and education

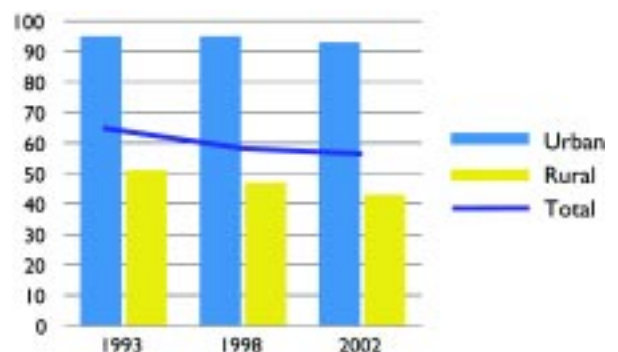
Lack of water is a particular burden for schools and other public institutions. Although national data do not exist for school and hospital water supplies, anecdotal evidence suggests that the situation in many cases is precarious. A joint UNICEF/ACTED study was revealing in this regard: evaluation of school sanitation and hygiene projects implemented in 600 schools in Khatlon and Sughd oblasts showed that more than 45% of schools had no access to safe drinking water. Another UNICEF study suggests lack of safe drinking water is an 'important' factor for 25% of students who failed to attend or dropped out of school. Even without firm data on water-carrying times (a further factor keeping children from school, and as yet under-

Figure II.1:
Population by water source in Tajikistan



Source: SES, 2001

Figure II.2: Access to piped water: declining steadily since independence



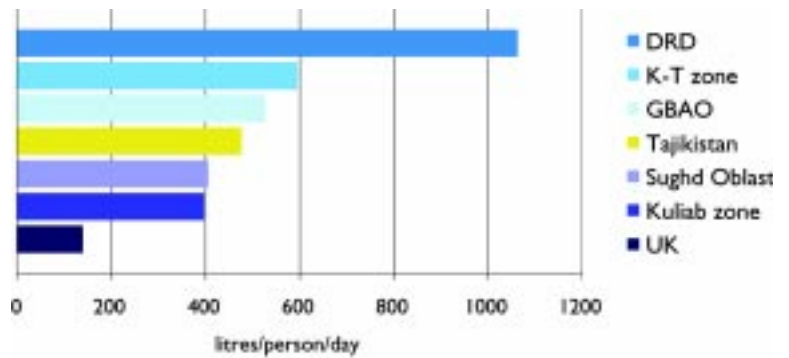
Source: UNICEF

researched in Tajikistan), the implications of these figures for the government in meeting its education goals are worrying.

Water treatment

Water treatment is one of the areas to have suffered most since independence. Low staff levels and consistent under-investment have led to a 50% decrease in treatment capacity, from 245 million cubic metres per year in 1990 to 120 million cubic metres per year in 2000. (These figures apply only to the 650 million cubic metres of water that is supplied annually to the 57% of the population connected to centralised piped water systems. The 1.7 million inhabitants for whom rivers and irrigation ditches provide the main sources of water clearly do not benefit from any form of centralised water treatment). In addition, purification efficiency at those plants still in operation does not exceed 50%. Less than 10% of the water in the main supply networks is adequately treated.¹⁴ Extrapolated across the population connected

Figure II.3: Water consumption in the Direct Rule Districts is more than twice the national average, and nearly eight times Western European levels.



Source: World Bank

to piped water systems, this places safe water supplies at 44 litres per person per day.¹⁵ However, this water is mixed with the remaining 90% of centrally supplied water, which receives no adequate treatment: actual supplies of clean water thus fall well short of the targets established by Agenda 21 of the 1992 Rio Earth Summit, which set 40 litres per person per day as a recom-



School children wait expectantly for a rehabilitated hand pump to come online. A UNICEF study found that 45% of schools were without safe drinking water. Installing a deep well for a school typically costs around \$3,000.

Photo: UNICEF

Table II.1: Drinking water sources for 600 schools, 2002

Water Source	%	Safe/Unsafe
Open channel irrigation	35	Unsafe
Closed Irrigation Channel	5	Unsafe
Well	5	Unsafe because of contamination from outside sources
Piped water	25	Safe though lack of resources for chemicals has resulted in limited treatment of drinking water
Water Tank	15	Generally safe
Hand Pump	15	Safe
TOTAL	100	

Source: UNICEF/ACTED

Box II.3: Human stories - impacts of improved water management

Two interviews conducted by Oxfam in Beshkent District shed light on the hardships of villagers without easy access to water.

Mrs. Hakimova, mother of five, lives with her three disabled children, two of whom are paralysed. Completely immobile, they must be helped with such simple tasks as washing, eating, drinking and getting dressed: they must also be carried everywhere they go. For Mrs. Hakimova, the pressures of single-handedly caring for her children while keeping up with household duties such as cooking and tending the family vegetable plot were once compounded by the arduous task of collecting water from a distant well. A tap installed outside her home has freed up much needed time and energy to devote to other pressing tasks.

Mother Ruhshona's family also used to face many difficulties, owing to a lack of easy access to water. Since a hand pump has been installed, the situation she describes of family life, though far from rosy, is one of significant improvement. Not only has the pump eased the burden on her daughters, it has also enabled the family to expand the kitchen garden. While last year they were only able to grow wheat, this year promises a richer harvest: "Soon my family will have vegetables," remarks Mother Ruhshona.

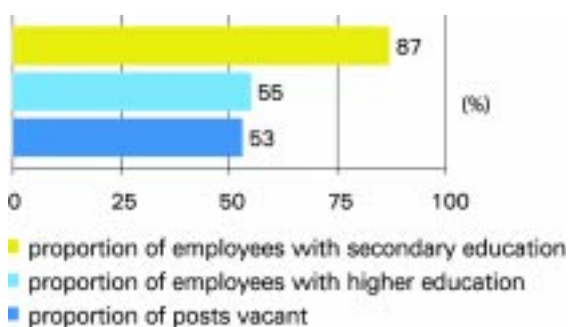
For these two families, as for many others, the installation of something as simple as a tap or a water pump has brought modest yet meaningful improvement, and more hope for the future.

Source: Oxfam



mended minimum for urban dwellers. With such low treatment levels, and another third of the population obtaining water from totally untreated sources, water contamination and the attendant threats to public health remain an everyday reality.

Figure II.4: Low staffing levels at Tajikistan's water treatment plants



Source: MOE

Shortages of chlorine, other coagulants, equipment and spare parts have hampered efforts to maintain water quality. As mentioned earlier, the outflow of qualified water management personnel during the civil war has also impacted heavily on the system. While staff demonstrate great resourcefulness in keeping dilapidated systems up and running, there is an urgent need to upgrade the technical and managerial competencies of existing personnel.

Sewage and sanitation

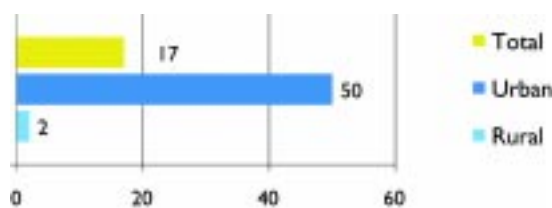
Hygiene conditions in Tajikistan are not well documented. Available governmental statistics provide information on the limited share of the population covered by centralised sewage systems. Sewage coverage has historically lagged behind coverage of piped water systems. Disparities between urban and rural areas can be large: while some 40% of the rural population is connected to piped water, just 2% have access to centralized sewage systems. Within urban areas the situation varies among larger and smaller

With low staffing levels and ageing equipment, water treatment in Tajikistan is greatly weakened. In Dushanbe, 16% of supplies are diverted directly from the river into the distribution network, with no treatment whatsoever.

Photo: Surat Toimastov

cities and among central districts and peripheral areas. As a rule, sewage systems exist only in district centres. Available statistics also do not reflect the deteriorating state of sewage systems, many of which are no longer functioning due to ageing pipelines, lack of maintenance and disruptions during water and power cuts.

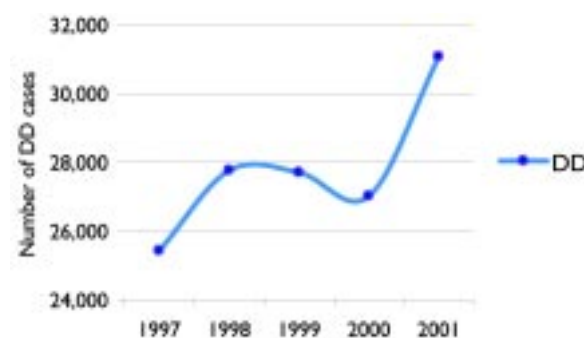
Figure II.5: Just 17% of the population is connected to a sewage system. In rural areas, coverage is as low as 2%



Source: UNICEF. *The government's Poverty Reduction Strategy Paper for 2002* gives a national average of 23% coverage.

Nationwide data on latrine coverage is also lacking. Independent surveys suggest that coverage is nearly universal. However, surveys also indicate that the vast majority of latrines are poorly constructed and, more importantly from a public health standpoint, uncovered. Uncovered latrines raise the probability that insects will spread contamination, a problem especially in the summer months. Pit latrines both in individual homes and in public institutions such as rural schools and hospitals are in a particularly poor state.

Figure II.6: Diarrhoeal disease cases in Khatlon Oblast



Source: SES

Water quality monitoring and health

Five different agencies are responsible for monitoring water quality in Tajikistan. The principal agency is the Sanitary Epidemiological Station (SES), which conducts its own monitoring and has authority to take enforcement actions if water is contaminated. The Ministry of Irrigation and Water Resources, Tajikselkhozvodoprovodstroy (the rural water supply authority) at MIWR, Tajik Municipal Authority (the urban water supply authority) and khukumats are responsible for monitoring supplies to their respective populations. In addition, the Ministry of Environmental Protection also monitors water quality, and, as with SES, has enforcement powers. Meanwhile the water supply authorities are trying to re-establish their water quality laboratories, most of which were destroyed during the civil war. Funding problems are hampering these efforts.

Map II.1 shows the results of water quality analysis carried out by SES during the last two years. While data are available only for Khatlon and Sughd Oblasts, chemical and bacteriological contamination is clearly a serious problem. With over 2,000 samples taken in each oblast, the proportion of samples exceeding regulation levels of contamination varied from 20.6% for chemical contaminants in Sughd to a worrying 54.7% for bacteriological contaminants in Khatlon. These figures show the imperative need for urban and rural water authorities to be supplied with treatment chemicals.

Results from 1997 to 2000 show that an even greater proportion of samples - around two thirds - were substandard. Substandard water quality resulted in large typhoid outbreaks in 1997-2001 in Dushanbe, Khatlon and Sughd Oblasts, and the DRDs.¹⁶ The incidence of acute enteric infections, typhoid fever, malaria and diphtheria, all related to the consumption of poor quality water, remains high in Tajikistan.

According to the World Health Organisation, 60% of all diseases are water-related. Illnesses such as typhoid, diarrhoea, dysentery, diphtheria, and hepatitis are caused by the consumption of contaminated water, while

swamping sites provide breeding grounds for malaria. Tables II.2 and II.3 present the rates of infectious diseases - all water related - in Tajikistan for the period 1998-2000.

The incidence of disease is between three and nine times higher in areas of irrigated agriculture, where ditch waters provide the main source of water for most of the population. The heavy dependence on agriculture in Tajikistan and the resulting exposure to chemicals involved in cotton farming and other agricultural wastes all impact negatively on the nation's health.

Chapter 5: Impacts on irrigation and drainage

Why are irrigation and drainage systems so important?

Of Tajikistan's total 851,000 hectares of arable cropland, 720,000 are irrigated, and these generate 80% of the nation's total agricultural product. Agriculture is a key component in Tajikistan's economy in terms of employment, exports and potential for rural poverty

Map II.1: Water quality monitoring in Tajikistan

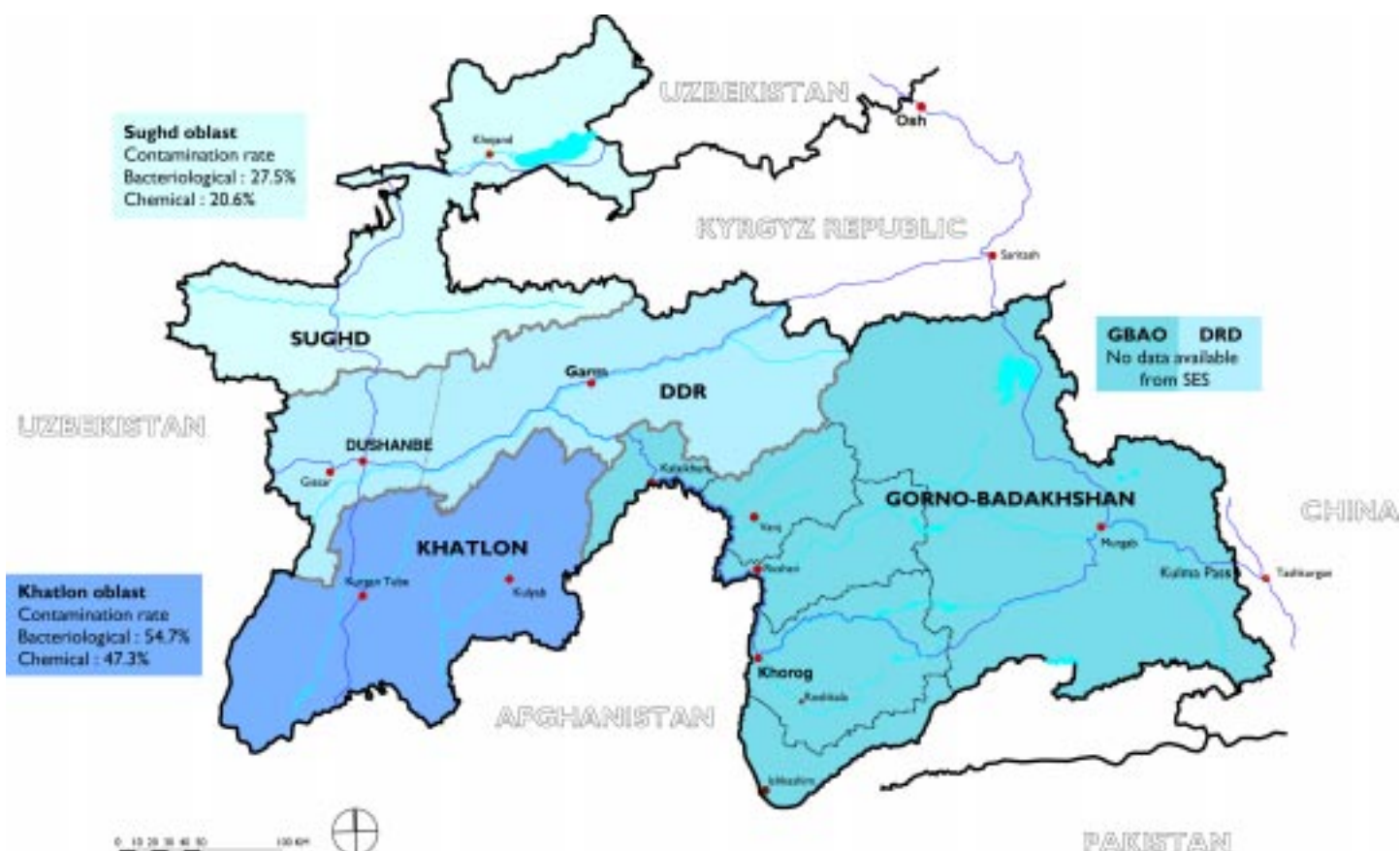


Table II.2: Infectious diseases in Tajikistan per 100,000 people

Year	Typhoid	Diarrhoea	Bacterial Dysentery
1998	171	999	63
1999	120	1,213	60
2000	71	1,377	43

Source: Ministry of Health of the Republic of Tajikistan

Table II.3: Malaria, diphtheria and hepatitis, by comparison with Kazakhstan, per 100,000 people

Year	Malaria		Diphtheria		Hepatitis	
	Kazakhstan	Tajikistan	Kazakhstan	Tajikistan	Kazakhstan	Tajikistan
1998	0.58	319	0.49	2.7	267	122
1999	0.36	220	0.11	0.5	106	164
2000	0.25	308	0.08	0.2	186	159

Source: Ministry of Health and WHO

alleviation: the sector employs 65% of the labour force, and generates 11% of export revenues.

Following independence, subsistence agriculture became a safety net for much of the population as industry and labour markets collapsed: by 2001 employment in agriculture reached 132% of 1991 levels, while employment in industry was still below 50% of 1991 levels (see Table II.5). Although agricultural output declined in the first half of the 1990s, the fall was not as steep as in other sectors, and recovery has been more rapid.

SUBSISTENCE AGRICULTURE BECAME A SAFETY NET FOR MUCH OF THE POPULATION

Much of the population is indirectly dependent on irrigation and drainage systems for food production: rehabilitation of these systems will thus play a crucial role in efforts to redress Tajikistan's food deficit. Changing patterns of agricultural production give some insight into this aspect of poverty in the country: since independence, the share of production devoted to basic foodstuffs such as grain and potatoes has risen sharply. With decreased incomes since 1991, a major shift occurred in the diets of most Tajiks: consumption of meat and vegetables fell by around 50% as the population substituted into cheaper food. Production of potatoes in-

creased from 108,000 tons in 1996 to 318,000 tons in 2001. While substitution into cheaper products has helped to mitigate the impact of falling incomes, the country still runs a 20% food deficit (see Part I) with an annual grain shortfall of over 100,000 tons. Food production could be increased either by cutting back on cotton production or by hastening the farm restructuring process, giving farmers more choice (not to plant cotton, for instance), facilitating credits and upgrading irrigation systems. The UN requested \$43 million in food aid for 2003, but large volumes of external aid, while badly needed, serve to conceal the scope of the problem and reduce the incentive for policy change.

What are the impacts on the irrigation and drainage system?

Since 1991, financing for the sector has plummeted from around \$72 million to a reported \$6.5 million in 2002.¹⁸ Over the same period, about 130,000 hectares - more than a sixth of all irrigated land - have ceased receiving water. As Table II.5 demonstrates, output and productivity declined during the 1990s. Owing to the general economic depression and post-independence civil war, it is difficult to assess the extent to which agricultural output has suffered as a direct conse-

Table II.4: Agriculture - a significant contributor to GDP

	1996	1997	1998	1999	2000	2001	2002 ¹⁷
National GDP (millions of somoni)	309	632	1,025	1,345	1,807	2,512	3,344
Real GDP growth (%)	-4.4	1.7	5.3	3.7	8.3	10.2	9.1
Sectoral distribution of GDP (%)							
Agriculture	36	27.1	24.9	25.4	27	26.7	22.0
Industry	25.7	19.7	20.1	21.7	23.9	22.6	18.7
Trade	14.6	10.2	22.1	19.7	18.3	19.3	20.2
Construction	2.6	2.1	3.9	5.4	3.4	4.1	2.6
Other	21.1	40.9	29	27.8	27.5	27.4	36.5

Source: State Statistical Committee and IMF



Agriculture is the economic lifeblood for 65% of the national workforce. With funding for irrigation and drainage at less than 10% of 1991 levels, the system today is on the brink of collapse: just 51% of water entering the irrigation system is thought to reach the fields. Rural incomes, not to mention the national economy itself, pay the price.

Photo: Surat Toimastov

Table II.5: Agriculture and industry in Tajikistan: sectoral output and employment, 1996-2001

Index 1991 = 100	1996	1997	1998	1999	2000	2001
Agriculture						
Output	58.7	57.3	57.8	58.6	66.1	73.5
Employment	116.4	129.9	123.7	126.8	128.8	132.4
Productivity	36.8	34.2	38.5	38.6	44.4	48.0
Industry						
Output	33.0	32.3	35	37	40.6	46.6
Employment	69.8	63.2	57.1	51.3	46.7	50.5
Productivity	56.4	62.9	75.5	83.6	99.8	115.5

Source: State Statistical Committee and IMF

Box II.4: Making modern mirabs - alternatives for increasing staff capacity in irrigation

The importance of the traditional watermaster in Central Asian society is illustrated by an anecdote. Traditional law has it that when the position of watermaster - or mirab - fell vacant by death or some other exigency, a new mirab was chosen through a trial by fire. Candidates who declared their interest in the position were given a test in which they were required to build a small demonstration canal from one point to another. The engineer whose canal guided the water to its destination first won the test and became the new mirab. Other contestants suffered more than the mere ignominy of defeat - they were put to death. This practice reduced the number of contenders for this important societal post while ensuring that the science of irrigation engineering was pursued with a fitting seriousness of purpose. This legend, of course, may be largely apocryphal, but it nevertheless illustrates the importance that Central Asians have traditionally attached to the management of irrigation systems.

Source: Adapted from Gregory Gleason's *The Central Asian States - Discovering Independence*.

quence of the degrading of irrigation and drainage systems. I&D systems are not exclusively to blame for earlier declines in production, and output is rising towards 1991 levels at a rate of around 8% per year. However, the I&D system's state of disrepair after a decade of underinvestment will restrain agricultural recovery.

The main impact on I&D systems is the disuse of a sixth of formerly irrigated lands. If 80% of the agricultural product comes from irrigation, this contraction in the area to which water is actually delivered, or sown area, represents lost earnings of 16% in the agricultural sector, and of over 4% in GDP terms (2001 figures).

Maintaining technology-intensive systems is proving unsustainable as utility tariffs rise and the skills gap persists. One of the main reasons for such a rapid decrease in sown irrigated land is Tajikistan's high dependence on pumping. Around 48% of the country's irrigated land depends on pumping systems, with lift heights ranging from 10m to more than 200m. High lift pumps are found principally in Sughd and Khatlon Oblasts.

SINCE 1991 MORE THAN A SIXTH OF ALL IRRIGATED LANDS HAVE CEASED RECEIVING WATER

While gravity irrigation schemes rely on river intake structures to divert flow into a gravity conveyance system, pumped irrigation schemes lift water from rivers up to main canals or to piped conveyance systems at a higher level. Some of the pump schemes used in Tajikistan, known locally as cascades, involve pumping lifts of several hundred meters through a succession of staged pump stations. The 445 pumping stations in the country, comprising 1,845 actual pumps, require higher levels of electricity and know-how than regular gravity-fed irrigation. Few farmers can afford the new electricity tariffs required to pay for this infrastructure, and many of the top engineers and technicians who used to service these systems left the country in the aftermath of independence and the civil war. In addition, the lack of spare parts means that cannibalization of other machinery for makeshift repairs is widespread, further hampering efficiency and accelerating degradation of the rest of the system. While there is generally sufficient

construction equipment to undertake desilting work, operational funds are insufficient even for the purchase of fuel to undertake this. The Ministry of Irrigation and Water Resources reports that as much as 65% of pumping systems may be out of operation, while water supplies are down by 40% or more.

LARGE VOLUMES OF FOOD AID, WHILE BADLY NEEDED, ALSO SERVE TO CONCEAL THE SCOPE OF THE PROBLEM AND REDUCE THE INCENTIVE FOR POLICY CHANGE

Many farmers find it hard to pay electricity tariffs for pumping. The agricultural sector consumes about 2 billion kilowatt hours a year (the IMF reports this may be as high as 4.5 billion kilowatt hours - a third of total consumption in the country). In line with government policy, tariffs should increase from \$0.16 per kilowatt hour in 2002 to \$0.32 in 2003, and \$2.38 by 2006. A sixteen-fold increase over four years, this will give pumping costs of between \$10 and \$35 per hectare. Given the slender profit margins of many farmers, it is hard to see how they will be able to meet these tariffs without corresponding increases in yields and farm revenues.

THE LACK OF SPARE PARTS MEANS THAT CANNIBALIZATION OF OTHER MACHINERY FOR MAKESHIFT REPAIRS IS WIDESPREAD, FURTHER HAMPERING EFFICIENCY AND ACCELERATING DEGRADATION OF THE REST OF THE SYSTEM

Water losses are on the increase. Efficiency (the proportion of the water diverted from the river or other source that actually reaches the fields) averages around 60% for most of the country. The predominance in the country of earth irrigation channels (41%) with high rates of silting, evaporation, and filtration (seepage into the ground), rather than lined (29%) or piped channels (30%) significantly reduces delivery efficiency. In the absence of funds to upgrade channels, more water will need to be pumped to meet demand. But this will only contribute to the strain on dilapidated pumping systems and risk increasing tensions with downstream neighbours, especially in times of water shortages.

Table II.6: Irrigated land by pump lift heights in Tajikistan

Lifting height (m)	Pumped irrigation (ha)	Pumped irrigation (%)
0-100	247,450	70.7
100-150	50,750	14.5
150-200	44,800	12.8
200-250	4,550	1.3
250-300	2,450	0.7
Total	350,000	100

Source: Ministry of Irrigation and Water Resources and World Bank

Other impacts on irrigated lands

Poor management and limited drainage infrastructure have resulted in salinization and waterlogging. While the main impact on I&D of low funding and poor management has been rising inefficiency of water transport, a separate problem concerns over-watering and its impact on soil fertility. Collection and drainage networks cover only 311,200 hectares - less than half the total irrigated area. As a result, around 15% of irrigated lands are over-saturated every year. Without adequate drainage, water dissolves salt occurring naturally in the soil and causes it to rise to the surface. When enough salt enters the root zone of the crop, plant growth is retarded and yields fall. Moreover, rising salinity increases water requirements: farmers try to flush salt out of the soil by applying large volumes of water before or after the growing season, a practice known as leaching. While salinization is not as acute in Tajikistan as in the downstream countries, 16% of Tajikistan's irrigated lands are affected. Given the constraints in delivering water to the fields, effective leaching is difficult, reducing yields still further. Table II.7 shows the areas of irrigated land affected by salinization. The Ministry of Irrigation and Water

Resources estimates cotton production losses from salinization at 100,000 tons per year.

With just 0.12 hectares of irrigated land per capita (just over half the average for Central Asia) this is a sizeable loss.

Footnotes

- 9 Academy of Sciences
- 10 World Bank. Dushanbe Water Supply Project, Project Appraisal Document, May 2002, page 4. Most recent figures from Dushanbevodokanal, the authority responsible for water supply to the capital, report a consumption rate of around 450 litres per person per day, including losses.
- 11 UNICEF Tajikistan, Mid-Term Review, 2002
- 12 World Bank Project Appraisal Document for the Dushanbe Water Supply Project, page 5
- 13 *Ibid*, page 20
- 14 120 million cubic metres at 50% purification efficiency = 60 million cubic metres adequately treated each year, of a yearly total 650 million cubic metres of piped water in the country = 9.2%
- 15 60 million cubic metres divided by 3.7 million people connected to centralised piped water systems = 16 m³/person/year = 44.4 litres/person/day (16 cubic metres / 365 days = 0.0444 m³/person/day × 1000 = 44.4 litres/person/day)
- 16 Direct Rule Districts
- 17 Preliminary data
- 18 Ministry of Irrigation and Water Resources
- 19 World Bank: 'Irrigation in Central Asia - Social, Economic and Environmental Considerations', 2003.

Table II.7: Area of irrigated land in Tajikistan affected by low, medium and high salinization

Degree of salinization	Low	Medium	High	Total
Irrigated land affected (ha)	21,032	73,555	21,497	116,200
Irrigated land affected (%)	3%	10%	3%	16%
Estimated loss in cotton yields ¹⁹	20-30%	40-60%	> 80%	

Source: State Land Committee

Part III

Cotton: maximizing water benefits through improved management²⁰

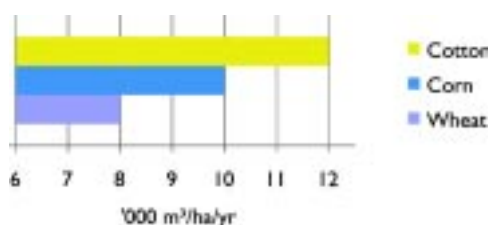
Cotton is big business in Tajikistan. Accounting for 20% of the workforce and 11% of exports, it fetches a high price on world markets owing to its special lustre, the result of autumn sun throughout the picking season. Cotton revenues have the potential to be a powerful tool for poverty alleviation.

Photo: uxop



Part II of this report considered some of the constraints facing water management in Tajikistan and the impact of poor management on economic and human development outcomes. This section addresses the extent to which farmers are able to maximize benefits from the country's rich water resources. All water users, domestic and agricultural alike, suffer from poor management of the water sector. However, a key problem in maximizing water benefits for many agricultural users concerns not only the constraints and weaknesses of the water system, but problems in the structure of the agricultural sector itself. The cotton subsector in particular is problematic.²¹ This chapter examines the importance of water as a key input for one of Tajikistan's main income generator. It asks the question: is the lucrative cotton sector structured in such a way as to return maximum benefits to the economy and to the people involved, farmers and their families?

Figure III.1: Tajikistan's competitive advantage - plenty of water means thirsty cotton can be a lucrative income generator in Tajikistan



Chapter 6: The relevance of cotton in a discussion on water

A discussion of water resources in Tajikistan must address the subject of cotton for four reasons:

- **Cotton production is highly water intensive.** With its vast water resources, Tajikistan is well-placed to produce cotton.
- **Cotton is one of the country's most valuable export commodities.** Although cotton's predominance is often blamed for perpetuating the country's low food supply, it also generates key export revenues on which the economy depends.
- **Cotton revenues have enormous potential for poverty alleviation in Tajikistan's agricultural sector.** With the decline in industry since independence, agricultural employment had risen 32% by 2001, as employment in industry halved.²² This increasing dependence on agriculture is most acute in rural areas, where poverty is greatest. It is in these areas that the benefits of stronger water system management could have the strongest impact on the welfare of farmers and their families.
- **Dependence on the cotton sector distorts the allocation of water resources.** For the reasons above, Central Asian states have historically favoured cotton over other crops. Indeed it was cotton exports from Central Asia in the early 1960s that turned the Soviet

Union from a net importer of cotton to a net exporter. As a key source of foreign exchange, employment and fiscal revenue, state farms were obliged to plant cotton. Since independence, the sector has been shielded from liberalization in order to maintain revenues for the state. In 2001, cotton accounted for 43% of all planted crops in Tajikistan. 77% of this cotton came from state-owned farms, though this was down from 89% in 2000. By contrast, 43% of overall non-cotton croplands were still under direct government control in 2000.²³ The state is directly and heavily involved in this lucrative sector, and private farms are also forced to plant cotton (although many of these are only private on paper): if they do not, inputs such as water, seed and fertilizer may be withheld by the local authorities and suppliers. Credit for all these inputs is also often conditional on planting cotton. As a result, a large portion of the agricultural workforce (conservative estimates put the figure at 400,000 - over a third of all employment in the sector)²⁴ is involved in cotton production. Owing in part to the state-sanctioned emphasis on cotton production, many farmers lack the opportunity or the skills to diversify into other crops. Without a more diverse mix of crops, many agricultural workers are dependent on this one commodity for their livelihoods.

**IN 2000, 89% OF ALL COTTON CAME
FROM STATE-OWNED FARMS**

Given the water-intensive nature of cotton production, its historical importance as a revenue-generator for the state, the potential welfare benefits of cotton-sector restructuring and the distortion of resource allocation driven by dependence on the sector, a discussion of water in Tajikistan must address in some depth the subject of cotton.

Chapter 7: How valuable is cotton for Tajikistan?

Best agricultural export. Though the cotton sector has declined considerably since independence (from 34% of exports in 1993 to 11% in 2001), cotton is still the

country's third largest export, after aluminium and electricity (61% and 12% respectively). Cotton currently fetches around \$1,000 per ton, as compared to wheat, for example, which brings in \$160 per ton.²⁵ As cotton is Tajikistan's only major agricultural export, and as the agricultural sector accounts for 65% of employment in the country, cotton has great potential for improving the livelihoods of Tajikistan's rural poor.

Competitive advantage. In addition to plentiful water, Tajikistan has another distinct advantage in producing cotton. With 300 days of sun per year, the weather in Tajikistan is still sunny in September during the picking season. This lends Tajik cotton a unique lustre that fetches a 10%-15% premium on the world cotton markets.

Increased yields - increased incomes. Estimates from the World Bank indicate that yields can rise by 40% from 1.8 tons/ha (2001) to 2.5 tons/ha once irrigation and drainage systems are rehabilitated. They also envisage a revival in world cotton prices after the slump of the past few years, from around \$1,000 per ton at current rates to around \$1,350 per ton in 2010, an increase of 35%. With a 40% increase in total yield (from 453,000 tons to 634,000 tons) combined with a 35% price increase, revenues are projected to rise dramatically.

Chapter 8:

Why don't farmers feel the full benefits of cotton production?

On the basis of the information above, Tajikistan's farmers ought to be doing very well. In reality, though, the sector is deeply in debt, and farmers capture little of the benefits of plentiful water and sun. Table III.1 shows the gross profit margins per hectare for a range of crops. Cotton, the most valuable on the export markets, returns conspicuously low margins for farmers, suggesting the costs of getting cotton to world markets

Table III.1:Tajikistan - average gross margins for selected crops

Crop	Gross Margin (\$/ha)
Potatoes	1,756
Vegetables	619
Corn and hay	295
Grains and rice	260
Fruits, inc. grapes	248
Cotton	169

Source:Asian Development Bank

are particularly high.

Background

From state-sponsored to quasi-deregulated: a sector in transition. With the collapse of the command economy, Tajikistan lost both its main market for cotton as well as its prime source of financing and investment - Russia. In order to maintain production after independence, the government gave credit loans to state farms through the National Bank of Tajikistan. Owing to the national bank's weak fiscal capacity, this practice was difficult to sustain and was ended under an agreement with the IMF in 1996. The following year, the government sought and received new loans from Credit Suisse First Boston (CSFB), with the help of P.Reinhart, the world's second largest cotton trader. Reinhart owns a majority share in Agroinvest, Tajikistan's main agricultural bank, which distributes funds through the National Cotton Exchange (NCE). The NCE replaced Glavkhlopprom, the state organ that formerly set prices for and purchased almost all cotton in the country.

ESTIMATES PUT THE COST OF COTTON FINANCING FOR FARMERS AT 21%

NCE funds are finally channelled to cotton farmers through local intermediary companies, known as "investors". There are around 16 such investors, entering into annual contracts with farmers and typically taking a proportion of the crop for repayment of the loan. Despite formal deregulation, the NCE and district governments administer the entire system, assigning crop area quotas and planned output targets to collective farms and private farmers alike. Export operations remain the province of those few with the influence and

connections necessary to obtain an export licence.

Profitability, financing and debt

Slumps in international cotton prices combined with low yields and inadequate inputs mean that profitability in the cotton sector has declined considerably in recent years, with productivity decreasing from 2.8 tons per hectare in 1990 (ADB reports 1990 level of 2.0 tons) to 1.5 tons in 1997-2000. With the end of the drought, expanded crop area and more timely inputs, yields increased in 2001 to 1.8 tons per hectare. However, the 1997 loan from CSFB that helped finance this revival, totalling \$80 million, has never been fully repaid, and has since become an annually rolled over financing facility for cotton production.

Lucrative commodity, but high production costs.

Cotton production in Tajikistan requires capital inputs of around \$65 million a year, of which farmers provide around 8% from their own funds. This means that farmers must raise a further \$60 million in capital inputs each year from commercial investors. Commercial loans, largely from CSFB, are available to Agroinvest at interest rates of around 10% per annum. Agroinvest loans to investors at 12% per annum. There is no fixed margin for investors' returns, but they employ a variety of means for covering costs, including commission on provision of inputs, control of ginning margins and control of the amount of fibre returned to the farmer for sale or export. The ADB estimates the cost of financing for farmers at 21%. Farmers report that inputs, especially fertilizer, are frequently delivered late; delays in payments for labour are common, especially for picking, as these are due after the investors have taken possession of the

Table III.2:Tajikistan - profitability of cotton exports, 2001 (in \$ per ton of cotton fibre)

	Costs and Price
Total costs	884
Growing ²⁶	450
Harvesting ²⁷	105
Ginning	150
Transport	125
Others	54
Sales tax ²⁸	98
Break-even export price	982

Source:Agroinvestbank and IMF



For Tajikistan's farmers, apples and grapes present two lucrative alternatives to cotton. According to World Bank figures, they return gross margins of \$404 and \$48 per hectare respectively, compared with \$17 per hectare for cotton, under the present structures. Fruit and vegetables have the added advantage of augmenting the rural food supply.

Photo: www.tajnet.com

produce and are, therefore, least concerned to pay. This financing system is extremely costly for farmers. Cotton revenues in 2001 were around \$111 million, of which \$52 million is owed to creditors, including interest on debt. This leaves \$57 million to cover farm costs, while working capital required is \$65 million. The deficit of \$8 million is equal to \$30 per hectare per annum - and this in a relatively good year when yields averaged 1.8 tons per hectare, as compared with a low 1.25 tons per hectare in 1999.

Crippling debts. National debts in 2002 totalled over \$90 million, pertaining to around 70% of irrigated lands. Average accumulated debts are \$300 per hectare, rising to \$2,000 in some cases. Until September 2002, local administrations set up systems of "cotton balances" through which farmers would begin to pay back their debt. The debt "bill" for a given district was converted into an area of cotton, based on agreed productivity levels, and the target area was then allocated to indebted farmers. This practice gave local administrations a strong hand in distributing inputs and controlling ginning margins and fibre returns to farmers.

Persistent monopolies. According to the IMF, since the first CSFB loan direct financing arrangements between farms and foreign cotton importers have multiplied.²⁹ In reality, Reinhart, the Swiss trading company, controls 95% of all cotton exports. There is also very little competition in the ginning process. Tajikistan has 23 ginneries: 20 have already been privatised, with the last three due for privatisation in 2003. Investors own five of them outright, the others being joint ventures with the Ministry of Agriculture, which retains a 25% stake. Ginneries are effectively

local monopolies; normally there is only one ginnery in each district, and each ginnery assesses the quality and quantity of fibre, and accordingly the value of raw cotton, from suppliers. Ginneries are reported to pay well below market prices for raw cotton. While the law allows for the free movement and export of cotton, in practice it is very difficult for farmers to take their produce to another ginnery for a second opinion or a better rate.

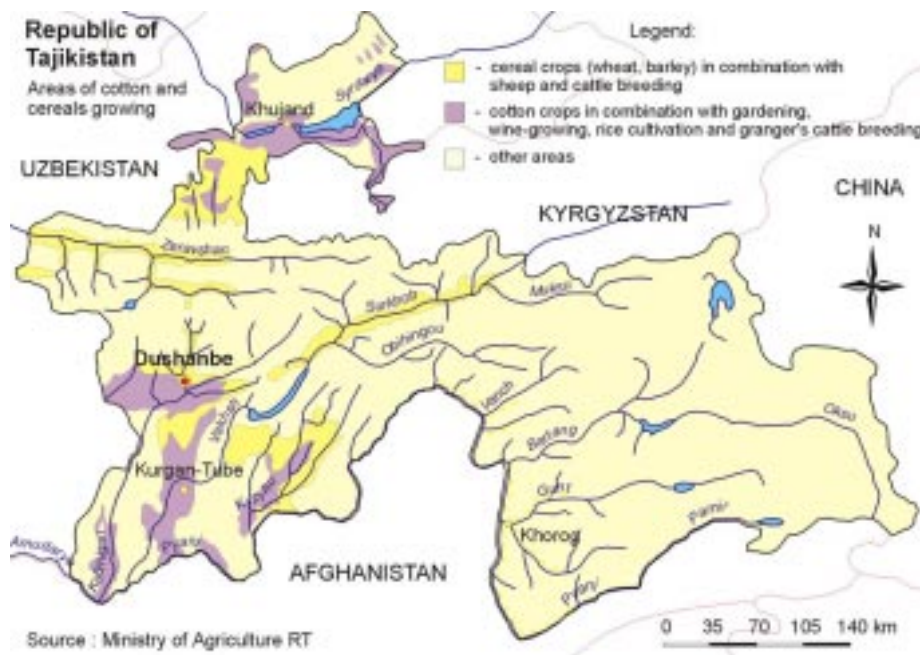
AS THERE IS NORMALLY ONLY ONE GINNERY IN EACH DISTRICT, THEY TEND TO ACT AS LOCAL MONOPOLIES, PRESCRIBING BOTH THE QUALITY AND QUANTITY OF FIBRE REQUIRED FROM FARMERS

Transport costs are high and discourage competition among ginneries for raw cotton, and local administrations prefer that the local ginnery be used.

While a presidential decree from September 2002 removed value added tax on cotton, the government still levies a 10% export tax: less than a third of the cotton product is consumed domestically, meaning that most farmers are hit hard by the tax.

The impacts on farmers

- Farmers' relations to the free market are distorted by the current production structures. They have little choice over where to obtain credit and other inputs, and consequently experience severe delays in payments in their often-unreliable relations with investors and district governments, amounting to implicit taxation.
- Farmers are underpaid for their raw cotton by ginneries which act as local monopolies. Despite the



Map III.1: Cotton-growing areas in Tajikistan

reduction in export taxes (from over 50% of the value of output in the mid-1990s to about 10% currently), the price of raw cotton paid by ginneries is on the order of \$190 per ton (which is low compared to neighbouring countries where the gin price is in the order of \$240-\$300 per ton, and even lower compared to world farmgate prices). Even this low figure of \$190 is disputed: the Ministry of Agriculture reports that returns to farmers may be as low as \$40 to \$45 per ton, depending on quality.³⁰ The financial returns on cotton are potentially good, but the actual returns paid to the large farms producing cotton are very low (with farm wages also very low as a result). Increased competition in the sector would do much to alleviate problems in this area.

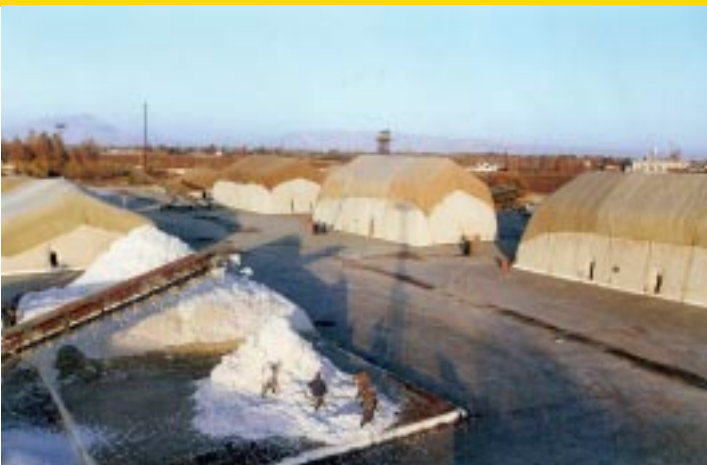
- The interest of the state in promoting cotton to maintain its revenues and foreign reserves induces it to maintain large farms and limit restructuring in the cotton growing regions of Khatlon and Sughd.
- Futures contracts between farmers and investors have been concluded on bad terms for farmers who have little familiarity with such financial instruments. Futures contracts ensure regulated prices for several years and remove uncertainty from fluctuating commodity prices. Contracts were negotiated with farmers who had (and still have) very limited access to market information and little knowledge or experience

of fair contracting arrangements. Some contracts stipulated that farmers had to purchase inputs from the investor without fixing input prices for the duration of the contract: prices were then raised above market levels, leaving farmers with no contractual recompense.

FUTURES CONTRACTS BETWEEN FARMERS AND INVESTORS HAVE BEEN CONCLUDED ON BAD TERMS FOR FARMERS WHO HAD LITTLE FAMILIARITY WITH SUCH FINANCIAL INSTRUMENTS

- Investors and local administrations with interests in cotton exert disruptive pressure on communities. During the picking season (from September to December), school pupils, university students, factory workers and others involved in state-run institutions are taken to pick cotton. Classes are cancelled throughout the autumn so that thousands of students can join in. Labourers are given food and water for sustenance, but wage rates are extremely low.³¹

Movement for change? In the wake of positive roundtable discussions in September 2002, presidential decrees resulted in two significant developments: value added tax on cotton was removed, and the cotton 'balances' (planting requirements) described earlier were formally abolished. Officially this ends the monopoly of Agroinvest Bank and gives farmers more



Stacks of cotton in Khatlon Oblast: representing 11% of current exports for the Tajik economy, a more competitive cotton sector could do much to raise rural incomes

Photo: G. Ratushenko

latitude to select their investors. It is hoped, in turn, that this will promote competition amongst prospective local and international actors, thereby strengthening the hand of farmers. In addition, the decrees in principle reduce the influence of regional and district administrations in respect of cotton production. Whether these decrees will have the hoped for practical impact is an open question, one that should be under close scrutiny this coming season.

In conclusion, inadequate restructuring, vested interests, indebtedness and poor knowledge of market information amongst farmers mean that the considerable potential of cotton as a means of redressing rural poverty continues to go unrealised. Poor irrigation, a major factor contrib-

uting to low crop yields, is but one of many constraints on this potential. As mentioned earlier, improved water management could raise yields from the current 1.8 tons per hectare to a more profitable 2.5 tons per hectare. However, yields of any magnitude will only be profitable if measures are taken to reduce debt, increase competition amongst ginneries, raise awareness amongst farmers about their rights and provide market information, and confront persistent vested interests, including the Ministry of Agriculture's 25% holding in the ginneries and 77% control of cotton-producing farms. The Asian Development Bank in fact estimates that a yield of 2.5 tons represents the break even point under current conditions: it is clear that improvement in water management alone will not generate the cotton benefits that Tajikistan's rural poor so badly need.

Footnotes

- 20 This section was prepared with material from the Asian Development Bank, the International Monetary Fund, the International Crisis Group and the World Bank. Key documents consulted include 'Agriculture Rehabilitation Project - Report and Recommendation' (ADB, 2002); 'Tajikistan - a Roadmap for Development' (ICG, 2003); 'Tajikistan - Selected Issues and Statistical Appendix' (IMF, 2003); and 'Tajikistan - Towards Accelerated Economic Growth' (WB, 2001). Use of this material is gratefully acknowledged.
- 21 Strictly speaking, cotton is a subsector of the agricultural sector, but henceforth it will be referred to simply as the cotton sector.
- 22 IMF: 'Republic of Tajikistan: Selected Issues and Statistical Appendix', January 2003.
- 23 IMF: 'Republic of Tajikistan: Selected Issues and Statistical Appendix', January 2003.
- 24 ICG: 'Tajikistan - A Roadmap for Development', April 2003.
- 25 ADB: 'Agriculture Rehabilitation Project Report', November 2002, and ICG, *ibid*.
- 26 Based on \$300 per ha, yield of 2 tons of raw cotton per ha, and 1/3 conversion rate raw cotton into cotton fibre
- 27 Based on \$70 per ha
- 28 Based on sales tax rate of 10% of export price
- 29 IMF: 'Republic of Tajikistan: Selected Issues and Statistical Appendix', January 2003, p. 51.
- 30 ICG: 'Tajikistan - A Roadmap for Development'
- 31 *Ibid*.

Part IV

Hydropower: meeting needs, and addressing issues of effective demand

Tajikistan's greatest economic resource is hydropower. The second largest producer of hydropower in the CIS (after Russia) and the highest per capita generator in the world, there is much debate as to how Tajikistan should best develop its hydropower potential. The first chapter in Part IV examines the potential of hydropower as a means of advancing economic and human development in Tajikistan. A second section considers the dynamics of the regional energy market and the need for upgrading old infrastructure. The last section reviews the outlook for regional energy demand and possible roles for Tajikistan.

Chapter 9: Electricity and human development in Tajikistan

Electricity plays an important part in lifting people out of poverty. It is the most convenient source of energy for cooking, heating and lighting, thus freeing up time (from fuel gathering, for instance) and enabling people to extend the working day (after sunset) and thus increase productivity. In addition, it is an essential resource for the emergence of small businesses and industrial initiatives. Rural electricity services help promote non-farming enterprises (such as food processing), thus stimulating more opportunities for cash-generation and diversifying the rural economy.

Impact of electricity on education

Modern energy services promote education. At school, electricity provides essential heat and lighting, while at home it allows for homework or evening classes. At home, electrical power eases the burden on children of household chores such as gathering firewood and fetching water. Power paves the way for access to educational media and information and communications technology³² (ICT) in schools and at home. By improving access to pumped clean water, sanitation, lighting and heating, energy can help to create a more child-friendly environment.

Girls collecting firewood in Gorno-Badakhshan: electricity shortages across the country have increased dependence on traditional fuels, such as wood. The costs: deforestation, and more time spent away from school.

Photo: AKFED



Box IV.1: How can electricity improve health?

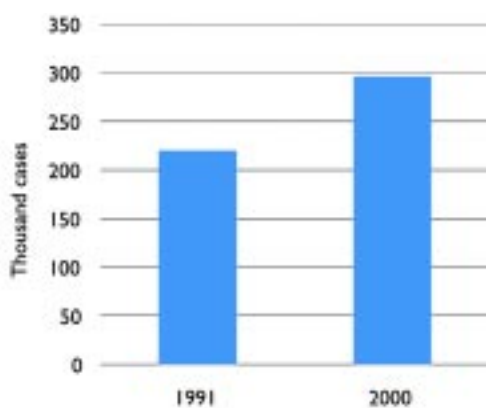
Electricity:

- * Helps in the preparation of well-cooked food and boiled water, and in heating the home.
- * Facilitates pumped clean water and purification.
- * Promotes household safety (less burns, accidents and house fires).
- * Enhances access to better medical facilities, enabling night availability, helping retain staff, and allowing equipment use (e.g. for sterilization).
- * Allows vaccine and medicine storage for preventing and treating diseases and infections.
- * Enables access to health education through ICT and broadcasting.

Impact of electricity on gender equality and women's empowerment

Improving access to energy is of particular benefit to women. Women are generally responsible for gathering fuels and performing household duties, such as cooking, that require energy. As gas and electricity coverage has receded since 1991, traditional substitute fuel sources such as wood are being diminished. Women and girls often spend large amounts of time searching for and transporting fuel. These chores leave less time for productive employment, education or community involvement. Only a reliable source of electricity can relieve women of these burdens.

Figure IV.1: Acute respiratory infections in the rural population have increased by 35% since 1991, largely as a result of burning wood indoors



Source: ADB

Impact of electricity on health

Traditional stoves that burn wood or other biomass (animal dung, for example) are much less efficient than modern gas or electric stoves. Exposure to pollutants produced by burning wood and biomass - mostly carbon monoxide and carcinogenic compounds - can lead to acute respiratory infections, chronic obstructive lung diseases and lung cancer. (See Figure IV.1) The same pollutants have also been linked to pregnancy-related problems including stillbirths and low birth weight. Indoor air pollution is also associated with blindness and immune system deficiency.

When fuel is scarce, food is less likely to be adequately cooked and water is less likely to be boiled for drinking, putting the whole family at risk.

A hospital kitchen in Gorno-Badakhshan: no electricity hampers even basic service provision, such as hot meals for patients



Chapter 10: Meeting electricity needs - hydro generation and the regional dynamic

Tajikistan's hydro has the potential to meet all the needs discussed above. The country is famous for its hydropower: with the ninth largest installed capability in the world, 95% of the country's internally generated electricity comes from clean and renewable hydro-power. And at present, just 10% of potential generation capacity has been harnessed.

However, Tajikistan's vast generation capacity belies several problem areas in the power sector.

First, Tajikistan runs a net energy deficit. According to the IMF, Tajikistan imported 35% more electricity than it exported in 2001. This deficit is larger than in previous years (see Table IV.1), possibly due to the drought and lower water levels in Tajikistan's reservoirs in 2000-2001. In general the energy deficit is owed to two main factors: 1) reservoir capacity in the country is not sufficient to store enough snowmelt during the spring and summer to see Tajikistan through the winter months and 2) the northern part of the country is not connected to the main power grid in the south.

Although there is ample generation capacity, the country's largest reservoirs are forced to spill water every summer because they are simply not big enough. This spillage represents lost winter generation potential (essential for heating and lighting) and economic loss. Demand for surplus electricity is weak during summer

months and is sold at low prices to Tajikistan's neighbours. The case of Nurek Reservoir is illustrative: despite possessing the highest dam in the world, Nurek must spill 1.5 billion kilowatt hours every summer. With this spillage - from just one reservoir - Tajikistan's power output is reduced by more than 15% (though this does have desirable benefits for the downstream environment).³³

IN PER CAPITA TERMS, TAJIKISTAN USES A QUARTER OF THE AMOUNT OF ELECTRICITY CONSUMED IN THE DOWNSTREAM CENTRAL ASIAN STATES, AND A TENTH OF THE AMOUNT USED BY WESTERN EUROPEANS

As a result the country must import power from Uzbekistan (90% of imports), Turkmenistan (7.5%) and Kyrgyzstan (2.5%) during the winter months, to meet heating and lighting demands. Kyrgyzstan, by contrast, has twice the reservoir capacity of Tajikistan and consequently is able to supply sufficient power to meet its own needs in most years.

Second, Tajikistan is ill-equipped to handle rising domestic power demand. At present, Tajikistan has one of the lowest per capita energy consumption rates in the Former Soviet Union. The country's inhabitants use a quarter the amount of power consumed per capita by their neighbours in downstream Central Asian states, and a tenth of the amount used by Western Europeans. In addition, although the proportion of the population connected to the electricity grid is reportedly very high (around 98%), only 14% of the rural population uses electricity for cooking and heating.³⁴ This is because the majority of the rural population cannot yet afford modern electrical appliances. Even if they could, however, there would not be enough electricity to

Table IV.1: Tajikistan - electricity output, trade and consumption, 1996-2002 (billion KWh)

	1996	1997	1998	1999	2000	2001	2002 ^(Jan-Jun)
Output	15.0	14.0	14.4	15.8	14.3	14.4	7.2
Of which:							
Hydropower	14.9	13.7	14.1	15.6	14.1	14.2	7.1
Thermal power	0.1	0.3	0.3	0.2	0.2	0.2	0.1
Imports	2.9	4.0	3.6	3.6	4.3	5.4	2.4
Exports	3.8	3.9	3.3	3.8	3.9	4.0	1.7
Total internal consumption	14.1	14.1	14.6	15.6	14.7	15.7	7.8

Table IV.2: Internally produced electricity by source and output in Tajikistan, 1996-2000

Sources: State Statistical Committee and IMF

	1996	1997	1998	1999	2000
Electricity production (billion kWh)	15.0	14.0	14.4	15.8	14.3
Electricity source - gas (%)	1.2	2.1	1.9	2.3	...
Electricity source - hydroelectric (%)	98.8	97.9	98.1	97.7	98.6

supply them. Unless power is imported or domestic output is increased (or both), rising domestic demand will make for more frequent power shortages.

The Central Asian Republics rely on Tajikistan and Kyrgyzstan at peak hours. While susceptible to shortages for year-round generation, upstream hydro is ideally placed to meet early morning and late evening demand. Since hydropower may be instantaneously turned on or off (compared with thermal power stations, which require more time to reach maximum output), Tajikistan is better able to meet demand for electricity at peak hours. Since power prices are higher at peak hours, this competitive advantage generates valuable export revenues. Conversely, Tajikistan pays lower prices for its own base-load power imports, at non-peak hours in winter. To secure this competitive advantage, Tajikistan endeavours to store enough water to meet peak hour needs for itself and its neighbours, both in summer and in winter. As storage capacity in winter does not allow for the country to provide electricity throughout the day, Tajikistan relies mainly on Uzbekistan to provide base load from January until April.

However, these energy swaps are not always as profitable as they could be: Tajikistan's geography compounds power supply problems. The northern part of the country lies in the Ferghana Valley, separated from the main electricity grid by two large mountain ranges. This

region is home to most of the country's non-aluminium industry, which consumes more power than Tajikistan is able to supply from northern generators. At 800 GW (16% of annual output),³⁵ the shortfall is small, but owing to the north's isolation from the southern grid Tajikistan is forced to engage in less favourable energy swaps with Uzbekistan. Despite the higher prices paid for peak hour electricity, power imports to Tajikistan typically exceed exports by around 10% in dollar terms.

Covering costs

Since the civil war, energy sector revenues have barely covered operating costs for Tajikistan's hydro network. There is not enough money in the system to pay for badly needed maintenance and upgrading, nor for further development. The government has increased tariffs considerably, in line with donor requirements. But with fluctuating collection rates and the depreciation of the Tajik somoni, revenues remain limited.

TAJIKISTAN'S HYDRO SECTOR SUFFERS AN ANNUAL SHORTFALL OF \$20 MILLION FOR BASIC CAPITAL INVESTMENTS IN MAINTENANCE AND UPKEEP

Full operating costs for the system (including maintenance and depreciation) are reported to be around \$60 million a year.³⁶ Under the command economy in the late 1980s hydropower in Tajikistan had a turnover of \$150 million, sending \$90 million of profit to Moscow every year. Today, revenues only cover current costs, at around \$40 million a year, leaving an average annual shortfall of \$20 million for basic capital investments in maintenance and upkeep. Even if tariffs and collection rates were to increase to cover this annual shortfall, it seems unlikely that the sector will be able to recover from the last ten years of underinvestment without more substantial help from the government and international actors.

Table IV.3: Import and export tariffs for electricity to and from Tajikistan, \$/KWh

	1997	1998	1999	2000	2001
Export	0.039	0.031	0.046	0.046	0.019
Import	0.045	0.033	0.049	0.047	0.018

Source: Barki Tojik

The impacts of underinvestment

The greatest impact of underinvestment is on the power infrastructure itself: increasing leakage in dams, failing turbines and transformers, reduced staffing and monitoring - all threatening efficiency, reliability and security. While hydro systems typically lose around 10% of power in normal operating circumstances, Tajikistan's hydroplants are estimated to lose as much as 30-40% of their power output. In practical terms, this means that to produce an average year's 15 billion kilowatt hours of electricity, Tajikistan must use 30% more water than should be required. Given the limited storage capacity (and decreasing precipitation rates over the last 50 years), the need for rehabilitation is urgent.

A strong case can therefore be made for urgent rehabilitation of Tajikistan's existing hydro system. No detailed assessment has been carried out of the impact that serious system failure would have on the country, but given the degree of dependence on hydropower and the losses already being realized from faltering infrastructure and equipment, impacts could be devastating.

In terms of impacts on the population, the gradual wearing down of hydro infrastructure is likely to

Box IV.2: Electricity shortages can be mitigated by better efficiency

In winter, Tajikistan imports expensive electricity during the day to cover heating and lighting needs. Load (the flow of electricity imported), and therefore the government's electricity bill, could be significantly reduced if customers were more prudent with their energy use. More modern electrical appliances, ranging from fluorescent bulbs to more efficient heaters and refrigerators, can help save valuable electricity.

A new law has been passed by the government on energy efficiency that promises to tackle the question of demand management. So far, little has been seen in the way of consumer education or increased efficiency, but it is a step in the right direction.

increase disruptions to everyday life. Without adequate power it will become harder to pump or boil clean water, irrigate fields, keep schools warm and medicines cold. Less power will lead to more undercooked food, more malnutrition, increased dependence on wood for fuel, and will add to air pollution. Faced with these human realities, the case for safeguarding current output through essential maintenance is clear. It will also be imperative to explore cost-effective means of raising power output, to meet both growing domestic and foreign demand for energy.

Chapter II: Future developments - assessing effective demand

The challenges surrounding development of Tajikistan's hydropower are many and varied: funding for construction, ramifications for downstream neighbours, and security in an earthquake-prone region are just a few of the issues that politicians and planners will have to contend with. However, the key factor in determining the success of any future developments is the extent to which other countries in the region need, want and are prepared to pay for Tajik hydro. This chapter will address the question: is there effective demand for large-scale development of hydropower in Tajikistan?

Prospects for growth in the region

A key factor in assessing demand for Tajik hydro is economic growth. Is the region as a whole growing and consuming more electricity?

Although GDP plummeted across the CAR region in the aftermath of the break-up of the Soviet Union, economic growth has increased steadily ever since (with the exception of Tajikistan, where the civil war delayed recovery until the mid-1990s). In 1999-2000, growth in the CAR region was 9% (see Table IV.4). As the CAR economies recover and diversify, expanding their industrial and service sectors, the demand for cheap and clean electricity is expected to grow.

Table IV.4: Economic growth and energy use in CAR, 1999-2000

Indicator	Population	GNI per capita	GDP	Urban population	Commercial energy use	Commercial energy use per capita	Energy imports net
Unit	millions	\$	% of growth	% of total	ktoe ³⁷	ktoe	% of commercial energy use
Year	2000	2000	1999-2000	2000	1999	1999	1999
Kazakhstan	14.9	1,260	9.6	56.0	35,439	2,374	-82.0
Kyrgyz Rep.	4.9	270	5.0	33.0	2,451	504	47.0
Tajikistan	6.2	180	8.3	28.0	3,344	543	59.0
Turkmenistan	5.2	750	17.6	45.0	13,644	2,677	-93.0
Uzbekistan	24.8	360	4.0	37.0	49,383	2,024	-12.0

Source: World Bank Profile of Infrastructure and Energy Sector Activities of the World Bank in Europe and Central Asia Region

Afghanistan's energy use and demands are poorly documented. Only around 6% of the Afghan population is thought to be connected to the electricity grid, and the World Bank estimates that 75% of energy needs are met by traditional fuels. In addition to some hydropower infrastructure, generating a reported 478 GWh in 1999 (3% of Tajikistan's output), Afghanistan has considerable known reserves of fossil fuels.³⁸ However, as direct investment in Afghanistan will most likely remain in the distant future, imports of cheap hydropower from north of the border seem a more realistic option in the medium term. With a population of 26 million (larger than any other Central Asian neighbour, and so few users currently served, Afghanistan presents a large if uncertain market.

Xianjiang Province. Demand for electricity in Xinjiang Province is expected to grow by 10% by 2010, while growth in GDP in the region should average around 5% per year.³⁹ The growth in electricity demand is expected to create a 25% deficit in current generation capacity in the region, which Tajikistan and Kyrgyzstan are well placed to exploit. (Plans to build a 220 KW transmission cable between Naryn (Kyrgyzstan) and Kashgar (Xinjiang Province) could facilitate this).

Pakistan. With a GDP of \$74 billion, Pakistan's economy is over three times the size of Kazakhstan's, in recent years growing at a little under 5% per year. Like Tajikistan, Pakistan is also rich in hydropower (around 35% of the country's internally produced electricity comes from hydro), meaning that Tajikistan's competitive advantage in supplying peak morning and evening

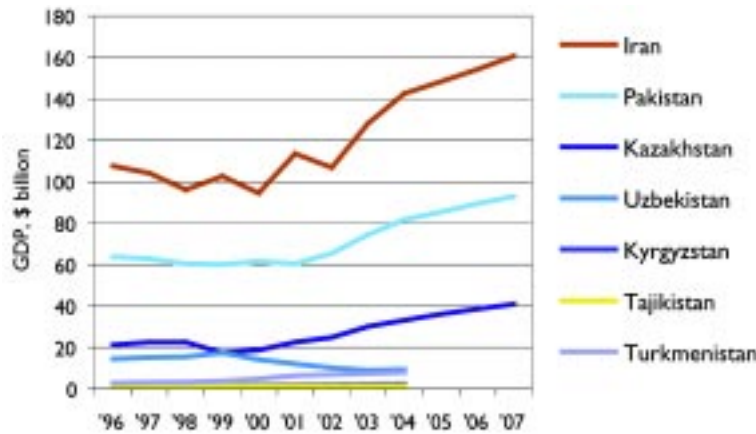
demand may be weaker here than elsewhere in the region. However, Pakistan also runs an energy deficit of around 30%, distinguishing it from the energy surplus states in the region - Iran, Kazakhstan, Turkmenistan and Uzbekistan. This makes Pakistan a potentially large market for Tajik hydro.

Iran, with its enormous hydrocarbon reserves, is at once the biggest threat and the best opportunity for development of Tajik hydro. In 2000, Iran was the fifth largest oil exporter in the world (2.6 million barrels per day), of a total production of 3.8 million barrels per day. However, oil generates only 18% of domestic power generation, with the majority (75%) coming from natural gas, and the remainder (7%) from hydropower. The Iranian government has plans to expand oil output to 4.9 million barrels per day by 2025, and to double power generation capacity by 2012, from 31 GW to 60 GW. This is in spite of huge generation surpluses in recent years: in 2000 Iran generated 8 billion KWh of surplus electricity (more than half Tajikistan's total annual output) that was neither exported nor used in the domestic market.

Tajikistan's capacity to meet growing electricity needs

These growth projections and energy expansion plans indicate that there is a strong need for cheap electricity in the region. Figure IV.2. shows recent GDP performance in the region, and highlights the size of the markets to be captured, notably in Iran and Pakistan. Tajikistan has considerable resources with the potential to meet much of this future demand: exploitable

Figure IV.2: Iran, Pakistan and Kazakhstan - large regional economies present lucrative electricity markets



Sources: ADB, Economist Intelligence Unit, IMF, UNDP. No reliable forecasts exist for Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan

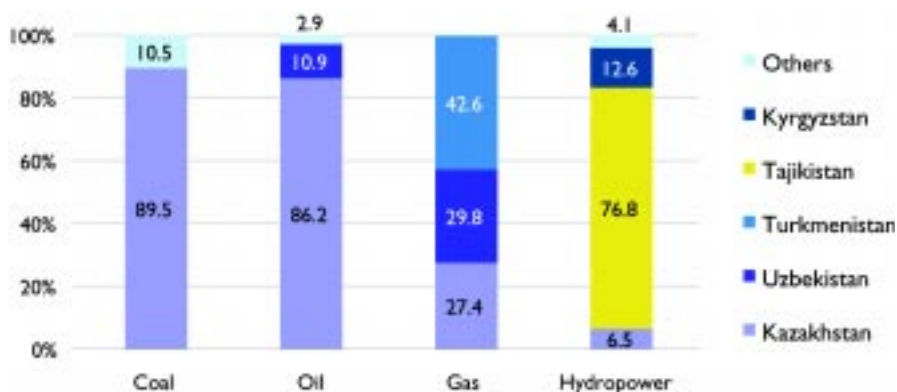
hydropower in Tajikistan is estimated at around 264 billion kilowatt hours (kWh) per year, of which less than 10% is currently being used. Total electricity consumption in the five Central Asian republics over the last few years has averaged 135 billion kilowatt hours per year: if Tajikistan's hydro potential were fully harnessed, the country could single-handedly power the whole Central Asia region twice over.

Competing with other energy sources in the region

Iran and CAR possess huge energy reserves, including fossil fuels, hydropower and nuclear power, now

under development in Iran. With such plentiful resources, domestic energy prices in the region are likely to remain low for some time to come. In addition, the distribution of resources across the region is such that countries (with a few notable exceptions, for example northern Tajikistan) have been able to pursue self-sufficiency since independence, a policy favoured on grounds of energy security (see Figure IV.2.). As a result, any future developments in Tajik hydro will have to deliver extremely cheap power to compete with other forms of energy in the region. This will constitute one of the main factors determining future viability and profit-

Figure IV.3: Distribution of energy resources in CAR - fossil fuels and economically viable hydro potential



Source: UN SPECA⁴⁰

ability of Tajik hydro.

Do the other states in the region need Tajikistan's hydropower?

Yes. As a clean and potentially cheap source of renewable energy, Tajik hydro is an attractive proposition. Crucially, a cheap and secure source of energy from Tajikistan would free up the region's considerable hydrocarbon resources for export. It is more profitable to export fossil fuels than to use them to supply internal energy markets: some states, notably Kazakhstan, have made it government policy to generate as little of their own energy as possible, aiming to import from cheaper sources elsewhere in the region, and thereby preserving their hydrocarbons for export. Other states, such as Iran, are planning to expand domestic power generation. In the long-term,

A MORE POWERFUL INCENTIVE FOR DEVELOPING HYDROPOWER IS THE PROSPECT OF RESOURCE DEPLETION IN HYDROCARBONS

though, the Kazakh approach will better serve national interests: for all those countries in the region with lucrative hydrocarbon export potential, the sooner they can free up those resources from domestic electricity production, the sooner they will be able to raise revenues. Hydropower is especially suited to filling this gap in the market because, unlike oil or gas or coal, it cannot easily be transported over long distances to world markets. Hydropower must be consumed locally because power losses make electricity transmission economically unviable beyond the region.

Environmental factors - carbon emissions and resource depletion

Hydropower is attractive for two further reasons: it generates almost zero carbon emissions, and it is an entirely renewable resource. Each terawatt hour (1 billion kilowatt hours) of hydropower that replaces coal-generated electricity offsets 1 million tons a year of carbon dioxide equivalent. Currently more than a third of Central Asia's electricity (47 billion kilowatt hours per year) comes from coal alone. There are enormous gains to be realised from switching to renewable energy sources, in terms of reducing air pollution and acid rain, limiting ozone-depletion, and reversing global warming. However, in the

short term these concerns will remain a lower priority for most states in the region. Although some have submitted preliminary reports on global warming strategies, energy policy for the foreseeable future is likely to be focused on extracting maximum value from hydrocarbon exports: if hydropower has a larger role to play in the region, it will be primarily because it frees up fossil fuel reserves for export, and not because it reduces carbon emissions. In this connection, though, Tajikistan's own experience of global warming serves as a chilling warning. (Box IV.3.)

A more powerful incentive for developing hydropower is the threat of resource depletion. Table IV.5 gives the expected depletion dates for the various resources in Central Asia at current extraction rates. When compared

Table IV.5: Depletion rates for regional oil and natural gas reserves.

The R/P (reserves/production) ratio is calculated by dividing proved recoverable reserves at the end of 1999 by production in that year. The resulting figure is the time in years that the proved recoverable reserves would last if production were to continue at 1999 levels.

	R/P ratio (years)
Iran	71.9
Kazakhstan	23.5
Turkmenistan	10.5
Uzbekistan	8.5

Source: World Energy Council

Box IV.3: Carbon emissions and global warming - where's the evidence?

Although the debate continues on how close the link is between carbon emissions and global warming, statistics from Gorno-Badakhshan, the mountainous province in eastern Tajikistan, leave little doubt as to the urgency of the situation. In 1949 glaciers covered nearly 18,000 square kilometres of Tajikistan's mountainous hinterland. Satellite images from 2000 indicate this area has shrunk to just 11,863 square kilometres - a 35% decrease in the space of just 50 years. Although the rate of retreat must decrease as glaciers at higher altitudes begin to melt, if the current trend continues, Tajikistan's glaciers will have disappeared within 120 years. Water for drinking, irrigation and energy are all at stake.

Source: Kharitasov Mapping Research Centre

with the rising costs of extracting reduced and hard-to-exploit hydrocarbon reserves, the high initial investment costs and environmental sacrifice associated with hydro development will surely become more palatable.

In sum

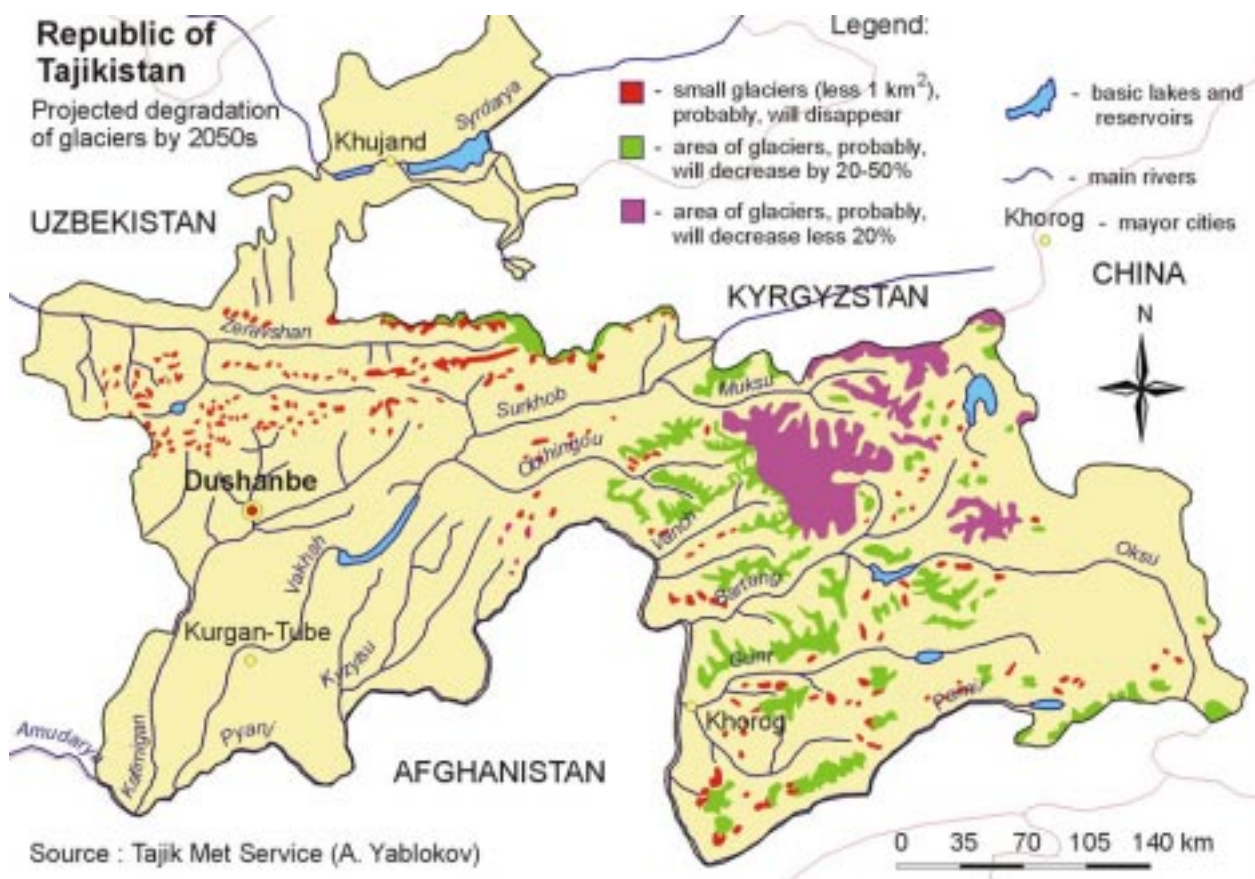
Hydropower offers a cheap, clean and renewable long-term solution to regional energy challenges. Freeing other resources in the region for export and developing alternatives to combat inevitable resource depletion will together be the main drivers for expansion in Tajikistan's hydropower sector. The pace of development will thus depend heavily on the strategies of neighbouring states for expanding their hydrocarbon export potential, and on their political will to manage a transition towards renewable energy sources. As long as enough support can be mobilised for development, commitments to long-term pricing structures can be collateralised and the required funds made available. At present, the primary obstacle is not lack of funds, nor a lack of demand; it is a temporary lack of political will to invest in the future. In the light of this conclusion, what are the next steps for

Tajikistan's decision-makers? With large-scale developments dependent on political will abroad, the associated benefits for Tajikistan - in terms of hugely increased generation for domestic consumption - will also remain beyond the horizon. What are the more affordable options to be explored in the shorter-term? The country's current financial situation combined with its mountainous topography present two different paths for urgent consideration: restoring existing infrastructure to normal efficiency levels, and exploring options for small hydro. Both of these are considered in the next section - Part V - on resource allocation.

Footnotes

- 32 For more on this subject, see UNDP Tajikistan's National Human Development Report 2001-2 on ICT.
- 33 ADB notes that spillage may result in generation losses of up to 4 billion kilowatt hours every summer
- 34 Asian Development Bank
- 35 Academy of Sciences
- 36 Academy of Sciences
- 37 thousand tons of oil equivalent
- 38 5 trillion cubic feet of gas, 95 million barrels of oil, and 73 million tons of coal reserves. US Department of Energy
- 39 http://wip.tu-berlin.de/de/kontakt_mitarbeiter/cvh/energy_policy_china_%20power.pdf
- 40 www.unece.org/energy

Map IV.1: Glacier degradation to 2050



Part V

Resource allocation

A crucial area in the improvement of water systems in Tajikistan is finance. Meeting the Millennium Development Goal targets for water provision is likely to be costly and complex, owing both to the deteriorated state of water systems in the country and to the large share of the population - approximately 43%, mostly in rural areas - without regular access to piped water.

In assessing the likely costs associated with improving water provision a few questions are critical for analysis:

- What is the actual state of the system, and what are current investments?
- What are the objectives for any future investments?
- What resources are needed to meet those objectives?

Ascertaining the answers to any of these questions is difficult. To get a clear picture of the costs involved, both present and future, would require a technical costing analysis that is beyond the scope of this report. This chapter therefore aims to identify key issues of concern and provide some focus for how these can best be addressed. Potential financial requirements for renovating and expanding the water system are explored, case studies illustrating the practical complexities of rehabilitation are considered, and priorities for resource allocation are discussed.

5% of the population depends on rivers and streams as its main source of water.

Photo: World of Polygraphy

Chapter 12:

Water supply and sanitation

What are current investments in water supply and sanitation?

For water supply and sanitation, Tajik Municipal Authority (TMA), the agency responsible for urban water supply, reported total funding of TJS 2.48 million in 2002. Revenues from water users totalled TJS 582,000, while TJS 676,000 came from the republican



budget and other state financing organs. An additional TJS 155,000 was earmarked for social protection payments. The remaining TJS 1.22 million was provided by self-financing organisations, mainly local khukumats.⁴¹ TMA supplied 72.3 million cubic metres of water to more than 2 million users, giving minimum unit costs of 3.4 dirams⁴² per cubic metre of water supplied, and TJS 1.24 per user per year (assuming all funds go towards service provision and capital expenditure, which totalled TJS 300,000 in 2002).

In the same year Tajikselkhozvodoprovodstroy (TSK), the rural water authority, reports providing a total of 28,956,000 cubic metres of water to its 1.1 million water users, at a reported cost of TJS 727,000. With a collection rate of only 32%, revenues from user fees totalled just TJS 484,000 of what was owed by water consumers (TJS 1.5 million). TSK also received support (via MIWR) from the republican budget of TJS 243,000 including TJS 191,000 for capital repairs, and TJS 52,000 to compensate for user arrears. Assuming all funds are used to cover operating costs of the system and that there are no further resources available, these figures imply per capita costs of roughly 66 dirams per person per year,



and minimum unit costs of 2.5 dirams per cubic metre of water supplied. This compares with 5.2 dirams per cubic metre in the hypothetical case of 100% collection rates.

RURAL WATER SUPPLY SURVIVES ON JUST 66 DIRAMS (\$0.20) PER PERSON PER YEAR

In 2002 Dushanbevodokanal (DVK), the authority responsible for water supply to the capital, provided 198.7 million cubic metres of water to its users, at a total cost of TJS 1.585 million for the year. However, two thirds of this water never reaches its end destination, owing to leakages and other inefficiencies in the water infrastructure. By this reckoning, three times as much water must be put into the system as is required (or currently consumed) by users. Of the water that does reach its destination (around 67.3 million cubic metres), half is for domestic consumption (32.4 million cubic metres). While charges to domestic and commercial users are different, it is assumed that the actual costs to supply domestic and non-domestic users are roughly similar, giving minimum unit costs of 0.8 dirams per cubic metre, and per capita spending of TJS 2.6 per person per year (based on the official population figure for Dushanbe of 600,000). Of DVK's total expenditures for the year, TJS 153,000 (around 10%) went on capital repairs and investments.

Between them, these three agencies, provide drinking water to the 57% of the population or 3.8 million people connected to central water supply systems, at a total cost of TJS 4.79 million a year. These unit costs contrast starkly with Western European levels: 1.2 US cents per cubic metre for urban and 0.9 US cents for rural water in Tajikistan compare with average UK rates of \$1.18 per cubic metre, rising to \$1.91 in Germany, well over 100 times more than in Tajikistan. While these figures reveal huge funding gaps, they also highlight the difficulties faced in preparing and accessing comprehen-

The water users not connected to the network must fetch water from standposts, often over long distances and keep water in containers.

Photo: Surat Toimastov

sive and transparent information regarding financial operations in the water sector.

At present, available external financing for water supply for the period 2002-2004 is around \$15 million, according to the government's Poverty Reduction Strategy Paper (PRSP) 2002. At \$5 million a year (TJS 13.8 million at 2002 exchange rates), NGO and IFI spending is therefore around three times more than national spending on water supply and sanitation (see Table V.1).

What are the objectives for future investments in water supply and sanitation?

Ideal scenarios for future access to water would envisage 100% coverage across the country, with equivalent improvements in quality. Given the acute shortage of funding and other constraints, Millennium Development Goal 7 and the government's own Poverty Reduction Strategy Paper (PRSP) of 2002 set more realistic targets in determining investment needs.

Table V.1: Current funding sources for water supply and sanitation, 2002

Funding source	TJS mln	%
TSK (Rural Water Authority)	0.73	
TMA (Tajik Municipal Authority)	2.48	
Dushanbevodokanal	1.59	
Total national funding	4.79	25.7
External assistance	13.80	74.3
Total	18.59	100.0

MDG 7 aims to halve the number of people without access to safe drinking water by 2015, while the PRSP aims to increase coverage to 80% by 2015. While MDG 7 stipulates access to 'safe drinking water' there is no globally agreed, practical measure of what constitutes safe water.⁴³ Even so, connecting households to a reliable source of water that is reasonably protected from contamination would be an important first step. This uncertainty over quality has important consequences for any costing exercise, as it demands that policy makers make clear choices about strategy: is the priority increased coverage, or is it improved quality? Given the costs of unreliable supply outlined earlier in

this report (time spent fetching water, or risks of disease from irrigation ditches, for instance) extension of basic supply seems a good starting point. In any case, incidental improvements in quality will most likely result from improved supply coverage. By contrast, no further gains are made in supply if quality alone is prioritised.

INCIDENTAL IMPROVEMENTS IN QUALITY WILL MOST LIKELY RESULT FROM IMPROVED SUPPLY COVERAGE

The majority of Tajikistan's urban population (93%) is in principle already connected to a piped water system. The bulk of the population without access to household water (43%) lives in rural areas. If, as discussed above, the proportion of the population without access to piped water is assumed to be the proportion without access to safe drinking water, MDG 7 demands a reduction from 43% without access to 21.5% without access. A national access rate of 78.5% (57% current coverage + 21.5%) is also very close to the PRSP's 80%, and both have the same target date of 2015.

What resources are needed to meet objectives in water supply and sanitation?

Tentative data from TSK, the rural water authority, indicate capital expenditure of between TJS 20,000 and TJS 130,000 in recent years. Anecdotal evidence suggests that almost all of these funds have been spent on emergency repairs, and that no new investments have been made to increase coverage. Indeed TSK reports a decrease in coverage from 1.35 million users in 1991 to 1.1 million users today.

TSK has made notional projections about future spending that give a sense of the scale of expenditure that may be necessary to expand and operate piped water systems in rural areas. These estimates suggest that total capital expenditure of \$468 million would be required to upgrade and expand coverage to the remaining 2.8 million⁴⁴ members of the population currently without access to piped water. Operating costs would be in the order of \$56 million per year, or \$14.36 per person per year.

These data from TSK aim to expand access across the

entire population, exceeding both the MDG and PRSP targets. As the marginal costs of reaching outlying populations will push costs up considerably, it is likely that total capital expenditure requirements to meet more realistic coverage rates of around 80% will be less than the \$468 million given above.

UPWARDS OF \$207 MILLION WOULD BE REQUIRED TO UPGRADE AND EXPAND COVERAGE TO THE REMAINING 2.8 MILLION MEMBERS OF THE POPULATION CURRENTLY WITHOUT ACCESS TO PIPED WATER

The PRSP gives total water costs for the period 2002-2004 of \$44.3 million, which extrapolated to 2015 gives a total figure of \$207 million. As Table V.2 demonstrates, this leaves a funding gap of some \$93 million to 2015. As a baseline these figures are useful in illustrating the likely scale of the financing challenge: spread over the coming 12 years to 2015, spending to meet the PRSP/MDG targets will have to exceed 1.1% of GDP. This in itself sounds feasible, but it should be remembered that this is in a country where total public expenditure was just 16% of GDP in 2002.

Chapter 13: Irrigation and drainage

What are current investments in irrigation and drainage?

Irrigation has survived on operating expenditures of \$6 million a year since independence. Before 1991 and the collapse of the command economy, the sector received \$72 million a year. Monies spent have barely covered salaries and running costs, and have allowed for

practically no repairs whatsoever. This cumulative underinvestment has led to a shortfall of well over half a billion dollars since 1991 and resulted in the severe deterioration of the entire irrigation system.

What are the objectives for future investments in irrigation and drainage?

As with water supply and sanitation, evaluating the financial requirements for upgrading irrigation and drainage (I&D) infrastructure is difficult. The irrigation network does not require radical expansion of the same sort as community water supply. The most pressing need is for general rehabilitation and efficiency improvement in the existing infrastructure. According to the World Bank, Tajikistan's I&D system is teetering on the brink of collapse: of the 720,000 hectares of irrigable land in Tajikistan, only 591,000 hectares were irrigated last year, the remainder having been set aside due to waterlogging and salinization resulting from poor or non-existent drainage. Many fields have fallen out of use because dilapidated irrigation systems are no longer able to deliver water. Unfortunately, no detailed nationwide assessment exists of the state of irrigation and drainage systems in the country. The Ministry of Irrigation and Water Resources reports that 50% of the I&D network is 'worn out', which may indicate either inoperative or poorly performing. MIWR also reports that 65% of pumping systems in the country are 'worn out'.

What resources are needed to meet rehabilitation objectives in irrigation and drainage?

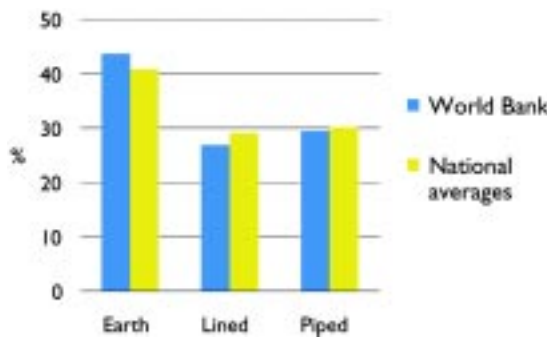
A study of the World Bank Rural Infrastructure Rehabilitation Project gives some insight into the practical

Table V.2: Funding needs for water supply and sanitation, 2002-2015

\$ million	PRSP		
	2002-2004	Annual Average	2002-2015
Costs	44.3	14.8	206.8
Total available		6.7	113.4
Available internal*		1.7	23.8
Pledged internal	4.2	1.4	19.6
Financing gap			93.8

Source: PRSP and *TCS, TSK and DVK

Figure V.1: Nationally representative proportions of earth, lined and piped irrigation channels make the World Bank's project a good basis for other costing estimates



challenges and financial requirements of I&D rehabilitation. Begun in 2000, the project aims to increase water supply and efficiency to main and secondary irrigation canals supplying a project area of 130,000 hectares. Additional project components aim to develop institutional capacity in land and water management, and to improve the quality of drinking water in selected villages within the project area.

NO DETAILED NATIONWIDE ASSESSMENT EXISTS OF THE STATE OF IRRIGATION AND DRAINAGE SYSTEMS IN THE COUNTRY

The Bank's project area covers a large and relatively representative portion of Tajikistan's irrigated land: the 130,000 hectare project area comprises over one sixth

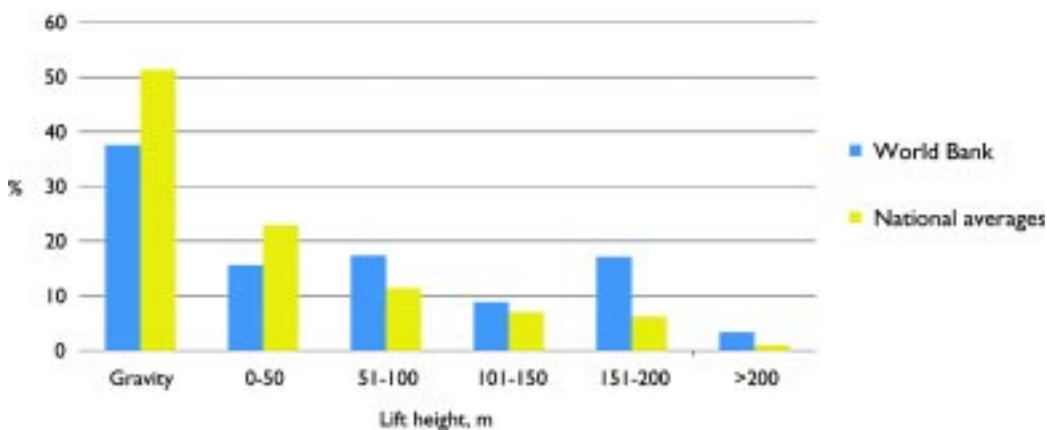
of nation's irrigable land, and is distributed across the three main agricultural regions of Sughd, Khatlon and DRD. Proportions of earth, lined and piped irrigation channels - each with widely differing rehabilitation costs - are also nationally representative, as is the distribution of pumped irrigation lift heights (ranging from 10m to more than 200m). Figures V.1 and V.2 show respectively the distribution of earth, lined and piped irrigation channels in the Bank's project areas, and the breakdown of lift heights, both by comparison with the national averages.

These comparisons suggest that the Rural Infrastructure Rehabilitation Project is sufficiently representative of national I&D conditions to give a fair sense of the magnitude of expenditures required for the rehabilitation of the rest of the irrigation and drainage system.

INVESTMENT IN I&D SYSTEMS HAS A SOCIAL VALUE THAT GOVERNMENT MAY WISH TO SUPPORT, IRRESPECTIVE OF ECONOMIC CONCERNS

There is some debate as to what proportion of I&D systems will remain economically viable once utility prices (for water and electricity) rise to reflect true economic costs. As nearly half of the country's I&D network depends on pumped irrigation, this is a particular concern for Tajikistan, where the estimated economic value of electricity is several times higher than its present financial price. A World Bank study⁴⁵ based on the districts covered by the Rural Infrastructure Rehabilitation Project, found that without rehabili-

Figure V.2: Slightly higher lifts across the World Bank project areas mean per hectare costs will tend toward the expensive end



tation 54% of irrigated lands in the project area would be unprofitable with electricity charged at full economic prices. Economic returns are not necessarily the only reason for rehabilitating I&D systems, however: with so many people dependent on irrigation for their livelihoods, investment has a social value that government may wish to support, irrespective of economic concerns. Indeed, it may be cheaper to rehabilitate I&D systems than to re-train, relocate or otherwise compensate farmers where systems are allowed to degrade, as has partly been the experience in Kyrgyzstan.⁴⁶ Given the high dependence of the population on irrigation systems in the country and the expectation that most of these would return a profit if rehabilitated, it is concluded that a near comprehensive rehabilitation of the I&D system is in the national interest.

With I&D rehabilitation costs totalling \$22.76 million over five years (including institutional capacity building), average unit costs come to \$178 per hectare. This includes \$15 per hectare per year for operation and maintenance, giving an annual unit cost of \$36 per hectare per year during the rehabilitation phase.⁴⁷

Box V.1: Biodiversity and big dams - a cautionary tale

In 1970 a new virus—the grassy stunt virus, carried by the brown plant hopper—threatened rice production in Asia. The virus appeared capable of destroying as much as one quarter of the crop in some years, making it critical to develop a rice strain resistant to the virus. This was done with the help of the International Rice Research Institute (IRRI), which researches rice production and maintains a huge bank of rice seeds—about 80,000 varieties of rice and near-relatives of rice. In this instance, a single strain of wild rice not used commercially was found to be resistant to the grassy stunt virus. The appropriate gene was transferred to commercial rice varieties, yielding commercial rice crops that were resistant to the virus. Note that this strain was found in only one location, a valley flooded by a hydroelectric dam shortly after the IRRI took the strain into its collection. Without this strain—which had no apparent commercial value—the well-being of hundreds of millions of people would have been seriously affected.

Source: World Bank, *World Development Report 2003*

Assuming similar rehabilitation requirements and O&M elsewhere in the country, it would cost \$106.2 million ($\$36 \times 5 \text{ yrs} \times 590,000 \text{ ha}$) to rehabilitate the rest of Tajikistan's irrigated land. Post-rehabilitation costs for operations and maintenance are estimated at \$30 per hectare per year,⁴⁸ giving total O&M costs for the country of \$21.6 million per year ($\$30 \times 720,000 \text{ ha}$).

Chapter 14: Hydropower

What are current investments in hydropower?

During the Soviet period Tajik hydropower generated a reported income of \$150 million a year, with running costs (including maintenance and depreciation) of around \$60 million a year, and profits to Moscow of around \$90 million. Income over the last ten years has averaged around \$40 million annually, contributing, as with irrigation, to chronic underinvestment. Since 1996 alone, the country's hydropower system has depreciated by \$165 million. Associated efficiency losses are estimated at between 30% and 40%.

What are the objectives for any future investments in hydropower?

This question provokes much debate in Tajikistan. Soviet planners and their successors envisage massive hydropower development of the scale examined in Part IV. However, as that section has demonstrated, while there is a clear need in the region for cheap, clean and renewable hydropower, effective demand will only materialize when sufficient political will is mobilized to secure the high investment commitments required.

Such commitments are not yet on the horizon, owing to the generally weak state of national economies, and the prevalence of rich hydrocarbon reserves in the region.

There is also much debate as to the real benefits of large-scale hydro developments for local populations. High investment costs risk diverting funds away from other development needs; long construction periods mean that populations wait years for electricity to come online. In addition there are the potential problems of population displacement, changes in water quality, and inundation of pasture, arable land and wildlife habitats (see Box V.1.)

Small hydro as a solution for meeting population needs in the short term

Proponents of small- and micro-hydro development cite the many advantages of more modest development in the sector: shorter amortization periods mean more immediate benefits for users; 'run-of-the-river' systems do not affect downstream flow patterns, and there is little or no flooding upstream. The technology required is simpler, such that expertise can often be found locally, while maintenance is easier and reliability higher. Disadvantages associated with small hydro include its potential to limit local development as demand outgrows supply. Similarly, if the capital costs for the electricity grid have already been met, (as is the case for most of Tajikistan, with 98% of the population already connected to the grid), increases in consumption affect only generation costs, while the costs of distribution per unit actually fall. By contrast, with decentralised systems each increment of energy use requires additional capacity.

THE TECHNOLOGY REQUIRED FOR SMALL HYDRO IS SIMPLER, SUCH THAT EXPERTISE CAN OFTEN BE FOUND LOCALLY, WHILE MAINTENANCE IS EASIER AND RELIABILITY HIGHER

On the basis of this analysis, it can be seen that installing small hydro facilities across the country would not be the most cost-effective solution for increasing access to electricity. However, in prioritising resource allocation and targeting the most vulnerable sections of the population, investments in small- and micro-hydro represent quick and cheap ways to increase electricity and so decrease poverty.

Hydropower - what resources are needed to meet development objectives?

A project to rehabilitate and upgrade small hydroplants in the Pamirs, begun in 2003 by the Aga Khan Fund for Economic Development (AKFED), provides an illustrative costing case study. The project will deliver year-round power to 145,000 people, schools, hospitals and businesses in Gorno-Badakhshan, in eastern Tajikistan. Capital costs total \$26.4 million, to double existing capacity from 14 MW to 28MW by completion in 2005. In 2001, the government ordered reductions in

power consumption of around 20%, owing to shortages in winter: to meet these targets, normal power was only available between 5am and 10am, and 5pm and 11pm.

In large hydro, reported inefficiencies in generating capability of 30% to 40% have resulted from a shortfall of \$20 million a year. The prohibitive costs in developing large hydro (the bill for the planned Rogun hydropower station alone is estimated at \$2 billion)⁴⁹ make smaller-scale developments and improvements in efficiency a priority in meeting these electricity shortfalls.

Chapter 15: What does this costing exercise tell us?

Detailed assessments of the true condition of Tajikistan's water systems are severely constrained by gaps in available data. Likewise, there is a lack of detailed information about the structure of current and capital costs in the water sector. These gaps complicate plans for future investment and indirectly hamper efforts to form strategies for development.

Rough studies of investment requirements reveal, however, that the need for dramatically increased funding in water is both great and urgent. In order to meet national targets for expanding community water services action on these fronts must be taken soon. Delaying action on irrigation systems risks further degradation and higher future costs of rehabilitation and reconstruction; with every month that passes, the costs to salvage current systems increase.

BESIDES INCREASED FUNDING AND PROMPT ACTION, THERE IS AN IMPERATIVE NEED FOR CLEAR PRIORITIZATION

Most importantly, besides increased funding and prompt action, there is an imperative need for clear prioritization. Funds are not sufficient to address all needs in the water sector, and prudent choices will have to be made as a result. In water supply and sanitation this report recommends emphasis on



Construction work underway at the AKFED-World Bank Pamir Utility Project in Gorno-Badakhshan: this small-scale hydro development will take just two years to complete, and deliver power to 145,000 people in the region.

Photo: AKFED

increasing access, with improvements in quality expected to follow as a result. In irrigation and drainage, there is an urgent need to assess which irrigated lands are worth rehabilitating, as reports suggest that many may not be economically viable in the long-term. In hydropower, the priorities must be returning existing infrastructure to full efficiency, and exploring the as yet under-developed potential for small- and micro-hydro in the medium-term.

Footnotes

- 41 The khukumat is the local town or village council, with power to collect taxes.
- 42 TJS 0.034
- 43 World Bank: 'Goals for Development: History, Prospects and Costs', 2002.
- 44 Total population = 6.5 million. Without access to piped water = 43% of total population currently without access to piped water. TSK plans to expand coverage from 1.1 million users to 3.9 million users. The difference = 2.8 million = 43% of total population.
- 45 World Bank: 'Irrigation in Central Asia - Social, Economic and Environmental Considerations', February 2003.
- 46 *Ibid.*
- 47 World Bank: 'Rural Infrastructure Rehabilitation Project PAD', May 2000. (Total estimated project costs of \$24 million minus village water supply component \$1.24 million = \$22.76 million / 128,000 ha = \$177.80 per ha / 5 yrs = \$35.56/ha/yr).
- 48 World Bank: 'Irrigation in Central Asia - Social, Economic and Environmental Considerations', February 2003.
- 49 The situation at Rogun is complicated: Nurek reservoir, further downstream, suffers from heavy silting. Experts estimate that up to 2 cubic kilometres of silt may have gathered in the reservoir since generation began in 1972. Since the reservoir only holds 10.5 cubic kilometres of water, this silting represents large losses in storage capacity (and therefore generating capacity as well). While costs for the full scheme envisaged at Rogun are enormous, some elements of the plan are essential for safeguarding downstream generating capabilities: a *small* dam at Rogun, for instance, would reduce silting in Nurek and preserve generating capacity.

Part VI Conclusion

Water is central to human development

Water has a central role to play in human development in Tajikistan. Increasing access to household water and improving water quality can bring important benefits to the country. Access to water is a fundamental right, the denial of which prevents individuals from satisfying basic human needs, and keeps people in a cycle of poverty where life revolves around survival instead of advancement. The intimate relationship between water, living standards and a broad range of social indicators including women's empowerment, education and health makes improving water provision and quality a key element of the Millennium Development Goals. The broad, multidimensional significance of water makes this sector a high priority for national development strategies: no other sector affects so many people, so many aspects of every day life or so many areas of the economy.

Good water costs money

Despite the importance of the water sector, funding for upkeep and development of water-related infrastructure and institutions has been lacking. The levels of investment required for adequate rehabilitation and maintenance of household supply and irrigation networks are large by comparison with available financial resources. Salaries in public ministries and other agencies also need to be raised and sector management strengthened. It is salutary to recall that at present drinking water is supplied to 1.1 million rural users on the basis of annual expenditures of TJS 750,000 - around \$0.20 cents per person per year. High and sustained levels of funding will be required to develop the sector. Improved policy, planning and water sector management at the local and national level will ensure that investments have maximum impact. Since it is unlikely that Tajikistan will be able to finance the high capital costs on its own, renewed commitment from the international community for the long-term will be essential. Finally,

international financial support must be administered prudently so as to avoid deepening economic dependency or aggravating Tajikistan's already substantial international debt burden.

Institutional capacity must be strengthened

Institutional constraints remain a serious impediment to water systems reform in Tajikistan. In part, the problem is one of financial resources: departments do not have sufficient financial means to support basic operations such as monitoring activities in the field or maintaining statistical databases. Better collection and presentation of reliable and standardised information will greatly facilitate future efforts in the sector. Information regarding water financing is a particular concern: inter-agency cooperation will be frustrated as long as access to clear and transparent financial data is denied. A more complex problem concerns the skills and competencies of personnel. While sector-specific levels of expertise remain reasonably high, much of this expertise is now outdated, unsuitable to a system in transition to a market economy and out of touch with modern approaches to water management. Institutions need to take more account of human development indicators (as opposed to scientific or technical indicators) in preparing service plans. Authorities should invest in training and in Tajikistan's water-related academic institutions to educate a new generation of policy-makers able to combine the high technical standards of the previous era with the more sustainable and user-oriented approaches of today. This will generate more holistic approaches to water policy, with sanitation measures accompanying future water supply interventions, and drainage playing a more integral role in irrigation rehabilitation. Overall institutional capacity building will be essential for the development of the water sector and guidance of related policy.

Water consumption patterns need changing

Improvements in funding and institutional capacity will only deliver meaningful change for human and economic development outcomes if inefficient consumption patterns can be changed. Water shortages result not only from weak service provision and infrastructural deficiencies but also from wasteful patterns of usage. An

important means of changing consumption behaviour is to increase public appreciation, awareness, and ownership of water as a shared national resource.

There are two policy options for reigning in excessive water consumption. The first is to raise water tariffs as a means of strengthening incentives for responsible use. One objection to this approach is the difficulty many water users face in paying current and rising utility charges. Tajik authorities should improve their ability to measure and monitor water consumption as one means of improving low collection rates. Despite these drawbacks, charging more for water should help generate income for a cash-strapped sector and broaden the scope for badly needed re-investment. A second option for lowering consumption is to launch a public information campaign aimed at changing public attitudes and practices. Such a campaign might be conducted through schools, health clinics, local water user associations and the media. Radio has been effectively used in many countries to disseminate information on best practices, especially to rural areas where communities are more dispersed. Water's key role in maintaining public health as well as in improving school enrolment and attendance levels makes schools and clinics ideal places for disseminating information about water and sanitation.

Priorities in the short term must be refocused

Tajikistan's water resources give the nation a competitive advantage in two important commodities: cotton

production and hydropower. Properly developed and regulated, these industries have real potential for improving the country's economy and alleviating poverty.

In cotton, more restructuring will be required to make the sector more competitive and to ensure a broader distribution of benefits. Recent presidential decrees promise constructive change and show that the government is moving in the right direction; but sustained commitment to further reforms *and* implementation will be required from authorities at all levels in order to realize maximum benefits from policy changes. Efforts to increase competition among ginneries at the district level must be made in order to reduce local administrations' monopolistic hold on cotton processing. Continued restructuring and farm privatisation are required to ensure that farmers have a freer choice in what to plant. Under present circumstances, agriculture and its key input - water - are underutilized as a tool of rural poverty alleviation.

In hydropower there is a comparable need for policy prioritization. Demand for Tajik hydropower depends in large part on developments in other Central Asian and neighbouring states, particularly regarding hydrocarbon policies. Given that foreign demand has not yet mobilized and that financing for large-scale hydro development will take time, restoring efficiency in existing generation capacity and exploring options for more small- and mini-hydropower projects will be critical in addressing domestic power needs in the medium term.



Tapping the potential

Few poor countries are blessed with resources as rich as Tajikistan's water. Its potential for radically improving living standards and raising incomes is enormous, and gives grounds for great optimism about Tajikistan's future. This report has demonstrated the wide-ranging impacts of good water management on people's lives, and revealed the main barriers currently obstructing progress. With a realistic appreciation of what can be achieved with the limited resources available, combined with high-level political commitment to targeting the poorest sections of society, water can be a powerful tool for development in Tajikistan.

Given the high infrastructure costs of extending electricity transmission lines to outlying regions, mini- and micro-hydro can present cost-effective solutions for remote populations.

Photo: Surat Toimastov

Annexes

Statistical Appendix

All data are from State Statistical Committee unless stated otherwise

1. Human Development Index

Indicator	Year	Value
Life expectancy at birth*	2001	68.3
Adult literacy rate (% age 15 and over)	2000	99.5
Literacy index	2000	98
Expected term of education	2001	9.5
Knowledge index*	2000	0.90
GDP per capita (PPP\$)*	2001	1,170
Adjusted GDP per capita (US\$)	2002	187.9
Human Development Index*	2001	0.677

Additional source: *UNDP

2. Profile of Human Development

Indicator	Regions	Year	Value
Maternal mortality rate (per 100,000 live births)*	Tajikistan average	2002	50.6
	Dushanbe	2002	69
	Direct Rule Districts	2002	44.8
	Gorno-Badakhshan	2002	140.2
	Khatlon	2002	42.2
	Sughd	2002	53.9
Population per doctor	Tajikistan average	2002	497
	Dushanbe	2002	143
	Direct Rule Districts	2002	886
	Gorno-Badakhshan	2002	524
	Khatlon	2002	1,005
	Sughd	2002	429
Scientists (per 1,000 people)	Tajikistan average	2002	0.4
Education enrolment at all the levels (% age 6-23)	Tajikistan average	2002	58.4
	Dushanbe	2002	85.3
	Direct Rule Districts	2002	55.6
	Gorno-Badakhshan	2002	63.1
	Khatlon	2002	58.8
	Sughd	2002	61.8
Total education expenditure (% of public expenditures)		2002	16
Total health expenditure (% of public expenditures)		2002	5.6
Tertiary full time equivalent gross enrolment (thousand)		2002	24.2
Female (%) of total enrolled at tertiary level		2002	25
Newspapers (copies per 100 people)		2002	167.7

Additional source: *Ministry of Health estimate

3. Profile of Human Distress

Indicator		Year	Value
Official unemployment rate (%)	As of 01.01.2003	2003	2.5
PRSP estimated unemployment rate (%)		2002	33
Youth (age 15-24) '000 unemployed by census data		2000	16.9
Female wages (as % of male wages)	As of 01.12.2002	2002	69.6
Intentional homicides (per 100,000 people)		2002	2.3
Reported rapes (per 100,000 women, age 15-49)		2002	3.9
Sulphur and nitrogen emissions (kg per year)		2002	0.34

4. Female-Male Gaps (female as a percentage of males)

Indicator		Year	Value
Life expectancy		1998	108.4
Population	As of 01.01.2002	2003	99.5
Completed secondary education		2002	58.6
University full-time equivalent enrolment		2002	33.2
Registered unemployment	As of 01.01.2003	2003	122.5
Wages	As of 01.12.2002	2002	69.6

5. Status of Women

Indicator	Regions	Year	Value
Life expectancy at birth	Tajikistan average	2001	68.3
Average age at first marriage (years)*	Tajikistan average	2002	20.0
	Dushanbe	2002	20.3
	Direct Rule Districts	2002	19.7
	Gorno-Badakhshan	2002	21.5
	Khatlon	2002	19.9
	Sughd	2002	19.8
Maternal mortality rate		2002	50.6
Secondary special net enrolment ratio (%)		2002	53.4
Secondary graduates (% females) (schools, gymnasiums, lyceums)		2002	37.0
Tertiary full-time gross enrolment ratio (female %)		2001	24.9
Women in labour force (% of economically active population) by 2000 census data	Tajikistan average	2000	45.2
	Dushanbe	2000	39.7
	Direct Rule Districts	2000	45.3
	Gorno-Badakhshan	2000	46.4
	Khatlon	2000	46.4
	Sughd	2000	44.8
Administrators and managers (% female)		2000	42.0
Parliament (% of seats occupied by women)		2000	16.0

*UNFPA, 2002

6. Demographic Profile

Indicator	Regions	Year	Value
Estimated population (millions)	Tajikistan	1970	2.9
		2000	6.1
		2003	6.5
	Dushanbe	1970	0.4
		2000	0.6
		2003	0.6
Direct Rule Districts		1970	0.6
		2000	1.3
		2003	1.4

	Gorno-Badakhshan	1970	0.1
		2000	0.2
		2003	0.2
	Khatlon	1970	0.9
		2000	2.1
		2003	2.3
	Sughd	1970	0.9
		2000	1.9
		2003	2.0
Annual population growth rate (%)	Tajikistan	1989-1995	1.6
		1996-2000	1.9
	Dushanbe	1989-1995	-2.2
		1996-2000	2.6
	Direct Rule Districts	1989-1995	2.0
		1996-2000	2.0
	GBAO	1989-1995	2.5
		1996-2000	1.6
	Khatlon	1989-1995	2.3
		1996-2000	2.1
	Sughd	1989-1995	1.8
		1996-2000	1.5
Contraceptive prevalence rate (%) female 15-49*		2002	16
Population ratio rate 60 and over (%) as of 01.01.2003	Tajikistan average	2003	5.6
	Dushanbe	2003	5.4
	Direct Rule Districts	2003	5.3
	Gorno-Badakhshan	2003	7.0
	Khatlon	2003	5.1
	Sughd	2003	6.4
Life expectancy at age 60 (years)		1999	18.3
Male life expectancy at age 60 (years)		1999	17.3
Female life expectancy at age 60 (years)		1999	19.1

*UNFPA

7. Health profile

Indicator	Year	Value
Deaths from circulatory diseases (% of total)	2002	45.9
Death from tumors (% of total)	2002	6.7
Public expenditures on health (% of total)	2002	5.6
Public expenditures on health (% of GDP)	2002	0.9

8. Educational Profile

Indicator	Regions	Year	Value
Education enrolment at all levels (% age 6-23)	Tajikistan average	2002	58.4
	Dushanbe	2002	85.3
	Direct Rule Districts	2002	55.6
	Gorno-Badakhshan	2002	63.1
	Khatlon	2002	58.8
	Sughd	2002	61.8
Completed secondary schools, gymnasiums, lyceums (thousands)		2002	65.2
Tertiary full-time enrolment ratio		2002	24.2
Tertiary natural, applied science enrolment (% of total)		2002	10.4
Total education expenditures (% of public expenditures)		2002	16.0
Public expenditures on education (as % of GDP)		2002	2.6

9. Human Capital Formation

Indicator	Year	Value
Expected mean years of schooling (secondary)	2002	9.5
Female	2002	8.9
Male	2002	10.4
Scientists (per 1,000 people)	2002	0.4
Expenditure on research and development (% of GDP)	2002	0.1
Science graduates (% of total graduates)	2002	2.7

10. Employment

Indicator	Regions	Year	Value
Labour force (% of total employed population) by census data	Tajikistan average	2000	63.2
	Dushanbe	2000	43.5
	Direct Rule Districts	2000	64.6
	Gorno-Badakhshan	2000	71.0
	Khatlon	2000	68.6
	Sughd	2000	62.0
Annual growth rate of population earnings (%)		2002	21.9
Weekly hours of work (per person in manufacturing sector)		2002	40.0

11. Unemployment

Indicator	Year	Value	
Number of unemployed, officially registered	As of 01.01.2003	2003	46.7
Unemployment rate (% of registered in employment centres)		2003	2.5
Female (thousands)	As of 01.01.2003	2003	25.7
Youth (aged 15-24, thousands)	As of 01.01.2003	2003	18.4
% of long term unemployment (more than 6 months) by employed		2002	16.9
% of long term unemployment (more than 12 months) by employed		2002	11.9

12. Natural Resources Balance Sheet

Indicator	Regions	Year	Value
Land area (thousand km ²)	Tajikistan average	2003	143.1
	Dushanbe	2003	0.1
	Direct Rule Districts	2003	28.6
	Gorno-Badakhshan	2003	64.2
	Khatlon	2003	24.8
	Sughd	2003	25.4
Population density (people per km ²) as of 01.01.2003	Tajikistan average	2003	45.5
	Dushanbe	2003	6,040.0
	Direct Rule Districts	2003	50.1
	Gorno-Badakhshan	2003	3.3
	Khatlon	2003	92.5
	Sughd	2003	77.3
Arable land (% of land area)		2002	5.2
Pastures (as % of land area)		2002	26.1
Forests and wooded land (as % of land area)		2002	2.1
Irrigated land (as % of arable area)		2002	68.3
Renewable water resources per capita (thousand m ³ a year)		1999	90.5

13. National Income Accounts

Indicator	Year	Value
Total GDP (US\$ mln)*	2002	1,209.8
Agricultural production (as % of GDP)	2002	26.4
Industrial production (as % of GDP)	2002	22.1
Services (as % of GDP)	2002	41.4
Gross domestic investments (as % of GDP)	2001	11.0
Tax revenue (as % of GDP)	2002	14.8
Central Government expenditures (as % of GDP)	2001	15.0
Exports (as % of GDP)	2002	61.0
With services	2002	66.7
Imports (as % of GDP)	2002	59.6
With services	2002	65.9

Source: State Statistical Committee, * estimate

14. Trends in Economic Performance

Indicator	Year	Value
Total GDP (US\$ mln)	2002	1,209.8
Annual growth rate (%)	2002	9.1
GDP per capita annual (US\$)	2002	187.9
Average monthly rate of inflation (%)	2002	1.14
Contribution of exports as % of GDP growth (% of annual)	2002	13.1
Tax revenue as % of GDP (% of annual growth rate)	2002	14.8
Direct taxes (as % of total taxes)	2002	24.1
Overall budget surplus (as % of GDP)	2002	0.8

15. Wealth, Poverty and Social Investments

Indicator	Year	Value
Real GDP per capita (US\$)	2002	187.9
Industrial production, share of GDP (%)	2002	22.1
Social security expenditure (as % of GDP)	2002	2.1
Total education expenditure (% of public budget)	2002	16.0
Total health expenditure (% of public budget)	2002	5.6

16. Communication Profile

Indicator	Year	Value
Radios (per 100 people)	2001	3.3
Televisions (per 100 people)	2001	3.4
Annual theatre attendance (thousands)	2002	644
Annual museum attendance (thousands)	2002	428
Registered library users (thousands)	2002	838
Newspapers (copies per 100 people a year)	2002	168
Book titles published (per 100,000 people)	2002	4.1
Letters posted and wires (per capita)	2002	0.09
Telephones (per 100 people)	2002	3.0
International telephone calls (# of calls per capita)	2002	1.5
Motor vehicle (per 100 families)	2001	2.2
Motorcycles (per 100 people)	2001	0.6
E-mail users (%)	2002	0.25

17. Energy Consumption

Indicator	Year	Value
Total consumption (bln KWh)	2002	16.1
Consumption per capita (KWh)	2002	2,466

18. Urbanisation

Indicator	Regions	Year	Value
Urban population (% of total) as of 01.01.2003	Tajikistan average	2003	26.4
	Dushanbe	2003	100.0
	Direct Rule Districts	2003	12.8
	Gorno-Badakhshan	2003	13.3
	Khatlon	2003	17.2
	Sughd	2003	26.0
Urban population annual growth (%)		2003	1.7

19. Pollution

Indicator	Year	Value
Sulphur and nitrogen emissions (kg per year)	2002	0.3
Pesticides consumption (kg per ha)	2001	3.7
Air pollution (kg per capita)	2002	24.2
Water contamination (kg per capita):Weight particles*	2000	11.5
Nitrogen ammonium	2000	0.14

Sources: State Statistical Committee and Ministry of Environment

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Useful websites

Asian Development Bank <www.adb.org>
Economist Intelligence Unit <www.eiu.com>
Global Water Partnership (GWP) <www.gwpforum.org>
International Crisis Group <www.intl-crisis-group.org>
International Monetary Fund <www.imf.org>
Interstate Commission for Water Coordination <www.icwc-aral.uz>
International Water Management Institute <www.cgiar.org/iwmi>
Millennium Development Goals <www.developmentgoals.org>
Strategic Asia <www.strategicasia.nbr.org>
World Commission on Dams <www.dams.org>
United Nations Country Team in Tajikistan <www.untj.org>
UNDP Tajikistan <www.undp.tj>
United Nations Development Programme –
Sustainable Energy and Environment Division <www.undp.org/seed/guide/intro.htm>
United Nations Economic Commission for Europe <www.unece.org>
United Nations Educational, Scientific and Cultural Organisation – International Hydrological Programme
<www.unesco.org/water/ihp>
United Nations Environment Programme – Freshwater Portal <www.freshwater.unep.net>
United Nations Environment Programme –
Global Environment Monitoring System <www.cciw.ca/gems/gems-e.html>
United Nations Children's Fund <www.unicef.org>
Water Aid <www.wateraid.org.uk>
World Bank Energy Programme <www.worldbank.org/energy>
World Health Organisation <www.who.int/en>
World Bank <www.worldbank.org>
World Energy Council <www.worldenergy.org/wec-geis>
World Water Assessment Programme/UNESCO water portal <www.unesco.org/water>

On cotton:

Cotton Incorporated <www.cottoninc.com>
Cotton on the Net <www.cotton-net.com>
Cotton Outlook <www.cotlook.com>
International Cotton Advisory Committee <www.icac.org>

On hydropower:

ATLAS Project – small-scale hydro <www.europa.eu.int/comm/energy_transport/atlas>
IEA Hydropower Agreement <www.ieahydro.org>
International Hydropower Association <www.hydropower.org>
International Journal on Hydropower and Dams <www.hydropower-dams.com>
International Network on Small Hydro Power <www.inshp.org/small_hydro_power.htm>
US Department of Energy Hydropower Program <www.hydropower.inel.gov/facts/facts.htm>

About the National Human Development Report

This is Tajikistan's eighth NHDR. The product of many months of collaboration and consultation, it was conceived as a complement to the government's Dushanbe International Fresh Water Forum, in August 2003. Previous NHDRs have sought to provide timely analysis and advocacy as Tajikistan experienced and emerged from the 1992-1997 civil war, exploring ways to consolidate the peace process, deepen social cohesion and ensure social protection for the most vulnerable groups. As Tajikistan has entered the transition period, so the focus of the NHDR has shifted to address issues of sustainable development and poverty eradication. This can be seen in the tighter policy focus of last year's report on information and communications technology, and of this year's on water resource management. As a "nationally-owned process",

the NHDR has sought to promote dialogue amongst a broad range of actors involved in water management, culminating in individual contributions for the report. This dynamic process aims to bring together actors who may have different approaches, but share a common vision of enhanced development in the country. Complementing this aspect is the goal of building local capacities to identify and address development concerns in Tajikistan. In short, the process of preparation is just as important as the final product, the report itself. Moreover, this process extends beyond publication, through wide and active dissemination, further policy advocacy through roundtable discussions, and through follow-up and monitoring of the ideas and recommendations outlined within the NHDR.

UNDP is the UN's global development network, advocating for change and connecting countries to knowledge, experience and resources to help people build a better life. We are on the ground in 166 countries, working with them on their own solutions to global and national development challenges. As they develop local capacity, they draw on the people of UNDP and our wide range of partners.



tapping the POTENTIAL

THIS REPORT AIMS TO MAKE WAVES, TO ASK THE QUESTIONS THAT NEED TO BE ASKED ABOUT WATER IN TAJIKISTAN. IT IS HOPED THAT IT WILL BE RECEIVED IN THE SAME SPIRIT AS IT IS INTENDED – A SPIRIT OF DEDICATION AND COMMITMENT TO IMPROVING THE LIVES OF TAJIKISTAN'S PEOPLE, AND OF OPEN AND HONEST REFLECTION ON HOW BEST TO DO THIS.

THIS REPORT, AS THE TITLE SUGGESTS, IS ABOUT TAPPING THE POTENTIAL OF TAJIKISTAN'S WATER RESOURCES. TWO ASSUMPTIONS ARE IMPLICIT: FIRST, THAT THE COUNTRY'S WATER RESOURCES HOLD ENORMOUS POTENTIAL FOR MEETING A WIDE RANGE OF DEVELOPMENT OBJECTIVES; AND SECOND, THAT THIS POTENTIAL HAS NOT YET BEEN FULLY EXPLOITED.

ENVISAGED AS AN ACCOMPANIMENT TO THE DUSHANBE INTERNATIONAL FRESH WATER FORUM, HELD BY THE GOVERNMENT OF TAJIKISTAN IN AUGUST 2003, THE REPORT IS THE RESULT OF MANY MONTHS OF CONSULTATION AND COLLABORATION WITH NATIONAL AND INTERNATIONAL EXPERTS. WHILE FAR FROM EXHAUSTIVE, IT IS HOPED THAT IT WILL PROVE AN INSTRUCTIVE ADDITION TO THE POLICY DEBATE ON WATER, AND THAT IT MAY CONTRIBUTE TO REAL AND LASTING CHANGE IN TAJIKISTAN.



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