GEF AGENCY of the IFAS

ARAL SEA BASIN PROGRAM

Water and Environmental Management Project

Sub-component A1

National and Regional Water and Salt Management Plans

ADDENDUM to the Joint Report No.1

INCEPTION

2 March 2001

HASKONING
Consulting Engineers
and Architects

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1. INTRODUCTION

A1. Comments received on the Inception Report relate to i) concerns that regional energy issues would not be taken into consideration at the level they deserve, and ii) that the application of optimisation techniques, in conjunction with simulation techniques, would be beneficial in analysing the various future scenarios for water management. In addition, the World Bank wishes work on the development of strategies to start in 2001 and a preliminary document on strategic choices to become available by the end of this year.

A2. This addendum is in response to the main comments received. It presents the adaptations necessary to achieve a better balance of representation of the various water-using sectors in the project, the impacts on the composition, skill mix and inputs of the teams concerned, and proposed adjustments in the work plan. Moreover, the main text of the Inception report has been revised in regard to several aspects following comments received from the five States.

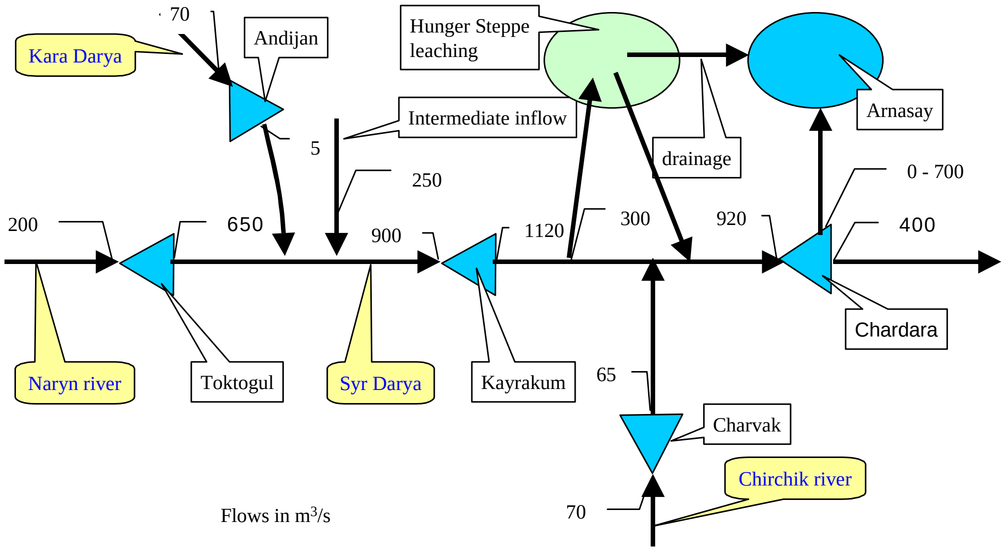
2. REGIONAL WATER AND ENERGY ISSUES IN THE ARAL SEA BASIN

A3. The expansion of irrigated agriculture since the 1960s was achieved by the construction of water regulating dams on the Syr Darya and Amu Darya. Hydropower stations were joined to the reservoirs but the main operating rule was - and basically still is - that the upstream reservoirs release water in spring and summer for irrigation in the downstream areas. Centralised decision making in the Soviet Union times allowed the separate management of water for irrigation and for energy production. The hydropower stations obviously formed a significant part of the energy system, complemented by a series of gas- and coal-fired thermal power stations. Problem in compensating the upstream republics for releasing water in summer for irrigation rather than in winter when demands for energy were highest did not exist, but already since 1988 flows started occur.

A4. Since independence, the timely and sufficient supply of energy in winter to the upstream countries must be agreed upon and organised between the States to ensure that the downstream countries can continue to rely on water releases in summer to the earlier agreed amounts. An interstate framework agreement for the Syr Darya Basin was reached by the end of the 1990s, and each year the concerned states negotiate jointly and bilaterally on the exchange of water (monthly) and energy (quarterly). Although this is a big step forward in water and energy management in the region, its implementation is still seriously hampered every year. Especially during years with below average precipitation and snowmelt, or in years with severe winters, it appears extremely difficult for the countries to comply with their agreements. Various reasons are at the root of these problems, including: i) the privatised energy market in Kazakhstan, ii) limited gas and coal resources to satisfy all demands, and iii) technical problems with the gas supply pipelines, and iv) lack of efficient regional management.

A5. Non-compliance with the agreements over the past years has already led some states to consider 'second best' solutions to cope with the situation: e.g. changes in land use (shifting to crops that consume less water but are economically less interesting), and the creation of downstream storage in Kazakhstan to capture at least part of the winter releases.

A6. The consequences of winter releases from Toktugul for power generation are that i) less water is available for irrigation, and ii) water is released to the Arnassay depression and to the Northern Aral Sea. However, a virtue is made out of necessity in that part of the excess water which cannot be released to the Syr Darya because of capacity limitations in the lower reaches is used for leaching the fields. The following simplified scheme demonstrates the water balance situation in the Syr Darya basin at the end of February 2001. It is expected that this year about 1 km^3 will be diverted to the Arnasay depression. As a result of the releases made during the dry year 2000 the upstream reservoirs are at a very low level, and current forecasts by Hydromet show again a bleak picture for the coming summer.

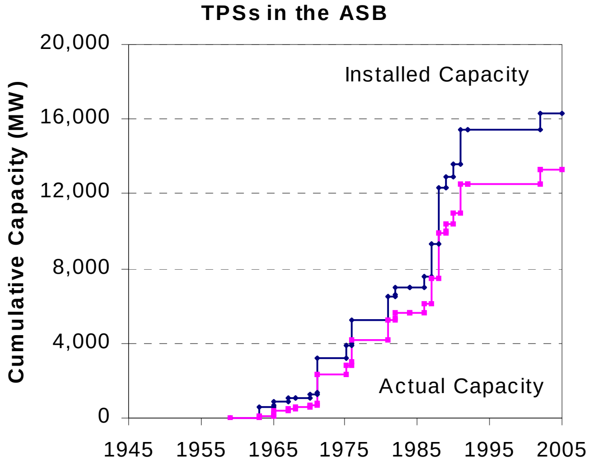


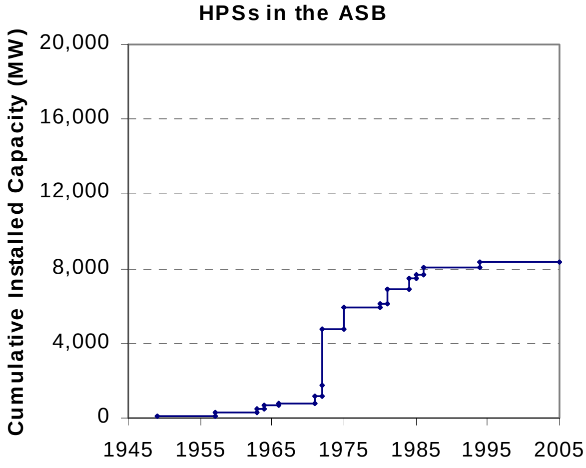
Flows in m³/s

A7. Thermal power stations (TPS) in the Aral Sea Basin part of the Central Asian republics have a total installed capacity of 15,500 MW. Of that capacity, about 38% was constructed before 1985, 62% between 1986 and 1991. The modern TPS at Taraz in south Kazakhstan (1,230 MW) is not in operation because it has not been possible to sell the electricity at the price set by the private operator. To the production capacity in the Aral Sea basin can be added some 600 MW of power which can be transferred from north Kazakhstan through a 500 kV line. Due to technical problems the real available TPS capacity is much less than the total installed capacity, and totals about 12,000 MW. One new TPS at Talimajan, Uzbekistan, is nearing completion, work having started in Soviet times. It comprises one single unit of 800 MW, and commissioning is not expected before 2002.

A8. The total installed hydropower capacity amounts to about 8,400 MW for the main facilities, including 364 MW at Kapchagai, located east of Almaty, which is outside the Aral Sea Basin but connected to the interstate grid. The Naryn cascade accounts for 2,870 MW and the Vaksh cascade for 3,840 MW. There are also a number of smaller cascades. Earlier reviews (EPIC, 2000) show that the share of hydropower in electricity production amounts to about 40%. Obviously, the hydropower stations (HPSs) are very important for peak power generation and for frequency regulation. Both upstream countries have great potential for further hydropower development.

A9. The low rate of development of both thermal and hydropower generation capacity over the past ten years, and projected into the near future, is illustrated in the following diagrams.





A10. All power stations are connected to the 500 kV and 220 kV interstate electricity grid operated by the Joint Dispatch Centre (UDC Energy) in Tashkent. This constitutes the link between the two river basins, not only in terms of electricity management but implicitly also for water management.

A11. The major issues of concern in the energy sector are: i) the need for integrated water management at both regional and basin levels, ii) supply of gas, coal and oil to the TPSs, iii) shortages of peak power in winter, iv) the fact that a substantial part of the system consists of aging TPSs which will require high investments for refurbishment or replacement in the near future, and v) technical problems in the distribution systems. On top of this is the current (almost annual) acute and critical water storage situation in the upstream reservoirs at the beginning of spring. Nurek reservoir in particular is drawn down in winter, creating difficulties in spring in the supply of electricity to industries.

A12. The above mentioned issues highlight the absolute necessity to integrate water management and energy management in the Aral Sea Basin, because only then can mutually beneficial and sustainable use of the resources be achieved by the States. The WEMP A1 project therefore will also integrate in its activities the relevant energy issues, such as energy production in both hydro and thermal stations, and transport and import/export of electricity, gas, coal and oil. This implies some restructuring of the workplan and changes in the composition of the National and Regional Working Groups.

3. MODELLING

A13. The Consultant has investigated a number of existing optimisation models in greater detail. Over the last four years optimisation models were developed under the WARMAP and EPIC projects. Our conclusions are that all models are in fact scientific work, and are incomplete, too detailed, and are conceptually inconsistent. None of the models include all essential elements, but on the contrary use a level of detail unwarranted at the regional scale. We also consider that combining certain elements of some models into a new model, or continuing development of the models, will not be feasible. Hence, at this stage we consider the existing models are unsuitable for the evaluation of strategic options for water, salt and energy planning and management.

A14. Our approach is that modelling is not a purpose in itself, but should have the objective in this project of analysis of the impact of alternative scenarios for water, salt and energy management at the level of the basins, the region, and the countries. Based on scenarios developed by the NWGs and the RWG, optimisation techniques will now be used to evaluate optimal water and energy allocations between the States and the basins, and their socio-economic impacts. Because of the strong links and dependencies between water and energy, and the existing regional interstate electricity grid, the optimisation process must be done at the regional level, in other words it cannot be done for the two basins separately.

A15. Thus, the basic question can be formulated as: given a development scenario (a vision based on a coherent set of assumptions), what would be the optimal land use and optimal energy production system to satisfy minimum projected regional and national requirements for grain, energy and ecology and in addition, production of industrial crops (cotton), subject to constraints on:

- water availability (basins, country, PZ: surface and groundwater);
- irrigated land (PZ: maximum area per soil type);
- crop patterns (PZ, soil type: crops, crop water requirements, water-use efficiencies on-farm and off-farm, yields, energy required for irrigation and drainage);
- fossil energy sources and transport (pipe)lines (country: gas, oil and coal);
- a set of TPSs and HPSs (country: existing, projected and potential);

A16. Given a set of economic costs and benefits and investment levels, other conditions and assumptions will include:

- for the most upstream reservoirs, the volume at the beginning and at the end of the year is equal;

- allowance for wheat/rice and energy imports/exports (with constraints for different countries where appropriate);
- shortages of energy or wheat will be covered by imports from available excess capacities from least cost sources.

The outcomes will be tested against a number of sustainability criteria or parameters.

A17. It should be noted that crop yields will be determined by the scenarios and calculated outside the optimisation process, so no water stress and salt stress functions will be included in the optimisation model.

A18. The objective function could look like: maximise total net benefits for the region, or maximise net benefits per country under the set of constraints and conditions. The result of the optimisation will basically be the optimal land use per PZ. As the optimisation modelling framework we prefer AIMMS, which is in fact a user-friendly variant of GAMS.

A19. This will then be followed by the simulation of water and salt balances (RIBASIM) a.o. also for statistical analysis and dry/wet year conditions. Soil/water salinity trend analyses for selected areas will be carried out with a one-dimensional model (SALTMOD), which will provide expected salt concentrations in the drainage water from the PZs to be used in the simulation model.

A20. If the simulated water balance results deviate from those of the optimisation, the question will arise as to which model is correct (both being representations only) and adjustments may be needed in either or both models (optimisation and simulation) to achieve coherent results.

4. DEVELOPMENT OF STRATEGIC OPTIONS

A21. According to the time schedule laid down in the Terms of Reference, the development of the strategic options is not to start before April 2002. In the light of the current urgency for the States to come to solutions in water and energy management, it is now desired to start this part of the project earlier. A preliminary discussion paper on ‘strategic options’ will now be prepared by the end of 2001. In fact, a first draft has already been prepared by the RWG and has been distributed to the NWGs for internal discussion, adjustments required in view of the national contexts and further elaboration.

A22. The discussion paper will focus on issues and questions such as:

- Water allocation mechanisms for transboundary water;
- Improved mechanisms for compensation for winter storage of water by the upstream countries;
- Directions for achieving rational water use in irrigated agriculture, both on-farm and off-farm;
- Water quality standards to be achieved in the long term;
- Directions to safeguard water supplies to wetlands and the Northern Aral Sea;
- Accompanying measures required in the agricultural sector to achieve sustainability and, at the same time, increased production;
- Directions for the future disposal of saline drainage water;
- Concepts for regional and basin water management institutions;
- Concepts for the operation (and maintenance) of regional infrastructure;
- Potential regional projects which could alleviate water and energy tension in future;
- Mechanisms to be considered for timely coordination and management in periods of crisis (extreme dry or wet conditions);
- Directions for modernisation of the legal and regulatory frameworks for water and energy management.

5. COMPOSITION AND SKILL MIX OF THE NATIONAL WORKING GROUPS

A23. The World Bank has proposed that the NWGs working in the upstream countries should have a greater representation of expertise from the energy sector, and that an energy specialist should take the lead of these teams. This proposal was discussed by the Consultant's Team Leader in Kyrgystan and Tadjikistan. In Bishkek this was discussed with the Director of the State Energy Agency and with a Deputy Director of Kyrgyzenergo (the Director was not available), and in Dushanbe with the Minister of Energy. All expressed clearly that 'water resources' is not a *sector* in itself, but serves the interests of municipal and industrial water supply, irrigated agriculture, power, and protection of water quality. They expressed the view, therefore, that the energy sector should not take the lead of the NWGs, but because of the apparent interests of these States they do see the need to be more involved in the project. In both NWGs, deputy team leaders have been appointed from the energy sector, as well as other energy specialists from the power companies. In Kyrgyzstan the deputy team leader will be Mr. Davidov, who holds the position of deputy director in Kyrgyzenergo; while in Tadjikistan the deputy team leader will be Mr. Petrov, former deputy chairman of Barki Tadjik (power company) and currently advisor to the Minister of Energy.

A24. During the visits to Bishkek and Dushanbe the Team Leader also met the country representatives of the World Bank (Mr. Mudahar and Mr. Ruiz) and the ministers of water (Mr. Kostuk and Mr. Nazirov). The vice prime ministers responsible for IFAS both were out of their countries.

A25. The incorporation of these experts in the teams will be accommodated by reducing the inputs from other NWG experts, especially in the field of irrigation, which is feasible in view of the lesser importance of irrigation in the upstream countries compared with the downstream countries. Staff changes are reflected in the adjusted schedule attached.

6. COMPOSITION AND SKILL MIX OF THE REGIONAL WORKING GROUP

A26. A review of tasks ahead in Phases III to VI has led to the following changes in the RWG:

- The project economist, Dr. G. Bauer, will be replaced by Dr. G. Vogel, who holds a Ph.D. in energy policy and economics and has extensive experience as a senior energy expert in national and regional energy studies and projects, especially in CIS countries. Six person-months are allocated for this position. Possibly the team would still need some input from Dr. Bauer at the end of Phase III.
- Inputs of the participation specialist and the senior irrigation and drainage specialist, who provided important contributions in Phases I and II, are considered not to be crucial in Phases III to VI. The ecologist has left HASKONING/IWACO and in his new position he is unable to participate in the project. It is proposed to combine the time inputs from these three experts (7 person-month in total) and allocate it to Mrs. Rimma Dankova, environmental economist, with extensive experience in the CAR. Mrs. Dankova left the World Bank recently to join HASKONING.
- Input of the hydrologist, Prof. Bogacki, is no longer essential, since the pure hydrological issues are well covered by the local experts. Topics related to mechanisms for transboundary water allocation will be covered by the team leader, the senior water management advisor and the institutional specialist. The two person-months for the hydrologist have been added to the inputs of the agronomist, who will play an important role in the development of scenarios for agricultural sector development.
- The Chief Engineer of the JDC Energio, Mr. Ametov, joins the RWG as short term consultant.