Sectoral Allocation and Pricing of Groundwater

V. Damle, Senior Adviser
Confederation of Indian Industry,
Bunglow No. 2, Ganesh Khind Road, Pune - 411005, Maharashtra, India.
e-mail: v.damle@cii.in

Abstract

This paper highlights the need for moving towards comprehensive management framework for integrated management of all water resources in predominantly agricultural and other rural (where industrialization is being promoted) watersheds and aquifer command areas. It suggests a framework for an allocation policy that will provide rights and entitlements to farmers so as to enable a livelihood above poverty line, an allocation to environment to promote forestation and allocation policy for commercial agriculture and industry. As for framework for pricing policy for industry, this paper suggests taking into consideration various cost factors and approach to determine the respective costs. Different pricing regimes as policy instruments for encouraging efficient water use and enabling cross subsidization have also been discussed. This paper also suggests a framework for a pricing policy for irrigation (through groundwater) that will honor the recommendations of the National Water Policy, 2002 for financial and physical sustainability with respect to recovery of O&M costs and a part of capital costs and transparently targeting the subsidies to the disadvantaged and poorer sections. This paper also suggests a framework for permitting trading of agricultural allocations within the sector and with industrial sector and also suggests safeguards for preventing speculative purchase of water allocations by investors primarily interested in investments in water markets. This paper suggests 7,500 to 15,000 ha as a suitable size for hydrological units for integrated planning and emphasizes the need for comprehensive assessment of all water resources together- surface as well as ground water, for actual quantification of allocations to different users and uses. The need for decision support systems for annual evaluation of water availability and decisions on water allocations to different users and uses has also been emphasized. Gaps in existing groundwater assessment methodologies concerning confined aquifers have been pointed out. This paper further suggests that there should be a national policy to protect aquifers for which the recharge mechanisms are not clear or do not exist, or the recharge durations are very long whereby sustainable exploitation is not feasible. It is also suggested that there should be a national policy to protect natural recharge sites of confined aquifers and that recharge structures should be constructed at such sites to facilitate enhanced natural recharge .Lastly, this paper identifies major roadblocks in the transition process and suggests that a beginning should be made with establishing and demonstrating methodologies for assessment of water resources and creating water access for water users in the poorly endowed areas of hydrological units. It is suggested that a pilot scale national programme may be considered to invite R&D organizations, NGOs and Corporate organizations to demonstrate methodologies for water resource assessment and creating access to poorly endowed users.

1. Introduction:

Over the last 2 – 3 years the groundwater issue has come up in a big way in India, thanks to the Central Ground Water Board. There are various new initiatives underway – pricing, recharge, credits – which are going to determine the groundwater regime in India for years to come. As an Industry Association we would like to express our appreciation that the CGWB has tried to involve us in the various policy and steering bodies for the changes that are underway. We also appreciate that we have been invited to express our views in this Special Session, which is itself indicative of the Government's initiative to involve the stakeholders in the change process. We are happy to make our little contribution to the discourse and the national policy on groundwater.

In this Special Session we have been requested to express our views on the important topic of "Sectoral Allocation And Pricing of Groundwater" and this paper will try to make certain propositions in the context of the policy changes that are underway.

This paper takes a generic and integrated view of water resources, i.e. surface water resources (including small water harvesting structures to large reservoirs), groundwater aquifers (not including delayed flows that contribute to surface flows in relatively short duration after storm events), infiltrated waters due to surface waters (water harvesting structures and surface flows) that recharge local shallow wells and are use conjunctively, and discharges in the discharge zones of aquifers due to base flows and considerably delayed flows, etc. It is understood that use of surface water is always the top priority of all users and groundwater is used to make up for the shortfall. However, there are considerable large areas where there do not exist significant surface resources and groundwater is the primary source for irrigation as well as industry. The allocations discussed here are based on co-management of surface resources with groundwater resources at the level of local scale watersheds and/or aquifers. This concept of co-management is different from that of conjunctive use. The latter is more or less an extension of surface resource like for example the influence zones of canals and check dams.

Further, so as to address the issue of sustainability, this paper will consider only the groundwater resources where the recharge mechanisms are clear and artificial recharge is possible and cost effective. There should be a national policy on protecting aquifers where recharge mechanisms are absent or recharge durations are too long for sustainable exploitation. There should also be a national policy on protecting natural recharge zones and strengthening natural recharge through recharge structures.

Apart from making suggestions on a framework for groundwater allocations to industry, this paper also explores the possibility of addressing priority issues such as poverty alleviation, food security, maintaining indigenous production base so as to protect the country from adverse international market conditions, etc. through a water allocation policy.

It also needs to be mentioned that the concept of water markets is getting highlighted in policy discussions at various levels. A regime of water allocations can give further impetus to this. However, such initiatives may be premature since we first need to learn to provide and manage allocations, and further create the required institutional mechanisms for regulation before water markets are promoted.

There are studies on informal rural groundwater markets that suggest this is already happening (and therefore the need to formalize it). But the present so called groundwater markets thrive on the fact that groundwater is yet not unambiguously in the public domain and the access to groundwater is purely on the basis of natural endowment conditions. A premature introduction of water markets will give rise to privatization and extreme unsustainable exploitation of a resource which though not in public domain yet is still widely considered as something that should be brought under common property regimes.

This paper will mainly focus on allocations and pricing for irrigation and industry with the bottom line that appropriate allocations have to be created for domestic use and ecology as a top priority. However, in this paper only the allocation to forestation has been discussed briefly as allocation to environment in the rural and predominantly agricultural watersheds and aquifer command areas.

The above position on water markets in this paper not withstanding, this paper also suggests which water rights and allocations are tradable, within sectors and between sectors, and under what circumstances. This should lay the foundation for introducing water market regimes that will allow individuals to choose alternate occupations without foregoing the benefit of water right, provide stimulus to water users to enhance water use efficiencies, and will at the same time prevent privatization of water resources through speculative purchase of water allocations by investors that primarily aim at water trading. Such checks and balances are very essential for a regime of water allocations that has an inherent potential to move towards formal or informal water markets.

2. Scale of Operation

The size of individual assessment and regulation units will depend upon the surface and subsurface hydrology of a region. But experience in different parts of the country suggests a minimum scale of 7,500 ha to 15,000. But this is just a ballpark figure.

As far as surface hydrology in concerned, the scale should incorporate water harvesting structures up to the level of at least the minor irrigation tanks and the smaller medium irrigation tanks. The water management system may include inter micro watershed water transfers and pumping of water from d/s larger reservoirs in to the u/s smaller reservoirs and recharge structures.

As where subsurface hydrology is concerned this should be based on the pattern of base flows so as to ensure inclusion of perennial water availability areas in the unit along with seasonal water availability areas so that water access can be ensured to all water users and uses all round the year.

3. Sectoral Allocations

This paper mainly focuses on policy for predominantly agricultural watersheds and aquifer command areas and other rural watersheds and aquifer command areas where industrialization is being promoted and is spreading. It is not the intention to neglect the urban industrial areas where there is, to a lesser or greater extent, dependence on groundwater. However, in such areas the primary issue is not the policy for inter sectoral allocations, the primary issues are curtailing draft, enhancing water use efficiency and high quality wastewater treatment so as to enable recycling and reuse.

Whereas in the rural and agricultural areas the primary issues are protecting agricultural subsistence livelihoods, protecting allocations to industry, protecting drinking water for lean summer months, response mechanisms to temporary water shortages due to deficient rainfalls, wastewater treatment to facilitate use in agriculture and industrial utilities, protecting water resources from contamination, etc.

There is fair amount of clarity in what needs to be done in the urban areas, and doing it is primarily a question regulatory control and administrative will. But in the rural areas where industrialization has already reached some of the adverse impacts are now becoming visible – lowering of water levels, deterioration of water quality, worsening conditions of small and marginal farmers, and so on. Solutions need to be found to the emerging challenges and a coherent policy needs to be developed to enable sustainability and viability of industry as well as agriculture, and also protect the livelihoods of marginalized agricultural households.
Similarly, much attention is also necessary for the predominantly agricultural watersheds and aquifer command areas since there are clear and extreme disparities in terms of water access endowments in such areas. The common refrain among Government and Non Government agencies involved in watershed development and aquifer recharge programmes is “it is up to the people now to pluck the low hanging fruits”. This is not acceptable. Some sections are reaping the low hanging fruit due to purely the favorable endowment conditions, and the others are getting further marginalized. This paper suggests policy measures to address this situation too.

4. Basic Water Rights and Allocations to Farmers as Basic Service

Can rural food security and poverty alleviation be addressed through water allocations as basic right?

The water rights movement in India has not really taken off. The usual refrain among Government as well as Non Government agencies involved in watershed projects is “watershed treatment augments water resources, it is then up to the local people to harvest the low hanging fruits”. However, even in micro watersheds, e.g. 500 ha, there are poorly endowed areas (small watersheds on 2^{nd} 3^{rd} order streams) and richly endowed areas in the valley plains. Farmers in the valleys have been reaping the fruits but the farmers in the upper portions are not much better off except perhaps marginal amount of protective irrigation during monsoons. Therefore it is necessary to provide not only an allocation to all families but also clear access mechanisms.

In Maharashtra there has been some amount of water rights movement and some amount of experimentation around this. Presently the basic water right that is being advocated is about 5000 m^3 per ha per year per nuclear family (of about 5-7 members including children and aged). This is considered as sufficient for irrigated cultivation of water efficient crops along with in situ use of rain water on 1 ha. Together (i.e. in situ rain water and applied irrigation) can enable dry biomass production of about 20 to 25 tons per ha and harvest of about 5 to 6 tons of food grains. With voluntary use of irrigation equipment a farmer may be able to cultivate up to 1.5 ha and can therefore go much above the poverty line.

The water rights movement in Maharashtra suggests that such basic water rights should be totally delinked from land ownership so that small and marginal farmers with holding below 1 ha can resort to higher irrigation intensity agriculture of higher value crops. The landless can access lands of larger land holders on suitable terms. Alternately both these categories can trade their water rights.

Since this allocation is basically subsistence allocation the water rates for this should be bare minimum. These entitlements, at least at the initial stage, should not be available for inter sectoral trading with industry since the basic objective of the basic water right is enabling a minimum livelihood on par with poverty line income levels.

While this allocation is primarily aimed at sustainable livelihood of poorly endowed farmers, it will also serve the purpose of ensuring a minimum level of agricultural activity in the hydrological unit if this allocation is allowed trading only within the sector that is agriculture.

5. Allocations to Environment

Can forestation be promoted through water allocations for environment?

Forest cover parameters (% of land in a watershed that needs to be brought under forest cover) may be fixed on a regional basis and also taking in to consideration green belt requirements of industries. Ideally such plantations should be commercially viable and could be provided allocations from 3000 to 5000 m^3 per ha per year, not including in situ use of rainwater, and can enable production of 15 to 20 tons of dry biomass per ha. This water may be made available to any entities that have water entitlements within the watershed and/or aquifer command area, farmers as well as industries, and are willing to undertake the forestation programme. These allocations should also not be available for trading with other sectors since these are meant to protect the environment, make available biomass for local use (fuel, fodder, wood for housing, energy biomass, horticultural food supplements, etc.), and also for creating supplementary employment opportunities. Non-permissibility of trading with other sectors will encourage private sector to make investments in biomass production and processing, e.g. renewable energy systems, bio fuels, herbal formulations, paper, etc.

6. Additional Basic Rights and Allocations to Farmers as Economic Service

Depending upon further availability of agricultural land and water (over and above the cultivation possible through the basic water service) further allocations may be made for agriculture. These may be considered as additional basic rights so as to enable farmers to go significantly above poverty line by using this allocation. It is recommended that these allocations may be at economic rates (rates higher than those for the basic service but not the same level as water rates for industry) since water for livelihood security would have already been allocated. In a predominantly agricultural watershed / aquifer command area with higher level of land and water endowment a differential pricing system may also be considered for successive slabs of water allocations. These additional allocations to agriculture may also be tradable rights, including trading with industry. Farmers wanting to take up agriculture in additional lands or wanting to take up water intensive crops may do so using the additional entitlements and may also access more water from farmers who do not use up their additional entitlements. On the other hand farmers who do not want to utilize this allocation, fully or partially, should be free to trade this with industry. This will allow some amount of flexibility in the land and water use choices in a hydrological unit.

7. Allocations to Industry and Commercial Agriculture as a Commercial Service

This allocation may be considered only after providing above discussed allocations to farmers and environment. Allocations to industry and further allocations to agriculture as a commercial service would be subject to the local agricultural and industrial policy. The water rates for both sectors should be more or less on par since agriculture based on these allocations would be fully commercial agriculture in terms of cropping choices as well as affluence status of farmers. A State Government may choose to provide some degree of concession to either certain types of industries or agriculture depending upon its policy for the region. Where concessions are provided to agriculture, it should be mainly with the objective of promoting agro processing and packaging industry, and therefore directly or directly promoting industrialization.

It is being suggested that economic models need to be developed for taking decisions on such allocations. Such models may take in to consideration various levels of impacts such as –

- Impetus to u/s and d/s economic activity (inputs supply and market linkage)
- Creation of income and employment opportunities for local communities
- Impetus to high quality essential services such as health, education, transport, information connectivity, etc.
- Impetus to services sector
- Additional requirements of water for domestic and other civic use

and most importantly

- Revenues on water services
- Value addition per unit volume of water for the whole value chain
- Tax returns and revenues to local self government and state and central governments.

The commercial allocations should be allowed trading only on the basis of enhancement of water use efficiency. Trading of unused allocation should also not be permitted. This will prevent an investor from speculative purchase of water allocations and will ensure that the water allocations are directly for productive use.

It is also needs careful consideration that an industry can take some time to reach full production capacity and in the meantime may not be able to fully utilize its allocation. Till such time as it achieves full production capacity the unutilized allocation may be reallocated to other uses and users on annual basis.

8. Water Resource Augmentation and Management

It may be noted that the proposed model necessitates due attention to water availability and the need for scientific assessment of water resources. The methodology for water resource assessment may be based on following considerations

- Surface flows over the annual cycles
- Potential for surface reservoirs
- Aquifer capacities
- Potential for enhancing recharge at natural recharge zones and also artificial recharge through injection wells
- Hydrological models based on soil and slope conditions, infiltration rates, delayed run-offs, base flows, etc.
- Calibration of run-offs, surface storages and groundwater availability with respect to rainfall vagaries (total rainfall as well as intensity patterns)

It needs to be mentioned and noted that – a) The watershed development programme has so far not comprehensively addressed the issues of techniques for water resource assessment and creating a water rights movement, b) The groundwater assessment by Government agencies is mainly at regional scale and techniques for micro level mapping of aquifers are yet not available, c) The aquifers being addressed by regulatory and technical agencies are mainly water table or phreatic aquifers, and therefore assessment

techniques and regulatory mechanisms for confined aquifers are yet not available, d) There is not much clarity on the requirement of ecological stocks in groundwater, and e) the watershed development and aquifer recharge programmes are yet to evolve and adopt a "management" framework, and continue to work with "supply side" approach.

A "management" approach requires a regime of rights and entitlements on the one hand and a decision support system for annual evaluation of water availability, so that decisions on allocations to different uses and users can be taken on year to year basis depending upon post monsoon water availability.

The National Water Policy will come in to play primarily during deficient rainfall years, but this also requires some modification to accommodate the above approach to sectoral water allocation. The modified priorities for rural watersheds and aquifer command areas may be as follows –

- Drinking water
- Basic allocations to agriculturists (farmers as well as landless labor to address food security and incomes on par with poverty line)
- Allocation to environment (to support forestation)
- Additional basic allocations to agriculturists and allocations to commercial agriculture and industry
- Allocation to ecology (surface flows and groundwater stock – requires a scientific framework)

Drinking water will always be the absolute top priority. Next priority would be to support food security and minimum income levels of farmers. Following this priority would be to preserve forests so as to make available essential biomass.

Following the above three top priorities it will be a matter of judicious choices to distribute remaining waters between three types of uses – additional water rights and allocations to farmers, commercial agriculture and industry. Commercial agriculture needs to be protected as much as possible since often this would be perennial and long duration crops (e.g. cotton, sugarcane, grapes, herbs, etc.) that can entail huge losses to farmers if not provided irrigation, and also for protecting the processing and packaging sector, to ensure that it operates at least at the break-even point. Similarly, it is also necessary to ensure that industry also operates at least at the minimum viability level and industrial investments are protected. If possible it is also necessary to ensure additional incomes to farmers so as to enable them to spend on essential services such as health and education and prevent the debt trap.

9. Institutional Mechanisms

The institutional mechanisms may include at least four types of essential institutions –

- The regulatory authority
- The local Governance institutions
- The local management institutions
- Technical and training support institutions.

Apart from the essential institutions it will also be necessary to have presence of private sector organizations and professionals to provide specialised technical and maintenance services.

The regulatory authority role may include deciding on the basis and quantum of allocations as well as permissible uses for each type of allocation. For example, which types of crops may be made the basis of deciding upon basic allocations, which types of crops are permissible for actual land and water use under basic and additional basic allocations, which types of crops are permissible under commercial allocations, which types of industries are permissible in a particular hydrological unit, etc. The regulatory authority may also be required to adjudicate on disputes among different stakeholders and recommendations by stakeholders and civil society institutions. The regulatory authority may be a central authority (e.g. CGWA) with regional units.

As for Governance institutions, hydrological unit level institutions may have to be created through representation of Panchayats that fall within the units. Hydrological units at the proposed scale will include a number of Panchayats. The Governance institutions may also have representation from Water User Associations of farmers and other stakeholders.

The management institution will have an important role to play – creating water access to all water users and also monitoring of abstraction and use by different users. This agency may have to undertake actually water delivery service to users that are not in a position to manage their own water draft. For example, farmers in the upper portions of watersheds and in seasonal water availability portions of aquifer command areas will have to be provided water access from public or private abstraction structures in the better endowed areas. This will require hydrological unit level water distribution system that is managed professionally.
The technical and training support mechanism may be at the level of clusters of hydrological units and will be responsible for providing the required technical and training support to the Governance and management institutions.

10. Sectoral Water Pricing

The CGWB has already circulated a policy for pricing. However, the basis of arriving at the proposed values is not yet clear – what are the factors considered in pricing, and the justification of the price/cost value for each factor.

The various factors that could be considered in pricing may be – royalty, administrative costs, infrastructure development and O&M for groundwater augmentation or recharge, O&M costs of water abstraction and distribution service, wastewater treatment service, wastewater conveyance service, etc. The additional pricing components could be price as deterrent for excessive use, cross subsidization, opportunity cost, etc., i.e. factors other than direct costs.

Presently of course only the industry is in the price net, agriculture is not being charged. This policy needs to be examined in the context of the recommendations on allocations to farmers and agriculture discussed above. Along with pricing for agriculture the issue of energy tariff for pumping also needs to be discussed.

11.Groundwater Pricing for Industry

As said above, the CGWB has circulated the pricing policy but the basis for arriving at values is not clear. In this section the pricing factors mentioned above will be discussed in the context of pricing for industry. A number of Central and State agencies are involved in the regulatory, monitoring and management functions and all their costs need to be incorporated in the pricing. But there needs to be a clarity on various cost components and the respective components should go the concerned agencies so that they are able to discharge their functions efficiently.

Royalty

As per the assessment of case law and constitutional and legislative provisions by the Expert Group on Groundwater Management and Ownership (Planning Commission, 2007), Government has regulatory powers so that one user's pattern of use should not affect the rights of other users with respect to quality and quantity. However, the basic right to access groundwater is as per the Indian Easements Act, 1882 and tied to land ownership. Therefore charging of royalty could be legally contentious.

Administrative costs

This may cover costs of regulatory functions, monitoring, etc. A number of Central and State Governments agencies may be involved, e.g. CGWB / CGWA, Central and State Pollution Control Boards, State Water Resources Departments, District Administration, Municipalities, etc. A realistic assessment of costs being incurred by all concerned agencies be made and the respective components should go to the concerned

agencies so that they are able to discharge their duties efficiently. This framework also enables a "single window" approach and therefore reduces transaction time and costs. Presently, the CPCB is charging cess on water permits. But it is not clear whether it is towards administrative costs or for providing wastewater management facilities (such as treatment and conveyance). But pricing components towards such services should be assessed separately and charged accordingly.

12.Infrastructure for Groundwater Augmentation and Recharge

This component may be charged if the Central or State Governments are actually developing infrastructure for groundwater augmentation and recharge, similar to the head works and conveyance systems for surface water management. The National Water Policy 2002 recommends (in the context of financial and physical sustainability) that "There is, therefore, a need to ensure that the water charges for various uses should be fixed in such a way that they cover at least the operation and maintenance charges of providing the service initially and a part of the capital costs subsequently". This recommendation can become a basis for fixing the rates for this component of pricing. Again, this component should go to the agency that is actually executing these activities, i.e. the State water resources departments.

13. O&M Costs of Water Abstraction and Distribution Service

This issue is hypothetical presently since the Central and State water resources departments are not offering this service in rural areas to industries. But if this service were to be provided then O&M costs and some part of capital costs may become the basis for fixing rates for this component. Again, this component should go to the agency that would be actually executing these activities, i.e. the State water resources departments.

14. Wastewater Treatment Service

This issue is relevant to mainly small and medium industries. The larger industries using substantial amounts of water are normally mandated to undertake wastewater treatment and therefore discharge only treated wastewater (i.e. if permitted to discharge, since many companies have been mandated "zero" discharge). But the pricing of this service requires careful attention. Treated wastewater can be used in agriculture as also as utilities in industries and residential areas, which could be a revenue generating service to end users. Therefore it is possible that part of the revenue for this service can come from the users of treated wastewater. Therefore industries that want to avail of the wastewater treatment service may be charged in the framework making up for the gap between revenue from treated wastewater users and the actual cost of treatment and redistribution. The service providers for this service may be mainly private agencies. However, usually such projects would be facilitated by State / Central Government agencies, e.g. the industries development corporations. Therefore the revenue movement issue needs to be sorted out, whether the state governments collect the revenue, the central agencies, or the subscribing industries pay directly to the service provider. The National Water Policy 2002 framework for pricing quoted above will be useful for fixing the rates for this service as well.

15. Wastewater Conveyance Service

This issue comes up when the State Government (through local municipalities) need to provide for the drainage system for conveyance of treated wastewater to the designated river flow or discharge points in the seas. Presently at least the larger water user industries based in rural areas are being mandated to discharge their water at approved points. Therefore this issue also becomes more relevant to small and medium industries.

16. Other Methods of Water Pricing

Apart from the pricing based on direct costs there are other methods of pricing are also being discussed the world over. These are deterrent to excessive use, cross subsidization, opportunity costs, etc.

The thinking behind the deterrent price is that the price may be kept at a level where the user is compelled to invest on improving water use efficiency. However, while applying this method the impact of this on the competitiveness of the industry needs to be considered. Perhaps the better way would be to persuade industry to improve water use efficiency through dialogue. Other method would be to develop a database on best practices in terms of production per unit water, assess the potential for achieving higher water use productivities under Indian conditions, and put a high price for water use over and above what may be the acceptable use. Government should work with the industry to evolve acceptable norms.

Other method that is often discussed is cross subsidization where pricing of water to industry may subsidise other priority uses. However, this method has the danger of bringing in arbitrariness at the lower end as well as at the higher end. If this method is to be applied then it is first necessary to assess what should be the actual reasonable cost of water service, including the investment costs as well as O&M costs. It is very likely that the high end water user will get charged for the inefficiencies of Government utilities and administration.

Other method that is frequently discussed by economists is opportunity cost which is based on potential benefit to foregone uses. Since in India the top priority is to agriculture the opportunity cost may be assessed with respect to foregone use in agriculture. For example, if 20,000 m^3 per ha is the allocation to sugarcane cultivation and Rs. 50,000 per ha is the projected net income per ha, then the opportunity cost of water would be Rs. 2.5 per m^3. If this method is to be applied then it would be necessary to first assess what should be reasonable, easily achievable water use efficiency, for say sugarcane cultivation, to take this example forward. The desirable water requirement should be significantly lower than the existing level of requirements of flood irrigation, and therefore the opportunity costs should also be much lower than the above example.

However, if opportunity cost is to become the basis of water pricing for industry, then it should be charged only for the amount of water that is lost in industrial use – i.e. productive consumption, losses in conveyance, evaporation losses in storage and evapotranspiration in the green belt. That is, the opportunity cost should be charged only for the quantum total intake minus total wastewater discharge.

17. Concessions to Industries in Groundwater Pricing

As per the new and emerging groundwater regulation policy industries are being mandated to conduct artificial recharge proportionate to their water requirements. The Quantum of recharge is decided with respect to the level of exploitation in that region. Infrastructure for recharge should get the status on par with surface water infrastructure and if companies are required to invest in the recharge infrastructure they should be given a concession in pricing.

Presently there is another emerging policy where industries are proposed to be provided “groundwater credits” for recharge undertaken over and above the mandatory requirement, and based on the credits top industries will be provided awards. This policy does not appear to be sufficient to motivate industries to undertake additional recharge over and above the mandatory requirement. The groundwater credits should entail direct and assured benefits.

The concept of groundwater credits is clearly seen as a first step towards “markets”. However, such markets will take some time to emerge as it will require a whole institutional mechanism (for evaluation of claims and for regulating the markets) and policy before they can be operationalised. In the mean time there is a necessity for providing assured benefits to such initiatives by companies. This may be in the form of concessions in water rates

18. Water Pricing for Agriculture

Totally three types of allocations to farmers and agriculture have been discussed above, viz.

- Basic allocation to farmers

- Additional basic allocation to farmers
- Commercial allocation to agriculture

Many State Governments have developed groundwater irrigation schemes for farmers' water user groups. These are usually handed over to the groups so that they take care of O&M. No water rates as such are being charged to farmers. Also that in most states the pumping energy is also highly subsidised. The quote from National Water Policy 2002 given above should become the basis for charging farmers. Therefore the groundwater user groups should be charged –

- At the least a part of the capital costs
- Energy costs in real terms.

The National Water Policy 2002 further recommends (with respect to financial and physical sustainability) that "The subsidy on water rates to the disadvantaged and poorer sections of the society should be well targeted and transparent". The implications of this recommendation require careful consideration while deciding upon water rates to farmers.

First of all it is necessary to have farmers' participation in investments. In the drinking water schemes as also in watershed development and other programmes it is now a well established principal that farmers' participation in investments is necessary for them to undertake the "ownership" of the assets. In the case of groundwater schemes for irrigation such investments result directly in to improved livelihoods and therefore it is appropriate that farmers are charged for capital costs. In the absence of such charge, it is found that many such assets actually benefit only a few farmers, usually the local big-wigs, and many farmers from the group are left out. Many such schemes become defunct since revenue from just a few farmers is not sufficient to cover the maintenance costs. If the farmers were to pay towards capital costs then they would surely struggle for their equitable right so that all the farmers in the group may benefit and there is adequate revenue for maintenance. It may also be considered that there are thousands of private groundwater irrigation systems of farmers where farmers are undertaking all the required investments. Therefore there is not much logic in subsidizing a few farmers.

With respect to the operational costs of groundwater to farmers the cost of energy is the most important factor. In many States the farmers are provided highly subsidized pumping energy. Such subsidies are neither "well targeted" nor "transparent". The water allocation policy to farmers and agriculture being recommended in this paper may be a pointer towards how subsidies can be "well targeted and transparent". If we look at the energy available for distribution as a "pool" of energy generated by different types of sources and the cost of generation (with respect to each type) it may become possible to target subsidies in a transparent manner.

The existing energy sources may be classified on the basis of types and corresponding costs of generation as follows –

- Old hydropower plants
- New hydropower plants
- Old thermal power plants
- New thermal power plants
- Nuclear power plants.

The basic allocation to farmers may be charged on the basis of the lowest generation cost power in the pool (most likely the older hydropower plants), the additional basic allocation may be charged the second or third lowest cost power (most likely the new hydropower projects or the old thermal power projects) and the commercial allocation may be charged at the normal commercial rates, or at the least at the average cost of generation. Even the rates based on the lowest cost power will also be a subsidy shock to farmers, sufficient to stimulate enhancement of water use efficiency in the basic services and perhaps investments in irrigation equipment in the commercial agriculture.

Similarly, the rates for "capital costs" may also be fixed accordingly. The basic service may be charged a suitably low rate towards capital costs, the additional basic service may be charged an intermediate rate, and the commercial service may be charged the same way as non agricultural users are charged. The recoveries towards capital costs may be integrated in the water pricing.

19. Managing the Transition

The transition from a near total lack of regulation to a regime of allocations is not going to be easy. The biggest stumbling block is going to be the existing groundwater users located in the richly endowed areas that have been having unrestricted access to water, and also perhaps indulging in the so called informal water markets.

One can anticipate that there will be a very volatile opposition. Many will also take legal recourse, terms such customary rights will be used. Government's powers to evolve a regime of allocation (and pricing) may be questioned. In the end power tariff and recoveries over investments on water resource augmentation may become important tools for bringing in water use discipline and freeing water for reallocation.
A realistic power tariff will itself become a deterrent to excessive use. Therefore it is important that the Government takes a fresh look at the power tariff to agriculture and considers the recommendation on the same made in this paper.

The tool of power tariff alone may not be sufficient. It may also become necessary to bring in a policy on irrigation efficiency and facilitate water saving through public and private investments – literally speaking buying back water through such investments. It may also become necessary to strengthen the legal position of the Government through legislative changes that support equitable water rights, at the least in a limited send within the bounds of a hydrological unit.

But on the flip side the Government is going to earn lot of goodwill from the poorly endowed farmers and they may become willing participants in the initial trials and errors and various participatory processes. The first step towards transition will be establishing and demonstrating methodologies for assessment of water resources and creating access to users in poorly endowed areas, and these activities will require much informed participation of the local people.

20. Concluding Remarks

This paper highlights the need for moving towards comprehensive management framework for integrated management of all water resources in predominantly agricultural and other rural (where industrialization is being promoted) watersheds and aquifer command areas. It suggests a framework for an allocation policy that will provide rights and entitlements to farmers so as to enable a livelihood above poverty line, an allocation to environment to promote forestation, and allocation policy for commercial agriculture and industry.

The allocation policy suggested in this paper has potential to address priority issues such as poverty alleviation, environment rehabilitation, promotion of commercial agriculture and d/s value chain, and also sustainable promotion of industrialization so as to enable a balanced economic growth of the hydrological units, with the hope this will also bring in a services sector with good quality services and essential services such as health and education.

This paper also suggests a framework for a pricing policy for irrigation (through groundwater) that will honor the recommendations of the National Water Policy 2002 for Financial and Physical Sustainability, viz. *"….that the water charges for various uses should be fixed in such a way that they cover at least the operation and maintenance charges of providing the service initially and a part of the capital costs subsequently…..… The subsidy on water rates to the disadvantaged and poorer sections of the society should be well targeted and transparent*".

As for framework for pricing policy for industry a framework that takes in to consideration various cost factors and approach to determining the costs. Different pricing regimes as policy instruments for

encouraging efficient water use and enabling cross subsidization have also been discussed. It is also being suggested hat the pricing policy for industry should be evolved through dialogue with industries where various costing factors and policy imperatives may be discussed transparently.

This paper also make suggestions on trading of allocations, which allocations are allowed trading within the sector (namely agriculture), and between sectors (that is agriculture and industry). Safeguards for preventing speculative purchase of water allocations by investors primarily interested in investments in water markets have also been suggested.

This paper also emphasizes the need for demarcation of hydrological units and for comprehensive assessment of all water resource together, surface as well as ground water, for actual quantification of allocations to different users and uses. Gaps in existing groundwater assessment methodologies concerning confined aquifers have also been pointed out. This paper further suggests that there should be a national policy to protect aquifers for which the recharge mechanisms are not clear or do not exist, or the recharge durations are very long whereby sustainable exploitation is not feasible. It is also suggested that there should be a national policy to protect natural recharge sites of confined aquifers and that recharge structures should be constructed at such sites to facilitate enhanced natural recharge.

Lastly this paper also outlines some of the important roadblocks in the transition process and suggests that a beginning should be made with establishing and demonstrating methodologies for assessment of water resources and creating water access for water users in the poorly endowed areas of hydrological units. Perhaps a pilot scale national programme may be considered to invite R&R organizations, NGOs and Corporate organizations to demonstrated methodologies for water resource assessment and creating access to poorly endowed users.