Some Key Issues in Policy, Pricing, Regulation, and Financing of Irrigation Development in India Today

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ABSTRACT

In this paper we discuss the stylised problems relating to water and irrigation in India and argue that most of the inefficiencies, misuse and environmental damage have their roots in the mispricing of water and electricity. Since the only kind of subsidies thus far used are price based input subsidies they end up distorting the allocative prices, from which the other distortions follow. The problems of the sector can be overcome by changing the method of subsidisation. Converting price based or tariff subsidies to direct subsidies and endowments with improved tradability would solve most of the problems in the water and electricity sectors. Administrative and managerial initiatives by themselves would not succeed without this crucial tariff and subsidy reform. Such reform would also result in political capital for its initiators, and should make private and public financing of water (and electricity) projects possible.

The issues related to pricing, water rights, subsidies and financing are deeply interlinked, and the correct pricing would necessarily have to recognise the financing dimension. Water being a scarce commodity with major composition and coordination economies in its use, its pricing cannot be discussed without a consideration of the rights (implicit or otherwise).

This study, unlike many previous diagnostic studies, has been led by the need to find solutions to a fast deteriorating situation: rising implicit subsidies, movement away from optimal use in a major way, huge distortions and resulting social costs in the use and misuse of water, and as much as 30% of the irrigation water supplied being wasted. The environmental effects of such inappropriate use and waste increase by the day. Our approach to the problem calls for a strategic shift in so far as we argue that reform is not possible if the present approach to work around major policy and design infirmities rather than remove them in the first place continues. This is because the distortions have been so deep rooted as to have

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fed back into the governance and institutional structure of water management in the country. We also argue for solutions that are incentive compatible in the sense that the designs for pricing & regulation and financing (within the appropriate policy and rights framework) are internally consistent and would work without depending continually upon political commitment, administrative initiatives and managerial energies.

Incentive compatible policies are those which by design meet the criteria that the actors, civil servants, proposed water companies and cooperatives, electricity companies, farmers have the correct incentives to do what is right for efficient production, management, allocation and consumption of the resource without administrative direction or urging or demanding the presence of persons with exceptional morals, or leadership qualities. Key elements of our recommendations are:

The right to water of a state to the rivers and other water bodies should include the right to trade i.e. to sell the water. This would be consistent with the fact that the bulk of he water is for commercial use today. A formal, perhaps constitutional basis of sharing the waters of interstate rivers rather than national level optimal use being pursued weakly through agreements as is the case today is important.

The irrigation sector at all levels is opened to the private sector through frameworks for various kinds of private finance initiatives including the DBF /DBFO type initiatives. Rather than cost plus, it would be far more useful to institute regulation which is incentive in approach and price cap in form, though uniform caps across the country would not be possible nor desirable. Price caps could be the same across fairly large regions.

All subsidies whether for electricity or water would have to be direct subsidies delivered to the farmer. An identification exercise carried out once that allows the endowments of a farmer to be fixed, so that he can be issued electricity coupons and water coupons periodically, is necessary. This ensures the political commitment of the farmer since now he has nothing to lose but a lot to gain. Without such commitment and certainly with their hostility as the current agenda to eliminate or reduce subsidies implies, no reform is possible.

With all subsidies going direct, there need not be restraints on commercial behaviour and orientation of all participants in the market. The productive organisations – bulk water companies, retail companies and distributors including (WUAs), and farmers can all relate to the regulated bulk, and retail market prices.

Current subsidies in irrigation are converted to endowments in units of water and provided to the farmer in the form of coupons with which (as also with cash) he can buy water, and even sell the same subject to certain restraints. Thereby prices are allowed to perform their function of ensuring allocative and use efficiency. Since water supplies may be limited (because of natural factors, and because of limited existing capacity to produce /store) bulk water rates ought to be regulated, with only small opportunity for water companies (bulk and distribution) to gain out of the (high) retail water market prices. Regulated prices could be

long run marginal cost (LRMC), in which case the difference between the commercial viability prices and the LRMC prices is made up for the private /commercial bulk water producer through annuities in an appropriate private finance initiative (PFI) deal.

The benefit of the difference between the regulated retail prices at which water is supplied to the farmer and the retail water market prices in the command area/ayacut is to the account of the farmer. Since the farmer is able to internalise this benefit with reference to the price, there are strong incentives for judicious use, and optimal trade. In water scare regions it would restore and enhance the incentives for even investments in water saving technologies. A little of the same benefits is designed to be internalised by the water distribution entity so that it has strong incentives to save water in distribution, recover losses, and make investments for repairs, rehabilitation and augmentation

Tradability across an entire command is a desirable objective, which can be introduced as experience is gained of the system. Cross command tradability should also slowly emerge subject to certain safeguards against the monopolisation of access rights to water.

Water distribution companies are ideally structured as WUAs i.e., cooperatives but with some allowed asymmetry in shareholding. But they ought not to be limited to WUAs or even to farmers' companies. Bidding for distribution business should be open to entirely private companies too, so that the process of decentralised distribution does not necessarily have to be constrained by the 'free rider' problem in cooperation.

For entirely new projects requiring construction of new distribution assets, the access rights can be sold at prefixed prices/market prices but strictly limited to farmers with operational/own holdings of land in the command area/ayacut, to raise the capital to construct the distribution system. This can be done separately for each of the distribution areas, since the bid prices are likely to vary depending upon such factors as the alternative supplies including from ground water available. Such purchase of the rights to water would lead to much flow of finance into the sector, and in a way that is functional and entirely incentive compatible. Banks and rural development finance institutions without any subsidy could then support the participation of farmers in the equity of distribution companies.

Tanks systems would also require a certain recasting with formally defined rights and prices for use of ground water and surface irrigation. The need here is to minimise the free-rider problem that is inherently a barrier in the management and judicious use of tank irrigation (a common resource in many ways). Herein the key to reform is to lead the system to an explicit relative valuation of the direct and indirect output of the tank (canal water and ground water) through bids restricted to farmers from within the ayacut. A prior fixation of the shares of each farmer in the 'tank' business that includes already existing use of wells is the key. Tradability among members of such 'rights water' would ensure its judicious use, and the expansion /savings in supplies would follow from the large profits that farmer would make in avoiding leakages and siltation.

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Towards a Water Resources Strategy for India – Some Key Issues in Policy, Pricing, Regulation, and Financing of Water Development

Sebastian Morris

INTRODUCTION

In Section I we introduce the principal problem that has vexed the electricity and irrigation sectors and bring out the complexities involved and suggest that their root cause lie in the inappropriate mode of subsidisation. We also suggest that solutions necessarily would have to transcend departmental boundaries and also be politically rewarding. In Section II we consider the specific problem of electricity use in irrigation, and the problem of the sector as such with particular concern about the low recovery rates, and wastage.

In Sections III, IV and V we consider the problems of the irrigation sector more closely. In Section V brings we highlight the core problem of tank irrigation. In Sections VI, we discuss the issue of water rights and its bearing on optimal use of water. Through the sections we work out methods by which the marginal (allocative) prices immediately are adjusted to the long run marginal costs, and the value of the current subsidies as actually enjoyed by the consumer is converted to 'entitlements'. We also work out the arrangements by which the administration of the same is feasible and incentive compatible, and distortions if any are minimal. The objective of these alternative arrangements is to lead to better and efficient use of water resources, cap the fiscal costs and reduce them. The arrangements would also meet the condition of being politically feasible in the sense that we mentioned earlier. In the medium to long term as investments (such as those in water conservation and savings, shifts in cropping patterns) begin to take place on the basis of these prices rather than the distorted prices, the gains would be very large for the economy.

In Sections VIII onwards we outline various financial measures (some of which are contingent on the nature of the organisation providing the service) that would lead to enhanced investments in the water and electricity sectors that is necessary for a steady and sustained increase in extending the service network and thereby overcome denial in water and electricity that is currently large in India. All these financial measures either presume that the subsidy administration has already been cast in the non-distortionary manner above, or they are themselves part of the content of change.

THE PROBLEM OF REFORM

Large Budgetary Subsidies

Budgetary subsidies (of the centre and states) constitute as much as 13% of GDP. The primary fiscal deficit of the centre is about a percent, and the fiscal deficit of the entire non financial public sector (NFPS) is under 10% c.2003. A large part of the budgetary subsidies are on account of economic goods and services like water and electricity where the recovery rates are quite low. If cross-subsides are also brought in then the total implicit subsidies are around 20-25% higher[2] (Srivastava, et al 2003). The scope to reduce the fiscal deficit by raising the charges and more efficient delivery of these services is therefore very large. Principal among these services is energy (electricity) and water both of which account for a large part of the budgetary subsidies which are non-merit in nature and are mainly directed towards production of agricultural goods.

In the first flush of reform the solution to the problem of large subsidies was seen as the reduction in the subsidy or its elimination. In this paper we argue that such 'brute force' reduction of subsidies is neither necessary nor feasible. The real solution to having low and sustainable subsidies is to recast subsidies as direct (to the user) so that the efficiency gains and incentive gains can be taken advantage as also the ability to limit and direct the same.

Direct Subsidies and Endowments as the Key

Direct subsidies would be 'incentive compatible' and bring forth political support for the contemplated change. Only such measures which are politically not unpalatable but which create support for reform are feasible in active and contested democracies, especially when the political cycle is also too short.

The space for feasible reform is created by the fact that as much as two thirds of the total 'fiscal' cost[3] currently incurred in subsidisation is in excess of the value of the transfer actually delivered to the subsidised groups.[4] Very roughly about a third of

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[2] These are the Srivastava et al (2003) estimates. But in electricity it is well known that the agriculture sector is treated as a residual, and the cost of supply to the non-subsidised sectors is also exaggerated. Today no sector other than agriculture is charged below cost. All others are charged well above costs. Therefore the cross subsidies would have increased from their 1997 figures, and is likely to be about 50% of the reported implicit subsidy.

[3] This would also include cross subsidies, since cross subsidies functionally are no different from (differential) taxes.

[4] In the case of programmes of expenditure of the Planning Commission especially the centrally sponsored schemes and taking the Jawahar Rozgar Yojna as an example (which many claim to be among the better structured programmes), 'it cost Rs.4.35 to direct one rupee one to the poor' (Srinivasan, T.N., 2000). Similarly, the ratio of central government

the 'fiscal' cost may be accounted for by illegitimate transfers (leakages, avoidable wasteful consumption, diversions, substitutions by high priced segments resulting in revenue losses) and the remaining by avoidable (dead weight) losses and inefficiencies that arise naturally out of the mode of subsidisation.

If allocative diseconomies, and the fallouts of the same are also brought in (i.e. the entire social cost), then the actual value the transfers to the subsidised is a small part of the total social cost. Thus the strategy for reform would be retain the transfers at the current realised (or better) levels by announcing at the highest levels as policy that these would be protected, even as reform and removal of distortions take place. This would nullify the opposition of the subsidised to reform, or in fact invite their active support as we have argued in the case of electricity. (Morris, S., 2001)

Inter Departmental Coordination cannot be Avoided

Such measures would necessarily demand the attention and decision of several departments /ministries, and this more than other reason has prevented the wider recognition and acceptance of direct subsidies. Appropriate measures that remove the policy level infirmities (which we bring out in this paper) , unlike what is generally believed, are not politically infeasible. Nor does the decision maker having to alienate or go against important political groupings like farmers or rural populations. They would only need to overcome the vested interests who in numbers are small[5]. Typically these would be those who have gained out the leakages, and unintended transfers that differential prices have brought about.

Since deadweight losses and wastage are large in the current systems of subsidisation, a more efficient method of subsidisation in avoiding these losses can release vast resources which can then provide the wherewithal to overcome the marginal dissent the few vested groupings who may be adversely affected in the reformed (subsidisation) system. In the case of food direct subsidies, such as well designed system smart card and stamps, that do not distort the market prices nor create a parallel distribution system as the current PDS does, can improve efficiency

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spending to actual transfer benefit realized by the poor in the case of food subsidies is as low as 6.35, (Srinivasan , T.N. 2004). A large part of the total loss of the Gujarat State Electricity Board amounting to as much as 200% of the reported losses c.1995 is in the form of leakage and wastage. (Morris S., 1999).

[5] Vested interests as a barrier to reform has been exaggerated in a vital sense. If reform means removal of subsidies altogether, then the entire farming community would be against reform and would therefore become a vested interest. On the other hand if as we propose, subsidies are to be retained and directly delivered, the vested interests that one would have to contend with are only those that gain out of leakages –typically the employees of SEBs who connive and others outside who gain out the diversion of electricity. These can be easily contended with if the bulk of the farmers are weaned on to the side of reform.

significantly. Even if stamps are sold, the benefit would have been delivered to the target group rather than to the middlemen. (Joshi and Little, p.234, 1996).

Reform has to be Benefit Neutral

Reform also need not impose sudden large burdens on the exchequer if essentially sound, consistent and politically sustainable measures are pursued. This is because the future "savings" both fiscal and social can at least in part be taken advantage of through appropriate measures that bring in the financial markets and institutions into the process. Reform that results in enhanced gain to the currently subsidised sectors (both through the retention of current level of transfer benefits and through efficiency gains) would be necessary if reform as such has to move forward.

On the Wrong Foot in Electricity

The proposals and actions in electricity thus far have not had the potential to unlock the hidden waste and inefficiencies. Reform then ends up being viewed as a zero sum game by farmers. Ill-advised politicians but with considerable political energy and sincerity have spent themselves on the futile option of directly cutting out subsidies. This has alienated them from the subsidised sectors allowed opposition to reform to organise resulting in immense damage to the reform process. (See Morris, S. 2002). Thus directly attacking agricultural subsidies through enhanced denial, uncompensated rise in tariffs in the states of MP, AP, Tamilnadu and now Gujarat has brought political disaster upon energetic chief ministers who earlier had much goodwill and commanded large majority in the assemblies. We had anticipated the same but had it gone unrecognised among policy makers. Thus: "The second task is to right-structure subsidy administration in critical areas: electricity, water and petroleum sectors where reform is caught in the bind of subsidisation. Removal of subsidies would not be the answer, since that would require prior reform, and would be political hara-kiri" (Morris,S., 2002).

Unfortunately today since ham-handed reform was pushed through in electricity there has been a massive political reversal in many states (Gujarat, MP, AP and Maharastra). Free electricity to the agriculture sector has become the slogan of political rightness and the ill designed reform has to bear responsibility for such reversal. Political initiative and commitment to anything but the status quo and populism may have been killed for quite a while. The tragedy is that simple options that would have actually enhanced the political support for reforms in electricity were available but either not understood or ignored. Enormous political energy, and what is even rarer bureaucratic commitment and organisation, have been all wasted in micromanagement of dysfunctionalties and perversities created by infirm policies, and poor design of schemes which should have been corrected in the first place. We had earlier (Pandey, Ajay and Morris, S. 2004) commented on the stupendous efforts in electricity reform and specifically on revenue mop up in MP. "How much easier

the task would have been if the moral hazard of consumer price mix arbitrage with which the company [WESTCO] struggles against is removed at one stroke through uniform prices and direct subsidisation of farmers. This would have ensured that the vast organisational energies and political commitment currently spent could be used to greatly speed up [revenue] recovery". We were also not optimistic that the effort would be sustained since political commitment was being wasted in administrative approaches to manage dysfunctionalties rather than to remove the same, and build up political support to reform thereby. It would now require a herculean effort to bring reform back on the agenda. The set back coming from ill thought advice of policy makers and others who did not worry about the incentive compatibility of the measures they sought, or in simpler language about its implementability and political implications, would now unfold to the detriment of the economy.

Allocative Price Distortions at the Root of the Problem

Under pricing of water and of electricity used in pumping up ground water (electricity supply to the agriculture sector) has been at the root of the fiscal crisis. The budgetary contributions that have to be made to cover the losses in the irrigation sector in 1998-99 was estimated to be Rs. 23,802 crore about 10% of all budgetary subsidies, the latter amounting to 13.54% of GDP (Sirvastava et al, 2003) See tables 1 and 2. [Since the pricing of water is based on amortising the value of assets over a long period of 50 years, and other costs which are lower than LRMC, the true subsidies can only be larger than this figure]. The total state subsidies amounted to Rs. 155,923 crore in the same year, of which energy and irrigation amounted to Rs. 15,115 and 23,525 crore respectively. See table 3.

Assuming that electricity subsides occur only at the state level, and nearly all of these are on account of supply to agriculture, the total budgetary subsidies on account of water (irrigation and electricity to farmers) is approximately Rs. 23,802+15,115 crore i.e. about Rs. 40000 crore. In the same year (Srivastava, et al, 2003) quoting Govt of India reported the cross subsidies in electricity to be about Rs. 8000 crore, thus giving an estimated total subsidy of about Rs. 48,000 crore on account of water provision to the agricultural sector. This as a proportion of GDP at market prices is about 2.76 % of GDP.[6] Since then since prices have remained the same, but costs have gone up and growth could only have been positive and in all probability higher than at the growth of the economy as a whole (especially electricity) the ratio could only have gone up. See table 4.

[6] The Planning Commission (2002) estimated the subsidy to the agricultural sector on account of electricity to be Rs. 30,462 crore. The gross subsidy including the 'subsidy' to domestic consumers was around Rs. 43,060 crore in the same year. Much of the subsidy to households may be fictional since the cost to serve for this segment (not the realised tariff) was close to or below the notified tariffs for the segment. Thus conceptually subsidies can account only due to the agricultural segment and on account of losses, theft and diversions. Thus the cost of agricultural subsidies is of the order of Rs. 43,000 crore.

Large Costs to Deliver Little Subsidy

Subsidies to agriculture on account of electricity as reported by the Planning Commission have grown at about 14.5% CAGR over the period 1996-97 to 2001-02. The compounding effect of price based subsidies on revenues is indicated by the growth in losses which was at a rate of around 24%. Given that over this period the average applicable tariff rates grew at a rate of 8% [the realised tariffs grew only at 7%] or more, which was higher than the inflation over this period, the losses unadjusted for tariff increases (resulting in increased tariffs for paying consumers) would have grown at a rate faster than 24%!

The reported cost of supply is based on assuming that electricity losses cannot be recovered. Thus the cost of subsidisation is growing at a rate of 24 plus percentage. The benefits derived by the farmer would be a small fraction of the same. Cost of supply to agriculture need not have been more than Rs. 2.2 in that year [given that agriculture is typically supplied offpeak. Hence the delivered benefits adjusting for the same is only Rs. 30,462*2.2/3.50 which is Rs.19,148 crore. Since agricultural consumption is misreported by at least 30% the benefits adjusted for the same is no more than Rs. 14729 crore. Since about a third of agricultural consumption is wasteful and could have been avoided the actual subsidy benefit delivered cannot be more than Rs. 9800 crore i.e. say about Rs. 10,000 crore and hence about a third of the total cost of subsidy. In relation the total cost of subsidy attributable to agriculture is between Rs. 30,462 and Rs. 43000 crore. The difference is an estimate of the fiscal gain that the movement away from price based subsidies to direct subsidies can realise.

Price based subsidies have brought about vast allocative inefficiency losses. We discuss these in detail later. Besides the large static efficiency losses, farmers and others using these distorted prices make incorrect investment and input choices. What is not often recognised though is that the underlying basis for the corruption and mis-performance of the state electricity boards also lie in the use of differential prices. (Morris, S, 2001) So intertwined are the issues of under pricing, subsidisation and management that attempts to reform the sectors both electricity and water supply by conventional measures such as privatisation, unbundling, independent regulation or distribution "reform" have all failed or are likely to fail unless the overarching policy level infirmities are first removed, and policy is made internally consistent. (Morris, S, 2001).

In canal water and publicly supplied water too it was in the era of redistribution (from 1964 onwards) that the prices began to get out of line with the costs (Vaidyanthan, A.,2003) and over a period they generally do not even cover the O&M costs of water production and delivery'. (Vaidyanthan, A., 2003); World Bank (1991); GOI (1992); (World Bank (1998). Instead of prices being used to subsidise, defined quantities could have been given away while retaining the prices at the long run

marginal costs Then the use, allocative, input choice and technology choice inefficiencies, that together have by now have become stupendous could have been avoided. That no other options than the bipolar one of removing the subsidies altogether or continuing with price based subsidies reflects a singular inability of the policy designers, for which it is unfair to ask the politician to take blame, since mispricing lies at the root of most of the other failures. The priorities for water development have got quite misplaced. Drinking and town use water which should have had the highest priority is sometimes even denied supplies since the administered low prices for such uses restrict supply expansion. The need for re-prioritising water use has been argued. Cf. Alagh, Y.K. (c.2003). We would content that prices must not contradict priorities as they do today.

STATEGY FOR ELECTRICITY[7]

The core of the approach is the movement from price based subsidisation to "entitlements". Price based subsidisation has the major infirmity that they rob prices of their crucial roles in the system – to inform the investment and input choices as also the direction of technical change. They are seemingly easy to administer[8] but only when the product in question cannot be diverted and has entirely inelastic demand – conditions that are rarely met. Indeed when different prices are used as in the case of electricity the 'price arbitrage' by diverting supplies from low paying customers to high paying customers (illegitimately) is what is at the root of corruption, the resistance to metering, the inability to hold anyone accountable to revenues. This is because the product (energy account) and the revenue account can never be reconciled. The feed back effect of this perversity is what has all but destroyed the state electricity boards (SEBs) and made them or even their successors post 'unbundling' irreformable. Additionally, the dysfunctionality of the interface[9] between productive public enterprise and the government – the interference in the operational decisions of such entities has been responsible for the poor management systems within SEBs.

It is useful to outline systematically, the nature of the distortions that occur with price based subsidisation as is the case today. We may classify them into those on the user side and those on the utility side. While the former are recognised though not well enough the latter are less understood. The interaction of the two creates the

[7] We have discussed the reform strategy for electricity covering inter- alia the ushering in of market, how direct subsidization can be brought about to overcome the crippling distortions on the sector and the necessary regulatory strategy. This section is only a presentation of the core findings related to subsidies. See Morris, S. (2002a) principally.

[8] Price based controls and subsidization could have been a short term measure in a national emergency at best.

[9] This is a problem common to nearly all public enterprises, and is the one single reason for the failure of public enterprises in India. For a discussion of the political economy of the interface between government and public enterprise see Morris, S. (1986).

Catch-22 situation where conventional reform (that which does not include the removal of price based subsidies) is almost guaranteed to fail.

User Side Distortions in HP Based Tariffs

The following are the user side distortions[10]:

1. Excessive and wasteful consumption by low priced consumer segments. In the case of irrigation this is considerable since the marginal price is close to zero. Thus inefficient pump sets, poor associated equipment, inadequate use of capacitors resulting in very low power factor, all of which wastes energy is more the norm than the exception since these involve private costs and as along as the marginal price of electricity is zero there are no savings to be made. The collective gains in not wasting electricity since then more would be available would also go unrealised since that is a common resource and there is no private incentive to save. Micro studies have shown that the possibilities of saving electricity in pumping operations are very large. Cf. Reddy et al (1991) for an early analysis of the problem. See also Sant and Dixit (1995) who additionally argue that tariff rationalisation even by SEBs could have saved vast sums.
2. Cropping pattern distortions, since with horsepower (HP) based tariffs it makes sense to grow crops that are water intensive irrespective of the social (true) cost of the same. See for instance (Singh et al (2004),
3. Input use distortions that arise from the above. Because of cropping pattern distortions, related input distortions such as in fertiliser use, in the use of water to destroy weeds, in using flooding rather than deep ploughing are all possible.
4. Repelling the use of water saving technologies, especially in the drier areas since these costs have to be borne privately by the farmer while the incremental cost of extracting ground water is zero with HP based tariff. Thus attempts by government to promote sprinkler and drip irrigation systems have had little effect. Yet the social and private profitability, had the price of electricity not been distorted, is beyond doubt in the drier areas and in the case of water intensive crops. See for instance Narayanamoorthy, A. (2004).
5. Environmentally destructive practices: Besides the environmental fallouts of the above, in areas of water scarcity the attempt at excessive drawl (above the rate of charging of the aquifer) would damage the resource, reducing its ability to store water. The over drawl of water in water scarce areas is well known. What needs recognition is that much of it can be attributed to zero marginal price of water. Salinity ingress in coastal areas of Gujarat and especially in Saurashtra are examples. The water markets of North Gujarat amount to rational use of a good rendered free by the state! Some economists have mistakenly even lauded these developments on the mere fact of the existence of markets. Indeed if markets that could not have existed otherwise is made possible then the distortionary impact can well be imagined. See Shah, Tushar (1992). See Dhawan (1991). See also Box1.

[10] Based on Pandey, Ajay and Sebastian Morris (2004)

from Morris, S. (2001a) for a conceptual analysis of the vast divergence between the social and private costs that HP based tariffs bring.

6. With long usage of low priced (or zero priced) electricity, farmers get used to thinking of water as a free public good. It is not just farmers but even policy makers and politicians get used to the idea of subsidy being necessarily in the form of price differences.
7. Attempts to bring about measurability of the electricity consumed, to meter etc are strongly resisted.
8. Since output (agricultural produce) markets are competitive and not essentially subject to controls (except in a limited way in food grains through the support pricing), the benefits of these low electricity prices when not wasted are competed away so that without the use of such low priced water, the farmer would make large losses, because his business without the subsidy would be unviable. This is particularly true of drier areas without alternative sources except deep wells from which water is drawn with much use of electricity. In such situations, there would be much resistance to reduction in subsidy. Therefore an all or none situation is created. If farmers say in a region or state or weaned away from distortionary input subsidies they would not be able to compete with farmers in neighbouring regions where such input subsides continue. Pandey Ajay and Morris, S.(2004). This makes the task of reform even more difficult therefore.
9. Where farmers are a strong group politically – as in the case Punjab and Haryana entirely, and in other states in part - the above would further consolidate their political cohesion around the subsidy so that programmes of phased price subsidy removal (when uncompensated with direct subsidies) become unrealistic or can be pushed only at great political cost to the party pushing for the same. Indeed all efforts at solving the subsidy problem other than the one which credibly converts current benefits to endowments would become issues around which political mobilisation would take place, to stall reform as such.

Utility Side Distortions

The utility side distortions are perhaps even more important. These distortions result in a breakdown of the distribution business as such. These may be listed as follows:

1. Low prices for agriculturist create the need for cross subsidisation and hence high prices for other segments. Even with no other distortion, this reduces the consumption by the higher priced segments so that increased cross subsidisation takes place with the (increasing) reduction in the ability to cross subsidise.
2. Governments' typically tend to ignore the demand side effects (given short run price inelasticity) so that the tariffs for the paying and the high priced consumers could easily go above the revenue maximising tariffs – as is the case with most electricity boards. Today by actually reducing the tariffs on bulk and industrial customers it is possible to increase (decrease) the surpluses (cash losses) of the state systems. Morris, S. (1999a).

3. The political temptation to indulge in cross subsidisation is strong since, while political capital is gained, the ill effects take a much longer duration to reveal, and initially hurt only a non-numerous group. Their long term consequences to hurt every one including the subsidised sections, take place slowly but surely.
4. The commercial departments of utilities face a range of prices, and the temptation to "arbitrage" the same is strong and often irresistible. This implies diverting electricity to other consumers who face high prices for personal gain while reporting the same as consumption by the low (zero) priced segment. With a few indulging in such 'theft', the practice can spread like wildfire since the price difference per unit of electricity sold, is large and can be used to soften up those resisting or trying to oppose the practice of condoning theft or conniving with theft. Morris, S. (1999a)
5. Even where practices akin to (4) have not emerged or are restricted to a small part of the organisation, the ability to account for sales revenue is lost without extensive metering at virtually all points in the distribution network. Morris, S. (1999).
6. The higher prices to the cross subsidised segments (whose consumption is high but face competitive output markets –as in the case of the small industry), can result in evasion and theft by such groups. This is natural given that such firms lack market power. When other competitive firms indulge in theft, the firm in question is forced to, or be driven out of the market. So any small weakness in monitoring and in severely punishing theft, allows the practice to spread rapidly among small and tiny industries. Connivance is therefore expected to emerge. Unreported/under reported `sales' to such consumers are then met by the over reported sales to the subsidised segments or over reported technical losses. Morris, S. (2001b)
7. Vastly lower prices for important segments result in shortages and the need for allocation through some administrative mechanism. Administrative allocation in the face of shortages can further accentuate the problem of revenue realisations. Shortages when attempted to be uniformly allocated (even when not perversely) have asymmetric quality effects across various uses. Thus while IP pumpsets /households may be able to 'bear' interruptions, critical processes in many industries would not be able to, so that in response to the interruptions they exit out of the utility system to set up their own captive units. The response to such a situation is typically to set up multiple and parallel feeders, single wire transmission, two and single phase transmission , metering at every branch in the network, centralised reading of meters, etc. These amount to pathetic efforts to respond to the distortions caused by price based subsidisation, rather than remove the distortion in the first place. All of them are guaranteed to fail, or impose huge avoidable costs on the system. (Morris, S., 2001b).
8. When the price for the segments whose long run price elasticity is significant rises beyond the 'stand alone costs', they would permanently quit the utility greatly reducing the cross subsidy ability of the utility. This has happened widely. Today for high tension customers the principal source of electricity is

already captive generation. Levels of captive generation had reached more than 60% of demand in 1995. Today there is no large consumer that does not have captive generation. The social inoptimality in captive generation when forced to operate at plant load factors well below 50% can be easily imagined. Morris. S. (2001b).

9. This in turn increases the prices for others, so that quitting the utilities becomes a mass phenomenon.
10. In response to the need to have control over revenues given (4) distribution companies attempt technological approaches which even if they work for a while soon enough become dysfunctional. Thus single wire transmission to rural house holds to separate the irrigation pumpset (IP) consumption from household, single phase supply (with its large load imbalance effect), to deny IP use during certain hours of supply, etc emerge. In response to the same, the consumers learn to convert single phase or two phase supply to these phase.
11. One important response to manage the system in the face of the perversities [see (4)] is to meter every point at which the supply network branches off so that there is feeder level metering. Even this may not (even theoretically solve the problem) if there are more than one tariff type consumer on a feeder. Then within the feeder there is still scope for consumer mix arbitrage though of course much limited.
12. The need of the distribution organisation for control necessarily demands that every IP set be metered. (This arises because of the need for accounting). But the same would be vehemently resisted by the IP set users given the HP tariffs, since they would always assume that metering in making their consumption known would lead to some action to limit their consumption.
13. When power cuts have to be imposed, certain essential services hospitals, railway traction, electricity companies, telephone companies would have to be provided electricity. This creates the need for parallel and additional feeders /dedicated lines etc. Soon enough demands from VIPs and others emerge. To accommodate these and others and to manage the shortages, the demand for additional feeders and lower level control over the feeders emerge. Besides raising the cost of supply and operations, this also creates and makes possible a 'politico-administrative' mode of operations that has little reference to the commercial and revenue realisations aspects except in a perverse manner. When such a culture gets entrenched obvious opportunities for revenue and contributions through appropriate scheduling (such as purchasing even 'expensive' power when unit realisation is higher than cost to supply to paying customers), or limiting tariffs to high tariff consumers to revenue maximising tariffs are all missed.
14. Administrative direction gives the distribution entity the power to discriminate and to micro manage the supply as brought out in (13) and to discretion as in (7) above. This in turn necessarily brings the political (and bureaucracy/ executive) on to the task of electricity distribution, rendering what is as simple commercial business into 'important socio-political-fiscal task' thereby shifting the decision making upwards. The resulting powerlessness within the entity allows various

kinds of dysfunctionalities including the setting in of processes (4) and its institutionalisation.

The Only Option

The necessary reform without which no other measure would deliver the system from its continuing losses is direct subsidisation. What we propose is very different from the direct subsidies proposed under the Electricity Act 2003. Therein the stipulation is for the cross subsidies to be eliminated in a graduated manner, and subsidies if any to be handed over to the distribution company. This would not work at all for the simple reason that it still leaves the allocative price small or zero for the subsidised segments and keeps open the price and hence consumer mix "arbitrage" that distribution entities and their staff can indulge in. Therefore wastage, misuse and diversion would continue, and strong incentives for connivance remain. DISCOMs when private would have the additional incentive to indulge in consumer mix "arbitrage" when there are differential prices. So that both user side and utility side distortions as above would continue.

If on the other hand all subsidies are got rid off that would work but would be politically impossible, and attempts in that direction would only invite political disaster. (Morris, S, 2001, 2002, 2003, 2004)

In its essence the only option possible today would be institute direct subsidisation in the sense of the subsidy being handed over to the farmer in the form of electricity stamps or coupons through a well crafted system. The key aspect of the system would be to work out the actual realised transfer benefits under the current system (which are quite small in relation to the actual losses incurred –not more than a third of the current losses incurred, as brought out earlier) and to hand the same over in the form of entitlements, and move the prices immediately to reflect costs. The farmer using his entitlements would pay the distribution entities. Distribution companies accepting such coupons can then collect cash from the government. Then the marginal prices are right even if the average prices for consumer groups are far from the marginal. Since it is the marginal prices that decide the allocative, input use and technology choice decisions the system does not move far away from optimality. And absurdities like production of water intensive crops in areas of water scarcity, attempts to control through two and single phase supply[11] or investments and R&D to use/find ways to convert single or double phase electricity supply to three phase on the part of farmers, or the repulsion of water saving technologies and investments can all be entirely avoided. (Morris, S, 2001a, 2002b)

[11] Other such measures include phased power cuts, regulated hours of supply, supply at low frequency, etc. All these administrative measures with the passage of time creates further distortions and increase the line losses.

When tradability (without any restrictions and sometimes with local area restrictions) in the entitlements is allowed, the system moves to a situation where all distortions other than the "first order" of transfers (that identified in comparative statics), are removed. Complete tradability would remove even this one but then the subsidy is no longer a production subsidy but an income subsidy. It would not be desirable to move altogether to an income subsidy quickly, in which case there would have to be specified limits to tradability. This can be imposed by limiting tradability to within the taluka or the village.The principal insight is that in subsidisation there is no need, or it entirely dysfunctional, to change the marginal prices from their true values.

The Steps in Direct Subsidisation of Electricity for Farmers

We may list the sequence and elements in the institution of a direct electricity coupon based system for farmers in the paragraphs that follow: [12]

- Announcement by government at the highest level that farmers would not lose is necessary.
- Getting the farmers' agreement to a subsidy scheme that is non distortionary and can save the government and the economy money. Direct bargaining of the government with farmers groups and lobbies would be necessary.
- Announcement of a direct coupon based subsidy scheme
- One time identification that fixes the endowment as a function of operational (owned) holdings, whether "below poverty line" (BPL), the extent of access to canal irrigation, and the type of region, and such other criteria which farmers themselves can decide.
- Separation of the identification exercise from the issuance. This unbundling is necessary for correctly targeting the beneficiaries.
- Identification is a one time activity than be carefully carried out with much diligence by an outsourced agency. Identification process can be made entirely transparent, through an open and iterative process, so a self generating and self correcting list of beneficiaries is possible. Thus a taluka/ block level initial listing of endowments due to each farmer can be put up for public scrutiny and reactions. The total value of endowments can be fixed through land/ crop records/ National Remote Sensing Agency (NRSA) data. Thus if each farmer in the village knows who are closest to him in terms of land cultivated /operated and income levels, then that information can be used to generate the entire ordered list of farmers which would be largely correct. Private information available with each farmer would then have been used to generate the complete information . Panchayats can play an important role in bringing the process and the method to the attention of the farmers. Since some thousands of rupees per farmer per year with net present value of the order of thousands of rupees or

[12] Taken from Alagh, Y.K,, Sebastian Morris and Sunil Parekh (2004)
Since now the quantum of subsidy is fixed for each district, taluka and clutch of villages, all farmers have strong incentives to ensure that they are correctly positioned in the list.

more is at stake, the intense involvement of the beneficiaries is inevitable. Moreover, when one farmer gets more it is others that get less. This 'subtractibility' can be used to great advantage to correctly order the list and to correctly fix the endowments. The identification as such would have to be carried out in a programme mode with prior announcements, much publicity and agreement of all political parties, especially 'kisan' parties. Once identified each farmer can be issued a chip card with all details of his persona, the entitlement per quarter of the number of coupons (each say entitling him to 100 KWH of electricity) for each quarter of the year, the geographical area of tradability, etc.

- With such cards the coupons can be routinely issued through post offices and bank braches almost as easily as banking instruments are handled.
- Tradability of coupons would render the design of the system simple enough. If no tradability is desired to keep the subsidy entirely a production subsidy then a more involved design of the coupons that links each issued coupon with the person to whom issued would be necessary. It is far better to allow complete tradability but to ensure the same in a graduated manner that restricts the tradability to within the block first then the taluka and finally complete tradability.

- Exchange /discount house to trade in coupons would he an interesting mechanism to ensure tradability at low cost to the farmer and to ensure a minimum value to the same.. Coupons would have to be on security paper and have completely unique nos and identification. Carry over/across limitations can be imposed. Govt itself can trade in the coupon market.
- Cap on subsidy is easily imposed and that would define the number of coupons.

Fiscal Feasibility Exists

Current (2001-02) government expenditure on subsidy in the form of subventions was Rs. 8339.62 crore. (See Table 4) leaving an uncovered subsidy of Rs. 28, 977 crore on account of both domestic consumers and farmers. The subsidy cost to the agricultural sector was reported as Rs. 30, 462 crore. Our rough estimates of the benefits delivered to the farmer is of the order of Rs. 10, 000 crore. Electricity equivalent to this sum at todays current price of about Rs, 2.5 per unit is issued as coupons (45 billion KWH) every year. An additional Rs. 2,500 crore or 15 billion KWH coupons could be issued to farmers who are organized and have a vested interest in the current system of price based subsidies. Examples of such farmers would be the banana farmers of MP and the drier parts of the Khandesh, farmers of Mehasana in Gujarat, farmers of Punjab, Haryana and Western UP not well covered by canal irrigation systems. Alternately, such farmer can be persuaded with additional subsidy for drip/ sprinkler systems.

Even if Rs. 20, 000 crore per year is put up in the form of electricity coupons it would lead to much social and fiscal gain since nearly all the distortions mentioned before can be avoided.

The proposed identification is a one time activity and involved no repeat work. As such it demands that the government is 'good' only once and not all the time. It is therefore light on governance. Once such a scheme is implemented nothing more is required. It unbundles the 'problem of reform' from the problem of subsidization. It amounts to 'right subsidisation' rather than removal of subsidies so is farmer friendly at a cost with an upper bound to the government, which is no higher than current costs. Later other subsidies such as fertiliser and other farm subsidies could be bundled along with electricity subsidies through more general coupons issuance that allows the farmer to lay out the coupons on any of these inputs.

With farmers on the side of reform the distribution entity's and the regulator's task of monitoring of distribution is no longer complex involving data mining to check if reportage has been correct. If distribution companies do not respond to the removal of perversities, they can then be easily privatised. Under direct subsidization as described above all distribution businesses will be highly profitable. The cap on subsidy means that the subsidy is not open ended. The positive effects on agriculture are large and follow from the allocative price being back to what it should be to at one stroke remove all the debilitating effects of distorted prices.

In India, subsidisation to most policy makers and practitioners evokes little else but price based subsidies. Price based subsidies have been used for so long and in a variety of sectors, that the distinction between subsidy and lower price has been lost on the politician and the civil servant. What is strange is that even reformers who should have known better have not seen the distinction clearly enough. The distortions, therefore, have been very severe and have deeply affected the entire economy. And for too long they have not been correctly addressed.

THE CHALLENGE OF IRRIGATION

Vicious Circle of Low Prices and Inefficiency

Subsidies under the head "Irrigation and Flood Control" have been estimated to be Rs. 23802 crore in 1998-99. They constituted 10.10% of all India budgetary subsidies. The state governments incurred as much as Rs. 23, 525 crore of these subsidies which constituted over 15% of all budgetary subsidies of the state governments over the same period. Srivastava et al (2003). These constituted the second largest head of account after "Agriculture, rural development and allied subsidies. These subsidy estimates are in relation to the costs as worked out using depreciation rates that are very small –which presume that the life of the asset is as large as 50 years. With a more reasonable assumption of asset life, the subsidy would be even larger. Today in

many places full cost recovery that includes the capital charge even at these low depreciation rates has for all practical purposes been given up, and it would be a major victory to even recover the O&M costs in full. Irrigation is almost entirely a non-merit good and does not suffer fundamentally from excludability problems. Both traditional systems as well as the systems created by the British were based on full charges in the case of most projects. The problem with irrigation has been that the scale and of construction has been far larger than possible through private initiative without concessions, and the charges at commercial rates of depreciation (in keeping with the borrowing tenures of capital markets) would make the water much more expensive than its economic price since asset lives can be very large. Recovery rates close to 100% or better was much the practice even in post independence India. It was during the 'redistribution era' from 1964 onwards (Morris, S. 2003) that recovery rates began to decline. (Vaidyanathan, A., 2003). Today recovery rates are absurdly low to result in a situation where maintenance is grossly neglected, there are hardly any resources to add fresh capacity and much of the expenditure of the ID is spent in covering salaries. (World Bank, 1998) (GOI, 1992). Notice from table 6 that the recovery rate has been under 10% in all states and in most states under 5%. These are very poor rates for an eminently appropriable good used as an input in agriculture. They are lower than in the case of poorly appropriable goods such as education and sewerage and sanitation services!

Good Advice Ignored

Thus since the significant recommendation of the Irrigation Pricing Inquiry Committee (IPCI) (GOI, 1992) the problem has only worsened. The Committee (as also many others before, besides the multilateral agencies(Cf. World Bank, 1998) had recommended that the prices be linked to inflation so that a convergence to full cost recovery is possible. If nothing else such linkage would have prevented the divergence of realisations from costs. IPCI's many significant recommendations especially those bearing on cost recovery were not worked upon. (Vaidyanthan, A., 2003). The IPCI had also recommended handing over of distribution assets to farmers' organisations and water user associations (WUAs) to improve the maintenance, and the management of allocation to WUAs in order to bring about optimality in the use of water. Earlier other committees and the World Bank had made similar recommendations. Government has been attempting to promote WUAs but they have had limited spread for reasons that are not entirely clear[13]. Similarly little of the distribution assets have been handed over to farmers' organisations. Despite the promotion of WUAs by the government success in term of the area under WUAs is limited. But where WUAs have taken root there has been improvement in the social efficiency in the use of water. (Rath, B., 2003). Whatever the efficiency

[13] The matter of WUAs will be taken up later when we take up the matter of organizational forms for water distribution and transmission, The free-rider problem in the structure of WUAs could have been one problem. Cf. Shah, Tushaar (1992)

change in the use of water that WUAs, and the more recent 'warabandi' systems, have brought about the rates remain low and recovery continues to decline.

In many places even the low charges are not collected. The reasons could vary from the difficulties that the revenue officials encounter, militant farmers who refuse to pay, poor organisation and individual incentives for collection, the bundling of irrigation revenues with other revenues, and the very smallness of the monies due that makes collections seem worthless! (Rath, B. 2003). In contrast costs can only be expected to go up for building a unit of irrigation capacity. The poor recoveries result in complete dependence of the irrigation department (ID) upon government allocations which become problematic. Hence the capacity additions especially in major irrigation where the government fully invests, have been declining.

The spurt in public capacity in minor irrigation in the seventies and eighties is also now on the decline. An increasing part of the investments in creating irrigation is now private and at high cost, and suffer from failure to realise compositional economies, and what is more could also be environmentally damaging in many areas. In large and medium scale canal and storage based irrigation systems there are positive large spillover effects on ground water and hence on private irrigation. Hence when underprovided, the system is pushed to less efficiency and effectiveness.

World Bank Recommendations

The World Bank (1998) made a comprehensive assessment of the situation with regard to water and called for a paradigm shift in the approach to irrigation. It noted significantly that inter alia since about 70% of the irrigation capacity had already been reached the returns to maintenance and judicious use would be an important element in effective augmentation of capacity[14]. We will not make a reference to many other similar recommendations drawing attention to the need to improve the efficiency in the use of water and in raising the user charges for irrigation. Nevertheless the report lacked a politically feasible and implementable strategy to reach the indisputable objective. We have considered these objectives. The strategy

[14] Shah, Tushaar (http://www.adb.org/Documents/Events/2004/WAP/IND/Delhi/Shah_presentation.pdf) has argued that no country uses ground water as much as we do. With more than 60% of the population being dependent upon ground water in relation to about 23% in China, and India extracting more than double the amount of water that China does, the failure of the state in creating sufficient surface capacity is evident. In the future therefore for more efficient use of resources (a lot of ground water extraction would be uneconomic at the social cost of electricity) investment in surface capacity to shift away from ground water would also be called for in addition to improvements and increased efficiency with regard to the existing capacity.

that we outline is to be seen as a feasible way forward, one that need not be politically difficult.

The World Bank noted that:

"*Common physical constraints include, in particular, inadequate maintenance, resulting in progressive deterioration of the surface systems, and poor water management due to ineffective control structures for surface irrigation and inappropriate incentives for ground water use. The institutional constraints start most importantly with the persistence for purely public sector management, without accountability to the client, viz. farmers. Further, there is no direct link between the irrigation service provided, revenues generated, expenditures, and staff incentives. The state IDs are traditional government departments which in most cases have changed little over time….. The main financial constraint are firstly, low water charges, requiring continual subsidisation by state governments of operations and maintenance (O&M), and the entirely of construction, and secondly, partly as consequence of the weak revenue generation, persistently inadequate allocations for O&M, most of which go for staff salaries leaving negligible amounts for actual maintenance works. Finally incentives for efficient use of water are largely absent. Surface water charges are in addition to being low based on area rather than charge volumetrically, and electricity for pumping is also heavily subsidised on a fixed rate basis"*.

The problem with regard to irrigation and especially the ID could not have been better summarised. As the framework for reform the report called for a change from the vicious circle to a virtuous circle, with the key being the need to change "the incentive structure both at the level of the service provider (the present government monopoly) and the client (farmer)". As the reform agenda or the strategy it outlined the following measures: (1) Institutional reform by which it meant the transfer of significant part of the management assets to the farmer and his organisations including WUAs, and restructuring the state irrigation departments. As part of the restructuring it discussed the role of 'water service agencies' (WSAs), independent regulatory authority, public private partnerships, involvement of the WUAs and agriculture in the planning process, the WSAs being separated from the IDs which limits itself to planning, designing, investment funding etc. It also drew attention to the possibilities in public private partnerships especially in the activities of the WSAs. (2) "Achieving Financial Viability and Sustainability" the elements of which were increases in the water tariff steeply to make up for the backlog of poor recovery, expenditure prioritisation and accessing credit and capital markets. (3) It also identified key technical actions to improve performance, which again were possible only with appropriate changes in the institutional structure and structure of incentives. Similarly Briscoe (1997) identified the key elements of water reform that recognised the need for political support and feasibility, and the need to not loose very good second bests in the pursuit of what seems first best. Briscoe (1997) also identified the need to be both sensitive to general principles and at the same time to contextualise the design of the reform and the process to local realities.

Elements of the Strategy for Irrigation

The key action that would make the reform in the direction outlined above possible is non-distortionary subsidisation of electricity to farmers and of surface water supplied. The case of electricity has already been considered. Raising water charges is the key change without which all other changes would either be nullified would not be possible, Thus on any extensive scale private funds or market borrowings would not be possible unless the revenue stream is set right. But raising tariffs is not politically easy since around 60% of India's population is involved in agriculture and the market for votes is important. We argue quite like in the case of electricity that the key is to right structure the current subsidies that are implicit in the low charges for water as endowments while raising the water rates. This in changing the allocative price of water would bring about much user efficiency.

'Leverage Point' for Change

The improvements to the system which can result in additional supplies when valued at these higher prices of water should support private /commercial investment with expanding supplies. In other words if the actual delivered benefits to farmers can be protected and in a way that removes all distortions to the judicious use of water then the reform on the utility side would be meaningful. A strategic or a paradigm shift is more than a laundry list of the problems, or even a list of of what needs to be done. The strategy has to articulate the 'linking pin' as it were or the 'leverage point of change' (Morris, S., (2002)) which is crucial and necessary for success. In that sense right subsidisation is crucial.

Thus it is easy to say that maintenance expenditures should be a priority, but within the government maintenance cannot become a priority unless the budgetary processes are changed. Current process in creating a link between accessing Plan funds and fresh investment creates strong incentives to put up projects on the part of parastatals and departments of government to pursue new projects rather than worry about maintenance since they come out of non-plan funds where there is little or no leverage. (Mitra, Shantanu and Vijay Pillai, 2003; Sen, Tapas, K., 2003). Thus the central government has had typically to carry out R&M programmmes (laying out monies under Plan funds) to 'force' states to carry out maintenance of such assets as electricity generation and transmission, roads, and irrigation!! It is of course first best to remove these distortions that create strong biases against carrying out routine maintenance (that should have been the norm for any organisation), rather than provide such recourse which has the ill effect of relaxing the budget constraint of state governments and their parastatals too prematurely. (See Morris, S., 2003).

DISTORTIONS ARISING OUT OF LOW TARIFFS

Inefficient water use for the reasons that the marginal (allocative) price (as sensed by the user) is low, brings about much demand for water pushing certain basins to the limits of the capacity that can be sustainably tapped. The difference between the conjunctive demand for water and the gross water supplied by irrigation is far too large (Vaidyanathan, A., 2004).

There is large scope for efficiency if farmers see the correct marginal prices, that not only reflect costs but also in some manner (especially in water scarce areas and where the resource has been tapped at close to sustainable capacity) the scarcity, so that such regions have an higher incentive to conserve water and make investments in water saving technologies than other regions. Subject to feasibility and benefit exceeding cost, such regions could then place demands on import of water. With only one kind of response from farmers (the clamour for more water because prices are very low) giving way to many possible responses, the options to converge to socially efficient solutions would be revealed.

The problems of pricing of water provided from publicly owned systems, and of electricity used in pumping up ground water, are interrelated. This aspect is not understood or given due importance in the discussions that bear on reform and change. A rise in electricity charges without a rise in the tariffs for water creates major distortion between groups of farmers especially when they are not too far from each other and one group does not have access to the canal water. Similarly, if water rates for surface irrigation systems are raised steeply they would be incompatible with continued HP based tariffs for electricity. This situation does not justify non-reform but calls attention to the need for interlinked solutions. In both cases the subsidy actually delivered to the farmer would have to be retained to get the farmer's agreement and support to reform without which reform (cosmetic changes and tokenism apart) is not really possible,

Distorted Water Markets

Water markets that emerged in certain water scarce areas like North Gujarat are not socially functional since they are based on the HP based tariffs. Herein the limited optimal aspect is that particular wells that have high yields are being exploited in way that would not be possible if water could not have moved beyond the boundaries of the farm. Savings in terms of avoided multiple bore wells is of course part of the gain. But as the overall extraction is above the sustainable yields and the private cost of extraction is well below its social cost, both in the cropping pattern, and in water use intensity the social inefficiencies are very large. Additionally in the non use of water saving technologies there are further social losses. In the slow destruction of the aquifer and in salinity ingress especially in dry coastal areas there

is much environmental, and longer term productive losses. See Box 1 for a discussion.

Large Inefficiencies

Mis-pricing of water elsewhere in command areas is well known to have resulted in inefficient use by as much as 50% (World Bank, 1998); water logging and distortion of the cropping pattern (Dhawan,1991) . Here the savings possible in terms of enhanced yields are perhaps the most significant aspect of price reform. Firstly, with rational use and with investments in drainage having value (if the allocative prices of water are correct) the recovery of lands currently with poor yields would be an important gain. Similarly, the allocation (presuming that at any time there are fields that are unirrigated) of water would be over a larger (optimal) area. This would happen because the farmer currently without access could make payments to the farmer with access (but who currently overuses/misuses water) to get water and, therefore, both could gain under current pricing.. The principal of equal marginal net benefit within the command area /ayacut would hold, which would then be equal to the uniform price, if the (small) differing costs of transport of water within the ayacut are ignored.

From (Price) Tariff Distortions to Endowment Based Subsidies

Consider a farmer who today gets an allocation of water ***W*** at a tariff P_o which is far below the cost of production of water. Let us say that he is now charged P_n which is the long run marginal cost of water production, (while the subsidy inherent in the earlier scheme $(S) <= W*(P_m-P_o)$ is made available as an endowment. He would sell more water to result in greater total output, and he as also the farmer who was earlier out of the picture now gets water. Interestingly the gap between this situation and the earlier one of low tariffs is very large when trade was not possible in the first situation. This is so when the earlier supplies are based on land possessed at some time in the past, and are not entirely separable from the land holding or the operated holdings.

Let us presume that the allocations in the earlier situation are all fair and without bias to all farmers in the ayacut /command area and originally reflected the optimal (given the relative prices of a variety of crops, their other costs of cultivation, and requirement of water). Then the quantities allocated would have been in consonance with the condition of ($f1_{w1}(I,W1) =T1+P; f2_{w2}(I, W2)$ etc); where the ***f1*** or ***f2*** are the productivity as functions of water input ***(W)*** and other inputs ***(I)***, and the above are marginal productivity of water.

But the fact of variations in other factors such as land actually available at any time with the farmer, the family labour that he is able to bring (which tends to have a low/zero marginal price when there is disguised unemployment), his ability to carry

out cultivation due to changes arising out of other income possibilities, changes in the production function of crops which happens all the time as new varieties are introduced, the relative effectiveness of other inputs changing, all would demand flexibility in the use of water so that the social optimal within the ayacut /command area is maintained. While tradability may not be sufficient in all situations to maintain a state close to the optimal it is a most necessary condition. Almost all the case studies that have examined the cropping pattern and the changes in cultivation more generally, once (more efficient) water users' associations (WUAs) began to function, draw attention to the major changes in cropping patterns, efficient use of water by the individual farmer, and enhancement of the area irrigated. Most of these have happened because the WUA is able to bring about a change in the (implicit) allocative price of the water shifting it closer to the marginal return from water. This happens because the individual information of the farmer gets channelled for the collective good. (Vaidyanathan, A., 2003; World Bank, 1998) The earlier disincentives against worrying about inefficient use by a close-by farmer is reversed being counteracted by the gain the farmer can make, if other farmers are pushed to efficient and non-wasteful use. Explicit tradability could do the same. But tradability without WUA could be less egalitarian than allocations under WUAs that are active.

Recognising the Value of Collective Monitoring

In irrigation water provision by central especially public or large producer, the costs of supervision by the supervisor to ensure strict adherence at the farm level to the amount of water drawn etc. would be too large. Adherence is then built in through strict and large punitive measures. When overdrawl for example is noticed, and such punitive measures are in place for long enough periods only then would farmers have been `trained' into the right behaviour. Alternatively, if the private information of each farmer can be brought on to the problem, which happens when the WUA structure is created the farmer sees some other farmer's over drawl as implying less being available to him.[15] This means self regulation. This comes essentially from the

[15] An important aspect of agriculture which systematically continues to be ignored by the planner, is the role of specific information. The farmer to maximise his profits (or more typically to maximise the value added from the farm in peasant economies and systems) can never be on clock time. Some one has to be on job time, i.e. all the time. Even when the farmer sleeps he cannot avoid responding to the hail, or to other sudden changes in the weather. His acumen and dedication in early detection of pests and diseases is important to their control. This is what makes the economies of owner supervision most crucial. Corporates or other organisational forms would have to face the great challenge of developing the incentive and management structures and processes that can handle such exigencies. Hence, even though the scale economies arising out of the logistics is very large, and other marketing / branding economies are also large, contract farming is the more successful form than direct cultivation by corporates. Plantations under corporations have been successful only when they did not have face competition (or such competition could be pre-empted) from individual farmers. So large are these that services with scale economies like marketing, irrigation and water storage, all have taken forms that do not intrude into the owner supervision aspect of farms. The large

water company – farmer relation being translated into a farmer – farmer relation. Since there are other gains too from better management which involve common gains but mean private or partly common costs, a cooperative structure once formed and trained, can sustain itself. Hence the particularly large value of WUA especially in the management of the distributaries and in water distribution, given a total supply from the bulk water company irrigation department. *Thus there is no denying the opportunity to push for water user associations, create appropriate frameworks that encourage farmers to come together in WUAs.*

WUA do not Take-off

WUAs have been pushed in various ways, and have been under active promotion for over a decade. Where they have taken root the social gains have been large, but they have taken root in few places and even today in barely 12% of the total area under irrigation have WUAs been formed. Limitations within the irrigation dept to take up a complex activity that is not linearly or sequentially achieved, and the critical need to overcome the free-rider problem in the formation of the WUA, explain the rather limited success in this area. Governments everywhere would not be able to shoulder a task inherently complex and not amenable to rules or agreed processes. Recourse to non government organisations (NGOs) too would not be a solution to multiplying the number of WUAs, since an activity like formation of a working cooperative to enhance gains is tremendously intensive in leadership and organisational capacity. But we suspect that the very slow growth of effective WUA's despite notable successes elsewhere and the demonstration effects of success may be pointers to possible difficulties arising from infirmities in the design or policy. Questions that come to mind are: Are the benefits / power to control the WUA (voting rights) flexible enough to allow for a certain degree of inequality that is required for the functioning of cooperatives and associations? And have the formal rules of constitution and management enhanced the free-rider problem instead of lowering it? We do not know enough about WUAs to answer these, but prima facie the one farmer- one vote rule in the election of members as office bearers of WUAs would indicate that an unnecessary egalitarianism may have maimed the prospects of WUA in the country. The larger problem is that cooperative solutions require continual exercise of leadership and energies being spent, so that their ultimate replacement/evolution into property rights, rules and possible markets is desirable and the design should lead to such outcomes. This realisation is not widespread. There is an enchantment among students of common property resources of egalitarian cooperative solutions rather than easy to manage solutions through innovative definition of rights.

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economies of owner supervision arise from the absence of the agency problem and the value of specific and local information, and information generation itself to farmers in the cooperative-competitive relationship with each other. Ignoring the economies of owner supervision may have been at the root of the failure of Soviet farming.

For the Indian situation the more important issue is that WUAs have not come up in the required numbers. So even though they are most desirable, a perhaps less desirable, but eminently multiplicable model which does not have to overcome the large free-rider and associated leadership problems would be necessary, as one more of the possible alternatives for reform. In another sense too this is desirable. As the development of the market economy takes place the role of private property gets entrenched. And this does not happen without a destruction of most non-private especially community 'property', and custom based perhaps contingent rights to property or to the uses of property. In that process very functional systems and commonly understood rights such as community rights over commons, community management of certain resources like fishing grounds, water bodies, and irrigation systems which could have evolved a long time ago, etc, when not recognised or ill-recognised by the new paradigm of capitalism, would be lost[16].

THE TRAGEDY OF TANK IRRIGATION

The problem of tank-irrigation is essentially this. If the new paradigm is unable to create the special spaces for such properties and rights (and limitations) of use, there is of course much loss of well being and suffering. And if this has gone on long enough, attempts at revival purely on the basis of the old models, may be still born. New designs that are clear, formal, and less dependant on appeal to the past norms and values, or to continual exercise of leadership or decision making are necessary. They would have to be attempted, even as one builds on the features of the old rules and systems that are still functional. Thus any attempt to reform the tank irrigation system of south India would also have to recognise the private rights to ground water in some constrained form, for optimal management of the ayacut and the reservoir. Tank irrigation has been on the decline in South India being plagued by problems of poor maintenance low involvement of the beneficiaries. Cf. (SANDEE, 2004); GoTN(2002). See also Shankari, Uma (1991).

The HP based tariffs for electricity, which at very low or near zero marginal cost makes it possible to derive the benefits of ground water and hence tap into the

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[16] The enclosure movement described by the classical economists and important in understanding the transition from feudalism to capitalism is perhaps archetypal of such a process in the first industrial nation –England- itself. For the case of Russia, a late industrialiser, see the descriptions of the decline of the 'Obschina' in Lenin. V.I. "*The Development of Capitalism in Russia'*, Progress Publishers.,Moscow. Much of the enthusiasm about common property institutions for a variety of problems is quite misplaced in this regard. Not only as mentioned here, do they go against the tide but involve large resources in leadership to fructify. Thus to the problem of poor city services, citizens' organisations are suggested as a remedy which itself would be a common property requiring the free-rider problem to be overcome. The property rights approach linked to regulation of private business that uses the private information of those who own the common property would be far more fruitful.

positive externalities of tanks privately, may have been the most important of all the reasons for the decline of the common property institutions of management of tanks. Strangely, this aspect is not as widely recognized as it should be, despite the large literature that points to the substitution of tanks with bore wells, and wells!

THE PROBLEM OF WATER RIGHTS

Water rights in pre-capitalist societies, before significant tradability of grain and other products of water was possible, were naturally defined in terms of right to self use. Such definitions did not necessarily clarify the right to use as being constrained (not for commercial use) nor would there have been implicit mention of commercial use since commercial uses would have been in their infancy. Additionally, the issue of negative externalities in the use of water were largely local and could be dealt with though custom and was well understood and not perhaps incorporated in formally defined rules. Today, the use of water is far beyond the survival needs or what is required for for subsistence agriculture[17] The products/services of activities where water is a significant input which are eminently tradable – food grains and other agricultural products, electricity, water intensive industries use a significant part of the economy. This means that today the rights to water have to explicitly take into account the commercial uses of water even as 'self use' or survival use water rights are recognised. . Similarly, there are uses for water that return less water to the ground than others. These aspects need recognition in the definition of water rights so that socially efficient and feasible pricing which can emerge out of such water rights can be pursued.[18]

The Contingent Basis for National Optimality

The gains from the pursuit of a nationally optimal water development strategy are particularly large in India. This is because the rainfall is intense over the monsoon days and except in the southern tip and the north east, is limited to about three

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[17] In ancient societies with high population densities even subsistence use could involve vast quantities of water, including those produced.

[18] This is of course easier said than done. The conflict potentially is large especially in societies with enclaved development or much inequality in income distribution. Thus both African and Latin American societies show much conflict over water rights. Privatisation in some countries has brought about the danger of monopolization of water rights. Cf. Boelens, Rutgerd (2003). This was also noted by the World Bank (1998) for instance in Chile. Large income inequalities by bringing the inelastic consumption needs of the poor in conflict with that of the rich, creates a difficult situation and the role the state plays can in some situations instead of mitigating the problem leave marginal groups devoid of their basic rights. Morris, S. (2001b). In societies with egalitarian income distributions and which have grown rapidly (typically the East Asian tigers), the state typically has monopolised water, and through its plans, investments and allocations ensured basic access to all of water.

months in the year[19]. Therefore the required storage is large relative to the annual use of water. In addition large inter year variations, interregional variations mean that the returns to transbasin and inter-subbasin transfers are substantial. Historically too, India was always a hydraulic society and the high density of population in India was always based over control and storage of water. That need is now enhanced with higher incomes (which develops the commercial need for water) and a larger population. Further expansion of water resources necessarily mean its efficient use (well understood in the debate but not realised in practice due inter alia to mispricing) and what is not so well recognised, the need for national level optimality in the planning of water development. Similarly, planning that recognises the interrelationships and hence the need for consistency between prices, planning priorities and demands is crucial - Not planning per se.

Water in India is a state subject. This per se is not the problem. But the attempt to develop certain large river systems on the basis of a basin and trans –basin level optimality without clarifying the constitutional and legal basis for the same is at the root of the interstate water disputes that hold back exploitation for decades. The current arrangements have their basis only in contracts and the ownership (central and shared) of the underlying assets that store and manage water and not fundamentally in the water rights and the constitution, and as such are subject to the political push and pulls on the executives' decisions making process. A judicial /commission overlay of the process in the form of the "tribunals for water award of the waters of a system (basin) that is interstate" is not adequate enough as the recent experiences of state governments attempting the cancel their agreements with other states would show. Even more than the reluctance shown by certain states to adhere to tribunal awards, the awards themselves may not be based on a true intrabasin optimality. The right aspect rather than the efficient use aspect would have had the larger bearing. In any case there is no framework to ensure optimality of use in the transbasin case.

Water is Also an Economic Good

Greatly compounding the problem has been the limited (pre-commercial) basis of the definition of water rights. The rights of a state are to use, but not to sell. The right when necessarily including the right to sell, has the potential to move the system closer to the transbasin and intrabasin optimal use, since a state /region currently not using its allocations could earn out of its sale of water or water rights. And the (perverse) incentive therefore to use/inappropriately develop uses, however inefficient these are (in relation to alternative development or use of the same in other states/areas), would to that extent have been attenuated. When the right to sell across the state exists, and marginal (allocative) prices or tariffs reflect the cost of

[19] Even during the monsoon months, in the drier regions of Western India, in a few days as much as 40% of the total annual rainfall is not unusual.

generating /making available water, states would see water as being fungible with revenue, with the sharing of the rents from cheaper sources being negotiated.

Tradability and Water Rights

With direct subsidisation, if currently inefficiently used water can be traded transbasin, and the gains accrue largely to the farmer who reduces his consumption, then a political basis for transbasin or intrabasin transfers would have been created. This would mean that endowment coupons could be traded transbasin or over the basin and not just within the command area of a project.

The inefficient farmer in the better endowed areas would have to reference his use of water with respect to the market prices whether or not he bought the water, or he had been endowed with the same through a subsidy scheme. This would in a major way change the behaviour of states in water negotiations. States with water deficits but with high marginal product of water (in part arising from their greater availability of land) would be able to bring to the table this higher marginal product to bid high rent payments or prices to get the water. The important point is to clearly vest the rents with the source state and its people.

Negotiations under the current framework wherein water rights are incompletely defined necessarily make the parties view the outcome as a zero sum game, when indeed with a correct definition of the right to water, their approach could have been much that of developers. States with large water resources would attempt to develop the same, with the intention to sell the same through long and short term contracts. While this has happened to a certain extent (especially in the development of hydro-power), they have generally been imposed from above by planners and the centre by appeal to, and in, the national interest[20]. Typically, the states' allowing use of the waters of it rivers have gained little while others receiving the waters have gained much. The gain of the state giving up water arises only on account of the larger central funding of its water development. Rarely have benefiting states funded projects in other states giving up water. This implies that the optimal is rarely pursued systematically. The asymmetry has stood in the way of interbasin and particularly transbasin optimality.

Avoiding Monopolisation of Water Rights

One of the arguments against tradability in water rights is the possible emergence of monopoly control over water. The Chilean case has been brought to light by the World Bank (1998). Monopoly of course need not hold back either appropriate pricing or tradability. There are possible checks to monopolisation of water that can

[20] Lacking such clarity with regard to rights and the associated rents, the very large potential to develop the hydropower resources of the Himalayan states remains almost entirely untapped.

accompany tradability. Conceivably several possibilities arise. In a situation where there is limited potential to transfer out the water from within an area (a command area or an ayacut), and the traded prices are reflective of the marginal product of water, and there are no substitutes such as ground water, the water rights–holder in the ayacut could extract a large part of its scarcity value in the form of rents. This can happen when the rights are tradable and persons with large financial resources could buy at current market prices the rights and then enhance their prices given monopoly /high market power through control of the supply. If supply elasticities are large in this situation and there are no entry barriers to water development the ill-effects are temporary and muted since the supply can expand until the marginal product approaches close to the cost of water provision. But this may not be feasible or may take too much time to be of much solace to the farmer, so the assumption that the marginal product of water would be significantly above its cost of production is a reasonable assumption to make not only in water scarce areas, but also in the situation of underdevelopment of the resources.

To guard against cornering of rights, the rights to trade have to be circumscribed in interesting ways by which the value of water rights (and access) can be derived only by farmers, and others cannot garner the same easily. Thus if the rights are permanently vested in the farmers who enjoy endowments and cannot be reassigned without a formal process similar to that of sale of agricultural land and inheritance, but the water use coupons issued say quarterly can be traded, then the possibility of cornering is limited to the flows of water over a limited period. Since nobody can buy coupons much into the future the possibility of cornering water for extended periods is remote. Nevertheless, the value to cornering the coupons that allow access during crucial months of the crop cycle is large, such as in drier than usual month. This can be avoided by linking delivery to operational holdings initially within the ayacut and later across larger parts of the command area. The fact that the enforcement of the water quantities defined by the coupons cannot be done without the explicit cooperation of the farmers imposes limits to the ability of outsiders to extract the scarcity value.

ORGANISATIONAL AND DESIGN PROBLEMS IN GOVERNMENT OWNED PROJECTS

Except a miniscule part of the water development, and that too in recent times, much of water development has almost entirely been with the government. While coordinated and optimal water development is hardly possible without the involvement of the state, the role of the government has gone far beyond planning, or regulation to include design, project implementation and construction, and operations. The private sector's role thus far has been limited to provision of construction services with the private party typically bearing only part of the construction risk.

Massive Delays and Cost Overruns

Few projects have been turnkey or in smaller number of packages or have used turnkey principles. The typical practice is to have innumerable discrete contracts, with the task of project integration, and the risk arising out of the same lying entirely within government. Delays and cost overruns in water (hydro and irrigation) have been extraordinarily large, and been the highest for any sector. The cost overruns here have exceeded over 100% and time overruns have been even larger (Morris, S. (1990, 2003). The policy and legal infirmities with regard to land acquisition have been important but not the only factor in these delays and cost overruns. The financial constraint –actually arising from the tendency to spread thin the resources over a number of projects rather than focus the same over a more limited and feasible set of projects - is a major reason. Poor ground surveys geological surprises, ad hoc and post hoc changes in design are more the norm than the exception. (Morris, S., 2003)

Fundamental Infirmities in Procurement by Government

When the construction project implementation and maintenance are separated, as is the case today, there are large perverse incentives on the part of the private party to cut corners on quality and quantity.

This is compounded when, as it is the case today, government procurement does not give adequate weight to past performance or allow reputation to have a significant role in procurement. The possibility of long term relationships of construction contractors with government is almost non-existent given the L1 criteria without the adherence to other practices that would have made L1 functional[21]. Procurement problems arsing out ill-design are rampant. (Pandey, Ajay, 2003). Even a small improvement as in the case of the construction contracts of the National Highway Authority of India for the NHDP (the Golden Quadrilateral) where even a small improvement was able to bring much functionality and insulation from poor maintenance (Rastogi, Anupam, 2003, 2004) is illustrative of the potential to improve public procurement in India (Morris, S., 2004)

A reservoir /hydro resource being in part an 'experience good' and in part a complex entity quite like a power plant, cannot be procured the same way materials are procured. Thus, whether or not the setting of concrete has been as per design in all portions of a dam can be revealed only with use or with close and dedicated monitoring during construction. The monitoring costs are high and motivation is less in the current systems of procurement. Even changing the procurement of the public works department (PWD) to more rational measures and processes, such as

[21] For a detailed discussion of the problem of public procurement in India, see Pandey, Ajay (2003).

specifying the necessary certification by independent engineers, allowing a higher weight for reputation, using the prior information on performance of contractors across a number of government departments, not allowing the same contractor to operate under different legal entities, and following many of the tenets from good public procurement practices can ensure far better results.

Multiplying Risks

An associated problem with government procurement today is the numerosity of the packages that are awarded to private parties. And generally in most projects there are many private parties that are expected to work together. While in the contract the relationship of each contractor is with the government or the parastatal, in reality there would be umpteen points of contact where coordination between the parties would be required. These coordination tasks pose large risks. The scope for parties to take shelter under the non-performance/delay of another party, and situations compounding delays and cost overruns are many. The government/parastatals in taking all residual risks in construction would actually end up bearing much of the construction risk. The adherence to L1 without adherence to other concomitant safeguards, as argued above creates a higher probability of the winner suffering from "winner's curse" and therefore having a strong tendency to cut corners or corrupt the procurer. Excuses for non-performance and delays can be exploited to shift risks and costs on to government. This compounds the risks that the procurer bears on construction and project implementation. Hence, it is not surprising that the very best of parastatals of the government and large private groups, whose consciousness of costs is not in doubt, whose project implementation capabilities are very good, and who have had much experience, have moved over to turnkey assignments or to fewer packets. Thus both Reliance and the NTPC follow the policy of fewer packages with clear demarcation of tasks and responsibilities, greatly reducing the project construction and implementation risks. Coordination risks and monitoring costs being intangibles are not recognised in government budgeting processes, so that the gains that are possible in terms of manageability and reduced risks are lost in the pursuit of and an inappropriately specified L1. Other extraneous criteria, such as breaking up the packages into small size to encourage smaller construction firms, preferences for local parties, not penalising poor performers, ignorance of private information about contractors that have much value in predicting performance, involvement of multiple committees in the tender process, imposing large bidder side costs are all elements that bring about failure in the procurement process.[22]

[22] These are quite widespread in India, Responses to poor performance have further compounded the problem by building multiple layers of decision-making, imposing (ritualised) monitoring and enhanced reporting requirements. And detailed prequalification requirements have only added to the bidder side costs and uncertainties. The Controller and Auditor General in his several studies have brought out some interesting ways in which L1 parties gain through 'adjustments' of work quantities, besides the usual ways of cheating on quality and quantity. Pandey, Ajay (2003). Real reform can come only from more appropriate

Government departments including the ID are incomparably weaker in their procurement as compared to PSUs like the NTPC. They have lower capacity to monitor, or to lay out tasks in such a manner as to reduce coordination and define these tasks in contracts. Most important of all they are subject to strong pressures to get going with the procurement/construction even when all the loose ends have not been tied. The best and easiest way forward would be to necessarily link maintenance with construction and project implementation through appropriate private finance initiative (PFI) forms. If indeed the government can boldly go with design, build & finance (DBF) or even design, build, finance and operate (DBFO) option, the latter with either annuities or user charges or both, then bulk water development can take a big leap forward. The current fiscal situation additionally provides strong imperatives to go in this direction.

FINANCING WATER DEVELOPMENT

The DBFO Option

With fundamental problems of contracting and limited financial capacity, the design, build, finance & operate (DBFO) option would have much use as a vehicle for organisation and institutional reform of the ID. In the DBFO option the private sector is brought in as a developer and his responsibility includes the design (subject to approval by appropriate technical authorities /regulator), construction and management of water projects. The output of bulk water and hydropower projects is relatively easy to specify so that a private finance initiative (PFI) that is DBFO in form is most appropriate. Thus instead of building a dam and operating the same the government could specify the water requirements as a function of rainfall pattern over the months, giving appropriate values for fungiblity between months, and at sluice gates/or at various points in a command area/the electricity to be generated both gross and net (in case pumped storage facilities are being contemplated), the values for trade off between electricity and irrigation in case of multipurpose projects, the siltation rates, etc. It may still retain control over the project site though even on this the options for the project could be previously sounded out with the private sector since there are always aspects of the site that are not known in advance.

The risk of geological and topographical surprises although they ought to be minimised by the government by carefully crafted surveys by the government (or through independent contracts with the private sector), since the impact of such surprises is on the construction cost, they ought to be made on account of the party that is involved in the design and construction. The aspect is better considered as

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designs and rules such as the use of independent engineers, bundling construction with maintenance, use of more turnkey forms etc.

involving diligence by the private party, hence is best handled by the builder. The total (systemic) returns to the increased costs of proper topographic and geological surveys would most certainly be positive.

Annuities

If the project is based on annuities (so much for unit quantity of water) then the demand risk is being borne by the state. On the other hand in projects where the private water developing party is expected to earn revenues form water distribution companies / or from farmers for water sold at regulated prices (price cap for instance), then the demand risk is borne by the private sector. In this case the capacity decision of the project has to be on account of the private party. Otherwise the state would have to guarantee off take of a certain quantity of water, and in case there are surpluses (purchases are smaller than capacity output the government would have to be ready to pay for the availability whether or not it has use for the same. Where the capacity (and hence the basic design) of the project is determined by the state, then the demand risk too is better borne by the state. The option of the state carrying out the operations (allocations, supply and inflow decisions), while the private sector carries out design, construction and maintenance, is also worth considering. Herein the state would have to specify the capacity of the reservoir, and associated equipment and the availability norms, the standards of maintenance including the maximum siltation rates (when the control over the catchment area is with the private party).

Public 'Comparator'

The costs of such an approach would seem to be large if the government were to do an ex-ante comparison of the PFI approach with construction using the existing system and processes. But such a comparison would be quite misleading for the following reasons:

- The coordination risks that the government bears in the current system are entirely excluded, but would need to be estimated and accounted for. If this is actually carried out using past data, then on that count alone the ex-ante costs would have to go up by 50% or more.

- There is perversity within government departments in attempting to understate the costs, with a view to show improved viability of projects so as to access funds from the exchequer and from such sources as the Planning Commission. There are very large perversities in the capital budgeting and expenditure processes within government, that would make project reports on the basis of which

projects are cleared within the government suspect[23]. The involvement of the multilateral agencies in funding is known to have improved matters somewhat especially when their role is large. But because the government typically bears the risk and guarantees the loan from the MLA, MLAs have only a limited incentive and concern to improve matters, certainly not to bring about major changes. Since there are many ways in which project costs ex-approval can go up, project evaluation within the government is little better than a farce.

- Additionally, the cost of the service per unit of output, ceterius paribus would appear to be higher for privately funded projects on account of the limited period over which funds are available from markets to which the private party has access.[24] Thus if debt can be raised only up to say 15 years while the life of the principal assets of the projects is much higher say 30 years then there is a problem of the private party requiring a higher revenue stream that the government when its owns the project. This difference would make a significantly raise the capital costs of private projects. At the societal level it creates an intergenerational transfer problem, by making early users of the facility pay more than later users. Today for water/irrigation schemes the government, for cost recovery, uses a depreciation rate that would imply an assumed life of 50 years[25].

Higher Allowed Depreciation is Not Dysfunctional

Too much has been made of this intergenerational issue by neo-classically oriented economists, without recognising the dynamics of the situation. Today, in the advanced countries where most of the water systems that the society requires are already in place and growth rates are typically less than a per cent, the issue is significant if a new project is going to be built and capital subsidies are called for. Then there ought necessarily to be transfer clauses, so that governments can claim the value of the project once costs have been covered. Or risk cover may have to be

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[23] For an overview of the perversities in the expenditure and budgetary processes see Morris, S. (2003). For perversities in project approval by the Project Investment Board (PIB) see Morris, S. (1986). For details of the problems in the current budgeting process for state governments see Mitra, S. and Vijay, Pillai (2003).

[24] To the extent that the private party has raised funds from MLAs and other institutions that lend long, the problem is reduced. It is of course very important for the MLAs to increasingly provide funds to private parties building public infrastructure, rather than continually support government and its parastatals.

[25] Actual life of the assets has varied greatly. Ex-post some projects such as the Hoover Dam show a life in excess of 500 years. In India too some of the well built dams and the catchment areas of which are still under forests and reasonably well preserved show further useable life in excess of the design stage assumptions. Many others show siltation rates far in excess of what was anticipated and poor construction and design quality that would considerably reduce their life. The issue here is that in a technical sense dams and similar projects have large life in excess of the duration over which debt is available.

provided to the private party by the government. In the Indian case where much of the network has still to come, i.e. the capacities have yet to be built, the problem is not significant. The resources out of the higher tariffs borne by the current generation, when further invested would in allowing for higher growth, make the intergeneration problem less of an issue. After all faster expansion of the network for such basic services and products like water and irrigation when there is continued denial[26] gives social value large enough to justify a some deviation from the static optima of neo-classical analysis.

More than for the reason of intergenerational equity the current low charges to farmers would create problems when in a new project at full cost pricing the depreciation rates are higher. If there is willingness and affordability at such prices then with appropriate transfer clauses (or clauses of reversion of supplies to government) the project should go ahead, and surpluses on government account once the concession period is over could be used for expansion of water supplies if there are continuing demands. Or the system could then revert to the correct long run marginal cost (LRMC) pricing with the government keeping the surpluses. If such full private-cost prices are too high to promote near optimal use of the supplies, then the government should subsidise the private builder. In the PFI case, and especially when the government is fiscally stressed but under pressure to expand supplies, the contribution of the government should take the form of additional revenues (over the charges collected from users of water) and in the form of annuities. With the fiscal situation becoming better, the support of the government can take the form of credit support (credit support and enhancement), provision cover for interest rate risk, besides revenue support, depending upon the details of the project structure.

Financial Closure

Private parties unlike governments would not take up project implementation in a physical sense unless the project is financially closed, since the risks they otherwise bear would be impossibly high. Governments have inbuilt tendency to start construction without financial closures. Merely imposing financial closure on government projects, while useful is not the answer. To the extent that it leads to better understanding of the project and the risks such an approach would be important. But given that is the case of cost overruns, there is no way the government can externalise the cost (even in part), insistence on financial closure is not necessarily going to ensure the strong incentives that exist for the private party to

[26] Denial we define as happening when there is enough income to buy the service /product in question but the service is poorly provided or is absent. Given very low price elasticities for public necessities in the consumption of the initial amounts (necessity phase), the welfare losses that those subject to denial have to bear are very large, and sometimes many times the cost of production of the good. Good examples would be water and electricity where for the basic consumption the willingness to pay is very high for the first few units of consumption.

work within the budgeted costs. With private parties at least to the extent that the party looses its equity there are incentives for cost control and behaviour ex-ante to reduce surprises/ anticipate risks.[27] This is most important in the Indian context since it is surprises, and poor and delayed implementation that have resulted in high cost of projects.

Contextualising DBFO

It is surprising that the DBF and DBFO options have not been used in countries like India for projects in water supply. Part of the answer may lie in the process of reform trying to mimic the developments in the advanced countries in their detail and prescription. The attempt should have been to apply the core aspect of the reform (the innovation or the principle) to a contextually different situation. In the advanced countries when the idea of DBFO took root there were hardly any water projects left since much of the capacities had been developed either privately or publicly in a much earlier period through direct state/local government involvement or through concessions. Thus the existing literature does not discuss the DBFO type options for irrigation projects. In dynamic countries of East Asia and especially China which have added vast irrigation and water projects the state systems have been particularly strong, and success has been large. With little or no failure the pressures to search for alternatives is so much lesser. An elitist environmental focus of MLAs and other global financiers have kept out the private sector from large projects in China despite the willingness of the Chinese government to try out PPPs.

How Much Annuity Financing?

The Annual Plan Outlay on account of "Irrigation and Flood Control" for the Centre, States and Union territories has been of the order of Rs. 10,000 crore in the late nineties, and the revised estimates for the same for 2002-03 has been Rs. 17,750 crore. (Annual Report, MoF, various issues). Since these are Plan expenditures a large part of the same is directly for capital expenditures. Taking about Rs. 15,000 crore as directly capital expenditures or expenditures supporting capital formation, the same may be reasonably assumed to be available for annuities for PFIs, in case government adopts that route. It would constitute the current upper bound for the revenue support ceterius paribus that the government can provide to private parties taking up DBF/DBFO projects. This flow arises from allocations to the ID and the user charges currently accruing to the government. With the marginal user charges being higher on new projects, this revenue without stress on other aspects of government's budget can be expected to grow at a marginally higher rate than the growth of government expenditures.

[27] When of course there are major deviations arising from unanticipated risks (fundamental), which exhaust the equity of the private party, even in the case of PFIs, the project would end up on the government account.

Government expenditures in real terms have been growing at around 6% (roughly at the growth rate of the economy). Thus a growth rate of 6.5% in real terms of capacity addition would be feasible (assuming that water projects do not face a rising cost curve). If about a third of the same is available for water storage and bulk distribution projects (dams, reservoirs and canals), then the government can take up PFI support to the extent of 5,000*(1/Per Period Payment(N, interest rate)) which for 12% interest rate (assuming that all risks passed on to the private party are commensurate with a risk premium of 4% if the risk free rate today is 8%), which would be equal to 5,000*(13.65), which is roughly Rs. 68,000 crore. If user charges finance everything else except that which accounts for the difference in the depreciation rates, then the total investment that can be mobilised is 68,000*6.4 = R. 435000 crore. Assuming a standard period of construction to be about 10 years for water projects this would mean an annual realisation of Rs 43000 crore approximately of private investments that can be leveraged, rising at rates higher than the growth rate of the economy. Even if our assumption of the capital expenditures currently taking place are wrong by a wide margin, say it is Rs. 5000 crore instead of the assumed Rs. 15,000 crore, the estimate of the private investment that can be supported is about Rs. 14,000 crore per year. Thus, if the same resources being put into capital expenditure by the government are used as revenue payments to support private investments (PFIs) then the investment rate can go up, and what is more important can be far more efficiently carried out. Taking credit for the efficiency gains would mean that far more effective capacity can be every year than what is possible under the current regime.

PFIs in Growth Situation

PFIs bring up front the efficiencies and transfer on to the private sector the task of raising finances, and creating, and owning assets, while leveraging the governments strength in being able to sign credible long period contracts. This underlies the workability of the PFI /DBO approach in public infrastructure. Its merit, in a situation where the supply can (and need to) for a long time expand at rates close to the growth rate of the economy, is particularly large. In water, as said before, because specifying output and quality is actually easier than in roads where DBFOs have been common there is no reason why the same cannot be used for water development.

A large part of the PWD the ID is engaged in operations, construction, maintenance, monitoring of construction, and design of water and related projects. Conceivably if the ID were to shrink ultimately to a planner, identifier and basic designer of projects, and an accountant and monitor of PFIs, and spin-off the office of a technical and price regulator[28] of the water sector, the employment levels could go down

[28] The World Bank in asking for a paradigm shift with regard to irrigation development in India has inter alia been asking for a reorganistion of the IDs as part of its recommendation under institutional change. See World Bank (1998), op.cit.

immeasurably. Today, while there is a ceiling/ban on fresh recruitment in government including in the ID/PWD since neither the work processes nor the task roles have changed demoralisation and 'overworking' especially for crucial tasks occurs. This can be avoided, and large numbers of manpower rendered entirely surplus, if projects can go PFI.

Evaluating PFIs

What should be the public comparator for projects to go PFI? We would first of all underemphasise the need for a public comparator as a universal requirement. If private parties not depending upon state subsidies/annuities are willing to take up water supply projects entirely through user charges, which are capped by a regulator on the basis of price cap regulation valid through a region and unrelated to the specifics of the particular project, then there is no need for any comparator. The regulator/government would then need to ensure that it is optimal in the project's external effects on resource use, and does not impose any safety hazards. To go for bids for PFIs in the case of projects that in part or full depend upon revenue support it would be necessary to have a base line estimate of the project. It is important that in the comparison exercise the necessarily higher 'cost' of a private project arising on account of the limitation in the duration over which debt can be raised is kept out. It is relevant only to work out user the charge and the extent of support that is if at all to be provided by the government.

The fact that there have been hardly any large projects in irrigation in the private sector would mean that to start with the asymmetry in the information base between the government and the private sector would have to be addressed. Many changes ought to happen – greater transparency, compulsory provision of information including maps and topographic sheets to private citizens and parties outside the government etc, before innovations in design can happen. It is not a large problem as it is made out to be. A private sector with large demands ahead could build these skills very quickly by recruitment of excellent talent (poorly motivated and little used) available in the irrigation departments, especially of hydraulic and civil engineers, surveyors, and geologists, and other technical personnel.

BULK WATER BUSINESS IN THE PRIVATE SECTOR

In bulk water development and supply, large private (including foreign) companies could have an additional functionality. For fresh supplies there would be less resistance on the part of farmers or retail companies / cooperatives of farmers including WUAs to pay the full cost to the bulk provider when the bulk provider and developer is not seen as being the state. Such a developer would have made comprehensive studies to assess the willingness to pay and affordability at regulated prices. They would also have assessed the boundaries of the demand and collection risk. The developer would ask for additional safeguards to ensure payments.

Governments should not typically cover the collection risk, since that would, given the competitive populist politics result in defaults to the private bulk supplier who would then evoke such provisions.

It is far better to strengthen the legal position of the bulk supplier in his responsibility as a collector of user charges by special provisions and changes if necessary, including provisions by which he could evoke the powers of the magistrate to collect water charges. But his most important instrument to collect would be the freedom to deny water to such companies or cooperatives that do not pay on time. He would in order to hedge his dependence on a limited number of buying entities have planned for extensive networks that may be a little superfluous from the purely technical matter of optimally distributing irrigation water but would give him the flexibility to reach a larger number of buyers than whom he can serve at any time. This flexibility is important not only from the point of view of providing a hedge against collection risk but also to enable retail water markets to develop and be linked to wholesale water markets and prices therein, as and when intra-project trading is opened up.

Existing productive water assets with the state can also go on maintenance and operation (MO) contracts valid for long periods. Here they key challenge is to simultaneously evolve a regulatory framework. The more complex task of socially and environmentally efficient design need not be addressed since the asset already exists.

The regulatory tasks are common to new projects too. Thus based on studies of the current maintenance costs incurred by the state with adjustments for both better capex (since the state may have under fiscal stress put off or neglected maintenance), and lower cost of the private sector due to lower wage cost and efficiency, an estimate of the true costs likely to be incurred by the private party could be arrived at as also a time profile of the same. Given the price cap for bulk water which could be common for an entire region or basin/or specific to the ayacut/command area of a project (with some variations for transportation costs), the value of the maintenance contract can be estimated. Much would depend upon the gains the private party could make through repairs, renovation and augmentation activities (RR&A) by enhancing the supplies which would be to its account.

Thus if :

R(t)	: annual expenditure planned for RR&A for say *Nr* years;
RK(t)	: Construction cost of project over *Nk* years; for new projects
Nc	: Concession period (about the same as longest tenure in the debt market)
r	: Discount rate (including the risk premium for the project = *i* + risk premium (assumed to be 4%) i=8%; so that *r* = 12 %

Cx(t) : Annual capex for maintenance

OM(t) : O&M expenditure annual (for simplicity assumed to rise over the concession period in the same manner as the price cap) as relevant for the private sector

PWo : Wholesale prices for water (regulated) at the beginning of the period i.e., the current price cap. Assume also for simplicity that the indexation of the price cap correctly forecasts the rise in the O&M expenditure.

Inf : The rate at which the price cap, *OM(t)* and *Cx(t)* rises over the years, assumed to be uniform through the concession period.
And

V : is the estimate of the value of the MO business then *V* is given by:

$$V = \sum_{t}^{Nc} \frac{(PWo*(1+Inf)^{t} * Q(t) - (OM(t) + Cx(t))*(1+Inf)^{t}}{(1+r)^{t}} - \sum_{t}^{Nr} \frac{R(t)}{(1+r)^{t}} - \{\sum_{-Nk}^{0} \frac{RK(t)}{(1+r)^{t}}\}$$

It is important that *PWo,* the price at which water is supplied by bulk water storage and Generation Company reflects cost fully from the very beginning. This would ensure the private profitability of the business/MO contract form the very beginning, and would create strong incentives for the private bulk water company to collect all water charges from the WUAs/retail water companies (RWCs)/(WDCs)/farmers' cooperatives (FCs) and to measure actual supply correctly. Besides the regulated price, the valuation would crucially depend upon the estimate of the O&M expenses. It is well recognised that it is here that the private sector has a distinct advantage. In the Indian context given that state systems have neglected maintenance, *Q(t)* could be significantly higher than current levels of output both because leakage/seepage can be avoided through better design and RR&A activities for which the private parties unlike state entities would have strong incentives. Parties with a capacity to reach high *Q(t)* would bid higher.

If *PWo* is based not on the life of the asset but on the maximum tenure of debt possible in markets i.e. assuming that the asset is depreciated over a 15 year period, then only large positive bids are possible. (A concession period that is lower than 15 years). This may not be politically feasible for new capital intensive projects, and either a much larger concession period has to be expected (there are limits to this) . If *PWo* is based on the (long) life of the asset then a required annuity payment from the government say for say 15 years can be made the bid criteria. On the other hand for existing projects, i.e., those which have been in existence for many years, the tariffs based on asset life could for MO projects with RR&A still attract positive bids.

WATER DISTRBUTION BUSINESS AND ENTITLEMENTS

A framework such as the above for bulk water generation and distribution companies which sell water at regulated prices to WUAs /RWCs /WDCs / FCs would not be politically feasible even with the 'subsidy' implied by annuity, if *PWo* plus the standard distribution costs are higher that what farmers currently pay as average prices for water. Therefore adequate arrangements to ensure that farmers are compensated for the higher prices they have to pay by a subsidisation scheme that is non-distortionary is essential. This we have argued before. It is far better to implement such a scheme at the level of the farmer directly or at the WUA (less preferable) leaving the water distribution and production entities free to behave in a way that promotes efficiency.

Let us suppose that farmers today pay effectively *PFo* for a unit of water. This is based on the cash payments that they have actually made and not on the billings that have been made on them. This divided by their consumption of water *CFo* is the lower bound of what they should pay for the same level of consumption. The current level of subsidy therefore is

*Subsidy = (PWo – (CASH/CFo))*CFo*

Where *PWo* is the regulated price based on costs being considered assuming depreciation over the life of the asset. This is the maximum level of subsidy that need to be provided for in money terms. In terms of water their entitlement would be

E = Subsidy/PWo = CFo –(CASH/PWo) which is the upper bound of entitlement. If the actual entitlement is fixed upfront in a reform programme which involves farmers' groups and is well communicated to them, then there is no need for the farmer to oppose reform that involves price rationalisation. Price rationalisation in order to be fair to the farmer would have to correctly estimate *PWo*. This cannot be by loading the cost increases on account of delays, poor management and design on to the project as is the current practice but by making due allowance for such overruns[29]. In any case the entitlement cannot be greater than the amount of water that he currently consumes.

Thus if today in the aggregate, the revenues *R* from a supply of *S* units of water that cost (on a standard cost basis) *C* rupees and since *C* is more than *R* , the entitlement that protects the level of subsidy for the farmer would be to the extent of *S – (R/C)*. If the water supply as a result of improved maintenance is augmented by *AS*, it would bring in an additional revenue that is equal to *C*(AS)* where *C* now is also the regulated price for supply. Farmers would now enjoy an entitlement of water to the extent of *S- (R/C)* for which they pay nothing and for any additional water they pay

[29] This has emerged as a practice in many projects. Cf. Binayak Rath (2002).

at C. Thus the marginal (allocative) prices would have moved up to their correct values. The key to the realisation of this benefit of the reform is to incentivise the same by building it into the contract of WUAs/WDCs/RWCs/FCs, with the bulk water entity and the state. This is best done by allowing all who can act to save and improve supplies in distribution to do so, and providing strong incentives to do so that is to internalise at market prices the savings /augmentation of water that distribution companies can make

As before

$$V = \sum_{t}^{Ne} \frac{(MPW(SD(t) - loss - E) - (OM(t) + Cx(t)) * (1+Inf)^t - PWo * (1+Inf)^t * SD(t) + DMo * (1+Inf)^t (SD(t) - loss)}{(1+r)^t}$$

$$- \sum_{t}^{Nr} \frac{R(t)}{(1+r)^t} - \{ \sum_{-Nk}^{0} \frac{RK(t)}{(1+r)^t} \}$$

Where now

MPW	: is the price of water in water markets
OM(t)	: O&M cost of the distribution company
Cx(t)	: capex annual of the distribution company
PWo	: purchase price of water from the wholesale company
DMo	: regulated distribution margin
SD(t)	: the amount of water bought /received by the distribution company
Loss	: distribution losses of the distribution company

The large incentive for the distribution company WDC/RWC/FC/WUA arises from the contract that allows it to sell all water saved at the high water market prices. Similarly, all surpluses after endowments have been met are sold at the water market prices. Individual farmers too would be seeing the market prices for their endowments and so would use the same optimally since they always have the opportunity to sell part of the water that is allocated to them as their endowment at *MPW*.

THE SPACE FOR WUAs IN DISTRIBUTION

The costs of monitoring use and upkeep of distributaries and field channels by parties other than farmers themselves are significantly large. This arises out of the farmers' comparative cost advantage to incur these activities, and due to asymmetric (private) information in favour of the farmer. The farmer also has strong incentives to ensure that others do not misuse, since that would increase his costs and lower his availability, especially in WUAs when they are not too large and quantities to the WUA are limited. But this incentive does not operate in all situations. Interestingly if

there is a system that is working well and misuse/over drawl etc is rare, then farmers would show a larger propensity to set right the error. This is so because the misuse/overdrawl being rare would be considered as almost criminal and since the probability of success in ensuring correct behaviour is large, he would not be averse to collective action or even individual action for the collective good. But in situations where misuse /overuse is rampant, the situation is already akin to a traffic jam. The low probability of anyone (without authority) being able to make a difference, ensures that few or none act, so that inaction inevitably sustains the jam/the optimal situation or long. Thus the equilibrium of optimal use by WUAs is stable only if the implicit behaviour and rules have been in existence without violation for long, in other words it presumes strong leadership over the formation and institutionalisation phase.

Leadership and Asymmetry

Leadership is somewhat easy to come by when the potential payoffs to leadership are increased through asymmetric benefits. This is well known from the study of industry associations. Typically such associations are led and funded by the large players, but the voting rights tend to give them representation less than in proportion to either their contribution or size. Thus a firm 10 times larger than another may have only twice or three times the vote of the other firm. Since firms range considerably in their size, the largest firm (say of size equal to a third of all industry) may be able to get as much as a tenth of the value that is created by collective action. With a couple of such firms coming together they have the ability to internalise a significant portion of the benefits. This could render leadership activities rewarding to lead to better collective outcomes. In situations where there is far less concentration, effective associations are difficult to take root, without the efforts of self sacrificing leaders (or highly parasitic leadership), because internalisation can begin only once many have got together. In other words, the need to come together in a major way is prior to the effectiveness of the association[30].

In the situation of asymmetry though, the transition path of a few taking the initiative to form the association and of others joining them is possible. (Others even if they do not bring in significant additional benefits to the existing members of the association are graciously admitted since members would not like to be confronted by the (negative) value of keeping them out or being dissenters. Among farmers there is little of the wide variation in unit sizes that one observes in an association of industries. Some natural asymmetry emerging out of differences in the land

[30] This is observed for instance in the case of small industries in India, Their extreme numerosity have led to formal distanced associations that are able to at best generate political voice. Few association have evolved to offer services of interest to their members or even to effectively lobby for policies that are favourable. Activities that involved significant cost are rarely taken up so that they are at best reduced to lobbying for lower duties and taxes, an activity that needs little effort and few costs to be borne.

ownership may have been attenuated in Indian WUAs by the insistence on one member one vote without due recognition of land ownership or assigned access rights to water. WUAs have a better chance if the natural asymmetry is allowed to work. Equally importantly the formal codification of rules and behaviour that are adopted or evolve after struggle with ready formats of punishment for non-adherence would over time reduce the total costs of monitoring. It is difficult for a group that has come together to go ahead and work as a WUA when many others are still not in, given the tree like structure of distributories. Thus there is a near all or none situation and no automatic transition path as such exists.

Improving Upon WUAs

A formally separate identity of the WUA with its own accounts would go someway to reduce the individual cost of continuous cooperation. One option that seems to have much potential is the model of sugar cooperatives that are not only cooperatives but have certain flexibility vital to their success and ease of administration. (Shah, Tushaar, 1996) Essentially a cooperative sugar mill's share is held by cane farmers. And cane farmers have the right to sell cane to the mill in proportion to the stock they hold. Such share holdings (in small denominations) are bought and sold in a flourishing market. The value of the share capital in the market arises not only on account of the profitability of the crushing and sugar refining business (the mill as such), but principally on the higher returns that farmers make in selling cane to the sugar mill than the alternative of selling cane in a competitive market (destined to the gur industry). The flexibility has been important since the (high) value of his right to sell to the sugar mill is rendered liquid enough through such trade. Additionally if in a particular year his crop is below his access right then he has the ability to sell the surplus access right. Since the access right had a definite value in the market, there would hardly ever be a situation (except in severe drought) where these are underutilised. Since the capacity of the plant is limited, overproduction of cane that kills the cane prices are also avoided.[31] Compared to other places where the sugar mills are privately owned the farmers' risks are reduced and returns are considerably enhanced. If WUAs move to farmers' water cooperatives (FCs) with an independent legal identity and shareholding (restricted to those owning a minimum amount of land in the ayacut/command area of the distributory main), and the share holding is proportional to the access rights, then such share holding would have a market in the command area, that is reflective of the value of the assured water that the access right gives.

[31] Cane being non storable has to reach the plant quickly, and too many plants cannot be set up since their capacities would be utilized only in the crushing season. This gives rise to the need for some regulation /self regulation, which in the Indian context was sought to be done by licensing of sugar mills.

BRINGING IN PRIVATE AND USER FINANCING

A new large irrigation project for example can be self financing[32] in the following way. Once the broad contours of the project are known and the same is consistent with basin/transbasin level optimality, and with water sharing treaties, the state government could invite bids for certain capacity of storage with specified flows during the seasons *K* and *Qmin(t.s)* respectively with a regulated price of water *PW(t,s)*. The project goes to the bidder who bids lowest combination of concession period *Nc* and *annuity(t)* support . If the project has positive value (as would be the case if the depreciation period is less than the tenure of the market and/or the return that was the basis of the pricing is large), then the criteria would be the lowest *Nc* and no support. Of course there would be due safeguards of design check, independent engineer's approval condition, bank guarantees, confidentiality of certain kinds of geological and hydrological information, etc.

Simultaneously smaller water distribution companies are invited on DBFO basis for the distributories from the mains. Farmer owned water companies are given a handicap in the bids to a pre-specified extent but they do not have a monopoly. Again they bid for a concession period *Nc* given the distribution margin *DMo(t)*, norms regarding allowed losses *loss*, and endowments of water *E*. The excess of *Q(t)* over $\sum_s Qmin(t,s)$ is appropriable by the water distribution company at expected water market prices *MPW(t,s)*.

Farmers' companies could in turn raise the funds for construction by selling the share capital of the farmers distribution companies to farmers thereby guaranteeing a certain `purchased' *E*, with the value of the share capital reflecting the linked right to water at no cost. Not all of the expected water flow through a particular distribution company's territory should be so sold, so that bids for the water companies are positive based on the distribution margin. Such bids should be bankable so that farmers can, anticipating the future rise in productivity of their lands and hence incomes participate in the project (the distribution side of the business).

Distribution organisations that are not farmers' cooperatives would need to incur higher cost in monitoring than do farmers' companies. On the other hand farmers' cooperative companies particularly those structured on more egalitarian principles than would be the WUAs, would need to have leadership. On the whole it is difficult to say whether the farmers' cooperative company/WUA would need some

[32] Except to the extent of the difference in the rate at which the private party recovers its capital charge and the government does. With regulated prices *PWo* being allowed to be higher than the long run marginal costs (LRMC) even this annuity is in all probability not called for. Support for this contention comes from the observation that the water market prices are way above the cost of production of the same in large public schemes, so that even say a 50% increase in the regulated price over the LRMC, can make the majority of the irrigation projects, self financing, i.e. not depend on government support.

bid preference. It would be necessary to start with all options and let the system evolve. WUAs have the potential to handle the situation of positive externalities from surface flows better, since the members could take a collective view on the economies of supplying water and residually charging for ground water use. It would also be socially meaningful when the aquifers are local and access to the same is possible for one and all in the command area, but not to outsiders.

TAKING TANK IRRIGATION FORWARD

We have already outlined the problem of traditional community managed water assets such as tanks. Here the problem is particularly severe because the external effects of the surface storage and flows from the tank are large, and users and non-users of the tank derive benefits from such externalities. The controllability that ground water provides in its use without having to worry about collective processes and costs towards maintenance further highlight the difficulties in collective maintenance of the tank. Neglect of maintenance of the tank has little short term effects on users of ground water but yields of water from the ground go down over the long term.

The economics of letting the tank fall into disuse and deriving value merely from its external effects (as is the case when nearly all water being ground extracted), versus that of proper maintenance of the tank and tank based irrigation to the maximal extent and conjunctive use of ground water is incomparably in favour of the latter, so that there is a need to move to the latter from a point that is close to the former today. The private economies though, may be closer to use of ground water. The problem is made severe by the HP based tariff for irrigation pumpsets which artificially reduces the private cost of extraction of ground water. The incentive to therefore worry about the common resource (in itself not very strong) is therefore hit very hard indeed.

Necessity of Electricity Price Reform

Therefore, the first step would be to move to correct prices for electricity that reflect the cost to serve the farmer. Current subsidies on account of electricity can be given as direct subsidies through the institution of an entitlement and annual/ monthly issue of coupons which can be used in lieu of cash by the farmers to pay for electricity. Tradability of such electricity coupons outside the ayacut and indeed outside the basin should be allowed to so as to realise the gains of more optimal surface water development and judicious use of water. This change is absolutely necessary. This we have already argued. But that alone does not fully address the special problem of management of the tank.

We would think that the complete solution would lie in further constructing a framework for action that recognises the peculiar features of the situation and alters suitably the definition of property rights within the command area of the tank. Let us

suppose that the entire ayacut shares the same aquifer and yields of all wells existing and potential and of the same type and depth are similar.[33] Let us also imagine an ayacut management company in which all farmers have shares proportional to the value of their rights and assets. Traditional rights to water, and land holdings would have to be incorporated as rights to the shares of this company. If they are entirely separate only the rights to water from the tank need be considered.

Bidding to Reveal Internal (Value) Prices

Individual farmers give their bids in rupees for rights to use/extract water from a well of say standard depth operating for *X1(s)* hours in the year. So would bids be invited for a standard quantity of water *S(s)* from the tank over the year. If there are more than one standard well type similar bids can be invited for that well type *X2(s)* too. Farmers pay in IOUs. The actual indicative price for the right of using the well that year is determined by the clearing bids at which all wells in current use, and planned available quantities of water are fully allotted. The surface supplies from the tank have a built in risk aspect. A prior formula to allocate the shortfall over the periods *s* and proportionately over the current holders of the allocation would be the default mode of operation of tanks' surface water. The positive variance over the planned availability of the tank's surface water may be assigned to the cooperative /joint stock water company which is free to sell the same at actual market prices for the water in the command area to members. (The negative variance though would have to be assigned to the farmers in proportion to their rights). A local exchange for intra-farmer trade of water can operate every fortnight. The problem of inter-period sales is an issue that can be dealt with in the following manner. Farmers wanting to consume more in a certain period that what they had contracted for would have to buy the excess requirement in the market. Assume that the price would rise above originally bid prices as a result. If the water company now decides that it is in the collective interest to release more water this period than in a later period it could do so, by buying up future access quantities equivalent to the same in the market for a price. If that price is higher than the price today then there is no incentive for the company to do so. Thus with this condition the collective well being would be ensured. Since profits of the cooperative /company belong to the same farmer members the system should not have perversities[34].

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[33] This can never be true but at the second stage we would relax this assumption to consider the more realistic but involved case.

[34] A lot would depend upon the concentration of share holding within the WUA. There would have to be safeguards that limit share holding to farmers within the ayacut, and ensure limits to holdings by any individual, caste group etc. We have no idea of these details but with adequate information on these and the marginal product of water which would determine the price elasticities of demand, and the relative economics of ground water to surface water from the tank, the total supplies in relation to the actual land which can use the water, it should be possible to simulate the best rules and design of a bid based ownership and allocation of water from the tank.

Would the company make losses? This is most unlikely since the clearing prices would be way above the small cost of maintenance and operations. The large notional profits of the company would in reality be distributed to the owners. Farmers settle their IOUs with their share of profits from the company. Any difference is settled in cash either way. At the end of the day there would be very strong incentives to conserve water to sell to others outside the members group.

The same can be achieved but with somewhat lower flexibility by assigning rights to the surface water of the tank and the right to draw underground water (with an appropriate equivalent as proposed before) being distributed in proportion to share holding. And trades between farmers would allow some of the unanticipated variability to be taken into account. Both designs could be tried out on pilot basis for their functionality.

ENSURING OPTIMAL OPERATIONAL PRINCIPLES

The activities of water distribution involve a certain complexity that has to be recognised. Water in a certain month when say typically little or no rain is expected but is an important month for growth has high value relative to water when the crop does not crucially demand the same. Similarly the value of water in an unanticipated dry period is very valuable since it has a high marginal value in being able to save standing crops over which so much effort has gone in[35].

Complexities

These are all difficult to visualise and estimate ex-ante. (A planner attempting to do the same would always find significant variance of the realisations from his projections). For the bulk water company or the distribution company (if it has storage, or could draw water more flexibly) there are issues of inter-temporal optimality. Thus limiting water releases during a drought year, or releasing such that only for one where two additional crops were usual, etc. has much significance.

To bring some of these aspects into play it is better if a certain entitlement (share holding) allows the farmer to obtain coupons for water for each of the 52 weeks in the years, which he can then use or trade, so that weekly spot prices are formed. In the aggregate inter period trade could only be allowed if the optimal release strategy for the reservoir has changed due to unforeseen events, and without trade across the periods it is not possible to get to optimal release.

[35] In the current administrative allocation of electricity to farmers, it is this interseasonal aspect that gets reflected (with political amplification) in the very high prices paid via UI charges by certain States such as Punjab and Haryana.

Who should determine the optimal release plan and in what manner? This is a crucial question. Ideally an organisation with adequate technical expertise and with information about crops and water requirements and represented by all WUAs, water companies in the entire command would be the correct one. If no flows are expected after the monsoon then the problem is relatively simple. It involves working out the periodwise requirements knowing what the cropping pattern that season is, and would be in the next season/s. (Or, given knowledge of the quantity, the cropping is determined, which then fine tunes the release). Can the same be organised through markets? Allowing the bulk water producer to trade in the water market for a part of his output would be one way, but since he can influence the water market prices, this is fraught with dangers unless carried out with safeguards. These can be simple enough if there is complete ownership separation of private bulk water companies from any other water businesses. We would be cautious in using option in areas where there is no alternative to the water from the bulk supplier.

Bulk water prices should be regulated as outlined earlier in the discussion of financing and organisation of the bulk water business, so that the bulk water company irrespective of release and storage period gets the same revenue per unit of water.[36] In cases where there is ample ground water and the cost difference between using ground and canal water is not large[37] the farmer's countervailing power is sufficiently large for the experimentation of the bulk water company being allowed

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[36] Some allowance (higher price) can be given to the bulk water company to late releases over early releases in the case where post monsoon little or now flows are expected. This is to cover the costs of holding water. The matter is a little more complicated when significant flows are expected over the year as is the case of those areas that have flows due to melt water, the north east and off seasonal rains. When DBFO kind of contracts are being specified either seasonal demands (or capacities to make available) can be specified or seasonal prices that reflect costs of storage and demands arrived at through detailed studies can be incorporated into the price cap. Then the price cap would be as $PW_0(t,s)$, along with a minimum capacity to supply $Qmin(t,s)$ would have to be specified. In order to incentivise the response of the bulk water company to the unanticipated needs of the farmer, which can be accommodated by adjusting the inter-temporal releases from their planned levels, an operating rule that releases more when the prices are high could be adopted, but without any benefit on that account to the company.

[37] This is relevant particularly in the Ganges basin if there have to be significant incentives to ensure that bulk water in the Ganges basin is also generated from storage and not just through barrages. There are reasons from the point of view of national optimality to add storage for the Ganges Basin Rivers. Today the extensive irrigation in the Ganges basin arises largely from the diversion of rivers than from storage. As the lean season flows of these waters have fallen considerably there is increasing need to store more water if the full potential of the Ganges basin is agriculture is to be realised. The problem of inter-seasonal variation of prices of water for bulk water companies is of crucial importance in this regard, since thereby the plan objective of storage of Ganges basin waters can be translated to a regulated or market determined premium price in the lean season to which private and commercially oriented bulk water companies can respond.

to respond to price variability in the water market, for a small part of its revenue. This has the potential to allow the planned releases as worked out in advance to the starting solution and the optimal solution for releases to emerge. Alternatively to bulk water company's revenues there could be an added notional component which is inversely related to the inter-period variation in the water market prices.[38]

CONCLUSION

The issues related to pricing, water rights, subsidies and financing are deeply interlinked, and the correct pricing would have to recognise the financing implications. Being often enough a scarce commodity with major compositional and coordination economies in its use, water pricing cannot be discussed without a consideration of the rights (implicit or otherwise).

More than a diagnosis of the problem we have been led by the need to find solutions to a fast deteriorating situation: rising implicit subsidies, movement away from optimal use in a major way, huge distortions and resulting social costs in the use and misuse of water with as much as 30% of the irrigation water supplied being wasted. The environmental effects of such inappropriate use and waste increase by the day. A large part of the electricity subsidies arise on account of irrigation needs, While the delivered subsidy value may be under Rs. 15,000 crore annually the total fiscal cost of the same to the government (central and state) and its parastatals is as high as Rs. 50,000 crore or more and is rapidly increasing. Moreover the distortionary effects of such price based subsidisation of electricity, through the incentive for corruption, destroys the very organisation that produces electricity. They also make conventional reform approaches to electricity meaningless. Governments' resources and ability to add to the stocks of water generation and storage assets is declining sharply. Large cost and time overruns in projects constructed under public management, besides the general situation of fiscal stringency are the problems.

Our approach to the problem calls for a strategic shift in so far as we argue that reform is not possible if the present approach to work around major policy and design infirmities rather than remove them in the first place continues. This is because the distortions have been so deep rooted as to have fed back into the governance and institutional structure of water management in the country. We also argue for solutions that are incentive compatible in the sense that the designs for

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[38] Unless the actual numbers with regard to supplies, costs and demands, and flexibility in demands that different crops entail are available and there is first hand experience, it is difficult to work out what is best a priori. Except in dry areas where cultivation as such is entirely dependent upon the canal – an extreme example of which is the Ganganagar area of the Indira Gandhi Canal – some experimentation to arrive at the rules and the pricing mechanism is called for. As farmers are able to make investments in ground water extraction and even afford to keep them 'idle', the option in this direction is bound to become interesting.

pricing & regulation and financing (within the appropriate policy and rights framework) are internally consistent and would work without depending continually upon political commitment, administrative initiatives and managerial energies.
By incentive compatible we also mean that the policy and design meet the criteria that the actors, civil servants, proposed water companies and cooperatives, electricity companies, farmers have the correct incentives to do what is right for efficient production, management, allocation and consumption of the resource without administrative direction or urging or demanding the presence of persons with exceptional morals, or leadership qualities. Similarly, policy change should be politically viable so that in the pursuit of reform politicians do not lose the support of their constituency, but are actually able to enhance their support base, i.e., expand their 'political capital'. Reform should also be fiscally sustainable. This is ensured when the other aspects are right. Typically the distortions that have been in place for long have created much waste and leakages from the system. The recovery of these as well as the future efficiencies ensure that with appropriate instruments and mechanisms, the exchequer also gains out of the reform.

Key elements of our recommendations are:

- The right to water of a state to the rivers and other water bodies should include the right to trade i.e. to sell the water. This would be consistent with the fact that the bulk of he water is for commercial use today. A formal perhaps constitutional basis of sharing the waters of interstate rivers rather than national level optimal use being perused weakly through agreements as is today, is important.

- The irrigation sector at all levels is open to the private sector through frameworks for various kinds of private finance initiatives including the DBF /DBFO type initiatives. Rather than cost plus, it would be far more useful to institute regulation which is incentive in approach and price cap in form, though uniform caps across large regions would not be possible nor desirable

- All subsidies whether for electricity or water have to be direct subsidies delivered to the farmer. An identification exercise done once that allows the endowments of a farmer to be fixed, so that he can be issued electricity coupons and water coupons periodically, is necessary. This ensures the political commitment of the farmer since now he has nothing to lose but a lot to gain. Without such commitment, and certainly with their hostility no reform is possible

- With all subsidies going direct, there need not be restraints on commercial behaviour and orientation for all participants in the market. The productive organisations – bulk water companies, retail companies and distributors including WUAs, and farmers can all relate to the regulated bulk, and retail market prices.

- Current subsidies in irrigation are converted to endowments in units of water and provided to the farmer in the form of coupons with which (as also with cash) he can buy water and even sell the same subject to certain constraints. Thereby prices are allowed to perform their function of ensuring allocative and use efficiency. Since water supplies may be limited (because of natural factors, and because of limited existing capacity to produce /store) bulk water rates are regulated, with only small opportunity for water companies (bulk and distribution) to gain out of the (high) retail water market prices. Regulated prices could be LRMC, in which case the difference between the commercial viability prices and the LRMC prices is made up for the private /commercial bulk water producer through annuities in an appropriate PFI deal.

- The benefit of the difference between the regulated retail prices at which water is supplied to the farmer and the retail water market prices in the command area/ayacut has largely to be to the account of the farmer. Since the farmer would thereby be able to internalise this benefit with reference to the price, there are strong incentives for judicious use, and optimal trade, and depending upon the situation for even investments in water saving technologies. A little of the same benefits ought to be designed to be internalised by the water distribution entity so that it has the incentive to save water in distribution, recover losses, and make investments for repairs, rehabilitation and augmentation

- Tradability across an entire command is a desirable objective, which can come as experience is gained of the system. Cross command tradability should also slowly emerge subject to certain safeguards against the monopolisation of access rights to water.

- Water distribution companies are ideally WUAs but cast as cooperatives with some allowed asymmetry in shareholding. But they ought not be limited to WUAs or even to farmers' companies. Bidding for distribution business should be open to entirely private companies too.

- For entirely new projects requiring construction of new distribution assets, the access rights can be sold at prefixed prices/market prices *but strictly limited to farmers with operational/own holdings of land in the command area/ayacut*, to raise the capital to construct the distribution system. This can be done separately for each of the distribution areas, since the bid prices are likely to vary depending upon such factors as the alternative supplies available including from ground water. Such purchase of the rights to water would lead to much flow of finance into the sector, an in a way that is functional and entirely incentive compatible. Banks could support the participation of farmers in the equity of distribution companies.

- Tanks systems would also require a certain recasting with formally defined rights and prices for use of ground water and surface irrigation. The need here is to minimise the free-rider problem that is inherently a barrier in the management and judicious use of tank irrigation (a common resource in many ways). Herein the key to reform is to lead the system to an explicit relative valuation of the direct and indirect output of the tank (canal water and ground water) through bids restricted to farmers from within the ayacut. A prior fixation of the shares of each farmer in the 'tank' business that includes already existing use of wells is the key. Tradability among members of such 'rights water' would ensure its judicious use, and the expansion /savings in supplies would follow from the large profits that farmer would make in avoiding leakages and siltation.

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Table 1: A Comparison of Budgetary Subsidies in India: Selected Years (Centre and States)*

Year	Estimated subsidies	Fiscal deficit	GDPmp	Revenue Receipts	Subsidies as a % of		
					GDPmp	Fiscal Deficit	Revenue Deficit
1987-88(M-R)	42324	32182	354343	66838	11.90	131.51	63.32
1992-93(Tiwari)	95373	50726	748367	135422	12.74	188.02	70.43
1994-95(NIPFP)	136844	70062	1012770	178012	13.51	195.32	76.87
1998-99	235752	155760	1740935	274769	13.54*	151.36	85.80

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*Table 5.2 of Srivastava et al (2003), p. 50

Table 2: Relative Share of Major Sectors in All India Subsidies (in Descending Order)*

Sector /head	Amount (Rs.crore)	Share (%)
Agriculture, Rural Development & Allied Activities	44568	18.90
Irrigation & Flood Control	23802	10.10
Energy	22927	9.73
Industry & Minerals	22101	9.37
Other Subsidies	19820	8.41
Elementary Education	18606	7.89
Transport	17490	7.42
Secondary Education	15214	6.45
Medical & Public Health	13740	5.83
Other Education including Technical Education	10286	4.36
General Economic Services	8937	3.79
Water Supply & Sanitation	7734	3.28
Social Welfare and Nutrition	6391	2.71
Housing	4136	1.75
Total	235752	100.00

Source: Table 5.5. of Srivastava et al (2003), p.52

Table 3: Sectoral Shares of All State Subsidies: Arranged inDescending Order*

Sector /head	Amount (Rs.crore)	Share (%)
Agriculture, Rural Development & Allied Activities	25380	16.28
Irrigation & Flood Control	23525	15.09
Other Subsidies	18661	11.97
Elementary Education	16291	10.45
Energy	15115	9.69
Secondary Education	14147	9.07
Medical & Public Health	12259	7.86
Transport	9191	5.89
Other Education incl. Technical Education	7319	4.69
Water Supply & Sanitation	7082	4.54
Industry & Minerals	4999	3.21
Housing	1954	1.25
Total	155923	100.00

Source: Table 4.3. of Srivastava et al (2003), p.52

Table 4: Financial Performance of SEBs

No.		1996-97 (Actual)	1997-98 (Actual)	1998-99 (Actual)	1999-2000 (Actual)	2000-01 (RE)	2001-02 (AP)	"Growth Rate" 2001-02 over 1996-97 (% p.a CAGR)
1	Cost of Supply (paise per Kwh)	215.6	239.73	263.05	305.12	327.16	349.85	10.2
2	AverageTariff (paise per Kwh)	165.3	180.3	186.77	206.98	226.26	239.92	7.7
3	% of Recovery	76.7	75.21	71	67.84	69.16	68.58	-2.2
4	Average Agriculture Tariff (paise per Kwh)	21.2	20.22	21.01	22.61	35.38	41.54	14.4
5	Commercial Losses (with subsidy, Rs. Crore)	-4674	-7598	-10509	-15088	-17794	-24837	39.7
6	Commercial Losses (without subsidy, Rs.crore)	-11305	-13963	-20860	-26353	-25259	-33177	24.0
7	Net Internal Resources (Rs.crore)	-2091	-6209	-8954	-13316	-15620	-19104	55.7
8	Subsidy for Domestic Consumers (Rs. Crore)	4386	5258	6332	8121	10036	12239	22.8
9	Subsidy for Agriculture Consumers (Rs.crore)	15585	19021	22473	24650	26950	30462	14.3
10	Subsidy to Agriculure and Domestic consumers (Rs.Crore)	20211	24750	29262	33145	37331	43060	16.3
11	Subvention Received (Rs.crore)	6631	6365	10352	11265	7465	8340	4.7
12	Uncovered Subsidy (Rs. Crore)	5805	9374	10600	16616	24119	28977	37.9
13	Gross Subsidy Per Unit of Sales (paise per Kwh)	75.4	87.25	98.81	110.98	118.57	126.62	10.9

p.xv of Planning Commission (2002)

Table 5: Subsidy Estimates of State Governments Under the Head "Water Supply and Sanitation" (1998-99) (Rs.crore)

	Costs			Receipts	Subsidy	Recovery rate (%)
	Current	Capital	Total			
Andhra Pradesh	677	41	718	4	715	0.49
Arunachal Pradesh	38	13	51	0	51	0.52
Assam	123	3	126	0	126	0.37
Bihar	166	162	328	2	326	0.64
Goa	56	34	91	41	49	45.44
Gujarat	193	226	419	1	418	0.14
Haryana	183	84	266	21	245	7.88
Himachal Pradesh	170	113	283	4	278	1.55
Jammu and Kashmir	139	201	340	3	337	0.91
Karnataka	283	61	344	37	307	10.67
Kerala	150	81	231	8	223	3.55
Madhya Pradesh	480	26	506	9	497	1.74
Maharashtra	713	171	885	95	789	10.79
Manipur	8	40	48	0	47	0.91
Meghalaya	29	42	72	0	71	0.20
Mizoram	35	17	52	2	50	3.20
Nagaland	27	28	55	0	55	0.32
Orissa	219	41	260	12	248	4.71
Punjab	123	4	126	10	117	7.66
Rajasthan	555	561	1116	124	992	11.10
Sikkim	10	22	31	0	31	0.48
Tamilnadu	263	160	423	59	364	14.05
Tripura	6	41	47	1	46	1.34
Uttar Pradesh	396	23	419	1	418	0.13
West Bengal	279	3	282	1	281	0.41

Source: Tables Series S of Srivastava et al (2003)

Table 6: Subsidy Estimates of State Governments Under the Head "Irrigation and Flood Control" (1998-99) (Rs.crore)

	Costs			Receipts	Subsidy	Recovery rate (%)
	Current	Capital	Total			
Andhra Pradesh	1229	1322	2552	8	2544	0.30
Arunachal Pradesh	17	6	24	0	24	0.02
Assam	91	288	379	0	379	0.05
Bihar	357	895	1253	43	1210	3.40
Goa	14	57	71	0	71	0.55
Gujarat	1521	1457	2978	135	2843	4.53
Haryana	299	413	712	61	650	8.59
Himachal Pradesh	47	46	93	0	93	0.19
Jammu and Kashmir	112	83	195	1	194	0.40
Karnataka	576	1348	1924	21	1903	1.11
Kerala	147	321	468	7	461	1.54
Madhya	324	1111	1435	43	1392	2.97
Maharashtra	1777	2407	4184	53	4131	1.28
Manipur	21	64	85	0	85	0.22
Meghalaya	8	9	17	0	17	0.34
Mizoram	2	1	3	0	3	0.18
Nagaland	6	0	6	0	6	0.01
Orissa	170	719	889	14	875	1.54
Punjab	290	665	955	16	939	1.72
Rajasthan	680	930	1609	42	1567	2.61
Sikkim	6	0	6	0	6	0.00
Tamilnadu	395	224	619	14	606	2.22
Tripura	18	28	46	0	46	0.09
Uttar Pradesh	1428	1349	2777	85	2693	3.04
West Bengal	410	388	798	9	789	1.18

Source: Tables Series S of Srivastava et al (2003)

Box 1: **Over-exploitation of ground water can be overcome by correctly pricing electricity and diesel (from Box of Chapter IX(v), Morris, S. (2001)**

A powerful (political and economic) argument from the farmers for continuing with the electricity subsidies emanates from their desire for parity with farmers supplied with irrigation water from surface water schemes -typically dams and barrages. Surface water is supplied at low prices that often cover only a small fraction of the O&M costs. The prices typically are far below the marginal product of water, and certainly below the prices prevailing in nearby water markets. They are also well below the costs of water that can be delivered through efficient construction and management of resources, i.e. the costs for an efficient supplier (without the typical delays and cost overruns of public sector projects, and with efficient operations). The issue of overexploitation of ground water, resulting out of the governments' policy of subsidisation of electricity and diesel, have been matters of much discussion and debate. We can extend Dhawan's categorisation (Dhawan, B.D., 1991) into land scarce and water scarce systems, appropriately to understand the phenomenon of over-exploitation. In Saurashtra, Rajasthan large parts of the Deccan and Malwa Plateau, North Gujarat, which are water constrained, it is almost certain that overexploitation has taken place. In other areas like the Gangetic Basin and the East Coast especially the deltaic areas, and the Punjab with either much larger rainfall or synergistic benefits of large and well developed surface irrigation schemes, the evidence of overuse is not very strong, despite evidence of ground water tables having receded.

These are areas where relative to easily exploitable water (surface irrigation or ground water close to the surface) it is land that constrains output; hence additional water exploitation would have lower returns as compared to water exploitation in the water constrained regions. For the land constrained regions the current constraints to land enhancement and use would have to be overcome, before available water is fully utilised. These are principally adverse-tenurial relations like share cropping and interlocking credit and landmarkets (except in the Punjab), but also such things as drainage, land shaping and bunding, protection from floods, and consolidation of land. Unfortunately their resolution requires state (or collective) action as in bringing about security of tenure or land reforms, or collective or state action as the development of drainage and flood control measures. Given state failure and the 'tragedy of the commons' only the slow path of expensive individual and capitalistic 'solution' is to be expected. Quite in contrast, the exploitation of ground water is an individual activity always with lower private costs than social costs. Therefore, once started it can lead to an accelerated process of ground water exploitation to a point far beyond that socially optimal. In other words relative to the water 'abundant' regions the marginal product of additional water is much greater. In such areas therefore overexploitation results in the 'common resource

management problem'. One aspect of this is the sub-optimal way the exploitation of the resource takes place. The combined capital assets put into use, and the costs incurred privately in drawing forth a unit quantity of water is far larger than what actually needs to be incurred with cooperation among the exploiters (Shah, Tushaar., 1992). The overcapitalisation and extra costs that have been imposed thereby still remain to be estimated. In areas like the 'tank' regions of Tamil Nadu and Guntur on the escarpment of the Deccan, the returns to revival of the older tanks and ayacuts are large (Shankari, Uma, 1990), but the costs are private or the state's and the benefits public, so in a capitalist world with state failure, unless special organisational (cooperative) initiative is possible, the second best viz. ground water irrigation (despite its higher social cost) results. Here the tanks' unintended consequences of synergistic benefits to ground water helps.

Thus to prevent, reduce, or optimally use ground water in the water constrained regions, many measures have been put forward. These range from micro-initiatives like encouraging people to form water cooperatives, bringing them together to construct and maintain such things as 'check' dams to improve seepage, regulations by the state as in the current proposals put forward by the Karnataka and Maharashtra governments, removal of subsidies for ground water exploitation but more particularly the socially obnoxious HP based metering. Others have suggested that formal sources of credit as from NABARD ought to be to denied to farmers in areas with overexploitation of ground water. Still others have argued for complimentary subsidies that create incentives for water saving such as subsidies for installation of drip systems.

The attack on electricity and diesel subsidies, in a way that limits and redirects the same better, we would argue, would be most potent. The collective initiatives come up against the test of reproducibility, being dependent upon leadership, or the assignment of property rights in new ways. State based solutions such as regulation would also not work because of the massive state failure at the lower executive levels, and possibly very high policing costs with low punitive measures that are possible. Neither have credit restrictions worked, since the additional cost of going to private markets including the moneylender is well worth the effort. A regionally differential subsidization while seemingly possible could very well be counter productive since not all the lands even in a large area like say North Gujarat are water constrained. Small islands with good aquifers could actually be 'water rich'.

Electricity and diesel subsidies directly affect in a very large measure the ability of the farmer to lift water. Thus suggestions to replace the electricity and diesel subsidies with an adjustment of the terms of trade through higher purchasing power, while having other problems would work to attenuate (but possibly not remove) the overexploitation of ground water in water constrained systems.

Consider the schedule of private marginal cost *CC'C''P* as a function of the amount of water drawn to the surface. The private cost beyond a certain point increases more than linearly, since as more water is drawn out one has to typically go deeper. The social cost schedule *CC'C''S* is at or above *CC'C''P* since water has a common property aspect. Typically at low levels of extraction, when a farmer's drawal does not reduce the drawal of another farmer the two are nearly coincident. In water constrained systems even a drawal at say Q_n would create a significant divergence between the social and private costs. (In systems with abundant water that point of divergence would be at drawal much higher than at Q_n, and may not exist if the marginal product of water declines in water abundant systems. This is not shown in figure 9.2). This is because an addition of a tube well to an existing 100 tubewells producing at 100 units of water for a certain cost would now be able to produce say 90 units, and the additional unit would see the effect of his own entry differently giving him 90 units for his effort. The subsidies particularly the HP linked small flat charge allows the farmer to increase the production of water at marginal zero energy costs. Since energy has zero price for him, his subsidised marginal cost schedule is much below *CC'C''P* and may be usefully visualised to go up as C*C'C''U*. With a marginal product of water equal to *M* and assumed to be constant for simplicity, the production takes place at Q_s when there are subsidies, and at Q_n without subsidies. Both involve deadweight losses to society given by areas *DUP* and D*D'D''* respectively. But the latter would be far smaller than the former, since water constrained regions with overdrawal would be operating in the zone where the private and social costs diverge much. A removal of all subsidies would take the system from Q_s to Q_n. (To take the system to the first best socially optimal Q_o a tax on water extraction appropriately structured would be necessary. We do not discuss this aspect). While this will not guarantee that the system would be below the level of sustainable exploitation, it is likely to be close enough in all except the most water constrained areas. In some like Rajasthan and coastal Gujarat with much lower rainfall or threat of salinity ingress, additional measures (common property management measures or assignable water rights) to take the system to Q_o may be called for. Many scholars have vehemently put forward assignment of water rights as a way out. (Saleth, M., 1994, Moench, M. 1992). Even in such areas where definition and protection of water rights would be necessary, the first measure would have to be to take the system to Q_n from Q_s since otherwise even the specific micro approaches would have to work against adverse individual incentives. If now measures to use the water more efficiently are encouraged via 'proving' subsidies and demonstrations of systems like sprinkler or drip irrigation systems they could spread very widely, since they would have the effect of raising the marginal product of water. With the distortions created by pumping subsidisation in place such measures would hardly be effective.

The measure would most certainly reduce the output of the water in constrained areas, unless Q_s is already at a point where the aquifer is being destroyed, which is rarely the case. (It is not rare though in coastal Saurashtra and Rajasthan (Shah,

Tushaar; 1992)). But output nationally need not fall at all! The dead weight losses that are avoided could finance land augmentation in land constrained areas and water augmentation activities like investments in water conservation including use of plastic lining, drip and sprinklers systems wherever appropriate in water constrained areas. In other words, the marginal returns to both land enhancement and to water extraction would get 'equalised'. If anything, it would be more appropriate for policy to create a bias in favour of land enhancement since the market failures here at the early stage itself preventing their exploitation. (The market failure for ground water is after a great deal of extraction and is in the nature of overexploitation. The most optimal way to enhance land would be to carry out land reforms which would restore the incentive for the tiller to make the long gestation period investments in land shaping bunding etc. These in any case would only use largely 'idle' labour). Indeed, the point is that since there is a national market in agriculture, the adjustments resulting in reallocation of land use from the current distortions would happen. Agriculture output would then rise in the better endowed regions, and the water scarce regions would shift out of water intensive crops.

Removing such distortionary subsidies, would have to be accompanied with pricing of surface water to cover costs, for the distortions between farmers to go. Yet overnight withdrawl of subsidies would not be feasible. What would be most appropriate would be to value the actual subsidy that farmers enjoy, and direct them through coupons or stamps. Such stamps should be made tradable across a variety of inputs purchases: fertilizer, pesticides, water, electricity, drip systems, pumpset purchases etc.

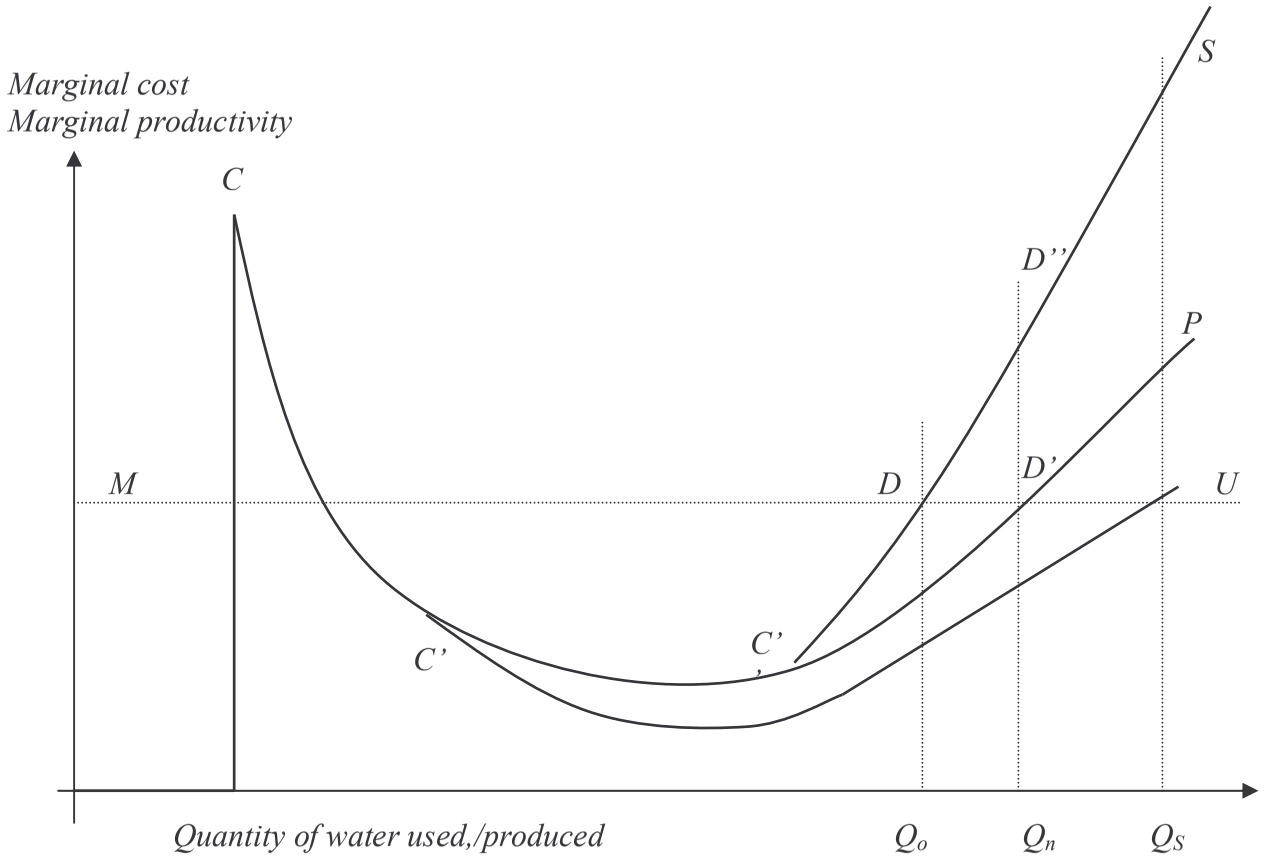

Figure: Dismantling the HP based tariffs can result in major benefits