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DEMATEDEE

Market Development of Water & Waste Technologies through Environmental Economics

Développement des marchés des technologies de l'eau et des déchets par l'économie de l'environnement

Final Synthetic Report

Rapport synthétique final

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Présentation générale

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1- Travail réalisé:

a)- Le réseau d'économistes indiens et français DEMATEDEE (*Développement des marchés des technologies de l'eau et des déchets par l'économie de l'environnement*) a été créé pour engager un dialogue sur les moyens de répondre aux besoins croissants d'infrastructures vitales (eau, assainissement, déchets) en Inde. L'expansion de la population s'y poursuit du fait d'une transition démographique plus lente que dans d'autres régions. Il faut rappeler que l'Inde compte quelque 4000 villes de plus de 5000 habitants, dont 35 villes de plus d'un million d'habitants et 500 villes de plus de cent mille habitants, même si la population urbaine ne représente en moyenne que 30% du pays. Le pays est donc représentatif de la diversité des situations géographiques et de l'ensemble des problèmes de l'eau dans les pays du sud.

b) Au vu du faible niveau des réalisations en infrastructures vitales par rapport à des besoins en croissance rapide, des personnalités indiennes (D.B. Gupta, Président de la section indienne du « Global Water Partnership », et P.S. Rana, depuis, Président de HUDCO, banque Publique de financement des infrastructures urbaines) et un consultant privé MEED SA[1], bientôt appuyés par le CERNA (Ecole Nationale Supérieure des Mines de Paris) ont lancé ce réseau en 2001 sur une base volontaire. Les premiers contacts ont montré que l'utilisation des nouveaux outils coûts/bénéfices rejoignait les préoccupations les plus avancées de la recherche indienne en économie, laquelle avait encore peu d'échanges croisés avec ce secteur en France. Le réseau s'est rapidement étendu à des chercheurs des laboratoires d'économie environnementale des principales métropoles indiennes. DEMATEDEE a bénéficié fin 2002 d'une labellisation de RITEAU assortie d'une subvention du Ministère de la Recherche.

c)- Depuis lors, le réseau a réuni de manière régulière des chercheurs, praticiens et techniciens Indiens et européens (voir liste des contributions) sur la question des services d'eau et d'assainissement durables et accessibles dans les villes de l'Inde. Au centre des travaux, figure le rôle de l'analyse systémique et économique dans l'orientation des stratégies des divers acteurs du monde de l'eau. Deux séminaires se sont tenus, avec l'appui du Centre de Sciences Humaines de New Delhi. L'un à New Delhi en octobre 2003, hébergé par un « think tank » indien, *Observer Research Foundation*, et le suivant à Paris, fin mai 2004 à l'Ecole des Mines, et en présence de décideurs publics et privés. Les programmes figurent en annexe.

d)- Au cours des échanges réguliers et de travaux spécifiquement commandés à des chercheurs indiens[2], les contributions au réseau ont mis le projecteur sur les points suivants:
1. Valorisation et gestion des ressources locales (souterraine, d'orages et de pluie, eaux usées).

[1] Cette PME est, par ailleurs, animateur du « *Club de l'eau pour la relance des investissements par la réduction des coûts et la coopération industrielle* »
[2] Contributions de Joyashree Roy et Pushpam Kumar.

2. Coordination entre acteurs dans la gestion quantitative de la ressource au niveau régional mais aussi de la qualité ;
3. Développement de la gestion de la demande et d'outils en ce sens pour les municipalités ;
4. Définition de stratégies adaptées et modulaires pour l'assainissement ;
5. Autonomisation institutionnelle et décentralisation (et pas seulement déconcentration) des agences publiques.

2- Résultats comparés aux objectifs annoncés.

A- Rappel des objectifs :

Constant le manque d'outils d'évaluation et le besoin d'une logique d'action pour une relance des investissements, les thèmes retenus ont été:

- En ce qui concerne les objectifs, étudier si des solutions innovantes à la portée des revenus moyens des collectivités et des foyers pouvaient suppléer les modèles conventionnels et contribuer à relancer les réalisations;
- Pour le contenu des échanges, réunir les données sur les enjeux locaux significatifs en se servant des outils d'analyse coûts/bénéfices, incluant notamment les coûts indirects pour la santé et l'environnement;
- Enfin, dégager les critères de choix et les méthodes d'approche des systèmes et des techniques à promouvoir pour répondre aux enjeux représentatifs ayant fait l'objet d'analyses concordantes.

Sur ces thèmes, les questions posées par le Ministère de la Recherche, lors de l'octroi de son soutien, ont été les suivantes :

1. Quelles sont les innovations par rapport aux stratégies des entreprises, notamment celles présentes au sein du Club de l'eau ?
2. Les solutions économiquement satisfaisantes seront-elles faisables pratiquement?
3. Quelles technologies bénéficieront d'une promotion en termes opérationnels ?

B- Enseignements généraux de la recherche.

a)- Au-delà d'une diffusion de l'information sur l'Inde auprès des économistes, praticiens, acteurs économiques français et européens, ainsi que d'une meilleure connaissance des agences de bassin et SDAGE pour les membres indiens du réseau, les débats se sont concentré sur les limites du seul modèle centralisé accompagné de formules juridiques diverses (gestion déléguée en particulier). Compte tenu des caractéristiques spécifiques de l'Inde en termes de processus de prise de décision publique, d'organisation du secteur public (planification centralisée, gestion non commerciale des infrastructure, mais aussi contrôle de droit et non de fait de la ressource), des réformes organisationnelles, technologiques et des systèmes physiques innovants sont à mettre en place[3]. Dans le contexte organisationnel actuel, les solutions intensives en main d'œuvre ainsi que les ruptures technologiques ciblées et une révision systématique de la protection de la ressource et du traitement de la demande sont parties prenantes de la solution. Le réseau a permis de valider comme étant centrale la question de la gestion intégrée entre ressources et services.

b)- La généralisation des systèmes centralisés n'est pas envisageable dans un contexte où la majorité des villes moyennes de l'Inde n'offre pas des économies d'échelle suffisantes, ni ne permet de mettre en place des mesures managériales nouvelles d'une portée satisfaisante. Ainsi, dans les conditions observées dans des pays dont l'Inde est représentative, une relance des infrastructures d'eau et assainissement ne peut être assurée avec les seules méthodes qui

[3] Giraud et al.

prévalent dans les schémas traditionnels: délégation des fonctions centralisées à de raccordement au réseau de distribution, de gestion de ces réseaux et d'évacuation de la pollution vers l'extérieur.
Au 19ème siècle, avant le progrès des connaissances sur la contamination par contact avec les germes, seule comptait alors la dispersion de la pollution alors qu'elle contribue à diffuser les impacts. Aujourd'hui, une rénovation des infrastructures existantes et leur extension dans les périphéries des villes en croissance nécessitent d'appréhender pleinement la portée des changements intervenus avec, d'une part, la densification urbaine et l'intensification agricole et, de l'autre, le progrès des recherches sur les phénomènes biochimiques de contamination. *Désormais, la menace principale vient de la large diffusion des germes biologiques et des molécules chimiques toxiques entraînant, une raréfaction de l'eau de qualité à l'échelle des bassins versants entiers*. Cette observation suggère de traiter les rejets dangereux sur place, en unités plus petites et décentralisées, pour protéger les ressources locales. Un nouveau paradigme émerge qui, par la juxtaposition de systèmes autonomes et d'une optimisation d'ensemble, fait passer les principes d'ingénierie de la recherche des effets de taille à celle des effets multiplicateurs par une application à grande échelle de solutions décentralisées[4].

c) Tant que les municipalités devront poser les tuyaux pour raccorder en priorité et sans avoir les financements nécessaires pouvoir s'occuper de l'assainissement, la dégradation écologique l'emportera dont le coût santé et environnement est de plus en plus élevé. On observe deux types de situations :

- les extensions urbaines englobent progressivement les villages ruraux avoisinants que les réseaux n'atteignent pas encore. Le danger est de polluer ce qui existe (puits, forages) en amenant des tuyaux d'eau dite « protégée » sans trop se préoccuper des quantités d'eaux usées non traitées qui seront émises. La mise en place de « boucles courtes » de recyclage est une des solutions envisageables si la géologie s'y prête;

- dans le cœur des villes, la construction se densifie sur des services inadaptés qui se dégradent. Les habitants d'un quartier ou d'un ensemble d'immeubles disposant d'un revenu moyen sont souvent prêts à payer pour une eau vraiment potable, mais moins chère que l'eau en bouteille : une rénovation des infrastructures en réseau peut être efficace avec un système dual dans des sous unités plus ou moins autonomes qui auront la capacité de délivrer des services complémentaires plus flexibles en fonction des revenus. Les solutions de distribution bon marché existent (eau empaquetée, livraison par porteurs) et les besoins des plus pauvres peuvent être plus pratiquement organisés. Quant à l'assainissement, il suppose que les eaux usées traitées soient valorisées le plus près possible des lieux de collecte : sinon, il est difficile de le facturer aux usagers.

C- Les innovations par rapport aux stratégies d'entreprises.

A partir d'une dizaine de cas, il a été mis en évidence que les entreprises souhaitant se positionner avec des offres viables sur les marchés émergents, comme ceux de l'Inde, devront prendre en compte dans leurs stratégies
- les phénomènes environnementaux majeurs, typiques des régions en croissance[5], à savoir la surexploitation des ressources locales et ses remèdes, la préservation des écosystèmes concurrencés par d'autres usages ;
- les résultats des recherches universitaires et des laboratoires sur l'éventail des technologies disponibles.

[4] Pour les déchets, question abordée indirectement par le biais de la protection des sols et de la recharge, les principes peuvent être différents en raison de la rareté des sites de décharge.
[5] Giraud et al. Dematedee: lessons for policy maker §1 Valuation and management of local resources. 08-2004

Pour ce faire, la comparaison des travaux indiens et français a montré que des méthodes économiques similaires (études coûts/bénéfices), rendues d'ailleurs obligatoires dans la directive Européenne sur l'eau du 2 octobre 2000, pouvaient servir à orienter les choix des collectivités et des entreprises entre les différents systèmes de gestion.

a)- Enjeux environnementaux :
La réflexion a montré l'importance stratégique des zones périurbaines où se focalisent les conflits d'usages et les impacts de la croissance urbaine. Dans ces zones de transition où l'on étend les réseaux de distribution mais pas ceux des eaux usées, la pollution croissante atteint une intensité dangereuse qui sature la capacité naturelle de régénération des sols et de l'eau. Par ailleurs, un détournement des usages des sols et de l'eau au profit des besoins de la ville et au détriment des usages agricoles peut être constaté. Cette captation comporte des conséquences irréversibles. Les données réunies sont représentatives de problèmes essentiels des zones de transition urbain/rural à l'échelle de l'Inde et des villes du Sud en général.[6]

- Les ressources locales et les structures de gestion (recharge) traditionnelles des bassins versants apparaissent comme particulièrement vulnérables aux impacts de la croissance urbaine : leur restauration est une des composantes de l'offre de projets viables. Dans ce cadre, la politique de gestion des déchets solides revêt une importance particulière et ne peut être dissociée des mesures de prévention et de protection de la ressource. Il n'a pas été possible d'en mesurer l'impact spécifique au-delà d'ordres de grandeur approximatifs sur les économies à attendre de systèmes de gestions décentralisés. Ceci devra figurer dans les travaux à venir.

- Le constat d'une surexploitation et de l'épuisement prévisible des aquifères souterrains des formations de socle, constituant une des sources principales d'alimentation des ménages à la périphérie des villes, appelle des mesures urgentes de redressement. Les risques d'une exploitation désordonnée des ressources souterraines par la multiplication de solutions autonomes ont été mis en relief[7].

- La prise en compte de la valeur des écosystèmes (sols meubles, lacs, zones humides, plaines alluviales) les plus menacés dans les zones périurbaines a montré l'intérêt des analyses coûts/bénéfices pour décider des conflits d'usage. Les critères utilisés ne sont pas sentimentaux : mais reposent sur des données fiables, par exemple la valeur de l'eau infiltrée dans une plaine alluviale[8]. S'y ajoute les atteintes à la biodiversité qui n'ont pas fait l'objet à ce stade de mesures spécifiques, mais qui devront être examinées au stade de projets pilotes.

b)- Technologies ciblées :
Les travaux des universités et des laboratoires, notamment les nombreuses recherches menées en Europe sur *les techniques de traitement, montrent une grande flexibilité* dans les outils de traitement, de modélisation et de contrôle pour s'adapter à la diversité des conditions écologiques[9]. Ils incorporent les outils les plus utiles à la restauration des structures de gestion traditionnelles. Leur place dans les stratégies d'entreprises reste néanmoins décalée par

[6] Pushpam Kumar . Ecosystem services of floodplains ; S. Janakarajan: water conflicts in peri-urban catchments.
[7] CERNA, étude de Dwarka dans la banlieue de Delhi.
[8] Voir Pushpam Kumar, Ecosystems services of floodplains.
[9] B.B. Gupta : Conventional and emerging technologies ; A. Dangeard , Guidelines for entreprises - page 11 technology roadmap.

rapport à une dynamique convergente des progrès techniques et des réalisations dans différentes disciplines.

- d'un côté la connaissance des risques biologiques et chimiques de pollution liés à la densification urbaine et intensification agricole, appelle une gestion spécifique de chaque cas, donc une décentralisation des systèmes (application des techniques biochimiques à l'industrie de l'eau ; micro et nano technologies ; techniques membranaires permettant de multiplier les barrières à opposer à différents types de pollution en fonction des usages) ;

- de l'autre, les outils de suivi et de modélisation en temps réel permettent d'optimiser des ensembles autonomes dans un cadre plus large reflétant conditions naturelles. (GIS, modélisation, contrôle « on line » et réseaux sans lignes). Décentralisation et centralisation sont alors les deux faces d'un même objectif d'optimisation des cycles naturels et des interventions humaines.

D- Existe-t-il des perspectives économiques et peuvent-elles être mises en oeuvre?

a) Y a-t-il des solutions économiquement satisfaisantes ?

On dispose désormais de plusieurs séries de données sur les budgets théoriquement et pratiquement disponibles. Ces montants peuvent être rapprochés de l'ordre de grandeur des économies attendues pour que la mise en œuvre de systèmes alternatifs devienne un chantier à investir.

- Les travaux sur les budgets[10] consacrés à l'eau dans différentes régions du monde confirment un écart trop important expliquant le peu de chances de voir s'imposer un seul modèle face à la diversité des situations géographiques, climatiques et socio-économiques. Néanmoins, les moyens des municipalités et la capacité de payer des usagers représentent un large marché potentiel qui est loin d'être efficacement exploré. La recherche a notamment réuni des informations précises sur la capacité/volonté de payer des ménages pour pallier les déficiences du service public en réseau. Ces analyses peuvent contribuer à **renouveler les débats sociologiques trop confus sur les tarifs.**

- On assiste à une explosion des marchés privés de ces équipements ou services d'eau à domicile ou par groupe d'habitations. La question alors ouverte est celle de la viabilité à long terme de telles solutions sans une coordination entre ces marchés privés et les services publics. Un risque de morcellement de la mission du service public[11] ne peut être ignoré. Ces derniers demeurent le dernier recours pour une catégorie de population limitée mais bien réelle dont la capacité à payer ne sera pas suffisante. L'approche par les pauvres n'est pas suffisante : sans développement des entreprises et création d'emplois, la pauvreté ne peut régresser.

- Il est désormais possible de mettre en rapport les budgets théoriquement disponibles des ordres de grandeur des économies techniquement envisageables. Les différentes parties de systèmes destinés à améliorer les infrastructures existantes ou à en créer de nouvelles dans les zones en expansion doivent être réévaluées. Une à une. *Chaque composante n'est pas nécessairement révolutionnaire, mais, la somme de ces changements constitue un saut majeur dans la capacité d'organiser des services flexibles et à la portée des usagers :* modalités de la distribution finale pour différentes exigences de qualité, coût énergétique du réseau en fonction du diamètre des tuyaux et de leur disposition (topographie

[10] A. Dangeard , Economics of affordable water systems. J. Roy , Willingness to pay studies; a policy tool.

[11] A noter parallèlement, l'importance économique des marchés privés de l'eau souterraine pour l'irrigation dans les régions d'agriculture intensive où le niveau de la nappe baisse (les fermiers qui possèdent les pompes les plus puissantes revendent l'eau aux fermiers dépendant de puits ou de pompes à faible puissance).

gravitaire) , alternatives pour l'assainissement, priorité aux ressources locales (recharge, boucles courtes) sur les ressources importées, valorisation des eaux usées par traitement et réutilisation pour des usages différenciés. S'y ajoute l'économie sur les coûts indirects, santé et la sauvegarde des approvisionnements locaux par la protection de l'environnement local[12]. Dans ce cadre, politique des sols urbains et des déchets solides représentent des enjeux essentiels car elle conditionne la gestion des eaux d'orage, la validité de la recharge et du stockage dans les formations urbaines.

b)- Quels obstacles doivent être surmontés ?

Les freins sont en effet nombreux. Les autorités publiques et les municipalités sont par nature conservatrices. Les régies locales sont soumises à des contraintes de ressources difficiles à contourner. En progrès sur les sites industriels pour l'optimisation des cycles de l'eau, les outils disponibles restent à découvrir pour beaucoup de municipalités. L'idée que les technologies avancées ne sont pas faites pour les pays en développement est néfaste mais répandue: une technique avancée peut être facilement accessible. Deux considérations vont jouer :

- la perspective de créations d'emplois que de tels modèles suggèrent ;
- la considération des bénéfices et des risques de l'innovation pour la santé (programme sécurité/santé).

Le réseau a travaillé sur une méthode d'approche qui prenne en compte ces examens dès le départ : audit des systèmes, présence de la recherche technique dans la durée, accompagnement des réalisations par un consultant répondant de la bonne exécution du projet, sorte d'architecte/ensemblier. Une multiplication des diagnostics précoces et des audits permettra d'estimer le champ des municipalités intéressées par les approches alternatives. La perspective ainsi dégagée conditionne une révision des stratégies de financement des entreprises. L'attitude des banques ou des fonds privés est conditionnée par la probabilité des retours. Le secteur de l'eau n'est pas à priori très attrayant si les opérations sont envisagées une par une : mais, vu sous l'angle du nombre d'opérations de partenariat à réaliser pour suivre la croissance des besoins, la vision peut être différente. Reste aux pouvoirs publics à compenser cette faible attractivité en apportant les garanties institutionnelles qui dépendent de leur mission.

E- Pour que se crée une nouvelle dynamique de progrès technique, quelles collaborations publique & privée sont requises en termes opérationnels ?

Le marché des éco technologies est totalement déséquilibré entre pays industrialisés et pays en développement par rapport à la dimension relative des enjeux respectifs. Les réponses sont les plus ténues là où les ressources sont les plus menacées. Une idée reçue mais utopique est que la croissance économique rendra les systèmes traditionnels accessibles. On n'en voit pas les prémisses. Une nouvelle dynamique dépend de la prise en compte des aspects institutionnels publics car les entreprises ne peuvent agir seules. La volonté de contribuer au redressement doit apparaître en multipliant les signaux et les incitations destinés aux collectivités et aux entreprises. Les Etats doivent s'engager sans retenir tous les rôles. Des outils politiques pour la gestion environnementale existent sur lesquels le réseau a tenté de recenser les questions prioritaires. La viabilité à long terme de solutions autonomes suppose une coordination entre les marchés privés qui explosent et les services publics. Mais, la création d'emplois et de partenariats d'entreprises sont les enjeux essentiels qui dépendent de l'appropriation des avancées technologiques par les intéressés eux-mêmes.

[12] A. Maria , The costs of water pollution in India.

a)- Pour rendre la décentralisation crédible, *une concertation locale et régionale* (municipalités, organismes de développement métropolitains le cas échéant, administrations des états, acteurs privés, ONG, associations de résidents et/ou d'usagers, représentants des zones agricoles périurbaines) doit être mise en œuvre sur les questions d'allocation des ressources, sur l'acceptabilité des solutions techniques et des coûts correspondants[13]. Est en jeu, l'efficacité des méthodes de gestion des unités naturelles de base en vue de rendre l'ensemble durablement et socialement acceptable. Il s'agit d'aider à identifier les priorités politiques et de faire accepter les conséquences des choix retenus par les acteurs locaux. Le cas le plus important concerne les retards constatés sur l'assainissement qui ne trouveront de solutions que si les ménages eux-mêmes participent aux choix des solutions à mettre en œuvre[14].

b)- *Lever les contraintes réglementaires et diversifier les normes est un impératif pour une décentralisation opérationnelle*. La flexibilité de l'offre de services en dépend. Les standards uniques n'incitent pas les municipalités à recueillir des données fiables sur les besoins réels des populations[15]. Grâce à une optimisation de gestions parallèles autonomes et en réseau, une sorte de dégroupage coordonné de la boucle locale peut relancer, dans un cadre renouvelé, la participation publique/privée[16]. De telles approches sont de nature à multiplier les occasions de partenariats entre PME technologiques des pays du nord et du sud.

3. Acquis du réseau et prolongements de la recherche.

La valeur ajoutée du réseau, sur ces points, provient de l'intégration de ces différents aspects publics et privés, écologique et technique. Le rôle des entrepreneurs locaux et des partenariats potentiels a été souligné à nouveau. A noter que parallèlement, les travaux qui ont été menés dans d'autres cadres rejoignent certaines des conclusions de Dematedee (Mc Kenzie & Ray[17]). Un consensus général sur l'approche intégrée est partagé par les divers experts, sachant que l'information référencée et validée scientifiquement sur ces points est encore très limitée en Inde (Zerah[18]).

a)- Au-delà d'un nombre limité de projets pilotes en Inde, nous proposons de distinguer conceptuellement mais d'articuler en dynamique les problématiques des centres des villes, et de leurs périphéries. Les travaux précités sur la périphérie de Madras et de Chennai sont exemplaires à cet égard : changements dans l'utilisation des sols, déplacement des sites industriels, surexploitation de l'eau, contamination de l'air, vide institutionnel, déclin agricole…Il s'agit de développer des systèmes d'information et de *benchmarking* basés sur coûts réels pour les centres des villes et de réfléchir à la faible attractivité financière des seuls systèmes de canalisation centralisée pour les zones périurbaines. Il y a, évidemment, interaction entre ces deux types de zones tant au niveau des financements que de la gestion à long terme de la ressource. En dynamique, les zones périurbaines tendent à se développer et à augmenter leur niveau d'équipement en infrastructures et leurs capacités à payer pour un service (le réseau, dans ses travaux et débats a distingué au-delà entre zones périurbaines 'riches' et 'pauvres' et la nécessaire solidarité à ce niveau décentralisé).

[13] Giraud et al : Dematedee : lessons for policy makers §2 Stakeholder coordination in the management of water resources quality and quantity at the regional level.
[14] A. Kumar Global water and sanitation, An assessment § on Khamman District
[15] Giraud et al: Dematedee: lessons for policy makers § Demand side management tools for municipalities.
[16] A. Dangeard , Guidelines…page 13 Reorganising city's infratstructure in autonomous areas.
[17] Household water delivery options in urban and rural India, paper prepared for the 5th Stanford Conference on Indian economic development, June 3-5 2004.
[18] Zérah Marie-Hélène, "The Cancellation of the Pune Water Supply and Sewerage Project", Water and Sanitation Program South Asia, The World Bank, 2001.

b)- Un des produits de Dematedee est l'accent mis sur une question fondamentale du développement durable : la croissance économique produite par la ville est-elle si gourmande des ressources naturelles locales, régionales, voire nationales au point qu'inévitablement elle ne pourrait les reconstituer et se saperait elle-même ? La réflexion se focalise alors sur les conflits d'usage notamment dans les zones périurbaines. Cette recherche suggère alors de mettre en priorité des travaux sur le suivi **de la montée des contradictions liées à l'accès aux ressources naturelles dans les pays où l'expansion urbaine se fait à un rythme** sans précédents en Chine, en Inde, au Moyen-Orient et en Afrique. Seront alors poursuivis:

- des travaux opérationnels dans un cadre européen :
    - un programme Asia-Urbs a déjà été attribué en juillet 2004. Il vise à aider les municipalités indiennes à initier et développer des approches innovantes pour la rénovation ou l'expansion de leurs projets d'infrastructure eau/assainissement, afin de préserver la qualité environnementale de leurs ressources. L'objectif est de rendre opérationnels les acquis de la recherche en supportant l'idée que les nouvelles technologies peuvent être combinées avec des approches plus traditionnelles pour accroître la flexibilité d'adaptation aux situations extrêmement diverses rencontrées.
    - deux projets Europ-Aid sont en cours de préparation avec la participation de membres indiens du réseau ; ils concernent des démonstrations dans les zones d'extension urbaine de systèmes protégeant la durabilité des ressources en zone semi-aride et en aval de régions inondables.

- Multiplication des diagnostics écologiques comme guide pour le montage de projets de démonstration en Inde et dans d'autres régions représentatives afin de **signaler aux décideurs publics et privés l'ampleur du marché potentiel à investir.**

DEMATEDEE – Lessons for the policy makers. Elements for a sustainable water policy for Indian cities.

Main redactors: Giraud, Maria, Nadkarni, Ruet, Zérah

Introduction to the network and relevance in the current scientific debate

The Dematedee network has gathered, during the years 2003 and 2004, Indian and French researchers and professionals in order to discuss the role of economics in orienting the strategies of the different stakeholders toward a sustainable development of water and wastewater services for Indian cities.
The initiative of creating an Indo-French network of economists focused on water and wastewater issues was motivated by the observation of the very low pace of investment in the sector, in India as well as in other developing countries (see the 'Camdessus report'[19], and for India see NCAER report[20]). Beyond the sole low pace of investment, we consider the lack of innovative solutions (technical as well as institutional) as a bottleneck in the water sector reforms. Indeed, although poor governance is usually mentioned as the main reason for this situation, it appears that cities from the developing world have to face unprecedented challenges, and this might call for new solutions both in terms of institutions and technology.
The network brought together economists from Europe and India to share their views on the central question: What are the strategies needed to bring sustainable and affordable services to the developing cities?

The main lesson of the debates and discussions is that, given the organisational functioning and decision-making in public agencies in India, in terms of planning and operation of infrastructure, and in terms of use of the resource, the model of management delegation is neither going to be enough to solve the whole country's issues, nor to even function locally in the present organisational context. It can neither be a panacea because such schemes are based on economies of scale and require large enough cities with a sufficient income. They have at least to be completed with work-intensive measures and modular small-scale measures. It can not work in the present context of both hiatus on the local resource, totally neglected on paper and actually over and mis-used in practice, as well as hiatus in the over-centralised functioning of the public system while the number of private actors proliferate in a totally uncoordinated manner.
Central to this, the exchanges of the network confirmed clearly the relevance of the notion of integrated water management understood at the level of the city as the integration between resources management and service management. The contributions of the network highlight several challenges to this integration, which can be summarized as follows:

1. Valuation and management of local resources (groundwater, storm water, wastewater).
2. Stakeholder coordination in the management of water resources quality and quantity at the regional level.
3. Development of demand-side management tools for municipalities.
4. Well defined and adaptive strategies for sanitation.

[19] "Financing water for all", http://www.gwpforum.org/gwp/library/FinPanRep.MainRep.pdf
[20] India Human Development Report, National Council for Applied Economic Research, NCAER, Delhi, 1999, as well as India infrastructure Report, directed by Rakesh Mohan, NCAER, 1995).

5. Institutional autonomy and restructuring as well organisational decentralisation (rather than mere geographical deconcentration) of public agencies, a sine-qua non condition for enabling the first four points.

The added value of the Dematedee network comes from the aim to integrate these different aspects together, to go beyond the general consensus that has emerged among experts. This consensus is well represented by a paper from Mc Kenzie & Ray, who survey the 'state of the art' in the domain[21], and recognise that the water sector is at a turning point in most developing countries. A few innovative schemes are being attempted but, at least for India, no projects have gone beyond the pilot stage. In addition there is very few peer reviewed available information and analysis (for India, see Zerah[22]). Let us distinguish the centres of the cities, the 'city proper' and the peripheries. Experts recognise the problem of quality failure and the need to develop information and benchmarking on real costs for centres and the financial unattractiveness of a piped system for developing peri-urban areas. There is, besides that, also an emerging debate on proposals raised by members of the network of the need not to neglect more local entrepreneurs for that case, and similarly with the fact that information needs being developed.

If one puts in perspective this analysis to which the network debates subscribe largely, our network aims at going beyond this already acknowledged assessment of the sector. Our approach is to look more crucially at the issue of integrating the various dimensions mentioned above. As such, the network takes a more encompassing approach to the sector:

- We propose to link up quality and quantity, by considering, beyond the (analytically useful) centre/peri-urban classification, the integrated management of resources and watersheds, especially by putting re-use of water in a perspective of segregated uses and qualities.
- We explicitly consider that competition is a second order issue compared to coordination in present developing countries' situation,
- We consider that a *mix of classical and innovative decentralised solutions* is to be explored from a technico-economic point of view,
- And that, linked to technico-economics, capacity-building in terms of coordination mechanisms is needed between, on the one hand public organisations that will remain major actors but are not currently equipped to coordinate with other actors, and on the other hand private and civil society actors who cannot and don't want to take over the whole systems. Looked at in other terms, both contracts and coordination instances have to be set-up, parameters and information systems for their monitoring having to be defined and created. The latter also calls for development of new –decentralised-decision-making processes based on cost information, as well as granted those information and procedures a 'control rights' architecture. This relates to training public actors to develop these systems of information as well as forums or ways to negotiate and interact with other actors.

Namely, integrating these many dimensions call for more than mere technical and economical studies, that is accompanying the municipalities in building coordination capacities as well as new information systems.

[21] Household water delivery options in urban and rural India, paper prepared for the 5th Stanford Conference on Indian economic development, June 3-5 2004.

[22] Zérah Marie-Hélène, "The Cancellation of the Pune Water Supply and Sewerage Project", Water and Sanitation Program South Asia, The World Bank, 2001.

This document will review the five different themes mentioned and present for each of them the relevant contribution from the members of the network, as well as the analysis of the network, some recommendations, and perspectives for further research.

1. Valuation and management of local resources

By local resources, we understand local aquifer systems, urban water bodies, as well as wastewater considered as a potential resource. Development of local resources is subject to a growing interest, be it through rain water harvesting, wastewater reuse for agriculture, or rehabilitation of urban lakes or reservoirs. However, it appears that the institutions in place do not ensure the adequate investment in such projects.

Network inputs.

Rohilla[23] shows with the example of Delhi that water harvesting at the macro scale can bring important quantities of water available locally to the city. Kumar[24] provides an economic valuation of one technical component of this project and highlights the conflicts between policies of local water resources management and the short run logic of urban development. Raju[25] illustrates with the example of a middle size city the critical but ambiguous role of groundwater in the water supply of Indian cities. Ruet[26] points out that for several cities the energy bill –due to both transportation of water from distant sources and 'drought schemes' costs due to absence of planning availability of local sources- is prohibitive. This is the very reason –besides physical and quantitative long run protection of the resource- that calls for optimisation in the use of local resources (this argument is actually much more central than the often argued perspectives of saving on potability treatment costs).

Analysis

The engineering centralising paradigm that has ruled the development of urban water supply systems so far has led on paper to the neglect of local resources for municipal supply. On the other hand, due to the poor performance of piped supply, groundwater abstraction for private uses has developed in an unruly manner and the depletion of urban groundwater resources puts an imminent threat on urban water supplies.

The effective private appropriation of urban groundwater that takes place in most of cities explains the lack of incentive for the municipal bodies to invest in the kind of technical solutions mentioned above that could bring high improvements in terms of recharge.
Moreover, no expertise exists in the protection and management of urban surface water bodies. Traditional management structures that organised the preservation of such water bodies have been erased by urbanisation, and when they still exist, there is no coordination between these structures and the municipal bodies. More often, the existing water bodies have been technically removed by drainage works whose management is often disconnected from

[23] Suresh Rohilla « Water augmentation in Delhi. Techno-feasibility study on urban water harvesting"
[24] Pushpam Kumar « Ecosystem services of Floodplains : An exploration of water recharge potential of the Yamuna Floodplain for Delhi »
[25] K.V. Raju « Groundwater supply to Urban Market : Can it Sustain ? A case study of Kolar City in South India"
[26] Joel Ruet "Water in Urban India. The scenario, energy linkage, and private participation"

the management of water supply. As a consequence, the only priority for municipal utilities is to develop the only tool they control and are used to develop, that is, the network relying on external water resources.

As a consequence, despite recent attempts at regulating the private use of groundwater in a number of cities (namely Chennai and Delhi, see Ruet, Zerah & Saravanan), the current trend is that local resources act as a buffer that allows populations to cope with the current shortfalls of piped municipal supply (Zérah, 2000).

Recommendations

By keeping the local resources at the margin of their process of strategic planning, Water Boards and/or urban local bodies fail to ensure a sustainable relationship between their city and its environment. Given the current state of local water resources in the environment of Indian cities, its inclusion in strategies for sustainable municipal supply would require some technological and institutional innovations.
Technically, there is a need to assess precisely the costs, risks and benefits of urban groundwater recharge as well as urban surface storage. This includes not only the technical cost of recharging a certain quantity of water, but also the quality risk associated with artificial recharge.
A shift in paradigm is necessary, for groundwater and recycled water to serve as the basic resource and consumption from distant canal-imported water becoming the 'marginal' or 'adjustment' variable (this is sometimes already the case de facto, beyond official statistics). This implies a shift of focus in planning and operation. In terms of economic incentives, in some cases (Bangalore has to pump to a higher altitude its water, or Delhi has to built mountain dams) the distant canal-imported water source is more expensive than treatment and re-use of water. Operating the distant sources as 'marginal resources' in a context of stabilised local water and recycling optimisation, would allow in the long run the highest costs savings? Actually the comparative costs of the two resources have to be assessed for all kinds of situations, and establishing thresholds based on typology of cities (density, availability of local resources, altitude, distance to other sources, weather…) should be given priority.

Institutionally, technical interventions oriented towards the development of local resources will only prove economically viable if well defined property regimes allow the benefits and the risks of these interventions to be managed by informed communities or institutions. Namely the public agencies need greater autonomy as we detail later, and the 'colonies' or associations of residents which de facto play a large –today uncoordinated- role in managing the local resource.

Perspectives for further research

Institutional set up for management of local resources in an urban context
The integration of local resources such as urban aquifers, urban lakes, traditional reservoirs, in a municipal strategy of water resources augmentation is a novel approach for which institutional capacity has to be built. With the development of some original projects in several Asian cities, some experience is being developed which is worth studying with a well defined grid of analysis.

As well, environmental studies need reinforce knowledge on estimating the potential positive impacts of such measures and making clearer whether these measures are damageable or not for the environment in the long run.

Cost of imported water
In some clear-cut cases, partial information is available on the "cost" of imported raw water in several Indian cities, but it has to be reconstituted from public information systems that hardly compute all kinds of cost, but rather follow a public accountancy type of logic. The information available within public organisations can not directly be used as a tool for policy making. There is therefore a need to evolve and implement a well defined methodology to assess the cost of access to raw water from varying sources. This cost should include, not only the initial investment associated to the projects, but also some operation and maintenance cost, as well as a valuation of the social and environmental impact of the projects.

Cost benefit analysis of urban groundwater development
Methods for economic cost-benefit analysis of aquifer rehabilitation have been evolved in Europe in the context of the water directive[27], and Rinaudo[28] provides an example of such a study in a context where different stakeholders share a common decision-making cum financial forum, which does not exist per se in India. Similar studies could be applied to urban aquifer in India.

2. Stakeholder coordination in the management of water resources quality and quantity at the regional level.

In the first section, we argued in favour of an effective integration of local resources management in the process of utility planning. Additional arguments in favour of this approach come from a better integration (or internalising) of the externalities that urban utilities impose on their environment either through abstraction or pollution by municipal wastewater. Reciprocally, cities need a way to make the other stakeholder accountable for their own externalities.

Network inputs

Janakarajan takes the example of Chennai's peri-urban catchments to illustrate the problematic of city-hinterland relations in the management of water resources, in terms of water resource, confirmed in terms of social pressure by the study of Gambiez & Lacour. Janakarajan provides an example of some innovative attempts to built stakeholders forums in order to facilitate the emergence of sustainable policies. The French experience of water parliaments ("agences de l'eau") could be a valuable input in the institutionalisation of such initiatives. Of course, given the traditionally public-centred financing mechanisms in India, this experience would rather serve as an input for establishing locally adapted mechanisms than as a 'model'.
On the other hand, as described by Saravanan[29], India has developed an extensive experience in micro – watershed development in rural areas.

[27] reference directive européenne
[28] J-D Rinaudo, S. Loubier "Cost-Benefit analysis of large scale groundwater remediation projects in France"
[29] V.S. Saravanan " Institutional Analysis of Watershed Management"

The necessity of an enhanced dialog between the stakeholders does not come only from quantity issues but also from quality issues. As Maria[30] reports, the pollution from industrial as well as municipal and agricultural uses puts an increasing threat on urban water supplies. Although a command and control regulation is in place, the social and economic cost of compliance makes its enforcement unrealistic on the short term. Stakeholder dialog and flexible economic-based instruments, as described by Murty[31], should be promoted as a way to find the optimal trade-offs between development and environment protection.

Analysis

Given the existing pressure on the resources, both in terms of quantity and quality, cities and their regional environment cannot afford to follow a uniform rule in terms of resources sharing and pollution regulation. Only stakeholder dialog and informed negotiation can allow the policy maker to identify the priorities and the necessary trade-offs between development and environment protection. Stringency of course varies from dry to semi-dry regions, but all over India water table are fast depleting. Studies by the BRGM conducted in some dry areas show that reducing the demand by a 15% -merely rationalising irrigation and avoiding wastage of water- would in some cases be enough to stabilise the water table (*** BRGM quote the reference).

Recommendations

The conjunction between micro-level dynamics of community-based resource development and macro-level institutions for enabling stakeholder dialog can bring a good environment for Indian cities to identify the priorities in their policy of integrated water management. This necessarily has to integrate agricultural practices and notably irrigation schemes.

Research gaps

Policy instruments for environmental management
Although stringent norms and standards exist in the country in order to mitigate the economic damage of environmental degradation, the gap between the target and the implementation is so large that it makes the system inefficient. The current tools and institutions have to evolve in order to provide with more adaptive measures, which in turn can lead to a better enforcement.
Current research on economic tools for environmental regulation should lead to experimental implementation on pilot scale.

Stakeholder forums as policy making bodies
Experimentation should be done in order to assess the capacity of stakeholder forums to identify the priorities in terms of water resources management in their area. Capacity building among the communities is already taken up in urban and rural context, and the success factors should be assessed and disseminated.

[30] Augustin Maria " The Costs of Water Pollution in India"
[31] M.N. Murty "Valuation and Accounting of Industrial Pollution and Design of Economic-Based Policy Instruments in India"

3. Development of demand-side management tools for municipalities.

It appears that municipalities still lack a good understanding of the demand of their population for various levels of water and sanitation services. Although some norms allow deducing some demand-supply gaps from the comparison of projected capacity and populations, very few information is available on the real household preferences.
As pressure on water availability keeps increasing for most cities, the discussions held highlighted the importance of a better understanding of the respective demands for water and sanitation services.

Network inputs

As demonstrated by Roy[32] with the example of Calcutta, Indian cities show a high willingness to pay of the middle classes for high quality and reliability on the potable segment of their requirements. Zérah[33] has also put into evidence the high coping costs attached to unreliability concerning the overall quantity available to the household as well as low quality of service. Other studies reinforce these findings (WSP studies, Vaidya on Baroda, Choe on Dehradun). These results, however, have to be interpreted with caution, especially in the context of the widespread ambition of upgrading the urban supply systems to 100% potable supply. Indeed, there are various issues: (i) some of the investments made by households are long term. Therefore the willingness to pay would not necessarily directly translate into a willingness of increased tariff, (ii) there is low confidence in the public system. Further, as Ruet[34] points out, potable requirements only constitute a low fraction of the overall household demand. No existing study proposes a model of municipal demand for services linking quality, quantity, and reliability.

Analysis

Municipalities need to reassess the existing (unrealistic) supply norms when planning future investments in water supply and sanitation. Examples in Europe show that residential demand can be reduced to low level compared to the existing supply norms prevailing in Indian cities. This has to be taken into account in policies oriented towards equity in distribution. Consuming more than 125 litres per capita per day is a luxury in the context of Indian cities, and those consuming more should contribute fully to the financial sustainability of the system. Capacity building for demand management has to be undertaken immediately and the efficiency of the different tools available has to be assessed. Community-based organisations such as resident welfare associations are bound to have a critical role in bringing information to the policy makers through local water audits and discussion groups.
In addition to this, the different uses of water have to be considered separately in order to assess the potentials of differentiated supply and conjunctive use of local and imported resources with different characteristics. There is a need for a methodology for water audits that provide municipal utilities with all the information needed. This include willingness to pay of the users for original schemes of service delivery, but also geographical information on the repartition of the different uses in the city .

[32] Joyashree Roy “An economic analysis of demand for water quality, A case from Kolkata City”
[33] Marie Hélène Zerah (2000) Delhi – Unreliable supply
[34] Joel Ruet “Water in Urban India. The scenario, energy linkage, and private participation”

Recommendations

In order to assess development scenarios including the conjunctive use of local and imported resources with different characteristics, a model of demand for differentiated supplies would need to be developed in order to value the potential of matching between the different sources, and the different uses.

Simultaneously to a better understanding of the valuation of different level of services by the users, it is also critical to understand their behaviour in different scenarios of tariff increase. Indeed, before being a tool for cost recovery, tariffs are bound to be tools of demand management. There are no examples, though, of tools enabling the municipalities to assess the impact of a tariff policy in terms of demand management. The problem of competition between unregulated groundwater abstraction and use of municipal water also has to be assessed before implementing policies of tariff increase.

Research gaps

Willingness to pay for alternative services
Based on the characteristics of local resources, some willingness to pay studies could be carried out in order to assess the willingness to pay of the populations for differentiated supplies. However, the problem of WTP is that they should be based on a realistic technical scenario, fitting with the real quality demand of people, including for instance the proper share of drainage and sewage.

Effectiveness of demand management tools
Also tariffs, education, and some technical devices are known to act as a tool for demand management, there is a lack of research about the efficiency and the cost of implementation of the different water demand management policies.

4. Well defined and adaptive strategies for sanitation

Network inputs

Network exchanges have underlined the potential interest for the Indian context, of some aspects of sanitation situation in parts of Africa, especially regarding the power of the African multi state municipal organisation in initiating research and operationalising research findings for water and sanitation services.

In the Indian scenario, case studies presented at the two conferences (Kumar[35], Zerah) point out clearly that the provision of sanitation services has to go beyond a simple top down interventions. Lessons from the field about sanitation programs show that resources protection and health objectives will need to be clearly delineated as priorities by policy makers to realise the benefits of sanitation rather than tagging it on to water. Kumar also brought in the differences between top down and bottom up approaches to sanitation, pointing out that in many cases though toilets were built, they were not always used as such, but turned into storage structures instead, because the objective of the sub contractors was to build toilets, not improve health. The question of demand drivers' for sanitation services was highlighted and

[35] Arvind Kumar "involvement of stakeholders in installing, executing and subsequently managing the rural drinking water supply based on khammam district" and role of public private partnership for drinking water / sanitation / rural / urban water supply.

programmes such as sanitation marts and models made accessible so that people have a choice and know what they are getting. Both Kumar and Zerah[36] introduced participation as critical element of sustainability in the provision of sanitation services to poor population. Along with this, in the urban situation, the role of NGOs, contractors and the relationship each has with municipal bodies seems important (Yannic).

The amount of water that is required by urban sanitation services and the problems of pollution caused by lack of proper sanitation were also pointed out (Maria), bringing to the fore the connection between the two. Together with groundwater reserves and storm water, wastewater is a local resource of critical importance in developing sustainable systems to meet the urban needs that should be acknowledged by the public bodies, and should lead to a shift in the engineering paradigm, along with the incorporation of alternative technologies, including traditional ones. Complementarily to that, Nadkarni[37] introduced an approach of the city as an ecosystem in order to show the potential of alternative approaches to sanitation in bringing additional value to the conventional process of evacuation and treatment of urban wastewater by introducing original designs, and pointed out the need to understand what the function of sanitation services is in order to think of alternatives and cost reduction.

Analysis

Sanitation provision seems to be different from water provision (as shown by Kumar), yet since both water quality and quantity are constraints in India, attention should be given to sanitation as distinct yet connected to access to water resources. And the thinking of sanitation services as secondary to water, needs to be questioned and its importance emphasised, since pricing alternatives (sewage and sewerage costs as a part of water prices) and technology alternatives: for example, aquifer injection of membrane technology treated of wastewater may increase resources (Dangeard) may influence each other.

Recommendations

- Though they may be conjoined in actuality, for research purposes a decoupling of water and sanitation services needs to be done since demand drivers seem to be different and hence approaches to providing such services may differ.
- Yet at the some time it needs to be repeatedly pointed out that it is not enough to provide water, sanitation must be taken care of too, both in rural and urban areas. Delhi and provides a good example of the problems and costs of environmental pollution as well as resource depletion due to lack of sanitation.
- The possible varieties of situation—specific financing strategies for such services need to be explored.

Research gaps…

- With reference to on the ground situations in India, a closer look needs to be taken at the differences between water and sanitation in terms of significance and modalities of decentralisation respectively for water supply, distribution and treatment?

[36] Marie Hélène Zerah "Participative management in water supply and sanitation and its implications in the urban set up"
[37] Manoj Nadkarni “The meaning of sanitation : an ecosystem approach”

- Good information exists on coping strategies and their use as a measure of, or relationship to, affordability for water, but it is seldom as far as sanitation is concerned.
- There certainly is a place for modern technologies such as membrane treatments for wastewater treatment but where exactly do they fit in? Only for ground water recharge, surface water augmentation or are there possibilities for shortening the loop furthered? In this regard are the various types of source separation (and multiple water quality streams) a possibility in the urban Indian scenario?
- Where do technologies fit into and affect services for the poorer urban areas?

5. Providing real Institutional autonomy and organisational decentralisation of public agencies, a sine qua non condition for enabling the first four points.

Network inputs and Analysis

Ruet, Saravanan, Zérah and Giraud, Maria, Ruet, Zérah analyse the organisational aspects of planning and management in public water agencies. They show that these agencies lack internal delegation and decentralization which leads to objectives and evaluation methods that favour building new equipment, increasing access to distant surface water, rather than controlling the demand and optimizing the maintenance. Put in a defective system, these equipment are soon inefficient. On the institutional plane, decisions linked to water keep interfering with all subjects under the responsibility of municipalities, for the water departments or even boards are hardly autonomous from the day to day political operation of the municipalities or States, leading to a paralyzing instability. The case of Chennai, on the contrary, shows –though in a timid fashion- that, under resource constraint, a relatively more autonomous body is able to design and implement some non-conventional measures (a beginning of industrial recycling) as well as *partial and light* delegation to *local* private sector (see Ruet, Saravanan and Zerah, as well as Ruet & Zerah in Cohen and Janakarajan 2003). On a similar line, Yannic shows that, once granted clear decision-making rights in a decentralized fashion, sanitation can be really improved at the local level.

Recommendations

Public agencies lack a serious cost-based information system, to be developed and made operational by allowing decentralisation of its use, and hence decentralisation of decision-making. This would be a necessary step to better use the local resources, assess their valuation, coordinate with other actors, make incentives in using local resource clearer, optimise demand-side.

Research gaps

Classical private-public partnerships (PPPs), large delegation contracts, have serious limitations for the water sector in today's India, for they are based on capital-intensive systems to be repaid through economies of scale which are not accessible in such cities. In the context of a preliminary process towards autonomy and decentralisation of public agencies, the various degrees and levels of PPPs have to be pragmatically analysed; if they involve labour-intensive measures, local agreements, phased out delegation, agreements with local entrepreneurs, coordination with already existing private and collective actors, they need not being neglected, and deserve further studying.

Conclusion

Analysis of Indian countries' water systems underline now a double fact:

- on the one hand, the model of centralised piped water systems developed and operated by public organisations failed to provide sustainable solutions in terms of water resource and supply quantity. It also failed to find sustainable means to finance both supply development and sanitation, in a context where the centralised supply-oriented model has often led to high catchment and transportation costs,
- on the other hand it is now unlikely that large private groups will operate all developing cities –and lesser the countryside- given not only the socio-economic but also institutional but again cost-structure of the sector (linked with the high catchment and transportation costs themselves). Indeed, there is a clear withdrawal from large international water companies.

Parallely, in terms of analysis, we see the emergence of proposals and pilot projects for better integrating resource management and services on the one hand, technological choices and financing on the other hand.

The need of the hour lies is in 'integration': both resource and demand management, water supply and sanitation (ensuring a paced co-development of both, ensuring that water supply is enough to allow runaways, that local sanitation techniques preserve the local resource…), development-operation-financing, coordination between larger and local actors. In terms of systems, the water scenario in urban India calls for a conjunction of centralised piped systems and optimisation of local water, the latter being the base or the core of the system: both (i) in time precedence, where the long run optimisation of local underground water should be given explicit preference in newly developing peri-urban areas, either beforehand development of networks or using groundwater and built reservoirs to initially have a local network with a controlled evolution of demand over time, and (ii) conceptually and practically, in terms of quantities, use and re-use of local water and optimal re-use of a limited piped supply.

In water systems as in other systems, institutions and stakeholders matter, the key issue for realisation, acceptance, definition, optimisation, and implementation of such schemes will lie partly in capacity building for coordination between public and private and civil society actors. India is specific in that regard, for its experience in this domain has been severely limited by decades of ideological monopoly by the public agencies but practical encroaching of various other actors. The task is that way not to be underestimated, for public agencies of today are not geared for such a coordination, nor are the private or civil society ready to overtake the charge of the whole sector.

In short, a new activity is to be created: accompanying municipalities and stakeholders in such a coordination; this role is most likely to be fulfilled by both private/civil organisations and central level government/bilateral or multilateral cooperation.

Alternative water management systems will create new types of markets
Guidelines for municipalities and enterprises

Alain-Louis Dangeard

I. Preliminary.

a) Alternatives to conventional management systems are expanding regularly but mostly in industrialised countries' settlements. The focus is on decentralised units, desalination, reuse and recycling allowed by rapid advance in technologies:

1. EU R/D programs have published many results and there some individual success stories in Europe (IWVA, Torrele Plant in Koksjide, Belgium).
2. A large set of data on alternative projects which are operating is derived from a significant number of US[38] and Australian experiences[39]. The recent tendencies in the US and Australia has been a shift of emphasis towards urban needs. Costs and benefits are often presented in detail.
3. In a systematic application of modern technologies, many industries worldwide are turning to holistic optimization of the water cycle on a production site. This is a rapidly expanding market. Industries are also managing adjacent watershed[40] addressing water challenges of stakeholders (including their workforce families) in the vicinity.

The multidisciplinary character of these new approaches allows more flexibility: a diversity of economic solutions can be adjusted to local characteristics. New models are explored, project by project, by municipalities and industry. While conventional models are organised on transport from source to city of uniform quantity and standard quality per capita per day (300 l/c/d. in Roman times, 150l/c/d in present day EU and India Metro cities), in the future, the benchmarking of the investment or O&M costs of m^3 will not be derived from a unique mainstream reference. Models will be made of different grouping of decentralised "water matching"[41] tools, quantity/quality of raw water to be qualified with a specific need of a particular service. B. Barraqué expression is "from further quantity to nearer quality".

b) Though there is a large diversity of contexts, the methods for choosing appropriate solutions for extension or modernisation of existing systems reveal a number of common characteristics. These are not yet totally accepted by the classical water industry. Public reservations may have to be dispelled by further work on health issues. Studies do not always lead to alternative systems. But, the principles themselves are undisputed: to rely on ***analysing the built environment as part of an ecosystem whose sustainability has to be a priority***. They are incorporating fundamental knowledge of the chemistry and bio-chemistry of the water cycle. Though the objectives are site specific, they usually have the same basic motivations:

[38] See in particular, in Florida, the reuse inventory published by the Dept of Environment (July 2004) and in California, "Water Recycling 2030" report of October 2003 from the Recycling water Task Force of the Dept of Water Resources

[39] CSIRO & AWA Australian Conservation and Reuse Research Program - Integrated Urban Water Management A Review of current Australian Practice by V. grace Mitchell April 2004.

[40] See GEMI "water sustainability tool", a US industry organisation.

[41] Expression used by the "Bureau of Reclamation" in Desalination and Water Purification technologies Roadmap" Jan. 2003.

- reduce the discharge of pollutants by sound wastewater treatment and disposal for protecting eco-systems value & services;
- Providing a high quality water source to replace other sources resulting in more security of water supply.
- finding a benefit in waste water treatment for irrigation and, possibly, additional source of organic matter and nutriments,

c) The costs/benefits analysis will have to answer the following queries. In countries with a well developed infrastructure, the questions are: will recycle help save drinking water capacities when it can be devoted to irrigation, industrial use, landscaping or recharge of aquifers? In situation of severe scarcities, how to protect local sources and supplement drinking sources in period of drought or for expanding populations?[42]

- From current practice in developed countries, "the effects of externalities can be more influential than the differences between infrastructures related costs options"[43]. In Australia a figure of 25% is given for the benefits of externalities of the infrastructure related lifecycle costs. In many innovative schemes, the main benefit of non-potable reuse is avoiding the damage caused by wastewater untreated discharges. Indeed, externalities may be source of savings and value added in the bottom line of the utility or in the local environment. Examples thereof will be examined later (ecosystems valuation, reducing the indirect costs of pollution).
- The costs/benefits ratio of pollution prevention is certainly the first issue to concentrate on. The main example is urban soil environmental management. It may represent some 20-30% of potential savings on the budget lines of treatment (preserving the natural process of purification of water) and management costs of storm water. It can generate positive costs/benefits ratio in adding local storage capacity and improving soil biological and nutriment value for cultivation.
- One significant indicator of where savings can be made will be the energy consumption of the system: addressing two types of issues: peak demand through optimization of adequate sizing of reticulation and storage (Reducing of pipe size and optimizing the lay out may represent potential savings of 15%). Conserving local resources means reducing the need for the high energy expenses of diversion upstream and transfer costs.
- Alternative systems of lower cost sanitation are starting to emerge from being a research subject to reaching the stage of demonstration. In conventional system, the costs of wastewater & sanitation may be half of total expenses. Reference to alternative clustered systems is provided by experiments made in Germany (Ecosan, Fraunhofer Institut ISI). It is also a key item in joint R/D within the EU.
- Last but not least, the benefits of perfectly clean water are everywhere present in terms of health. The public knows: it is voting with its feet, with a large bottled water industry in developed countries and points of use or packaged water expanding in emerging markets.

d) The above principles have no reason to be confined to the industrialised world. Indeed, the rationale should be even more relevant for regions where the present networks are not capable of delivering an acceptable quality of service. Of course, the priorities are not going to be the same for fully equipped communities than for developing contexts. Urban expansion adds to the need for new infrastructure. But, green-field projects allow technologies with smaller

[42] In California, recycled water mostly used for irrigation or recharge of coastal aquifers should free fresh water sources to meet the drinking water needs of 30 to 50% of an additional 17 millions people in 2030.

[43] CSIRO. Australian Water Conservation and Reuse Research Program. Integrated urban water management: a review of current Australian practice by V. Grace Mitchell April 2004.

incremental steps and adapting quality to use (water matching). Thus the door is open to innovative concepts, addressing the main obstacles to improved services worldwide, *that of affordability*.
Thus, the issue of this report is how to **answer back to the accepted idea that advanced technology is only a rich man's business** and that a majority of urban local bodies in developing countries may not be in a position to afford what appears at first to be costly technologies.
Some initial observations will prepare further analysis contained in the paper:

- the average household water consumption in the US is very high (needs of a family is estimated at 5 000 gallons per month, some 600 l per day); saving a number of m^3 of water by using unconventional sources at comparable costs in a second network for non drinking uses, including golf courses and gardening makes sense in wealthy communities. In Florida, these landscaping represents 45% of the markets.

- At the origin of advanced technologies are filtering processes used in desalination. Nobody contest that desalination facilities can produce water of high quality as reliable source to meet existing or projected demand in developed or developing coastal areas. The 2004-2005 Indian budget is providing funding for the first large desalination plant to be installed near Chennai and more such plants to be built along the Coromandel coast through public-private partnerships. The cost of energy will be a limiting factor. And, the pipes will have to be in perfect conditions. The central issue of affordability remain: the technologies derived from desalination have to concentrate on the highest quality demand, thus implying a quantum change in efficiency of design and use of the networks.

e) Thus, the same technologies could be used for very different types of realisations and diverse potential markets in the developing world:

- Presently, conventional systems, which are still the mainstream reference, are **financially unsustainable for most settlements** outside a small fraction of metro class cities or export zones. In addition, conventional technology meets with increasing infrastructure or environmental constraints: it is not sufficient to deal with new types of pollution threats to food production and human health; quality resources per capita are fast depleting.

- Discrepancies between industrialised and emerging countries expenditure *($250 billion for 20% of the world population –industrialised countries-, $75 billion for the remaining 80%)* on both capital investment and O & M would at the very least call for rebalancing in an accelerated fashion. Increasing the rate of investment in the developing world is a necessity and an opportunity. Indeed, the categories of income levels that are taking part in the globalisation represent the **largest untapped market for quality water**, provided the services are adapted to their most pressing needs. Other studies of the network have attempted to give an order of magnitude of potential unmet demand from the expanding lower middle class of globalisation. In India, it may represent some 300 million people, meaning markets with the potential of reaching rapidly 10 billion $ or more as order of magnitude. More data has to be assembled on theses classes of households constituting the growing demand for better quality services in the next decades. **What is advanced is that solidarity should be based on local alternatives that make economic sense and address efficient services for all.**

The priority for exploring alternatives to the risks of "business as usual" is the subject which will be developed in this contribution. These guidelines will address successively the following questions;

1. Why have realisation stalled while there is a large unmet demand?
2. Where are the opportunities to initiate new projects?
3. What approach should be followed?

II. Why have realisations stalled in developing countries where there is the largest unmet demand?

If initiatives are to take off, barriers to innovation should not be underestimated.

a) Central-piped models and distant water transportation as a single solution are too costly and rigid for most cities. When there are differences of per capita revenue raised by local governments per year, from $ 2906 in developed countries, to $ 153 in Asia, $ 87 in Latin America and $15 in Africa, it is spurious to act as if the same management systems could be supported in developing regions[44]. The average costs of water for a household in the EU being 300 euros per year, the transposition of similar systems in lower income regions cannot be feasible. Of course, there are cases where large metropolis will be able to face the higher costs of traditional systems: in particular, where they are engine of growth in installed platforms to export to the new global markets. These are the places where the bulk of external intervention is confined. But, the need of the hour should be to combine existing centralised networks with endogenous solutions to be created for the majority of expanding cities[45] and their outskirts. Beyond financial aspects, the increased pressure on distant resource leads to re-think the use of locally available water, which calls for a long to come paradigm shift.

b) Cities have little margins for the risks of new untested solutions and smaller projects lack glamour. Their financial resources cannot allow them to function efficiently, in particular to insure constant flow and treat pollution effluents downstream. The majority of utilities are unable to take any efficient initiatives because of their parlous financial position. Their necessary caution does not incite them to turn to entirely new approaches. The immediate reference and recourse to centralised piped systems makes it easier to design and to operate new systems. As they are the only one to be depicted in the media, people forget the huge barriers which prevent their development. And, many utilities' engineers do not have the training and desire to innovate.

According to studies quoted in the 10th Plan, 76% of Indian Towns did not raise enough finance to cover their revenue expenditure. Performance indicators established by the Institute of Technology for Water Supply and Sanitation for utilities in Rajasthan in their contribution to Dematedee disclose a bleak picture. Due to constant influx of people, their growth has been haphazard. A story of recurring crises is a corollary of severe pressure on infrastructure designed initially for much smaller population. Improvements can be negotiated piecemeal with State governments to avert collapse. Thus as long as State governments are subsidizing day to day investments and covering the deficit in O&M, the existing systems continue. *As long as subsidisation of local municipalities by the State governments remain dominant (98% of subsidies to water and sanitation comes from State budgets in India), the transfer of decision in decentralisation is somewhat virtual*. Centralised networks prevail and high subsidisation will not go away easily[46].

[44] UNCHS 2001 quoted by Rakesh Mohan at the World Bank 2004 Water Week

[45] In India, there are 5161 towns of which 500 cities have a population between 100 000 and 1 million habitants (2001 Census)

[46] The yearly revenue raised by local governments are respectively 2 906 $ per capita in developed countries and 153 $ in Asia. Ref UNCHS 2001.

c) Aid programs and international governance are sending disorderly signals on the priorities.
There is no distinct pattern to prove convincingly that the volume of external aid has so far made a difference[47] in average sanitation or percentage of treatment of wastewater. Aid programs are often bound by precedents and tend to reinforce the conservative bent of the sector worldwide. TOR and engineering studies are on the same pattern. It is not so much the lack of diffusion of information on specific technologies. But, there are no clear signals of the need to encourage innovation[48] by binding them together. The linking of research and innovation with the business communities in demonstration and diffusion is not there. The basic rationale of alternative systems, smaller projects in large numbers should be better emphasized and the potential for unproven albeit new designs is to be made central to their message.

d) Banks and the private sector need a quantum size to cover the transaction costs of their initial involvement.
Conservatism could be noted with commercial banks credits: either, limits of indebtedness are reached before decisive steps towards water sustainability are made; or, projects concern small amounts and the initial preparatory investment is unlikely to be recovered. Thus the financial establishment's contribution to innovation has so far remained limited.
The technologies SME have more difficulty than larger enterprises of accessing finance and information while they should to be at the core of change. But, the high profile of large enterprise makes for political suspicion, which explains the desire to limit exposure.
Civil society contribution is in a sense more significant. NGOs in India are developing a large array of innovative concepts: the question is how these could be taken up by enterprise creation and reproduced rapidly enough to meet the pent up demand for higher quality services.

III. Where are the opportunities to initiate new projects? Basis for future economic strategies contributed by Dematedee's work in India and in the EU

1. Strong user's motivations are **drivers of developments** outside but also within the public service.
1-1. Cases of **spontaneous private markets developments:**
Where the service falls short of pressing needs, deterioration of common infrastructure is indirectly creating a mismatch between demand and offer of public services. Two cases of spontaneous alternatives have important lessons for public/private cooperation.
a) *Individual demand for services and equipment for purifying drinking water is a strong incentive to municipalities and the private sector to innovate*:
A sizeable portion of household expenditure *(and company's water budgets*) is being redirected towards this market. It is seen as the most reliable and convenient, indeed cheapest (albeit insufficient) way to reduce child mortality risks[49]. The result is a strong resistance to the principle of paying the real costs of service provided by the public infrastructure and/or a

[47] In Egypt or Morocco, external aid it is above 5% of capital formation; it is more limited in other instances: negligible in Turkey and only 0.6% of capital formation in India). Beyond specific local situations (Jordan), influence on environmental averages seems indifferent.
[48] The number of World Bank projects containing sanitation activity has grown in the 80-90, but slightly ***declined*** in the 00s.
[49] see concluding remarks at the end.

particularly low tolerance to any increase in tariff. When spending goes to more efficient private substitutes, the willingness to pay for Municipal services improvements is affected.

- In Kolar, there are as many private as city council tube-wells (120). It is estimated that most households spend Rs 100-500 per month for drinking water, while official water fee is just Rs. 45 per house per month.

- In Kolkata, the studies of people behaviour for quality water[50] shows preference for water purification equipment at point of use. A wide variety of purification methods are adopted for a daily consumption of 2.43/ l per capita for drinking to 7.56 / l per capita for drinking and cooking purposes. The choice of modes of purification is linked with the income and education (boiling costs Rs 0.26/l, UV filter: 0.21/l, other filter: 0.18/l). The estimated average is Rs 168.72 per month per household within a range of Rs 1.97 to 887.50. The study does not include bottled water.

What lessons to draw from this expressed willingness to pay for high quality services? The resistance to pay more in the absence of a demonstrated improvement in service quality may entail the risk of a vicious circle: unable to recover the costs of improvements, the utilities fail to collect even the funds of maintenance. It is a strong incentive for municipalities to initiate visible improvements of service quality they can afford. For the private bottled water industry, there is a major interest to see such improvement take off rapidly in the public service. They are not the one standing in the way.

b) Use of groundwater is another typical case of a markets developing spontaneously, but not foe the common good

Cases of severe depletion of groundwater: tools now exist to predict groundwater conditions: they record an exceptionally serious picture in many regions, requiring urgent steps to limit abstraction.

- In Andhra Pradesh, the rural water schemes (RWS) are considered a success story: but, they depend on groundwater for almost 90%, compounding the uncontrolled exploitation for irrigation. The paradox is that most of these RWS consume more groundwater than hand-bores/small schemes they replace. They are in stress areas where water levels have already gone down beyond reasonable limits. Action of different departments will have to be initiated at District level to prevent potential deadlocks.

- The case of Kolar city in eastern districts of Karnataka. With hardly any perennial rivers, the Kolar Taluk depends heavily on groundwater. Overexploitation and deepening of the water table has created acute scarcity combined with high fluoride content.[51] A growing population of 113,230 (2001) will reach 168,000 (2011). A double challenge has to be faced: not only the quantity of water cannot be increased and providing services to expanding areas looks problematic, but, the present level of abstraction should be reduced to preserve the minimum groundwater capital and prevent a complete collapse. Kolar is only one case among many.

The uncontrolled use of groundwater implies rapid measures of prevention by farmers, industries and local authorities. As written in the 10th Plan "There is a grave danger that cities

[50] Joyashree Roy. Department of Economics Jadavpur University. "An economic analysis of demand for water quality: a case from Kolkata city" .

[51] Case study of Kolar city in South-India y K.V. Raju and al. Ecological Economic Unit. Institute for Social and Economic Change Bangalore.

may, in many instances, slip back to lesser levels of water supply, due to poor maintenance and depletion of resources even as the population continues to grow. This may lead to a situation where the per capita availability of water by 2020 may actually decrease". In a sense, this remark is a strong inducement to give flexibility to quantitative standards, a condition for alternative systems to be examined on their own merit. But, corrective action is to be taken up expeditiously, as in recent budget initiatives. If increase in income does not go to infrastructure betterment, the argument that economic growth can compensate environmental degradation collapses.

1-2 Cases of successful **innovation within the public service**.
Drinking water schemes in rural areas in Andhra Pradesh. "In rural areas, people are willing to execute drinking water works in their villages. They are interested to take up the operation and management of drinking water works and share the financial burden partially" (Sector Reform Pilot Project).[52]
NB This communication is only touching water services in rural communities to show the dimension and approach to water services in rural India. Only 1/3 of rural households have water within their premises. The majority of rural population uses open wells, hand pumps and draws groundwater. The paper is mainly focused on urban and periphery areas. In the future, the main issue will be in areas where the cities are gradually merging with rural areas as both depend on the same natural resources.

2. What are not included in present calculations may be the most important **sources of value creation**.
2-1 ***The case of urban soil/water interaction****:*
a) Selecting urban soil areas for rain water harvesting: water augmentation in Delhi: by selecting a number of unoccupied sites and catchments by satellite one can show that in principle water harvesting could contribute significantly to expected shortfalls in raw water requirement. Such a project will be feasible if it is part of a larger rehabilitation program, including soil, solid waste and drains. The complex connection between surface and subsurface (and the detailed GIS) is to be central in such a project if it is to be implemented. The management of solid waste becomes part of protection of local water sources.

b) *The problem of sanitation: development opportunity. An analysis of sanitation in ecological terms is clarifying strategic and tactical possibilities of utilizing excreta and urine as resources*[53]*in particular in high density urban soil.* Large stakes are involved:

- The task of completing sanitation infrastructure is a most conspicuous need in rural communities (urban sanitation coverage: 86%, rural sanitation access 38%[54]). The 10th Plan notes that only 17.5% of rural population were using latrines.
- For the majority of urban centres, low cost sanitation is the only practical solution. It is also the preferred choice where underground drainage is not feasible.

2-2 ***Representative studies on the value of wetlands***:
The recharge function from floodplain wetlands: *the case of the Yamuna floodplain in Delhi*[55]. An elaborate method is comparing the value for the Delhi Jal Board of the quantity of water recharged in aquifers in the study area with the costs of alternative water sources, including

[52] quoted from V. Naidu 06/05/02 World Bank Water Forum
[53] The meaning of sanitation: an ecosystem approach by Manoj Nadkarni; presented in Paris, may 2004
[54] Global water and sanitation by Arvind Kumar (Dematedee contribution); May 2004
[55] Dr Pushpan Kumar, (Dematedee contribution , May 2004)

transport and treatment, which the floodplain saves. The comparison with alternative scenarios of using the land for different development activities in an urban context would imply choosing a discount rate: if it is too high, no wetlands can be preserved.

3. The importance of engaging local actors: **success stories have participative management**. For comparing costs/benefits effectiveness of different type of measures (prevention & remediation), a local framework is to be installed as a representative institution. Ownerships of operative solutions by the users themselves are then made possible: "what people own, they are more willing to conserve and use better".
3-1 The slum and sanitation program in Mumbai[56]*:* New form of service provision includes the notion of community participation. The delimitation of "communities", the various forms of participation in three metro cities and limits and risks of such options are detailed. Though focussing on the poor, the experience underlines the coming up of forces that aim at transforming the public sector which associate NGO and contractors.

3-2 The case of the Palar Basin in Tamil Nadu (catchment's area of Chennai)[57] illustrates how to deal with community participation in the mains issues affecting the peri-urban areas:
a) *To help allocate resources, a private initiative of a "social committee"* of 24 members representing different local actors was the way to rectify failure of solutions imposed from the top. Vice-versa, solutions induced by local actors need the engagement of the authorities if it is to be opposable to third parties. In the upper basin, pollution by tanneries is compounding the scarcities. The situation is fraught with potential conflicts: it illustrates the rationale for local institutions that allows negotiating between provision different stakeholders groups.

b) Traditional irrigation systems degradation: tanks and spring channels decline in Tamil Nadu. In the lower basin, the urban expansion builds up pressure on water resources in peri-urban agriculture where available surface water sources have been utilised. Thus a water market "rural to urban" is flourishing, adding further competing claims on groundwater used by the farmers and rising demand from industry. *The priority of conservative measures is in the program of the Government.* In its first budget, the new central government is launching a scheme to repair, renovate and restore all the water bodies that are directly linked to agriculture. Pilot projects will begin in 5 districts. The program of restoration of water bodies should be completed in 7 to 10 years.

4. The underlying vision of infrastructure as part of local ecosystems sustainability is mirrored in studies coming from French and EU participants. Indeed, these concurrent trends may suggest more areas for further joint research and initiatives from the network.
While globally, the built environment is relatively efficient in the EU, common problems born of environmental issues exist at different scales:
4-1 Progress in raw water quality issues (nitrates) need still to be pursued. Despite an overall positive evolution, unsatisfactory situations remain for wastewater discharge in areas sensitive to eutrophication. More joint studies on the value of ecosystems and how such studies could be systematically included in the usual costs/benefits analysis of enterprise and municipal projects could thus be usefully conducted. The risks of micro pollutants and their characterisation is a new international problem: will control of better identified health risks require added investments to conventional systems or require entirely new concepts?

[56] Summary of a rich analysis of community based projects by Marie-Hélène Zerah "Modes and Practices of Participation in Urban Water Supply and Sanitation Services" Dematedee presentation on 30th October 2003.
[57] S. Janarakarajan « Facilitating negotiations over water conflicts in peri-urban catchments. » 2004

4-2 Another common concern is the degree of real control of groundwater abstraction: only 1/3 of irrigation is metered. Self-supply is also observed as substitute to network supply.

c) Evolution of regulation impact of the EU framework Directive:

- the concept of "good ecological status" is a driving force for change ; art 9 on costs recovery and annex III of the Directive 2000/60/CE prescribe that an economical analysis be made of measures to be taken for long term water use within an hydrological district;
- Use of cost/benefits analysis for implementing the Directive. Dematedee was offered a good example of the economic evaluation of large scale remediation project to be conducted in France[58]. The question was whether restoring good ecological status within a predetermined time frame was justified. The methodology was based on avoided costs by groundwater quality restoration and benefits of (accelerated) groundwater remediation.
- The challenge is in the estimation of the benefits of restoration of good ecological status: the costs/benefits analysis is largely dependant on the choice of the discount rate, since benefits are spread over long periods while the costs are incurred in the initial stage. The criteria to decide on nature restoration projects, by their very nature, are subject for public-private consensus building.
- Increased role of local consultation for planning, technical and ecological management of "water bodies" (SAGE). The process had a slow start but will be reinforced by the new water law that should be adopted in 2004. A detailed report on the methodologies employed may be useful for future joint work.

e) The private sector in France is concentrated on a few large operators. Developments of alternative models will probably mean an increased role in R/D and partnerships with a more diversified size and structure. Technological companies are starting to emerge on the EU scene. Specialised expertise in various technology enterprises could be the drivers of change: but, for this to happen, they have to operate jointly. An incentive to help them act together and acquire a higher profile should be a priority.

IV- What approach should be followed? Is-there enough perspective of economic benefits to encourage municipalities and enterprises to elaborate projects and strategies?

A) Elements for an economic strategy

*1- **Geographical scope** of alternative approaches for affordable community systems.*

- Regions with non-sustainable water production (withdrawal exceeds annual renewal); natural recharge area is not large enough to support the needs of dense cities or intense rural development; reversing groundwater decline is mandatory (Western Turkey, NE China, India...); thus, aquifer protection is a priority;
- Places where geology favours storage and extraction of water in underlying soil and rocks layers; water table or aquifer is not too deep for artificial recharge to be cost-effective within a reasonable time frame;

[58] J-D Renaudo and S.Loubier.

- Diverting and importing surface water would directly affect other priority requirements, in particular would be at the expense of sensitive habitats;
- untreated discharges of waste water in surface water deteriorates rivers to the point where natural purification processes (sunlight, bio-oxygenation) cannot function; significant upgrading of existing wastewater treatment plants becomes necessary.
- regions where diffuse pollution would require upgrading drinking water purification for all quantity delivered at the tap, thus reaching costs beyond the means of the majority of the population.

*2- Identifying **how economic value would be created**:*
2-1 From innovative designs including a reuse component:
a) Preventing negative feedbacks of uncompleted systems[59]: untreated waste water (health, absenteeism, workforce productivity), diseconomies of scale of central infrastructure, large public works impacts avoided (for storage, transfer of imported water or STP),
b) Assessing value added for user's productivity and incomes:
- How will local households benefit from improvement in the quality of potable water delivered with relatively modest infrastructure requirements? Not by large lumps, but step by step with lower energy and land requirement; Comparison with expansion of centralised systems at the outlying areas of large urban settlements;
- Positive effects on the reliability of existing service (increasing the capacity to face seasonal variation of demand or extra ledge against future drought);
- Local employment benefits for building, setting up and servicing the modular components of decentralised systems.
- retaining business and attracting new investments: hauling of water does not prevent development, but is judged too risky for new competitive industries to be attracted to a given location.

2-2 From agreeing with stakeholders on diverse pathways for households water as food consumption and as non food uses so as to deliver total households needs at a lower cost**.** Membrane technology cannot be the generic treatment for tap water: the more expensive treatments could be limited to a few percentage of consumption, the quantity for kitchen use, maintaining total water consumption at an acceptable quantity and quality for the largest uses.

B) What could be the likely shape of demonstration projects?
The optimum designs of "close loops" recycling are site specific as they depend on the context:

- If the community is already served by central distribution network, then the closed loop will become part of the existing water distribution network with which it will coordinated: the objective is to improve the capacity, efficiency and reliability of the already operating infrastructure.
- If, on the edges of expanding cities, unconnected developments are only served by substitutes (haulage by bulk water providers, water retail vendors...), the alternative of an autonomous system, localised collection of rainwater, treatment of wastewater,

[59] The enormous investments involved in conventional forms of centralised sanitation means that only 10% of wastewater is really treated in developing countries.

storage and reuse should be examined between the utility, the local stakeholders and authorities.

1- Broad categories of reuse systems:

a) *non-potable uses* (for irrigation, for industry or non kitchen households needs) and *potable use* are regulated differently; the latter can directly augment potable supplies with multiple treatment barriers (ex: Namibia) or indirectly increased supplies stored in reservoirs or underground (artificial recharge); in the case of recharge, natural processes provide additional treatment depending on the condition of the aquifer and on travel time in the natural environment.

b) *Decentralised sewage treatment* (distribution to recycled water users; "scalding" –also called "sewer mining" by picking up into the sewers for treatment on the spot of consumption of the reclaimed water) and decentralised *treatment units* (on site, by clusters).

2- Structure of a pilot for decentralised "clusters" systems with "closed loops".

The following components (strategic decisions underlined) have to be pictured on a "flow sheet" based on data obtained from the community concerned:

- Decentralised effluent collection from households and small industrial or trade users;
- effluent treatment options : the level of treatment required for reservoir augmentation is one of the strategic choice for preparing a project;
- recharge methods options: injection or percolation;
- methods for central monitoring of the reservoirs condition;
- Services options: the decision on quality and quantity standards is the other strategic turn: at this stage, the mooted question is whether dual (conditioned water and ordinary tap water) treatment & distribution of pumped water is the trend of the future. One suggested hypothesis is for "conditioned " water to be carried to users by unconventional means after "membrane" treatment; other domestic uses being simply filtered and chlorinated.
- Interconnection within a whole city and/or watershed system**:** significant benefits from a cluster development are accruing through increased flexibility to meet a fluctuating demand. It assumes design of a real time monitoring on the basis of agreed rules of joint management.
- Methods for dealing with impurities (sludge and brine residues management).

3- The following cases are describing **real situations** where community's social fabric is on average of lower income middle class with some poorer segments. They would seem worthy of attention for enterprises and utilities:

- The need to find benefits for wastewater treatment units, the additional costs of which households cannot afford if they had to be charged the full additional expense for the utility. The benefits are likely to come from increased irrigation;
- The case of urban households being built and inhabited ahead of service provision: alternative models are likely to be cheaper than private service of tankers and overexploitation of groundwater, both expensive, probably unsafe and unsustainable;
- The case of urban spread in coastal areas, not necessarily poor, where wastewater discharge is endangering the seawater, compromising fishing, and destroying ecosystems; where there is a need to put barriers to protect local aquifers against seawater intrusion;
- The increasing number of situations where service continuity cannot be assured because groundwater resources are fast depleting and their quality is degrading;

scenarios of artificial recharge with treated water may be affordable because they are less expensive than large transfers and municipalities may have a capacity to borrow for such alternative scenarios;

- When further extension of the central network means high energy costs and pipes losses: isolation of satellite and autonomous units should be a costs efficient alternative.

C) Generic Methodology

a) Choosing a place:

1- Main drivers:

Geography and population being given, criteria for prioritising sites depend on **motivations** of the end-user which may justify a role for enterprise creation. The main reasons behind an initiative may be inadequate services or future risks of water shortages. Looking at market potential, is it in the resource or in the infrastructure?

1-1 Typology of resource issues:

a) Resource exhaustion: surface drying out of rivers or groundwater depletion;

b) Surface and groundwater pollution: natural (seawater intrusion; deep water pollution (fluorite, iron, arsenic...) or man-made domestic, agricultural, industry);

2-1 Typology of infrastructure issues,

a) Excessive withdrawal capacity in comparison to available resources:

b) Services inefficiencies in coverage or operations,

- Related to quantity standards
- Related to quality standards.

2- Other factors for enterprises to consider.

a) Given context:

- Situation and availability of local finances. What tools are available to assess the existing financial situation? The "feasible" software of OECD[60]. Credit worthiness of the municipality.
- Institutional capacity and standards (flexibility?); will the water authorities be open to integration and innovation?
- Existing planning projection
- Donors activities existing (facilitate our information; disseminate experiences & our results)
- Existing experience of our team in the country

b) Chosen approach:

- "green-field" case (totally new concept) or "brown-field" case (remodelling an existing experience)
- Holistic / integrated approach authorised
- Size of the project (big enough to serve as an example, small enough to be easily handled.
- Probability of finding comparable (recurring) situation.

c) Objectives definition.

- Cost reduction (affordability: What users can pay for water services: average income levels of different households categories).

[60] See OECD Observer May 2003 "Feasible Financing Strategies for Environmentally Related Infrastructure"

- Value creation (health, …)
- No negative impact on the users / at least balanced by positive impacts
- Consistency with the funding agencies policies
- Possibility to identify measurable and time goals through performance indicators.

d) Conditions for implementing a realisation.

- Local « champion » to among local stakeholders to support a concept and keep it on track.
- Local partners for future operation, research and replication of the project (university, consulting engineers).

b) Choosing a concept

1) - Identifying a range of technologies available for each particular situation.

For each project, it is essential to identify the range of available technologies, progress which are being made, research teams with whom it would be valuable to be associated. One presentation of Dematedee is a useful summary of the recent progress in treatment. **They should be examined on their individual merit knowing that real breakthrough is in bundling them together (funding packages for new technology adoption),** focussing on value creation and technology appropriateness to the situation at the time.

- GIS systems and their use in environmental mapping and data generation;
- Biotechnology applications for environmental improvements;
- Purification technologies which can save costs for a diversity of communities at an acceptable level of risks;
    - Water technologies for small holders (septic systems and leach fields) and irrigation;
    - Water technologies (on site wastewater management or integrated approaches, short loops) for urban community based systems.
    - Matching quality and use; multistage of advanced treatment and levels of filtration. ; RO as maximum filtration barrier for contaminated water.
- The areas of sensors, and metrics in general and software interfaced sensors for on-line characterisation of water supplies;
- Ecological economics as an engineering tool:
    - re-examining water transfers and diversion
    - Aquifer storage and retrieval: keeping storage protected from contamination; Technologies for detecting or dealing with risks of nano particles accumulation.
    - widening scope of storm water management
- Technology for decentralised units to be coordinated with central systems: continuous remote operational control, wireless networks.
- Clean energy technologies.

*2) - **Estimation of the range of economic stakes**. Scenarios building: economic **issues to be examined** for an initial diagnosis.*

A series of questions have to be examined with the local actors as a method of consensus building on an early diagnosis on key outcomes. This is an iterative process using a logical process that every participant will follow through the process of devising several coherent scenarios and choose the best combination of available techniques. The figures are orders of magnitude based on various experiences.

2-1 increased efficiency of services:

- *Reintroducing the value of higher quality water in the offer* to facilitate total financing: the central network delivers standard treated water to connected users. Including final reticulation to tap, which may represent some 50% of distribution costs, correcting inefficiencies is a considerable challenge. Health benefits can be obtained either by a complete upgrading of conventional systems or by point of use or packaged water delivery. WHO has made calculations on the relative costs/benefits ratio of rehabilitation of distribution networks compared to point of use. Upgrading the network has the highest health gain but the lowest cost/benefits ratio in all regions surveyed. Similar calculation could be made for packaged water distribution compared to networks rehabilitation.
  One idea to explore might be for local users of purified water treatment plants choose a mode of delivery (refilling stations, HOD, local shops) which may receive subsidies provided tariffs of central network are accepted. Pollution charge is reduced if decentralised treatment leads to reusable water.

- In industrial countries, sanitation is 1/3 of the price for existing systems, but close or above 50% for new plants. It comes with little added value. The benefits are mostly the result of pollution abatement, indirect costs savings. A more rational use of water in sanitation has two additional stakes
    - It doesn't absolutely call for drawing on and contaminating of clean resources for its evacuation, should.
    - But, sanitation seen as provider of resources (fertilisers and micronutrients) could have important ecological benefits on poor and degraded soils.

2-2 Energy savings in the design of the network play an important part in financial viability savings may be up to 15%. Many networks were oversized at the initial design stages. Examples abound: in many places (Newly Independent States and New Member States of the EU, for example), energy indicators above 50% of Municipal Water Bodies are signals of bad network lay out; in India, the ratio of energy/total costs is 69% in Ajmer (Rajasthan) and 60% in Bangalore, while the average ratio in OECD countries is 20-30% . Too costly to operate and maintain, the quality of services is much lower than suggested by the connection rates and capacities of the treatment plant.

- adapting the sizes of pipes to regular flows and pressures, (*for instance evening out peak demands of seasonal and daily variations)*, not to speak of the gains if there is a possibility of uninterrupted supply, with lower pressure and thus reduced leaks[61];
- Some involved long transport from the start: *reviewing water transfers requirements* against actual needs and checking that alternatives to the transfer via e.g. a more effective use of local resource do not prove more cost effective.

2-3 Local resource conservation and protection measures from superficial pollutions:

- **Prevention of soil degradation and conservation of local water resources may represent some 30% of the economic stakes**: in most cities, soil and aquifers are too polluted to be used as water supply resource or water storage zones. Functions of natural attenuation are compromised. Treatment costs are high. Rain harvesting and recharge potential benefits are delayed. Drainage is made more troublesome and storm water from urban areas cannot be used for recharge. A first series of investigations should re-examine what steps can be made beneficially on the urban soil/water interface by a revitalisation process. The most important measure starts with solid waste management and identification of sewerage impacts. Important sustainability gains are in these sectors.

[61] Systematic efforts for reducing the pumping costs are noted in Jordan.

- Recording the conditions and potential services of wetlands, flood-prone areas, riparian forests and alluvial groundwater; and, concerning coastal areas, on estuaries.

- Value creation through storage and the use of non conventional resources namely recycling wastewater after appropriate treatment for various uses (irrigation, indirect potable resource, environmental eco-systems needs...). Large technical progress have been made recently in the knowledge and modelling of the urban and rural ecosystems services, their various functions, the potential for recycling and urban planning.

2-4 reorganising the city infrastructure in interlinked & autonomous areas.
A scenario could be discussed wherein the various city sections would be unbundled into in semi-autonomous local services linked as a sort of satellite network, whose mode of delivery and use of resources could be chosen by the users and operated by them, a new focus for PPP.

c) Implementation of a viable strategy.
1) Engaging the public:
- **Public perception**: gaining public understanding and acceptance is a major part of a successful strategy. The public has to be familiar with the concept of domestic waste water being a source to recharge groundwater aquifers. The perceived risks may be as important to deal with as the risks themselves: indeed the shortest recycled loop (within the group of houses) is psychologically difficult but probably the cheaper and safest alternative (at least people control what is in their own sewage). Recycling is loaded with emotional values. On the other hand, preserving the natural purification of water in the soil should appeal to the public.
- Training and education requires expertise in a broader range of disciplines and skills than in conventional technologies.

2) Preliminary issues of public service:
- *Health and environmental risks*: The management of risks has to be made part of the design by including procedural steps to be followed for anticipating risks. It is essential in particular with the invisible hazards of pathogens and chemicals. Research need to accompany demonstration and operations during a long period of time in order to validate assumptions on complex issues. As in all innovative process, the research community (scientists, economists etc) has an important risk abatement role to play in formulating the parameters of decentralised systems in the first stages of its development. Hence, research in assembling decentralised components together lays way beyond fundamental or lab experimentation.

- As nobody can afford an accident, the terms under which remnant uncertainties may or may not be safely and viably tested (health, interaction between soils, water treatment…) need to be clarified to bring to the parties all conceivable assurances as to the preservation of the public interest. Epidemiological studies: current assessment of public health and water reuse issue testing and certification laboratories and tools. Monitoring and risk assessment will make use of information technology in real time; it will also imply laboratory capacity on or near a cluster or group of decentralised unit.

- While a strong institutional centre is a normal condition for decentralised projects, *regulatory issues* are to be addressed on concrete situations and solutions. Local control and central regulation have to come to agreements with local stakeholders' expectations if users have to support the project. They need to be convinced that less dependence bring

less vulnerability. Behind this issue of public confidence, there are many institutional questions (regulatory framework) to be examined in the process: groundwater rights; transaction capacity; WHO guidelines, source control, authorisation to deliver conditioned water, permitting recharge of treated effluents. This should not be a pre-condition as their content will have to be adjusted when practical issues are appearing: is there a need for new standards? Is-there a need for a social net? Should solidarity be part of the design? While institutional reforms are worked out, the situation need not be passive/ should there be an impasse, test experiment should be made possible.

*3) Choosing a **promoter to accompany the local authority** during the process:*

- This is based inter alias upon the consideration that the success of any operation involving some degree of *innovation*, especially in those impacting upon human health, requires that operations be carried out in continuity, with complete transparency with stakeholders and under constant monitoring and supervision by a party accepted and trusted by all those involved. This is likely to be a **new line of business**, where the interested company will be investing in so far as it is prepared to champion and take the technical risk of implementing these new realisations beyond the mere level of technology provision. There will have to clarify relations should there be a "private developer".
- The World Bank is using the expression "Operator Consultant" in one of its project in India (Karnataka Urban Sector Improvement Project. March 12, 2004). The job description include: "finalize the works, design the works, prepare the bidding documents, procure contractors, signs contracts with the contractors and supervise the contractors' work". The bank considers that this should "facilitate awareness creation and communication between and across shareholders within and outside the demonstrations zone; formation of local levels forums for shareholders interaction; customer education on proper use of 24/7 supply systems and health/hygiene behaviour and participatory monitoring of outcomes in the demo zones".

4) Choosing accompanying institutions: association with decentralised research institutions and NGO may be favourable to insure accountability and transparency. NGO are not markets promoter. But, they do innovate and their realisations are not taken up by markets development at the desired scale.

*5) Choosing **Partnerships** with local industries for large markets developments.* Evaluating the costs benefits has to encompass industry strategies that will accompany and help drive such developments. User actively engaged in the process: the role of agriculture; the role of industry.

Pilots to be rapidly reproduced thus creating visible job creations. The equipment (sensors for pollutants detection and continuous monitoring, disinfection technologies including nutrient & heavy metal removal, membrane bio-reactors, UV, pumps, meters, laboratory…) would be locally fabricated and marketed in modular component of appropriate size, packaged and delivered. The maintenance of a network of decentralised schemes will be a new type of servicing for community management.

d) Financing strategy:

The huge size of commitments for centralised renovation and extension projects which are to be made upfront and guaranteed for long periods of 20 years minimum has attracted all the attention. It should not be at the expense of alternative financial strategies, namely the financing of a larger number of smaller decentralised units (plant, clustered networks): the scale of investment is smaller but comes on repetitive modules. Examine the financial

structures based on the borrowing capacity of the municipality and/or specially designed vehicles for public/private participation
The financial risks inherent in this type of projects should be much reduced in comparison with classical solutions. Nevertheless, financial risks are to be shared for a minimum number of demonstration projects. As such projects will develop gradually; they will not have the lumpiness that is one of the main obstacles to markets take off for conventional projects. The study also has to find out what type of guarantee should be appropriate to cover the specific risks (heath) associated with new concepts.

e) Exchange of experience on an international scale.

There is a need for more exchange of experience at the international level. This should help to benefit from success stories as well as failures. Further international research should focus on appropriate tools to "evaluate the merits of alternative water servicing options, against environmental, social and economic criteria, considering short, medium and longer time horizons[62]".

V- Concluding remarks: Enterprises cannot act alone for such a sector. There are no alternatives to enterprises engagement. But, their involvement depends on Governments being aware that business as usual present unacceptable risks.

1- In a new series of international studies, there are **warnings of trouble ahead.**

- UN Task Force on water and sanitation 2003, providing a measure of the scale of health costs of poorly operating services;
- The "Water challenge" of the Copenhagen Consensus 2004[63] underlines the importance of resource conservation besides services improvements.
- WHO health costs analysis[64]. It suggests that for conventional piped water supply and sewerage connections to have economic benefits on improved health, income levels would have to be above 850 $ to 7 800 $. This would exclude most of the developing countries. Other strategies, such as disinfection at point of use, as suggested in the Guidelines, have a lower income level for benefit to be obtained. The costs-benefits ratio is much higher for systems adding point of use to existing solutions than complete rehabilitation of piped systems.
- Other recent inventories conducted by international organisations shows that the present agenda of national policies and international actions is *unlikely, by itself, to reverse some dangerous trends affecting the durability of quality resources or services that people want*. Figures clearly show that strategies carried out in recent years for promoting an enabling investment in emerging countries have not met with sweeping success.

2- Mere catching up measures is unlikely to be sufficient. The needs of rapidly growing urban populations[65], and increasing agricultural density, involve in practice that, in a very short period of time, the tasks of extending new urban and outlying urban water infrastructure be undertaken simultaneously with the rehabilitation of existing systems, under the constraint of resources scarcity. In India, Turkey and the Mediterranean countries and Kenya, the rate of population growth (+/- 1.4 % per year) suggest a pressing need for scaling up actions. The urban growth rate itself is higher (+ /- 2,5%) : between 2000 and 2015, it will add 120 million habitants to Indian cities (from 281 in 2000 to 401 million in 2015); 10 million urban

[62] V. Grace Mitchell . Integrated Urban Water Management April 2004 CSIRO
[63] The Water Challenge by Frank Rijsberman. May 2004
[64] Evaluation of the costs and benefits of water and sanitation improvements at the Global level. By Guy Hutton and Laurence Haller. WHO Geneva 2004
[65] In 2007, the world's urban population (*3 billion people in 2004*) will out number the one living in rural areas *(3,2 billion in 2004*)

population in Turkey (from 49 to 59 millions), 40 million in North-Africa (from 84 to 123 millions) and 8 millions in Kenya (from10,9 to 19 millions). Illegal poor settlements in India, Turkey, Mediterranean countries and East Africa are compounding the difficulties.

3- The international community is giving a high priority to programs for the poor, which is highly justified. This is at the top of the millennium development goals. However, few will contend that the Millennium objectives have not the slightest chance of being met merely through the means so far proclaimed -namely donor aid and private sector finance[66]. The result is to transfer responsibility to aid and finance first, and, eventually to political decision makers. While water condition is commonly regarded as a fairly reliable generic indicator of sustainability, serious deterioration of the water cycle may be detected in entire regions (in NE and S Asia, Africa, parts of Latin America, the Mediterranean, the Middle East…). In such instances, non sustainable situations do not merely impact negatively on the "poor" or "very poor" -as international reports are focussing on - but on the middle class as well. The number of people affected increases approximately from 2.7 to 4.5 billion people if unduly high child mortality at 5 is added as a benchmark. Beyond a certain level of deterioration of resources and infrastructure, social development and economic growth are likely to be substantially hindered by the lack of reliable services. Then, far from remaining local, the implications will become global. Since a substantial part of the world's foreign investment and natural resources supplies involve countries that do not have water policies to speak of *(or are not enforcing them*), the present inability to address the "water and sanitation millennium challenge" has moved on from being a world solidarity issue to a straightforward security problem.

4- Mainstream forecasting reckons that economic growth and governance reforms will deal with deferred pollution of environment and resources constraints. Thus, the general approach tends to give priority to regulatory reinforcement and new financial tools. This line was adopted by the Camdessus report. But, to a large extent, it is somewhat doubtful that such top-down approaches will produce results without **initiating a sufficient number of demonstration projects**. Indeed, the water sector interacts with and on the economy in a multifaceted fashion: health, industrial and agricultural productivity & quality, dependability of the workforce… It is difficult to neglect the indirect costs of environmental degradation and scarcities will force their entry in the national accounts. Taking environmental costs into consideration at the political level is beginning in a number of Environmental Action Plans: Turkey (1999), India (second report on the State of the Environment 2002-2003; States are required to produce their own Environment Reports) and Algeria (January 2002) have initiated evaluations[67]. In the EU, the entry of environmental economics in the book of classical economics came with article 9 and the annex III of the Water Framework Directive (23 October 2000) making it obligatory to calculate the costs/benefits of different measures for restoring the good ecological status of water bodies. The Algerian Plan includes a chapter calculating the costs of environmental degradation and the replacement costs. *But, macroeconomics still continues to rely on models where environmental conditions are supposedly constant ("no structural change"), when, by cumulative effects (space and time), they are modifying the assumptions.*

The current international action continues to give priority to regulatory reinforcement and new financial measures. This line is a follow-up of the Camdessus report. But, it is doubtful that such top-down approaches will produce visible results unless there are a sufficient number of demonstration projects enhancing the effectiveness of water resources management. This should be recognised as the first international priority.

[66] Assessment provided by the Joint Monitoring Project. UNICEF-WHO, 2000.
[67] Ref DEMATEDEE study of environmental costs (A. Maria).

Programme des deux séminaires

A- First seminar of the DEMATEDEE network:
Market development of water & waste technologies through environmental economics
CERNA - Meed SA – CSH - ORF

Thursday 30th and Friday 31st October, 2003
At the Conference Hall, OBSERVER RESEARCH FOUNDATION
20, Rouse Avenue Institutional Area, New Delhi – 110 002

Thursday, 30th October 2003

9:30 – 10:45	**Inaugural session to present the DEMATEDEE Network** - Welcome address: ORF - Presentation of the network and its objective by Prof. Pierre-Noël Giraud (French side) and Dr. Devendra Gupta (Indian side) - Inauguration by Dr. Marie-France Gonnord, Scientific Attaché, French Embassy
11:00 – 13:00	**Session on the costs of water pollution – Chair : Vice Admiral (Retd.) K. K. Nayyar, ORF**
11:00-11:45	The costs of water pollution in India – Mr. Augustin Maria, Cerna, Ecole des Mines de Paris
11:45-12:15	Discussant: Prof. M.N. Murthy, Institute of Economic Growth, Delhi
12:15-13:00	Open discussion – Notes for restitution taken by Dr. Joël Ruet
14:00 – 16:00	**Session on watershed management – Chair : Dr. P.S. Rana, Hudco**
14:00-14:45	Institutional Analysis of Watershed management – Mr. VS Saravanan
14:45-15:15	Discussant: on the paper by Prof. R. P. Malik
15:15-16:00	Open discussion – Notes for restitution taken by Mr. Augustin Maria
16:00-18:00	**Session on participative management – Chair: Dr. Devendra Gupta, NCAER**
16:00-16:30	Participative management in water supply and sanitation and its implications in the urban set up – Dr. Marie-Hélène Zérah, Institute of Research for Development, Paris
16:30-17:00	Participatory Irrigation Management in the context of Changing role Tanks – Prof. Janakaranjan, Madras Institute of Development Studies
17:00-18:00	Discussion of the paper by Prof. K.V. Raju, ISEC, Bangalore Notes taken for restitution by Mr. Alain-Louis Dangeard

Friday, 31st October 2003

9:00 – 11:00	**Session on sustainable management and the cost of public policies – Chair: Dr. P.S. Rana, Hudco**
9:00-9:30	Economics of affordable water systems – Mr. Alain Dangeard, MEED SA
9:30-10:00	An economic analysis of demand for water quality, A case from Kolkata City - Prof. Joyashree Roy, Jadavpur University
10:00-10:30	Discussion on the paper by Dr. V. Satyanarayana – Fire Project (USAID)
10:30-11:00	Open discussion
	Notes taken for restitution by Dr. Marie – Hélène Zérah
11:15-13-15	**Session on the DEMATEDEE network** (session open to the members of the network) – Moderators: Prof. Pierre-Noël Giraud and Mr. Alain Dangeard - functioning - programme of the next few months - identification of potential collaboration
14:30 – 15:30	**Findings of the Indo-French Network on "Market development of water & waste technologies through environmental economics" Chair: Prof. Ramaswamy Iyer, CPR** - restitution of working sessions by Dr. J.Ruet, Mr. A-L. Dangeard, Dr. M-H Zérah. - main conclusions - potential of the program - dissemination among industrialists and international funding agencies
15:45-17:00	**Open debate on the urban water and sanitation scenario: enterprise, job creation and alternative technologies.** **Chair: Ambassador A. R. Deo, Distinguished Fellow, ORF** Panel participants: Prof. Ramaswamy Iyer, Dr. D. B. Gupta, Dr. B.B. Gupta, Dr. P. S. Rana, Prof. R. P. S. Malik, Prof. S. Janakarajan, Prof. K. V. Raju, Prof. Joyashree Roy, Dr. V. Satyanaryana, Prof. P.-N. Giraud

B- Program second seminar Dematedee
(Market development of water & waste technologies through environmental economics)
Paris, 28th- 29th May
Ecole des Mines, 60 Bd St Michel, 75 006 Paris
Organised by CERNA, Meed SA, Centre de Sciences Humaines (New Delhi)

Friday 28th

9-9:45 OPENING SESSION: INTRODUCTION

- P.-N. Giraud, Ecole Des Mines & A.-L. Dangeard MEED SA
- A. Kumar, Indian Administrative Service

WORKING SESSIONS

10-12:30 SESSION ONE: MACRO-ISSUES AND REGULATION
Chair: P.-N. Giraud

Bernard Barraqué, Ecole des Ponts "The new French law and the 'SAGE' "

Alain-Louis Dangeard, Meed SA "Economic conditions for a new start in environmental realisations (water and waste) comparison India/Mediterranean"
Peter Börkey, OECD : "OECD and the water infrastructure in the NIS and transition countries"

14:00-15:30 SESSION TWO: WATER IN DELHI
Chair: Marie-Hélène Zerah

Hélène Farfati Leduc, Project Manager, on behalf M. J.F. Gibier, General Secretary, FENARIVE (association of water user industries) "Industry water policy: the example of the textile industry"

Suresh Rohilla, Belfast University, "Urban Water Augmentation in Delhi (a Techno - Feasibility for rainwater harvesting in and around Delhi metropolis)"

Pushpam Kumar, Institute of Economic Growth, Delhi, "Ecosystem Services of Floodplains: An Exploration of Water Recharge Potential of the Yamuna Floodplain for Delhi"

16:30-18:00 SESSION THREE: RURAL AND PERI-URBAN WATER
Chair: Joyashree Roy

S.Janakarajan, Madras Institute of Development Studies, "Peri-urban water issues"

Arvind Kumar, Indian Administrative Service "Involvement of stakeholders in installing, executing and subsequently managing the rural drinking water supply based on khammam district".

Saturday 29th

9:30-11:00 SESSION FOUR: INDUSTRY AND TECHNOLOGY
Chair: M.N. Murty

Manoj Nadkarni, CERNA, "Ecosystem approach to sanitation"

A. Comiti, FENARIVE (Federation of water using industries) "The role of industry »: recycling and relations with stakeholders".

AK Mittal: “Management and Financial aspects of sustainable water and sanitation operations: the case of Rajasthan”

Bharat Gupta, Indo-French Water cell, Indian Institute of Technology, Delhi, "Water Related Problems in India: Conventional and Emerging Technologies, with focus on the assessment of potential for cost reduction”.

11:30-14:00 SESSION FIVE: METHODOLOGIES AND ECONOMICS OF WATER
Chair: S. Janakarajan

Joyashree Roy, Jadavpur University, Calcutta “Willingness to Pay Studies – A Policy tool”

M.N.Murty, Institute of Economic Growth, Delhi University “Valuation and Accounting of Industrial Water Pollution and Design of Economic Policy Instruments in India”

Jean-Daniel Rinaudo, BRGM “Economic assessment of groundwater protection : methodology and French case studies”

Arvind Kumar: role of public private partnership for drinking water / sanitation / rural / urban water supply.

Joël Ruet, CSH-New Delhi & CERNA, Water in urban India: “The scenario, energy Linkages and private participation”

Dematedee - bibliographical note

Prepared by A. Maria

This bibliographical note aims at providing readers interested in the Dematedee problematic with a introduction to the existing work on the various subjects studied by the Dematedee network.

In order the make the use of this bibliographical note, we have presented the different reference following a thematic classification.

In the first section, we provide the reference of the major policy documents downloadable on the web.

The second section gives an overview of the academic and policy paper available on urban water issues in India. This section includes case studies of the functioning of several water utilities in India, as well as specific discussions on willingess to pay for water services, opportunities in private-public partnerships, the role of the small scale private operators, experiences in community participation, and alternative systems.

The third section looks at water resources management with a focus on irrigation and its different aspects: tank irrigation, groundwater irrigation, and integrated watershed development.

The fourth section provides information about the Indian environmental policy, its current status, and the existing studies about different options for reform.

Major policy papers

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