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Water Governance in a Changing Climate- Challenges for New Delhi, India

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ABSTRACT

Urban agglomerations like Delhi are witnessing notable demographic pressures that are projected to exacerbate further. Climate variability coupled with resource stress could further exacerbate the pressure on water resources. Decreased surface water availability could further imply increased extraction of groundwater resources. Given that heatwaves could increase, it becomes essential that the citizens have continuous access to drinking water. In this context, the paper examines the climate science-society-policy linkages in New Delhi. Issues related to provisioning of water in the context of the discourse on private provisioning vis-à-vis community lead efforts are discussed. The lacunae in The Delhi Climate Change Agenda (2009-2012) is critically examined and attempt is made to learn from an interesting experience in utility reform (Porto Algere in Brazil) and from cities which have better mechanisms to deal with climate change issues (Mexico City and New York). We argue that Bhagidari program of community participation of the Delhi Government needs to "deepen" itself and become more inclusionary. This should pave the way for a slow and steady discussion of "Rules of the Game" (Dumol, 2000) for water provisioning in the city.

Keywords: *Water; Governance; Climate Change; Delhi*

1 The views expressed are our own and may not be entirely endorsed by the Institutions, which we represent and the usual disclaimer applies.

Governement efforts to deal with scaricty mainly focus on increasing water supply, now going as far as the Tehri dam in Uttarakhand. Delhi's demands also override the needs of farmers in Harayana. Our Ecological footprint tramples on the other people's livelihoods and threatens fragile mountain landscapes. Yet perversely, while we draw upon distant sources, we're busy destroying our biggest local resource, the river Yamuna and her flood pain, which recharges groundwater for all of East Delhi. (Baviskar, 2010)

1. INTRODUCTION

The next twenty years of global demographic transformation is projected to witness a growth in the world's urban population to 5 billion and by 2030, developing countries will have 80 percent of the world's urban population[2] (UN-Habitat, 2006). Situated next to Yamuna River, Delhi is one of the world's largest urban agglomerations—an international hub for commercial, transport, and cultural activities, as well as the political centre of India, with a population of more than 13 million. The city faces numerous challenges related the public provisioning of various goods and services to its citizens and water availability in the city has not been satisfactory in the recent past (Zerah, 2000, Baviskar, 2006, Mishra and Goldar, 2008). The role of Groundwater in meeting the drinking water needs of the city has assumed greater significance and currently 50% of the drinking water needs are met from it (WDR, 2010, p.143)[3]. A recent enquiry (Rodell, *et.al*, 2009) based on satellite data for the period August 2002 to October 2008 alarmingly reveals that there has been very severe groundwater depletion in North India (equivalent to 109 km3 of water for the states of Rajasthan, Punjab, Harayana and Delhi).

It is estimated that due to climate change natural storage in the form of ice and snow in the aquifiers would be reduced, due to reduced recharge and increased artificial storage would be required (WDR, 2010, p.142). The Indo-Gangetic basin is likely to witness increased water availability from snow melt upto 2030, but gradual reductions would be

[2] The United Nations Organisation through its Millennium Development Goal (MDG) 7 aims at halving the proportion of people without sustainable access to safe drinking water by 2015. Making adequate amount of good quality water available to households reduces the hardship of poverty related issues such as child mortality and morbidity at micro level (Galiani et al. 2005; Jalan and Ravallion, 2001)

[3] The management of groundwater has become all the more important as surface water sources have become less reliable (WDR, 2010, p.412).

faced threafter and parts of the basin would receive less rains than in the past. Change in key climate variables available from various General Circulation Models (GCMs) paint an uncertain picture (Table 1) although not all agree with each other. However it is clear that the future is set to witness change in terms of both temperature and precipitation. In terms of scientific explanation, a warmer climate is 'likely' to exacerbate the intensity of hydrologic regimes as the decades progress—implying both more droughts and more floods— due to the increased water holding capacity and volatility of the warming regional atmosphere (Rosenzweig, et.al, 2008). Climate events such as heatwaves as well as present observations of climate variability are indicative of future changes that have to be dealt with—making it a strong case for climate change to be factored by city administrations. The threats of inadequater water availabilty (from both surface and groundwater sources) would prove a greater challenge in the future. This is in a scenario where already a a significant proportion of poor people are paying more for the water than the middle class residents of the city (Chandran, 2009). In this context the paper examines the challenges facing the city in terms of the vulnerabilties due to climate changes and misgovernace of the water supply provisoning. We attempt to learn from the expereince of cities in the developed and developing countries so that some practical lessons could be learn in the context of Delhi.

The IPCC defnes vulnerability as a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity. This in the present context—limiting to urban areas and impact on water resource—could mean the vulnerability[4] due to increased water stress from declines inflows that would lower the surface and groundwater capacity. Here we assume that urban ecosystems need to meet the demand of residing human populations that need access to water resources[5] in carrying out basic minimum daily activities. For Delhi—given that the city could witness higher growth in terms of residing population; a significant portion of whom are and will

[4] Various attempts have been made to quantify vulnerability; these remain mostly focused on energy consumption and Green House Gas (GHG) inventories and do not sufficiently account for factors like rural-urban dynamics. Some initiatives include the International Council for Local Environmental Initiatives and the World Bank's Global City Indicators Program.

[5] Iyer (2009) very rightly has described the dimensions for equitable use of water as being a *life support first, livelihoods next, everything else later*.

be slum dwellers (Table 1) —a long-term planning instead of current project based approach becomes essential.

Table 1: Population statistics of Delhi Metropolitan

Population	Area	Population density	Slum population as a percentage of urban population
12.9 million	9,745 sq. km	1,324 people per sq. km	34.8 percent

Source: National Census (2001) and UN Habitat (2008)

Coping or adaptation strategies become essential especially of urban populations were to be exposed to due to heatwaves and increased shortages to water supply (a huge portion of which is goint to come from groundwater sources) especially in summer seasons. We approach mitigation not only in terms of capitalizing on new opportunities from carbon sequestration potential but also as imperitives that would be required if we were to save water (not in the sense that could in future be translated to water credits – if there is going to be such a concept) but rather as water responsible behaviour towards the utilization of this scarce resource.

2. CLIMATE CHANGE IN DELHI - OVERVIEW OF SCIENCE-SOCIETY-POLICY LINKAGES OR THE LACK OF IT

It has been increasingly recognized that the challenge at the city level is to translate information from climate science into knowledge that triggers a realistic assessment of the vulnerability of a city and its systems so as to facilitate the development of pragmatic adaptation strategies (Rosenzweig 2007; Rosenzweig et al 2008; Mehrotra et al, 2009; TERI 2009a). Mehrotra et al (2009) propose an "Urban Climate Risk Framework". The framework marks three specific objectives that include: characterization of hazards associated with climate change at the city level; identification of the most vulnerable segments (people, locations, sectors) of the city; and assessment of the city's ability to adapt to anticipated changes in climate. Local climate change information is derived from the scenarios of greenhouse gas emissions and global climate model simulations. Figure 1 depicts a set of projections of temperature and precipitation.

To add to the existing conditions, climate change induced variability in rains could worsen the severe shortage of drinking water in summers and aggravate the floods in the monsoon season, thus making the existing energy shortage more challenging to address. This has been an observation for most of the cities around the world and hence, one has to be prepared for increasing risks associated with 'climate extremes' at the city level. (ibid)

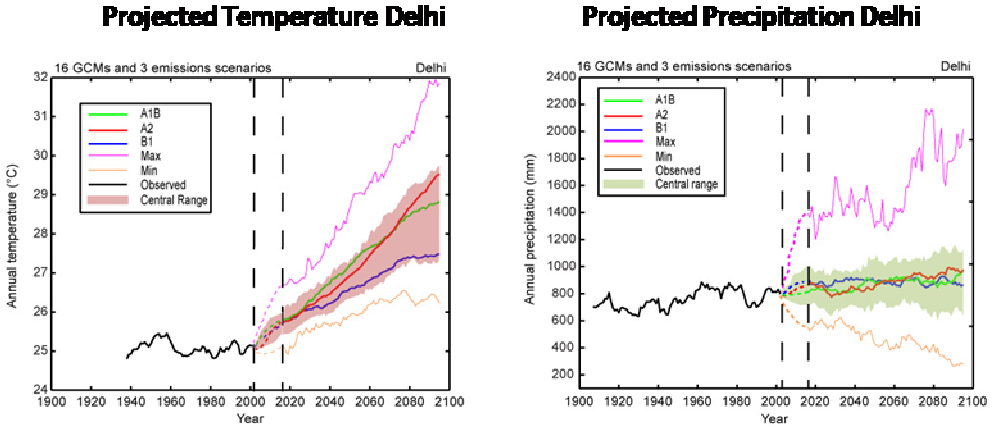

Figure 1: Projections of key climate variables for Delhi
Source: Center for Climate Systems (Columbia University)

Regarding vulnerability, it becomes essential to separately look at vulnerability that is predominantly determined by the physical and underlying social 'characteristics' of a city. Being a part of the larger ecology, these two factors are interlinked and include weather patterns, physical geography population size and composition, density, size of city, quality of infrastructure, type and quality of its built environment and its regulation, land use, governance structure and the like (Mehrotra et al (2009). A few population indicators are listed in Table 1.

The adaption strategies of the Delhi Jal Board could include energy efficiency improvement programs in water supply, wastewater treatment, and methane recovery. Delhi Jal Board has proposed a project under the Clean Development Mechanism (CDM) with the objective to reduce greenhouse gas. But the these initiatives remain project based – and concerns to address the adaptive needs of the urban poor need further momentum

especially in terms of ensuring supply of water from groundwater sources (Mehrotra *et.al* ,2009, also see TERI, 2009). There has been active engagement from the civil society and local NGO's in the city and campaigns in water harvesting are on the rise. However these civil society initatives is often not matched with the same zeal from the government's initiative and lack of coordination between departments and among levels of government continue to inhibit a faster and efficient approach.

Change in key climate variables available from various General Circulation Models (GCMs) paint an uncertain picture (Table 2) while there is no consensus across the models . However it is clear that the future is set to witness change in terms of both temperature and precipitation. In terms of scientific explanation, a warmer climate is 'likely' to exacerbate the intensity of hydrologic regimes as the decades progress— implying both more droughts and more floods— due to the increased water holding capacity and volatility of the warming regional atmosphere(Rosenzweig, et.al, 2008).Significant changes associated with climate events such as heat waves as well as present observations of climate variability are indicative of future changes that have to be dealt with—making a strong case for climate change to be factored by city administrations.

Table 2: Climate variables for Delhi

	Japanese High Resolution GCM (20 km.)	**IPCC GCMs**		**India Average Values**
	Change (2091 - 2100 vs. 1981- 1990)	**Change (2030 - 2049 vs. 1980-1999)**	**# Models Projecting Same Change**	
Mean Annual Precipitation:	4%	2%	12 out of 20	3%
Mean Annual Temperature:	3 (°C)	2 (°C)	--	2 (°C)
Heatwave Duration Index:	--	16 day(s)	8 out of 8	11 day(s)

Source: World Bank Climate Portal (reference coordinates 8° 40' 0 N, Longitude: 77° 13' 0 E approx.)

3. PROVISIONING OF WATER: A REVIEW OF EFFICACY OF PRIVATE AND COMMUNITY INITATIVES

Urban drinking water has the characteristics of a 'private good' as it is divisibile and excludabile in nature. However, for some, particulary the anti-privatisation and globalisation activitsts rally "water is a commons and a human right" (Bakker, 2007). Efforts in Common pool resource water management strategies have proven to be success under a few conditions: a small geographical area with well defined boundaries, low levels of mobility, a small community with a high degree of social capital and an overlap between residential and resource location (Bacdayan, 1974, Wade, 1998, Trawick, 2001 and Mosse, 2003).[6] This conditions often do not hold true in the context of provisioning of water in urban areas and particulary in the case of a large metropolis, like Delhi[7].

Private provisioning of water could lead to various benefits (reduced tariffs[8], greater efficency due to reduction in distibution and unaccounted losses, reduced infant mortality due to better quality water (also see Venkatachalam, 2007, p.7-8). However one of the problems in making the private sector work is to identify the rules of the game, which might take several years, especially in the case of, when they are being adopted for the first time and the trial and error method might be costily (Dumol, 2000). There are however several problems with the privatisation mode of water supply particulaly and the expereince from the Latin American experience (see the review of the Latin American experience in Bakker, 2008) warns that caution should be exercised. So the efforts towards privatisation in Delhi has to proceed extremely cautiosly and it is important that

[6] Other research points out the limitations of some of these collective action approaches in Water (Mosse, 1997, Cleaver, 2000, Mehta, 2001 and Potanski and Adams, 1998)

[7] Community governance structures however do hold importance wherein under nested governace structures, effective negotiations have to take place with public and private utilities. This is more important when private utilities are involved as the collective bargaining power of this communities could prove as checks and balances within a proper regulatory framework.

[8] In Tiruppur, Tamil Nadu, India, citizens used to pay Rs. 1000/kilo litre in the informal private water market but, once the private sector operation started, the price has drastically come down to Rs. 5/kl (Vyas, 2004)

the rules of the game are properly worked out (Dumol, 2000). Although this process is going to be time-consuming, it would be the first-best option, rather than proceeding hurriedly and then the process being stalled due to various factors.

3.1 Provisoning of Water in Delhi

The national capital territory of Delhi is part of the Indo-Gangetic alluvial plains and the river Yamuna, a tributary of the Ganga flows through the eastern part of the territory. The average rainfall is 611 mm, most of which falls during the monsoon season between July and August. The utility which has the responsibility of public provisioning of water is the Delhi Jal Board. According to the data available (Table 3), groundwater contributes only a minor portion of the water supplied by the Delhi Jal Board, latest estimates from the World Development Report suggests that in the context of drinking water, groundwater contributes 50% of the supply. It is crucial to point out that the domestic water supplied by the DJB entirely is not deemed fit for consumption as drinking water and often separate supply for drinking purposes is done during during designated times in the day and night[9]. Further, the quantity of groundwater extracted may be an underestimate as there is lack of updated data while those available at various government and non-government sources are inconsistent with each other. This also indicative that a lot of groundwater may be unaccounted and there would be a need for better reporting of groundwater and suitable protocols need to be developed.

An estimation of the costs in 1998 based on a study by an NGO, Public Affairs centre found that "hidden costs of a whopping (more than) Rs 2,100 crore were incurred by the Capital's citizens to cope with the poor quality of service by investing in items like overhead tank, water pump, borewell, emergency lights, generators, water filter and Acqua Guard"[10]. An investigation of private strategies for coping (with unreliabile public supply) found that the total annual cost of these strategies represented twice the annual public expenditure on water in Delhi (Zerah, 2000). Not only the poor, but also

[9] Often the designated timings vary significantly and household member spend anxious hours waiting for the water to start trickling.

[10] http://www.expressindia.com/news/ie/daily/19980504/12450254.html, accessed on 15th February, 2010

the middle class residents do not have a dependable source of clean water (Sengupta, S, 2006)

Table 3: Source of Water supply for Delhi Jal Board

S. No	Source	Quanitity (MGD)
1	Yamuna	210
2	Ganga	100
3	Bhakrastorage	240
	Sub total(surface water)	550
4	Ranney wells/ Tube wells	81
5	Total	631

Source: Economic survey of Delhi, 2001-02.

3.2 Domestic Water in Delhi - Problems in availability

The total renewable resources have been estimated around 290 million m^3/year. Isotopic Investigations to assess the natural recharge of NCT Delhi found that levels of recharge lower than 5% in most area, while in the urban centre, it was even lower at 3 %, Datta (1996). Therefore there are inherent limitations for supply enhancement through groundwater recharge. The inference of the data on per capita availability of water for the 1991-92 to 2006-07 period reveals that there has been a drastic decline in per capita water availability to its residents. While in 1991-92, the per capita consumption was 149 K. Lts(Table 2), by 2006-07, this had decline to 48 K. Lts (68% decline). Further there are problems of unequal access across different localities and communities in the city[11].

[11] To illustrate this point, the sociologist Amita Baviskar observes – In *a water-scarce area like south Delhi where groundwater has been sucked dry, richer residents can buy tanker-loads of water to top up their supplies for watering gardens and washing cars, while poor slum-dwellers are forced to fight over a trickling tap. (Baviskar, 2006)*

Table 4: Consumption of Water in Delhi (Per Capita)

Year	Per Capita Consumption of Water (K. Ltrs.)
1991-92	149.00
2001-02	40.00
2002-03	39.50
2003-04	39.00
2004-05	48.20
2005-06	47.50
2006-07	48.00

Source: indiastat.com

3.3 Quality of the Domestic Water in Delhi

A recent study reveals that there was a high correlation between the health of the Yamuna river and the citizens of the city (Peace Foundation, 2009) . The study states that Delhi's per capita spending on health care is thrice the national average, showing the disease burden faced by its citizens. The figures testify the state of affairs. While there were 9,750 cases of Typhoid in 200, it increased to 20,864 in 2008; while there were 0.13 million cases of diarrhoea, it increased to 0.24 million in 2007. The report states that this figures in reality would be far higher as the complete data from private health practiconers (a significant proportion of who are quacks[12]) do not reach the government recording system. A report of the Central Pollution Control Board in 2007 reported that the numer of Coliform Bacteria and Faecal Coliforn numbers to be the highest in the Yamuna, with a count of 3.2 billion MPN/100 ml and 2.3 billion MPN/100 ml respectively (MPN is the most probable number). The acceptable levels for bathing purposes, total coliform organism count should be 500 or less than 100 ml and for drinking it should be 50 or less and in Delhi this is in Billions. Not only is surface water, but groundwater is also contaminated with various contaminants – nitrate, arsenic, floruide coliforms. Certain areas also have cadmium, mercury and other heavy metal contamination also.

[12] http://www.hinduonnet.com/thehindu/thscrip/print.pl?file=2009100454110400.htm&date=2009/10/04/&prd=th& accessed on 10th January, 2010

An estimate (in 1998) based on a study by an NGO, Public Affairs centre is that "hidden costs of a whopping (more than) Rs 2,100 crore, incurred by the Capital's citizens to cope with the poor quality of service by investing in items like overhead tank, water pump, borewell, emergency lights, generators, water filter and Acqua Guard"[13]. An investigation of private strategies for coping (with unreliabile public supply) found that the total annual cost of these strategies represented twice the annual public expenditure on water in Delhi (Zerah, 2000). Not only the poor, but also the middle class residents do not have a dependable source of clean water (Sengupta, S, 2006)

3.4 Governance mechansism for water supply

The Delhi Jal Board (DJB), the nodal agency for supply of water in the city is inefficient in various grounds. While the expenses of the DJB is 1,202.27 crores, the revenue is only 564.91 crore. The leakage and loss ratio of the utility is 47%. (Ghosh and Chandran, 2009) This translates into a total loss of over 200 million gallons per day (MGD) while the total supply is not more than 720 MGD.

According to an estimate in 2000, the unreliability of water in Delhi costs annually Rs.3 billion which was double the annual municipal expenditure on water. The inequality was estimate by measuring the share of household expenditure on water or/and the investment in the equipment to procure/purify the water (Zerah, 2000). A survey by Public Affairs Centre in 2006 involving 14,165 respondents, the Delhi Jal Board was rated the worst in terms of user satisfaction (PAC, 2006)[14]. The Governance structure for water(including groundwater) in Delhi is governed by GoD(1998, 2002). The comand and control system has been ineffective and therefore not surprisingly, the regulations in terms of registration of borewells or norms for useage of water are not followed. But however recently some steps have been taken for enforcment and Special Magistrates in a court in North Delhi (Kanhayia Nagar) have fined 14 people for misuse of water. At a hearing on 30th

[13] http://www.expressindia.com/news/ie/daily/19980504/12450254.html, accessed on 15th February, 2010

[14] See A1 Table in the Appendix for some of the complaints that citizens of Delhi have made against the Delhi Jal Board.

January, challans of Rs.2000 to 9 people were issued[15]. The governance measures being adopted in terms of the *Bhagidari* approach of governance has not been of much use because there are inherent problems within the utilty, DJB, which requires strcutural reform of the utility itself . So until such structural issues cannot be resolved, attempts in involving community (such as the *Bhagidari* approach[16] of the Delhi Government) would, we argue not be of much utiilty. It is rightly observed that community governance models are only meaningful when implemented in tandem with alternative service delivery approaches (TNI, 2005).

The inefficent functioning of the public utility (DJB) is a classic case of utilities in the developing country context, and often the route suggested to solve the problem is to privatise. Such an attempt was made earlier and was rightly opposed due to the *modus-operandi* of the privatisation exercise. (Bhaduri and Keirwal, 2005). However recently, there has been some discussion of attempts to privatise[17]. According to the Delhi Chief Secretary Mr. Mehta the objective of the privatisaton exercise was to bring down the distributon losses, especially in the context of Delhi having any new source of water for the next 8 years, while population is expected to increase. The Chief Secretary's response reflects thinking from a Malthusian mindset. There is no sensitivity to issues related to efficency in water use (both surface and groundwater) and regulatory mechanism to ensure optimum utilisation. The water activists (under the umbrella of Citizen's Front for Water Democracy) contend that this is a

> "continuation of the trend of selling basic natural assets of the city to global corporations…For the last 15 years, the agency has been outsourcing work to private agencies in every area, from distribution to the laying of pipelines to sewage rehabilitation. But have we seen any positive result?" (Sardar Ahmad Naqvi, Convenor of Citizen's Front for Water Democracy)

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[15] Ramachandran, Kak Smriti (2010)

[16] http://en.wikipedia.org/wiki/*Bhagidari*_System accessed on 9th January, 2010

[17] http://www.indianexpress.com/news/djb-to-rope-in-private-players-activists-cr/500137/, accessed on 5th January, 2010

This is the current status-quo scenario as far as reforms of DJB and therefore public provisioning of water is concerned in the metropolis (in February 2010). We now proceed to examine the empirical evidence of cities in the developing and developed countries who have attempted to solve the problems relating to the governance mechanism and put in place systems to tackle the emerging issues related to climate change.

4. REVIEW OF INTERNATIONAL EXPERIENCE

There are inherent limitations of the community water supply models and the experience of Cochabamba, third largest city in Bolivia could provide some useful lessons for Delhi. Similar to Delhi, in Cochabamba, while wealthy consumers and business received municipally subsidized water, half the cities residents who lived in poor neighbourhoods relied on water delivered by tanker trucks, private wells or small scale community water systems. There were attempts to privatize the utility in 1999 with two large water companies being involved (Betchel of USA and United water of England). There were wide spread protests in 2000 with thousands taking to the streets. Eventually the privatization process was stopped and there were attempts to gain greater 'social control' over the water utility. But this did not happen, two rounds of elections of community representatives to the board attracted less than 2000 voters in a city of 6,50,000 and this was attributed to the suspicion of government as a means of advancing elite interests. The utility continued to be corrupt, inefficient and leakage continued to drain both the financial and water resources of the utility.

We have a similar situation in Delhi, wherein the DJB continues to be 'inefficient', while previous attempts to reform, thorugh privatization were opposed for the right reasons as the rules of the games where highly unfavourable (see Bhaduri and Keirwal, 2005). But DJB continues to be inefficient leading to distress to its citizens and the financial viability of the utility itself is in question. The situation is going to worsen due to increased demands from a rise in the population of the city and with a further pessimistic assumption the regulation and controls in efficient use of both surface and groundwater are not going to be put in place at least in the short term. Moreover the failure in the

agriculture sector even this year due to drought[18] has resulted in migration to cities including Delhi implying additional stress due to increasing demand for potable water.

The *Bhagidari* approach of the Delhi Government to involve communites is, we argue, exclusionary in nature. The resident associations that are to be part of the governance process involve the middle class and richer sections of the urban populace, while there is no representation, even notionally of incorporating the interests of the vast population that reside in authorized and unauthorized slums in the city. The interventoin in terms of organising these communities is limited to the attempts of a few scattered NGOs. Such an approch of the Delhi Government supports the argument of Chatterje (2004) of the exluding nature of the 'modernization project' (*our useage*) of the State.

An interesting experience, from which Delhi could learn is the experience of Porto Algere in Brazil wherein alternative governance and business models are combined in the utility – DMAE. The utility is fully self financed with a progressive tariff structure (with cross subsidies) with nearly 100% coverage of water supply despite recent population growth. With a low non-payment ratio and high approval rating, DMAE is one of the best utilities in the developing countries. However, replication would not be easy and Chatterje (2004) rightly explains that political culture is important, and in the context of developing countries wherein exclusion has been an integral part of the 'modernization project' of the state, were only a sub-set of the citizens are identified as 'full citizens' with a full set of rights and entitlements.

4.1 Lessons from two cities

Cities (New York; Quebec and Mexico) around the world have become successful models of local governments and many are proactively engaged in integrating climate risks in city resilience strategies. We now draw on the study of the New York and

[18] Deficient monsoon and drought have affected 316 districts in 13 states in 2009. This has been reported by the Reserve bank of India and is available at www.rbidocs.rbi.org.in/rdocs/Publications/PDFs/02MMDOUT0110.pdf

Mexico city successful models of a proactive and informed city that consider climate risks in city management strategies.

The New York City's Office of Long Term Planning and Sustainability (OLTPS) was set up in 2006 as the Mayor's Advisory Board for Sustainability and is a special body that coordinates and oversees efforts to develop and implement a long-term strategic vision for the City's future by working with city agencies, universities, scientists and experts and communities themselves and the. One notable initiative of the OLTPS has been the PlaNYC – launched by Mayor Bloomberg in June 2007 – the plan aims to provide a comprehensive sustainability plan for strategic management of the city's resources to meet growing demands of the population. The plan has the following elements: Land; Water; Air; Transportation; Energy; and Climate Change. In terms of water management the city has adopted strategies that include establishment of Water Network for increased vigilance to counter encroaches on the city's watersheds, ensuring quality of our water at its source by building new filtration plants and storm water runoff management. The approach has been seen as involving well monitored community led management of water resources.

A principle lesson to be learnt by Delhi from the NYC model could be the involvement of various stakeholders in activities like water extraction vigilance and vulnerability assessments. The detailed mechansim for identifying all the stakeholders coherently and their active participation in such an exericse is an arena for future work for the Delhi Government, building upon the *Bhagidari* model of governace with conscious attempts in 'deepening' governance. However, there should be clear postive and negative incentives for the stakeholders, else such a participation would remain only at the level of rhetoric

This Mexico City Climate Action Program (2008-2012) sets a road map for a proactive climate program by the Mexico City government to further the framework of the Mexico City Environmental Agenda and the Green Plan. The Program deals with a set of city level actions – these actions include public policies and sector specific actions. The water actions include two specific action plans –one focused on mitigation and Green House Gas reduction and the other is focused on adaptation. In the water sector, the former

primarily deals with the reduction of GHG within water related activities in the period 2008-2012.; the adaptation is outlines three forms of micro-basin management: Soil and water conservation projects, rural development and soil and water conservation on agricultural lands and urban ravines.

Lessons from the Mexico and New York model include a clear vision and action strategy for both supply and demand side of groundwater management. In context of climate change and groundwater management, there will be increasing to focus on water efficiency, interlinked energy efficiency and reduction of GHG through better waste-water and solid waste management. More so the capacity at the local level will become important so that there are networked communities that will manage and monitor the consumption of water resources. Moreover there would be a need of coordinated action not only across the government departments but with the civil society at large, including the academia, local NGOs and communities themselves. Thus overarching all this, there would be a requirement for local governments to recognize the potential implications of climate change and be proactive especially if they were protects the increasing population of the urban vulnerable. The Mexico model teaches the importance of deployment of water efficiency (along with energy efficiency) technologies – this approach leverages on both mitigation and adaptation strategies.

4.2 A critical appraisal of the Delhi Climate Change Action Plan

Mr.Rakesh Mehta, Chief Secretary (Government of National Capital Territory of Delhi) and Chief Minister Ms. Sheila Dixit launched the Climate Change Agenda for Delhi 2009-2012. This policy document follows a ‘sector specific’ and ‘target oriented’ approach that aligns with the National Action Plan on Climate Change (NAPCC) and ‘outlines’ encouraging actions relevant to city governance in context of climate change. However the implementation agencies principally remain to be the line departments with little or no linkages with the civil society. Principal water specific implications are largely focused on addressing pollution of the Yamuna River, new infrastructure for waste water treatment, improving waste treatment for sewers and revitalizing of traditional water bodies.

Some specific lacunae in the action plan are as follows:

(a) Given the water supply irregularities, particulary in the context of groundwater assuming a greater significance (WDR, 2010) and the variationsin surface water availability addressing problems relating to groundwater depletion assumes increased importance. Since the scientific evidence (Datta, 1996) suggest that groundwater recharge may not occur in any significant manner, there is a stronger reason to protect groundwater sources. Further it is extremely neccesary to examine conjunctive use and linkage between surface and groundwater resources. For example, the Yamnua river and the flood plain recharges a significant part of East Delhi. Only when we have sufficient surface flows of good quality water, would the groundwater resources be protected. It is imperative for the bureacurats and policy makers to understand such synergies in the water resource regime so that meaningful and concrete action plans could be implemented with efficay.

(b) Another crucial lacunae is there is no mention of Drinking water in the Action Plan. The myopia of the bureacurats on this issue is a cause for concern but also opportunity to articulate that the action plan is incomplete and a comprehensive revamping might be required to comprehed the challenges being faced. We suspect that very less inputs from the academia has gone into the preparation of the action plan and this needs to be rectified at the earliest.

(c) *Consulta previa* with local communities become important especially so that issues of concern to them regarding resource use are clearly articulated before local action plans designed; so that these plans benefit the most vulnerable sections of the society (TERI 2009b, Noronha 2004). This is a very challenging process as the most urban vulnerable may not be in a position to predict the state of future urban systems and so decison-making continues to be in the doman of a few handful. However there is a need to involve a consultative process wherein knowledge, information, and specially best-practices cab be disseminated. The Delhi Climate Action Plan again falls short of detailing this.

(e) Access to potable water for basic human needs is an approach that needs to be considered as essential part of urban adaptation strategies. For this apart from technological interventions, regulatory frameworks[19] could play an important role in ensuring minimum water availability (Iyer, 2009) Also specifically for groundwater, absence of uniform law or policy pertaining to use of groundwater in India and groundwater remains tied to land rights (TERI, 2009b).

(f) The action plan does not list of mitigation activities such as reduction of energy consumption by deployment of energy efficient technologies[20] at point sources along the groundwater chain including extraction, usage and treatment. Also it fails to list of water saving technologies or a plan to promote vigilance[21] and regulation of groundwater extraction along with initiatives of public awareness.

5. CONCLUSION

Urban areas are going to face increasing demand of potable water of which a large portion is going to have to come from groundwater sources; this is primarily going to be as a result of growth in urban population and based on the assumption that regulation and controls to facilitate efficient utilization is going to be weak/totally absent. Moreover, reduced inflows in rivers and surface water could further act as a double stress factor on groundwater resources. Additionally, extreme weather events such as heatwaves and water shortages during peak summer season could limit the adaptive capacity of the vulnerable urban populations.

The Delhi Climate Change Agenda (2009-2012) is encouraging way forward that indicates that decision-makers are already willing to factor climate change for a long-term roadmap. However to truly ensure water security in urban regions, we need an

[19] Iyer (2009) gives the example when South African president Thabo Mbeki in 2001 had announced a "Free Basic Water Policy", under which on the basis of 25 litres per capita per day and 8 persons per family, the provisio1n of 6000 litres per month to a household free of charge was envisaged. Also available at http://www.anc.org.za/ancdocs/anctoday/2001/at24.htm
[20] See the Mexico city model
[21] See the New York City model

approach that compliments the willingness; for this many lessons can be learnt from city initiatives like New York and Mexico. The Mexico model teaches us of incorporation mitigation activities relating to reduction of energy consumption by deployment of energy efficient technologies at point sources along the groundwater chain including extraction, usage and treatment. Lessons that we learn from the New York model include promotion of community-based vigilance and greater stakeholder involvement along with initiatives of public awareness.

In terms of the public provisioning the Porto Algere experience could be useful in the context. We need to reform the utility and either privatize or corporatise it with sufficient community involvement and the participatory budgeting exercise could help us. The *Bhagidari* program of the Delhi Government needs to "deepen" itself and more inclusionary process of community participation should pave the way for paving for a slow and steady discussion of "Rules of the Game" (Dumol, 2000).

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Appendix

A1- Consumer Complaints on the Delhi Jal Board Registered Online[22]

We are making this complaing that we are suffering with scare city of water in 31 block west patel nagar New Delhi. Met politician , Engineer of Delhi Jal Board also. But no result. Continue 3 days water supply is not there it is regular feature of our block. If Board supply water it is up to 10 minute only. Can any body survive with this. This is really shame on us as a citizen of India. We are income tax payee and other tax are also paid as per the rules. Following all the rules made but sorry to say that Delhi jal Board never think that this is a right of every citizen of india to get water as a fundamentle right. Because of the indisperity of Govt office one persone become helpless and forced to raise voice against the corrupt officer. if they will not resume the continue and smooth supply definetly we will file a case against the currept officer of patel nagar and also make complaint in Sonia darbar to get the justice

http://www.consumercomplaints.in/complaints/water-not-supplied-c252790.html, accessed on 17th February, 2010

*There is no water supply for the last 25 days in EG Block (Inderpuri) . In spite of repeated complaints and the assurances from the officials of Delhi Jal Board the water supply has not been restored causing undue hardship to the residents of these block who are living on the tail end of the street as any water released is pumped by heavy motors installed by the residents who are living in front row depriving us from getting any water. There are also taps attached to the main pipeline which are always found to be running and lowering the preassure of water which could not reach the exact destination.*Kindly look into this and save us from lving a miserable life without water

http://www.consumercomplaints.in/complaints/no-water-supply-in-eg-block-inderpuri-c175684.html accessed on 17th February, 2010

[22] The readers may note that this complaints have directly been taken from the website and there is no attempt from us to correct the spelling and grammatical mistakes of the person making the complaint. The message does come across, without the need for us to do any corrections.