Size matters: plans for the Upper Thames reservoir and the new environmentalism.

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SYNOPSIS. Thames Water Ltd is planning to construct, over farmland near Abingdon, a very large reservoir (100 MCM) for completion by 2026, mainly to supply London. The social and historical context of this Upper Thames Reservoir (UTR) is explored. Water transfers from the Severn catchment as proposed by the Water Resources Board in 1974 to supplement storage are not included in the present plans. Nor is heed taken of Thames Water Authority planners who argued in 1981 that small, environmentally-sensitive reservoirs could be just as economical as the huge.

More recently, a new environmentalism has developed. This encompasses anthropogenic climate change and produces both anxiety and hopes that dire consequences may be offset by urgent human actions. In response, many changes of significance for energy and water supply planning are underway. Emerging decentralised technologies focusing on combined heat and power and renewable energy lessen water demand, promise more accountability, more co-operation from the public and more integration between production and use of energy, water conservation, waste disposal and improvements in habitats. The emphasis on local initiatives for sustainability and consequent predicted reduction in demand for water supply suggests a reappraisal of the case for an UTR on the scale proposed.

INTRODUCTION

The size of reservoirs reflects economic, social and political issues as well as engineering possibilities. Flows of political power and of public and private capital affect our waterscape. Realisation of the enormity of human interventions leads to increasing anxiety about lack of control. “Small is beautiful” wrote Schumacher in 1974, referring not specifically to reservoirs but to harmful applications of technology generally:

> Scientific or technological ‘solutions’ which poison the environment or degrade the social structure and man himself are of no benefit, no matter how brilliantly conceived or how great

> their superficial attraction. Ever bigger machines, entailing ever bigger concentrations of economic power and exerting ever greater violence against the environment, do not represent progress: they are a denial of wisdom. Wisdom demands a new orientation of science and technology towards the organic, the non-violent, the elegant and beautiful. (Schumacher 1974, 27).

This challenge to easy acceptance of 'economies of scale' and to conventional ideas of progress exposes links between technology, concentrations of power and social structure, whilst raising ambitions for aesthetic enjoyment as well as profit and economic gain. The ideas of Schumacher remain an inspiration for many environmentalists.

In contrast, the "imperatives of engineering" claimed by the engineer and historian, Eugene Ferguson, "favor the very large, the very powerful, or – in electronics - the very small" (quoted in Davis 1998). The large project needs the engineer and provides interesting technical challenges. In favouring the large, the civil engineer has allies in economists such as Beckerman and Swanson who privilege the benefits of economic growth (including clean and reliable water supply) over possible environmental damage in their book "Small is stupid". Yet large reservoirs may prove to be wasteful investments if the predicted demand for the stored water does not materialize.

The question of size is also political. Large scale reservoir construction, even if drawing on private investment, demands the power of the state to enforce compulsory purchase and to move people and houses. The territorial separation of those people who would suffer from the intrusion of a large reservoir from those who stand to gain introduces social tensions which provoke opposition, sometimes violence, and costly planning delays.

In this paper, the question of reservoir size will be illustrated in the context of a current proposal by Thames Water Ltd to build a large (100MCM) and very extensive (14 square kilometres) reservoir over farmland near Abingdon. This Upper Thames Reservoir (UTR) proposal will be considered at a public inquiry in June 2010, although the completion date for construction has been postponed to 2026.

HISTORICAL BACKGROUND

Debate over construction of reservoirs for water to supply London has waxed and waned. Suggestions in the 19th Century of damming the Thames' Kennet tributary or for bringing water by pipeline from as far afield as the Lake District were discarded in favour of reservoirs nearer the city in the Lee valley and large pumped storage reservoirs, built near Staines in the outer suburbs of London from 1903 to 1974. Further enhancement of supply was suggested by the Water Resources Board (WRB) in its final plan in 1973.

The WRB concluded, after nearly a decade of study, that there was no “intrinsic shortage of water in England and Wales”. Problems arising from uneven distribution of available water over both time and place could be overcome by a combination of intermittent transfers of water from areas of surplus to areas of shortage, as well as reservoir and groundwater storage. The WRB predicted that by 2001 the Thames could be augmented by a proposed new reservoir at Otmoor near Oxford, a groundwater scheme in the Kennet basin and water transfer from a regulated River Severn, supported by new or enlarged reservoirs in Wales as well as at Longdon Marsh in Gloucestershire. Transfer from a Dee or Wash estuary storage scheme was another dream.

During the last three decades, there has been very little investment in large reservoirs in England. The waterscape in 2001 turned out to be very different from the one portrayed in the 1973 WRB forecast. No reservoirs were built in estuaries, and Otmoor plans were defeated by public opposition. No water has been transferred from the Severn to the Thames for supply to London. Demand for water did not double. The economic context of decline in manufacturing industry and the political context of rising power of environmentalists undermined ‘rational’ plans based on too few premises. Analysts also note a “collapse of the notion that civil engineers could roll out integrated infrastructure rationally to meet perceived needs, whilst abstracted from the social and political worlds” (Graham & Marvin, 2001). Opposition, politically and socially, to imposition of national plans has been fuelled by globalisation, the failure of communism, doubts about legitimacy, growing awareness of environmental issues and the value of the diversity and spontaneity of market choices.

Although the Environment Agency reports “total demand for public water supply in England and Wales has remained broadly constant in the last decade at 15,000 Ml/d” (2006), four recent droughts in the South East (1974-76, 1990-92, 1995-97 and 2004-06) and increasing population have revived plans by Thames Water for a large reservoir near Abingdon. Rather than choosing the WRB’s option of intermittent transfer from the Severn basin, which would involve costs of pumping over the watershed, and, perhaps more importantly, purchase of water during a drought from another privatised water company, a site first identified in the mid 1970s as a possible alternative to Otmoor has been selected for the UTR. An application for development of a reservoir on this site was first made in

1991 but the planning application was withdrawn in 1993 in the face of opposition and development of alternative sources of supply. The potential reservoir, then called the South-West Oxfordshire reservoir, was included by the National Rivers Authority (now the Environment Agency) in its strategic review of water resource development options in 1994. The site was chosen as one of the few large sites available on impermeable rock strata, relatively free of settlements, main roads or railways and within reach of the River Thames, which is planned to be used both as a source of water for storage and as a conduit for water to the main consumers downstream.

The enclosing dam of the UTR would rise to as much as 25 metres above the flat clay floor. Unlike Rutland Water, which has moulded itself to natural contours on most of its circumference, the UTR would be surrounded entirely by an artificial dam creating a new, simplified landscape, intruding on a well-loved scene. Extensive rural views over the flat clay Vale of the White Horse to the distant Wantage Downs would be blocked by man-made embankments. Nearby villagers fear diminution in the value of their properties, once under the shadow of the dam. During the long construction period, increased construction traffic and diversion of a minor road would cause disturbance and recreation facilities on the reservoir would change the rural landscape. About 1400 ha of farmland would be lost to cultivation. Such a huge reservoir magnifies risks. Evaporative loss of water would be large; high storm waves would develop with the long fetch. Dam break, malicious or accidental, although unlikely, would be catastrophic. In seeking water so far from its beneficiaries, the antagonism of the local people grows. Resentment is already felt as Oxfordshire receives waste from London

Environmentally there are risks also. Water to fill the reservoir would be withdrawn from the Thames reducing the flood cleansing of the channel. Cool water discharged from the reservoir in summer would disturb those fish and other wildlife adapted to natural temperature variations. Withdrawal of the reservoir because of any contamination would be a serious supply loss. The quality of the water to be released from the reservoir would need to be carefully monitored. Releases, if sudden, would affect the recreational boating and fishing on the river.

AN ALTERNATIVE VIEW ON DESIRABLE RESERVOIR SIZE

The art of the possible, the largest feasible engineering project with promise of economies of scale, has not always been the aim of those custodians of the Thames with responsibility for supplying potable water to the London region. In 1981, a remarkable alternative view was put forward by the Planning Directorate of the Thames Water Authority. Rather than looking to build further large reservoirs to supply London, it was proposed “to set aside engineering and size consideration and seek sites which are primarily acceptable in terms of land use and environmental value" (Sinnott and Davies 1981). By seeking environmentally-acceptable sites rather than technically ideal ones, new possibilities opened up for using reservoirs to enhance landscape. Former gravel or brick clay pits could be harnessed, derelict and unsightly land could be hidden beneath the reservoir water, sites polluted by aircraft noise could be employed and settlements in need of recreational facilities areas could be favoured. Wildlife corridors or stopping places on the paths of migrating birds could be prioritised.

The authors countered two obvious criticisms to their revolutionary proposals by investigating the economics of constructing small reservoirs and the means of overcoming geological problems of building reservoirs on porous rocks: a) Higher construction costs for several smaller reservoirs which would be needed to gain the capacity of a large reservoir could be offset by lower costs generated by long delays in planning. (By 2026, the UTR will have had 50 years' gestation with high expenditure on feasibility studies, consultations and legal costs); b) Geotextiles could prevent seepage.

Speed of construction and the possibility of a closer match between supply and demand would have significant economic attractions. Instead of lumpy investment with all the associated problems of fluctuating interest rates, new reservoirs could be brought on stream at favourable times. (By way of contrast, the construction of the large Kielder scheme 1978-82 involved borrowing some of the capital at very high interest rates, which added a legacy of high costs to water consumers in the region (McCulloch 2006)

Sinnott and Davies concluded from their study that "there need be no financial penalty arising from the choice of smaller reservoirs suitably located to meet environmental constraints" (Sinnott & Davies 1981, 229).

CHANGING POLITICS.

Since the 1980s there have been important changes which affect plans for the size of reservoirs. The creation of Water Authorities with wider responsibilities than the previous River Authorities expanded the possibilities for water supply, conjunctive use and creation of positive rather than negative externalities. Both authorities, as governmental bodies, needed to consider how their plans fitted with other national and regional plans for social or economic betterment. In 1989, privatisation led to the emergence of a different dynamic. Planning and development of linkages between different aspects of urban development became eroded. Analysts note that "given the long-term and risky nature of infrastructural investment…investors will tend to demand a project-by-project risk assessment identifying individual revenue and profitability streams for particular infrastructural developments, within tight definitions of accounting that minimise social or geographical cross-subsidies" (Graham & Marvin, 2001, 93). The vision of Sinott and Davies of the wider social and environmental benefits of small reservoirs is replaced by a tendency for private investors to require large discrete projects.

A further political incentive to "think big" when designing the grandiose UTR is new legislation[1] devised to secure speedier planning decisions taken at a national level for large infrastructure projects, although local objections would be heard and Parliamentary scrutiny permitted. The UTR "is of sufficient size to fall within the scope of the new National Policy Statements." (Defra letter announcing the Public Inquiry 03/08/2009).

CHANGING DEMAND AND THE NEW ENVIRONMENTALISM

Size of reservoirs depends on projections of demand for at least their economic life, the time needed to recoup the investment. For a water supply reservoir this may be considerable and the continued functioning time may extend well over a century. Forecasts of demand for surface water storage over such a long period as a century are notoriously difficult to make: industries may come and go; industries may adopt water recycling and reuse; power generation methods may change from high consumptive to low consumptive water use; farming may or may not become more intensive using irrigation; alternative water sources such as groundwater may become less available; household demand changes with number and size of households; with change in hygiene; with use of water in gardens; with changes in popularity of outdoor swimming pools; with increasing water efficiency of household equipment and with leakage controls in water supply systems. In view of large errors made in the past, careful observation of incipient social trends needs exploration before a very large reservoir is built.

Considerations of climate change suggest that the past cannot be used as a reliable guide to the future. UK's Climate Projections (UKCP09) show that this Thames region is likely to experience hotter, drier summers; warmer, wetter winters and rising sea levels within a matter of decades. This new environmentalism, which encompasses anthropogenic climate change, increases anxiety whilst simultaneously raising hopes that dire consequences may be offset by urgent human actions. Mitigation of carbon-induced climate change becomes elevated in priority above other human and environmental problems. The resulting melding of science and policy (van der Sluijs et al 1998) since the first international assessment of global

[1] http://www.communities.gov.uk/documents/planningandbuilding/pdf

anthropogenic climate in 1979 has been translated by the UK government into legally-binding agreements to reduce carbon emissions by 34% by 2020 and at least 80% by 2050 (Climate Change Act 2008).

The changes underway to meet these targets will have a profound effect on water storage planning. The UTR has been postponed until 2026 but, by then, many important changes are likely. Whilst the predicted longer droughts and hotter summers would increase demand, many of the responses to the threat of climate change will lower demand significantly. In view of this uncertainty, together with fluctuating economic conditions, a more flexible and gradual approach to increasing water storage may optimise fit of supply with demand and ensure that major investment is made when capital can be raised most cheaply. Such an approach is endorsed in the latest Environment Agency report:

> Incremental solutions are needed to deal with uncertainties as they arise. We need to make sure we take a flexible approach to allow us to adapt to a changing climate. We also need to make sure that we are taking actions to not only adapt to a changing climate but also mitigate against increasing greenhouse gas emissions. (Environment Agency, 2009)

In the case of the Thames River, the largest abstraction of water is for cooling during electric power production at 2000MW Didcot A and 1360MW Didcot B Power Stations, supplying the National Grid. The Government's Water Strategy for England, 2008 is surprisingly nonchalant about such consumption in power generation which the Strategy falsely claims as relying "on direct non-consumptive abstractions and the water is readily discharged back to the environment with limited associated environmental costs." (p 20). Yet whilst 71% of the 45 million gal/day[2] of water taken from the Thames to Didcot Power Station is returned, 29% is lost by evaporation. This amounts to a consumption of 13 million gals each day or 59,000 CM/d (> 21 MCM pa) water loss from the cooling towers. Didcot A is scheduled for closure in 2016; if it were replaced by a power station with a dry cooling system, almost a third of the supply from the UTR could be met. Such dramatic water savings, which are achievable by applying innovations in dry or hybrid cooling, promise to be matched by water savings associated with increased use of wind power and combined heat and power (CHP) plants. By 2020, 40% of the UK's electricity is hoped to come from low-carbon sources, from renewables, nuclear and

[2] Figures provided in Didcot Power Station Technical Publications Department, CEGB Midlands Region MID/1667-6-81

clean coal (The UK Low Carbon Transition Plan 2009). A priority is the development of a Smart grid better able to respond to variable inputs.

RESPONSES TO CLIMATE CHANGE: WOKING AND LONDON.

Large-scale, centralised infrastructure for distribution of power and water is challenged by political and social changes in response to threats posed by climatic change. Modifying lifestyles to lessen environmentally-damaging consumption is difficult, especially when the links between sacrifice and benefit are unclear to the people expected to volunteer. Local action is seen as a way to engage the public in waste reduction and reduced consumption. Decentralised technologies promise more accountability, more co-operation from the public and more integration between energy production and use, water supply, flood defence and better waste disposal.

A lead has been taken by Woking (pop. c 90,000) in Surrey on the outskirts of London. In the belief that the large-scale National Grid, fuelled by fossil fuel power stations, is the primary contributor to UK's carbon emissions, Woking Council established, in 1999, its own combined heat and power (CHP) company Thameswey Energy. Electricity from the CHP plant is cheaper, and separate from, the National Grid and district heating is supplied to civic offices, residential homes and surrounding businesses. The town's electricity distribution system is also fed by dispersed hydrogen fuel and solar cells; all are operated by a joint venture Energy Services Company (ESCo). Off-grid electricity producers do not have to pay the Climate Change levy but currently are limited by national regulation in the amount of electricity and number of customers that can be supplied. CO_2 emissions have been reduced by 21% since 1990. Woking has won three Beacon awards for its environmental actions, including education on water saving (Woking 2007).

Inspired by the success of the Woking scheme, the 2005 Mayor of London set up the London Climate Change Action Agency (LCCA), importing as its CEO the official who had trail-blazed the scheme in Woking. The aim was to develop public private partnerships (PPPs) to develop more ESCos for CHP linked with energy efficiency, rainwater harvesting, sustainable drainage and education programmes. In 2008, the LCCA was absorbed into the London Development Agency. The new Mayor continues to support the greater use of renewable and low carbon generation technologies, and has set a target for London to generate 25 per cent of its heat and power requirements through the use of local, decentralised energy (DE) systems by 2025 (The Mayor's plan 2009).

So far, this £78 million programme has initiated 12 ESCos (2009). Also, water "neutrality" is the target for all new developments, such as the Thames Gateway. Other councils are expected to follow these pioneers.

CONCLUSIONS

Ambitious government targets for carbon reduction encourage decentralised energy production and localised programmes to promote wiser water use. The lessons of Schumacher may yet be applied. Resilience to climate change may lie in small-scale energy production and investment in relatively small reservoirs. A reappraisal is needed of the case for an UTR on the scale proposed. Size and flexibility matter more in times of rapid change.

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