

## Directive CR/E02/001

First Consultation on the Price Control for Abu Dhabi  
Water & Electricity Company

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# FIRST ADWEC Consultation Paper

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## **Foreword**

This consultation paper sets out the main issues to be considered in setting the first price controls for the Abu Dhabi Water and Electricity Company (ADWEC).

The price controls have effect from 1 January 1999 and have been developed by the Regulation and Supervision Bureau (the Bureau) in accordance with the Bureau's Primary and General Duties in Articles (53) and (54) of Law No (2) of 1998.

ADWEC has no direct competition and is therefore able to exercise monopoly power in setting terms for the purchase of water and electricity from generation and desalination companies and the terms of the 'bulk supply tariff' for the sale of water and electricity to the DISCOs. The Bureau has not yet determined the values to be taken by each element of the price control formulae, the so-called 'notified values'. This consultation will allow the Bureau to consider the views of ADWEC and others in setting these values.

The main objectives in setting the price controls will be to protect customers, while providing incentives to ADWEC to improve efficiency. The Bureau expects to publish price controls for consultation in November and final controls in December. Comments on the matters raised in this paper are sought by 10<sup>th</sup> November. Replies should be sent to:

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P.O. Box 32800  
Abu Dhabi

Comments submitted to the Bureau as part of the consultation exercise will be made publicly available. Please make it clear if your comments must be regarded as confidential.

Graeme Sims

**General Manager**

**The Regulation & Supervision Bureau**



## Part I: Background

### 1. Industry Structure

1.1 The emirate of Abu Dhabi has embarked on a broadly scoped privatization programme for its water and electricity sector. As part of the privatisation programme the water and electricity sector has been extensively restructured and all assets previously managed by the Abu Dhabi Water and Electricity Department (WED) transferred to a number of new entities:

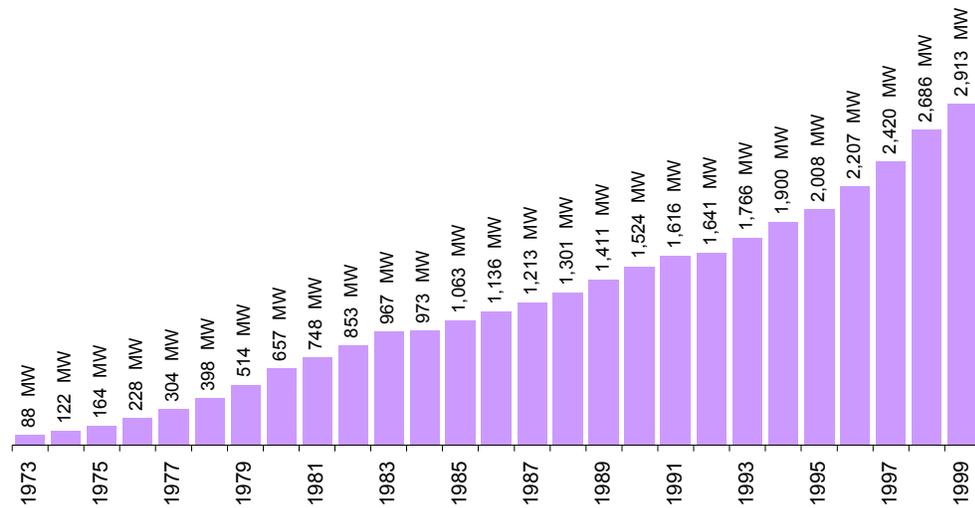
- Some 3000MW and 200MG/d of electricity and water production capacity have been vested in four generation/desalination companies: **Bainounah Power Company (PC)**, **Umm Al Nar PC**, **Al Taweelah PC** and **Al Mirfa PC**. Independent water and power producers (IWPPs) will have an opportunity to build, own and operate new power/desalination plants needed to meet the emirate's future requirements. The first such IWPP is under construction at the Al Taweelah site. Capacity additions will be procured by the Abu Dhabi Water and Electricity Company (ADWEC).
- The **Abu Dhabi Transmission and Despatch Company** (Transco) has assumed responsibility for the development, maintenance and operation of the water and electricity transmission systems in the emirate of Abu Dhabi.
- Two distribution companies (DISCOs), **Abu Dhabi Distribution Company** (ADDC) and **Al Ain Distribution Company** (AADC) are responsible for the distribution and supply of water and electricity to customers in their respective areas. The **Abu Dhabi Company for Servicing Remote Areas** (ADCSRA) is a vertically integrated entity responsible for the production, distribution and supply of water and electricity to customers in remote areas and islands within the emirate that are not connected to the main systems. ADCSRA also operates the well fields that provide a significant proportion of the emirate's water needs.

- **Abu Dhabi Water and Electricity Company (ADWEC)** is a new entity responsible for the procurement of water and electricity production capacity, ancillary services and fuel supplies necessary to ensure that, at all times, all reasonable demand for water and electricity in the emirate of Abu Dhabi is satisfied.
- 1.2 **The Regulation and Supervision Bureau** is the independent regulatory body set up to oversee the functioning of the reorganised water and electricity sector. Any person or entity wishing to operate in the water and electricity sector requires the Bureau's authorization. The main form of authorization is the licence. The Bureau has licensed the new sector entities described above. It is principally through the conditions of these licences that the Bureau exercises control over the sector.
- 1.3 It is envisaged that the sector will eventually reflect a mix of private and government ownership. ADWEC, Transco and ADCSRA are expected to remain in government ownership. The Generation/Desalination companies and the two DISCOs are expected to transfer to private ownership. This process is already underway with the intended sale of a large minority stake in the Taweelah A1 plant (part of the Bainounah PC) to one of a number of short-listed international power companies.
- 1.4 The remaining sections of Part 1 provide further detail of ADWEC's legal obligations and outline the context in which the initial price control will operate. Part 2 discusses the price control issues on which views are sought.

## 2. Growth in Electricity and Water Demand

2.1 ADWEC has assumed procurement responsibilities in a market experiencing strong demand growth for both water and electricity. Chart 1 shows the growth in electricity peak production<sup>1</sup> by stations on the main Abu Dhabi system subject to central despatch. Production units connected to the Western Region system are not at present centrally despatched. By 2000, the Western Region system will be connected to the main system and all major generation/desalination stations will be subject to central despatch. Over the period shown in the chart, peak electricity production increased at an annual average rate of 14.4 per cent.

**Chart 1: Abu Dhabi System Peak Electricity Production: 1973 – 1999**



Source: ADWEC Operating Results (1998) & ADWEC provisional data for 1999

2.2 The increase in electricity peak production has been higher in some periods and lower in others. For example, between 1973 and 1980 peak demand on the Abu Dhabi system (excluding Western Region) increased at an annual average rate of 33.3 per cent. Between 1980 and 1990 the rate of growth slowed to 8.8 per cent and slowed further to 7.5 per cent between 1990 and 1999.

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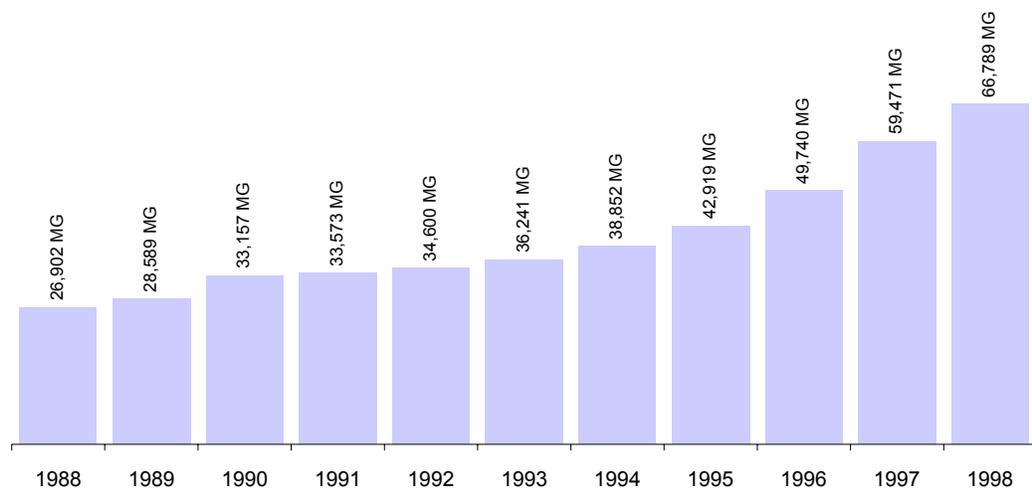
<sup>1</sup> Chart 1 shows gross electricity generation including auxiliary generation for desalination plant. The 1999 figure is provisional.

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- 2.3 Growth in electricity peak production has, however, accelerated in recent years. Between 1988 and 1993, average annual growth was 6.3 per cent, and increased to 9.7 per cent between 1995 and 1999. Provisional data for 1999 indicates an increase in peak electricity generation of around 8.5 per cent.
- 2.4 Recent forecasts suggest that peak generation will continue to grow by between 8 to 10 per cent per annum through to 2001.
- 2.5 There are two main sources of water supply within the emirate, well production and desalination plant production. ADWEC is responsible for the procurement of desalination capacity and output. ADCSRA is responsible for the development of new well fields. Chart 2 shows the year on year increase in desalinated water production between 1988 and 1998.

**Chart 2: Water Desalination Production (including Mirfa): 1973 - 1998**



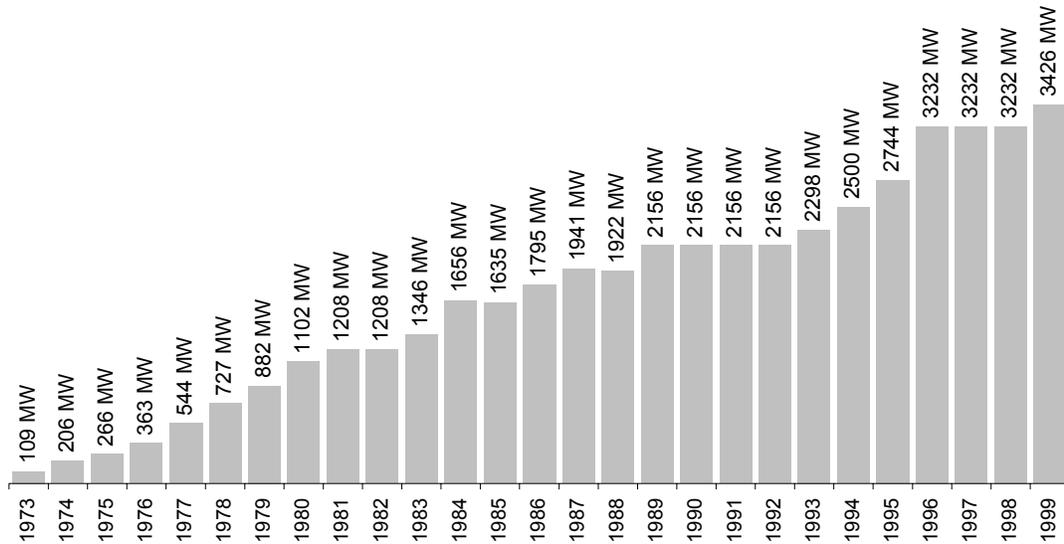
Source: ADWEC Operating Results (1998)

- 2.6 Between 1988 and 1998, production of desalinated water more than doubled. Desalination has accounted for a higher share of total water production in recent years, and this is expected to continue. For example, desalination production accounted for around 72 per cent of total water entering the transmission system in 1988. In 1998, the share of transmitted water from desalination plant increased to 84 per cent.

## 3 Generation & Desalination Capacity

3.1 Chart 3 shows the increase in electricity generating capacity connected to the main Abu Dhabi system (excluding Western Region) between 1973 and 1999.

**Chart 3: Total Electricity System Capacity (ex Western Region): 1973 - 1999**

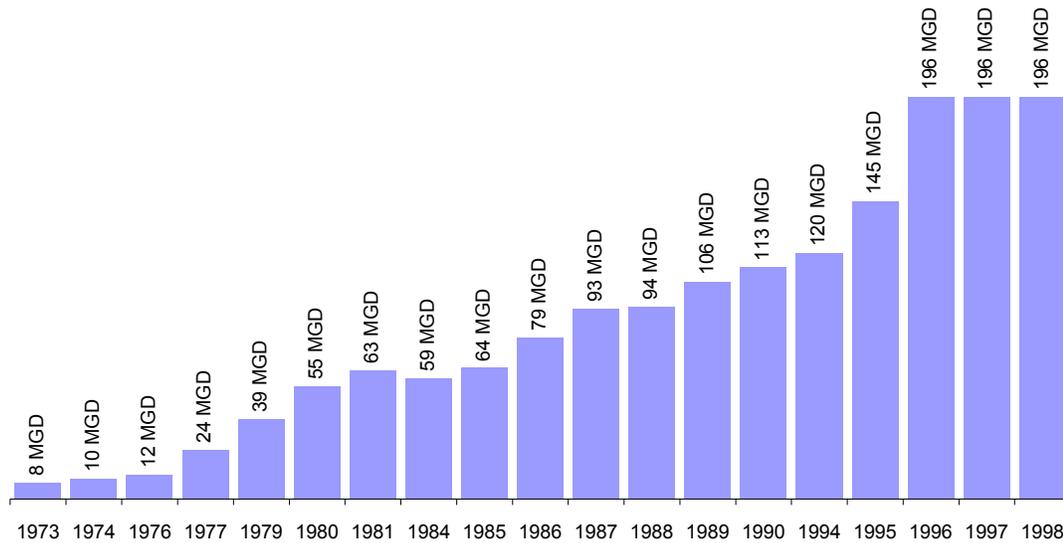


Source: ADWEC Operating Results (1998)

3.2 There are two production stations in the Western Region: Mirfa cogeneration station comprises 192 MW of generating capacity and 17 MG desalination capacity. The 100MW capacity of the second station, Madinat Zayed, is for generation only.

3.3 Chart 4 shows the cumulative change in desalination capacity on the main Abu Dhabi system (excluding Western Region) between 1973 and 1998. The capacity increases since 1994 reflect the commissioning of 72 MG of desalination capacity at Taweelah B.

**Chart 4: Desalination System Capacity (exc Western Region) MGD: 1973 – 1998**



Source: ADWEC Operating Results (1998)

- 3.4 The cogeneration station at Mirfa in the Western Region is another recent addition to the production units in the emirate. Further additions are planned. For example the B2 extension at Taweelah will, during 2000, provide a further 337 MW of electricity capacity and 23 MGd of desalination capacity. The A2 station, also at Taweelah, will on completion add over 700MW of generating capacity and 50 MGd of desalination capacity.

#### **4. ADWEC's Legal Obligations**

- 4.1 Articles 30 to 38 of Law No (2) of 1998 contain ADWEC's duties. These duties reflect ADWEC's responsibility to ensure the long-term availability of sufficient water and electricity production capacity at all times, and to economically purchase such capacity and fuel to meet demand in the emirate of Abu Dhabi.

- 4.2 To perform its duties in the emirate of Abu Dhabi, ADWEC has a legal obligation to:

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- Secure and contract for the purchase of sufficient production capacity to satisfy all reasonable water and electricity demand (Article 30);
- Contract for the purchase of all water and electricity output from licensed production operators (Article 31);
- Ensure long-term security of water and electricity supply by determining annually, in respect of each year and the next five years, the requirement for new or additional electricity generation, water desalination and water storage capacities (Article 32);
- Procure and supply fuel to each provider of production capacity (Article 33);
- Purchase economically when contracting for capacity, fuel, and ancillary services (Article 34);
- Invite tenders for the provision of new or additional production capacity or for the contract of existing production capacity (Article 35);
- Develop and apply evaluation criteria for such tenders (Article 35);
- Enter into payment agreements (PWPAs) with providers of available production capacity and delivered water/electricity output, and suppliers of ancillary services (Article 36);
- Supply licensed distribution companies with sufficient water and electricity to meet all reasonable demand in the emirate of Abu Dhabi (Article 37); and
- Charge each distribution company, a water and electricity 'bulk supply tariff', which is calculated on a yearly basis as prescribed by the Regulation and Supervision Bureau (Article 38).

4.3 ADWEC's legal obligations take practical effect through Conditions in its licence. For example, Conditions 17, 18 and 19 require ADWEC to meet generation and desalination security planning standards, to prepare annually

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a statement showing a seven-year projection of water/electricity demand and capacity requirements, and to cooperate with licensed operators in assessing future demands for water and electricity. These conditions enforce articles 30, 32 and 37 of Law No. 2.

- 4.4 Conditions 14, 15 and 16 require ADWEC to purchase economically when contracting for capacity, ancillary services and fuel. These Conditions relate to ADWEC's legal obligations under articles 31, 33, 35 and 36 of Law No. 2.
- 4.5 ADWEC is also obliged by its licence to enter into Power and Water Purchase Agreements (PWPA) with each of the G/D companies. The PWPAs set out the terms of payments to the G/D companies for available production capacity, delivered electricity and/or water output and ancillary services.
- 4.6 ADWEC is responsible for procuring the natural gas required by licensed producers of electricity and water. ADWEC does not charge the production companies for the natural gas used, but provides it free under the terms of energy conversion agreements. Incentive mechanisms in the energy conversion agreements allow for bonus and/or penalty payments to the production companies depending on whether fuel use at individual stations improves or deteriorates relative to a benchmark.
- 4.7 ADWEC is also required to produce a Bulk Supply Tariff (BST) for sales of water and electricity to the DISCOs (Condition 12). The 1999 BST comprises, for both power and water, energy/output charges and a demand charge. The energy/output charges reflect the (short term) marginal cost of providing units of water and electricity at different times of day and in different months. Demand charges reflect the cost of providing the generation and desalination capacity required to meet demand. Total BST charges in 1999 are estimated at AED 2.2 billion, of which AED 1.5 billion is for electricity and AED 0.7 billion for water.
- 4.8 ADWEC's licence includes a schedule of charge restriction conditions that define the application and operation of ADWEC's price control. The price control places a ceiling on the aggregate level of revenue recoverable in each

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year of the control, but does not specify the structure of ADWEC's charges to customers. The price control mechanism is set out in Part 4 of the licence (Schedule Charge Restriction Conditions).

## Part II: Issues for Consultation

### 5. ADWEC's Costs

- 5.1. ADWEC's costs fall into three broad categories: first, the payments to production facilities made through the PWPAs; second, the cost of fuel purchases; third, the costs of procurement activities and other functions (planning, setting the BST, etc) for which ADWEC is responsible.
- 5.2. As already mentioned, ADWEC has economic purchase obligations in respect of PWPA and fuel costs. These costs are significant and will vary year on year with changes in demand. Once the PWPAs have been signed, ADWEC has little direct control over these costs. They will reflect the performance of individual plant in terms of availability and fuel efficiency. They will reflect changes in the level and pattern of demand throughout the year. And they will reflect Transco's despatch of plant to meet that demand.
- 5.3. The Bureau would be interested in views on how ADWEC might be given enhanced incentives to manage these costs. One way to offer incentives to ADWEC would be to allow efficiency gains made in respect of PWPA and fuel costs to be shared between ADWEC, the generation/production companies and customers. Such an incentive mechanism operates, for example, in the price control of the power procurement business of Northern Ireland Electricity, a business with very similar obligations to ADWEC. That said, the Northern Ireland (NI) system's costs are, at least at present, somewhat easier to predict than those in Abu Dhabi. This is principally because the NI system is growing more slowly than Abu Dhabi's and has thus required no major recent capacity additions. Furthermore, the power procurement company despatches the plant under contract to it and thus has more direct control over certain costs. In these circumstances, the Bureau does not consider it practical at present to include in the price control direct financial incentives in respect of ADWEC's economic purchasing obligations. This does not rule out the introduction of such incentives in the future. They might be practical during future price control periods that do not face the uncertainty of major capacity additions or when demand growth is more moderate.

- 5.4. A related issue is that under the present price control formulae, ADWEC faces no direct financial incentive to meet the generation and desalination security standards. It is for consideration whether ADWEC should face the possibility of reduced profit if it fails to meet demand. Again, such an incentive is found in the licence of the NI power procurement business. The introduction of such an incentive for desalination security is probably not presently practical: water demand is at present subject to supply constraints. However, in the case of electricity, there is a surplus of capacity over demand and a clear generation security standard in place. The Bureau's present view is, therefore, that a financial incentive for generation security is both desirable and practical. Annex A contains the relevant condition from the licence of Northern Ireland Electricity. The Bureau would be interested in views on the introduction of an analogous condition for ADWEC.
- 5.5. The final category of costs mentioned in paragraph 5.1 above, those associated with ADWEC's procurement activities, are a small proportion of total system costs. ADWEC has significant control over these costs and some form of regulatory control is desirable in order to ensure that the procurement functions are carried out in an efficient manner and to motivate ADWEC to achieve efficiency savings which in due course can be passed on to customers. The analysis of costs in section 10 below therefore focuses on these costs and how they might be expected to behave over the price control period.

### **6. Scope And Duration Of New Price Controls**

- 6.1 It seems appropriate that the initial controls should cover all ADWEC's revenue recovered from charges to the DISCOs in respect of procurement and supply of water and electricity.
- 6.2 The case for excluding services from the scope of the control is generally based on there being services which are unpredictable and therefore difficult to capture adequately in the price control formula or services that are open to competition that need not therefore be subject to price control. It is not clear that, at present, any elements of ADWEC's costs fall into either category.

- 6.3 The duration of the price controls must strike a balance between providing incentives for efficiency and reducing exposure to unanticipated outcomes. A longer duration for a control can provide greater incentives for companies to implement efficiency savings. However, a longer duration also increases the possibility of performance being significantly at variance with expectations at the time the control is set.
- 6.4 Experience from other price control regimes suggests three to five years strikes a reasonable balance between the conflicting objectives discussed above. As with the other price-controlled businesses, ADWEC has to adjust to its responsibilities in the new industry structure while meeting rapid demand growth. In addition, there is little historical information on ADWEC's costs on which to base projections of future costs. These circumstances suggest a price control of a relatively short duration. The Bureau's initial view is that a three-year duration will be appropriate.

### **7. Form Of Control**

- 7.1 The form of price control chosen strongly influences the allocation of risk between the company concerned and its customers. Broadly speaking, incentive forms of regulation seek to allocate risks where they are best managed. Annex B discusses the advantages and disadvantages of different forms of control in more detail.
- 7.2 The Bureau's initial view is that an RPI-X form of control is appropriate for the procurement costs over which ADWEC has direct control. There remain, however, significant issues concerning the precise formulation of the control, and the approach taken to set it.

## 8. Price Control Mechanisms

- 8.1. ADWEC's price control operates through a formula that places a ceiling on the aggregate level of revenue recoverable in each year of the control. The maximum allowed revenue ADWEC can recover in a year is calculated according to the following formula:

$$MR_t = PWPA_t + F_t + A_t - K_t \quad (1)$$

- 8.2. Where  $MR_t$  is the maximum allowed revenue relating to ADWEC's regulated activities.  $PWPA_t$  is the aggregate of all amounts due measured on an accruals basis under Power and Water Purchase Agreements in year t.  $F_t$  is the amount due measured on an accruals basis in respect of fuel purchases in year t.  $K_t$  is the correction factor.
- 8.3. PWPA and fuel costs are effectively treated as pass through in the formula (although ADWEC is subject to economic purchasing constraints with regard to both components).
- 8.4.  $A_t$  is the allowed electricity and water procurement costs in year t. In the first relevant year the value of  $A_t$  shall be the notified value. In subsequent years the value of  $A_t$  is determined by the following formula:

$$A_t = A_{t-1} \left[ 1 + \frac{CPI_t - Xa_t}{100} \right] \quad (3)$$

- 8.5. Where  $CPI_t$  is the percentage change in the UAE Consumer Price Index and  $Xa_t$  is a value determined by the Bureau. Unlike PWPA and fuel costs,  $A_t$  is not subject to year on year correction.

## 9. Setting The Controls

- 9.1. Setting an RPI-X price control requires an estimate of the revenue that would be sufficient to finance an efficient, well run business including an adequate return on investment. Consideration is required as to the likely level of operating costs, over the period of the control and beyond, that a well-managed and efficient company would incur.

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- 9.2. In setting ADWEC's first price control, the Bureau will consider and make best use of all available information, including an assessment of procurement costs in overseas markets, and information to be provided by ADWEC regarding its estimate of future operating costs. The Bureau has also asked ADWEC to provide the water and electricity demand projections underlying its estimates of future costs.
- 9.3. As already mentioned, ADWEC's direct costs are small in relation to the total costs recovered through the Bulk Supply Tariffs. However, ADWEC has significant payment activities:
- Payments to the generation/desalination companies under the PWPAs;
  - Payments for ADNOC gas supplies, and
  - Receipts from the DISCOs under the BST.
- 9.4. Depending on the payment terms under these contracts, and the incidence of payments, ADWEC may have a requirement for working capital. The Bureau will wish to assess this need and, if necessary, include within ADWEC's allowed revenue an allowance for the cost of funding the working capital requirement. Annex C discusses the cost of capital that the Bureau considers appropriate to fund an identified working capital requirement.

### **10. Assessing Future Operating Costs**

- 10.1. The Bureau has reviewed information from a number of sources to inform its assessment of ADWEC's future costs. In setting the price controls of other licensed companies the Bureau made use of those companies' 1997 and 1998 income statements. ADWEC's income statements are not helpful to the present exercise. This is because the responsibilities and functions now undertaken by ADWEC were previously undertaken by various sections of WED and it has not been possible to provide a meaningful assessment of these costs in the past. Nevertheless, the Bureau has reviewed and made use of information from the following sources:
- ADWEC's 1999 budget;
  - Spend to date figures for January 1999 to August 1999; and
  - Cost information of the procurement business of Northern Ireland Electricity.

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- 10.2. ADWEC were also asked to provide to the Bureau cost projections for the price control period to inform the present exercise. No information has so far been received.
- 10.3. The 1999 budget estimate must be regarded with care: it was prepared by ADWEC before it had developed a clear understanding of its functions. The budget total includes a number of contingencies and many component elements are subject to uncertainty. However, the budget provides separate information on ADWEC's direct costs (staff costs, general expenses, and so on) and the cost of professional fees (for example, legal costs associated with the tender and procurement of new production units). The latter costs will be correlated with new capacity additions and will therefore be high in some years and low, sometimes zero, in others. The Bureau will therefore need to consider the likely level and profile of such costs during the price control period. Table 1 presents the main cost components of ADWEC's 1999 budget and expenditure to date.

**Table 1: ADWEC 1999 Opex Budget (exc depreciation)**

<b>Item: AED million</b>	<b>1999</b>	<b>Costs to date: Jan-Aug 1999</b>	<b>Annualised costs to date</b>	<b>Annualised cost to date as % Budget</b>
Staff & salary costs	8.0	2.4	3.5	44%
General expenses	2.5	0.2	0.3	11%
Professional fees etc	7.4	0.0	0.0	0%
<b>Total</b>	<b>17.9</b>	<b>2.5</b>	<b>3.8</b>	<b>21%</b>

Source: ADWEC 1999 budget

- 10.4. The costs in Table 1 are presented on a cash (not accrual) basis and might not accurately reflect the actual profile of ADWEC's costs. The numbers are nevertheless of interest, and show that staff costs and general expenses for the first eight months of 1999 represent just 30 per cent and 7 per cent, respectively, of the budget estimate for these items. Assuming that these costs are spread evenly throughout the year, annualised staff costs and general expenses represent just 44 per cent and 11 per cent of budget.
- 10.5. ADWEC has not thus far incurred any costs relating to professional services. Such costs that have been incurred this year in relation to the Taweelah A2 and A1 IWPPs have been settled by ADWEA. The Bureau will therefore need to establish whether ADWEA will continue to meet these costs or whether they will be charged to ADWEC at a later date.

- 10.6. Whilst there is clearly a case for ADWEC incurring cost for professional financial, legal and technical advice, it is also the case that some of these costs reflect ADWEA's interest as majority shareholder in the IWPPs. It may therefore be appropriate to allocate only a proportion of professional fees to ADWEC. The Bureau will need to ensure that the treatment of these costs is properly reflected in the notified value  $A_t$ .
- 10.7. The picture that emerges from the figures in Table 1 is that ADWEC's costs are running at a level far below budget. Examination of expenditure in recent months shows annualised expenditure is still only a little above AED 5 million. Whilst only a preliminary view, the Bureau sees little justification at present for annual expenditure over the price control period greater than AED 10 million, even allowing for expenditure on professional advisers.
- 10.8. It should also be mentioned that the 1999 BST includes an assumed level of  $A_t$  of AED 30 million. It therefore seems highly likely that, in respect of this component at least, the 1999 BST will over recover, with the over-recovery to be returned in the 2000 BST.

### **11. The Calculation Of Allowed Revenue**

- 11.1. Previous price control consultations have described a model for the calculation of revenue to be recovered under the price control. This model takes the form of a cashflow forecast for the period of the control. The control is then set so that the net present value (NPV) of revenue under the control is equal to the NPV of forecast costs.
- 11.2. A simplified version of such an approach may be suitable for ADWEC, under which the  $A_t$  term would be set so as to equate the NPV of revenue from  $A_t$  to the NPV of ADWEC's direct costs plus an allowance, if necessary, for funding working capital. The latter might take the form of assumed interest payments, or alternatively be expressed as a margin on turnover under the BST.

## 12. Issues For Comment

12.1. Comments are invited on all aspects of ADWEC's price control, including:

- Whether the control should cover all of ADWEC's revenue or whether some elements of revenue should be excluded from the controls;
- Whether direct financial incentives for economic purchase should be included in this first control, and if so what form they should take;
- Whether a direct financial incentive should apply in relation to ADWEC's obligation to meet the generation/desalination security standards;
- An appropriate duration for this first price control; and
- Whether RPI-X is an appropriate form of control, or alternatively should the control relate to reported profits or to some form of sliding scale regulation.

12.2. Comments are also invited on issues concerning the assessment of ADWEC's future revenue requirements, in particular:

- The future levels of operating costs and capital expenditure for efficient water and electricity procurement and sales businesses, and methods which are appropriate for projecting these costs forward; and
- Whether ADWEC has working capital requirements that should be recognised in the price control and the cost of capital to be used in assessing the funding of this working capital.

12.3. Comments are invited by 10<sup>th</sup> November.

### **Annex A: Extract from NIE Generation Security Standard Condition**

The Director, after consultation with the power procurement manager, may at any time and from time to time by directions issued to the power procurement manager for the purpose of this Condition make such modifications to this Condition or any other Condition to which this licence is subject as, in the opinion of the Director, are the most appropriate to ensure that, in circumstances where the power procurement manager fails to meet demand from relevant suppliers by reason of a failure of the power procurement manager to make arrangements on appropriate terms with suitable persons for a sufficient amount of electricity generation to be available to it in good time in order to ensure that the generation security planning standard shall be met, the profit of the licensee in the financial year next following the year in which the failure in question occurs shall be reduced. Such directions issued in respect of any financial year shall not in aggregate have the effect of so reducing the profit of the licensee by an amount exceeding the maximum profit or loss. A person shall be a suitable person for the purposes of this paragraph if the power procurement manager, at the time that it entered into the arrangements in question, was satisfied on reasonable grounds, having made all necessary inquiries, that the person with whom the arrangements were made was and would continue to be a person with the necessary capability and qualifications so to provide the electricity generation in question.

Source: NIE licence condition 6

## **Annex B: Forms of Regulation**

### **RPI-X Price Control**

- B.1 An RPI-X control constrains average price or revenue to increase by no more than a specified level (X) relative to the rate of inflation as measured by an appropriate price index (for price control purposes the index is the UAE Consumer Price Index). An RPI-X control reflects anticipated future operating and capital expenditure, and is set to provide an adequate return to those financing the business consistent with efficient performance. This form of control is extensively used in UK utility regulation and is increasingly the preferred form of regulation in the US, Australia and other countries.
- B.2 The RPI-X form of control provides strong incentives to efficiency insofar as companies keep the gains from greater efficiency or suffer the losses of inefficiency during the period in which the control applies. Customers can benefit from efficiency improvements as the control in one period can be set to reflect efficiency improvements regarded as achievable in that period and as achieved improvements in efficiency are taken into account when setting the control in subsequent periods.
- B.3 The precise formulation of an RPI-X control may differ according to circumstances. The revenue yield version of the control specifies that average revenue per unit (kW/MG of maximum demand or kWh/gallon of units transmitted) should not exceed RPI-X. An alternative formulation, known as a tariff basket approach, specifies that a weighted average of the prices of different products or services should not exceed RPI-X. Both approaches allow the licensee to adjust the structure of tariffs subject to meeting other statutory and licence obligations.

### **Profit Control**

- B.4 One alternative to an RPI-X price control is a profit control under which prices are adjusted to reflect movements in allowed costs and a specified return on capital. A direct control on profit has the advantage of less extreme variations in profit or loss and ensures a more rapid adjustment of prices to ensure normal profits.

- B.5 However, experience of this type of control suggests that there may also be less incentive to operate and invest efficiently which can result in higher prices to customers in the longer run.
- B.6 A major difficulty with a direct control on profit is the need to specify what allowed profit should be, how divergences from it should be identified in practice and how customers and those financing the business should apportion profits and losses which diverge from the allowed rate. There might be considerable scope for subjective judgement as to how an observed level of profit or loss ought to be adjusted or interpreted in the light of unexpected events. While this has historically been the predominant type of price control in the US electricity industry, other forms of control are increasingly being adopted.

### **Sliding Scale Regulation**

- B.7 A further alternative to an RPI-X control is sliding scale regulation. This mechanism attempts to preserve the incentive properties of RPI-X while ensuring a closer link between prices and profit year on year. When profit moves outside certain pre-specified limits, prices are adjusted downwards or upwards compared to the level implicit in the RPI-X component of the control.
- B.8 Experience of sliding scale regulation in the US and the results of independent research suggest that the disadvantages of the mechanism outweigh the potential benefits. There is evidence that profit-sharing measures may reduce incentives to efficiency or might reduce regulatory stability. Such controls also pose considerable measurement problems.

## Annex C: Cost Of Capital Calculations

### Basic Approach

- C.1 The method used to estimate the weighted average cost of capital (WACC) is the Capital Asset Pricing Model (CAPM). This model is the dominant approach used in calculating the cost of capital for individual businesses. Utility regulators typically use it in the determination of the weighted average cost of capital (WACC) for regulated businesses and it is widely used by financial analysts in evaluating conventional businesses.
- C.2 The CAPM considers the two main sources of finance used in most businesses: debt and equity. Separate estimates are made of the cost of these two sources of finance and they are then weighted by their relative proportions in the business to produce the overall WACC.
- C.3 The table below shows lower and upper estimates of the components of CAPM and the WACC.

**Table A.1 Weighted Average Cost of Capital**

	<u>Lower</u>	<u>Upper</u>
Risk free rate (%)	3	4
Debt premium (%)	1	2
Equity risk premium	3.5	5
Equity beta	0.6	0.8
Debt proportion (%)	50	70
Cost of debt	4	6
Cost of equity	5.1	8
<b>Weighted average cost of capital</b>	<b>4.55</b>	<b>6.6</b>

Source: Bureau

- C.4 The remainder of this annex discusses the components of CAPM.

### The Components of the CAPM

### **Risk Free Rate**

- C.5 This represents the return available from a completely riskless form of investment, that is one whose cashflows are fixed and that carries no risk of default. Typically, bonds issued by the UK or US government are taken as the most suitable risk-free investment. An additional advantage of using bonds issued by these governments is that both issue index-linked securities, that is bonds that, to all intents and purposes, guarantee a real rate of return unaffected by inflation.
- C.6 The UK government has a comparatively long history of issuing index-linked bonds and their return has tended to vary between three and four per cent. US index-linked securities have been available for only a couple of years and there is therefore a much shorter pricing history. However, these bonds have been issued with par rates of return of either 3.375% or 3.625% indicating little difference from the returns available on UK index-linked bonds. **For present purposes a range of 3 to 4 is assumed for the risk free rate.**

### **Debt Premium**

- C.7 The risk-free rate is not an appropriate measure of the cost of debt for businesses with uncertain cashflows and default risk. The debt premium measures the additional return required over and above the risk-free rate by a given business. There is little information about an appropriate debt premium for businesses in Abu Dhabi. However, Moody's rates the long-term debt of the UAE at A2. Analysis of data from the US Federal Reserve shows that over the past 27 years, American utilities with an A rating have yielded an average 1.6% over 10 year Treasury bonds. **The analysis presented in Table A1 has, in consequence, used a range of 1% to 2% for the debt premium ADWEC.**

### **Equity Risk Premium**

- C.8 This parameter measures the extra return required on average for investment in equities compared to the risk-free rate. Historically, this has been the most contentious component of the CAPM. However, in recent years a consensus has begun to emerge around significantly lower values for the equity risk premium than had previously been considered. This parameter also raises the question of the applicability of values derived from UK and US analysis to the Abu Dhabi situation. There is little information available regarding required returns in the UAE but it is at least arguable that the return required by water and electricity procurement business in Abu Dhabi need not be materially different from that required by comparable businesses in the UK. The regulatory regime developed for Abu Dhabi has drawn deliberately on best practice in the UK and elsewhere to minimise the level of unnecessary risk to which the businesses might be exposed. **Accordingly, a range of between 3.5 and 5 is assumed for the equity premium.**

### **Equity Beta**

- C.9 The equity measures the riskiness of a given investment relative to the average level of risk in the market. A beta of one indicates that a company is perceived as having average risk, a lower figure suggests lower than average risk. Utilities are generally regarded as comparatively low risk. US rate of return regulated utilities have reported betas as low as 0.2 for sustained periods. Betas on UK price regulated utilities have tended to be higher, in the range 0.4 to 1. **For present purposes a range of 0.6 to 0.8 is consistent with the view taken by regulators in recent price control reviews.**

### **Debt / Equity Proportion**

- C.10 Regulated utilities have relatively stable cashflows and are therefore well suited to a high level of gearing. It has been the experience in the UK that gearing levels have risen over time: `providers of capital are content with higher levels of gearing for utilities` Ofwat October 1998. For its present review of water and sewerage prices, Ofwat has focused on a gearing level between 50% and 60%. **For the purpose ADWEC price control calculations a proportion of debt of between 50% and 70% is assumed.**

### **The Weighted Average Cost of Capital**

## First ADWEC Consultation Paper

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- C.11 A strong consensus has developed in the UK around a pre-tax cost of capital of 7%. The water regulator, Ofwat, has indicated a range for the post-tax cost of capital of 4% to 5.5%, with a central value of 5.25% to be used in setting price limits. The Bureau proposes to use a value of [6% could be lower as procurement business is less risky than distribution and transmission businesses] for price-setting purposes. This value is intended to represent a post-tax return and has been calculated on the basis that companies will not face any taxation of profits or be able to offset interest expenses against tax.