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O F

Advisory Service on Energy to Zimbabwe  
25 - 28 February 1991

October 1991

**Report of ECA Advisory Service on Energy to  
Zimbabwe, 25 - 28 February 1991**

**PURPOSE**

At the request of the Zimbabwe Ministry of Energy and Water Resources and Development (MEWRD) for energy advisory service assistance, the ECA contributed to the review of the Zimbabwe Energy Supply Strategy Evaluation 1990 - 2010, at a Workshop convened for this purpose, 25 - 28 February 1991, in Harare.

**BACKGROUND**

The Ministry had in July 1989 requested for ECA advisory services on energy in two studies that it considered essential to ensure adequate supplies of energy to all sectors in future, namely:

- (a) The Ministry's in-house study of strategy for supply of energy to low-income urban and rural households, and
- (b) The integrated strategy for supply of the commercial fuels coal, hydro-electricity and petroleum products to meet energy needs up to year 2010.

The Ministry had initially indicated that it would be opportune to receive ECA's advisory assistance in November 1989. The mission programmed accordingly had however to be postponed several times at its request until the Ministry's 27 December 1990 invitation was received for the mission to be mounted in early February to provide ECA contributions to the review of the draft Green Cover Report entitled Zimbabwe Energy Strategy Evaluation (ZESE) sent with the invitation. But the Ministry had been obliged to postpone this schedule until travel restrictions due to the Gulf war were lifted and staff of the World Bank who had prepared the Evaluation could travel to participate in the review workshop convened in Harare 25 - 28 February.

**ECA PREPARATIONS FOR THE WORKSHOP**

The objective of the Energy Strategy Evaluation which was to be discussed at the Workshop is declared (para. 1.1) to be to "identify options to meet the economy's energy requirements at least cost and an optimal degree of reliability; and to recommend strategies, policies, institutional/legal/regulatory measures and investments to meet this goal".

The results of the analysis are to provide inputs into Zimbabwe's 1991-995 Economic Development Plan which aims at GDP growth of 4.6 percent per year. The plan is to be pursued within an Economic Reform Framework "designed to encourage investment and

stimulate future economic growth and development (under a) structural adjustment programme embracing trade liberalization, deregulation and deficit reduction" (para. 2.2).

The proposals in the ZESE report would obviously have far reaching effects on, and be affected by national development. The most direct of these interactions would include development finance, external debt, subregional and international trade, agricultural, industrial, mining and transport development, employment and social development, the environment etc. The report was accordingly circulated to relevant substantive Divisions of ECA for indepth comment on aspects of the proposals of their specific interest so that such comments may be integrated into ECA's multidisciplinary comments to be made at appropriate stages in the Workshop discussions.

The written comments received from the various Divisions were constrained by inadequate time for thorough examination of the report. Heavy prior commitments and mission travel schedules of concerned staff combined with shortage of time also made it impossible to clarify various aspects of the comments received or to convene in-house discussion of the report with a critical mass of ECA experts participating. Nevertheless the Divisional comments received proved to be valuable background for the ECA comments contributed at the workshop in Harare (Annex I).

## **ACCOUNT OF WORKSHOP PROCEEDINGS**

### **Opening of the workshop**

Mr. J.J. Chitauo, Permanent Secretary of the Ministry of Energy and Water Resources and Development opened the workshop at the conference room of the Zimbabwe Electricity Supply Authority (ZESA). The workshop was chaired by Mr. J. Chirara, Acting Director of Energy at the Ministry.

### **Attendance**

Participating in the workshop were staff from the Zimbabwe Ministries of Energy (9), Mines (1) and Industry (1), from the National Oil Corporation of Zimbabwe (2), the Wankie Coal Company (1), ZESA (9), and the Central Statistical Office (1). Two senior Zimbabwean energy consultants also participated throughout the workshop. The National Programme Officer at the UNDP in Harare attended the workshop as an observer.

Mr. A.J. Mc Kechnie, Chief of ESMAP Strategy Programme Division at the World Bank headed the team consisting of two senior Bank staff and one consultant that presented and discussed the proposed strategy.

### **Responsibility for the Evaluation**

The report attributes responsibility for the preparation of ZESE jointly to the Government of Zimbabwe and the Energy Sector Management Assistance Programme (ESMAP) supported by the World Bank, UNDP and Bilateral Donors. The Evaluation team it states, led by a senior economist at the World Bank consisted of ten international and eight Zimbabwean experts. The cooperation of the Ministries of Energy and of Mines, the National Planning Agency, the parastatals in coal, electricity, oil, industrial development and railways as well as the cooperation of the Confederation of Zimbabwe Industries is acknowledged in the Report.

However, speaking on their behalf at the first working session, a participant denied any involvement of Zimbabwean consultants in the preparation of the Evaluation. Several of these consultants had indeed taken part in the first workshop on the formulation of an integrated commercial energy strategy for Zimbabwe held with ESMAP staff in February 1990 in Harare. But contrary to expectations they had not been invited to subsequent stages of its preparation and therefore wished to dissociate themselves from it even if the report were to be considered only a draft.

ZESA, the Wankie Colliery Co. (WCC) and the National Oil Company of Zimbabwe (NOCZIM) each strongly criticised major assumptions, data inaccuracies, and some of the conclusions and recommendations of the report during discussions of the electricity, coal and petroleum sections of the report.

The absence of any participants at the workshop from the Ministry of Finance and Development and from the National Planning Agency was a decisive disadvantage in discussions of major macro-economic and intra-sectoral issues of central importance to energy sector strategy.

### **Main features of the proposed strategy**

The proposed strategy has the following main features.

(a) A focus on supply of the commercial fuels coal, electricity and petroleum products which account for 23, 15 and 17 percent of final energy consumed in the Zimbabwe socio-economic system (para. 4.6). Woodfuels and non-commercial fuels contributing the remaining 37 percent are to be dealt with in a parallel ESMAP study of Energy Strategy for Lower Income Group: The Strategy Evaluation Report outputs include:

- an analysis of energy supply, demand and investments during 1980-89 in the coal, electricity and petroleum subsectors;
- demand projections 1990-95 and indicative projections 1995-2010;

- assessments on the long term impacts of energy development on the environment and on the economy;
- least-cost investment programmes under alternative growth and energy policy scenarios;
- the benefits, costs and risks of proposed investments and of supply of electricity and petroleum products;
- a recommended institutional framework for energy sector development;
- a priority ranking of proposed investment and,
- a staff training program in energy policy and analysis.

(b) A least-cost energy investment programme recommended for implementing the strategy over the period 1990-2010 estimated to be Z\$ 7.6 billion (at 1989 prices and equivalent to about US\$4 billion) of which Z\$6.9 billion is designated the "core investment" portion for projects that are absolutely necessary (para. 21, page x). The Batoka Gorge hydro scheme included in the programme would, at an estimate Z\$2.17 billion, be the largest single investment to be undertaken in Zimbabwe (para 6.15).

(c) The macro-economic implications of the investment programme (para 8.7) namely:

- energy sector debt will by the year 2000, absorb 13.8 per cent of GDP;
- about one third of the investment would be foreign debt, assuming that the entire foreign exchange component of new investment is financed by external borrowing;
- the energy related external borrowing could become a problem if the expected rise in export growth fails to materialize;
- in that event imports would inevitably be compressed, projected economic growth would not be achieved and Zimbabwe would have invested large sums borrowed to create excess energy supply capacity;
- the effect of such misallocation of resources would be amplified by the high debt service also compressing imports;
- rising energy sector investment is likely to pre-empt private sector investment levels that are essential if the needed modernization and export expansion of the economy is to occur (para 8.8) through export growth

rates attaining 5.5 percent after 1994, a halving of government deficit by 1995 and a doubling of retained earnings of public enterprises;

(d) The electricity, coal and petroleum subsectors would absorb about 87, 3.7 and 4.9 percent of the core investment program respectively and the remaining 4.4 percent would go into energy efficiency and environment measures (Table 25);

(e) Electricity is used (para. 4.8) largely in manufacturing (47 percent) followed by mining (18), the residential sector (16), commercial agriculture (9), services (9) and transport (1);

(f) Given the large scale, complexity and long lead times involved, the energy supply investments now envisaged, need to be simultaneously evaluated and sequenced so as to minimize the costs within various financial, technological and other constraints (para 8.1);

(g) In view of the high degree of uncertainty, of sustained growth of energy demand, the supply strategy needs to be regularly reappraised and adjusted appropriately.

The authors of ZESE appear to be greatly concerned to warn of the high risk of over-investment in large energy supply projects that have long lead times (of up to a decade and more for the large hydroelectric schemes) in order to meet projected energy demand principally in industry, mining and agriculture producing for the projected expansion of exports. The report strongly advocates periodic reappraisal and adjustment of the strategy "in view of the high degree of uncertainty surrounding important decision parameters.

### Discussion of ZESE

Brief presentations of each of the major sections of the Evaluation report by individual members of the ESMAP team were followed by comment and discussion from the floor. As noted above, ZESA, WCC and NOCZIM participants strongly criticized various aspects of the relevant sections of the report. ZESA in particular presented a written review strongly challenging the analysis and projections of electricity demand growth as well as of the recommended sequencing of power plant investments to supply future demand.

Most of the workshop discussions understandably focused on the electricity sector which the evaluation estimates would absorb some 87 percent of total energy sector investment in the 20 year plan period. From ZESA's stand point neither considerations of uncertainty of energy demand growth nor the benefits of energy demand management ought to significantly influence investment planning in the electricity subsector. In its view it is uncertain that high tariffs recommended in the Evaluation would in fact induce the expected efficiency improvements and conservation in electricity consumption.

ZESA finds most inappropriate the ESMAP proposal that initial tariff increases of 40 percent be followed with average annual increases of 5 percent above inflation for the next ten years "towards long run marginal cost (EMRC) levels to (a) cover economic costs and (b) generate sufficient revenue for ZESA to fund at least the local cost of its investment" (para 2.2 of ZESA review of the Evaluation). This suggestion if applied to ZESA long term planning would:

- (a) "impose extreme and unnecessary financial burdens on ZESA consumers.
- (b) "effectively preclude selection of such an attractive solution (as large hydro-electric projects) in favour of less reliable and more costly over all solutions such as thermal plants and gas turbines" advocated in the Evaluation; and
- (c) impose "undesirable and unnecessary restrictions on industrial growth and improvement of living standards through the impact of high tariff levels."

In conclusion ZESA recommends that its Finance Plan (approved by ZESA' Board in January 1991) form the basis of the financial comment and recommendations in the ESMAP" (para. 3.2 of ZESA review).

This criticism of the Evaluation indicates ZESA preference for a supply expansion approach centered on large indigenous hydro-electricity schemes to meet presently projected sustained long term demand growth unrestrained by demand management policy options. The total of investments required under such a policy neutral scenario of electricity subsector development during the plan period, are estimated in the Evaluation to exceed the least-cost investments proposed under the policy active scenario by about £\$674 million or some 10 percent (para 6.45).

Even investment levels of the policy active scenario, the Evaluation warns may not be financeable because of the considerable burden that would be imposed "on public finances, the balance of payments and external debt" (para 21). Adoption of a core-investment programme is therefore advocated comprising only projects that are absolutely necessary. The core-program is to have sufficient flexibility for later addition of high priority projects in the event that the required additional funding becomes available.

### ECA contributions to the review

ECA contributed comments to the discussion of key strategy issues of ZESE at appropriate stages of the workshop discussions. These contributions are presented in consolidated form in Annex I under the following three headings.

Uncertainty of demand growth.

Strategies under highly uncertain future demand.

Recommendations.

The energy demand projections are derived from the energy requirements of the high rates of export-led growth of the economy as projected in Zimbabwe's 1991-95 development plan and its structural adjustment programme for the period 1991-1995 and beyond. But current trends and recent political developments in the Southern Africa subregion as well as internationally and in Eastern Europe in particular, make highly uncertain the prospects for growth of exports of commodities and manufactures of developing countries such as Zimbabwe.

Large scale energy supply expansion projects and particularly large hydro-schemes favoured by ZESA require high capital investments and have long lead times of a decade and more. When the projects are completed and enter into operation, the plants therefore face high risks of capacity under-utilization for long period if demand growth rates have remained appreciably below projections. Recent World Bank studies of supply expansion projects it had financed, revealed that even the Banks own energy demand forecasts in the project appraisals had in 80 percent of the cases proved to have been excessively high at the time the completed plants started operation. Moreover, about 30 percent of Bank financed large hydroprojects had ended up costing twice as much or more and had taken at least twice as long to complete as had been estimated at the start of the projects.

The failure of such projects to earn adequate returns on the large investments made which then arises, generates pressure for tariff increases and contributes to the growth of debt levels. These and other very severe repercussions of gross over investment in large-scale energy supply expansion to satisfy demand projected for the medium to long-term make it essential that energy planning be oriented flexible and pragmatically to alternative strategy options that are less capital intensive and less risk prone.

Various studies of energy in Zimbabwe including ZESE, advocate that substantial gains available from improvement of technical and economic efficiency be aggressively pursued by reducing high levels of energy waste which at present prevail in energy supply systems as well as in energy uses in most production and service sectors of the economy. A growing range of no-cost, low-cost, medium and high-cost means and methods of reducing energy waste are becoming available commercially and are being already applied in numerous countries. Substantial energy and economic gains are attained within very short periods after applying such measures at only a fraction of the investments that would otherwise be needed to expand supplies to meet wasteful energy demand.



Also, Zimbabwe can advantageously continue current imports of electricity supplies from under-utilized hydro-power plant in Zambia. Negotiations to import electricity from Mozambique's under-utilized Cahora Bassa hydro-plant are reported to be in progress. Other sources for Zimbabwe's future imports of inexpensive electricity supplies are Angola when the Kapanda hydro-plant is completed, and from a post-apartheid South Africa. Such imports would enable the country to avoid or at least defer risking large capital investments in indigenous hydro-schemes to satisfy projected but uncertain medium and long term demand. At the same time such bilateral and multi-lateral trade in energy among neighbouring countries would contribute to strengthening economic cooperation and integration in the Southern African sub-region under PTA and SADCC auspices.

Yet another strategic option is to expand electricity supplies with modest size power plant projects harnessing indigenous renewable or fossil energy resources at modest investment cost to satisfy relatively safely predictable demand growth in the near and medium-term future.

These and other ECA contributions to the review discussions sought to recommend strongly integrating as appropriate the above and other alternative strategy options into planning sustainable energy sector development. The aim of the resulting energy sector master plan would be pragmatically optimized benefits to the nation, of energy services at least-cost. Coal, electricity and petroleum development plans would be coordinated sub-sectoral plans derived as integral components of a national energy services master plan oriented to rapid transition towards cost-effectively efficient energy services and systems.

Among the major benefits to Zimbabwe of integrating such approaches to energy planning are lower levels of high risk investment debts, improved economic efficiency of energy services, minimization of tariff rises and enhanced competitiveness of exports on international markets.

ECA contributions strongly recommended that combinations of these and other alternative strategy options be pragmatically and effectively pursued in planning energy sector development with the strategic objective of optimizing benefits to the nation, of energy services at least-cost.

## **CONCLUSION OF THE REVIEW WORKSHOP**

The review discussions could not be concluded with agreement on commercial energy strategy options and on the portfolio of supply and demand management projects for the plan period, that would minimise the risks of over-investment large amounts of borrowed capital in large-scale supply expansion schemes to satisfy projected long term energy demand.

It appears in hindsight that the workshop as an open forum may not have been particularly suitable for weighing key macro-economic factors and repercussions for rational decisions on investing in large supply expansion schemes far in advance of projected demand. The issues

arising are intrinsically of national concern and can best be addressed from the national other than from sub-sectoral or even sectoral perspectives.

Notably absent at the review discussions, were representatives of both the Ministry of Finance, Economic Planning and Development (MFEPD) and the National Planning Agency (NPA). This meant that the key macro-economic and national level perspectives which these two Government bodies could authoritatively contribute to the discussions were not available during the review of ZESE.

The sensitivity of his obligations as Chair of the review workshop probably made it difficult for Mr. J. Chirara, Under Secretary and ranking representative of the MEWRD, to actively participate in the discussion of such key issues.

The workshop finally agreed that the Evaluation report be finalised on the basis of written contributions from a selection of ESMAP and Zimbabwean experts who had previously participated in the Evaluation.

The final draft report is to be submitted by ESMAP by mid-May.

**ECA Advisory Services on Energy**  
**Contribution to the Review of the**  
**Zimbabwe Energy Strategy Evaluation Report in Harare**  
**25 - 28 February 1991**

At the request of the Zimbabwe Ministry of Energy and Water Resources and Development, the Economic Commission for Africa contributed advisory services on energy to the review of the Report of the Zimbabwe Energy Strategy Evaluation 1990-2010 at a Workshop held in Harare 25-28 February 1991. The main ECA contributions to the review of key strategy issues are presented in summary hereunder.

**Uncertainty of energy demand growth**

It is declared in the report on the Zimbabwe Energy Strategy Evaluation (ZESE) that the analysis is to provide an input into the 1991-95 Economic Development Plan which aims at export-led growth of GDP at a sustained 4.6 percent per year. Zimbabwe's principal exports consist of minerals (gold, nickel and ferric alloys) and agricultural commodities (cotton and tobacco). Zimbabwe also hopes to substantially expand export of manufactures.

The principal exports of minerals and of agricultural commodities (produced with pumped irrigation) are highly energy intensive as are also the exported manufactures. Availability of adequate and reliable energy supplies is therefore a pre-requisite for the projected growth of Zimbabwe's exports. As current supply capacity of electricity and petroleum products are being almost fully utilized, rapid expansion of supply capacity is regarded a matter of priority.

Large scale energy supply projects in general and electricity projects in particular require large investments much of it in foreign exchange and have long lead-times. For large hydro-electric power plant lead-times are typically of the order of a decade. Thus the Kariba South Extension (KSE) and the Batoka Gorge hydro-electric projects which are two of the projects discussed in ZESE, are currently estimated to cost Z\$440 and Z\$2400 million respectively. Lead-times are estimated to be seven years for KSE and 12 years for Batoka.

Furthermore, large hydro projects during implementation are prone to considerable cost over-runs and long completion delays. It is noted in the Evaluation report that of 49 World Bank financed large hydro schemes, recently evaluated, some 30 percent ended up costing twice as much or more and took at least twice as long to complete as originally scheduled.

Returns on the large investments of the completed plants will in the case of the export-led economic growth envisaged in Zimbabwe depend on the achievement of sustained growth of exports as hoped for in the Economic Reform Programme and the 1991-95 Development Plan.

Markets and prices for developing country exports of commodities or manufactures have however been declining and far from predictable in the eighties. Recent developments and other developments likely to emerge in the near future at both the international level and in the SADCC subregion, could pose serious challenges and threats to growth of Zimbabwe's exports and of its economy. The following are among the factors that could affect the prospects for growth of Zimbabwe's exports.

1. The state of the economy in importing countries.
2. Competition from other exporters and especially from new entrants to the market.
3. Tariff and non-tariff barriers raised by importing countries especially on products manufactured in developing countries.
4. The trend towards decreasing material intensities in industrialised countries in order to reduce material costs of production.
5. Concern and alarm at adverse environmental impacts of production and consumption patterns prevalent in industrial societies. This is inducing growing pressures for rapid transition away from "use and throw-away" products, towards greater re-usable and repairable durable ones, and towards greater recycling of material components of discarded products and as well as towards greater recovery and use of "waste" in production and service sectors.
6. The trend towards substitution of alternative and man-made materials in place of imported commodities, e.g. optical fibres instead of copper conductors.
7. Depletion of readily accessible high grade ores and costlier production from lower-grade and remote endowments.
8. Recurrent droughts that cause shortage of water for irrigated agricultural production and for hydro-electric energy supply needed for maintaining and increasing agricultural and industrial exports to established markets. This provides competing producers with opportunities for greater access to markets developed and held by producers suffering such impacts of drought.

9. Emergence of a democratic socio-economic system in the Republic of South Africa leading to the lifting of trade sanctions and its entry into SADCC and other Intergovernmental Organisations in Africa.
10. Ending of internal conflicts and liberalization of the socio-economic systems in Angola and Mozambique leading to revival of production from rich natural resources that had not been accessible since the mid-seventies.
11. The ongoing changes in the socio-economic systems in East European countries and in the USSR facilitating rapid expansion and improvement of the quality and competitiveness of their products in international markets.

If the rates of growth of exports and of energy demand to generate exports remain substantially lower than forecast during its implementation, the total level of demand at completion of a large supply expansion project would be substantially lower than anticipated. World Bank has recently acknowledged that even its own forecast of demand levels made in appraisals of energy supply expansion projects, had in 80 percent of the cases proved to be far higher than actual demand levels at the completion of the projects.

The low output then required from the completed plant would not earn sufficient revenue to cover periodic payments of the plant investment loans as these fall due, until plant output has risen to exceed breakeven levels. Unmet loan payments would in the meantime accumulate raising the debt level with a chain of very damaging consequences for the supply utility and the country.

The OECD has pointed out recently in connection with funding of energy projects, that developing countries will have to compete for capital in a world short of capital. Borrowing countries also will have to meet higher real interest rates by ensuring that the returns on capital is sufficient to pay the cost of capital.

### **Energy sector strategies under highly uncertain future demand**

High levels of uncertainty of long term growth of energy demand coupled with the grave consequences of investing large borrowed sums in supply plant that remain underutilized for considerable periods, make it essential to adopt alternative strategy options in order to minimize consequential damage.

One such option given much importance in ZESE is to optimize the benefit of existing supplies by reducing energy waste throughout energy production, transport, distribution and end-uses by applying economically available high efficiency technologies and techniques. A growing range of no-cost, low-cost, medium and high cost methods and means are now available for

reducing energy waste at a small fraction of the avoided costs and lead times of expanding supplies to meet wasteful energy demand. .

Various studies including the present strategy evaluation indicate that in Zimbabwe energy uses in industry, mining, transport, and in households are highly inefficient. Energy intensity in industry sector for example is estimated to be 40 to 80 percent above that in more developed countries near and far. In particular, the use of electricity in industry which accounts for almost half of total electric demand in Zimbabwe, is assessed to be excessively wasteful. Because of its highly inefficient use, fuel has become a major cost item amounting to 25 to 30 percent of cost for freight and bus traffic. Total energy savings possible in 1990 are estimated in ZESE at Z\$104 to 165 million per year and could be attained with measures that have a one-time total investment cost of Z\$140 million.

Another option also advocated in the evaluation, is the import at competitive cost, of inexpensive electricity supplies readily available to Zimbabwe from its neighbours Mozambique and Zambia which have large underutilized hydro-electric plant capacity. Zimbabwe currently imports substantial quantities of electricity from Zambia and has recently conducted protracted negotiations for imports from Mozambique's Cahora Bassa plant. It is expected that Zimbabwe may advantageously import inexpensive electricity supplies also from a democratic Republic of South African and from a liberalized Angola under appropriate long term contracts. Such trade in electrical energy would contribute solid building blocks to subregional economic cooperation and integration.

Reliability of supply of such imports is considered in Zimbabwe to be lower than is possible from KSE and Batoka. But the high cost risks of large investments in these indigenous supplies in order to command higher security supply must be weighed pragmatically against the eventual losses due to lower security of imported supplies. In this connection it would be worth assessing the costs of maintaining improved security of supply imports.

Yet another strategy option emphasized in ZESE, is to give preference to electricity supply expansion with modest size, modest investment power plant projects based on cost-effectively harnessing of indigenous renewable or fossil energy resources. The operation of fuel oil fired gas turbine plants recommended in the evaluation could involve fuel imports and storage in very substantial quantities that make the feasibility of such plants seriously questionable. Such modest size projects should therefore be based on indigenous resources. Lower level investment and operating costs and shorter lead times of such plant would make it possible to keep supply expansion closely in close step with predictable demand growth.

Energy efficiency improvements, cost competitive supply imports from neighbouring countries and less centralized modest size indigenous resource based supply developments of course be pursued in parallel and pragmatically integrated into a sustainable pattern of