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# TELECOMMUNICATIONS SECTOR STRATEGY

## TABLE OF CONTENTS

|   | Page     |
|---|----------|
| <b>I. Executive Summary</b>                   | <b>1</b> |
| <b>II. Sector Overview</b>                    | <b>2</b> |
| <b>III. Sector Constraints</b>                | <b>6</b> |
| <b>A. Policy Constraints</b>                  | <b>6</b> |
| 1. Underinvestment                            | 6        |
| 2. Tariff Policies                            | 7        |
| 3. Self Financing                             | 7        |
| <b>B. Institutional Constraints</b>           | <b>8</b> |
| 1. Management/Technical Development           | 8        |
| <b>C. Technical Constraints</b>               | <b>8</b> |
| 1. Inefficient Call Routing                   | 8        |
| 2. Overburdened International Call Capability | 8        |
| 3. Urban Concentration                        | 8        |
| 4. Central Office Obsolescence                | 9        |
| 5. Lack of Network Management                 | 9        |
| <b>IV. USAID Strategy</b>                     | <b>9</b> |

## **USAID EGYPT: TELECOMMUNICATIONS SECTOR STRATEGY**

### **I. EXECUTIVE SUMMARY**

Telecommunications infrastructure is a significant input to the productive process similar to petroleum or electricity. Throughout the developing world, the unsatisfied demand for telecommunications services far exceed supply and typically applications for service represent a substantial percentage of the number of existing telephone lines. New applicants frequently wait many years to obtain service and all too often, a large proportion of the potential demand for telecommunications services remains unrecorded and emerges only as the system is perceived to be expanding. When there are acute shortages of telephone lines, the proportion of subscribers who are very intensive users tends to be high, and the average number of calls per line is also high leading to frequent congestion of the local and long distance services. This congestion is due in part to insufficient call traffic handling capacity of telephone exchanges and from the high proportion of the time the called telephone is in use.

With accessible and reliable telecommunications services, many of the physical constraints on organizational communications are removed in various sectors of the economy, permitting increased productivity through better management in both the private and public sectors, making it possible to adopt different organizational structures and locations, and aiding the evolution of increasingly complex organizations. With improved telecommunications, markets gain in effectiveness, more rapid response to market signals become possible, and access to market information is extended to village, town, city, governorate, regional, national and world wide levels. Not to be overlooked is the rise in the efficiency of household operations as telecommunication allows improved access to goods and services, and forms of work are supported that require some integration of the work place and home.

In Egypt, the development of the telecommunications network has not been able to meet demand. More than 2.15 million subscribers are presently being served, and an additional 1.2 million potential subscribers have applied for service, many being on the waiting list from 5 to 10 years. In other instances, potential subscribers, aware of the lag between application and service, have been discouraged from applying.

The Egyptian telecommunications system has expanded rapidly over the past ten years. Between 1981 through 1990, the number of communities connected to the direct dial network increased from 7 to 189, the number of international circuits increased from 820 channels to 5560 channels, the number of telephone lines increased from 510,000 to 2.15 million lines; and the telephone density increased from 1.2 to 3.9 lines per 100 population.

Underinvestment is the single greatest factor constraining the development of the telecommunications network. This under investment in facilities and dependence on financing from bilateral and multilateral financing agencies has resulted in an urban concentrated network composed of a diverse range of equipment meeting various technical specifications that results in a network that is overall complex and is impeded by technical constraints that result in inefficient call routing and overburdened capacity.

Future USAID participation in the development of the Egyptian telecommunications sector will support the Missions Program Goals of: enhanced human resource productivity and quality of life; and enhancement of Egypt's role as a model of stability, democracy, free markets and prosperity in the region. USAID will finance network standardization, expansion, and modernization and the development of facilities that will allow the effective management of the national network. An assessment of ARENTO and studies to define tariff strategies and operation and maintenance processes, will establish the basis for the development of a time phased agenda of regulatory, policy and institutional reforms that would permit growth to meet increased demand while at the same time attaining a degree of financial independence. Implementation of the reforms would set the stage for the telecommunications sector to operate on a commercial basis and would be able to finance its expansions without relying constantly on grants or soft loans or infusions of funds from the government of Egypt.

## **II. SECTOR OVERVIEW**

Public Telecommunications facilities in Egypt are state owned. The Arab Republic of Egypt National Telecommunications Organization (ARENTO), attached to the Ministry of Communications, is responsible for the operation and development of all public telecommunications facilities in the country. The Suez Canal Authority, defense services, railways, utilities, broadcasting and television, and civil aviation authorities maintain separate telecommunications facilities for their own specialized needs.

While the Egyptian telecommunication network has expanded rapidly over the last decade to meet the growing need for telecommunications, the sector remains overstrained and underdeveloped. Currently there are 2.15 million telephone lines in Egypt serving a population of more than 55 million people resulting in a telephone line density of nearly 4 telephone lines for every one hundred Egyptians. In comparison, other countries in the region far exceed Egypt's density: Greece 36; Israel 34; Kuwait 15 (Pre-War); Turkey 9. Other neighboring countries are providing nearly the same density of services: Oman 5; Iran 4; Syria 4; Tunisia 3; Algeria 3. Egypt's national telephone density understates the disparity between the relatively well developed urban areas that enjoy reliable access to a range of services, and other areas with erratic service or no service at all. The density in Cairo is nearly 9 lines per 100 while in Alexandria the density is 8 lines per 100 and compares favorably with: Damascus 10; Tehran 8; Algiers 8; Tunis 7. Conversely, Tel Aviv 56; Athens 41; Istanbul 20; Ankara 17 are major business centers with substantially greater telephone density.

Because so many Egyptians still do not have access to basic telephone service, investment efforts have tended to focus on additional exchanges and outside plant facilities as quickly as possible, wherever the waiting lists were greatest. The official waiting list for new telephone service is 1.2 million, of which Cairo and Alexandria account for more than 610,000 applicants. However, many Egyptians no longer bother to apply for new service since basic service does not yet extend to their villages or municipalities. Even when the basic telephone infrastructure is in place, many applicants must still wait for up to ten years before their phones are installed.

Switching technology has undergone rapid change. The earliest switches were motor driven stepping type Rotary switches that linked a customer to the network. These "Rotary" switches were slow operating, subject to frequent failure, and required continuous maintenance. These switches were superseded by electromechanical switches, utilizing relays and/or electromechanical switches to route calls through a matrix (Crossbars) to link customers through the network. These switches provided an improvement in operating time and reliability but were still dependent on preventive maintenance to insure reliability and quality. These "Crossbar" switches are now being replaced by electronic switching systems that utilize solid state devices, controlled by an analog computer, to accomplish the switching of telephone calls. These Electronic switches are fast acting, require minimal maintenance but utilize analog technology that is subject to interference and distortion. These Electronic switches are now being superseded by digital switches controlled by digital computers. These "Digital" switches, controlled and directed by digital computers, provide greater equipment flexibility, new user services, and centralized supervision and management capability of the network.

As of the end of 1991, only 19% of the total switching capacity in Egypt utilized digital technology. Approximately 44% of the switching capacity in the national network utilized stored program control (analog) technology, and the remaining 37% of total switching capacity used outdated electromechanical (crossbar) technology, some of which was installed as early as 1962. This heavy reliance on outdated technology results in costly maintenance, poor call completion, difficulties in procuring replacement parts, all of which will only be exacerbated over time, and limits the introduction of tariffs based on time-of-day usage and utilization of other tariffs for a wide range of services available through the computer controlled switches.

Since 1985, most ARENTO purchases of switching equipment have been for analog and digital systems. However, crossbars still comprise over a third of the total network, and many of these now need to be replaced.

The telecommunications sector has two distinctive features that must be given special consideration:

- (1) the use of telecommunications is pervasive: the telephone and related services (FAX and telex) are used to varying degrees by a diverse range of

businesses, governmental entities and private households.

- (2) the role of telecommunications in the productive process, though highly important, is "intangible" in the sense that requirements for use of telecommunications services cannot usually be calculated from physical input/output relationships. However, deficiencies in telecommunications impair the organization and co-ordination of the economy and result in the inefficient use of other factors of production such as management time; capital embodied in production plant; capital embodied in inventories; and skilled labor. Conversely, improved telecommunication services can enhance the productivity of other factors of production, raising economic output in other sectors both in absolute terms and in per unit of output. This implies, of course, that telecommunications services themselves must be regarded as a factor of production like land, labor, capital or energy.

These two considerations together suggest that investments in the telecommunications sector designed to expand the services area and accelerate the application of technology to reduce costs, enhance quality, and support a wider range of services could have a pervasive beneficial effect on the performance of the Egyptian economy.

Substantial additional investments in the Telecommunications Sector is absolutely essential to Egypt's ability to achieve its economic potential and to lay the groundwork for future development. A modern, efficient telecommunications network, which fully meets demand, is a crucial component of the economic infrastructure needed to foster rapid growth and raise Egyptian living standards. At the microeconomic level, adequate telecommunications service enhances the efficiency of private sector firms, government services, and agricultural producers. Telephones are more cost effective than other modes of communication which require physical transport (such as messenger services in Cairo and Alexandria, and automotive trips in more rural areas). Telephones also greatly improve the dissemination of market information, which allows both buyers and sellers to respond more rapidly to demand and price conditions. Aggregated, such benefits contribute to an environment conducive to investment, job creation, and economic growth. At the macroeconomic level, then, Egypt's development prospects hinge on upgrading and expanding the telecommunications network.

An in depth assessment of the Telecommunications Sector in 1978 identified the need for an ambitious 20 year, \$20 billion program to rehabilitate and modernize the telecommunications network. Over the past 12 years, investments of less than \$2 billion have materialized. The failure of the Egyptian government to invest adequately in telecommunications in the urban areas, due in part to the faltering economy, has prevented major segments of the economy from operating in a competitive manner. This is particularly clear in relatively high-tech service sectors which require integration with global communications networks. If the Egyptian economy is to expand, Egyptian financial institutions need access to up-to-the-instant information transmitted through

global electronic networks in order to expand operations into new services and markets. The development of the private sector will depend on reliable telecommunications that will link the Egyptian industry to world markets. If Egypt is to emerge as a gateway for trade between Africa and the developed world, instant access to international financial data banks and electronically driven exchanges are increasingly essential.

At the same time, Egypt must extend telecommunications services into more remote parts of the country where telephone densities of slightly more than 1 line per 100 population are common. Introducing telephones into areas not yet served will be a catalyst for tremendous social and economic development and growth. Some of these gains are immeasurable, such as the psychological benefits to a rural family able to call a doctor in an emergency or to maintain family relationships when the family is dispersed. Many others are more tangible. For instance, without telephone access to price and supply information, small farmers may have no choice but to accept whatever price is offered by the local trader. Telephones increase such farmers' bargaining leverage.

Since 1978, USAID and the Government of Egypt have jointly implemented a total of four projects in the telecommunications sector totalling \$282 million. USAID and ARENTO successfully completed three projects, Telecom I, II, and III, in 1989. These three projects provided financing for: (1) consultant services, (2) equipment to replace 10 obsolete motor driven rotary telephone switching systems in Cairo and Alexandria with electronically controlled switching systems increasing their capacity from 127,000 lines to 295,000 lines, and (3) equipment and materials to expand and rehabilitate associated outside plant cable networks.

Telecom IV which was authorized in 1988, was a \$40 million project to finance: consultant services; the installation of state-of-the-art digital switching systems to serve three new exchanges with a capacity of 74,000 lines; expansion of two existing exchanges by 24,000 lines; and rehabilitation and expansion of associated outside plant cable networks. A \$42 million amendment to Telecom IV is planned in 1992. This Amendment will finance studies of tariffs and operation and maintenance requirements and the initial replacement of the obsolete electromechanical (crossbar) switching systems in four exchanges with a capacity of 70,000 lines, with state-of-the-art digital switching systems and a network operations and maintenance control center.

USAID has also provided additional assistance to the telecommunications sector in a \$62.5 million microwave procurement financed from Commodity Import Program funds. All told, USAID's total assistance to the telecommunications sector has totalled \$344.5 million. With the approval of the Telecom IV amendment, this will increase to \$386.5 million.

Egypt has depended heavily on multilateral (IBRD) and bilateral financing which has been used for the importation of a relatively large amount of electronic telephone switching equipment and outside plant cables for installation in the major centers in

Cairo, Alexandria and Lower Egypt. Since 1980, nearly \$1 billion has been provided from France, Germany, Japan, Greece, Italy and Austria for the procurement of these switching systems, outside plant facilities and sea cables.

Some items of telecommunications equipment and cables are manufactured in Egypt. The state-owned Egyptian Telephone Company, attached to the Ministry of Communications, until recently produced crossbar telephone switching equipment and telephone instruments under license from L.M. Ericsson of Sweden. The Ministry of Communications has signed an agreement with Siemens (Germany) to establish the Egyptian German Telecommunications Co., which will produce digital telephone switching exchange equipment of Siemens design. The plant, when completed in 1994, will assemble digital switching systems. Plant output in 1994 is expected to reach 50,000 lines. Production is expected to increase at 25,000 lines per year, reaching full production of 200,000 lines in year 2000. The state-owned Electro Cable, Egypt, attached to the Ministry of Industry, produces wires and underground cables for telecommunications and electric power. The factory, however, does not cover the full range of ARENTO's needs and ARENTO has to rely on substantial imports of telecommunication cables.

### **III. SECTOR CONSTRAINTS**

The Egyptian telecommunications network currently faces a number of constraints which if uncorrected will increasingly impede the network's overall efficiency. Broadly, these constraints involve: policies related to economic pricing of telecommunication services, internal cash generation and self financing of network development; institutional issues relating to the development of technical staff; and technical issues caused by the complex interface requirements resulting either directly or indirectly from the policy and institutional constraints.

#### **POLICY CONSTRAINTS**

##### **■ UNDERINVESTMENT:**

Lack of foreign exchange with which to expand the telecommunications network is the single greatest factor currently constraining the Egyptian telecommunications sector to promote economic and social development. ARENTO has made notable progress since 1980 in greatly expanding the network's overall capacity, as well as increasing the spectrum of available communications services. In 1981, the entire network contained a mere 510,000 lines; by 1991 this number had quadrupled to 2.15 million. However, the telephone density has become nearly 4 telephone lines per hundred population with the service concentrated in Cairo and Alexandria. In rural areas outside of these two cities, the telephone line density is less than 1.5 lines per hundred population. Over the same time period, the total number of international circuits increased from 820 channels to

5,560 channels; and the number of municipalities connected to the domestic direct dialing network was increased from just seven to 189.

Egypt's large population, combined with its high annual growth rate, means that ARENTO must install an additional 45,000 lines per year (above and beyond the replacement of 175,000 lines of obsolete switches) just to maintain its current telephone line density of less than 4 lines per 100 population. In order to achieve ARENTO's goal of increasing the national teledensity to 10 phones per 100 population by the year 2002, an additional 300,000 lines per year is required. ARENTO will initially utilize digital switches manufactured by firms outside of Egypt and begin phasing in the digital switches assembled in Egypt as they become available in 1994.

■ **TARIFF POLICIES:**

The cost of domestic telephone service is not recovered in service charges. As a result, ARENTO must depend on revenue generation from connection fees and international tariffs. Connection fees bear no relationship to actual connection costs and are established in many instances to regulate application for telephone service. As ARENTO converts obsolete electro-mechanical exchanges to electronic and digital switching systems, tariffs based on usage patterns (on-peak and off-peak) can also be considered. USAID is financing a Cost of Service study that will identify appropriate tariffs and user fees and propose strategies for implementation that ARENTO may consider. This study should be completed by mid 1993.

■ **SELF FINANCING:**

Although the benefits which accrue from telecommunications investment are abundantly clear, ARENTO and the Government of Egypt have until recently been precluded from making these badly needed investments due to limited fiscal and foreign exchange resources. Egypt has depended almost entirely on bi-lateral or multilateral financing from USAID and European governments to finance the expansion of the telecommunications network. Telecommunications is inherently capital intensive, and rapid technological advances in the sector have required that a substantial proportion of the switching equipment be supplied from outside Egypt. Balance-of-payments constraints at one time severely limited the amount of foreign exchange available for capital infrastructure projects. With debt cancellation and debt rescheduling, the GOE is no longer under the same constraints and with the Egyptian Pound becoming a convertible currency, ARENTO should, through adjustments in the tariff policies, generate substantially greater revenues that can be converted into foreign exchange financing to meet the financing requirements of network development.

Under the 1980 law establishing ARENTO, ARENTO was permitted to retain surplus funds to be used for its investments. In reality, ARENTO must pay to the government LE 100 million each year and is able to retain the balance for rehabilitation or network

expansion. With the Egyptian Pound becoming a convertible currency, Net Income could be converted into foreign exchange to finance the development of the telecommunications network thus reducing ARENTO's dependence on bilateral and multilateral financing agencies. ARENTO is collecting foreign exchange from their international calls, portions of which may be used for equipment procurements. The Ministry of Planning must approve the level of foreign exchange funds that can be used for these procurements.

## **INSTITUTIONAL CONSTRAINTS**

### ■ **MANAGEMENT/TECHNICAL DEVELOPMENT:**

ARENTO's senior and middle management have been selected, generally based on seniority, from technical or administrative staff positions without the benefit of formal training in effective management. As a result, managers are not prepared to manage the organization and as a result, nearly all decisions, regardless of their nature, eventually reach the Chairman for his concurrence or more likely his approval. As a result, many of ARENTO's decisions are not timely and are often made without a firm foundation.

ARENTO's operation and maintenance staff are generally well trained and are capable and qualified to service the equipment that was the subject of the training. Additional technical training is required, both classroom and on-the-job, for the equipment and facilities being added.

## **TECHNICAL CONSTRAINTS**

### ■ **INEFFICIENT CALL ROUTING:**

The national network's operations are constrained by inefficient call routing patterns, which in turn stem from a patchwork configuration of multiple suppliers' equipment. The switching equipment in the network is divided between twelve types of equipment from a total of eight switch suppliers using different transmission standards. Calls originating from a switch that is not directly compatible with the receiving switch must be routed through one of the limited number of exchanges capable of handling the necessary conversion. This places excessive burden on the trunk lines between switches.

### ■ **OVERBURDENED INTERNATIONAL CALL CAPABILITY:**

Only one-third of the call attempts from the United States are successfully completed. This low completion rate is caused by congestion and failure within the national network. Most calls originating outside Egypt do pass through one of Egypt's two gateway exchanges but do not reach the desired terminal due to inadequate transmission facilities, inadequate outside plant facilities (distribution), inefficient traffic patterns and the finite international circuit capability.

■ **URBAN CONCENTRATION:**

Eight out of 100 Egyptians living in Cairo and Alexandria have access to basic phone service, as opposed to less than two out of 100 elsewhere in the country. Furthermore, the provision of new types of subscriber services such as reverse charging, international direct dialing, and cellular service continues to be limited to the two main urban areas.

■ **CENTRAL OFFICE OBSOLESCENCE:**

The electro-mechanical (crossbar) switches are not able to handle the volume of traffic being generated from the larger and faster digital technology so that the subscriber trying to make the call often gets a busy signal. The crossbar switches are difficult and costly to maintain and the availability of spare parts is no longer assured. Crossbar switches require nearly 10 times the physical space of digital switches of comparable capacity. Retirement of cross bar switches will eliminate facilities requiring exceptional maintenance expenditure and will provide space necessary for exchange growth.

■ **LACK OF NETWORK MANAGEMENT:**

There are no means of managing the telecommunications network. Effective management requires the collection and display of operating data in sufficient detail to permit network managers to respond to potential overload by routing calls through other exchanges and to monitor exchange (digital switch) performance and respond quickly to exchange failures.

#### **IV. USAID STRATEGY**

To achieve its goals of increased productivity and an improved standard of living for its citizens, the GOE has embarked on a major economic reform program designed to stabilize its economy, remove distortions, and give a newfound impetus to the private sector as a central element in its growth strategy. Telecommunications infrastructure is a significant input to the production process.

To meet the telecommunications needs of both the public and private sectors that will depend on reliable communications, ARENTO has developed an investment plan, for the period 1993 - 1997, based on the priorities and objectives of ARENTO. These priorities in turn reflect and support the development objectives of the Government of Egypt. The investment plan has five primary objectives, all of which relate to the technical constraints discussed above. These objectives are: 1) to extend telecommunication services; 2) to replace overburdened switching equipment which relies on outmoded technology; 3) to reduce service interruptions due to network problems through more responsive maintenance; 4) to improve call completion rates through both investment in equipment, which will reduce the problem of overstrained equipment

operating at or above their optimum capacity and through more rational call routing; and 5) to train ARENTO employees in the planning, operation, maintenance, and repair of the equipment provided under the project. ARENTO has requested USAID financing for the plan through a telecommunication sector program.

USAID's telecommunication sector program fits within the Mission's overall program and seeks to contribute positively to the GOE initiative to achieve successful economic transition in Egypt. The goal of USAID's overall program is "enhancement of Egypt's role as a model of stability, democracy, free markets and prosperity in the region." The Mission's Program Subgoal 6 is "enhanced human resource productivity and quality of life" and Program Subgoal 1 is "increased economic growth." USAID's telecommunication sector program is organized under Strategic Objective No. 6 of this Program Subgoal, "increased access to, and efficiency and reliability of public utilities in urban target areas" and Strategic Objective No. 1 of this Program Subgoal, "increased economic growth".

### Program Outcomes and Activities

The Mission's telecommunications sector activities are structured to meet three Program Outcomes that contribute to efforts to increase access to an efficient and reliable telecommunications network in urban targeted areas and increased macro-economic stability and market pricing. These desired outcomes are presented below, along with a description of projects and activities -- both current and planned -- that fit within this framework.

○ Program Outcome No. 6.1: Increased number of telephone exchanges.

USAID will finance, over a six-year period, major portions of this investment plan in the targeted urban areas. Financing will be in tranches that will be authorized annually following the Government of Egypt's compliance with previously agreed upon reforms. USAID funding will finance:

1. Extension of service: The plan will extend service to over 500,000 households and businesses currently without access to telephones. Service expansion will extend to 25 neighborhoods in Cairo and four neighborhoods in Alexandria. The plan also includes rural areas outside of Cairo and along the coast west of Alexandria. Of the new lines to be installed, over 400,000 are in Cairo and the remainder are in Alexandria.
2. Replacement of crossbar switches: The plan will replace approximately 175,000 lines of obsolete crossbar equipment and temporary switching equipment (173,000 lines in Cairo and 2,000 lines in Alexandria) that are unable to handle the volume

of traffic originating in other locations served by larger and faster digital technology. The obsolete crossbar switching equipment is difficult and costly to maintain and ARENTO is having trouble procuring spare parts for the exchanges, some of which were installed as early as 1962.

3. Improved call completion rates: The crossbar replacement will help to improve call completion rates. Currently the crossbars are unable to handle the traffic originating in areas served by digital technology, so the person trying to make the call gets a busy signal. In addition, the plan calls for the provision of a centralized network operations center, which will improve call completion by routing calls more efficiently. The centralized traffic management system will monitor call traffic and will automatically route data of calls switched through the new digital equipment to the same centralized location.
4. Training: The training to be provided under the plan will enable ARENTO staff to improve existing skills and gain new expertise in planning, operating, and maintaining Egypt's national network. ARENTO will allocate an existing building to house a comprehensive training facility. ARENTO staff will use this facility to provide for instruction and development of skilis in a wide range of fields, including network planning, engineering, problem diagnosis and response, and general management.

○ Program Outcome No. 6.4 Enhanced GOE capacity for utility management.

The plan calls for the provision of an operations and maintenance system which will monitor the condition of the switching, transmission, and other network equipment; will detect the existence and the location of problems in the system; and will automatically dispatch an "alarm message" to a centralized location. This will enable ARENTO to detect network problems and respond to them on a much more timely basis.

USAID will finance a centralized operations and maintenance control center that will identify system problems, generate status reports, and dispatch alarms in the event of service interruptions. The center would provide the ARENTO management sufficient information to diagnose problems within exchanges, in the transmission system and in the outside plant network that will allow for operating and maintenance decisions that would limit or prevent network disruptions.

USAID will also finance a Network Operations Center which will provide surveillance, analysis and control of local and toll traffic within the network. The Center will provide the necessary controls to route calls as efficiently as possible and will divert calls from overloaded switches.

○ Program Outcome No. 1.2 Improved market pricing and cost recovery .

USAID will finance a series of studies and assessments of the Telecommunications Sector whose objective will be to improve market pricing and cost recovery and define constraints to the efficient operation of the utility. These studies and assessments will include:

(1) a comprehensive examination and assessment of ARENTO and the Ministry of Telecommunications (as appropriate) to determine the political, legal and financial impediments that, if corrected, would enhance the performance of ARENTO through greater efficiency, flexibility, overall system reliability, cost savings, and increased revenue generation. The assessment would recommend a structured plan for, but not limited to: improvements in overall financial performance; changes in accounting systems; changes in policies/regulations; tariff structures, tariff collection; organization structures; operating procedures; and profitability of various services.

(2) a Telecommunication Pricing Strategy Study which will examine the existing telecommunications pricing and structure of rates for various classes of users and recommend rates that will generate sufficient revenue to meet revenue requirements and an increasing share of the capital costs for the network expansion.

(3) an evaluation of ARENTO's operation and maintenance (O&M) practices that will review processes, work centers and support systems for service order processing, network surveillance, and control and maintenance and repair. ARENTO's current O&M procedures will be evaluated and inherent operational inefficiencies will be identified and operational improvements recommended.

The specific indicators and targets which are intended to measure progress toward outcomes will be contained in an auxiliary document.