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**PROPOSAL FOR THE CONTINUED REFORM
OF THE ARMENIAN POWER SECTOR**

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Prepared by

Hagler Bailly
455 Market Street
Suite 1420
San Francisco, CA 94105
(415) 882-1602

Contacts

Jake Delphia
Robert Schurhoff
MK Shean
Dean S White

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EXECUTIVE SUMMARY

The collapse of the Soviet Union in 1991 caused an enormous disruption to the functioning of Armenia's power sector. Suddenly the sector was thrust into coping with issues that were previously unknown, such as struggling to obtain sources of fuel, enforcing tariffs at levels much higher than to which customers were accustomed and, most importantly, functioning as a market-based operation. Armenia has made great strides in recent years to restructure its power sector. This effort includes the breakup of the formerly vertically-integrated utility Armenergo into functional divisions, the intention of the government to privatize power sector assets to attract investment and management expertise, and the creation of an Energy Commission to regulate the new companies participating in the electric industry.

While these achievements represent strong initial steps towards a more market-based system, it is clear that Armenia must pursue further reform so that its power sector can function as a backbone for the country's economic growth. The overall objective for reform at this stage is to create a power sector based on fully commercialized and market-oriented operation. The project team recommends the following improvements to the power sector structure in order to achieve this goal:

- ▶ Completion of the functional separation of Armenergo into three separate, non-affiliated commercial entities including a wholesale power contractor, a transmission system operator and a system dispatcher,
- ▶ Creation of a funds administrator to significantly improve the transparency of payments from retail customers to the various power sector companies while providing incentives for the distribution companies to increase collections,
- ▶ Tariff "unbundling" to establish rates for the different services provided by the various sector entities including generators (including ancillary services), distribution companies, Armenergo, ArmTrans, the wholesale contractor and the funds administrator. In addition, multi-part tariffs should be implemented for the various services.
- ▶ Extensive improvement to contractual arrangements and regulations governing the operation of the sector.

Along with these changes, the transparency of the sector can be improved by refining the roles of the power sector participants and implementing trading arrangements that encourage the delivery of cost-effective and reliable electricity. These steps will position the sector for financial recovery, form the foundation of an efficient power industry and pave the way to a fruitful open

electricity market in conjunction with neighboring regions. Certainly, the power sector is poised to become a model for the overall economic reform of the country.

PROPOSAL FOR THE CONTINUED REFORM OF THE ARMENIAN POWER SECTOR

1. INTRODUCTION

The Armenian power sector has evolved from being a large exporter of electrical power during the Soviet period to one, which struggled to meet demand for several years following the country's independence. The present system, following aggressive restructuring and restoration of the power supply, is in a more reasonable supply/demand balance. Numerous reform steps have been taken, including the restructuring and separation of generation and distribution from transmission and technical dispatch, the passage of energy legislation, tariff reform and the creation of the Energy Commission ("Commission").

The purpose of this document is to facilitate the development of a consensus among policy-makers of the Republic of Armenia regarding the direction of reform. This report provides Hagler Bailly's recommendations for reform of the power sector structure in the near term (approximately through December 1999), and describes the steps required to implement the recommended reforms. These recommendations center on the development of a wholesale electricity market for Armenia. As further power sector reforms are achieved, an effective wholesale power market will provide a foundation for growth and efficient operation of the sector as conditions in Armenia and the surrounding region improve.

Reform of the power sector should be, of course, in accordance with the objectives desired. Clearly, if the objectives cannot be achieved through a particular structural model, then another structural approach should be pursued. The following represent some of the objectives that should govern the choice of a structural model for Armenia. These include:

- ▶ Improve the efficiency of the power sector on both the demand-side (consumer) and supply-side (generation, transmission and distribution) through the revision of tariffs, further reorganization of the sector and introduction of competitive pressures where feasible,
- ▶ Establish a clear market structure that will improve the environment for sector privatization and help attract investment to the country at more reasonable commercial terms,

- ▶ Create conditions for sustainable financial performance, including increasing collections to levels comparable with the successes achieved in other emerging markets,
- ▶ Increase public confidence in the energy sector, policy-makers and enterprise management

In short, the overall objective for reform is to create a power sector that is conducive to fully commercialized, market-oriented operations, able to support the economic growth of the nation

2 ALTERNATIVE MARKET STRUCTURES

An electricity market is comprised of a number of characteristics including the structure of the sector (e.g., vertically integrated, horizontally integrated, functionally separated), the type of ownership (e.g., public, private, mixed), pricing principles (e.g., cost-based, market price, value of service based), extent of open access to the electricity networks, the extent to which consumers can select their supplier and the type of regulation used (e.g., direct government oversight, independent regulation, so-called contract plans). The market structure in-and-of-itself does not *de facto* determine the structure of the other components. For instance, there can be a vertically integrated industry with a variety of different types of pricing and differing methods of regulation and ownership. Each alternative may have its advantages and disadvantages. In order to determine the optimal structure for Armenia, it is necessary to examine each of these components and assess the optimal “mix” that best meets the reform objectives noted.

Internationally, there are numerous ways in which countries have organized their power sectors. There are the traditional vertically integrated utilities, such as seen in some parts of the U.S. (although admittedly waning) and France. There are functionally unbundled markets, in which generation can be (or must be) bid into a power pool, such as in the U.K., Chile, and Ukraine. There are markets dominated by bilateral contracts (Norway) in which consumers are free to choose the supplier of their choice or, as is more customary, mixed markets in which pooling arrangements exist along with bilateral contract opportunities for buyers and sellers (Australia, New Zealand, New England and California). There is a single buyer model (such as seen in Hungary and Poland) where a central buyer purchases all wholesale power under contract with generation enterprises and then in turn resells the power to the distribution utilities and in some instances, large consumers.

Generally, the single buyer model has some weaknesses. Simply put, in a single buyer market, there is both a monopoly and a monopsony. Even if there are multiple generation enterprises, there is only one buyer of electricity, even if there are multiple distribution utilities, there is only one seller. Given this obvious shortcoming in the single buyer market structure, the model has

often been criticized by reviewers and not recommended for adoption. Other models, making greater use of competition and light-handed regulation, have been promoted instead.¹

In many countries, there is a growing trend towards more open and competitive power markets through the use of a price-clearing pool. In this model, generation enterprises compete to provide power to the pool (and in some cases directly to consumers). The pooling and bid-based approach is considered more economically efficient in that it creates a greater likelihood of competition between generation enterprises. Those enterprises bidding too high run the risk of not being dispatched and thus not receiving revenue. As the supply of electricity becomes more constrained, due to higher load levels or generating units being off line, the price of electricity rises in tandem because more expensive units are generating electricity in order to meet the load. Over time, as the supply and demand balance becomes more constrained, the higher prices seen in the spot market encourage new participants to enter the market to provide additional needed capacity. Use of a price-clearing pool creates incentives for those most cost-effective new units to be added as capacity.

3 CURRENT MARKET IN ARMENIA

The Government of Armenia has taken a number of steps designed to improve the power sector and to a large extent, many of these steps have been successful. These steps are represented in the following major restructuring phases including

- ▶ The divestment of generation and distribution from Armenergo (late 1995),
- ▶ The partial consolidation of distribution from over 60 distribution utilities to 11 and the divestment of the remaining generation from Armenergo (mid-1997),
- ▶ Establishment of the Energy Regulatory Commission (early 1997),
- ▶ Passage of the Energy Law of the Republic of Armenia (Energy Law) further codifying the Energy Regulatory Commission and providing an improved legal framework for the power sector, including establishing some principles on market structure, pricing, and regulation (mid-1997),
- ▶ The recent separation of transmission from Armenergo and the formation of ArmTrans combined with the further consolidation of distribution from 11 to four utilities nationwide (now underway)

¹ This is obviously an oversimplification of the single buyer model. Ultimately economic efficiency will be driven by pricing (i.e., does the pricing structure promote efficiency?) and the extent to which competitive principles are promoted. For instance, periodic transparent all-source bidding can be an effective way to encourage generation competition even in a single buyer setting.

The current structure closely resembles a functionally unbundled model in which generation, transmission, dispatch, and distribution are handled by separate corporate organizations. The method of pricing, at present, is loosely based on forward-looking cost-based analyses. The ownership is majority state-owned, but this is expected to change soon with the movement to partially privatize the power sector. The method of sector regulation resembles independent regulation, but the independence of the Energy Regulatory Commission is not assured due to the lack of a self-financing mechanism.

The current market structure in Armenia reflects the steps that have been taken in the transition from the single, monopolized system to a more fully market-oriented configuration. Figure 1 illustrates the energy flow relationships of the existing companies. At present, the Armenian power sector most closely resembles a “single buyer” model that is not fully developed. There is a central purchasing authority (Armenergo) responsible for purchasing power at wholesale and transmitting it to distribution utilities for ultimate sale to consumers. The Armenian structure is not fully developed in that usually in a single buyer market structure, the single buyer has no responsibility for, or oversight of, technical dispatch. Further, with regard to pricing, Armenia’s single energy tariff for wholesale and retail electricity sales lacks the ability to provide proper incentives to the enterprises in the sector.

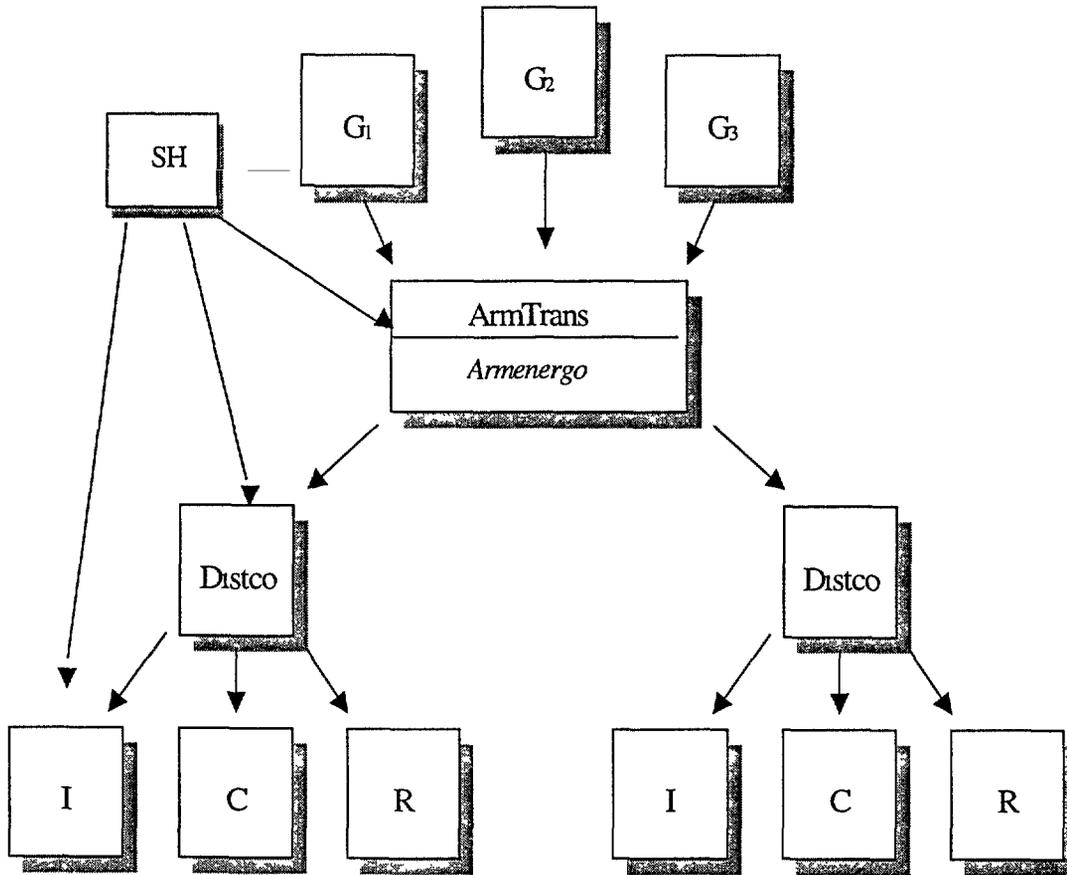
Although the Government of Armenia has taken significant reform steps to date, further reform is required. Persistent problems plaguing the sector include:

- ▶ Insufficient commercial orientation of the enterprises,
- ▶ Poor overall condition of the assets due to lack of sufficient maintenance and investment,
- ▶ Salaries for power sector employees at inadequate levels
- ▶ Tariffs that are still significantly below full cost recovery levels, thus leading to continued deterioration of the capital assets,
- ▶ Lack of sufficient internal financial control processes to ensure proper safeguarding of assets,
- ▶ Collections rates that, although improved, are stagnating at levels well below the amount required to restore financial viability, and,
- ▶ Unclear and arbitrary financial settlement procedures

These problems are, of course, interrelated. Insufficient collections combined with below full cost recovery tariff levels jeopardize the sector’s ability to provide adequate levels of maintenance and investment. Insufficient salaries for employees create incentives that can harm the internal control environment. Lack of clear financial settlement procedures leads to situations in not all parties benefit equally from improved collections, especially the generation enterprises.

To address these problems, it is necessary for the reform of the sector, as described in this document, to continue unabated

Figure 1 Energy Flow Relationships for Existing Companies



- G₁ G₂ G₃ Generators (only 3 shown) Currently include Yerevan TPP, Hrazdan TPP, Vanadzor TPP, Sevan TPP, Voroton TPP, ANPP and small hydros
- SH Privatized small Hydros
- Armenergo Dispatch and buyer organization
- Distco LV Distribution and retail supply organizations only 2 of 4 shown
- I Large Industrial Customer Served by Distribution companies but some may be connected at high voltage (i.e. directly to Armenergo) in the future
- C Commercial Customer
- R Residential Customer

4 RECOMMENDED MARKET STRUCTURE FOR ARMENIA

As the single buyer model is not optimal in promoting efficiency through competition, an obvious question is whether Armenia can move further along the spectrum towards a pool-based market structure where wholesale prices are driven by the competitive bids of the generation enterprises. In order for this market model to be a viable option, there are a number of conditions that should exist. First, there should be a sufficient number of generators with roughly comparable cost structures to permit direct competition. Second, there should be no significant and sustained supply constraints and shortage conditions. If such constraints exist, then the bid price can be driven to levels well above the costs of production. Although this may provide a strong incentive for the introduction of additional capacity, the profits collected by the existing enterprises may be quite excessive and politically untenable. A third precondition for a pool-based market structure is that there be adequate infrastructure to support the market, including interval metering capabilities and telemetry. Finally, there needs to be a clear set of market rules and market oversight to prevent bid-rigging and other collusive behavior.

Unfortunately, there are several fundamental characteristics of the power sector that limit the appropriateness of this approach for Armenia, at least in the near-term. These include

- ▶ *The mix of generation resources is not conducive to bid-based generation competition.* At present, the power sector is clearly dominated by the Armenian Nuclear Power Plant (ANPP) and the hydro power plants from two cascades. The ANPP is providing at times up to half of the system load as a result of low variable operating costs and availability of fuel. In 1998, it is expected to produce approximately 25% of Armenia's electricity supply. The plant would generate even more, but the level of generation is limited by system operating reserve requirements and minimum load constraints. In a market used generation bids to determine dispatch, the ANPP would almost certainly be dispatched as a base load unit given its low variable costs relative to gas-fired plants. During periods of natural gas shortages, the system would be dependent upon the power plant to provide power at any costs. The ANPP has dominant market power and could use that power to increase rates to exorbitant levels.

One option in such a circumstance is to treat the ANPP differently using a cost-based regulatory framework and remove the ANPP from the bidding process. The ANPP would not participate in the bidding but would instead supply power in accordance with a cost or performance-based regulatory formula. Competition for remaining electricity requirements above the capacity provided by the nuclear station would then take place among the other non-nuclear units.

Although this would address the problem of the ANPP's dominance in the system, the generation mix in Armenia is still not conducive to bid-based competition due to the impact of the large hydroelectric cascades. The cascades present complications deriving in part from their size and their low variable costs. With the cascades and thermal resources competing in the market, the cascades would be in a position to receive bid

prices more in line with the variable costs of the thermal stations. This would create a serious risk of the cascades receiving revenues far in excess of their costs and would likely be politically untenable.

In addition, the cascades provide most of the ancillary services on the system, thus restricting their operability for flexible energy production. The ancillary services provided by the hydroelectric plants include the provision of frequency control, voltage support, and system spinning reserve requirements. Furthermore, the electricity generation of one of the two cascades is generally limited to those time periods when irrigation requirements dictate water flow. Due to the operational limitations currently imposed on the cascade, its energy production would not change significantly regardless of the bid price.

The small hydroelectric power plants on other rivers are generally run-of-river plants where energy production is dependent on river flow. These plants are must-run and their output would not vary by bid-price.

The hydroelectric units could also be removed from the pool and treated under a regulated cost-based framework similar to the ANPP, but then the pool would only have the potential for competition among the thermal units. In addition to being a very "thin" market where only about 20% of electricity generated would fall within the competitive pool, the fact that the thermal resources are dominated by two enterprises, the Hrazdan and Yerevan thermal power stations, limits the amount of effective competition likely to be seen. Further, some of the units within these stations are dispatched to meet heat demand, not electricity demand. The dispatchability of these CHP units is constrained since their operation is partially dictated by local heating needs.

- ▶ *The cost structures among the various resources are significantly divergent, thus increasing the likelihood of some enterprises earning excessive profits, especially in the short-term.* About 1,400 MW of Armenia's total electricity installed capacity is characterized by having very low variable costs. Both the ANPP and the hydropower facilities have variable costs in the range of \$0.003 to \$0.01 per kWh generated. The thermal stations have a range of variable costs from \$0.02 to \$0.075 per kWh. If presented with an option to bid with no constraints on the bid price, the ANPP and hydropower facilities would have the ability to bid at least \$0.02 for each kWh provided to the pool. This ranges between two times and seven times higher than the variable costs for the units. Compared to the present wholesale price, it is likely that the overall costs of wholesale energy purchases will increase significantly if the price for electricity in the market is driven by the bid of the marginal thermal unit.²

When generating units are privatized in an open and competitive sale, the price paid by investors is typically higher per kWh of potential production for hydro plants than for thermal plants if the power market they will sell their output into is proposed to be a marginal-cost based market. If privatized through such an open and competitive sale

- ▶ *There is inadequate capability for effective oversight of a bid-based market structure, thus creating a likelihood of price tampering and other collusive practices* The regulatory framework in Armenia is still being established. Although the Energy Regulatory Commission has been formed, the ability of the Commission to effectively oversee the operation of the energy market in the short term is questionable. The generation enterprises could easily collude on pricing and it is doubtful that the Commission would be in a position to effectively prevent this.
- ▶ *The power sector's infrastructure cannot fully support a bidding based structure at this time* Although the generating stations appear to have reasonably good information on their variable production costs, there is a lack of adequate metering and system monitoring information thereby making introduction of a bidding system relatively difficult. The transitional costs associated with moving towards this type of structure could be quite prohibitive, especially in light of the limited benefits that may be derived given some of the other factors described above.

In short, the Armenian power sector is not presently configured in a manner that promotes adoption of a bid-based pooling market structure. If regional differences are overcome and cross-border trading of electricity becomes commonplace, then it may be possible to reconsider moving towards this type of market structure. In a regional context, there could be a sufficient mix of generating resources to permit a region-wide pooling type arrangement. Under present circumstances, however, this is not a near-term option. Instead, it is necessary to find a market structure that will be effective within the current configuration and institutional arrangements found in the Armenian power sector and achieve the reform objectives described earlier.

The Energy Law envisions a single buyer model for the power sector but at the same time permits greater competition to be incorporated into the sector by allowing open access to the electricity transmission and distribution networks and permitting the use of direct bilateral contracts between suppliers, wholesalers and consumers of electricity. The contracts are subject to the approval of the Commission, a somewhat unusual step not often seen in open competitive markets, but also understandable given the situation found in the power sector.³

In reviewing the power sector structure at present and the institutional arrangements in place, it is clear that a "rationalization" of the existing market is required. There are a number of steps that can be taken in the near-term to improve the operation of the power sector and enhance its efficiency, without requiring a massive overhaul of the existing system. The foundation for reform is in place given the establishment of the Energy Regulatory Commission, the

the hydro and thermal plants' total cost of production would be more or less equivalent making bidding at marginal costs more appropriate.

³ Deputies appeared concerned that the generation enterprises could enter into bilateral contracts that would not be in the public's best interest. For example, a generation enterprise such as one of the cascades could provide very low cost power to an industrial enterprise with which there was some other commercial relationship.

restructuring of the sector that has already taken place and some of the efficiency and competition oriented principles laid out in the Energy Law

It must be stressed that the project team does not recommend a single buyer model for Armenia under which all power must be contracted for by the wholesale contracting function. The structure recommended by Hagler Bailly also permits bilateral contracting, subject to Commission approval, as described in the Energy Law. There are many situations that could develop, especially related to attracting private investment, in which a bilateral contract may be an appropriate mechanism to govern the commercial arrangements between the buyer and seller. A market structure dominated by a single buyer should not hinder the use of other contractual vehicles that can enhance competition and better serve the public interest. Nonetheless, Armenia is at present characterized by a dominant single buyer type of model where only very limited supplies (less than one percent) are covered by bilateral contracts. This proposal recognizes that the situation at present most closely resembles a single buyer and provides a number of recommendations to improve the operation of the market. The proposals described below should not be interpreted as recommending a dominant single buyer market model as the long-term preferred approach for the Republic's energy sector.

An overview of the recommended near-term market model is shown in Figure 2. The major changes required to achieve this structure include the following:

- ▶ Completion of the functional unbundling of Armenergo, now underway, into three distinct, non-affiliated corporate entities including a technical dispatch operator, a transmission system operator and a wholesale contracting operator (i.e., the central buyer),
- ▶ Development of a funds administration function to improve the transparency and predictability of transfer of payments for electricity sales from retail customers to other power sector entities while at the same time ensuring that the distribution companies have incentives to boost collections,
- ▶ Significant revisions in tariffs for the wholesale market to move away from a single part tariff based only on energy to two-part, or multi-part, tariffs for bulk power supply and purchase. One part of the tariff for generators is tied to the generator's availability to be dispatched, thereby creating an incentive for the generator to increase and maintain their availability. The second part of the tariff is tied to the energy actually delivered into the power grid by the unit. This part of the tariff covers the variable energy costs and ensures that the generation station recovers the variable costs of production. It must be stressed that these changes can be introduced while maintaining average tariff levels at the same level as now seen (i.e., these changes can be revenue neutral for the sector overall)
- ▶ Tariff "unbundling" to account for the full range of services being provided by various parties operating in the power sector including ArmTrans, Armenergo, the funds administration organization, the wholesale contracting authority and the various providers

of ancillary services, such as the hydropower stations responsible for voltage control and spinning reserve,

- ▶ Vastly improved contractual arrangements and regulations governing sector operation as described further below

Although it is not a step specifically required to implement the market model outlined above, it is recommended that there be an endorsement of bilateral contracting where such contracting is demonstrated to not unduly harm the public interest. Consumers and suppliers should be encouraged to develop unique, tailored options for meeting energy supply needs. This will be an important way of introducing competitive pressures in the market and may also be critical for investment attraction.

This proposed market model meets the reform objectives noted earlier. The revision of tariffs to move away from a single part tariff to multi-part tariffs that better reflect the cost structure seen in the power sector will increase the efficiency of the use of energy. The revision of the supply tariff to compensate on the basis of generation plant availability will create an incentive to improve supply-side efficiency. These changes will also create the conditions necessary for dispatch of power supply on a purely economic basis, unlike the present dispatch practices.

The introduction of a funds administrator will ensure much greater transparency in the flows of funds seen in the power sector. In addition to providing greater clarity regarding the performance of each enterprise, this will also improve the likelihood for successful privatization of the generation enterprises by establishing a predictable and trustworthy pattern of revenue allocation for the generation stations, thus removing the arbitrariness in revenue flows seen at present.

The divestment from Armenergo of the wholesale market contracting function will also increase transparency and ensure that there is no conflict in roles such as may happen when the dispatch and wholesale market contracting function are housed within the same organization.

The financial performance of the sector should also be positively affected by this market model. First, the efficiency improvements gained from the revision in the structure of the tariffs should lead to lower costs for the power system overall. Similarly, creating a tariff structure that will encourage economic dispatch and increased plant availability should also reduce costs overall.

This model creates the conditions required for commercialization of the sector. It aligns the incentives much more properly than seen at present and will encourage enterprise management to make sound business decisions. It should encourage private investment by establishing a more rational and predictable organization of the power sector.

Perhaps most importantly, these changes should help to increase public confidence in the management and regulation of the power sector. It is understandably difficult for the public to have confidence in the sector when there are no clear efficiency improvement steps being taken, when theft of electricity is still widespread and rarely penalized, when the financial performance

of the sector is opaque and when there is the widely-held belief that cash collected from consumers is often misappropriated

5 PARTICIPANTS AND THEIR ROLES

In the recommended market model, there is some change in the roles of each participant in the electricity sector. This section reviews the roles each participant would have for the market model to be fully implemented.

5.1 Distributors

The distributors are responsible for providing to retail customers:

- ▶ A reliable source of electric power,
- ▶ Cost-effective electric energy and capacity, and,
- ▶ Non-discriminating customer service (i.e., treating similarly situated customers in the same fashion)

The distributors will strive to provide reliable and cost-effective power by:

- ▶ Contracting for wholesale power supply from the wholesale contractor,
- ▶ Planning, engineering, constructing, energizing, operating, and maintaining the distribution facilities needed to receive and deliver power to retail customers,
- ▶ Collecting and distributing customer information needed to develop monthly invoices,
- ▶ Providing energy services including conservation programs and innovative rate designs consistent with system requirements,
- ▶ Providing retail access (distribution network services) to consumers with Commission approved power contracts

Each distributor will be responsible for developing its own load forecasts and working with its major customers to predict its capacity demands. These demand forecasts will be relayed to the technical dispatcher and the wholesale contractor so that sufficient capacity is available on both a daily and long-term basis.

Each distribution company will also be responsible for computing a retail tariff for each of its customer classes. The tariff should include the cost of wholesale power and the distribution-related costs incurred by the distributor itself. Overhead costs of the wholesale contracting function, the high-voltage transmission system, and the operating costs of the technical dispatcher should automatically be included, since these costs will be embedded in the bulk

supply tariff, which is the tariff charged the distributors by the wholesale contractor for power supply

The calculation of the cost to serve the customer classes of each distribution company will ultimately result in different tariffs by utility service areas

5 2 Generators

The generators will include the ANPP, the hydroelectric companies, and the thermal generation companies. While the members of these last two groups should be operating as private entities in the near future, the privatization and market transition processes should be linked. In other words, the proper functioning of the power sector depends on the efficient use of electricity (accomplished through proper price signals being sent to the distribution companies), while the privatization of the distribution and generation companies can best be achieved if there is a rational, predictable wholesale market in place (ensuring that the generating companies will be paid). Furthermore, in order for the privatization process to be successful, long-term investment needs for each of the entities must be taken into account by the wholesale contractor, the Commission and the Ministry of Privatization, and provided for through the recovery of capital in the system's tariffs.

Completion of this work will require agreements between the wholesale contractor and generating companies that provide for two-part tariffs. The demand, or capacity portion of the tariff will cover the basic costs of the plant as well as the annual fixed operating and maintenance costs. The energy portion of the price will cover the marginal costs of production. Prices paid to each generator will be different, since their respective costs differ.

5 2 1 Armenian Nuclear Power Plant

The ANPP will likely remain a key generating asset until its planned shutdown in 2004. Additionally, the nuclear plant will continue to be managed by a state-owned enterprise. The ANPP will still need have a power sales contract with the wholesale contractor, which should allow for coverage of operating costs as well as maintenance and capital improvements. Further, provisions for decommissioning will also need to be included unless the government intends to fund the costs directly from other budgetary sources, which appears quite unlikely.

5 2 2 Hydroelectric Power Plants

The Sevan-Hrazdan cascade is currently limited in operation, due to the environmental restriction on releases from Lake Sevan. This situation is likely to continue for at least five, and possibly as long as eight more years. Only irrigation releases are being made from the reservoir, therefore, capital investments to improve the capacity of the cascade may be of limited value to the system in the short term. The situation with the Vorotan Cascade differs considerably. It is possible that the rehabilitation of this resource and the resulting increase in its power output may be an attractive alternative to purchasing thermal power. If rehabilitation is viewed as

economically feasible, this work can be accomplished as part of the privatization process. Capital put into the system can be regained by allowing cost recovery through power sales. However, a longer-term power purchase agreement (with a duration perhaps as long as 15-20 years) may be necessary for this capital recovery.

Since the variable cost of electricity from the hydro units should always cost less than from thermal projects, these projects, like the ANPP, are effectively “must run” resources. The contracts with the wholesale contractor should reflect this situation.

5.2.3 Thermal Power Plants

The thermal plants can be subjected to higher degrees of competition, but at the same time their respective capital improvements can be handled in a manner similar to that of the Vorotan cascade. During the planning for privatization, a decision can be made for each of the companies as to whether the existing operating level of the plants is sufficient, or whether rehabilitation of the plants is indicated. Depending on this determination for each respective unit, the bidders then can be asked either to provide for short term operations contracts or to supply energy and capacity for longer periods. For the latter, a longer term power purchase agreement should provide for the return on capital to the investor. At the same time, some of the thermal units also provide thermal energy. Particular CHP units may need to be treated as must run from an electricity supply perspective given the steam requirements of their customers.

5.2.4 New Power Suppliers

Increasingly, it is likely that the Government will rely on the private sector to fund new power supplies. To do so, there will be a number of conditions that private investors may seek including government/third party guarantees and long term power sales contracts. They may also require such items as escrow accounts tied to customer receivables to ensure payment of power sales and the ability to sell directly to consumers through the use of open access provisions in the Energy Law.

At this stage, it is not necessary to lay out the role that a new power supplier will play as the role will depend greatly on factors such as 1) the country's need for the power, 2) the Government's desire for the particular investment and development of a specific project, 3) the type of facility and fuel which will indicate how it will interact with the rest of the power system. Importantly, the model outlined in this proposal should be viewed positively by potential power system investors.

5.3 Wholesale Contractor

The wholesale contractor is intended to act as a broker between the generating companies and distribution companies. This entity will contract with all capacity and energy suppliers, including some new and small suppliers that might be able to provide “energy only” power on an as-needed basis or at attractive prices for short-term power.

Power would pass through the transmission network to the distribution companies and be priced at the bulk supply tariff. The bulk supply tariff will be designed to cover the fixed costs of the plants as well as the marginal costs of production as the units are dispatched. The wholesale contractor will be responsible for maintaining sufficient capacity and generation under contract to meet peak demand and the aggregate demand of the distribution companies.

The duties of the wholesale contractor are to

- ▶ Develop long term expansion plans for the power sector,
- ▶ Determine the near-term power requirements for the Armenian power sector,
- ▶ Develop a coordinated maintenance schedule for generation, transmission, and distribution facilities,
- ▶ Arrange power purchase contracts with power suppliers,
- ▶ Arrange power sales contracts with distribution companies,
- ▶ Arrange for emergency power and/or interruptible service,
- ▶ Arrange service contracts with the dispatching company, the funds administrator, and the transmission company,
- ▶ Collect system data and calculate monthly invoices for each distribution company in accordance with the provisions in the power sales contracts,
- ▶ Determine the payments for each service provider (generators, transmission company, dispatching company),
- ▶ Provide all financial information to the funds administrator,
- ▶ File system information with the Commission, and,
- ▶ Request approval of all power and service contracts from the Commission.

It is proposed that the costs of the service companies including the wholesale contractor be borne by the distribution companies, in other words, the costs of those services will be appropriately allocated to each distribution company and recovered through the bulk supply tariff charged to each distribution company. The distribution company will also recover the costs of the services from consumers through the retail tariff.

The wholesale contractor will contract for export sales to other countries as the opportunity arises. The dispensation of the monetary benefits of such sales, after payment of generating costs, should be decided by the management and approved by the Commission. Possible uses of

the proceeds from exports include coverage of the wholesale contracting authority's costs and overhead, off-set of costs of imported power (if necessary or attractive), or returned to the distributors as a discount at the end of a certain accounting period

The wholesale contractor will serve as the centralized "clearinghouse" for the entire wholesale market. All costs for the generators, the technical dispatch operations, the high-voltage transmission facilities, and the wholesale authority itself will be recovered from the distribution companies and then passed along to the other organizations, as illustrated in Figure 2, above

One complication that will need to be addressed during the formation of the wholesale contractor is the issue of financial risk. The wholesale contractor will be entering into power purchase and sales agreements but ultimately, the dispatch of the generating plants will decide the amount of the power purchase bill. If the bulk supply tariff remains unchanged, the wholesale contractor will be fully responsible for all excessive and deficient revenues resulting from the actual dispatch of the units to meet system requirements. As a service organization, this entity is not expected to have large financial resources or significant working capital to be able to withstand potentially large financial swings. At the same time, permitting a full pass through of all generation costs to limit the wholesale contractor's exposure may provide the wholesale contractor with less incentive to ensure that their contracting process results in the least cost mix of resources

5.4 Transmission Company

The transmission company ArmTrans will be responsible for the physical delivery of power from the generators to the distribution companies. It will remain a monopoly for the foreseeable future. ArmTrans will continually coordinate with the technical dispatcher to manage load flows and substation operations and allow the dispatcher to make adjustments necessary for technical purposes

The general duties of the transmission company are to

- ▶ Design, engineer, construct, energize, operate and maintain the high voltage transmission system in accordance with the transmission service contract,
- ▶ Develop a long-term maintenance schedule and coordinate its implementation with the wholesale contractor,
- ▶ Maintain metering points at every interconnection and read the meters as required to determine the energy flows to be invoiced by the wholesale contractor, and,
- ▶ Request approval of its annual revenue requirements and rate design for transmission

The transmission company costs will be recovered through the bulk power supply tariff charged by the wholesale contractor to each distribution company and collected by the funds

administrator. The transmission tariff should be of a level sufficient to cover capital improvements as well as operations and maintenance of the system.

5.5 Technical Dispatch Operator

The technical dispatch operator (“TDO”) will perform real time dispatch of the generating resources necessary to meet demand and maintain power quality (through spinning reserves and voltage regulation). The TDO will use information provided by the distribution companies, the wholesale contractor and the transmission company to determine the dispatch of system resources. The dispatch should be on a least cost marginal basis and be consistent with power purchase agreements between the wholesale contracting authority and existing available capacity.

The goal of the TDO will be to provide for system energy and peak demand requirements at the least cost using the power resources under contract with the wholesale contractor. Any potential shortfalls of supply will be immediately reported to the transmission company, distribution company (if demand is not met) and the wholesale contractor. The latter will attempt to arrange for any standby capacity or import, if that is available. Records of dispatch (including instances of failure to dispatch any contracted resource) will be reported to the wholesale contractor for payment and penalty calculations for each contracted generator.

5.6 Energy Commission

The Commission is tasked with several key duties under the Energy Law. However, the responsibilities of the Commission will be dictated not only by the Energy Law, but also by the structure and maturity of the power market. The general duties of the Commission include:

- ▶ Development of regulations governing the commercial operation of the energy sector,
- ▶ Determination of rates for monopoly services,
- ▶ Approval of power contracts,
- ▶ Oversight of market activities,
- ▶ Arbitrator of disputes over power contracts, access and interconnection, and,
- ▶ Collecting, summarizing and reporting on power market activities.

In the absence of competition, the Commission will directly regulate the price of power, that is, the Commission will act as an independent review and approval agency for all energy tariffs. For the electrical sector, this will include the tariffs (or tariff formulas) embedded in the power sales contracts between the distribution companies and the wholesale contractor, distribution company retail tariffs, and power purchase agreements between the wholesale contractor and the

generation companies. For each of these sets of tariffs and transactions, the Commission will set out performance objectives and tariff methodologies.

The Commission will also issue licenses to the parties operating generating facilities and network facilities, consistent with the Energy Law. These licenses will address terms and conditions for the parties to the respective transactions. The rights and responsibilities of the operator will be articulated, along with the responsibilities of the government. Any penalties or remedies available to the government for non-performance will be stated in the license. Draft licenses are currently under development at the Commission.

Some of the specific duties of the Commission will include

- ▶ Approval of transmission company costs and recovery through the wheeling tariff and any pertinent connection charges,
- ▶ Approval of the technical dispatch operator costs and recovery through a dispatch service tariff,
- ▶ Approval of the costs of the funds administrator and recovery through a service tariff ,
- ▶ Approval of the wholesale contractor costs and recovery through a service tariff,
- ▶ Approval of each distribution Company's costs and recovery through the distribution wheeling and any pertinent connection tariffs,
- ▶ Approval, in conjunction with the Ministry of Finance & Economy, of the settlement and funds administration procedures,
- ▶ Publication of all policy and regulations regarding the power sector including
 - the pricing policy and regulations of thermal and electric power,
 - the policy and regulations relating to open access of the electric system,
 - the regulations relating to licensing of power sector entities,
 - the policy and regulations relating to international power transactions and interconnections,
 - the policy of promoting demand-side and supply efficiency improvements, and,
 - the pricing regulations of power sector service organizations

5.7 Funds Administrator

The funds administrator will operate under a service contract with the wholesale contractor. The funds administrator will be responsible for

- ▶ Maintaining sufficient escrow accounts,
- ▶ Receiving settlement information from the wholesale contractor,
- ▶ Invoicing the distribution companies,
- ▶ Collecting payments from the distribution companies via customer receipts collected through the local banking system, and
- ▶ Allocating the payments to the power providers and service organizations based on specific and highly transparent settlement procedures

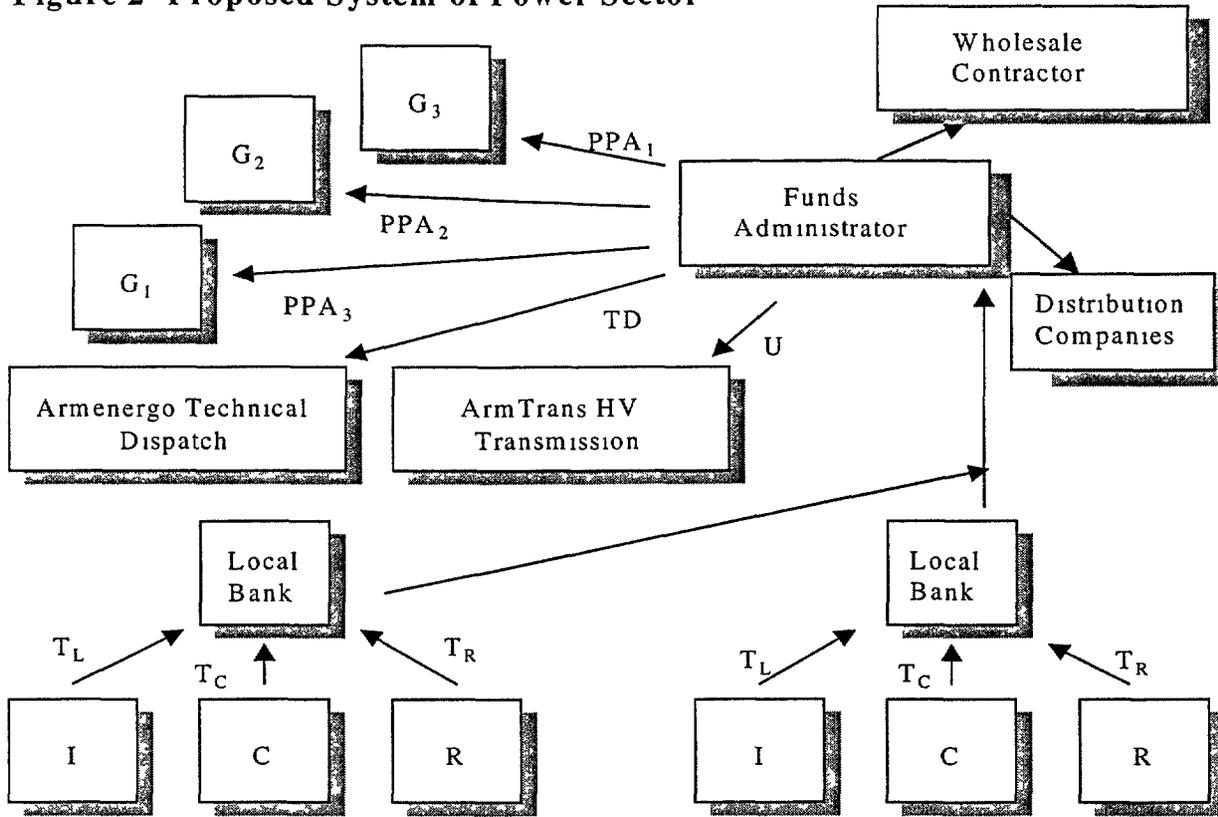
Figure 2 illustrates how the flow of energy payments is proposed. Essentially, there will be little discretion in determining monetary flows once the funds are transferred to the funds administrator. The funds administrator will distribute the funds in accordance with transparent rules for funds distribution. It is critically important that a) disbursement take place on a frequent basis so at least there is no significant impact on cash flow, and b) that the funds administration procedures create strong incentives for the distribution companies to increase cash collections. If the funds administrator decouples the incentive for improved collections from the distribution utility, then the concept will have done a disservice to the energy sector.

Governance of the funds administrator will be an important factor to address. In more developed markets, a market membership organization is an effective body to handle governance of the funds administrator, buttressed by a periodic audit requirement from an authority such as the Ministry of Finance & Economy. However, at present in Armenia, there is strong Ministry of Energy control over appointments/replacement of utility management. Hence, a market membership organization would not have the sorts of checks and balances one would normally hope to find as it would likely be dominated by the Ministry of Energy. This may change somewhat as the Board of Directors of each energy enterprise becomes more evenly balanced in representation between the Ministries of Energy, Privatization and Finance & Economy, but until that happens, a market membership form of governance will be problematic. In the near-term, this places even greater importance on the development of extremely transparent rules of operation of the funds administrator and also suggests that the funds administrator should be a private, non-government entity.

The funds administrator is meant to operate during financial shortfalls. As shortfalls are eliminated and distribution utilities demonstrate their ability to pay their power supply bills in full and on a timely basis, then the funds administrator is less necessary. However, private

investors may still prefer a funds administrator due to the administrator's ability to ensure payment and maintain escrow accounts

Figure 2 Proposed System of Power Sector



- PPA₁, PPA₂ etc Medium-term power purchase agreements for individual generators involving two-part payments to each generator
- BST Bulk Supply Tariff Includes energy and generation capacity payments and HV payments varying by time of day
- TL TC TR Tariffs for individual customer classes Based on customer class load factors and demand level by individual distribution company Tariffs include demand energy HV and LV charges
- U 2-part tariff for high voltage line usage
- TD Payment for costs of technical dispatch operations

6 TRADING ARRANGEMENTS

An objective of the reform process is to put into effect trading arrangements designed to provide incentives to energy suppliers to deliver cost-effective and reliable energy and capacity. These trading arrangements should also provide incentives to the wholesale contractor to make the proper resource selection to minimize total system power costs while maintaining at least the minimum reliability standard.

Initially, the trading arrangements will provide transparency in the power sector transactions. Through time, as experience grows with operating as separated functions, trading arrangements can become more complex providing the proper incentives to lower costs while maintaining a minimum level of reliability.

Distribution companies must be afforded the opportunity to bypass the wholesale contractor if the distribution company can prove to the satisfaction of the Commission that bypass is in the best interests of its customers and does not unduly harm other retail consumers or distribution companies.

Retail customers should also be given the opportunity to negotiate directly with developers of new power plants capable of cogeneration to determine if a total energy sale (steam, hot water, and electricity) can be provided cost-effectively. Surplus energy from the cogeneration facilities could be sold to the wholesale contractor or to distribution companies.

In all cases, the Commission must first approve a contract for any of these arrangements before any service is transacted under that contract. Potentially impacted parties should be provided the opportunity to review the contracts and provide their comments to the Commission before the contracts are approved or denied.

The issue of allowing distribution companies and consumers to choose their supplier (so-called open access) is an excellent way to introduce competitive pressures throughout the power sector. However, it also is more complicated and requires greater cost transparency through the “unbundling” of tariffs for network and ancillary services (e.g., wheeling of the distribution network, back-up service in the event of supplier default).

6.1 Contracts between the Wholesale Contractor and Existing Power Suppliers

The wholesale contractor will be responsible for entering into power purchase agreements with existing generating facilities on behalf of the distribution companies. Individual power purchase agreements will be negotiated with each generating facility in order to take account of the unique capital and fuel attributes of each facility. These agreements will include tariffs for energy production and capacity availability. In the near-term, generating facilities will be expected to provide specified ancillary services as required by the technical dispatcher. The costs of providing those services, if any, will be recovered through the power purchase agreement. In the longer term, separate contracts for specific ancillary services should be developed.

6 1 1 Bilateral Power Purchase Agreement

A bilateral power purchase agreement is a negotiated agreement between the wholesale contractor and an individual generating facility. The current contracts between Armenergo and each supplier are an example of this kind of agreement. The type of components recommended to be included in revised power purchase agreements to support this reform proposal include

- ▶ Term of the agreement (probably one year),
- ▶ A two part tariff with a rate for capacity based on an expected annual availability (i.e., its availability for dispatch) of the generating station. A premium is paid for higher than expected availability while a penalty is incurred for lower than expected availability. Capacity payments are made based on the capacity of the unit actually available for dispatch,
- ▶ The capacity availability component of the tariff is designed using estimated fixed O&M costs, investment requirements, and a profit margin,
- ▶ The energy rate is based on fuel and other variable costs and the generation is compensated based on the energy rate and actual plant generation, use of the two part tariff provides the generation enterprises with a strong incentive to be available for dispatch and makes them indifferent as to whether the unit is actually dispatched.

A two-part tariff for generators provides incentives for generators to make their generating units available as much as possible for dispatch purposes by linking payment to the station to the monthly availability of its generating units. The energy part of the tariff provides the correct variable costs to operate the units so that the least cost dispatch can be obtained. By only compensating the generator for variable energy costs when it operates, the generator is indifferent as to whether its units operate for energy production or provide stand-by capacity. Through the use of a capacity availability payment, however, the generator has a strong incentive to ensure that their units are available for dispatch when called upon.

A two-part tariff for generators will require a system of data collection and auditing to determine the availability of each generating unit. As further described below, it is recommended that the Commission run a parallel billing system for two or three months to determine the impact of the new billing system on the generators and to allow for education of the new rules and for adjustments before implementing the new tariffs. The Commission may wish to consider applying a price cap for an interim period such that no generator will be allowed to earn excessive revenues due to flaws in the rate design.

6 1 2 Contracts between the Wholesale Contractor and Foreign Power Suppliers

The wholesale contractor will also be the party that enters into supply agreements with foreign power suppliers. At present, the only such transaction is the Iran agreement. There are, of course, other legitimate government considerations involved in the import (and export) of power,

including foreign policy considerations, that will dictate some of the terms and conditions of a transaction. However, the Government should assign responsibility to the wholesale contractor the authority to enter into short term purchases of power as necessary for system stability, emergency and interchange power, or to reduce system costs without requiring Government approval. The wholesale contractor should report to the Commission on a monthly basis as to the foreign transactions that took place and the reasons for those transactions. Further, monies received from the export of power should also be handled by the funds administrator.

6.2 Bilateral Power Sales Contracts (Bulk Supply Tariffs)

6.2.1 Contracts between the Wholesale Contractor and Distribution Companies

The initial bulk supply tariff between the wholesale contractor and a distribution company will be based on the power purchase costs of the wholesale contractor, the cost of transmission services and the service organization costs associated with the technical dispatcher, the funds administrator and the wholesale contractor. When the wholesale contractor has matured, the contracts can be developed to provide incentives to both parties to reduce costs. The power sales contract should include

- ▶ The bulk supply tariff with the same tariff common to all distribution companies, there should no longer be a wholesale tariff for power purchase that is individually set for each distribution utility,
- ▶ Fixed term of two years,
- ▶ The bulk supply tariff will include a capacity payment provision based on a distribution company's reserved capacity and monthly peak demand
- ▶ The total of all of the capacity payments should recover the costs of capacity payments to the generating facilities as well as all service organizations costs that are demand-based,
- ▶ The bulk supply tariff will also include an energy component based on actual energy consumed by a distribution company as well as an allocated portion of the transmission losses, the price of energy will most likely vary and be separately specified according to several time periods (e.g., seasonal, peak, shoulder, off-peak),
- ▶ The total of all energy payments will recover all actual generation variable costs including all service organization costs that are variable in nature

Regarding two-part tariffs, distribution companies do not have a direct influence on the level of energy and capacity purchased from the wholesale market. Without the ability to introduce corresponding changes in the retail rate structure, the distribution company does not, through its pricing structure, have the ability to influence the customers' load. Distribution companies' load shapes may be significantly different. Two-part tariffs could be used to allocate actual hourly energy rates to each distribution company and allocate capacity costs based on each company's

share of coincident peak load. This method of allocation better allocates the energy and capacity costs to the distribution companies than the average energy rate presently being used.

Although the four distribution networks will purchase power from the wholesale contracting function at the same bulk supply tariff, the actual costs for each distribution network will vary, due to the application of the tariff. At some point, the Commission will be confronted with the need to remove the application of a nationwide uniform retail tariff.

6.2.2 Contracts between the Wholesale Contractor and Retail Customers

These contracts will be similar to the contracts between the wholesale contractor and the distribution companies. In addition, retail customers connected to the transmission system must also enter into interconnection agreements. Those retail customers connected to distribution company facilities, but purchasing power through open access provisions, should also be required to enter into interconnection and wheeling agreements with the distribution company.

6.2.3 Contracts Between New Generators and Distribution Companies

The Commission may allow new independent power suppliers to negotiate power arrangements directly with distribution companies if the Commission determines such actions are in the public interest. One likely difference between contracts with new generators and the distribution companies will be the term of the agreement. Private power suppliers may need longer term contracts in order to secure necessary financing. Further, there are likely to be a number of other unique provisions, such as those related to guarantees against certain kinds of risks, and handling of disputes (e.g., arbitration).

6.2.4 Contracts between Cogeneration Facilities and Retail Customers

Retail customers and developers of cogeneration facilities will negotiate energy service contracts. The developers will provide specific amounts of steam, hot water, and electricity. The developers will require a contract that is at least as long as the debt-service agreements from lenders (normally 12-15 years). Associated arrangements must be made for back-up service in cases when the cogeneration facilities can not provide the required electricity.

In addition, the cogeneration facilities may be able to generate cost effective energy to be sold into the power sector when the retail customer energy requirements are less than the capability of the cogeneration facilities. The buyers of this surplus energy could be the wholesale contractor or distribution companies. The Commission should permit flexibility for the cogeneration developer to negotiate the power sales contracts as long as these power contracts improve the economics of the power sector and do not impair the reliability of the power system.

6.3 Contracts between the Wholesale Contractor and the Transmission Company

The wholesale contractor should also enter into an agreement with the transmission company for the provision of transmission services for all generators selling firm power to the wholesale contractor. The agreement should specify

- ▶ The term of the agreement (probably one year),
- ▶ The tariffs that will be paid to the transmission company for transmitting power,
- ▶ The method of measurement to be used to determine the amount of power transmitted

There are, of course, many additional considerations that need to govern how the transmission company will interact with the dispatch authority, maintenance and investment planning to ensure reliability. Some of these will be included in the license for the transmission company, other provisions are best handled through inclusion in a grid code (a draft of which is under development). The contract between the wholesale contractor and the transmission company does not need to focus on many of these operational details as it is primarily a means for determining the compensation and money owed for transmission services.

6.4 Contracts between the Wholesale Contractor and Foreign Buyers

The wholesale contractor will also be the party that enters into sales agreements with foreign buyers. At present, the only such transaction is the Georgian agreement. The wholesale contractor should be given authority through its license to enter into short term contracts for sales to foreign parties when such sales represent a financial contribution to the utility system of Armenia, or are needed to maintain stability, and excess generation is available. Further, based on system requirements, if a generation company has excess generation that the wholesale contractor is unwilling to purchase, the generation company should be able to sell to a foreign party subject to transmission availability and in coordination with the technical dispatcher.

7. IMPLEMENTATION OF RECOMMENDATIONS

The market reform proposal outlined above requires a number of steps for successful implementation. Each of the major steps that need to be taken are described below.

7.1 Complete the Restructuring and Reorganization of Armenergo

Armenergo's responsibilities have changed over the last few years and their relationship with other power sector functions is becoming contractual rather than through subordination. Armenergo has, in fact, become a service organization for the other members of the power sector. With these changes, the restructuring and reorganization of Armenergo that was recently initiated needs to be completed so that what emerges is a series of well-managed and operated

organizations, separated along functional lines (e.g., transmission, dispatch, and wholesale contracting) that can provide services to meet the needs of its customers

Somewhat in accordance with the present reorganization of Armenergo now underway, Hagler Bailly recommends that three distinct service entities should be created, this includes a dispatch services entity (now considered as the main role of Armenergo), a transmission services enterprise (newly created as ArmTrans), and a wholesale contracting function (presently housed within Armenergo). The project team recommends further separation of the wholesale contracting function from Armenergo so that the only role remaining for Armenergo will be technical dispatch. Other existing departments or subsidiaries of Armenergo can either 1) become part of a temporary administrative services organization that supports all of the enterprises, 2) be separated and reassigned to each of the three enterprises, or, 3) be divested altogether and allowed to bid for such services with other potential providers of the same services.

The three enterprises need to clearly define the services each will provide. The services should cover all existing services that will apply in the future and any additional services that will appear as a result of the restructuring. Once the services are defined, the proper organizational structure of each enterprise can then be developed. Service contracts should be put in place to govern the commercial arrangements between the three enterprises. This will be especially important for the administrative support organizations that will in the near-term provide services to each of the three enterprises.

Each enterprise will need to have its own tariffs in place. The cost of providing services should be calculated, a rate design proposed and all corresponding data for the new rates provided to the Commission for approval.

7.2 Tariff Reform to Develop Multi-part and Unbundled Tariffs

The existing tariff structure does not provide adequate incentives for efficiency. For example

- ▶ The existing tariffs impose a fixed retail rate and are based on a fixed amount of assumed wholesale purchases. The difference between the price of purchasing wholesale power and the price of the retail rates is left to fund the distribution company's expenses. A distribution company with higher costs may receive a lower wholesale power purchase price than a distribution company with lower costs. If a distribution company lowers its internal costs through improved efficiency, it will be faced with the possibility of incurring a higher power purchase price. This provides a disincentive for efficiency in the distribution sector.
- ▶ There is no specified rate for transmission and dispatch services. The bulk supply tariff for a distribution company is equal to the retail rate less the planned distribution costs. The wholesale power price minus the bulk supply tariff equals the residual to pay for transmission, dispatch and ancillary services. It is difficult to determine whether the

monthly billings will result in positive or negative revenues for the transmission and dispatch enterprises. This lack of a specific tariff provides an incentive to spend little or no money on capital improvements. Regardless of the quality of service rendered, the revenues of the enterprises will remain unchanged as they rely solely on the residual between the power purchase and power sales tariffs for their revenue.

Access to the transmission network and distribution networks by generators, distribution companies and retail customers requires separate (or unbundled) tariffs for transmission and distribution services. Revising the tariff structure and introducing unbundled tariffs by function will dramatically improve the price signals seen in the power sector thereby encouraging greater efficiency in the sector. Further, with the introduction of unbundled tariffs for such services as wheeling, the transparency of the costs and revenue predictability of the various enterprises will be significantly enhanced.

The suggested steps for the rationalization of tariffs at the wholesale and retail levels include the following:

1. Develop two-part tariffs for energy and capacity purchases for generators and imports. All variable costs of a generating unit will be included in an energy rate and all other costs of the generating unit will be included in the capacity rate. Generators will be expected to provide a certain level of availability and will be assessed penalties for a shortfall of availability and paid premiums for exceeding the expected availability. Operating procedures will need to be developed for the reporting and auditing of generator unit availability. Commercial meters (and back-up meters) will need to be identified for each interconnection point and inspected for accuracy.
2. Develop tariff for transmission wheeling on a per kW basis. A simple postage-stamp rate should be developed where the total cost of providing transmission wheeling is allocated to bulk supply purchasers and customers purchasing directly from generators. The revenue requirements for transmission wheeling include all costs of owning, operating, and maintaining the transmission facilities except for those costs collected through a transmission connection charge.
3. Develop a tariff for transmission connection depending on the voltage level of the connection and special equipment/upgrades for a specific connection. Generators, distribution companies and retail customers connected to the transmission system should incur a transmission connection charge each month.
4. Develop a two-part tariff for dispatch operations. The tariff will consist of an energy charge for wholesale transactions and a demand charge based on capacity reservations. It will be used to fund the operation of the dispatch function.
5. Develop a tariff for the wholesale contractor on a per kWh basis. The tariff will be based on an energy charge on actual energy transacted on the wholesale market.

- 6 Develop a tariff for the funds administration service on a percentage basis of total revenue for each power sector entity
- 7 Develop a three-part tariff (bulk supply tariff) for distribution companies that includes a connection charge, an energy rate, and a demand rate based on capacity reservations. The energy rate of the tariff can be designed to have multiple time periods by day and/or season if economically justified. The bulk supply tariff will be designed to recover the sum of the power purchases from generators, the transmission wheeling services, the dispatch operation services, and the wholesale contracting services. Commercial meters (and back-up meters) will need to be identified for each interconnection point and inspected for accuracy.
- 8 Develop a tariff for distribution wheeling on a per kW basis. This tariff will be applied to individual customers with direct access to the bulk supply system. The revenue requirements for distribution wheeling include all costs of owning, operating, and maintaining the distribution facilities except those costs allocated to through the distribution connection charge. The distribution companies must maintain a level of expected reliability. The Commission will develop a standardized index for duration and frequency of outages for each distribution network. A system of tracking outages and reporting them to the dispatch center should be developed.
- 9 Develop a tariff for a distribution connection charge depending on the voltage level of the connection and special equipment/upgrades necessary for a specific connection.
- 10 Develop retail tariffs for industrial customers with a connection charge, an energy charge, and a capacity charge. The energy rate may be split into seasonal and time-of-day differences, similar to the bulk supply tariff. The allocated cost to serve these customers will only include the system expenses at or above the voltage level of the customer. All other costs will be included in the cost to serve non-industrial customers. Commercial meters (and back-up meters) will need to be identified for each interconnection point and inspected for accuracy.

It should be noted that each change above could be implemented while retaining overall revenue neutrality with the existing tariffs if that is the desired goal.⁴ However, even if the tariffs are designed to be revenue neutral, the change in the structure of the tariffs should still have an impact on the cost structure of the sector, the improved design of the tariffs better reflecting the cost structure seen in the sector should encourage reduction of costs and better utilization of sector assets.

The changes proposed to the tariff structures are significant and the effort required to develop and implement these new structures is considerable. There is also the risk of error and

⁴ Hagler Bailly does not believe current tariff levels are sufficient. Additional increases in tariffs overall will be required to provide for the full investment needs of the sector.

unintended consequences anytime such dramatic changes are made. To ease the transition to the new tariffs, the following steps are recommended:

First, the implementation of the tariffs should be done first on a “test” basis for a few months so that the power sector entities become acquainted with the new rate structures and can work through any problems found during implementation (e.g., excessive or deficient revenues). During the months the test is conducted, the existing tariffs remain effective for billing purposes but the new tariffs are calculated and compared with the results seen from the existing tariffs.

Second, the Commission should ensure that the new rates do not result in excessive additional revenues for any party or result in an excessive shortfall in revenues. The Commission may consider using revenue “bandwidth” to ensure that the tariff maintains reasonable revenue neutrality in the near-term for the power sector enterprises.

7.3 Develop Settlement Rules and the Operation of the Funds Administrator

Potential investors are interested in the probability (level of risks) of obtaining a reasonable return on their investment. High-risk investments will result in high expected rates of return. There is an obvious need to attract investment into the Armenian power sector. Facilities of the generators, transmission and distribution systems, and dispatching groups badly need to be repaired or modernized.

It is in the best interests of the Armenian retail customers to obtain the necessary investments at low rates of return so that the power sector can provide a reliable supply of energy at reasonable prices. Investors will examine the stability and level of prices for services rendered by the utility and the potential profits (collected revenues less costs).

The collection of retail customers’ electric payments and their allocation to the power sector entities is very important to the security of profits for each entity. Rules governing the settlements and administering of the funds need to be clear, specific, and transparent. In the longer-term, governance over these rules can come from a market members type of organization. However, in the near-term, it is recommended that the rules be drafted by a committee consisting of representatives of several power sector organizations (representing generation, fuel supply, transmission, dispatch and distribution), the Commission, and the Ministries of Energy and Economy & Finance. This working group could be supported with technical assistance.

7.4 Further Define the Legal Basis for Activities in Light of the Separation of Power Sector Functions

The legal basis for performing services for others in a power sector is normally found in several normative documents:

- ▶ Power contracts
- ▶ Market agreements

- ▶ Licenses
- ▶ Interconnection agreements
- ▶ Wheeling agreements
- ▶ Operating procedures
- ▶ Dispatch service agreements, and
- ▶ Ancillary services agreements

For example, a power contract between Armenergo and the hydro power plants was developed and signed between the parties. The contract specifies the compensation for delivery of energy to the wholesale market. The hydro plants provide many more services than just energy generation to the system. These services include black start capability, operating reserve, reactive power dispatch, and frequency control.

There is no legal basis at present for providing these services, but the system would immediately fail if the hydro plants did not provide these services. The technical dispatcher has no legal basis for demanding such services without an appropriate ancillary services contract in place. The above normative documents should be drafted and finalized as soon as possible.

Interconnection agreements should also be developed. The separation of the power sector leaves open the question of ownership of specific facilities. The interconnection contracts should specifically state the point of interconnection and specific facility ownership.

A set of documents consistent with the reforms must be completed. These documents will include the following:

- ▶ Licenses to define the rights, responsibilities and obligations of the licensees and the level of economic regulation. These are currently in development for generation, transmission, dispatch and distribution enterprises. A similar license will be needed for the wholesale contractor.
- ▶ Power purchase agreements for each type of plant, whether nuclear, hydro, or thermal, reflecting the tariff change recommendations.
- ▶ Transmission interconnection and use of facilities agreements to define the relationship between the distributors and Armtrans. These will define the technical parameters and conditions to be met in order for a party to connect to the network. They will also provide the structure of the tariff to be used for the pricing of transmission usage and connection fee.

- ▶ Power supply agreements between the distribution companies and the wholesale contractor for buying power under the bulk power supply tariff. They should reflect the rights and obligations of both parties, the conditions for delivery of power, and the design of the power tariff.
- ▶ Market members' agreement to coordinate the activities of the wholesale market among its members and develop pricing rules, settlement procedures, and operating procedures for the benefit of an efficient and reliable power sector. Market members will include distribution companies, generators, and service organizations.
- ▶ Market rules governing financial settlements to provide the details of when and how payments are collected from customers and allocated among power suppliers, transmission and distribution companies, and other service organizations. The provisions for handling shortfall situations will obviously be the most critical for successful financial reform.

7.5 Creation of the National Energy Association

In an interconnected electric system, the actions of an individual generator or consumer can have a positive or negative impact on other generators or consumers connected to the system. Transmission losses, for example, are not determined just by the actions of two parties to a bilateral contract but are determined by the actions of all the generators and consumers and the configuration of the transmission system at any moment in time. Likewise, all connected parties benefit from the presence of the transmission system and system security services, such as reactive support, frequency control, "black start" capability and others. Problems arise if the parties who benefit from services are not bound to adhere to the rules that give rise to those services.

The operation of any power sector needs close coordination between all functions. Planning, designing, constructing, energizing, operating and maintaining facilities require cooperation between the power sector entities. Formal planning and operating committees are found in almost all interconnected power systems. In restructured power systems where functions are separated, new committees such as market operations and settlement operations are being added.

The creation of a National Electricity Association ("NEA") is recommended to provide a forum in which market members participate to develop the rules for planning and operating the power system. The membership would include all distribution licensees, all generation plants (except perhaps those connected directly into the low voltage system or for self-use), the dispatching services enterprise, the wholesale contracting enterprise, and the transmission services enterprise. As a result of the interconnected nature of the electricity market, it is reasonable to require as a condition of licensing that all interconnected parties will be bound by a set of market rules developed by the NEA and reviewed and approved by the Commission.

The creation of an energy market organization is important to continue coordination of system operations and planning in the absence of a vertically integrated utility. The organization facilitates the creation of clear, fair and transparent market rules (pricing, settlement, operating procedures). It also provides a forum for resolution of power sector problems. It should be noted that this organization does not supplant the need for, or responsibilities of, the Commission, instead, it simply provides a mechanism which permits commercialized and eventually privatized market members to ensure that the system develops and is operated in accordance with sound industry and commercial practices.

8. CONCLUSION

Armenia has taken several impressive steps to reorganize its energy sector. As noted earlier, these include the aggressive restructuring of Armenergo from a state-owned vertically integrated utility into a structure separated along functional lines. The establishment of the Commission also provides the main institutional change required to oversee the transition to a much more market-oriented industry. The Government's pronouncements on privatization signal a willingness to capture the advantages offered by the private sector in terms of investment attraction and management talent. Clearly, the sector is poised to become a model for the country's overall economic reform efforts. The recommendations provided in this plan are intended to represent the next major phase of the power sector restructuring process. With the structural changes suggested in this proposal, supported by unbundled transparent tariffs, and the new institutions to be developed (e.g., funds administrator) the sector will be well-poised for sustained improvement and financial recovery. With this structure in place, Armenia will be positioned to address the next challenges facing the energy sector, that is, to attract the investment required to rebuild and modernize the power sector. Additionally, this structure will be well-suited for regional integration and cross-border power transactions, something that will hopefully continue to increase over time.