PN ACD 738 99533
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FUEL SECTOR STATUS ASSESSMENT
ARMENIA

NIS Institutional Based Services Under the
Energy Efficiency and Market Reform Project
Contract No CCN-Q-00-93-00152-00
Delivery Order No 15

Prepared for

United States Agency for International Development
Bureau for Europe and NIS
Office of Environment, Energy and Urban Development
Energy and Infrastructure Division

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September 24, 1998

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Summary

The only significant energy sources now in use in Armenia are oil, gas nuclear power and hydroelectric power Of these, only hydroelectric energy is indigenous Oil gas and nuclear fuel for the Armenian nuclear power plant have to be imported Prospects for the future development of significant indigenous fuel sources in Armenia are not encouraging for oil gas coal nuclear fuel, or renewable forms of energy other than possibly low-grade geothermal energy The Armenian economy will depend for the foreseeable future on fuel imports This in itself is not particularly disturbing, as long as efficiency is being restored in the energy markets The Government of Armenia is committed to resolving current bottlenecks One area of special interest is the gas industry where the Government has relinquished its sole ownership Armenia s natural gas operations are now predominantly in foreign hands This is a development should be monitored closely over the next year or two

Current Fuel Situation

Armenia has always lacked energy resources, except for a sizeable amount of hydroelectric capacity and, since 1976, a significant nuclear capacity The country is especially lacking in fossil fuels

Armenia's coal reserves are economically marginal and physically of low quality Most of the coal that was used in Armenia during the pre-independence days was imported for residential heating In its peak year of 1988, coal supplies, almost all of them imports, represented roughly 6% of its useable energy supply Since 1988 coal consumption declined, and by 1993 it ceased to exist for all practical purposes

Sizeable coal deposits are known to exist at various locations in Armenia, but either their quality is too low or the deposits are too deep to warrant large-scale economical extraction There are three coal mines and various test sites currently in operation in Armenia The three mines are located near Idjevan, Djadjur, and Nor Arevik However, these are minimal mining operations supplying fuel for heating to the surrounding communities The largest Armenian coal mine currently in operation is in Idjevan Using one shovel excavator and two trucks, it produces at

best 100 tons a day In short coal is not a significant part of the Armenian energy portfolio and it is not likely to be in the foreseeable future [1]

No economically viable oil or natural gas reserves have been discovered to date in Armenia Earlier exploration efforts, conducted during the Soviet regime, have not produced more than traces of hydrocarbons However new exploratory efforts are under way utilizing Western seismic and drilling expertise A first test well has come up dry in the summer of 1998 but the existing exploration agreement calls for the drilling of two more exploratory wells and other Western companies are currently negotiating for additional exploratory leases Thus while there are still no proven reserves of oil or natural gas in Armenia, this is a time of suspense and expectation If oil reserves are found, and this is highly uncertain, they will likely take a few years for full development Gas reserves, which have been equally elusive to date could be developed more rapidly, since the country already has a fully developed and viable, if somewhat deteriorated, natural gas infrastructure Domestic oil and gas therefore, is at best a long-term issue and it could well turn out to be a non-issue

Still, oil and natural gas are very much part of the Armenian energy portfolio Based on a rough estimate, oil represented about 38% of the Armenian primary energy supply in 1988, the peak year in terms of energy consumption All of this oil was imported, half in the form of relatively inexpensive residual fuel (mazut) used for power generation, and the rest as refined oil products used for automotive and other purposes Gas was even more important than oil, representing some 45% of the Armenian primary energy supply in 1988 Both oil and gas, and especially gas, will be discussed in some detail later on

As to non-fossil energy sources, Armenia's 880 MW nuclear capacity, as originally designed, represented some 24% of its electric generating capacity in 1988 Used as a base load plant, the Armenian Nuclear plant (Metzamor) produced about 31% of Armenia's total electric power in 1988 Following a lengthy shut-down period (1989-1995) that was implemented as a precautionary measure in the wake of a major earthquake in 1988, the nuclear plant has suffered considerable neglect As a result, only one of two reactor units has been reactivated, and that one at reduced capacity The second reactor unit is considered to be beyond repair Hence the nuclear power sector now and for the next few years exhibits considerable stability Of interest is the fact that Armenia lacks the ability to produce its own nuclear fuel, so that even in this area the country is dependent on imports to keep the system running

Hydroelectric power is the only indigenous form of energy of any consequence During the Soviet regime, when the importation of fossil fuels was relatively inexpensive and the nuclear power plant produced at full capacity, hydroelectric power was produced with restraint In 1988, hydro-electric power generation was 1,534 GWhrs, or roughly 10% of Armenia's total electric

[1] USAID has sponsored a study by Burns and Roe to investigate the possibility of a circulating fluidized bed coal plant using very low-grade Armenian coal Preliminary results indicate that a unit is technically feasible but not economic relative to other alternatives

power production With the nuclear power plant shut down and gas and residual fuel in scarce supply due to the Azeri embargo hydroelectric power generation was pushed to its limit in the early 1990 s, reaching 4,290 GWhrs in 1993 Approximately 56% of the installed hydroelectric generating capacity is fed by water from Lake Sevan which resulted in heavy over-use of the lake's water resources This was clearly not a viable long-term solution The reactivation of the nuclear power plant and the resumption of electric power importation from Iran have brought relief and hydroelectric power generation has been reduced below the 1988 level to 1 390 GWhrs in 1997 Given the significant reduction since 1988 in economic activity in general and in power production in particular, Armenia's 1997 hydro-electric power generation still represents some 23% of the country's total power production

In summary, Armenia is heavily dependent on foreign sources for its fuel supplies In a market environment, its coal reserves are not likely to attain economic viability, especially now that environmental concerns are part and parcel of the energy policy debate in the country Armenia s nuclear power sector is likely to be stable for the immediate future Oil and natural gas will continue to come from foreign sources, at least for the next 5-10 years but there are some interesting developments on the hydrocarbon front, especially in the natural gas sector These and other prospective developments are the topic in the following section

Short-Term Energy Developments and Long-Term Prospects

Natural Gas On January 18, 1997, a letter of intent was signed between the Russian natural gas pipeline company Gasprom, the foreign gas marketing company Itera, and the Ministry of Energy, seeking to establish a joint-venture company among these interests Negotiations continued throughout the year until December 19, 1997, when agreement regarding the merger was reached at a Founders' Meeting Ten days later, the newly-formed Company, known as ArmRusgasprom was officially registered in the Republic of Armenia ArmRusgasprom is a Closed Joint Stock Company (CJSC), responsible for all aspects of natural gas transmission and distribution inside Armenia Gasprom and the State of Armenia each have a 45% interest in that company The remaining 10% interest is held by Itera This makes the Armenian gas industry a foreign-held organization and it sets the stage for a major restructuring and commercialization phase in that sector

While negotiations between Gasprom, Itera, and the Armenian Ministry of Energy proceeded in 1997, preparations were made to effect a smooth transition from the state-owned gas industry towards the three-party Joint Stock Company envisioned in the letter of intent The first step in that direction was the breaking up of the state monopoly into essentially two state enterprises (a pipeline company and a distribution system) that would operate under a management company, Armgasprom State Concern The fate of various other subsidiary companies remained undefined at the time These included two pipeline construction companies, several manufacturing plants and a number of service companies

In May of 1998, the Armenian natural gas industry was restructured again, to accommodate the newly established ArmRusgasprom The pipeline company, Transgas, was retained as one entity,

but it was converted from a State Enterprise into a CJSC The distribution industry was broken into two CJSCs, the Yerevan Gas Company which essentially serves the Armenian Capital Yerevan, and the Haygas Company that holds all the distribution systems in the rest of the nation Haygas has several subsidiaries including ten local distribution companies in various cities, three technical service companies, one company selling compressed gas as automotive fuel, and two district heating companies Some of the remaining subsidiaries of the old Armgasprom State Concern have been spun off, but many remain nominally attached to ArmRusgasprom, pending a determination on how to structure ArmRusgasprom and what to do with the remaining peripheral subsidiaries

Even though required under their respective Charters, neither of the CJSCs has issued any shares The number and assigned value of the authorized shares reflect a valuation of the respective companies ("Charter Capital") somewhere between one fifteenth to one twentieth of the assessed value For example the combined shares of the two distribution companies add up to about $4 2 million, compared to the assessed value of the system of $72 2 million ArmRusgasprom also has a Charter Its authorized shares, not yet issued, add up to $280 million (the assessed value of the entire gas system of $270 million plus a cash infusion of $10 0 million), which closely matches the assessment that served as the basis of negotiations That value includes about $32 9 million for the peripheral companies whose fate will be determined at a later point in time

We do not know, and we suspect ArmRusgasprom does not know at this time, how the new gas industry is to be structured The low valuation of the pipeline and distribution companies may suggest that their value is carried as their buildings and other directly used equipment with ArmRusgasprom owning both the shares and the assets of the essential pipelines and distribution systems If so, that would spell confusion in developing meaningful pipeline and distribution tariffs that should include among their many components a reasonable allocation for depreciation, for the allowable rate of return on investment, and for property taxes All we do know at the time of this writing is that a meeting has been set for mid-October, for the purpose of resolving outstanding issues such as the respective allocations of charter capital, whether to establish individual company boards for each of the major constituent companies, and what to do about the peripheral subsidiary companies However, these questions will be resolved by the end of 1998, at which time an update on the gas industry's state of commercialization and corporatization would be desirable

The importance of this development in the natural gas sector is that it essentially denationalizes that sector and removes it from the direct control of the Government of Armenia where the Ministry of Energy is the designated lead agency Coupled with the establishment of an energy regulatory commission and the development of a cost recovery tariff system, the Armenian natural gas industry now has the tools to emulate the western regulatory and operating experience The regulatory commission currently operates with some, but not complete, independence from the government, but it is scheduled to become increasingly independent, especially in its rate-setting operations

With the regulatory environment defined along western lines and control limited to overseeing tariffs for the purpose of preventing ArmRusgasprom from reaping monopolistic rents the new foreign-owned gas industry is now in a position to expand It plans to do this domestically and internationally

On the domestic front, the immediate objective is to reactivate the now-dormant delivery of natural gas to the residential sector At its height in 1990 at 1 36 billion cubic meters the residential sector had for all practical purposes ceased to receive gas in 1993 because of the Azeri embargo Current plans call for the rehabilitation of the residential network and delivery of 1 0 billion cubic meters to the residential sector by 2001/2002 The increase, from essentially zero now to 1 0 billion cubic meters within 3 to 4 years will bring the full-cost-recovery natural gas tariff to reasonable levels A USAID-funded tariff recommendation suggests interim subsidies to the residential sector between now and the attainment of the 1 0 billion cubic meter target in 2001

There is also considerable slack in the industrial sector where consumption declined from 1 67 billion cubic meters in 1988 to a low of 60 million cubic meters in 1993 By 1997, industrial gas consumption had risen to a still very low 148 million cubic meters The restoration of industrial gas consumption to pre-independence levels is beyond the control of the natural gas industry The industrial sector has been and continues to be in a sustained depression The commitment of the Government of Armenia to privatize the domestic industrial sector and to restore confidence in the gas tariff system give hope that the industrial sector will eventually recover However, the prospects for that are not as immediate as they are for the resumption of large-scale gas deliveries to the residential sector Beyond the residential and industrial sectors, domestic gas deliveries will not grow much faster than the economy in general

On the international front, there is an immediate candidate for increased gas throughput and capacity utilization of the Armenian pipeline system, which would likely provide tariff relief to the rest of the gas industry This is the Armenian/Russian plan to use the Armenian trunk line system for the delivery of Russian gas to Turkey This could be achieved in relatively short time by building a connecting link approximately 60 km in length from the existing Armenian trunk line near Gumry to the Turkish border As long as this gas is moving through the existing Armenian trunk line system, it will contribute to the reduction of pipeline tariffs, to the benefit of all gas users in Armenia In the long run, a separate line might be built for transit gas to Turkey If and when that happens, the line will carry its own (unbundled) tariff, and the benefit to the Armenia gas user will be lost But that will be many years down the road In the interim, the shipment of Russian gas through the Armenian system will act very much like a temporary subsidy to the Armenian gas system

There is also talk about the construction of a pipeline from Iran to deliver natural gas to the southern region of Armenia which has not received any gas in a long time Whether that plan will materialize in the face of the newly-established gas connection through ArmRusgasprom is an open question, since the rehabilitation of the delivery system from Yerevan on south, with assured gas supplies from Russia, is now a realistic alternative In a competitive system, the

outcome of these two competing alternatives would depend on the relative costs of rehabilitation and the long-term delivery price of the gas To be incorporated into that equation are the various risks associated with the two natural gas sources In short from our perspective and at this time it would be impossible to draw any conclusion regarding the feasibility of delivering gas from Iran

Oil In 1988, total oil deliveries to Armenia amounted to 3 91 million metric tons Almost half of this amount was mazut that was used to fuel Armenia's thermal power plants The rest was used for automotive and other purposes

The use of oil for purposes other than thermal power plant fuel now resides exclusively in the private sector As a result, movement of this oil is not restricted by political barriers Other than quick and pronounced price responses, this oil will be able to overcome shortages in regional or world oil markets

As to mazut, its use as a fuel for thermal power generation has declined substantially During the period from 1988-1992, mazut was the primary fuel source for thermal power plants This situation changed as the Azeri energy blockage began to take its toll on the Armenian energy supply Because nearly all the mazut consumed in the Armenian thermal power plants came from either Azeri refineries or was transported on railroads running through Azerbaijan, the blockade has reduced the supply of mazut Today the mazut used in Armenia comes by rail from Georgia That makes this fuel very expensive by the time it is delivered in Armenia

The reduction of mazut as a fuel for thermal power plants was exacerbated by price movements in favor of natural gas Today, natural gas costs approximately 0 94 cents per 1000 kilocalories, compared to around 1 3 to 1 7 cents per 1000 kilocalories for mazut The only reason mazut is still in use at the Armenian power plants, all of which are dual-fuel plants, is as an emergency fuel that is kept on site and used in the event of a natural gas outage Even in that use, insufficient quantities of mazut are kept in reserve at the various power plants, mostly as a matter of cost-cutting measures In the early summer of 1998, the Razdan thermal power plant only had 6-7 day's worth of emergency mazut The Yerevan thermal power plant was even worse off Its reserve holdings were less than one day's worth of operations

Geothermal Prospects Various parts of Armenia are subject to unusually high geothermal gradients that suggest the possibility of geothermal power generation In fact, the exploratory well mentioned earlier that came up dry in the summer of 1998 has encountered a high geothermal gradient, reportedly not enough for power generation, but quite possibly enough for hot water and district heating The well, even though dry, was not permanently abandoned for the reason to keep open the prospect of making it the source of hot water supply for nearby residents Be this as it may, geothermal energy, even though of little immediate use, should not be left out as a potential source of fuel, especially for low-grade heating applications Other renewable energy sources have been investigated from time to time, notably wind power, but the evidence to date has not been convincing, at least not to foreign investors

Imports of Electricity Imports of electricity are not of course a source of fuel but they replace the need for fuel in Armenia and for that reason need to be mentioned

Importing electricity will do two things for Armenia For the immediate future it will help balance the electric power system which is dangerously close to being unbalanced in the summer when demand for electricity is low and the unexpected shut-down of Metzamor or a major thermal power plant could create havoc in the system There has been some discussion concerning time-based swap agreements under which electric power is shipped to Iran during the day, and the flow reversed in the evening, a sort of regional power balancing mechanism extending across international boundaries More importantly in the long run but apparently difficult to achieve now, is the outright reduction of the need for imported fuel by importing electric power on a sustained long-term basis The stumbling block here seems to be more the price at which this might happen rather than technical barriers

Other Considerations Overall, the Armenian fuel sector is beset with operational and structural difficulties that must be overcome if there is to be any hope of restoring balance fairness and long-term viability Generally the fuel delivery systems are in an advanced state of deterioration That includes the gas pipeline and distribution systems, the railroad system that delivers liquid petroleum products from Georgia, and, although not strictly speaking a fuel delivery system but very much part of the energy sector, the electric generating and delivery system The one issue that needs immediate attention, and it is getting it now, is a pricing methodology that breaks the cycle of delivering fuels below cost, with attendant cash flow problems for the delivery industries The entire capital allocation mechanism in a market economy depends on price signals that accurately reflect opportunity costs throughout

Sound operational practices are another factor that need to be introduced The Government's emphasis on corporatization and privatization is a step in the right direction In the energy sector, the establishment of ArmRusgasprom is a significant change If that foreign-held company succeeds in the market place, there is hope that others may follow Whether it can succeed will depend in large measure on the Government's ability to withdraw its direct influence over operational or pricing issues in the gas industry and the Russian partner's ability and willingness to promote the development of the gas sector