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**NATURAL GAS AND ITS UTILIZATION FOR
POWER GENERATION IN YEMEN***

Country Paper

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The views expressed in this paper do not necessarily reflect those of the United Nations.

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Natural Gas and its Utilization for Power
Generation in Yemen

Since 1950's natural gas started to share its percentage as primary energy source in various countries all over the world.

The number of countries which use the natural gas as a source of energy among other sources exceeds 65. This figure still increases and many countries are exploring to find natural gas.

Natural gas can be used as a source of energy for many plants which need energy for its operation.

In this paper we will concentrate on its utilization for power generation in the Republic of Yemen where a huge quantity of natural gas is discovered which offers this possibility.

The studies which were carried out and prepared by foreign consultants indicated that about 13 trillion m³ of natural gas is the reserve of Yemen in Maarib area. This availability of gas and with significant quantities provides the Government with an opportunity of minimizing the utilization of conventional fuel for power station to generate electricity which is expensive and affect the environmental impact.

One of the studies which were performed was named "Gas Utilization Study" and its final version submitted to the Ministry of Oil and Mineral Resources in 1988.

The purpose of the study was to investigate the possibilities to introduce LPG and natural gas in the energy economy of the Former-Yemen Arab Republic because it was carried and prepared before the unification of the two parts of the home land for which an updating to the study is necessary.

Availability of LPG and natural gas

Source	Natural gas		Propane 1000 tonnes	Butane 1000 tonnes
	Billion m ³	TCF		
ALIF ass. gas	8.5	0.3	1200	860
ALIF cap. gas	70.9	2.5	4000	2600
Meem	14.2	0.5	71	38
Total	93.6	3.3	5271	3498

The estimation of the potential quantity of LPG is 8.8 million metric tonnes mainly from ALIF field. And it was anticipated that this quantity is adequate to cover demand for the immediate future. But as it was stated that these figures are not valid now, mainly after unification and recent reserve estimates of Hunt Oil show a total proven quantity of 3.8 TCF which will cover the estimated demand in the coming 25 years. Other estimates show that reserve estimates of Natural Gas may cover the demand in the coming 50 years.

The study showed that it is not economically justified to distribute Natural Gas to individual households because of the wide dispersion of the population, the low consumption per household and the difficult geographic conditions. And as a result of this the study showed that it is suitable to use the natural gas instead of oil in boilers installations of existing power stations and cement factories which are located very far from natural gas field.

By these indications the study recommended a Pipeline System to supply the existing and new power stations and cement factories with Natural Gas without any justification in case of installing the new power station as an alternative near the gas field and erect a high voltage transmission line to reach the consumers who are in this case the cement factories only.

Demand and Supply of Electricity

Further demand of electricity is growing and its average increase is about 15% and may reduce to 8% in the near future.

The installed capacity in the unified electrical system in Northern Governorates is about 373 MW and the peak load is about 214 MW, and by adding the losses in the network mainly in distribution network which 30% we will find that a new power station must be installed and commissioned as soon as possible to meet the demand of various consumers and the annual growth in consumption, because the available capacity is not sufficient to meet the demand.

The following table shows the installed, available capacity (MW) and reserve position in the Republic of Yemen (ROY) in which we shall see that the two systems are not interconnected yet, and a project for interconnection of both Electrical systems is under implementation.

Installed, Available Capacity (MW) and Reserves Position

	1990	1991	1992	1993	1994	1995	1996
A. RCEP System							
1. Peak Demand	93	98	102	108	113	119	123
2. Installed Capacity	222	222	247	247	247	247	247
3. Retirements							
Hedjuff	0	10	0	0	0	0	0
Khormassar	0	0	8	8	8	0	0
Mansura	0	0	0	0	0	8	0
4. Available Capacity (2 - 3)	222	212	229	221	213	205	205
5. System Contingencies For Forced and Maintenance Outages							
o 1- Biswa Unit	25	25	25	25	25	25	25
o 1- Mansura Unit	8	8	8	8	8	8	8
Subtotal	33	33	33	33	33	33	33
6. Spinning Reserve Needs							
o 1- Biswa Unit	25	25	25	25	25	25	25
o 1- Mansura Unit	8	8	8	8	8	8	8
Subtotal	33	33	33	33	33	33	33
7. Minimum Capacity Needs (1 + 6)	126	131	135	141	146	152	158
8. Reserve Capacity	83	48	81	47	34	20	14
9. Reserve in I	68	50	60	43	30	17	11
B. YGEC System							
1. Peak Demand	190	208	227	248	266	285	305
2. Installed Capacity	373	373	373	373	373	373	373
3. Present Unavailable Capacity Due To Forced and Maintenance Outages	122	122	122	122	122	122	122
4. Net Available Capacity (3 - 4)	251	251	251	251	251	251	251
5. Minimum Spinning Reserve Requirements							
o 1-40 MW Unit at Al Mocha	40	40	40	40	40	40	40
6. Net Available Reserve Capacity (4-1-40)	21	3	-16	-35	-55	-74	-84
7. Reserve Margin In I	11	1	-7	-14	-21	-26	-31

M:\ROY\SUPTAB1

From the table it appears that reserve capacity for Northern Governorates (YGEC System) is minus in 1992 and a load shedding programme is followed.

As a result of present situation in shortage of available capacity, the power balance shows that YGEC-System will need additional generating capacity by 1993.

In our view as Ministry of Electricity and Water, we recommend to install the new Power Station near the field of natural gas and build a power transmission line to supply the consumers with electricity as an option which will avoid the risk of power shortage starting 1993.

The another option of building a Natural Gas Pipeline to supply the new gas fired power station in a place called MA'ABR very far from gas field will not solve the shortage of power because of long time of implementation of the pipe line and will lead to separate the project between two ministries:

- Ministry of Oil and Minerals which will be responsible for the implementation of the gas pipeline project.
- Ministry of Electricity and Water which will be responsible for the implementation of the gas fired power station.

Due to lack of coordination in planning and project implementation in our country the two projects cannot be completed in the target date. Beside this there are no other big consumers of natural gas except cement factories which are located in areas very far from each other, and connected with existing power network.

Therefore it is justified to install the new gas fired power station open cycle near the gas field and building a power transmission line to the centre of consumption including Cement Factories which get their supply of energy from the existing power system.

In this case it is advisable to supply the Natural Gas to its consumers in our case cement factories only by power transmission line instead of building pipeline system which is not required now and may be required in the future if new big consumers of natural gas may appear.

After visiting the gas fired power station located in Al-Rishah in Jordan which was built near the gas production wells by about 350 meters we are now convinced that the best solution to utilize natural gas for power generation is to erect the turbines near the gas wells and its gas gathering and dehdration plant.