that gas prices could increase if left to the forces of demand and supply and if the cost of gas supply is genuinely high. In most developing countries, however, gas prices are subject to some type of government control. Price cannot be increased because of political considerations. This is indeed a very serious constraint facing implementation of projects which are aimed at importing gas to developing countries.

Nevertheless, the use of LNG with CIF prices of $3.50 to $4.0/MMBTU is now considered economically viable in many countries. Indeed, if LNG could be bought like other fuels, i.e., in some type of international market, there would be a rapid growth in its use in developing countries. But purchasing LNG is not a simple matter. Prior to becoming qualified to purchase LNG, an entity (or often country) should be:

(a) very credible, and preferably able to contribute to the financing of project components;
(b) able to buy large quantities of gas and to sign long-term contracts to take the gas over periods of 20 to 25 years;
(c) have a flexible fuel demand so that it can rapidly absorb sudden supply of gas but also be able to tolerate probable delays in the construction of LNG supply facilities without substantial damage to its operations and economy.

Due to the above requirements, only a handful of countries presently purchase LNG. However, there are some signs of the emergence of a more open gas market. The new trend is likely to lead to a situation in which short-term LNG market can become a basis for gas supply to developing countries.Even if a short-term market does not emerge soon, there will be a tendency to deal with new customers-- rather than only well-established Japanese and Korean consumers. The more flexible attitude is bound to benefit developing countries in their search for sources of gas supply.

10 bcm/yr to outside the FSU through the Russian transmission system. Arguments over prices and transit fees lead to ending the trade agreement in 1994. Turkmenistan's gas export to other FSU republics also dropped because of lack of payment for the gas. Export to other republics declined from about 50 bcm in 1991 and 40 bcm in 1993 to 23 bcm in 1994. Part of exports flow through the Russian territory to Ukraine, Azerbaijan and Armenia. The rest are supplied to neighboring countries. Turkmenistan's gas export in 1995 is estimated at about 28 bcm which is all delivered to other FSU republics.

Turkmenistan's future gas export potentials are not limited by size of the reserves but by access to markets. A feasible option involves exporting gas to Russia for further re-export to Europe. At the present time the option is not considered very desirable to Turkmenistan because it is perceived to be under too much Russian influence. In the future, however, this could become an attractive option for both sides as Europe's demand expands and new fields in Russia may not have been developed. Nevertheless, Turkmenistan is keen to build alternative export pipelines for its gas in order to avoid Russian influence on this business. There are a number of projects under investigation. First, a 2500 miles pipeline through Iran and Turkey to Europe has been studied extensively. This pipeline system is not economically attractive under foreseeable gas prices in Europe. However, there could be shorter versions of the pipeline going only to Turkey, or even going only to Iran. Indeed, it is likely that at the early stages the pipeline system would supply gas to northern Iran. This will be attractive for Iran at least in the short and medium terms when Iran's gas production capacity may not be sufficient to meet its requirements for domestic use and reinjection into the oil wells. Another gas export pipeline project foresees a route running south from the Duletabad Field across Afghanistan to the Pakistan city of Sui. The third and by far the largest, project is proposed by Mitsubishi and China's CNPC. It envisages a 6,700 km pipeline across China to the Yellow Sea for exports to Japan.

Uzbekistan is in terms of gas resources the third among the FSU republics after Russia and Turkmenistan. However, since 1994 it has become the second-largest producer after Russia. Indeed, Uzbekistan is the only FSU republic which has not suffered a production decline following the collapse of Soviet Union. Gas production has been increasing steadily since 1960s. It reached 30 bcm in 1969, 38 bcm in 1989, and 45 bcm in 1995. The country's impressive growth is due to timely replacement of depleting fuels and presence of a large domestic demand for gas. Domestic gas consumption was about 40 bcm in 1995. The remainder of gas production was exported to neighboring Kazakhstan, Kyrgyzstan and Tajikistan. Uzbekistan continues aggressive expansion of the gas sector, most of which is aimed at meeting increasing domestic demand. It is expected to increase its export in the medium term but then become only self sufficient by 2010.

Kazakhstan, with relatively large gas reserves has experienced a continuous decline in production since 1992. The depressed level of production has forced the country to import substantial volumes (about 6-8 bcm/yr) of gas from Turkmenistan and Uzbekistan. There is still a gas shortage in the country. Almost 75% of the Kazakhstan is known gas reserves are associated with oil reserves of Karachagnanak and Tengiz fields. Gas production from Karachagnanak field, which is very close to the Russian border is at the Russian mercy because the corresponding gas treatment plant is in Russia an refuses to treat more of Karanchagnanak gas. Further development of both fields are also hindered by the unresolved issue of oil transit across Russia.

Gas production in Azerbaijan peaked in 1985 at 13 bcm/yr Since then production has continuously declined reaching about 7 bcm in 1995. Almost all of the gas is produced in association with oil. A large amount (6.6 bcm/yr) of the produced gas is flared. The marketed production of 6.6 bcm/yr is not sufficient to meet domestic demand. Some 2.4 bcm/yr of gas is imported from Turkmenistan. There are plans to substantially reduce gas flaring and to develop offshore non-associated gas fields. If these plans are implemented successfully Azerbaijan may become self-sufficient in gas by the year 2005 However, current projections indicate continuous import requirement through 2010.

Conclusions

The cost-benefit ration of gas use has improved to the point that economic benefits in many developing countries do exceed cost of gas supply even if gas is imported in the form of LNG. The current CIF prices of LNG are not more than $3.50/MMBTU. Adding another $0.40/MMBTU for the cost of regasification would result in a price of less than $4.00/MMBTU for imported gas at the city gate. This is less than the economic benefits of most uses of gas. There are, nevertheless, several caveats. First, in order for the gas to yield a high benefit, there should be a very firm and reliable plan for gas supply, a condition rarely prevalent in gas trade schemes. Second, there should be a coordinated plan to rapidly absorb the imported gas in the power sector which would represent the base and rather the main use of gas at early stages. Third, the fact that economic benefit of gas use is high does not mean that domestic gas prices will or should be set at similarly high levels. It does nevertheless mean

Table 6- Eastern Europe: Gas Imports Requirements and Export Potentials (MMCM)

		Consumption				Production				Net Export			
ountry	*Reserves (TCF)*	*1990*	*1995*	*2000*	*2010*	*1990*	*1995*	*2000*	*2010*	*1990*	*1995*	*2000*	*2010*
lbania	0.07	220	78	300	700	220	78	300	600	0	0	0	-100
ulgaria	0.25	5330	3995	5000	7000	10	50	50	117	-5320	-3945	-4950	-6883
zech	0.25	6450	6770	8000	8900	285	173	300	300	-6165	-6597	-7700	-8600
ungary	3.35	9630	9415	12200	14300	4230	4211	4700	3500	-5400	-5204	-7500	-10800
oland	5.34	9930	9929	15700	25300	2640	3481	3800	2300	-7290	-6449	-11900	-23000
omania	13	30750	19761	20800	18700	25370	16502	15000	12500	-5380	-3259	-5800	-6200
lovakia	0.25	4670	4768	4900	5000	285	173	300	300	-4385	-4595	-4600	-4700
ther	1.58	5880	3900	3900	3900	2410	2710	2710	2710	-3470	-1190	-1190	-1190

Table 7- FSU: Gas Imports Requirements and Export Potentials (MMCM)

		Consumption				Production				Net Export			
Country	*Reserves (TCF)*	*1990*	*1995*	*2000*	*2010*	*1990*	*1995*	*2000*	*2010*	*1990*	*1995*	*2000*	*2010*
Armenia		4060	996	2341	6110	0	0	0	0	-4060	-996	-2341	-6110
Azerbaijan		15790	8960	14662	16304	9240	6600	7000	7000	-6550	-2360	-7662	-9304
Belarus		13820	13200	14800	23750	280	280	280	280	-13540	-12920	-14520	-23470
Estonia		1380	627	1100	1200	0	0	0	0	-1380	-627	-1100	-1200
Georgia		4950	2625	3865	7000	60	0	0	0	-4890	-2625	-3865	-7000
Kazakhstan	65.00	12530	10876	14558	21629	6620	4000	7329	21000	-5910	-6876	-7229	-629
Kyrgyz Republic		1970	915	1403	3300	90	10	10	10	-1880	-905	-1393	-3290
Latvia		2710	1038	1800	2300	0	0	0	0	-2710	-1038	-1800	-2300
Lithuania		5590	2189	3800	3800	0	0	0	0	-5590	-2189	-3800	-3800
Moldova		3740	2783	2701	3325	0	0	0	0	-3740	-2783	-2701	-3325
Russian Federation	1699.28	420150	362976	320172	378960	597950	595000	593596	724131	177800	192000	220000	280000
Tajikistan		1720	932	941	1328	90	4	4	4	-1630	-928	-937	-1324
Turkmenistan	100.96	9800	10333	11186	13111	81900	37933	44186	46111	72100	27600	33000	33000
Ukraine	39.98	127820	86286	97111	136740	26210	17687	21686	37440	-101610	-68599	-75425	-99300
Uzbekistan	65.97	36840	40070	34365	52516	38060	45167	51306	52516	1220	5097	16941	0

Latin America

In Latin America gas consumption was 75 bcm in 1995 and is projected to grow at 4.2% p.a. during 1996-2010. Increase in gas consumption is expected to be met by additions to domestic production capacity and some gas trade within the region.

In Latin America, there is one gas trade scheme in operation which exports gas from Bolivia to Argentina. This pipeline system transported 2 bcm of gas in 1995. There are also a number of projects under preparation to trade gas within the region and to export gas to outside the region. The most significant project under preparation is the Bolivia-Brazil pipeline. The project envisages delivery of 3 bcm/yr by 2000 and expansion 1o 6 bcm/yr by 2005. Other schemes include export of Bolivian gas to Chile, Argentine gas to Chile and Brazil, and Peruvian gas to Brazil. In addition, Venezuela, Trinidad and Tobago may become sources of gas export to outside the region. In Venezuela, a joint venture between the national oil company, Shell, Exxon, and Mitsubishi have received approval to develop Paria gas fields and build an LNG plant with a capacity of 5.9 million tons/yr. The target markets are US and Europe. In Trinidad and Tobago, a joint venture between the national oil company and Cabot, Amoco, and British Gas is firming up the financing plan for construction of an LNG facility with a capacity of 2.7 million tons/yr. Again, the target markets are the US and Europe.

Former Soviet Union

Countries of the FSU represent a very important component of the international gas market because this region holds almost 40% of world gas resources, uses 25% of world gas consumption, and represents the largest source of gas exports. Another important feature in the short and medium-term is that new resource development cannot be easily financed, but the decline in domestic consumption of gas in the FSU is making a larger part of the existing capacity available for exports. The level of gas consumption in the FSU peaked at 665 bcm/yr in 1991. Since then, consumption has continuously declined to 544 bcm/yr in 1995.

Gas consumption in the FSU is concentrated in Russia, Ukraine, and Uzbekistan which account for 67%, 15%, and 7% of total gas demand. While FSU is as a whole a major gas exporter, there are substantial gas trades within the region. The net exporters are Russia, Turkmenistan and Uzbekistan. All other republics import part or whole of their gas requirements. Gas exports to outside the region are presently supplied by Russia. Exports were about 122 bcm in 1995 of which 70 bcm was delivered to Western Europe, 35 bcm to Eastern Europe and 5 bcm to Turkey.

Projection of gas demand in the FSU is difficult due to the potential impacts of governments' pricing policies and further structural changes in the economy and the gas industry. The consensus among industry analysts is that the overall gas consumption will reach its previous peak (occurred in 1991) only some time after 2005. There could, however, be significant changes in inter-regional gas trade as economic realities prevail.

Russia is by far the largest gas producer in the FSU. The level of gas production peaked at 643 bcm in 1991 and has declined since then to reach 595 bcm in 1995 primarily due to insufficient demand. Domestic consumption of gas declined from a peak of 386 bcm in 1991 to 363 bcm in 1995. Also gas exports to other FSU republics has declined from about 90 to 73 bcm/yr because of weaker demand and inability to pay.

There is little uncertainty about Russia's ability to supply additional gas to Europe. It is, however, not clear what options Russia would take to provide the incremental supply. First, it is argued that there is still substantial room for further decline in domestic gas consumption. The decline would not necessarily be the result of further depression in the country's economic activity, but would be due to more economically efficient pricing system and more technically efficient equipment which will be replacing old and inefficient gas consuming facilities. Second, the option of importing gas from Turkmenistan for reexport to Europe will become more attractive over time as Russia approaches its full production capacity and Turkmenistan recognizes the difficulties in finding alternative channels for exporting gas. Third, Western Siberian fields close to the existing infrastructure could be developed at costs not significantly higher than the producing fields. Fourth, new projects on the Yamal Peninsula and the Barents Sea could be implemented which would result in supply of high-cost gas. The proposed Yamal project includes also a 5,800 km new transmission system to Europe.

Finally, gas reserves offshore Sakhalin Island are considered for export to the Far East. Proven reserve is estimated at 30 tcf which represents only a fraction of Russia's total gas resources. However, because of the proximity of Sakhalin fields to Japan, substantial investments are made by the private sector to develop these fields. There are also plans for construction of LNG facilities which are aimed at supplying gas to Japan, Korea, and Taiwan.

Turkmenistan was the FSU's second largest gas producer prior to 1993. At its peak in 1989, Turkmenistan's gas production reached about 90 bcm. The output in 1993 was still about 61 bcm but dropped further to 33 bcm in 1994 and 38 bcm in 1995. Part of the initial decline was due to shortages of funds and equipment for maintenance of production, but the main reason for the subsequent sharp decline is lack of solvent market for the gas. In particular, until 1993, Turkmenistan exported about

late 1990s. Algeria will also start to export piped gas to Spain and Portugal in 1996, crossing Morocco through the Maghreb-Europe pipeline currently under construction. The pipeline will deliver 8.5 bcm/yr and could expand to 16 bcm/yr by 2005.

Libya exports 0.9 million tons of LNG to Spain. The LNG facility has a nominal capacity of 3.2 million tons but Libya's ability to utilize the capacity is uncertain. There are no plans to expand the LNG capacity. Nigeria is not a gas exporter but has for many years been in the process of becoming one. An LNG plant with a capacity of 5.8 million tons has become close to implementation several times but postponed because of problems in financing. Project sponsors have now decided to build the plant with sponsors' equity and refinance at a later stage. Project is expected to come on line between 2000 and 2005. The output is destined for export to Italy (3.6 million tons), Spain (1 million tons), France (0.5 million tons) and the US (0.7 million tons). Egypt is preparing a project to export 2.6 bcm/yr increasing to 6 bcm/yr) to Israel through a 500 km pipeline system).

In addition to the above projects, there are a few schemes which are aimed at gas trade within the region. First, Tunisia, which is currently receiving 1.5 bcm/yr. of gas from Algeria through Trans Mediterranean pipeline, is expected to receive about 3 bcm/yr. by 2010, while Morocco will be also receiving 1 bcm (expanding to 2 bcm) of gas through a branch of the Maghreb-Europe Pipeline. Second, the West Africa Pipeline system is envisaged to export gas from Nigeria to Ghana via Benin and Togo. The pipeline will supply up to 0.1 bcm/yr to Ghana and some small amounts of gas to the transit countries- Benin and Togo. Third, a gas pipeline from the Pande gas field in Mozambique is planned to export 1.5 bcm/yr of gas to South Africa through a 900 km pipeline.

Table 5- Latin America: Gas Imports Requirements and Export Potentials (MMCM)

		Consumption				Production				Net Export			
Country	*Reserves (TCF)*	*1990*	*1995*	*2000*	*2010*	*1990*	*1995*	*2000*	*2010*	*1990*	*1995*	*2000*	*2010*
Argentina	18.58	20290	25228	29036	35227	17840	23378	30136	41327	-2450	-1850	1100	6100
Bolivia	4.46	660	1035	1289	2002	3110	2885	2789	8871	2450	1850	1500	6869
Brazil	5.17	3830	4970	6642	17385	3830	4970	6642	8685	0	0	0	-8700
Chile	3.90	1690	2050	5009	7000	1690	2050	2409	2731	0	0	-2600	-4269
Colombia	10.00	4130	4793	7609	19173	4130	4793	7609	19173	0	0	0	0
Costa Rica	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Ecudador	3.80	100	100	100	100	100	100	100	100	0	0	0	0
EL Salvador	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Guatamala	0.01	0	0	0	0	0	0	0	0	0	0	0	0
Jamaica	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Nicaragua	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Panama	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Paraguay	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Peru	7.05	470	480	1380	2655	470	480	1380	2655	0	0	0	0
Uruguay	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Venezuela	139.90	21970	28435	32592	42816	21970	28435	32592	50781	0	0	0	7965
Trinidad & Tobago	0.10	5300	7485	8428	12004	5300	7485	8428	15649	0	0	0	3645

Africa Africa contains 7% of global gas resources. Its level of gas production was 80 bcm/yr in 1995 and is projected to reach 198 bcm/yr by 2010. Gas demand is expected to increase at 4.9% p.a. during the next 15 years. The increase in demand will be met based on domestic production or imports within the region.

In Africa, four countries- Algeria, Libya, Nigeria, and Egypt are considered to have significant potentials for gas exports to the outside of the region. Algeria exports already substantial amount of gas to Europe, through pipeline and in the form of LNG. The export of LNG started in 1965 when the first Arzew plant was commissioned. In 1995, Algeria exported one million tons of LNG to the US and 12.6 million tons to Europe. There is an ongoing effort to revamp and debottleneck the old plants. It is expected that the LNG capacity will reach 25 million tons/yr by 2010. Export of piped gas started in 1983 when the Trans Mediterranean pipeline to Italy was commissioned. The initial capacity was 14 bcm/yr. The capacity is expected to increase to 25 bcm/yr by

Table 4- Africa: Gas Imports Requirements and Export Potentials (MMCM)

		Consumption				Production				Net Export			
Country	*Reserves (TCF)*	*1990*	*1995*	*2000*	*2010*	*1990*	*1995*	*2000*	*2010*	*1990*	*1995*	*2000*	*2010*
Algeria	128.00	16080	20402	26038	33331	49220	55000	87960	125331	33140	34599	61922	92000
Angola	1.80	538	520	520	520	538	520	520	520	0	0	0	0
Benin	0.04	0	0	0	0	0	0	0	0	0	0	0	0
Botswana	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Congo	4.30	0	2	6	45	0	2	6	45	0	0	0	0
Egypt	22.10	6810	10662	15334	24320	6810	10662	17334	30320	0	0	2000	6000
Gabon	0.50	90	90	90	90	90	90	90	90	0	0	0	0
Ghana	0.80	0	0	0	1250	0	0	0	0	0	0	0	-1250
Kenya	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Libya	45.80	4960	5390	8589	14384	5730	6888	11469	17489	770	1498	2880	3105
Morocco	0.04	50	20	667	1680	50	20	20	20	0	0	-647	-1660
Mozambique	1.74	0	154	221	454	0	154	221	2454	0	0	0	2000
Nigeria	109.71	4040	4254	5175	7660	4040	4254	5175	16660	0	0	0	9000
Senegal	0.00	0	0	0	0	0	0	0	0	0	0	0	0
South Africa	0.96	0	2042	2508	5773	0	2042	2508	3773	0	0	0	-2000
Sudan	3.00	0	0	0	0	0	0	0	0	0	0	0	0
Tanzania	2.00	0	0	150	550	0	0	150	550	0	0	0	0
Tunisia	2.60	1380	2020	2605	3360	530	360	360	360	-850	-1660	-2245	-3000
Zaire	0.05	0	0	0	0	0	0	0	0	0	0	0	0
Zambia	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Zimbabwe	0.00	0	0	0	0	0	0	0	0	0	0	0	0

capacities have gradually increased by the addition of 1 or 2 trains every 5 years or so. The production capacity was 27 million tons in 1995 and is expected to reach 30 million tons by 2010. Malaysia's gas exports in 1995 consisted of a small volume (1.5 bcm/yr) of piped gas to Singapore and about 8.3 million tons of LNG to Japan and Korea. LNG capacity is expected to reach 15.8 million tons in 1996-97 and 23.8 million tons by 2005. No further expansion is expected between 2005 and 2010. The only new trade scheme which is close to implementation is a pipeline system from Myanmar to Thailand which would .have a plateau capacity of 5.5 bcm/yr.

Gas imports from outside the region are expected in the form of LNG from Qatar, Oman and possibly Yemen. There are also a number of proposed pipeline systems most of which face serious financing problems and have not been included in our base scenario.

Middle East Middle East contains around 30% of global gas reserves. Its level of gas production was 137 bcm/yr in 1995 and is projected to reach 315 bcm/yr by 2010. All the major gas consumers have sufficient domestic resources for their needs in the foreseeable future. Only Israel is planning to import gas. There are also two pipeline systems... from Iran to Azerbaijan, an one from Iraq to Kuwait, which are in place but have stopped gas delivery due to political events.

In the Middle East, five countries_ Abu Dhabi, Qatar, Oman, Iran, and Yemen_ are considered as potential sources of relatively large gas exports to the outside of the region. Abu Dhabi has delivered LNG to Japan since 1977. The initial volume of 2 million tons was expanded to 4.3 million tons in 1994. The overall capacity is expected to reach 10 million tons around the turn of the century. Qatar has firm contracts to start delivering 6 million tons of LNG to Japan and 2.4 million tons to Korea. It is expected that the LNG capacity will reach about 10 million tons around the year 2000 and 15 to 20 million tons by 2010. Qatar's gas resources are also considered as the source of supply for a proposed pipeline project from Qatar to Pakistan. Oman is considering an LNG plant as well as a pipeline export project. The LNG project would consist of two trains with total capacity of 6.6 million tons which could come on line between 2000 and 2005. The pipeline project would involve construction of 1500 km offshore line across the Gulf of Oman through waters more than 3000 meters deep. Iran has signed separate agreements for gas export pipelines to Pakistan and to India. It has also been exploring the possibilities of exporting gas to Europe. Iran's ability to export gas during the next 10 years is uncertain due to the country's substantial requirement of gas for reinjection into oil wells, and limitations in obtaining funds for development of gas resources.

Table 3- Middle East: Gas Imports Requirements and Export Potentials (MMCM)

		Consumption				Production				Net Export			
Country	*Reserves (TCF)*	*1990*	*1995*	*2000*	*2010*	*1990*	*1995*	*2000*	*2010*	*1990*	*1995*	*2000*	*2010*
Bahrain	5.30	5810	7176	9603	15793	5810	7176	9603	15793	0	0	0	0
Iran	741.61	22700	32550	41543	61494	24200	32550	41543	61494	1500	0	0	0
Iraq	109.50	1980	3000	3000	3000	3980	3000	3000	3000	2000	0	0	0
Israel	0.01	30	20	2000	6000	30	20	20	20	0	0	-1980	-5980
Jordan	0.20	130	252	322	524	130	252	322	524	0	0	0	0
Kuwait	52.40	6190	4832	5795	8334	4190	4832	5795	8334	-2000	0	0	0
Lebanon	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Oman	25.20	2600	5443	7998	14998	2600	5443	7998	23898	0	0	0	8900
Qatar	250.00	6300	13545	17287	28159	6300	13545	21630	55159	0	0	4343	27000
Saudi Arabia	185.40	30500	39530	50104	80495	30500	39530	50104	80495	0	0	0	0
Syria	7.00	2918	4608	8761	14408	2918	4608	8761	14408	0	0	0	0
United Arab Emirates	204.60	16910	20971	25043	35710	20110	26387	37080	49210	3200	5416	12037	13500
Yemen	15.00	0	0	0	3250	0	0	0	3250	0	0	0	0

gas consumption in the developing countries (excluding FSU) was 435 bcm in 1995, and is projected to grow at 5.4% p.a. during 1996-2010. Gas consumption in FSU is projected to grow at very modest rates.

There is very little gas trade among developing countries. The only countries which import gas are: (i) Korea and Taiwan which import gas in the form of LNG; (ii) Argentina, Singapore and Hong Kong which import gas through small but dedicated pipeline systems; and (iii) Tunisia which receives gas on transit from the Trans-Mediterranean pipeline and Morocco which will soon receive gas on transit from Maghreb-Spain pipeline. However, there are significant potentials for gas trade in the developing countries. There are also numerous proposed projects which are aimed at transnational gas transportation many of which face serious implementation constraints. Projections of gas trade in this section are based on trade schemes which are likely to materialize within the next 15 years.

Asia Among developing regions, the highest growth rates are forecast for East Asia and South Asia where natural gas has become a very desirable fuel for power generation. Gas consumption in East Asia is expected to increase from 91 bcm/yr in 1995 to 274 bcm/yr in 2010. Gas consumption in south Asia is projected to increase from 411 bcm/yr in 1995 to 109 bcm/yr. in 2010. Most countries in the Asia region are expected to be utilizing almost fully their domestic gas potentials. Nevertheless, there will be a substantial gap between demand and domestic production. Part of this gap will be fulfilled through likely import schemes and part of it will remain unfulfilled unless new prospects are introduced. Imports will be dependent on countries within the region and a few schemes from outside the region. Present gas importers- Korea, Taiwan, and Singapore- plan for substantial expansion of imports. Several other countries- Thailand, India and Pakistan- are actively seeking sources of gas imports. China and Philippines are investigating the possibilities and potential to import gas.

Within the Asia region three countries- Brunei, Indonesia and Malaysia are important sources of gas export. Other countries such as Myanmar and Vietnam have export potentials. Brunei was the first producer of LNG in Asia and started to export LNG to Japan in 1972. The production was 5.8 million tons in 1995 of which 5.5 million tons were delivered to Japan and the remainder sold on the spot. No addition to the capacity is envisaged. Indonesia is the world's largest exporter of LNG. There are two LNG plants- Badak and Arun. Both plants' designed

Table 2- Asia: Gas Imports Requirements and Export Potentials (MMCM)

		Consumption				Production				Net Export			
ountry	*Reserves (TCF)*	*1990*	*1995*	*2000*	*2010*	*1990*	*1995*	*2000*	*2010*	*1990*	*1995*	*2000*	*2010*
angladesh	10.09	4820	7362	11327	23346	4820	7362	11327	23346	0	0	0	0
runei	14.00	1430	1430	1430	1430	8460	9310	9310	9310	7030	7880	7880	7880
hina	59.00	14710	17674	24329	46100	14710	17674	24329	46100	0	0	0	0
ndia	24.97	12470	18682	26500	36500	12470	18682	26500	26500	0	0	0	-10000
ndonesia	68.92	20050	28794	40385	69613	45350	64832	81052	112813	25300	36038	40668	43200
orea, South	0.00	3360	8976	12000	30000	0	0	0	0	-3360	-8976	-12000	-30000
alaysia	68.00	7600	14996	25269	65515	17830	28666	46700	99015	10230	13670	21431	33500
yanmar	10.00	1000	1290	1861	3871	1000	1290	1861	9371	0	0	0	5500
akistan	27.00	10860	14698	29000	48900	10860	14698	29000	33900	0	0	0	-15000
hilippines	3.88	0	0	0	0	0	0	0	0	0	0	0	0
aiwan	2.40	1860	4360	9800	32000	1310	910	910	910	-550	-3450	-8890	-31090
hailand	5.90	6290	10543	13000	16500	6290	10543	13000	9000	0	0	0	-7500
ietnam	4.00	30	397	1501	2537	30	397	1501	2537	0	0	0	0

industrialized countries and present expansion plans there is no particular shortage of gas supply unless gas demand increases at much faster pace than projected in the above scenario. There are a number of other proposed projects to bring gas from FSU, Middle East, Africa, and Latin America to the markets in North America, Europe and Japan. These projects are not likely to materialize unless they can supply gas at lower cost than present suppliers or unless gas demand in industrialized countries increases much faster than anticipated.

Table 1- Gas Import Requirements of Industrialized Countries (Billion Cubic Meter/Year)

	Gas Demand	*Domestic Production*	*Supply Gap*	*Sources Of Import*	*Gas Demand*	*Domestic Production*	*Supply Gap*	*Sources Of Import*
North America	686.0	618.3	67.7	To US: 70.0 from Canada, * 0.8 from Algeria, From US: 1.5 to Mexico, * 1.6 to Japan	739.0	633.0	106.0	To US : 110.0 from Canada, * 1.5 from Algeria, * 2.7 from Latin America, From US: * 4 to Mexico, * 4.2 to Japan.
Western Europe	346.5	160.0	178.0	Within Europe: 28.0 from Norway, 41.0 from Netherland, 2.0 from Denmark, From Outside Europe: 85.6 from Russia, *16.4 from Algeria, 12.0 from Algeria, *1.5 from Libya	492.0	175.0	317.0	Within Europe: 80.0 from Norway, 40.0 from Netherland, 20.0 from UK, Outside Europe: 140.0 from Russia, *22.0 from Algeria, 32.0 from Algeria, *3.1 from Libya
Eastern Europe	58.6	27.4	31.2	Russia : 31.2	77.0	15.0	62.0	Russia: 62
Japan	60.0	2.0	58.0	25.5 from Indonesia, *10.8 from Malaysia, *8.1 from Australia, *7.4 from Brunei, *4.2 from Abu Dhabi, * 2.1 from US Alaska	108.0	2.0	106.0	*30.4 from Indonesia, *21.0 from Malaysia, *12.5 from Australia, *7.4 from Brunei, *6.4 from Abu Dhabi, *4.2 from US Alaska, *23.6 from Qatar

* Imports in The Form Of LNG, Converted to bcm/yr. at 1 million tons of LNG = 1.35 bcm of gas.

In the developing world natural gas is consumed in substantial amounts in: Asia (Indonesia, Malaysia, Thailand, China, India and Pakistan); Middle East (Saudi Arabia, Iran, Abu Dhabi and Qatar); Africa (Algeria and Egypt); and Latin America (Venezuela and Argentina). In addition, republics of FSU consume a large (25% of world consumption) of natural gas. The overall

potential exporter. Nevertheless, these resources are far from consumption centers (mostly in the north), and Mexico's access to financial resources for development of the resources is limited. Thus, Mexico may remain and even become a larger importer of the US gas. Nevertheless, the North American region as a whole would not absorb imports of gas from other regions unless they can be supplied at very low prices. Among projects under investigation in other parts of the world, three LNG schemes- one in Nigeria, one in Trinidad and Tobago, and one in Venezuela- seek to import gas to the US market.

Western Europe contains about 3.4% of world gas resources of which 70% are situated in Norway, the Netherlands and the UK. Thus, these three countries account for most of the current and projected gas exports within the region. Denmark is self sufficient in natural gas and exports only small volumes to its neighbors. Germany and Italy also have indigenous gas reserves, but are dependent on imports for a major part of their needs. Overall indigenous production for domestic gas consumption was 169 bcm in 1995 compared with the overall consumption of about 340 bcm. The supply gap was 171 bcm in 1995 of which about 71 bcm was supplied from countries within the region and the rest from Russia (70 bcm), Algeria (28 bcm) and Libya (2 bcm).

Gas demand in Western Europe is expected to increase at 2.5% p.a. from about 340 bcm in 1995 to 492 bcm in 2010. Production for domestic use is expected to increase from 169 bcm in 1995 to 170 bcm in 2000, 175 bcm in 2005 and remain at that level afterwards. Thus, the supply gap of Western Europe will increase to 317 bcm by 2010. This supply gap should be added to that of Eastern and Central Europe to show the gas import requirements of Europe as a whole. It is noted that Central and Eastern European Countries are being forced to pay the market price for Russian gas, and most of them are seeking to diversity sources of supply. Thus they will increasingly compete with Western European countries in purchasing gas from all potential sources. Besides gas systems of Eastern and Central Europe are interconnecting with those of Western Europe practically making the two and integrated market.

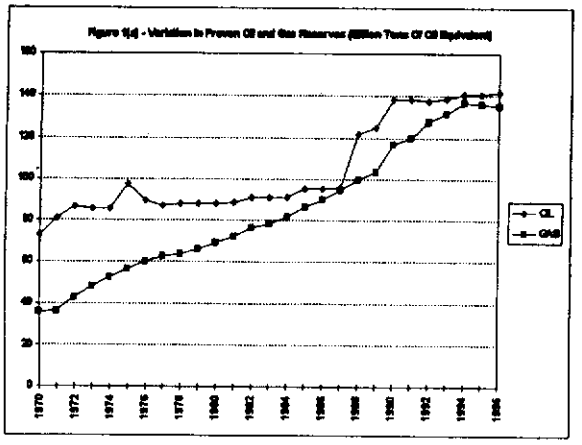
In the countries of Eastern and Central Europe gas demand was about 60 bcm in 1995. Three countries- Romania, Poland and Hungary- accounted for about 60% of gas consumption. Domestic production is also concentrated in the same three countries and provides about 25 bcm/yr. The supply gap of about 35 bcm/yr is imported from Russia. Projections of gas demand indicate 3.8% growth for 1996-2000 and 1.7% p.a. growth afterwards. Domestic production is expected to decline to 27 bcm/yr in 2000 and 22 bcm/yr in 2010 while import requirements will increase from 44 bcm/yr in 1995 to 62 bcm/yr in 2010.

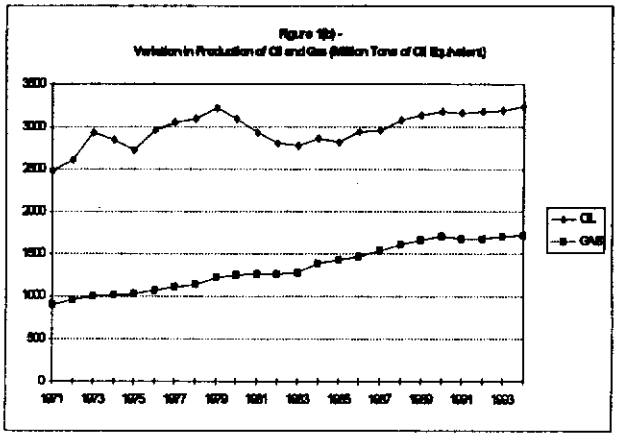
Gas import requirements of (Western and Eastern) Europe are estimated to reach 379 bcm by 2010. These requirements will be supplied by countries within the region and from outside the region. Within Europe, imports from Norway are expected to increase from 28 bcm in 1995 to 80 bcm in 2010. UK will also become an important source of supply by providing 20 bcm/yr by 2010. Imports from the Netherlands will not be expanded because this country's gas reserves are being depleted. The rest of the gap has to be met from outside the region. Imports from Russia are expected to double from 105 to 202 bcm/yr, keeping this country the largest gas supplier to Europe. Imports from Agleria are expected to increase from 29 to 50 bcm/yr while imports from Libya are projected to increase from 2 to 6 bcm/yr.

Japan is a new market for natural gas. It consumes about 60 bcm/yr of gas. It imports almost all of its requirements in the form of LNG. Thus it has become the largest importer of LNG. It also plays an important role in funding construction of LNG facilities, which otherwise connot be financed easily. Current sources of supply are Indonesia 43%, Malaysia 19%, Australia 14%, Brunei 13% and Abu Dhabi 7%. In addition, a very small amount (one million ton/yr.) of LNG is imported from the US Alaska.

Japan's gas demand is projected to grow at 4% p.a. The increase in demand, of about 48 bcm/yr (equivalent to 35 million tons of LNG) between 1995 and 2010, should be met by additional LNG imports. Indonesia will increase supplies from 19 million tons in 1995 to 22.5 million tons in 2010. Imports from Malaysia will increase from 7.5 million tons to 15.6 million tons; Australia from 6 to 9.25 million tons; and, Abu Dhabi from 2 million tons to 4.7 million tons. The only new source of import will be Qatar, which has a contract to supply 6 million tons of LNG to Japan by the year 2000. The volume is expected to expand rapidly to reach 17.5 million tons by 2010.

In summary, among the gas markets in the industrialized countries, only two- Europe and Japan- have a clear need to import substantial amounts of gas. The import needs of (Western and Eastern) Europe will amount to 379 bcm/yr by 2010 and are likely to be supplied by present suppliers (Norway, Netherlands, Russia, Algeria and Libya) and the UK while the Russian supply may include some transfer of gas from Turkmenistan. The Japanese import requirements are expected to reach 106 bcm/yr in 2010 and are likely to be supplied by present suppliers (Indonesia, Malaysia, Australia, Brunei, Abu Dhabi) and Qatar. The additions to the supplies envisaged here are in line with expansion plans of the corresponding exporting countries. Thus, in relation to demand in





countries are involved in a large bulky investment which is physically hooked to one point of supply and one market destination. Attracting equity and finance in such a project would require a coincidence of desirable political and economic conditions in both countries, the probability of which is by far smaller than that of prevailing desirable conditions in each country.

Because of the rareness of the occurrence of the required conditions, development of gas trade has been limited and also concentrated in certain producting and consuming countries which have offered more stable conditions. In the past, this translated into situations where both gas exporter and importer are industrialized countries, or in a few cases, where exports originate from a developing country but are destined for an industrialized country. Gas trade projects involving developing countries on both ends have rarely materialized despite the significant benefit they could have for both the exporting and importing countries. Our dialogue with potential investors and financiers indicateds that these projects are quite unlikely to materialize unless supported seriously by the corresponding governments and by the global an regional development banks.

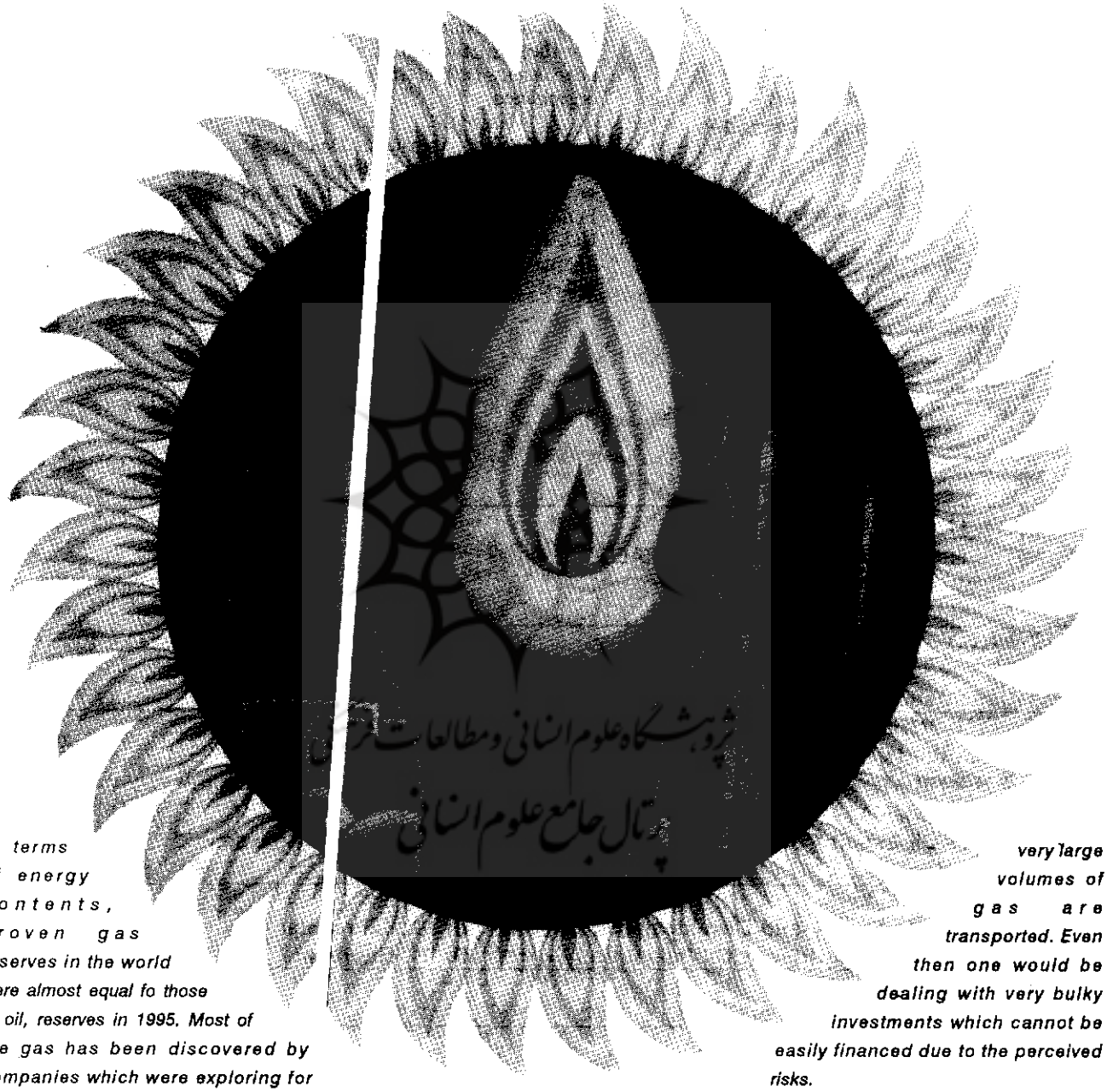
The proposed gas trade projects which involve developing countries are of two distinct types. First, there are a number of proposed schemes which aim at taking gas from developing countries to destinations in North America, Europe and Japan. Second, there are some projects which are intended to export gas from certain developing countries to other developing countries. These two groups of projects have quite different implications regarding impacts on energy availability and financial resources of developing countries. However, development plans of the two groups are often intertwined as sources of gas exports are common in both groups. Indeed in many cases gas may become available for export to developing countries only if it cannot be exported to the industrialized countries. Thus, we would need to review both categories of gas trade projects though our primary interest are projects which involve developing countries on both ends.

The Gas Import Requirements of Industrialized Countries

There are two major markets in the industrialized world: North America (consuming 34% of world gas demand), and Europe (16%). In addition, Japan, which consumes only 2.7% of world gas demand, has become an important market due to its significant influence in the world LNG market. North America is self sufficient in natural gas. It contains about 6% of global proven gas reserves, though the resource base is thought to be much larger, with substantial yet-to-find resources. The market became highly integrated and competitive after gas prices were deregulated in both the US and Canada. Prices declined by around 50% between 1986 and 1995. The price decline is attributed to intense gas-to-gas competition, low production costs due to most of the production taking place onshore, shorter transportation distances, and a long history of gas industry implying a high share of amortized facilities. All three countries in North America are significant gas producers. Aside from the small volumes of LNG exported from Alaska to Japan and small volumes of LNG imported from Algeria to the US, gas produced within the regions is traded within the region only. In 1995, Canada exported 70 bcm to the US while net exports from the US to Mexico amounted to 0.3 bcm.

In the North American market, gas demand is projected to grow at less than 0.5% p.a. in the foreseeable future. The increased demand is expected to be met by supplies within the region. Canada will remain a net exporter. Mexico has large gas resources in the south, which, if developed, could make this country self sufficient and even a

International Gas Trade in Developing Countries



In terms of energy contents, proven gas reserves in the world were almost equal fo those of oil, reserves in 1995. Most of the gas has been discovered by companies which were exploring for oil, indicating that a worldwide effort to explore gas would probably resultin much larger magnitudes of proven gas resources. Still, production of natural gas amounted to about 53% of the world wide oil production oil, gas resources a.e found in locations which are far from centers of energy consumption. However, unlike oil, gas is very expensive to transport. Gas transportation over long distances becomes economically viable only if very large volumes of gas are transported. Even then one would be dealing with very bulky investments which cannot be easily financed due to the perceived risks.

An almost extreme case of difficulty in financing gas projects arises when the project aims at gas exports. The main reason for the increased difficulty is that the perceived project risks increase exponentially when two or more