OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

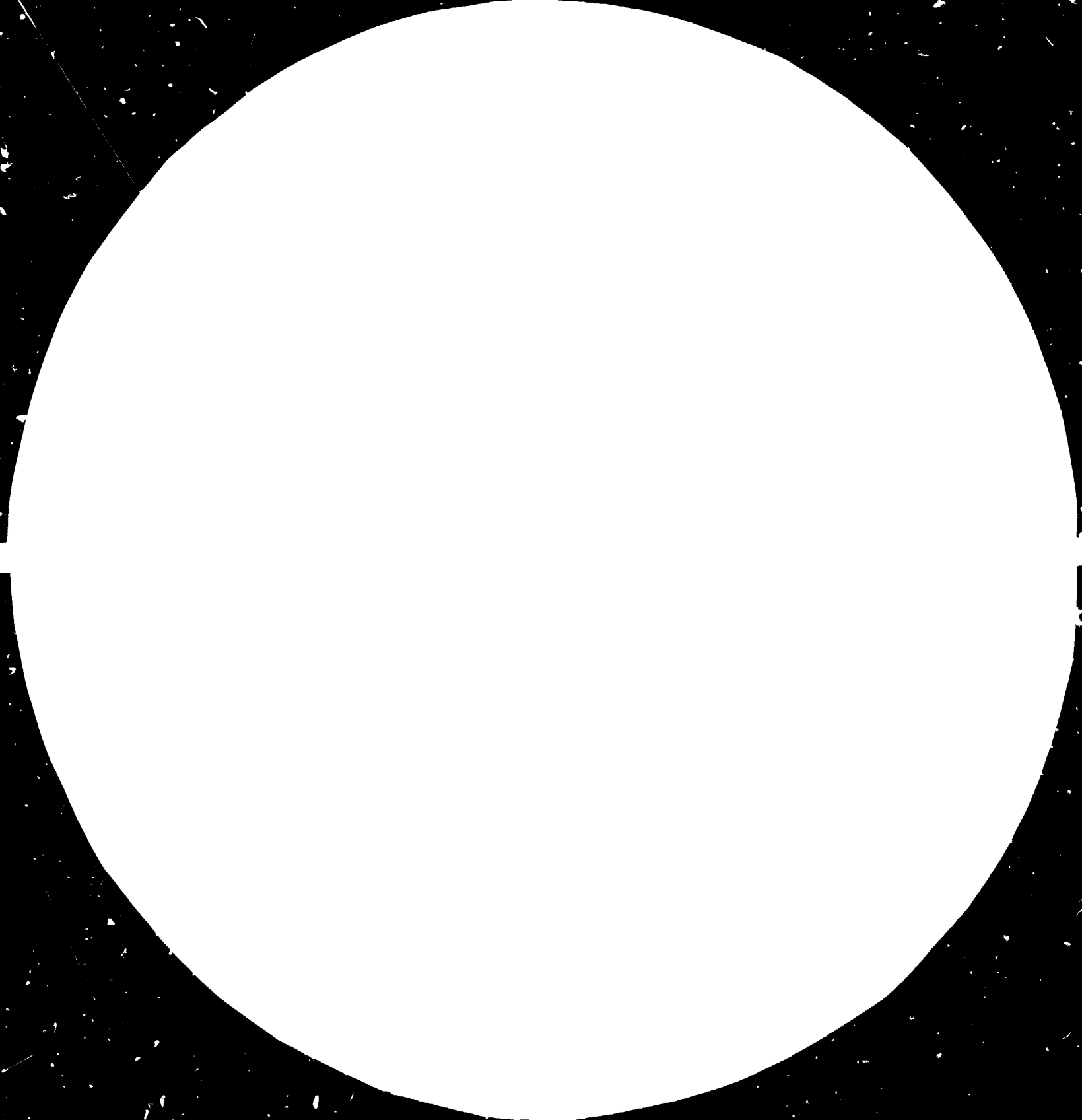
FAIR USE POLICY

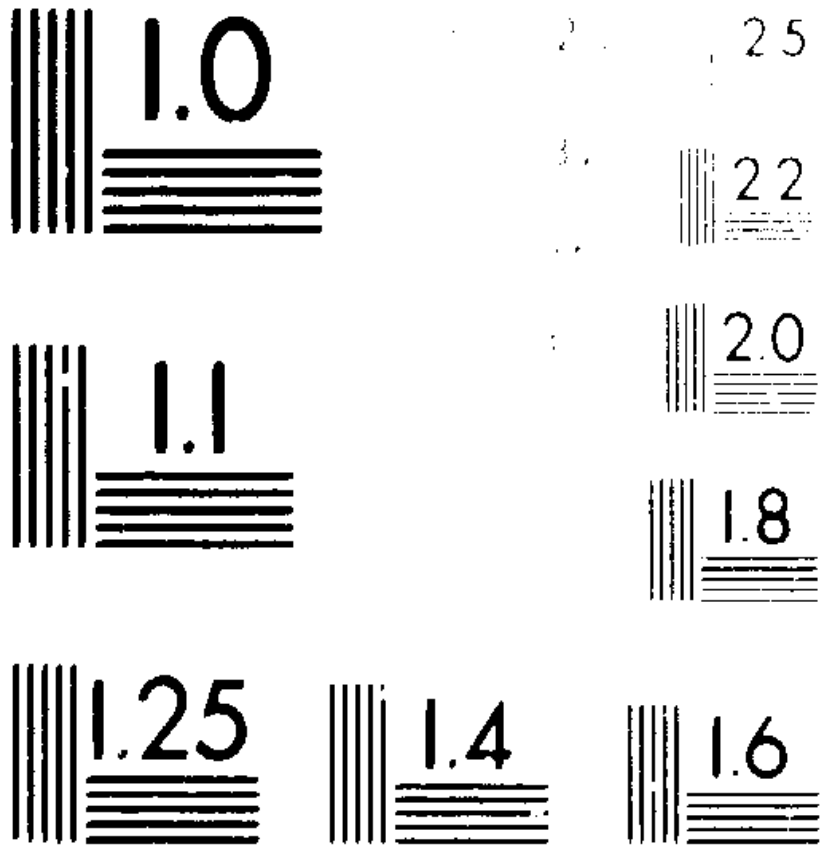
CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org





13771

Proposal For Defining An Integrated Industrial Strategy For The Gulf Co Operation Council Member States

1984

J. M. Wakim

Rec'd from Mrs. Bernstein

Table of Contents

Japan
. Freight and Duty
9. Summary and Conclusions

1. Intrcduction.

The GCC member states are endowed with a wealth of natural resources which include vast reserves of crude oil and natural gas as well as minerals. These resources exceed the needs of the region and constitute an important part of the global resource supply. In the past, the GCC member states carried their global responsibility honorably, and contributed more than their fair share to ensure a reliable supply of energy to the global community. This was done, in some instances, at a great expense to the GCC states and their nationals. The long term interest of the region was sacrificed to helpf solve global crises.

The global requirements for energy are in the midst of change. The energy intensity of the GDP in the consuming nations is declining. Substitution of alternate sources of energy is proceeding whenever feasible. This is progressing, in some instances, to solve national balance of payments deficits, and in others as a result of the repeated recommendations of the GCC representatives at OPEC from 1974 to 1979.

At the same time, the needs of the GCC member states are changing. The demands imposed on the national governments by the evolving social order require solutions which are diametrically different from those which were appropriate only few years ago. The governments of the GCC member states are aware of the change and need to adopt policies which will satisfy the emerging needs of their population.

A policy which is implemented as a result of social needs will inevitably lead to change and will carry with it the danger of conflict. If the policy is proactive and demands fast social change, it could be resisted by a segment of society. The resistance can be demonstrated in a conservative backlash,as modern history has shown. If the change arising from the new policy is too slow, it could create dissatisfaction among segments of society. This condition can also lead to social unrest.

In either case the fabric of society will be torn and the public good will suffer as a result of the conflict. Consequently national governments will not be able to act as instruments of stability and sources of confidence for the public at large.

More critical than both cases identified above is a condition in which the demands of different sectors of society, from their government, are in direct conflict. This usually arises when social needs are left unattended for too long.

An integrated industrial policy will take all of these forces into consideration. Specifically, the GCC member states have the human and natural resource base needed to develop such a strategy. The anticipated outcome of the strategy is the transformation of these points of strength into an instrument of growth for the region.

2. FRAMEWORK FOR AN INTEGRATED INDUSTRIAL STRATEGY

The framework of a strategy is a combination of options and a methodology of dealing with them. It is not a choice between alternatives; rather it is an illustration of how alternatives may be compared. It is not a listing of options. However, it does frame certain options and deals with them for illustrative purposes. It is not a rigid methodology but rather a starting point which can be modified as the conditions and the needs change.

A strategy is a tool which can be used by decision makers to respond to the dynamic needs of society. It gives a systematic process which can be used to evaluate and compare issues. It is an iterative process. It can be fed with the latest information as input and will reflect the influence of environmental change on direction of decisions. A strategy does not make decisions; it simply allows the decision maker to quantitatively evaluate alternatives so that he can quantify effects and chose the most appropriate route in light of the latest information.

An important input into strategy is the relative strength enjoyed by a participant vis a vis other players. An analysis of the capabilities of the important players reveals the areas in which each player has advantage. The GCC member states have relative positions of strength which can be used advantageously for building an industrial base.

The relative positions of the participants change with time. Therefore a policy framework should include the means for tracking the changes as they occur and the ability to use this input to alter the course in light of the new conditions.

When strategy is influenced by demands exogenous to the region it is important that those demands are identified and that the strategy has the flexibility so that such opportunities can be exploited.

3. NATURAL RESOURCE BASED STRATEGY

This analysis starts with the premise that a strategy is being developed for utilization of hydrocarbon natural resources. It could have started with any other industrial sector such as fisheries, minning and minerals, agriculture, high technology industries, wood and wood products, etc,. The products will be different but the same methodology will apply.

4. UTILIZATION OF CRUDE OIL OR NATURAL GAS. (CHART 1)

An examination of the facts reveals that the GCC member states can derive greater benefits by exploiting their natural gas reserves. So the process starts by identifying two different sources of natural gas i.e. dry gas and associated gas.

The study will then proceed to quantify the supply of each. The following parameters need delineation:

- Supply from each source:
  - Reserves - Volumes
  - Location of fields; ability to connect fields
  - Rates of flow; life of reserves
  - Factors which affect deliverability.
  - Impact of accelerated depletion of reserves on field performance.
- Composition of each source:
  - Pentane + content
  - Butanes
  - Propane
  - Ethane
  - Methane
  - Carbon dioxide
  - Hydrogen sulphide
  - other contaminants

The above data is sufficient to identify the supply of each of the components. It specifies average rates of flow as well as minimum rates of flow when factors affecting deliverability are defined. It indicates the maximum rates of flow under accelerated depletion conditions and the long term effects on field performance.

With these quantitative results at hand, the decision maker is well placed to proceed to the next phase of developing strategy.

Naturally the above analysis has to be repeated regularly to reflect the most recent conditions.

5. UTILIZATION OF METHANE (CHART 2)

The analysis conducted in char 1 identified the supply of some components of a natural gas stream. Chart 2, describes the means by which alternate values can be assigned to a raw material. The evaluations will be conducted strictly in financial terms when the terms of reference are generation of profit or return on investment. On a national scale, social values, or strategic considerations can be more important than financial reward.. In those cases the decision maker has the option to use different criteria for charting policy direction.

Chart 2 shows that there are three major outlets for methane:

1. To flare it in the field. When methane is a component of associated gas and has no alternate use, it must be burnt. It can not be allowed to escape to the atmosphere. In this form, it has no value to society. In reality, burning methane in this form is a loss of a non-renuable resource.

2. To export it. There are two viable ways to export methane.

- By pipeline

In different parts of the world methane is piped from gas fields to consumers thousands of kilometres away. The initial capital expenditure for laying the pipeline is significant. However, once in place, the transportation costs are reasonable when the reserves and the markets are matched.

- By tanker

The methane can be converted to LNG. The natural gas is compressed, cooled and shipped by tanker to consumers. Both liquifaction and shipping of LNG are costly.

Both forms of export yield at least some of the commercial value of the product. The seller receives a return on this non-renuable natural resource. The absolute value will change as the source and market change. The strategy should have the means of gauging the value of the exported gas to the nation.

3. To upgrade it. There are several ways to upgrade methane. Chart 2 shows only four ways. These are considered to be of immediate relevance to the GCC. Others can be added as desired.

CHART 2 Methane upgrading options

1. Electricity Generation. The demand for electricity is

growing, in the GCC member states, with population growth, urbanization and industrialization. The need for energy to increase generating capacity will grow accordingly.

The strategy should include the means to test the attractiveness of alternate fuels for generating electricity. The value of each fuel can be calculated using conventional economic analyses.

2. Desalination of sea and brackish water. Various studies have shown the importance of fresh water to the region. In the absence of less expensive methods, the incremental volume of water will most likely be produced by distillation or reverse osmosis. Even the most advanced distillation units are energy intensive. The energy needed for reverse osmosis is derived from electricity.

The strategy should include criteria which can assign a social and economic value on fresh water. It should also have the means to compare the value of methane in this application relative to its alternate uses.

3. Mineral Refining. An alternate use of methane is in mineral refining. These processes include the upgrading of ores to metals i.e. Aluminium, iron, etc. They are energy intensive and create a local market for methane.

The strategy should have the means to test the relative economic value of mineral refining to the region. It should also have criteria to relate the value of the industry to alternate industries.

4. Petrochemicals. This is the generic name given to all industries which use hydrocarbons as raw materials to produce a variety of chemical products. These products constitute an important component of everyday needs of society. They are used in agriculture to increase crop yields in the form of fertilizers (Ammonia, urea, and their derivatives, and pesticides). They are used by the textile industry to produce clothing (Polyesters, nylons). They are used in durable goods and housing (Components of refrigerators, wahing machines, cars, carpets, adhesives.) They are used in consumer goods (kitchen-ware, toys); they are used in the electronics industry (radios, televisions, computers, video cassets.) They are used in the health care industry (soaps, shampoo, skin care products.) They are used in pharmaceuticals (aspirin, sulfa drugs, antibiotics, etc.)

Petrochemicals, unlike the other industries which use hydrocarbons as fuel, require the hydrocarbon molecules as feedstock as well. They also differ from the other industries in that the molecules are not destroyed in use. They are upgraded to more useful products with higher value added.

As mentioned previously the strategy should have the means for comparative economic analysis of all the industries under consideration. Some typical analyses will be presented in the chapter covering PVC economics in Saudi Arabia and the US Gulf Coast.

6. METHANE.

Chart 4 shows the most important petrochemicals derived from methane. Ammonia is a first generation derivative which is used extensively as a source of nitrogen in agriculture. It is also an intermediate for manufacturing urea and nitric acid. Both products have agricultural and industrial applications.

The GCC countries are currently producing urea for domestic and export markets. The production of nitric acid and nitric acid derivatives in the GCC countries will open additional interesting markets for the natural gas reserves of the region.

The second important petrochemical market for methane is methanol. It is a commodity product which is traded globally for use as a solvent or as a raw material for the manufacture of formaldehyde, or methyl tertiary butyl ether, MTBE. Recently, the upgrading of methanol to acetic acid became a commercial reality. It is expected that all new acetic acid production will be derived from methanol.

The global productive capacity of methanol is forecast to exceed demand for the rest of the decade. Therefore upgrading methanol to its derivatives could improve the loading of the plants currently in place in the GCC countries.

7. ETHANE.

The fuel uses of ethane are similar to those of methane discussed earlier. Actually propane and butane can also be used as fuels. Chart 3 shows the various potential end use markets for these products.

Because of the difficulties associated with shipping ethane, it is usually transported by pipeline from the extraction facility to the ultimate end user. For the present exercise we will assume that ethane is used as a petrochemical feedstock.

The most important petrochemical derivative of ethane is ethylene. Chart 5 shows the major ethylene derivatives. It is beyond the scope of this report to describe each of these products. however, an integrated industrial policy should include a detailed analysis of each product and the criteria for selecting the most appropriate derivative for the GCC member state conducting the evaluation.

8. POLYVINYL CHLORIDE.

The analyses mentioned under item 7, should cover all aspects related to the product. As an example we selected polyvinyl chloride. Chart 6 shows the steps which should be included in the analysis.

A detailed study should be conducted to define the potential markets starting with the member state. The next potential market should cover all the GCC countries. This will be followed by the rest of the Arab World then Europe, the Far East, and other global regions.

Presently polyvinyl chloride is not produced in the GCC member states. Plans are in place to build a plant in Saudi Arabia. To define the size of the market we determined the volume and value of pvc imports to Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. The study is based on actual imports, as reported by the country of origin, from 1976 to 1982. We estimated the 1983 demand and forecasted the demand in 1988 and 1993. The results are shown in the attached graphs.

The demand for pvc in the GCC member states in creased from 13 kt in 1976 to 123 kt in 1980. Demand declined in the following two years reaching 98 kt in 1982. We are forecasting that demand will increase to 139 kt in 1988 and 173 kt in 1993.

A similar analysis was conducted to determine the demand for pvc in each of the Arab Countries. The results showed that the demand for pvc in the Arab World increased from 67 kt in 1976 to 317 kt in 1980. By 1982 demand dropped to 282 kt. We are forecasting that the demand will increase to 436 kt in 1988 and 579 kt in 1993. This means that by 1993 the Arab World will consume the output of five world scale pvc plants.

An integrated policy will include a detailed understanding of the producers, around the world, who are expected to compete with the GCC producer. It will also cover the end use applications and the consumers in all of the prospective markets.

Another important aspect of an integrated industrial policy covers an understanding of the economics of manufacturing the product. It is essential that comparative economic analyses are conducted on a regular basis to determine the position of the GCC producer as compared to his competitors in the U.S., Europe, and Japan.

We have conducted an analysis of the economics of producing pvc from a hypothetical plant in Saudi Arabia and an equivalent plant on the U.S. Gulf Coast using july 1983 conditions. The results are shown the last two tables in this report. They indicate that

pvc could have been produced in Saudi Arabia for only 85% of the cost on the U.S. Gulf Coast.

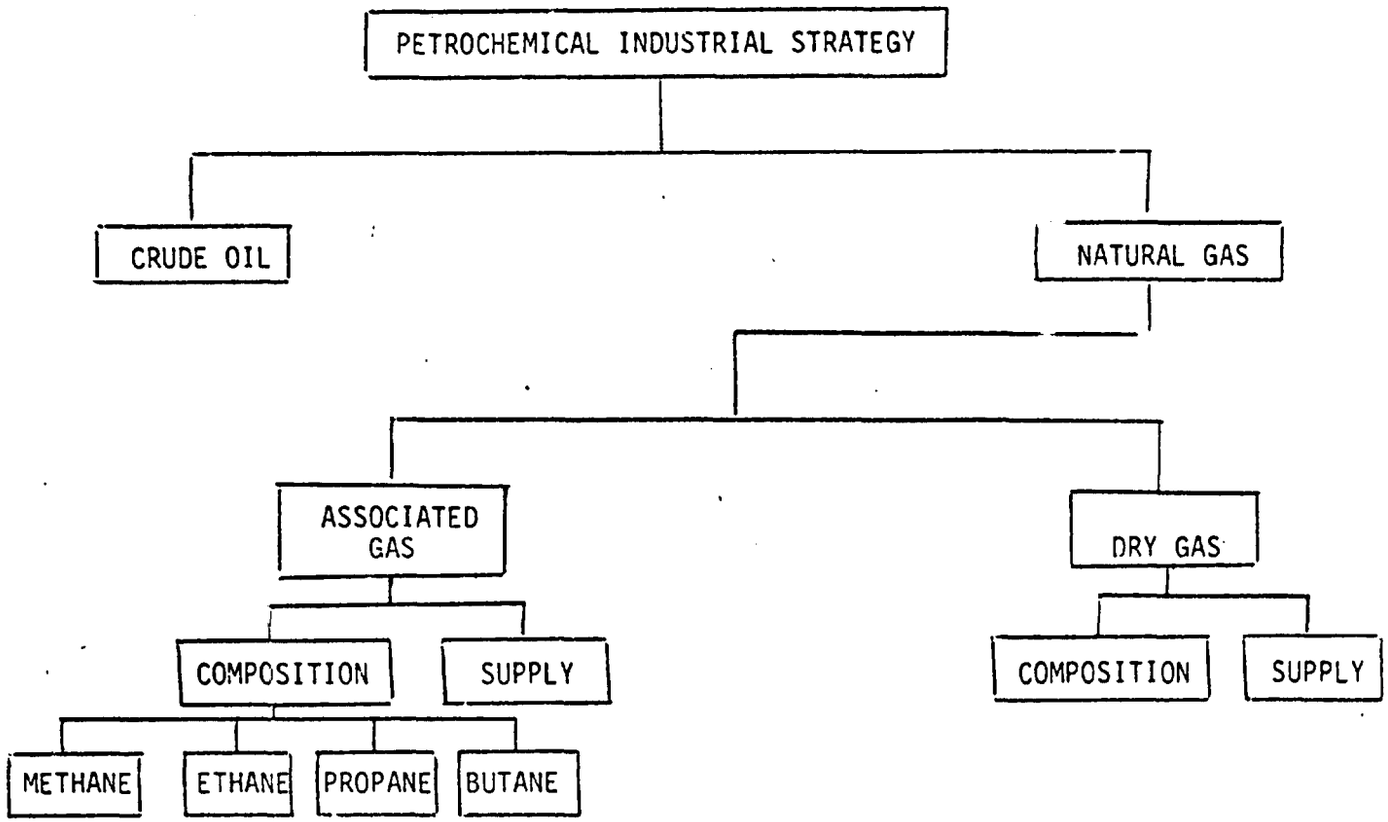
An integrated industrial policy should include the necessary mechanisms to update such economic analyses for all of the products of interest to the region.

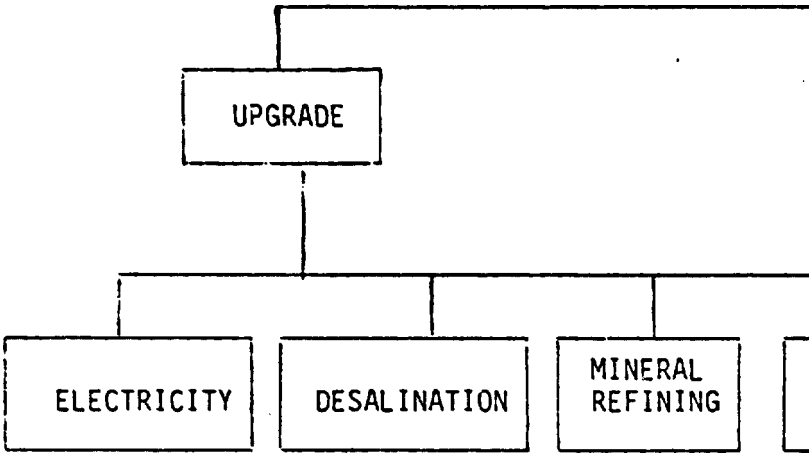
9. SUMMARY AND CONCLUSIONS.

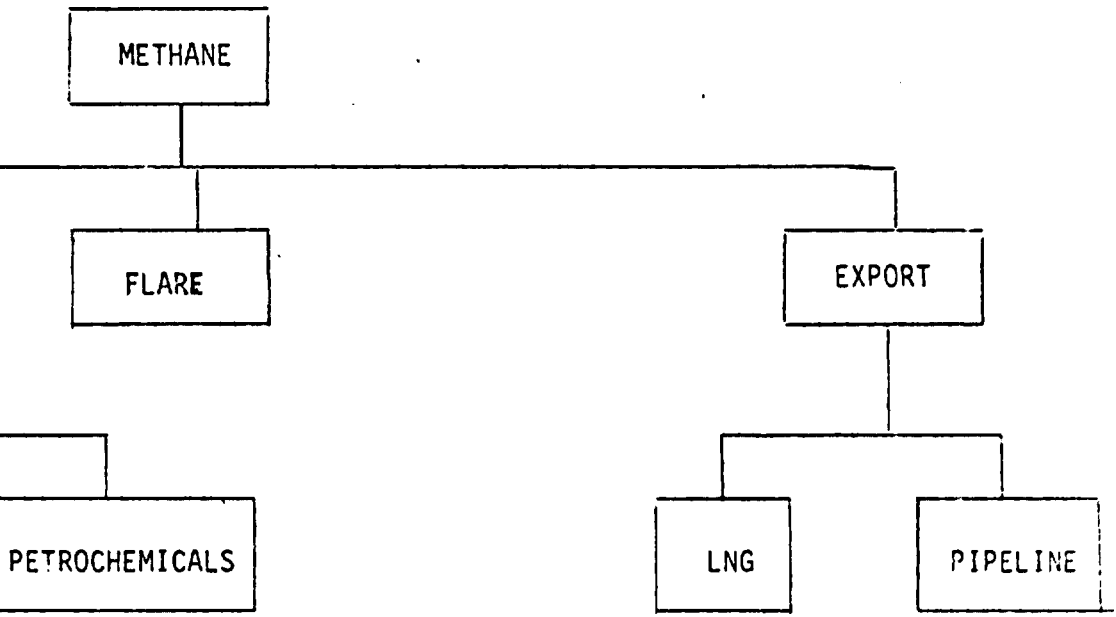
A framework for an integrated industrial strategy was developed with particular emphasis on areas of importance to the GCC member states. It identified the methodology needed to maintain a dynamic strategy which can respond to changing socioeconomic conditions.

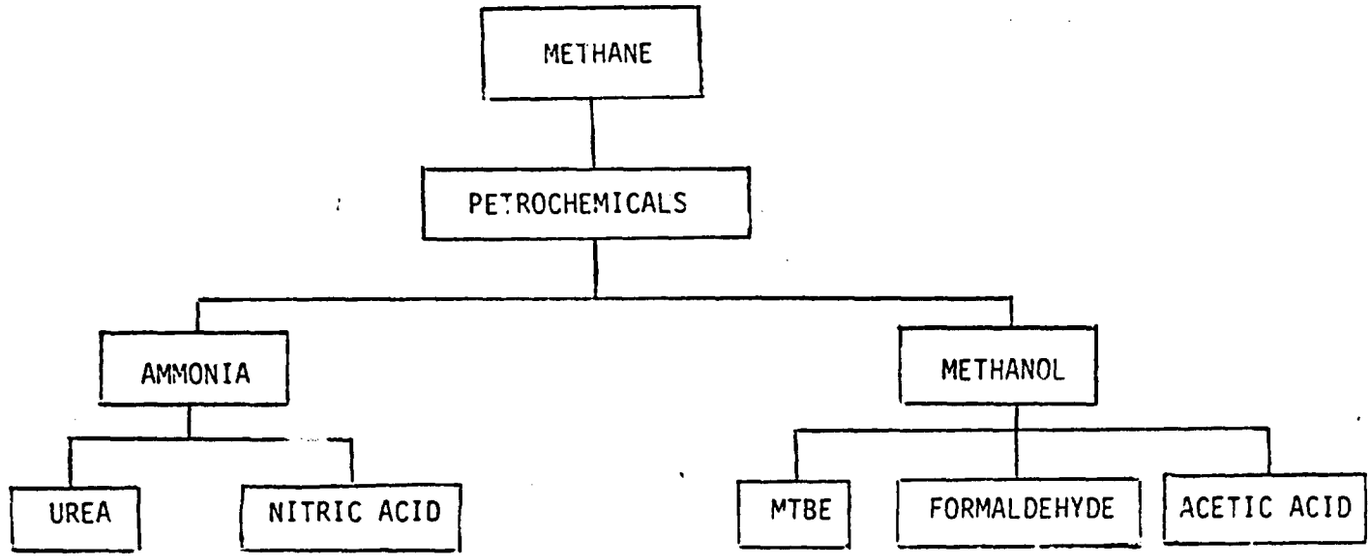
The study identified the main petrochemical products which can be produced in the region. Illustrative examples were used to show the methodology applicable to each of the decision points during the evaluation.

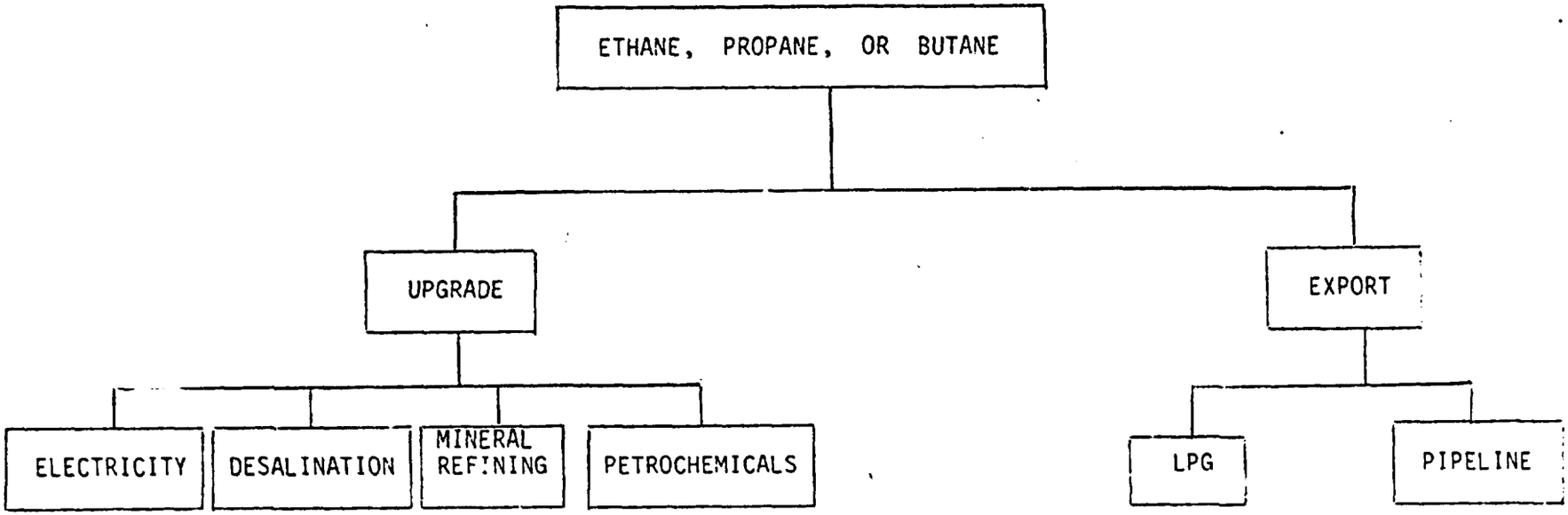
A presentation to the GCC secretariat can be used to explain the concepts used in the study. With minimum effort the programs can be modified to meet the specific needs of the secretariat.

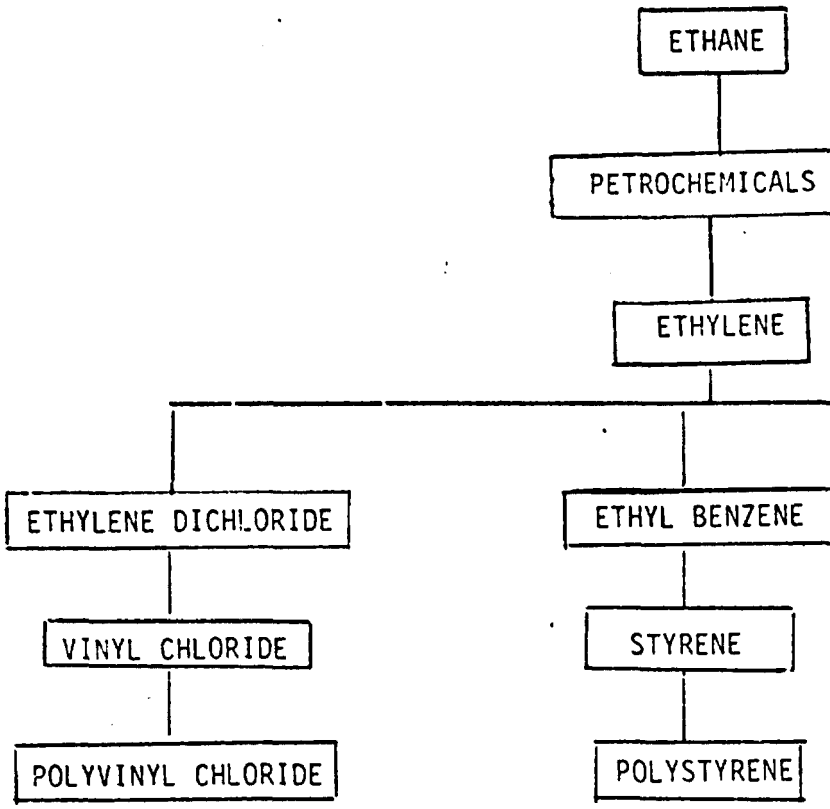

PETROCHEMICAL INDUSTRIAL STRATEGY
CRUDE OIL
NATURAL GAS
ASSOCIATED GAS
DRY GAS
COMPOSITION
SUPPLY
COMPOSITION
SUPPLY
METHANE
ETHANE
PROPANE
BUTANE

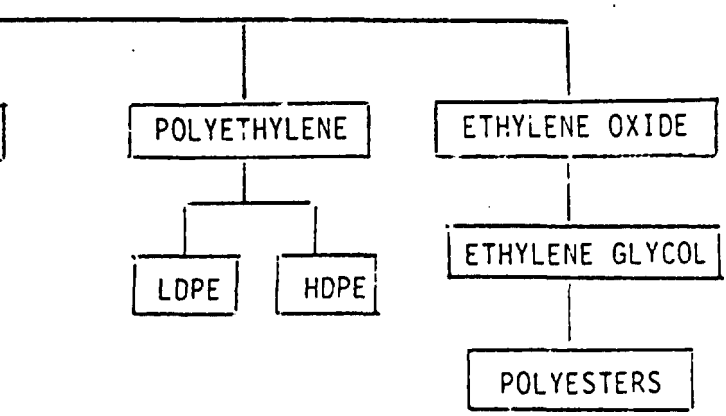

UPGRADE
ELECTRICITY
DESALINATION
MINERAL REFINING

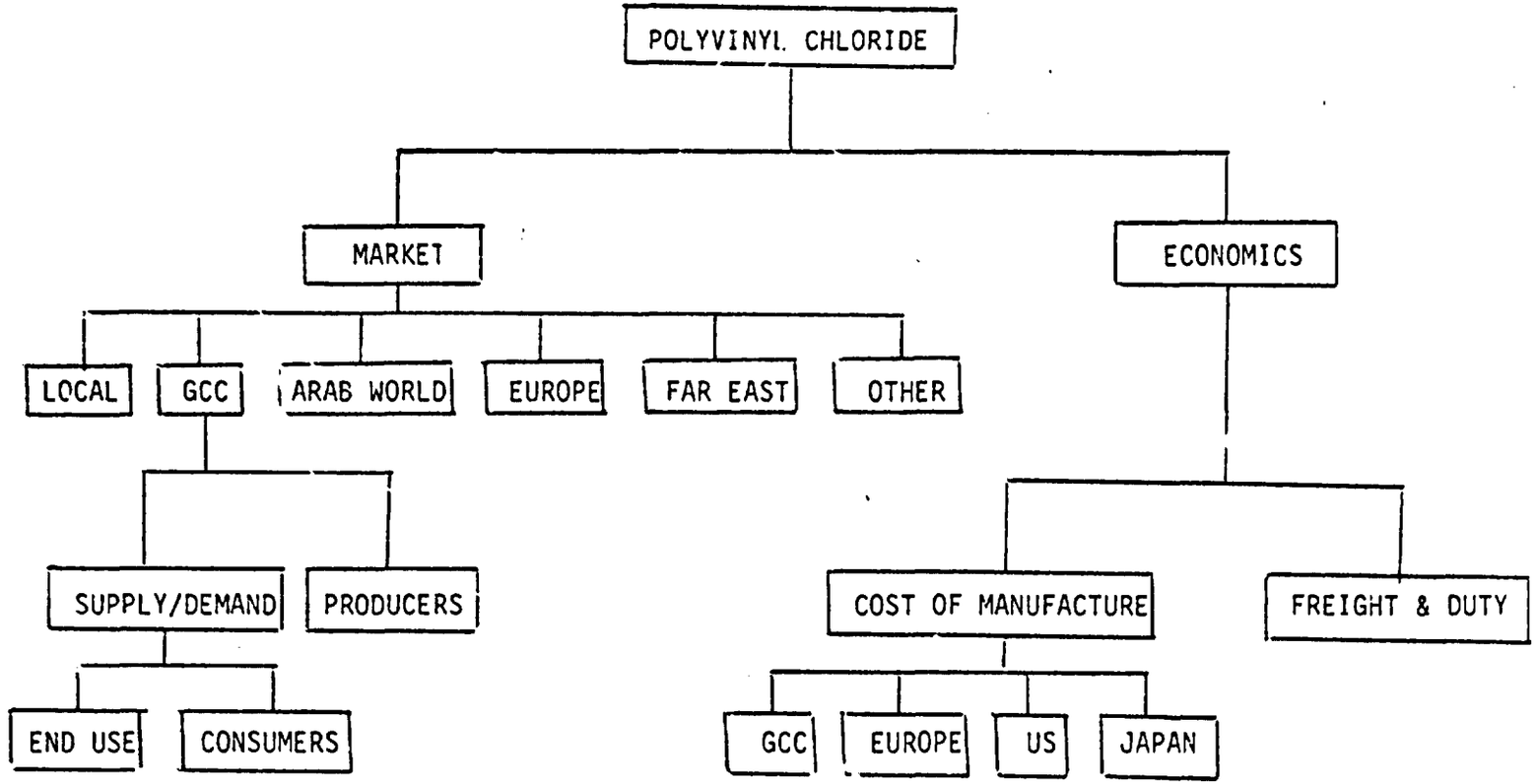

METHANE
FLARE
EXPORT
PETROCHEMICALS
LNG
PIPELINE


METHANE
PETROCHEMICALS
AMMONIA
METHANOL
UREA
NITRIC ACID
MTBE
FORMALDEHYDE
ACETIC ACID

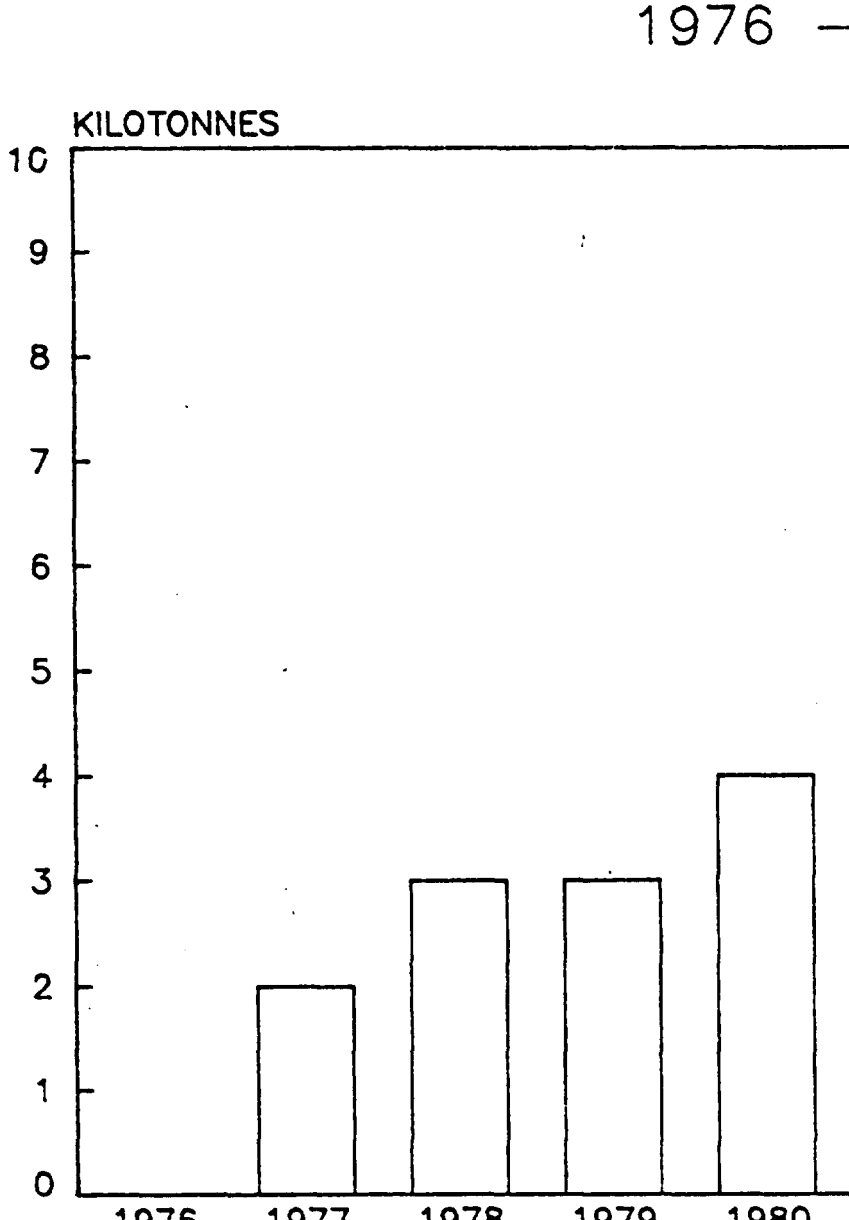

ETHANE, PROPANE, OR BUTANE
UPGRADE
EXPORT
ELECTRICITY
DESALINATION
MINERAL REFINING
PETROCHEMICALS
LPG
PIPELINE


ETHANE
PETROCHEMICALS
ETHYLENE
ETHYLENE DICHLORIDE
ETHYL BENZENE
VINYL CHLORIDE
STYRENE
POLYVINYL CHLORIDE
POLYSTYRENE

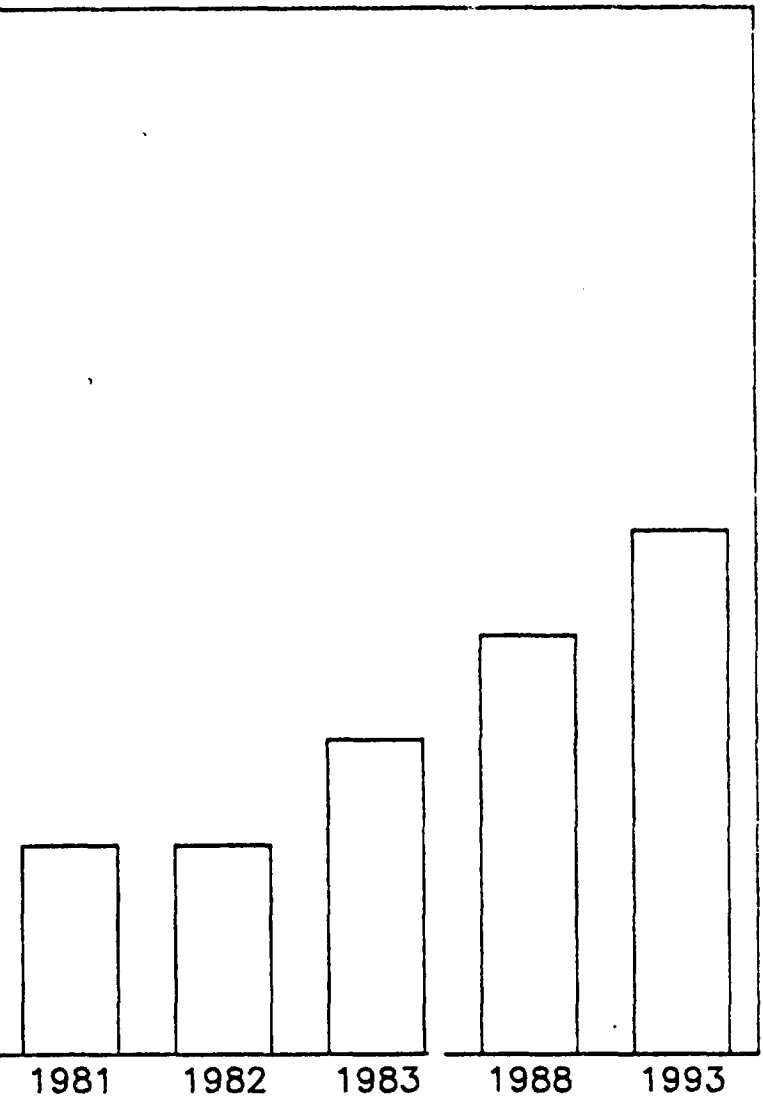

POLYETHYLENE
ETHYLENE OXIDE
LDPE
HDPE
ETHYLENE GLYCOL
POLYESTERS


POLYVINYL CHLORIDE
MARKET
ECONOMICS
LOCAL
GCC
ARAB WORLD
EUROPE
FAR EAST
OTHER
SUPPLY/DEMAND
PRODUCERS
END USE
CONSUMERS
COST OF MANUFACTURE
FREIGHT & DUTY
GCC
EUROPE
US
JAPAN

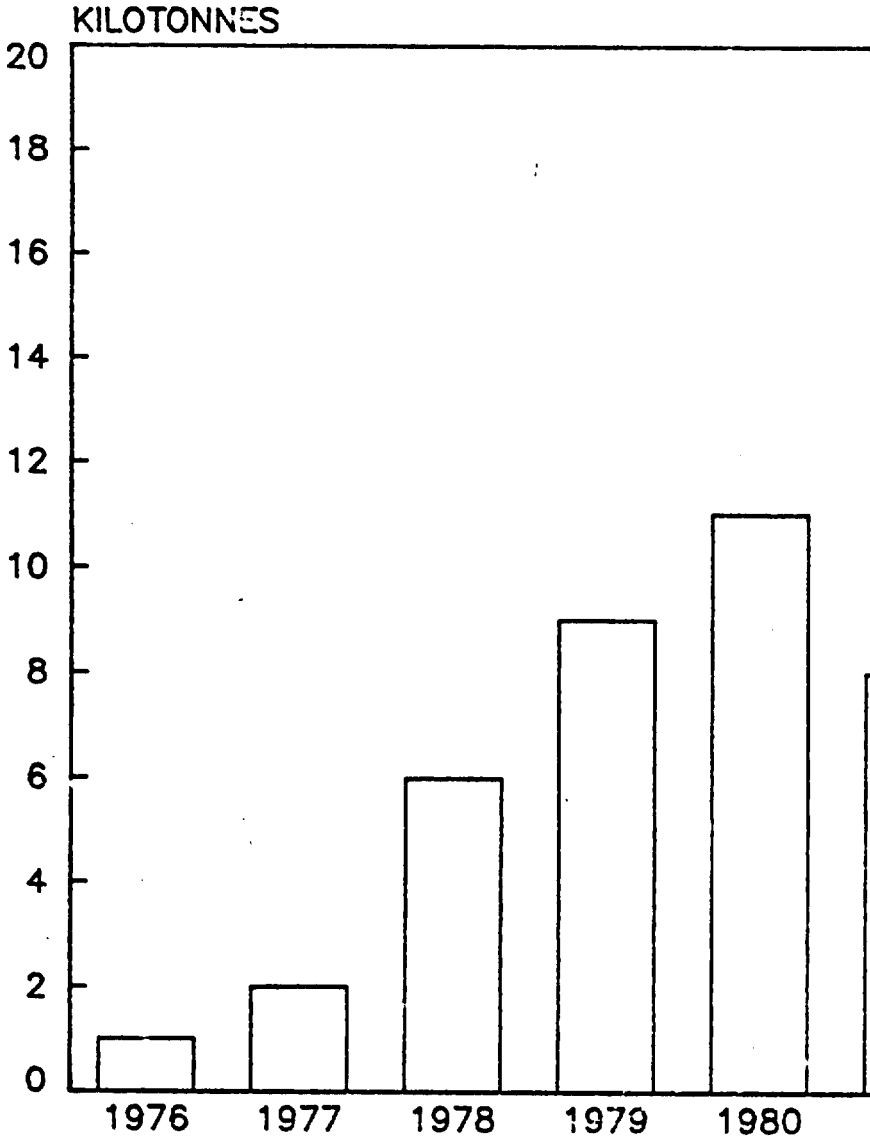
PVC DEMAND
1976 –



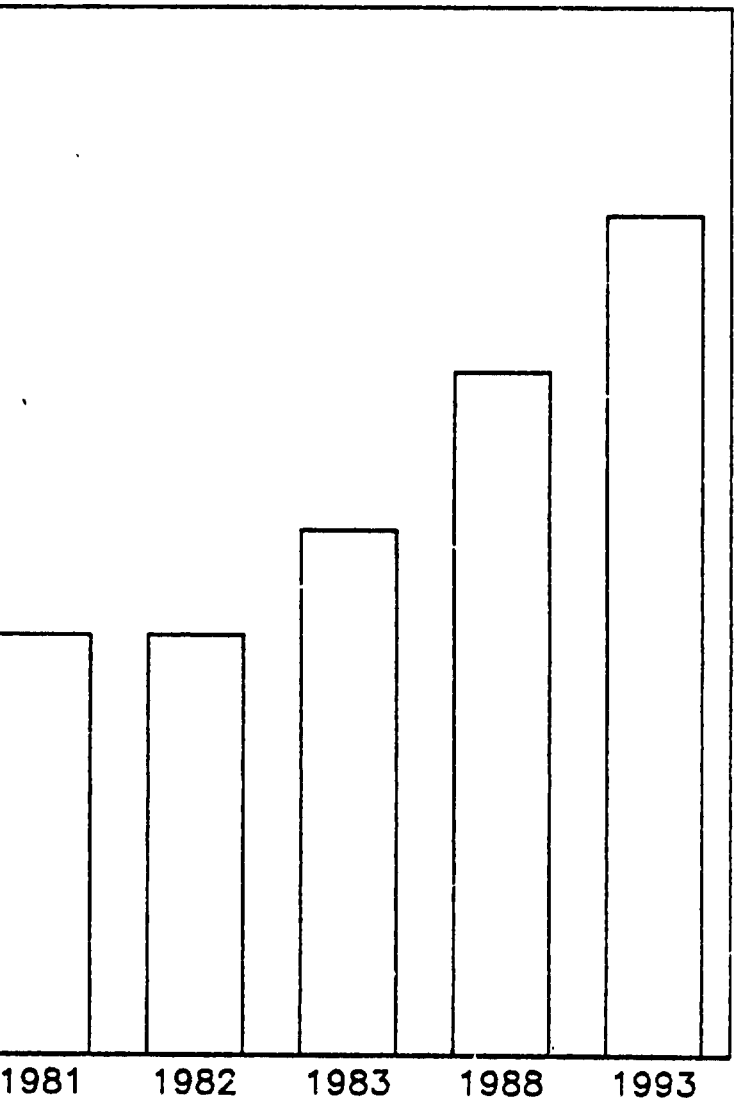
IN BAHRAIN
1993



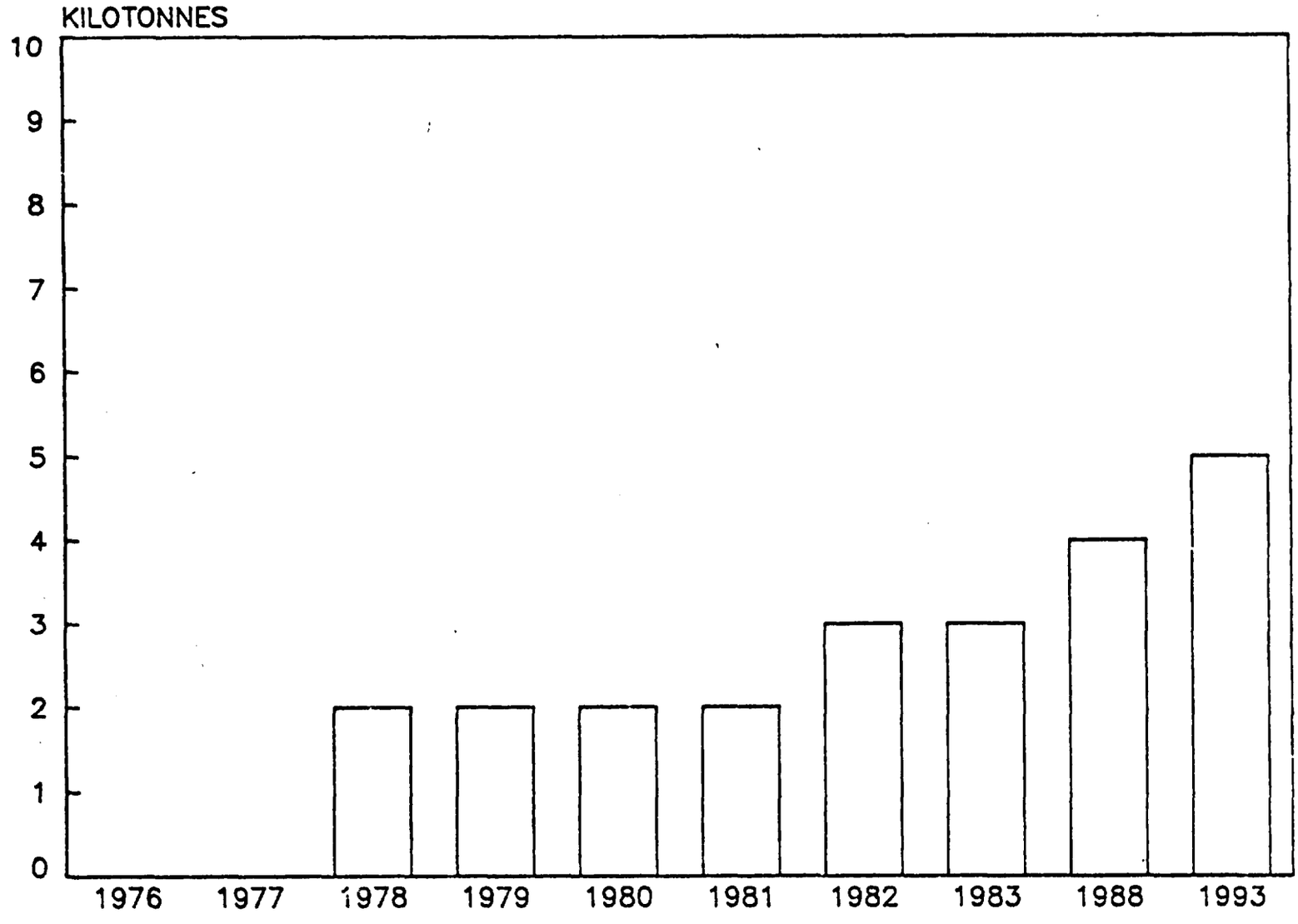
PVC DEMAND
1976 –



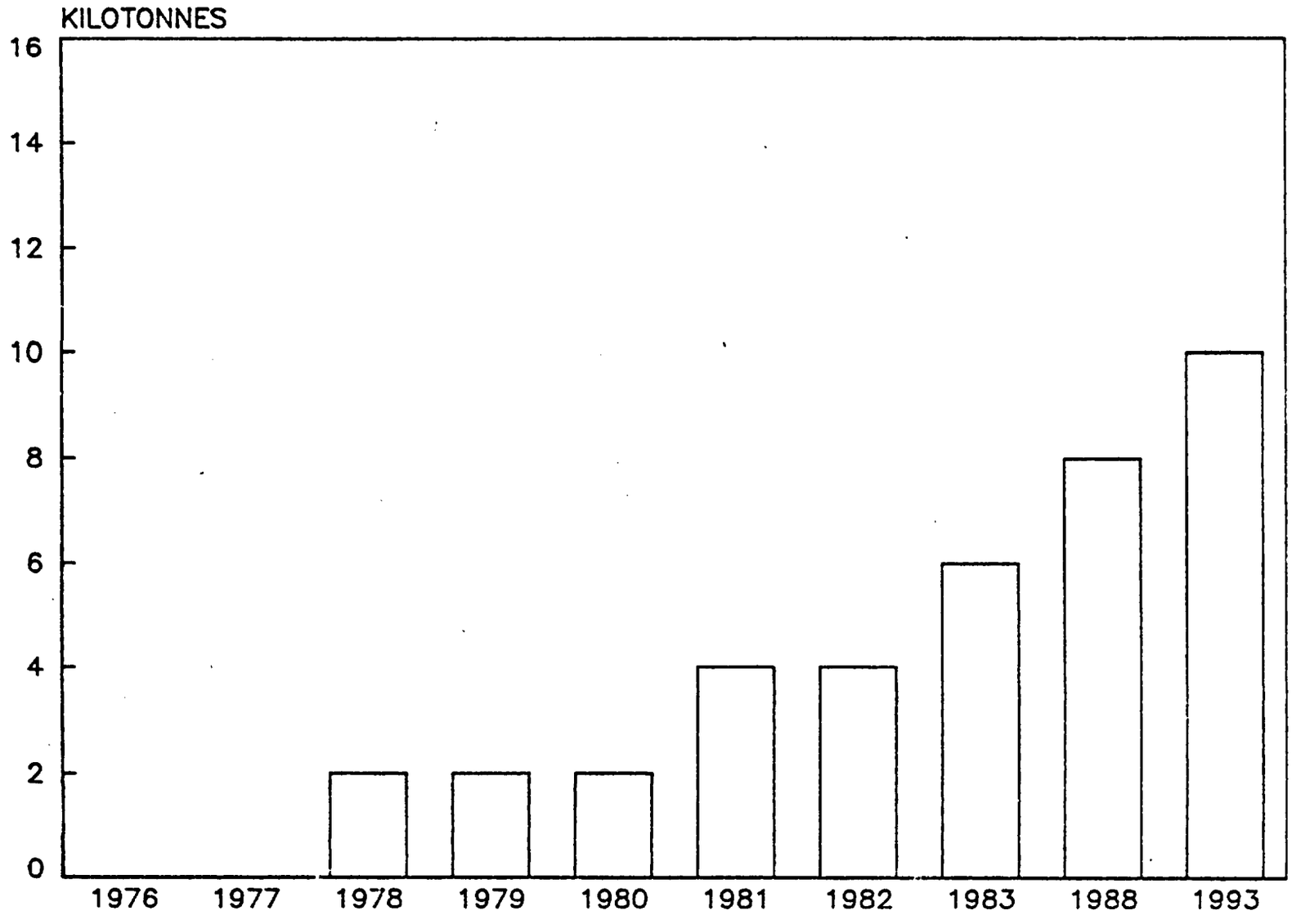
IN KUWAIT
1993



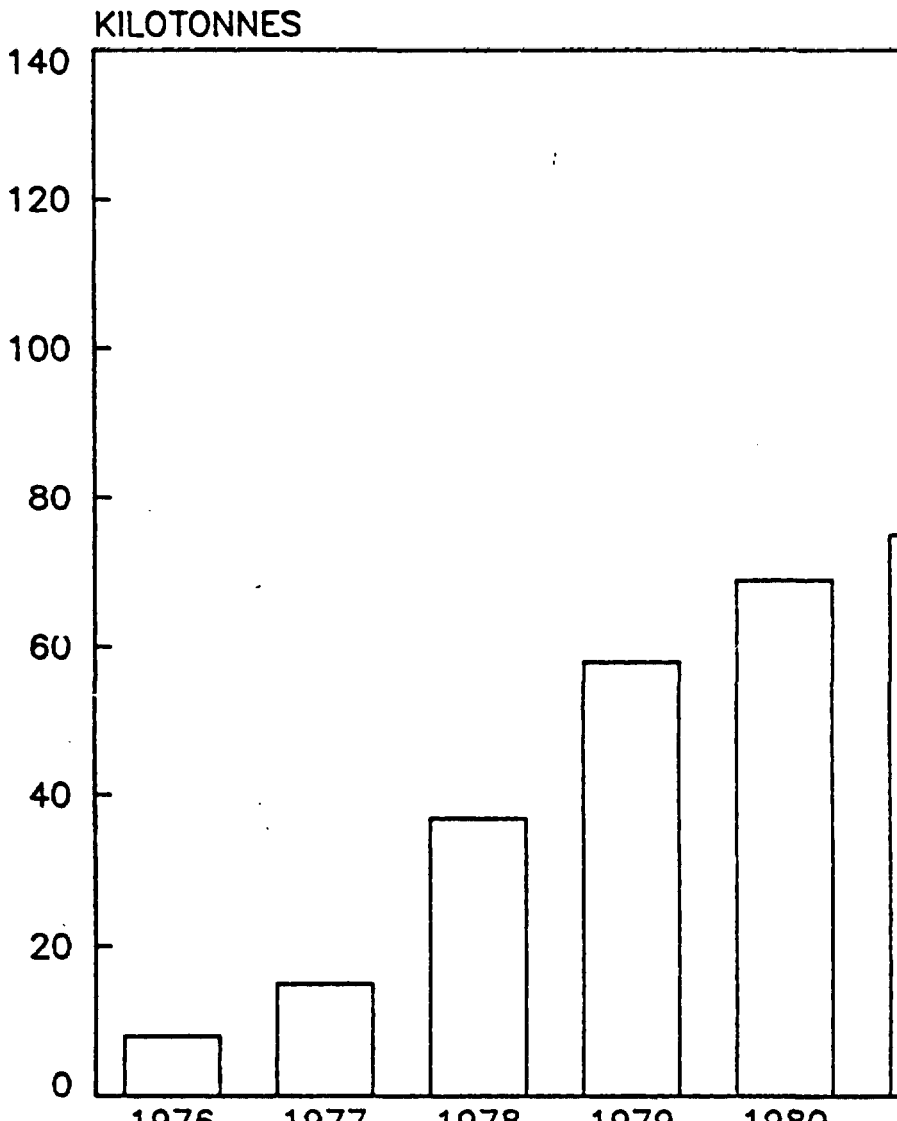
PVC DEMAND IN OMAN
1976 – 1993



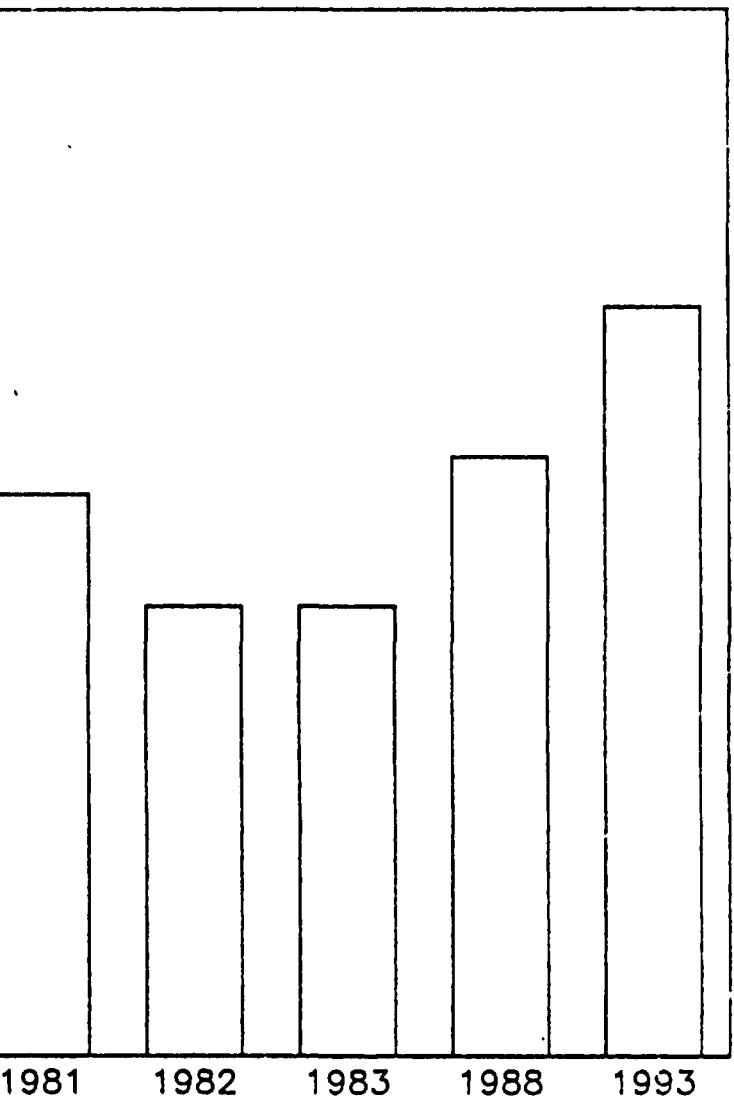
PVC DEMAND IN QATAR
1976 – 1993



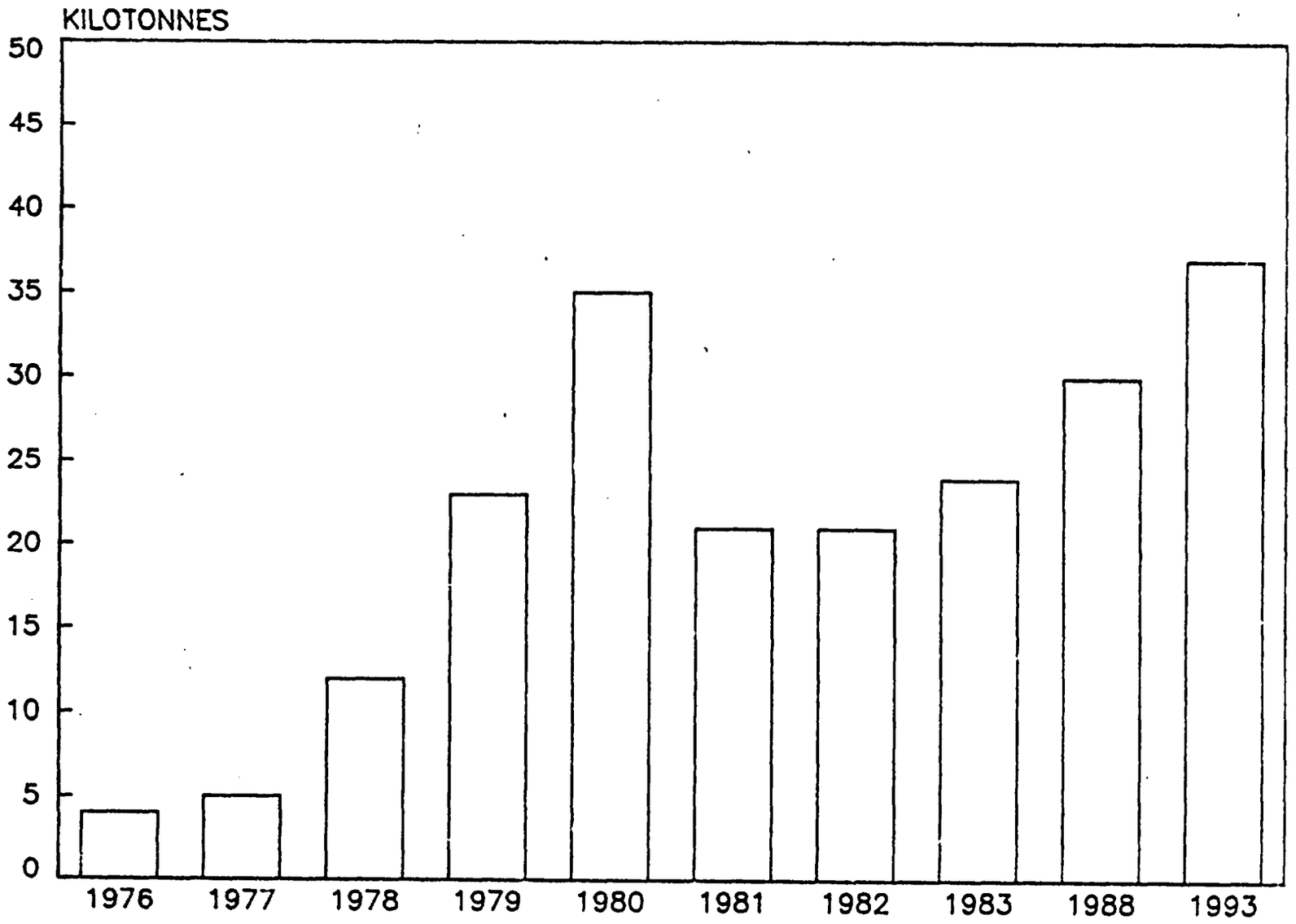
PVC DEMAND IN
1976 –



SAUDI ARABIA
1993



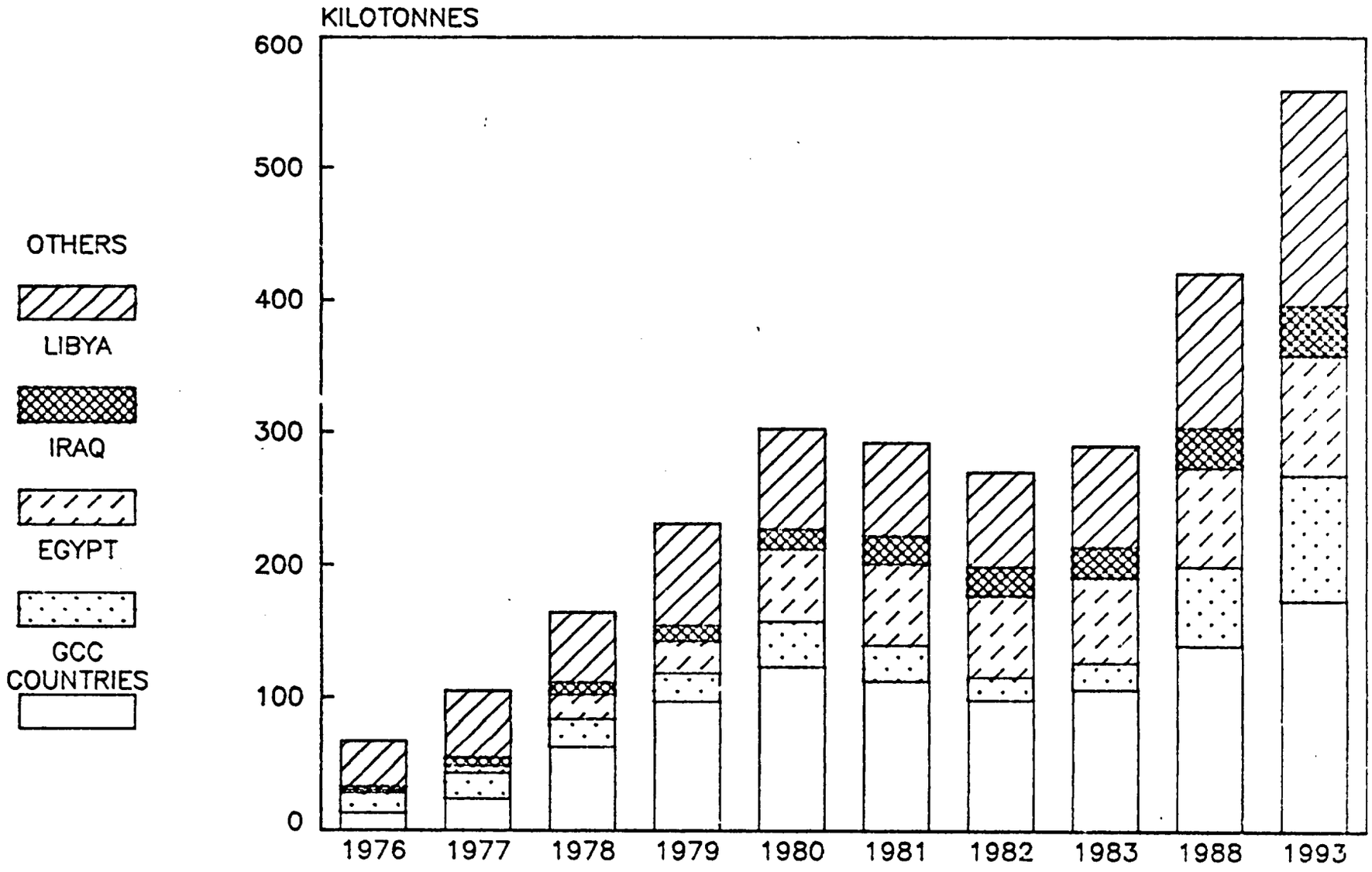
PVC DEMAND IN THE UNITED ARAB EMIRATES
1976 – 1993



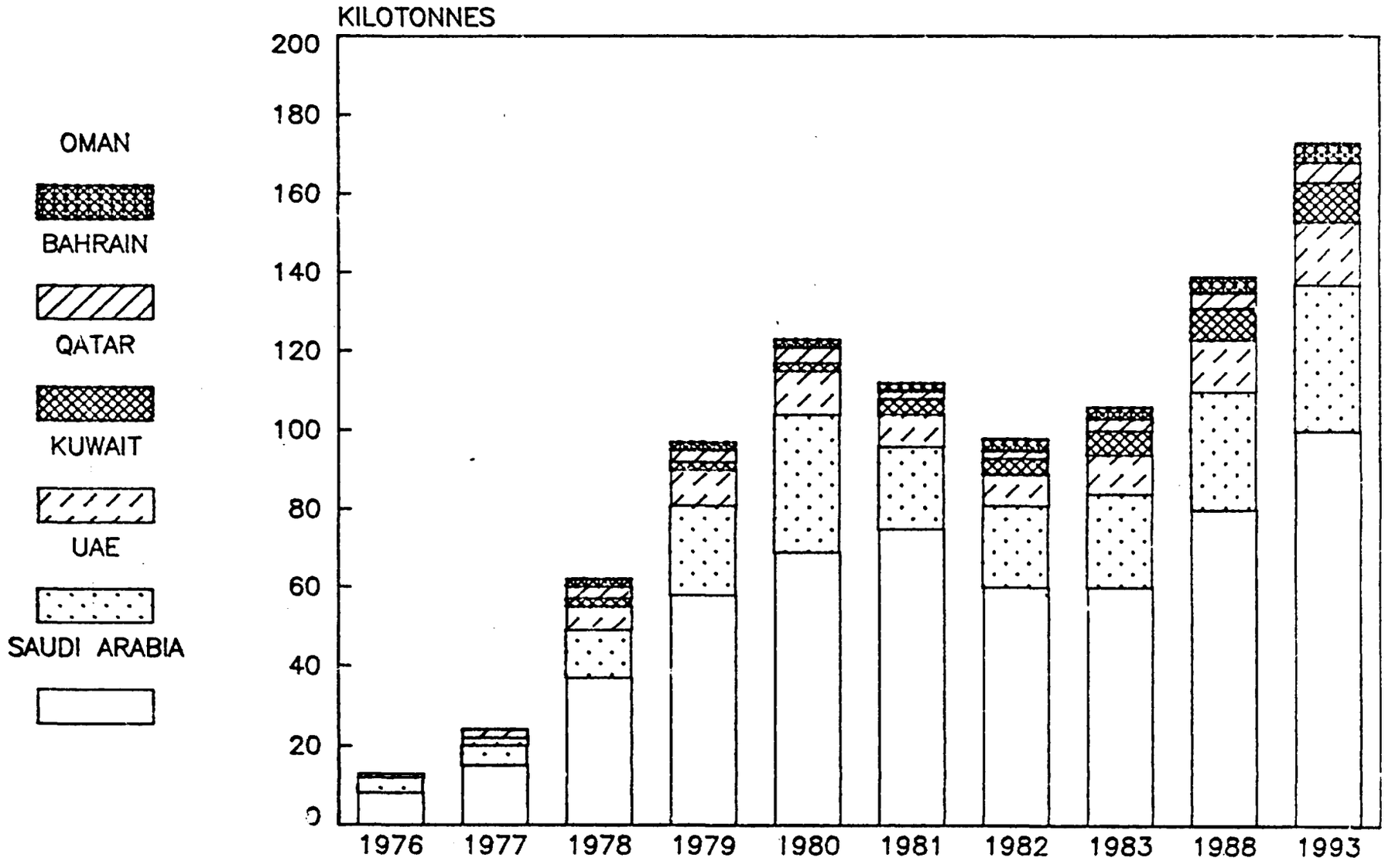
pvc economics	saudi arabia			july 1983
plant capacity	m lbs/y			440.00
annual production	m lbs			440.00
capital costs				
battery limits	m $			100.00
off-sites	m $			50.00
working capital	m $			0.00
debt	m $			105.00
equity	m $			45.00
total capital	m $			150.00
variable costs				
raw materials				
vinyl chloride c/lb		14.70		14.85
chemicals & catalyst				0.20
raw materials sub total	c/lb			15.05
utilities				
cooling water	usg/lb		7.04	0.05
steam	lbs/lb		0.15	0.02
electricity	kwh/lb		0.09	0.24
inert gas	scf/lb		0.08	0.01
utilities sub total	c/lb			0.31
fixed costs				
labour (op+main+con)	c/lb			0.87
maintenance mat & sup	c/lb			0.70
plant overhead	c/lb			0.70
cost of debt	c/lb			0.84
taxes & insurance	c/lb			0.68
depreciation	c/lb			3.41
plant gate cost	c/lb			22.55
sales admin & r&d	c/lb	10%of price		2.51
product cost	c/lb			25.06
product value	c/lb	25% roi bt		33.58
	c/lb	25% roe bt		27.62

pvc economics	us gulf coast			july 1983
plant capacity	m lbs/y			440.00
annual production	m lbs			440.00
capital costs				
battery limits	m $			68.20
off-sites	m $			32.20
working capital	m $			0.00
total capital	m $			100.40
variable costs				
raw materials				
vinyl chloride c/lb		21.00		21.21
chemicals & catalyst				0.18
raw materials sub total	c/lb			21.39
utilities				
cooling water	usg/lb		7.04	0.05
steam	lbs/lb		0.15	0.11
electricity	kwh/lb		0.09	0.52
inert gas	scf/lb		0.08	0.01
utilities sub total	c/lb			0.69
fixed costs				
labour (op+main+con)	c/lb			0.71
maintenance mat & sup	c/lb			0.49
plant overhead	c/lb			0.57
taxes & insurance	c/lb			0.46
depreciation	c/lb			2.28
plant gate cost	c/lb			26.58
sales admin & r&d	c/lb	10%of price		2.95
product cost	c/lb			29.53
product value	c/lb	25% roi bt		35.24

PVC DEMAND IN THE ARAB WORLD
1976 – 1993



PVC DEMAND IN GCC COUNTRIES
1976 – 1993



SAUDI ARABIA
PVC SUPPLY DEMAND BALANCE 1976-1993
KT

YEAR	CAPACITY	IMPORTS	EXPORTS	CONSUMPTION
1976		8		8
1977		15		15
1978		37		37
1979		58		58
1980		69		69
1981		75		75
1982		60		60
1983		60		60
1984		70		70
1988	200		60	80
1993	200		40	100

OMAN
PVC SUPPLY DEMAND BALANCE 1978-1993
KT

YEAR	CAPACITY	IMPORTS	EXPORTS	CONSUMPTION
1978		2		2
1979		2		2
1980		2		2
1981		2		2
1982		3		3
1983		3		3
1988		4		4
1993		5		5

BAHRAIN
PVC SUPPLY DEMAND BALANCE 1977-1993
KT

YEAR	CAPACITY	IMPORTS	EXPORTS	CONSUMPTION
1977		2		2
1978		3		3
1979		3		3
1980		4		4
1981		2		2
1982		2		2
1983		3		3
1988		4		4
1993		5		5

UNITED ARAB EMIRATES
PVC SUPPLY DEMAND BALANCE 1976-1993
KT

YEAR	CAPACITY	IMPORTS	EXPORTS	CONSUMPTION
1976		4		4
1977		5		5
1978		12		12
1979		23		23
1980		35		35
1981		21		21
1982		21		21
1983		24		24
1988		30		30
1993		37		37

QATAR
PVC SUPPLY DEMAND 1978-1993
KT

YEAR	CAPACITY	IMPORTS	EXPORTS	CONSUMPTION
1978		2		2
1979		2		2
1980		2		2
1981		4		4
1982		4		4
1983		6		6
1988		8		8
1993		10		10

KUWAIT
PVC SUPPLY DEMAND 1976-1993
KT

YEAR	CAPACITY	IMPORTS	EXPORTS	CONSUMPTION
1976		1		1
1977		2		2
1978		6		6
1979		9		9
1980		11		11
1981		8		8
1982		8		8
1983		10		10
1988		13		13
1993		16		16