英汉对照石油科普丛书

石油工业发展及其前景

石油工业出版社

英汉对照石油科普丛书

石油工业发展及其前景

陈　玉　胡君倩　译注

石油工业出版社

(京)新登字 082 号

英汉对照石油科普丛书
石油工业发展及其前景
陈 玉 胡君倩 译注
*
石油工业出版社出版
(北京安定门外安华里二区一号楼)
石油工业出版社印刷厂排版
石油工业出版社印刷厂印刷
新华书店北京发行所发行
*
787×1092 毫米 32 开本 $7\frac{3}{8}$ 印张 161 千字 印 1—2000
1994 年 2 月北京第 1 版 1994 年 2 月北京第 1 次印刷
ISBN 7-5021-0970-6/TE·904
定价: 4.80 元

出 版 说 明

英国石油公司出版的《Our Industry Petroleum》一书，迄今为止已重版（包括修订）了五次。这本书对于刚刚投身石油事业的工作者，对于希望概括了解石油工业结构、历史和各个生产部门情况的人士，起到了指南的作用。

我社以此为蓝本，按章（或几章）分册出版了这套“英汉对照石油科普丛书”，旨在向自学英语的同志，特别是石油系统广大职工和有关院校的学生提供一套全面介绍石油基本知识的英语读物。这套丛书计划出十二个分册。每一分册约3～5万字，并尽可能配用与内容密切联系的插图。为便于读者自学，除采用英汉两种文字相互对照的形式外，还对英语中某些语言难点（包括复杂的句子结构、短语等）作了必要的注释。因此，凡具有相当于理工科大学二年级英语水平的读者，都可以毫无困难地阅读这套丛书。为了保证丛书的质量，每一分册都先由熟悉专业的同志提供通顺可诵的准确译文，然后统一请南京大学大学外语部的教师对译文作进一步校订，并加做必要的语法注释。但能否真正收到预期的效果，则要由读者作出评定了。我们衷心希望能得到广大读者的批评、指正。

石油部科技情报所的张焱同志，倡导并协助我社组织了“英汉对照石油科普丛书”的编译工作，中国银行付正恺同志和石油科技情报所孙贤胜同志参与了本书工作，在此再次表示感谢。

Contents 目　录

DEVELOPMENT OF THE PETROLEUM INDUSTRY AND ITS FUTURE PROSPECTS

INTRODUCTION

Petroleum is "rock oil" because it is oil which over geological time has migrated and accumulated in porous reserveir rocks underground.

Petroleum consists mainly of hydrocarbons, that is a series of molecules containing atoms of hydrogen and carbon. These substances range from very light gases to solids.Petroleum is normally found at considerable depths beneath the earth's surface, where, under pressure. it is essentially a liquid. At ground level and atmospheric pressure, petroleum comprises both crude oil and natural gas. The majority of crude oils contain hydrocarbons with very few carbon atoms, gaseous at atmospheric pressure and temperature. Fields which contain only these very light hydrocarbons are referred to as "natural gas fields".

Normally both oil and gas contain substances* other than[1]hydrocarbons such as nitrogen in natural gas or sulphur and vanadium in crude oils.When separated out these substances may well be valuable .Frequently they* set[2]the petroleum refiner costly problems in removing them from the crude oil When a crude oil contains elements of natural gas, these are normally separated out

at , or close to, the oilfield enabling the oil and gas to be handled with greater efficiency and safety according to their distinctive characteristics.

NATURAL GAS

Natural gas is found in similar circumstances to crude oil and may, as stated, be regarded as comprising the lightest end of the range of hydrocarbons contained in petroleum. The gas may be found in association with oil in which case it is referred to as an "associated gas ", or it may occur* on its own[3]. When it is on its own it may be a wet gas containing certain of the lighter liquid hydrocarbons or natural gas liquids which will be separated out once the gas has reached ground level, or it may be a dry gas* devoid of[4] such liquids.

As produced it can be used directly as a fuel. The heavier and more valuable gases may be separated out as* liquefied petroleum gases (LPG) [5]. The great advantage of natural gas is that it is ready to burn. Its great disadvantage is that* in the absence of[6] local markets it is much bulkier than oil to move and to store.As a result much natural gas in remote gas– or oilfields has had to be wasted in the past, flared off to the extent that it cannot be used by local consumers, as a works fuel in the fields or local refineries or for reinjection to maintain pressures in underground reservoirs.

Markets have, however, developed in recent years for liquefied natural gas in energy–deficient areas such as Japan as an alternative to expensive town gas from the

carbonisation of coal or for supplementing declining local supplies of natural gas, particularly for "peak shaving" in countries such as the USA. It would be impossible to liquefy natural gas by pressure. The only way to reduce its bulk is to refrigerate it –and so induce it at –258 ° F* to re–enter its liquid phase at 1 / 600th of its gaseous volume[7].The process of liquefaction, transportation in specially designed tankers and storage and re–gasification close to the market are all costly and make liquefied natural gas an expensive alternative to crude oil and oil products.

Long–distance large–diameter pipelines have frequently been proposed in the past, but have seldom proved competitive with oil except in land–locked areas. Even when the economics have held up, the vulnerability of a single pipeline to interruption of supply through political risk or sabotage has frustrated plans. One proposal to move Middle East gas to Europe involved the crossing of nineteen national frontiers.

Where natural gas has been discovered close to ready markets as in North Americal and Western Europe major trunk pipelines and reticulation systems have been built up. Existing town gas production has virtually closed down and deep penetration achieved of established markets for liquid and solid fuels as well as rapid development into expanding markets.

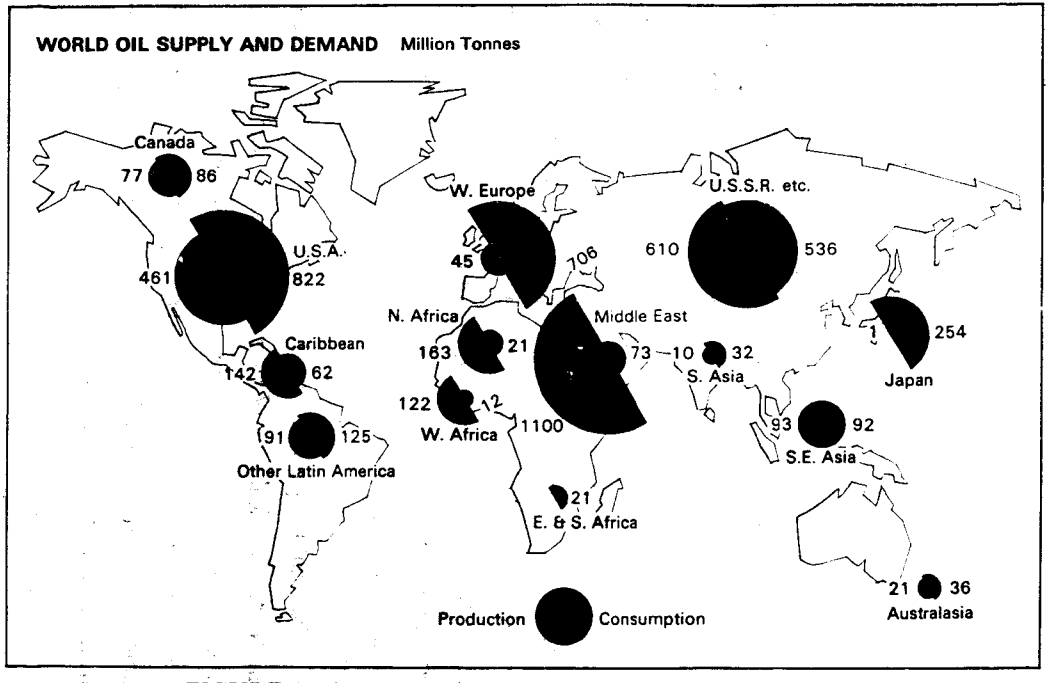

FIGURE 1.1 Disparity between production and consumption in various parts of the world (1976 figures).

Natural gas is not inevitably petroleum–based as sizeable deposits have been discovered in association with* coal measures[8]–the result of freshwater sedimentation rather than the marine sedimentation upon which petroleum is based.

CRUDE OIL

Because crude oil contains such a wide range of hydrocarbons from the lightest to the heaviest , the characteristics of individual crude oils vary greatly. They differ considerably between one oil province and another and may do so even within one province from field to field.This lack of homogeneity has in fact proved one of the greatest strengths of the oil industry* –in that by choosing a suitable variety of crude oils for processing in a refinery a close correspondence between the natural yield, distillation of the crude and the requirements of a market can be met by the most straightforward and, therefore, lowest cost refining processes[9].

PROPERTIES OF PETROLEUM

All fossil fuels are* ultimately burned as gases.The hydrocarbons contained in petroleum are* in the main[10]highly inflammable and are contained in a compact liquid*. It is crude petroleum's liquid nature which[11]to a great extent* accounts for[12]* the extreme competitiveness of petroleum in the energy field, the specific uses to which it has been put or which have been developed to use it and the very nature[13]of

the industry which has been built up to produce, transform and market it.

* The fact that crude oil is a liquid permits it to migrate underground, otherwise it would not have accumulated in commercial quantities.However, this sets the explorer for petroleum a considerable problem in locating it .He can apply techniques to identify geological structures underground which may contain oil, but his chances of discovering producible oil are only about one in thirty–in other words, one* " wildcat " [14]well in thirty drilled world–wide finds commercial oil. This means that exploration is an expensive process, as is the installation of production facilities.However, once these production facilities have been installed, the fact that oil is a liquid and under considerable pressure underground makes the actual production process relatively straightforward–and much more so than for solid or near solid fossil fuels such as coal, oil sand or shales.

Oil has, however, to be contained at every stage of its production , transportation, processing and distribution nowadays in steel containers.At each stage equipment specific to the oil industry has been developed to overcome the problems effectively.

* The fact that oil is a compact form of energy containing some 50 per cent more heat per unit of weight than coal and is pumpable means that the task[15]of transportation is easier than* in the case of[16]its competitors.Equally, handling oil in a refinery or depot–whether in a process unit or moving it

between units, to tank farms or loading it into tankers, rails cars, or road wagons–is made much simpler* because of[17] its liquid or gaseous nature.

NATURE OF THE INDUSTRY

* There are certain basic economic characteristics of the oil industry which stem from the nature of its raw materials, where it is found and the success[18] the industry has achieved in a competitive market.

INTERNATIONAL IN NATURE

Industrialisation in the eighteenth and nineteenth centuries was based upon ready access to coal and iron ore, which were frequently found in close proximity to each other. It was in these areas that economic growth started. By a chance of nature petroleum has tended to be found at a distance from these centres of development. This is true even of countries which are both producers and consumers, such as the USSR and the USA and to an even greater extent of the majority of other developed and developing countries which are importers.

Since the beginning of the twentieth century, the international nature of the industry has tended to increase with major producing areas developing in the Middle East, Africa and the Caribbean and major consuming areas in North America, Europe and the Far East. Despite sizeable discoveries in areas such as the North Sea and Alaska and the levels of current production in the USA and USSR, the

predominance of international trade in oil still persists to the point where it is the single most important commodity in international trade, both by volume and by value .In parallel with this development of both production and consuming areas world–wide, there has almost inevitably grown up a set of companies searching in all corners of the world for new oil and, once it has been found, moving it to the mature and developing markets wherever it is needed.

ECONOMIES OF SCALE AND SIZE

It has been suggested that the need to contain oil today in steel containers is a basic cost penalty upon the industry. However, there are marked gains from increasing the size of all the "containers" * called for as[19]the amount of steel, and, therefore, the basic cost, increases more slowly than the volume of oil that the steel can contain.This is equally true for pipelines, processing units in refineries or petroleum chemical works and for seagoing tankers, rail tank cars, road tank wagons or for storage tanks.

This characteristic has several implications for the oil industry.Firstly, the larger the scale of a company's operations the more it will benefit from economies of scale and improve its competitive advantage by minimising its unit costs.This minimisation of costs will, of course, benefit the consumer by keeping the price paid for a product down to a minimum also.In the last twenty years this trend towards large–scale operation has , for example, led to an increase in the standard size of crude oil tankers from 16,000

deadweight tons to 300,000 deadweight tons or even more and of distillation columns in a refinery from a capacity of 10,000* bpd[20]to units today of up to 300,000 bpd. This ability has not only led to the growth of very large companies operating throughout each aspect of the business but did enable them for some fifty years –into the 1970s–to hold the price of petroleum products in money* of the day[21]almost constand.This , in the face of inflation, meant a real reduction in the cost of these products.By 1970 many of these economies of scale were beginning to reach their technical limits and were* in any event[22]overtaken by the dramatic rise in the cost of crude oil and by rapid inflation affecting both capital and running costs.

In order to* take full advantage of[23]these economies of scale a company will also tend to build units of a greater size beyond its immediate needs.In many cases, where the size of a market does not warrant the construction of a very large unit by a single company, joint ventures have been set up whereby several companies collaborate in the construction and operation of , for example , a large–scale refinery.These economies of scale also mean that costs will be minimised by " breaking bulk" as late as possible in de–livering oil from oil well to customer.

CAPITAL INTENSITY AND INTEGRATION

The equipment required at each stage of the industry's operations is also likely to be extremely expensive* .Not only does the industry have to employ bulky hardware at each

stage of its operation from oil reservoir to customer's tank but the oil industry is[24], along with nuclear energy and the chemicals industry—at one time less closely linked than now with the oil industry—the most scientifically and technologically based of any large-scale enterprise.These two factors have made it capital intensive in the past, particularly in refining but now throughout all operations.With the delay between planning and completion of projects, this calls for the injection of large sums of money long before any income can be derived from the investment.It also means that the cost of plant—fixed costs—are high in comparison to running costs—variable costs.When these factors are linked* to the high[25]and sustained growth experienced almost without interruption unitl the mid 1970s—a doubling of demand and output every ten years world-wide—it is easy to see why companies involved in the business had to undertake forecasts and plans well ahead for an uncertain future, had to strive for profitability and credit ratings to command the funds necessary for investment, and had to maintain a high load factor on each element of their supply systems.If they failed to do this their high fixed costs would fail to be* covered[26].

These elements, along with the natural desire of companies to guarantee*, as best they can[27], an outlet for their products—crude oil, intermediate products such as chemical feedstocks or finished products ready for the market—have led companies to become involved in many or all aspects of