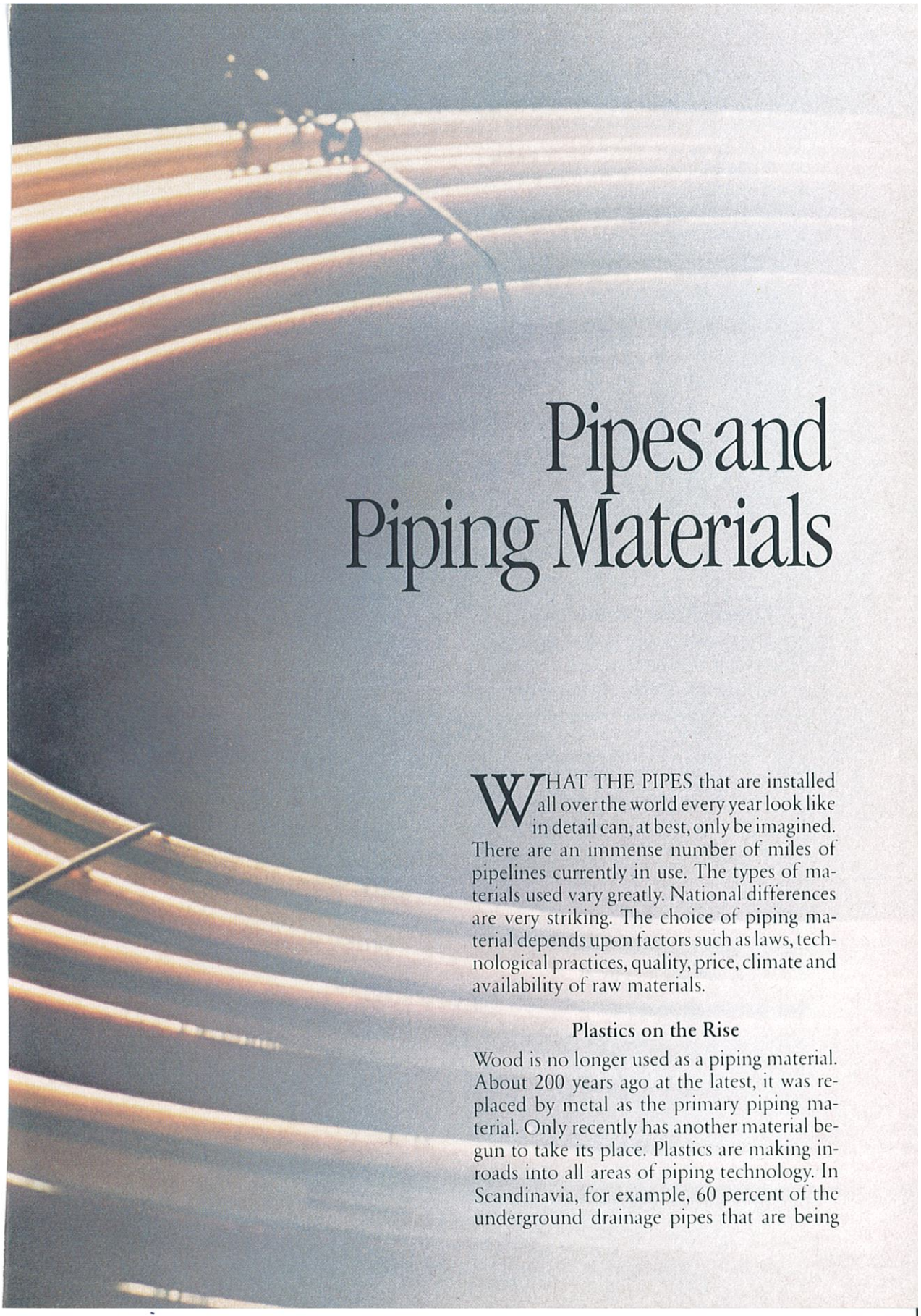


Pipes and Piping Materials

WHAT THE PIPES that are installed all over the world every year look like in detail can, at best, only be imagined. There are an immense number of miles of pipelines currently in use. The types of materials used vary greatly. National differences are very striking. The choice of piping material depends upon factors such as laws, technological practices, quality, price, climate and availability of raw materials.

Plastics on the Rise

Wood is no longer used as a piping material. About 200 years ago at the latest, it was replaced by metal as the primary piping material. Only recently has another material begun to take its place. Plastics are making inroads into all areas of piping technology. In Scandinavia, for example, 60 percent of the underground drainage pipes that are being

installed are made of plastic. In this case, they are being used instead of concrete pipes. This development has taken place only over the last 10 to 15 years.

The advancement of plastics into our civilization can best be seen by looking at the worldwide production figures from the last 3 decades as illustrated in Table 5:1.

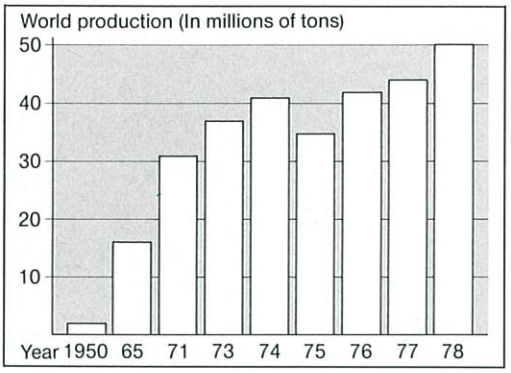


Table 5:1

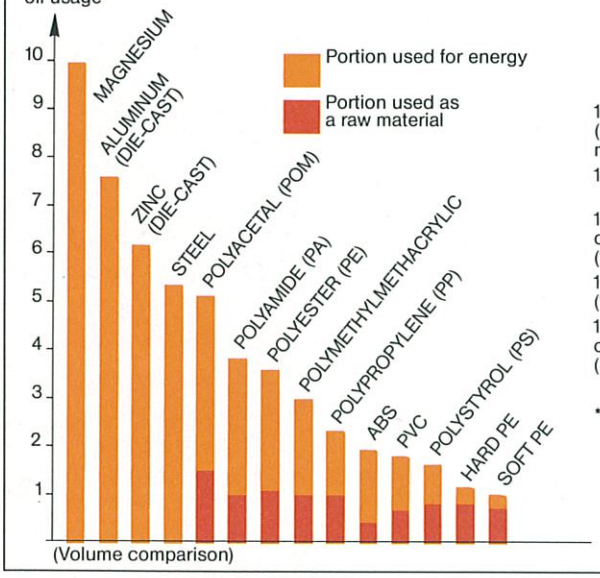
Energy-efficient Production

New materials will prevail in the long run only if they really demonstrate definite advantages over other materials and not simply because they happen to be the newest fad. Especially in the case of pipelines, there is too much at stake once they have been installed to act on a whim.

Plastics have been gaining in the piping materials market mainly at the expense of concrete and metals. This tendency is noticeable worldwide even though the extent to which it is true varies from country to country. The main reasons for the advance are the technological and economical advantages of plastic tubing. Even a few failures cannot alter that fact. What distinguishes plastic pipes from the others is the relatively "low cost for completely installed systems" despite the fact that they last at least as long as systems made of other materials. With this in mind, it is now simply a matter of how quickly one recognized technology is able to replace another one.

That the production of plastic tubing can be accomplished with relatively little energy expense is no doubt another reason why these new materials are becoming more successful. The following outline should serve to illustrate this fact.

Oil usage



For the Production of the Final Products (Selection)

1 million sq. yards (m^2) of packing material	POLYPROPYLENE*	110
	CELLULOSE	155
1 million sacks	POLYETHYLENE*	470
	PAPER	700
100,000 yards (m) of water pipeline (1 inch (25 mm))	POLYETHYLENE*	57
	COPPER	66
	STEEL (GALVANIZED)	232
1 million bottles (1 Quart (1 l)	PVC*	97
	GLASS	230
100,000 yards (m) of drainage pipes (4 inch (100 mm))	PVC*	360
	ASBESTOS CEMENT	400
	CLAY TILE	500
	IRON	1,970

* includes the oil used as a raw material

(Source: Perstorpshandboken, Maskin AB Karlebo, Sweden).

Table 5:2

***Amount of oil** used in the production of various products.*

An Overview of World Piping Production

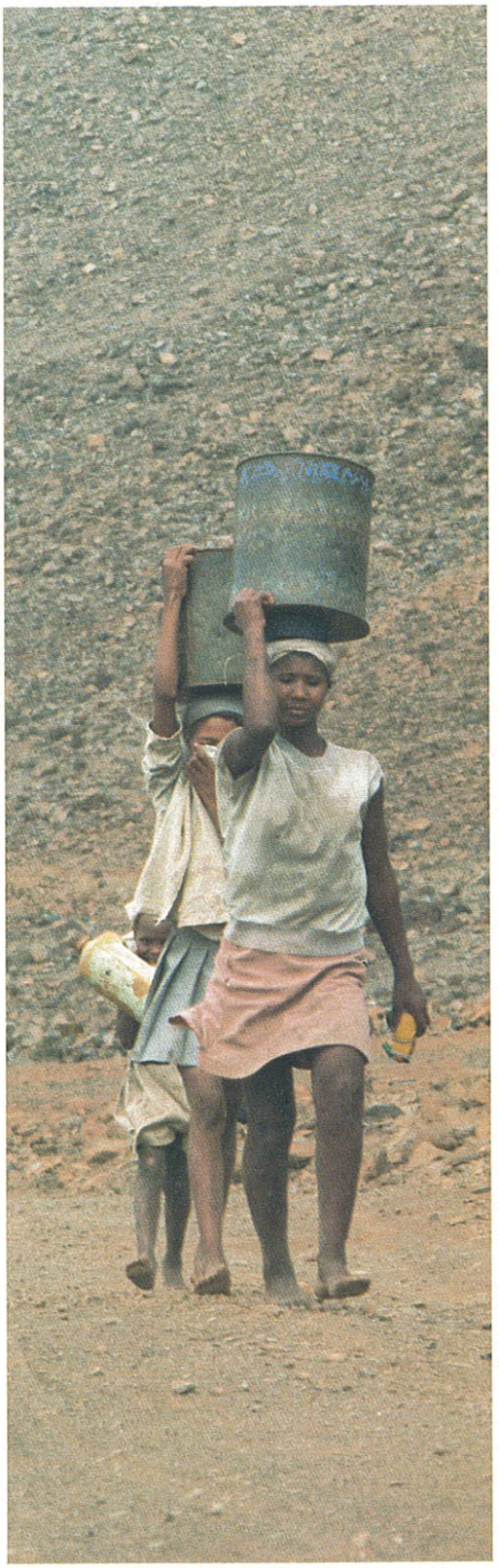
The technology of transporting water through pipelines will always remain up-to-date. What is constantly changing and undergoing new development are the materials used for the pipeline. Such changes are undertaken in an effort to achieve a longer life and easier installation. The most rapid progress, however, is made at times when there are very unusual circumstances to overcome such as high pressure and temperature or when active chemicals are being used.

It is interesting to note that in spite of all the achievements in piping technology, there are still relics of earlier times in use today. Clay pipes are by no means out of the picture. If we look at the world as a whole, the largest amount of all drinking water is still carried in pails and jugs.

The main materials and classes of materials used for pipelines are listed in Table 5:3.

Piping Materials	Uses
Metals	Sewage lines
Copper	in buildings
Steel	underground
Stainless steel	Drainage lines
Cast iron	Hydraulic supply pipes
Minerals	Heating systems,
Clay	in buildings
Stoneware	Drinking and hot water
Concrete	lines
Asbestos cement	Central heating systems
Plastics	Industrial pipelines
PVC	Pipelines (Gas and oil)
PE	
PEX	
PP	
PB	
ABS	
Wood	

Table 5:3



Buckets and pails *carried on their heads – this is how water is still transported in many parts of the world today.*

Plate 5:1

The West German piping market provides a good example for a comparison of the amounts and the values of the various types of pipes. That breakdown is shown in Table 5:4.

	1980	
Piping material	Amount (t)	Value (1000 DM)
Stoneware	311.442	125.545.–
Reinforced concrete (including smokestacks)	1.244.000	191.996.–
Precision steel pipes, total (seamless and welded)	885.000	1.552.492.–
Copper (nonalloyed)	74.383	351.711.–
Copper (alloyed)	90.228	551.573.–
GF-reinforced PE and epoxy resins	833	14.653.–
PE and other polyolefins	53.156	238.131.–
PVC	229.002	714.171.–
Other plastic materials	9.692	103.414.–

Table 5:4

Usage	PVC-C	PB	PEX	PP	Total
1980					
Surface heating (except floors)	0	30	150	0	180
Floor heating	0	2.085	3.300	5.915	11.300
Radiator heating	115	150	365	50	680
Water supply/drainage	215	150	100	15	480
Other	110	50	320	70	550
Total	440	2.465	4.235	6.050	13.190
1985					
Surface heating (except floors)	0	250	1.020	25	1.295
Floor heating	0	5.550	8.250	10.620	24.420
Radiator heating	310	1.315	1.575	200	3.400
Water supply/drainage	345	1.400	1.225	0	2.970
Other	210	300	1.130	115	1.775
Total	865	8.815	13.200	10.960	33.840
Country					
1980					
Belgium	40	0	25	125	195
France	175	10	790	460	1.435
West Germany	20	1.915	2.265	5.070	9.270
Netherlands	0	20	0	80	100
Italy	20	20	200	20	260
Scandinavia	100	370	720	220	1.410
Switzerland	0	20	105	50	175
Great Britain	85	110	130	25	350
Total	440	2.465	4.235	6.050	13.190
1985					
Belgium	40	25	50	425	540
France	50	950	2.750	1.400	5.150
West Germany	100	5.000	4.600	7.720	17.420
Netherland	25	200	150	125	500
Italy	50	170	1.000	300	1.520
Scandinavia	100	1.250	3.400	570	5.320
Switzerland	0	70	300	200	570
Great Britain	500	1.150	950	220	2.820
Total	865	8.815	13.200	10.960	33.840

Source: Consultex, Switzerland.

Table 5:5

***Usage** (in tons) of plastic pipes for hot water in Western Europe. Some of the advantages that come with using plastic piping materials are a longer life in the case of certain applications, a simplified installation method and a smaller amount of energy used for their manufacture.*

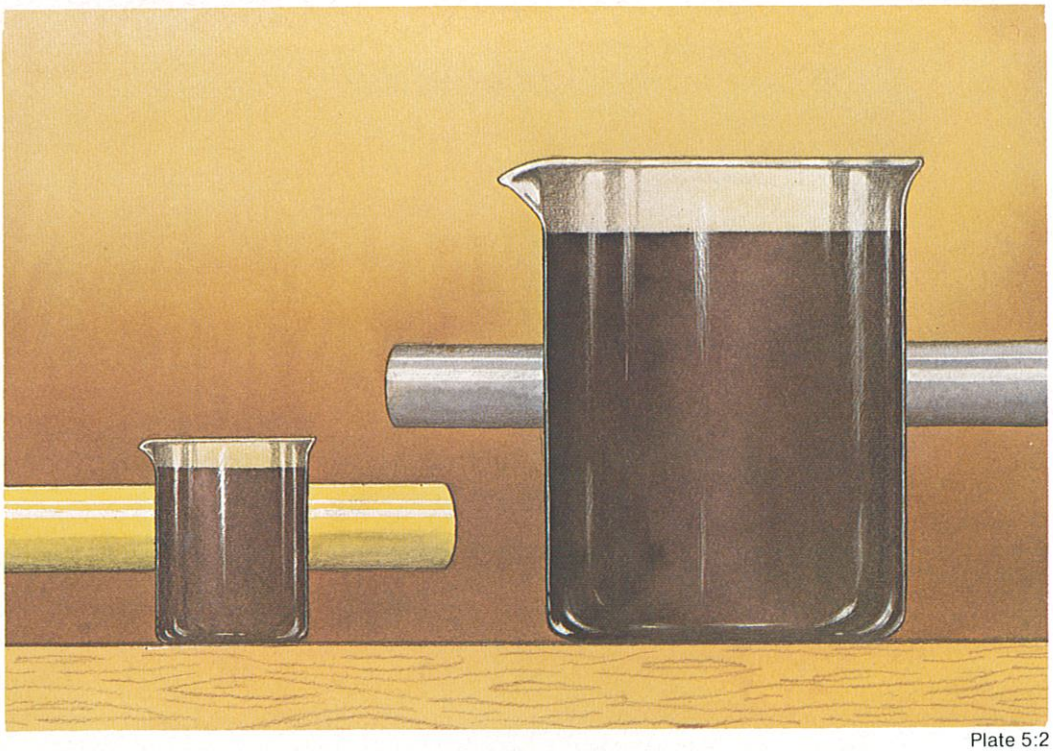


Plate 5:2

***A comparison** of the amount of energy (oil) used for manufacturing pipes made of PVC (left) and pipes made of cast iron (right).*

The sales of plastic pipes have continued to enjoy an immense amount of growth right up to the present day. The statistics shown in Table 5:5 are broken down according to type of material, kind of application and country. In summary, it can be said that plastic is without doubt the piping material of the future. That is why it would be absolutely desirable that everyone who has anything to do with this material gain a thorough and specialized knowledge of it. Such knowledge should include information concerning both its outstanding possibilities and its limits. The people who should gain this knowledge include manufacturers, the responsible officials, architects, consultants, instructors, industrial workers and craftsmen.