USE OF FUELWOOD IN EUROPE IN 1950—60 AND POSSIBILITIES OF CONVERTING FUELWOOD TO INDUSTRIAL USES BY 1975

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RESUME:
L'UTILISATION DU BOIS DE CHAUFFAGE EN EUROPE PENDANT 1950—1960 ET LES POSSIBILITES DE CONVERTIR LE BOIS DE CHAUFFAGE EN BOIS INDUSTRIEL D'ICI 1975

ZUSAMMENFASSUNG:
DER BRENNHOLZVERBRAUCH EUROPAS IN DEN JAHREN 1950—1960 UND DIE MÖGLICHKEIT DER INDUSTRIELLEN NUTZBARMACHUNG VON BRENNHOLZ BIS 1975

SAMENVATTING:
GEBRUIK VAN BRANDHOUT IN EUROPA VAN 1950—1960 EN MOGELIJKHEDEN TOT AANWENDING VAN BRANDHOUT VOOR INDUSTRIELE DOELEINDEN IN 1975

РЕЗЮМЕ:
ПОТРЕБЛЕНИЕ ДРЕВЕСНОГО ТОПЛИВА В ЕВРОПЕ В 1950—1960 ГГ. И ВОЗМОЖНОСТИ УВЕЛИЧЕНИЯ ВЫХОДА ДЕЛОВОЙ ДРЕВЕСИНЫ ЗА СЧЕТ СОКРАЩЕНИЯ ВЫХОДА ДРЕВЕСНОГО ТОПЛИВА В 1975 Г.

LYHENNELMÄ:
POLTTOPUUN KÄYTTÖ EUROOPASSA VV. 1950—1960 SEKÄ MAHDOLLISUUDET POLTTOPUUN TEOLLISEEN KÄYTTÖÖN V. 1975

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1. Introduction

Europe's consumption of forest products in 1950 amounted to 287 mill. cu.m. of roundwood[1], of which 169 mill. cu.m. were industrial wood and 118 mill. cu.m. fuelwood. In 1960, the corresponding quantities were 340, 233 and 107 mill. cu.m. All fuelwood requirements were met by local removals (European . . . p. 207).

While the increase in the consumption of industrial wood was significant from 1950 to 1960, during the same period the decrease in the consumption of fuelwood was rather small.

According to the official records, fuelwood use in Europe increased by about 10 mill. cu.m. between 1913 and 1925/29. Part of this increase is probably due to improved statistics. Since 1925/29 there has been a steady decline as shown below:

	mill. cu.m.
1925/29	144
1935/38	129
1950	118
1960	107

Again, it may be that the actual decline was more pronounced than shown in the above figures, owing to constant improvements in statistics. All the above figures may be considered as underestimations of what has actually taken place, and it is also quite probable that the difference between the recorded figures and the actual ones was much greater in, say, 1925/29 than in 1960, both in a relative and absolute sense.

Recorded fuelwood removals as a percentage of total wood consumption in Europe have been as follows:

1925/29	48
1935/38	43
1950	41
1960	32

A steady decline is shown again, but these figures cannot be considered as absolutely correct. This is due to the constant improvements in both fuelwood and industrial wood statistics and also to the fact that the recording of industrial wood consumption has always been more adequate than that of fuelwood con-

[1] Unless indicated otherwise, all data are solid measures without bark.

sumption. Therefore, actual percentage reduction has possibly been more rapid than shown in the above set of figures, but again the percentages have been greater in reality than on paper.

Despite the statistical deficiencies outlined above, one may conclude that the use of fuelwood in Europe in the 'fifties was considerable. At the same time (from 1950 to 1960) as consumption of industrial wood in Europe rose by almost 65 mill. cu.m. (European removals rose by almost 40 mill. cu.m. [European . . . p. 210], imports of forest products to Europe rose by about 20 mill. cu.m. of roundwood equivalent [European . . . p. 170] and the rest accounts for better utilization of removals, i.e. increased use of residues [European . . . p. 225, 213[1]]), recorded fuelwood consumption declined by only 11 mill. cu.m. This looks rather inconsistent with European forest policy during the nineteen fifties which, in many efficient ways, was aiming at, and also succeeded in achieving, an increase in European roundwood production. Therefore, the new European timber trends and prospects study (European . . .) referred to this aspect in its chapter »The prospects for increasing removals of roundwood» and stated ». . . gap between prospective consumption and removals can possibly be materially narrowed . . . by a further potential transfer of fuelwood to industrial usage . . .» (European . . . p. 161).

2. Aim of the paper

It is the aim of this paper to assess what part of European fuelwood removals in 1960 could be used for industrial purposes by 1975.

The advantage of transferring increased quantities of fuelwood to industrial uses in Europe is that this can be achieved over a short period, whereas, in forestry, alternatives for stepping-up roundwood removals produce results only after a relatively long time and lack the flexibility required by modern, dynamic economics.

As mentioned in the introduction, forest products consumption as well as roundwood removals statistics lack accuracy. It may well be that increased industrial wood removals did influence fuelwood removals, although the available information (on the recorded fuelwood removals) shows that this was not the case, but that the reduction in European fuelwood removals during the 'fifties was only what was expected on the basis of the trend from 1925/29 to 1950. It follows, therefore, that total fuelwood use in Europe during the 'fifties must also be assessed. To do this, all available additional statistical information was analysed. The major part of this information was taken from FAO or ECE correspondence files. Literature on fuelwood was also used for checking the data

[1] These components do not exactly agree with the total of almost 65 mill. cu.m., since different statistics result in different quantities. For instance, an analysis of Europe's forest products balance on the consumption/removals basis produces a »trade» difference of some 16 mill. cu.m. instead of the above mentioned quantity of about 20 mill. cu.m.

concerned. Where there was evidence that fuelwood use was different from that shown in regular reports to FAO, changes were made to FAO data. Owing to the nature of this additional information, no references could be given in most cases. The references to the sources from which GNP, temperature, energy production data, etc. were derived, have also been left out. There are several reasons for doing this. Although most of these data were taken from published material, the presentation of exact information on sources would have meant too much extra detail. In addition, differing data may be found in different sources and, for instance, data on the average temperature in one country cannot be consistent with similar data in another country, owing to the different network of measuring stations as regards their location, measuring times, etc. Forecasting a country's GNP for 1975, almost one and a half decades ahead, may also include considerable amounts of error. Furthermore, there is the question of conversion factors when different fuels are converted into equivalent heat units, etc. Since all these variables are approximations and since no clear-cut overall pattern of fuelwood consumption exists, the omission of this extra detail may be justified.

In order to assess fuelwood use in Europe in 1975, country patterns of fuelwood use in the 'fifties were analysed. If it is assumed that the patterns are to follow the 1925/29—1960 trend up to 1975, fuelwood removals will, by that time, be some 90—95 mill. cu.m. As will be mentioned later in this paper, this quantity, owing to pure coincidence, is the same, quite independently of whether the extrapolation of the 'fifties trend in the European fuelwood removals is done on the basis of the recorded or of the corrected series. Since reducing the use of fuelwood in Europe at a faster rate from 1960 to 1975 than from 1925/29 to 1960 seems likely and since this would indicate a sound forest and general development policy measure, it was assumed that the necessary policy decisions will be taken.

Per caput fuelwood use was calculated for 1950, 1955 and 1960, the latter being compared with per caput GNP, the degree of urbanization, availability of wood and availability of energy from sources other than wood; average annual temperature was also considered. The method is, therefore, basically a cross-sectional analysis of the 1960 data, supported by data on earlier developments in the variables under consideration. — Since no clear-cut overall pattern in fuelwood consumption exists, estimating the 1975 country figures meant, in practice, guessing them more or less.

Country groups were formed on the basis of certain similarities, which did not necessarily refer to fuelwood use. By examining these groups and by giving proper attention to individual countries within the groups, it was deduced how much fuelwood might be transferred to industrial uses by 1975. Since — as will be shown later — fuelwood use in a country can be affected drastically even

within a period of one decade, the 1975 estimated use of fuelwood is highly dependent on various assumptions made regarding the 1960 situation. The country and country group analyses (with deductions) are made on »a reasonable basis» but, in order to have an idea of the »minimum level» of 1975 fuelwood use in Europe, more drastic deductions have also been made.

Cross price-elasticity coefficients are often employed when forecasting consumption trends where a high degree of substitution is an important factor. A knowledge of these coefficients would be a help in judging to what extent the intensity of fuelwood use might be controlled by price policy decisions. The prices of both fuelwood and its substitutes depend very largely on transport costs and, therefore, comparable price series of a practical value were not available. Nevertheless, the influence of prices on the choice between fuelwood and substitutes for fuelwood loses its importance as the standard of living rises: more emphasis is laid on convenience in use (GARLAND 1950 p. 18 and VON MAYDELL 1958).

Regarding the quality of fuelwood, available information is not complete enough for making quantitative allowances for quality changes in fuelwood during the 'fifties and after 1960. Certain assumptions can, however, be made since it is known that a large proportion of fuelwood removals in 1960 could have been used industrially, from both a technical and an economic point of view.

To sum up the aim of this paper, one can use the following presentation:

$$q_0 - q_1 = d$$

where q_0 = total European fuelwood removals in 1960
q_1 = total European fuelwood removals in 1975
d = the amount of fuelwood transferable to industrial uses by 1975 (over 1960)

It is taken for granted that d is a positive quantity. First, q_0 and q_1 have to be estimated to make the necessary (upward) correction to the recorded quantities.

According to the 1925/29—1960 trend in the European use of fuelwood, d results in some 90—95 mill.cu.m., a quantity which is considered too high on the basis of the expected changes in (forest, fuel and general) policies already evident at the beginning of the 'sixties.

A »reasonable» quantity for d is »guesstimated» with the support of some variables related to fuelwood use, as well as a second quantity, by assuming more drastic changes.

Throughout the procedure, q_0, q_1 and, consequently, d are considered as fuelwood according to the FAO definition, given in the following sub-chapter. The

main point to note is that the wood (purposefully) burnt as fuel is classified as fuelwood. Since, with an increasing use of wood for industrial purposes in Europe, the quality (size included) of fuelwood and, consequently, that of industrial wood have been lowered, and since this development is likely to continue[1], it means that q_0 consists of better qualities and bigger sizes than q_1. Consequently, total industrial wood from European removals in 1975 will consist of more broadleaved wood, of inferior qualities and smaller sizes than in 1960.

3. Statistical background

FAO defines fuelwood as follows: »Wood to be used as fuel for purposes of cooking, heating, production of power, etc. It includes wood for charcoal kilns and portable ovens and may include wood from trunks and branches. The trade figures include also sawdust» (Yearbook . . . 1962, p. 138). It is not known to what extent branch wood is included in FAO fuelwood statistics, although it is probable that the diameter of fuelwood billets alone often decided their inclusion in fuelwood statistics. It is assumed here that where branches are included they are big enough to be used for industrial purposes. Accordingly, a detailed knowledge of the composition coverage of the statistics is not relevant to this paper. Wherever possible, fuelwood obtained from branches is included in the figures of this analysis. Sawdust is disregarded since it is assumed that it will continue, as a whole, at least for some years to come, to play a much more marginal role as a raw material than primary fuelwood.

According to the above definition, all wood used for cooking, heating, etc. is called fuelwood. The secondary or repeated use of industrial wood as fuel also comes under this definition. This use may be considerable in some countries and information on this subject would provide valuable material for assessing the possibilities for converting primary fuelwood to industrial use. It should be noted that FAO fuelwood statistics include only primary wood and, since data on the secondary use of industrial wood as fuel are almost non-existent, this topic was omitted from this paper.

The inadequacies of European forestry statistics, which were revealed in the new European timber trends and prospects study (European . . . p. 5), apply with at least as much force to fuelwood statistics. In many cases, fuelwood is felled independently of industrial wood, particularly when it is done by farmers for their own use; these fellings, often consisting of a large number of small items, are usually not recorded.

Even if fuelwood use were recorded or estimated on a sound basis, the results would not be directly comparable between countries because of different systems of measurement. Fuelwood is normally measured in piled volume or in weight.

[1] This clause is included in the statement of this paper that fuelwood will be transferred to industrial uses in increasing amounts.

The conversion of piled measures or weights with bark into cubic metres solid measure without bark might involve errors, the significance of which would often be underestimated.

Fuelwood is converted into the units used for industrial wood. From the point of view of fuelwood alone, this procedure is far from logical. Fuelwood, when used in round or splitwood form, is always used with bark since this contributes to the heating value of wood. The smaller the dimension of a tree, the higher the percentage of bark. Bark percentage of fuelwood, therefore, may exceed the national bark averages and this may have caused some errors in conversions.

For the purposes of this paper, it is assumed that fuelwood consumption (use) equals fuelwood removals. Exports of fuelwood were not deducted in order to balance unrecorded use. In addition, imports were not added to removal figures since it is assumed that fuelwood imports were used industrially and classified as such only because of price, customs and transport policies.

The basic statistical material of this analysis consists of FAO removals statistics for fuelwood which are published annually in FAO Yearbooks of Forest Products Statistics. When more reliable data became available, certain figures were revised and included in the FAO publication »World Forest Products Statistics, 1946—1955». For instance, it was found that the previous west German fuelwood figures included 40 % of wood which had been used for industrial purposes (World . . . p. 156).

For the purposes of this paper, FAO statistics on removals were checked against other sources. In most cases, FAO fuelwood removals statistics seemed to include only billets of more than 7 cm in diameter at their smallest end. Smaller sizes of primary fuelwood (»Nichtderbholz» or »Reisholz» were added to the Austrian, east German, west German and Polish figures. Brushwood was included in the Spanish statistics, hedgerow wood in those of the UK; these correspond to the inclusion of »Nichtderbholz» in the above-mentioned cases. In the case of Italy and Switzerland, fuelwood removed from trees outside the forest was included in the early 1950 statistics. As regards Turkey and Albania, new data on fuelwood were substantially different from earlier ones. Norwegian figures were adjusted to include rural consumption, those of Bulgaria to include removals from non-State forests. Adjustments to the Romanian and Yugoslav figures were only minor. In addition, the series were made more homogeneous, some conversion factors were revised, etc. Nevertheless, it should be remembered that differences in statistical coverage may still produce apparent discrepancies.

4. Characteristics of fuelwood

From the point of view of production economics, fuelwood is a typical example of a by-product. Pure fuelwood plantations in Europe are very rare. There

are forests in many regions which produce mainly or only fuelwood, such as maquis in the Mediterranean region, coppice in France and fjeld forests, particularly in Norway. Even in these cases fuelwood production cannot be considered the long-term aim of these regions since potential production capacity is often sufficient to yield valuable industrial wood. Therefore, fuelwood — looked at from the national point of view — remains a by-product. Where fuelwood is a by-product in forests producing mainly industrial wood, it is made up of thinnings, of the smaller parts of trees felled for industrial uses (tops, branches, etc.) or of dead trees or damaged parts of trees of whatever size.

As in an industrial process, the production of a by-product in forestry depends largely on processing techniques which, in forestry, are called silviculture. In a »good» industrial process the proportion of undesirable by-products is minimal and this is also the case in forestry where stands of industrial wood are concerned. As the proportion of well-managed forests increases, fuelwood production will decrease. This reduction will be both relative and absolute, in spite of the fact that total wood production is bound to increase.

Owing to the pronounced time lag between input and output in forestry, the application of a much more dynamic and intensive silviculture aimed at increased production of industrial wood will produce, for a considerable time, increased quantities of wood of inferior quality.

The main reason why removals of fuelwood are bound to be smaller in the long run is connected with the way in which forests are regenerated and seedlings are tended. By means of artificial regeneration, tree-spacing can be determined at the beginning of the rotation so that there will be minimum thinnings of poor quality small-sized wood. Proper care of naturally regenerated seedlings is intended to achieve the same result.

Economically, the characteristics of the by-product are connected with marketing and cost calculation, both of which factors are interrelated. According to common principles of cost calculation, the by-product has no bearing on the joint costs of multi-product production. This principle should be, and in many cases is, followed in forestry too. The limit of profitability in fuelwood harvesting is reached when harvesting costs plus the discounted value of improvements to industrial wood production by means of fuelwood removals equal the price of fuelwood, and not when the variable[1] costs, i.e. the cost of harvesting the fuelwood, equal the price of fuelwood.

The need to deal with fuelwood as a by-product in an economic sense does not depend only on its low utility value, which is reflected in low stumpage in comparison with the various categories of industrial wood, but also on the costs of harvesting. Fuelwood, being of small dimension and poor quality, requires a much greater labour input per cu.m. than industrial wood, and the larger the

[1] In many cases this variable cost is even loaded with a calculated share of fixed costs of forest management.

share of small-sized and poor-quality trees, the more difficult it is to mechanize harvesting operations. Since the cost ratio of labour to capital (machines) is widening to the advantage of the latter, the dressing costs of fuelwood become more expensive in relation to other costs and prices.

Fuelwood is a commodity with many uses, for all or most of which a substitute can be found.

The replacement of fuelwood involves technical as well as economic considerations. The price of substitutes for fuelwood, such as coal, oil, gas and electricity, per heating unit is competitive; what holds true as regards the harvesting costs of fuelwood may be almost inversely true as regards most of the substitutes. Their processing techniques can be highly mechanized and the ever-increasing demand for them opens up additional possibilities for rationalizing production and distribution, in which economies of scale often play a large part.

Fuelwood is used in abundance mainly in subsistence economies or in what remains of them. It is burned, therefore, by forest owners, particularly farmers.

Fuelwood use is also dependent on tradition, a factor which contributes to its wide use in more conservative rural areas, where »wood-oriented» heating and cooking facilities could be adapted to alternative fuels only after considerable total investments.

The third factor contributing to the abundant use of wood as fuel by the forest owner and by the local population is the high cost of transport for poor-quality, small-sized wood, particularly over long distances. Fuelwood transport also involves high terminal costs. Therefore, in many areas in Europe, fuelwood is either a monopoly or an ubiquity. But electricity, gas or oil may still be preferred. On the other hand, those regions where fuelwood is ubiquitous are usually the least developed. They often consist of underpopulated mountain regions where the income level is low, where under-employment is always a possibility, and where the use of fuelwood is traditional and logical.

Finally, it should be stressed that as the technical limitations on using fuelwood for industrial purposes become fewer and, consequently, as direct competition between fuelwood and inferior industrial wood assortments becomes keener, it is inevitable that the dividing line between fuelwood and industrial wood is becoming blurred.

5. Developments in fuelwood use in Europe during the 'fifties — salient features

Fuelwood consumption in Europe amounted to 157 million cu.m. in 1950, 144 million cu.m. in 1955 and 130 million cu.m. in 1960[1]. Per caput consumption was 0.38 cu.m. in 1950, 0.33 cu.m. in 1955 and 0.29 cu.m. in 1960[1].

[1] Three-year averages for 1949/51, 1954/56 and 1959/61 respectively.

Diagram 1 shows the development in fuelwood consumption in Europe between 1949 and 1961 in the light of the estimated totals and recorded removals. Diagram 1 also includes an estimate for developments up to 1975[1] on the basis of these two series and of policy decisions, the effect of which is discussed country by country in the following chapter.

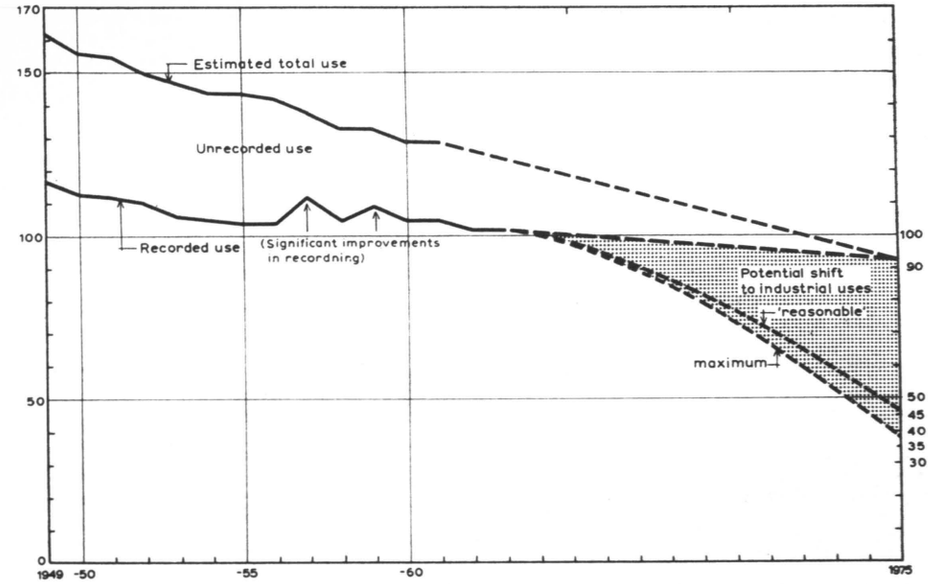

Diagram 1. Fuelwood use (removals) in Europe from 1949 to 1961 [2] and forecasted use in 1975 with potential shifts to industrial uses, mill. cu.m. (without bark).

Table 1. Fuelwood Removals in Europe in the 'fifties; Annual Averages, cu.m. without bark for 1949/51, 1954/56 and 1959/61 [3]

Sub-Region	Total, million			Per caput		
	1950	1955	1960	1950	1955	1960
Northern Europe	27.3	22.3	20.3	1.47	1.15	1.01
EEC	47.4	43.5	38.7	0.30	0.27	0.23
British Isles	0.9	0.9	0.9	0.02	0.02	0.02
Central Europe	19.1	14.5	11.6	0.68	0.49	0.37
Southern Europe	36.8	38.6	38.1	0.57	0.55	0.51
Eastern Europe	26.0	23.8	20.8	0.29	0.25	0.21
Total and average for Europe	157.5	143.6	130.4	0.38	0.33	0.29

[1] For comparison's sake, the 1975 estimates are shown in the context of developments during the 'fifties.

[2] The recorded 1962 and 1963 figures (103 mill. cu.m.) are estimates based on information from the FAO/ECE Timber Division in Geneva.

[3] Here the same country grouping is used as in the new European timber trends and prospects study (European . . .). Northern Europe consists of Denmark, Finland, Norway and Sweden; EEC of Belgium, France, Western Germany, Italy, Luxembourg and the Netherlands; British Isles of the United Kingdom and the Republic of Ireland; Central Europe of Austria, Switzerland and Yugoslavia; Southern Europe of Greece, Portugal, Spain and Turkey; and Eastern Europe of Albania, Bulgaria, Czeckoslovakia, Eastern Germany, Hungary, Poland and Romania.

The intensity of fuelwood use in Europe on a per caput basis was 76 in 1960 (taking 1950 as the base year) which means there was a reduction of 24 % over this period. It is difficult to say what part of this reduction was due to the more rational use of wood (in general and in heating) and what was due to replacement of wood as fuel.

In Table 2, European per caput fuelwood use is compared with that in the USSR, Canada and the USA. Fuelwood use in Europe during the 'fifties was generally similar to that in the USA and, as far as the development in intensity was concerned, also to that in the USSR.

Table 2. The Per Caput Use of Fuelwood in Europe, USSR, Canada and the USA in 1950 and 1960 — Annual Averages, cu.m. without bark for 1949/51, and 1959/61 — and the Intensity of Fuelwood Use in 1960 (1950 = 100)

Region	Per caput		Intensity
	1950	1960	
Europe, total	0.38	0.29	76
Europe (recorded)	0.28	0.24	86
USSR (recorded)	0.62	0.52	84
Canada (recorded)	1.24	0.40	32
USA (recorded)	0.38	0.24	63

The pattern of absolute per caput fuelwood use in Europe in the 'fifties varied from country to country. These differences are not, however, obvious from the figures given according to the country groupings used in Table 1.

The countries where per caput use of fuelwood in 1960 was very low were Belgium-Luxembourg, Denmark, eastern Germany, western Germany, Ireland, the Netherlands and the United Kingdom. These countries form a group with a gravity point in north-western Europe. Per caput use of fuelwood in these countries in 1960 was 0.10 cu.m. or less (in three of them, 0.03 cu.m. or less). The reduction in the per caput use of fuelwood in most of these countries was relatively small, implying that its use in 1950 was already low, leaving very little scope for further reduction. If the Netherlands, where per caput use was already extremely low in 1950, is excluded, the two exceptions as regards per caput reductions were eastern and western Germany. According to available information, the intensity of per caput use in 1960 was only 26 in eastern Germany (1950 = 100), a 76 % reduction between 1950 and 1960. The corresponding figure for western Germany was 50. Both these countries are good examples of what can be done in this direction even within a single decade.

The next group consists of those countries whose per caput use of fuelwood in 1960 ranged from 0.13 cu.m. to 0.42 cu.m. and where there was a considerable reduction in the intensity of fuelwood use per caput, intensity in 1960 (1950 = 100) varying slightly between 52 and 63. These countries are Bulgaria, Switzerland, Austria, Czechoslovakia, Norway and Yugoslavia. If Norway is excluded, these countries again form a geographical group, with a gravity point in the mountainous regions of south-eastern (central) Europe. Two countries neighbouring on this group, Poland and Italy, have similar patterns although the rate of reduction between 1950 and 1960 was much lower (the Polish intensity figure for 1960 was only 87, the Italian 65).

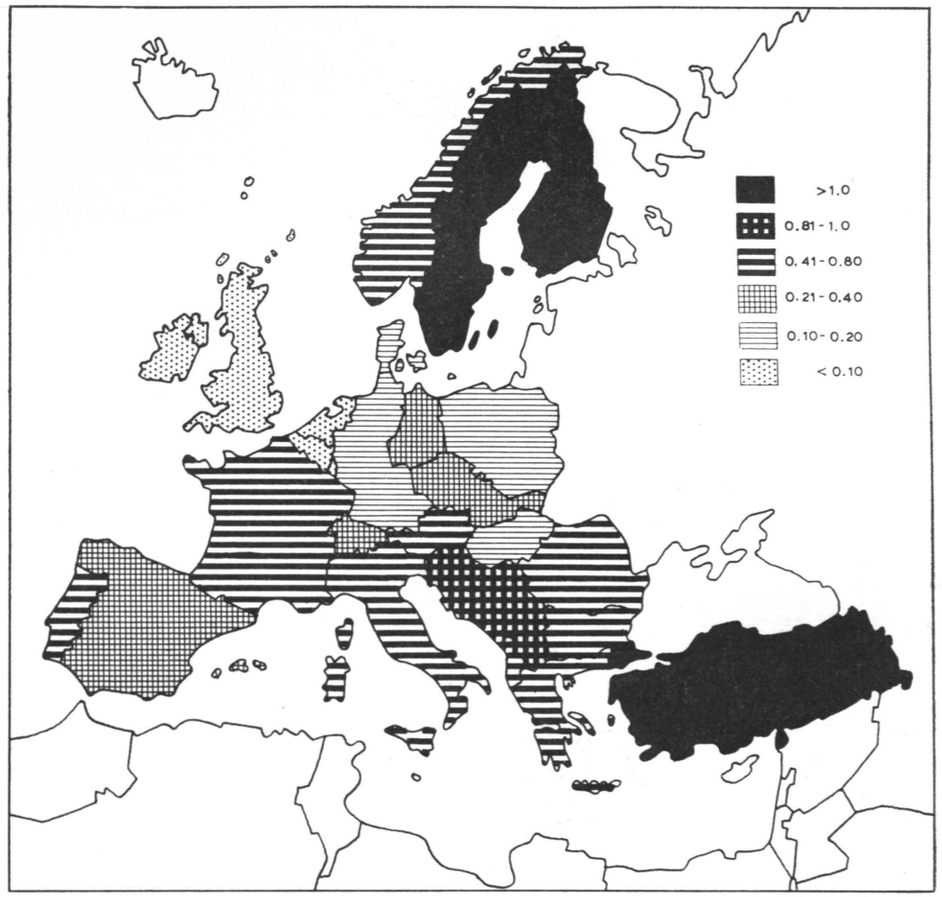

Diagram 2. Per caput use of wood for fuel in European countries in 1950, cu.m. (without bark).

The third group consists of countries whose per caput use of fuelwood in 1960 ranged from 0.28 cu.m. to 0.44 cu.m., a figure above the European average, and where development in the reduction of per caput use was very slow during the 'fifties, the 1960 intensity figure ranging only from 80 to 98. This group consists of France, Greece, Portugal, Spain and Romania. With the exception of Italy, which is a marginal case between this and the preceding group, »outer«

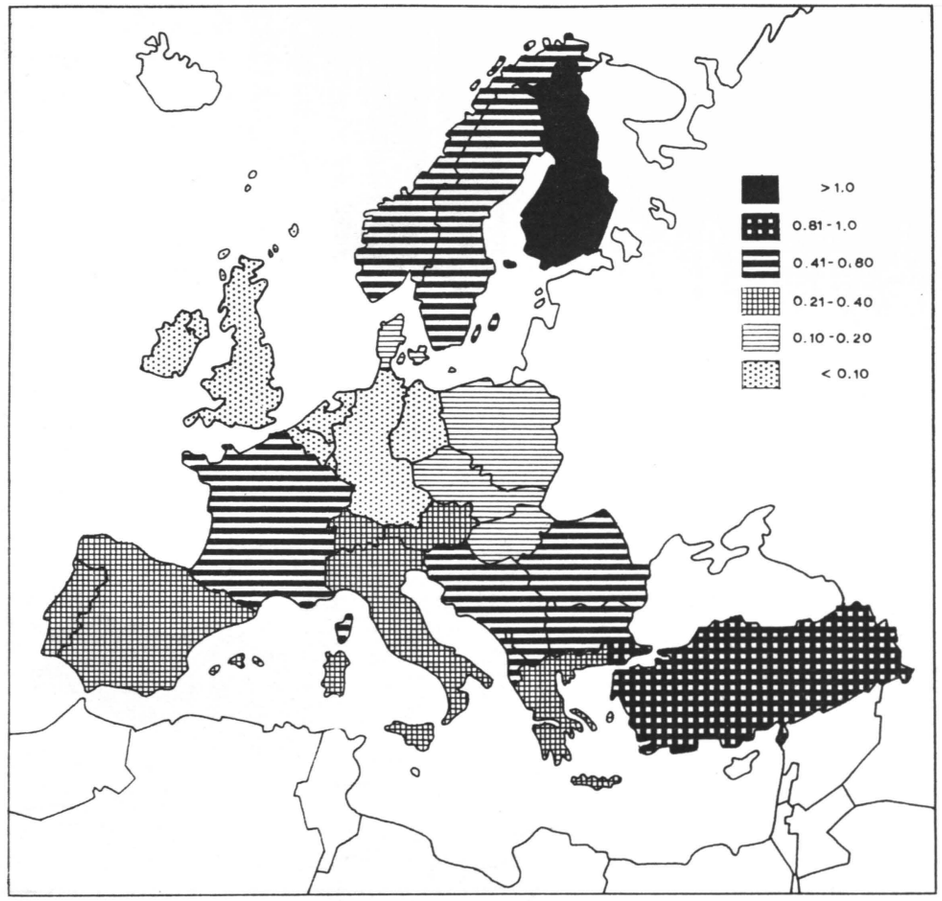

Diagram 3. Per caput use of wood for fuel in European countries in 1960, cu.m. (without bark).

Mediterranean countries dominate the group. France in the west and Romania in the east shift the gravity point in a slightly northerly direction. According to available information, development was lowest in France (98), but some statistical shortcomings may have contributed to this. Next to France come Spain (97) and Romania (91).

Five other countries had quite individual patterns of fuelwood use in the 'fifties.

Hungary used 0.20 cu.m. of fuelwood per caput in 1960, less than the European average, although per caput use increased by 11 % between 1950 and 1960 (perhaps the result of better statistics).

Albania showed a rather high per caput use, 0.68 cu.m. in 1960, and a low degree of reduction between 1950 and 1960 (the 1960 intensity figure was 93).

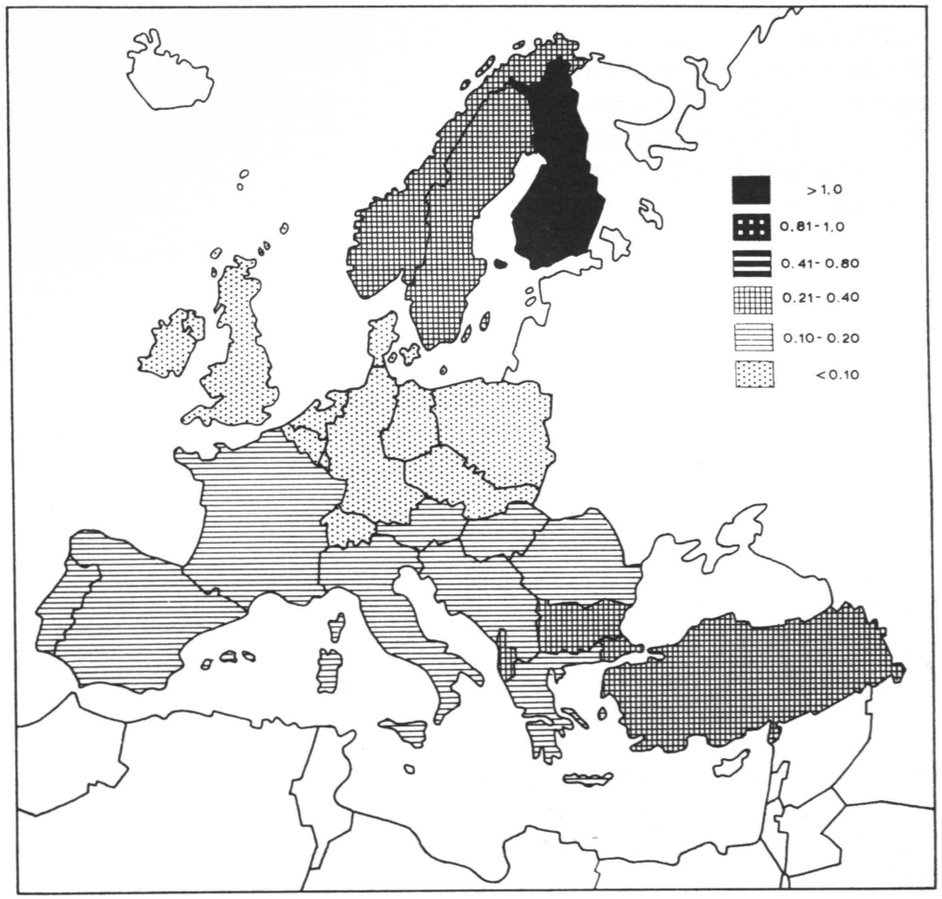

Diagram 4. Forecasted per caput use of wood for fuel in European countries in 1975, cu.m. (without bark).

Although Sweden used as much as 0.67 cu.m. of fuelwood per caput in 1960, developments in the reduction of use were extraordinary: use in 1950 equalled 1.41 cu.m. per caput and thus the intensity figure for 1960 was only 48.

However, there is a fact which makes one doubt the reliability of the Swedish fuelwood statistics: in the recent past, the reduction in fuelwood consumption has been 0.2 mill. cu.m. each year. It is hard to believe that reduction follows — independently of weather conditions for instance — such a clear-cut and relatively accelerated pattern.

Turkey's per caput use in 1960 was 0.86 cu.m. and consequently much higher than that of other southern countries (Spain 0.29, Italy 0.28, and Yugoslavia 0.45). Regarding reduction in use, it belonged to the southern group, its 1960 intensity figure being 85.

Finland is the largest user of fuelwood in Europe. Its per caput use in 1960 was 3.00 cu.m., a figure which is about 250 % higher than that of the next country, Turkey. Finland also showed a very strong tendency to continue this high level of fuelwood use, since the intensity figure for 1960 was as high as 90.[1]

Diagrams 2, 3 and 4 show the per caput use of fuelwood in Europe in 1950 and 1960 and the expected »reasonable» use in 1975.[2]

6. Developments in fuelwood use during the 'fifties by country groups and possibilities of converting fuelwood to industrial uses by 1975

61. Countries where fuelwood use is unimportant

The total use of fuelwood in the following seven countries amounted to less than 3 million cu.m. in 1960: Denmark, Belgium-Luxembourg, eastern Germany, Ireland, the United Kingdom and the Netherlands. Per caput use of fuelwood was extremely low, varying from only 0.005 cu.m. to 0.10 cu.m.

Except for Ireland, GNP in 1960 was above the European average, ranging from 920 US dollars (eastern Germany) to 1,335 US dollars (Belgium-Luxembourg). Many of these countries are highly industrialized, a factor which contributes to a high degree of urbanization. Excluding Ireland, the urban population probably formed over 60 % of the total population in 1960, a figure also above the European average.

Per caput growing stock (wood availability) in 1960 was very low in all these countries and lowest in the Netherlands, the United Kingdom and Ireland; values ranged from 1.4 cu.m. in the Netherlands to 16.8 cu.m. in eastern Germany.

The availability of forms of energy other than that produced from wood was very high in eastern Germany and the United Kingdom (second and third highest in Europe); 4.10 and 3.83 metric tons of coal per caput were produced, respectively, in 1960. Except for Denmark and Ireland, corresponding figures for the other countries were also rather high on a European scale.

Annual average temperature varies from 44.5° F in Denmark to 53.5° F in the United Kingdom.

All these features which are common to the countries in this group favour the use of means other than wood for cooking, heating and power production.

[1] In Finland, some large annual items are considered as constants, owing to the methodology used in fuelwood recording, and it may well be that new utilization surveys will reveal the 1960 estimate as too high.

[2] For comparison's sake, Diagram 4 is also presented in this context.

Even on the assumption that no fuelwood would be used by the above-mentioned countries in 1975, only very little fuelwood could be transferred to industrial uses in these countries in comparison with other areas of Europe. Three million cu.m. or less is so small an item, especially in the light of possible errors, that these countries could be ignored, although they serve as a good example of the degree to which fuelwood can be replaced.

For forecasting the »minimum level» in 1975 in these countries, it can be assumed that at least 1 mill. cu.m. of fuelwood could be transferred to industrial uses.

62. Fennoscandia

Finland, Sweden and Norway form a homogeneous group for reasons other than that of geographical location. As can be seen form Table 3, wood availability is extremely high, especially in Finland and Sweden. On the other hand, thanks to its numerous fast-flowing rivers, Norway produces more hydroelectricity per caput than the other countries of this group. There are practically no differences in climate. The degree of urbanization is more or less the same in Finland and Norway and well below that of Sweden; Norway's GNP was about 11 % higher than Finland's in 1960, while Sweden's GNP was the highest in Europe and about 35 % above that of Norway.

Table 3. The Use of Fuelwood in Fennoscandia, 1950—60, and some Related Facts

Country	Use of fuelwood				GNP, per caput US dollars 1960	Urban population, % of total population in the year indicated in brackets	Growing stock, m³ per caput, 1960	Per caput production of energy except that from wood, 1960, mill. metric tons of coal equivalent	Average annual temperature, °F
	per caput, m³			Total, mill. m³ 1960					
	1950	1955	1960						
1	2	3	4	5	6	7	8	9	10
Finland	3.32	3.16	3.00	13.4	1088	37.0 (1958)	276	0.18	38.5
Sweden	1.41	0.86	0.67	5.00	1629	47.5 (1950)	245	0.57	39.0
Norway	0.74	0.61	0.42	1.49	1207	32.2 (1950)	102	1.17	39.0

If wood availability in Sweden and Finland is compared on the basis of per caput growing stock in 1960, Finland's position appears to be rather favourable. By the end of the 'fifties, however, there was a certain degree of overcutting in Finland and some undercutting in Sweden.

Sweden's high GNP has contributed to its low per caput use of fuelwood, even though wood is available in abundance; the production of energy from other domestic sources is rather low and the climate cold. The intensity of fuelwood use was reduced from 100 in 1950 to 48 in 1960.

Further possibilities of reducing per caput fuelwood use in Sweden and Norway between 1960 and 1975 may be limited, since fuelwood has already been replaced to a large extent; it is assumed that convenience played a large part in this, especially in Sweden. In certain regions of Sweden and Norway wood remains a natural material for heating, although the use of substitutes will develop more and more. The regions where wood will remain a heating material have to pay heavily for the transport of imported materials (oil or coal) and, in any case, have abundant resources of low-quality wood.These regions are mainly in the northern and more mountainous parts. The continuous rise in GNP and in the level of urbanization may well result in some 2—3 million cu.m. of fuelwood being used as an industrial raw material by 1975. In comparison with the Finnish situation, however, this amount is negligible.

GNP and production of energy from domestic sources other than wood were lowest in Finland, although these facts cannot be attributed solely to the difference in fuelwood use. Since it is estimated that Finland's GNP will reach almost 1800 US dollars by 1975 (in 1960 dollar value) and since the degree of urbanization will continue to increase, its per caput consumption of fuelwood in 1975 ought to be the same as that of Norway in 1960, especially in the light of further expansion of forest industries. On this assumption, the reduction in fuelwood use would amount to not less than 11 million cu.m. Even assuming that the right policy decisions would be taken to reduce fuelwood use, a reduction of this magnitude seems too high in absolute as well as relative terms.

According to PÖNTYNEN (1962), total use of primary stemwood for fuel in Finland was distributed among users in 1955 as follows:

User group	Million cu.m.
Farming population	4.34
Non-farming population in rural districts	4.11
Cities and market towns	2.27
Industry (incl. dairies)	1.09
Transportation	1.07
of which State locomotives 0.81	
Others	0.84
Total	13.72

The rural population heads the list. According to HÄMÄLÄINEN (1963), a rise in the number and size of farms increased the use of fuelwood by about 0.41 million cu.m. between 1955 and 1960 and the replacement of wood-burning

stoves diminished the use of wood during the same period by only 0.25 million cu.m.

The species distribution of fuelwood used in Finland in 1955 is given below:

	Million cu.m.	Per cent
Pine	2.21	16.1
Spruce	2.01	14.7
Birch	8.15	59.4
Others	1.35	9.8
Total	13.72	100.0

Valuable coniferous species, *Pinus silvestris* and *Picea excelsa*, accounted for over 4.2 million cu.m. (about 31 %) of the total. It is surprising that most intensive use of coniferous species as fuel was in the southern and south-western regions of the country. There was insufficient industrial demand for small-sized coniferous wood in these regions, which are otherwise the most developed areas of the country.

The author's independent conclusions regarding the total use of fuelwood in Finland in 1975 are shown below in Table 4.

However, while this paper was being written and checked, several forecasts by Finnish authors or teams in Finland have been made. Although these forecasts may have more value than those made in this paper, it was not considered worthwhile changing the calculations accordingly. These forecasts compare with those of this paper as follows:

Author(s)	Total use of fuelwood in Finland in 1975 — million cu.m.[1]	Remarks
This paper	6.5	For the whole of Finland
HÄMÄLÄINEN (1965, p. 11)	7.0	Upper limit for rural property units only
ERVASTI, HEIKINHEIMO, et al. (1965, pp. 18—19)	11.7	For the whole of Finland; includes roundwood for building, poles, railway sleepers, etc.
As above	(9.9)	If one assumes that the relation of fuelwood to other non-industrial wood, listed above, remains the same in 1975 as in 1955.
As above (p. 17)	(7.3)	If one asumes that the total utilisation of »non industrial deciduous wood» forecasted by the team is used for fuel only.

[1] Green stemwood without bark.

A summary of the reductions in the use of fuelwood in Fennoscandia is given in Table 4.

Table 4. The Probable Use of Fuelwood in Fennoscandia and Transfers to Industrial Uses in 1975

Country	Per caput, cu.m.	Total, million cu.m.	Total transfer, million cu.m.	Of which coniferous species
Finland	1.30	6.5	7.0	3
Sweden	0.30	2.5	2.5	..
Norway	0.30	1.2	0.3	..
Total	.	10.2	9.8	4.0—4.5

For assessing the »minimum level» of the 1975 use of fuelwood in Fennoscandia, other deductions may be made than those summarized in Table 4. One could well argue that, although the developments in the use of fuelwood by the three largest categories in Finland — farming population, non-farming population and cities and market towns — during the 'fifties showed no marked decreases, as far as can be seen from the statistics, there is always scope for higher reductions than those envisaged above. Instead of 4.9—6.0 mill. cu.m. the reduction could well be of the magnitude of 7—8 mill. cu.m. Further reductions in the other groups are relatively so small that they can be ignored. For Sweden and Norway together the reduction could be increased by a further 0.5—1.0 mill. cu.m. if one assumes that more drastic policy decisions will be employed than those envisaged when estimating the reductions shown in Table 4. Altogether, the »minimum level» transfer for Fennoscandia may be indicated as a total of some 13 mill. cu.m.

63. The Central European wood exporting countries

This group consists of the following countries: Austria, Czechoslovakia, Poland, Romania and Yugoslavia. Table 5 shows the use of fuelwood in the 'fifties.

Except for Yugoslavia, all these countries belong to the same temperature zone, the annual average ranging from 46.0 to 48.5° F. Apart from Poland, all these countries are rather mountainous and this also contributes to their climatic similarities. Wood availability is generally rather high and where it is low, as in Poland and Czechoslovakia, the production of energy from domestic fuels other than wood is high. Czechoslovakia's energy production was the highest per caput in Europe in 1960.

The main differences are in per caput GNP and the degree of urbanization. In both respects Yugoslavia comes at the bottom of the list, with Romania next. Czechoslovakia had the highest GNP and urbanization among the countries concerned.

Table 5. The Use of Fuelwood in Central European Wood Exporting Countries, 1950—1960, and some Related Facts

Country	Use of fuelwood				GNP, per caput US dollars 1960	Urban population, % of total population in the year indicated in brackets	Growing stock, m³ per caput, 1960	Per caput production of energy except that from wood, 1960	Average annual temperature, °F
	per caput, m³			Total, mill. m³ 1960					
	1950	1955	1960						
1	2	3	4	5	6	7	8	9	10
Austria	0.45	0.36	0.28	1.94	801	49.2 (1951)	72.4	1.35	47.5
Czechoslovakia	0.22	0.23	0.13	1.78	944	51.2 (1950)	42.5	4.67	48.5
Poland	0.15	0.13	0.13	3.83	657	47.5 (1960)	22.9	3.62	46.5
Romania	0.47	0.54	0.43	7.86	500	31.7 (1958)	55.4	1.79	46.0
Yugoslavia	0.87	0.60	0.45	8.33	450	18.5 (1953)	46.4	0.75	54.0

The above differences are the main factors contributing to differences in the per caput use of fuelwood which was 0.45 cu.m. in Yugoslavia, 0.43 cu.m. in Romania and 0.13 cu.m. in both Czechoslovakia and Poland.

It is expected that Czechoslovakia's per caput GNP will increase to over 2,300 dollars (at 1960 dollar value) by 1975, and Poland's to over 1,700 dollars, both of which imply a much higher per caput GNP in 1975 than in 1960 in highly industrialized countries where fuelwood consumption was even less than 0.13 cu.m. per caput in that year. Czechoslovakia plans to use only 0.7 million cu.m. of fuelwood in 1975, a per caput use of 0.05 cu.m. and a transfer of about 1.1 million cu.m. to industrial uses. Planned use in Poland for 1975 is 1.2 million cu.m., a per caput use of 0.04 cu.m. and a transfer of 2.2 million cu.m. to industrial uses. These plans look realistic in the light of the increased GNP, urbanization and especially the high degree of availability of other domestic energy apart from wood. Correspondingly, it is planned to expand those industries using small-sized wood.

In Austria, much needs to be done to reduce the use of primary wood as fuel. There are controversial views on the degree of overcutting during the 'fifties and, although such overcutting may later prove to have been only due to a conservative allowable cut[1], the situation suggests that roundwood requirements have already reached the upper limits of wood availability. Under these conditions, and since Austria plays an important role as a forestry country on the Central European markets, it seems that efforts will be made to ensure an adequate flow of wood raw material to industry. It is expected, therefore, that a reduction in fuelwood use will henceforth take place at a greater rate than during the 'fifties, perhaps as a matter of policy. It seems reasonable that fuelwood consumption in Austria in 1975 will be at the same level as it was in Czechoslovakia

[1] The writer of this paper feels that Austria, according to modern principles of allowable cut, could cut still more.

and Poland in 1960. In this case, total fuelwood use in 1975 would be roughly 0.98 million cu.m.

Fuelwood use in Romania and Yugoslavia in 1975 could be greatly reduced from the 1960 level. Romanian figures for the 'fifties suggest that there was no great change in per caput use of fuelwood during the decade, whereas Yugoslav figures show an almost 50 % reduction.

The per caput GNP of Romania is excepted to rise to nearly 1,600 US dollars (1960 value) by 1975, that of Yugoslavia to over 1,000 US dollars. Changes in the degree of urbanization will take place at a more rapid rate than during the 'fifties. In Yugoslavia the proportion of rural population was the highest in Europe during the 'fifties. All these changes will reduce fuelwood use, but there also exist opportunities for further reductions by way of policy decisions. Forest industries, especially those using small-sized wood, will be expanded; other sources of domestic energy are available, such as natural gas in Romania and lignite in Yugoslavia. Yugoslav plans envisage an expansion of such a size in the pulp and paper industry that a shift of some 3 to 4 million cu.m. of fuelwood to industrial use by 1975 seems realistic.

If it is remembered that GNP in Romania and Yugoslavia in 1975 is expected to be much higher than it was in Austria in 1960, per caput use of fuelwood in Romania and Yugoslavia could be reduced to 0.20 cu.m. On this assumption, total use would be 4.30 million cu.m. in Romania and 4.50 million cu.m. in Yugoslavia by 1975.

Table 6 summarizes the results of the above discussions.

Table 6. The Probable Use of Fuelwood in Central European Wood Exporting Countries and Transfers to Industrial Uses in 1975.

Country	Per caput, cu.m.	Total, million cu.m.	Total transfer, million cu.m.	Of which coniferous species
Austria	0.13	1.0	0.9	..
Czechoslovakia	0.05	0.7	1.1	..
Poland[1]	0.04	1.2	2.6	..
Romania	0.20	4.3	3.6	..
Yugoslavia	0.20	4.5	3.8	..
Total	.	11.7	12.0	1.5—2.0

[1] There is a certain contradiction in the Polish figures. The planned fuelwood cut in 1975 is shown as 1.2 mill. cu.m. of roundwood of more than 7 cm diameter (European . . . p. 147). In this paper, the 1960 figure was corrected by adding the share of »Nichtderbholz». The 1960 and 1975 figures are not comparable and, consequently, the total transfer to industrial use by 1975 could not be derived from the difference between the above quantities. However, it is planned that by 1975, 2.6 mill. cu.m. of small-sized wood (less than 7 cm diameter) will be used for industrial purposes as well as 0.9 mill. cu.m. of stump and root wood. This being the case, it is difficult to believe that 1.2 mill. cu.m. of roundwood of more than 7 cm diameter will be burned as fuel. The reason for that may lay in transport, but since the 1975 planned total use of fuelwood does not look too unrealistic when compared with Czechoslovakia, and considering that in Poland all the prerequisites exist for moving in this direction, it was assumed that the 1.2 mill. cu.m. in 1975 include also smaller diameters than 7 cm.

Making the assumptions for the »minimum level» estimate of fuelwood use in 1975 for this group of countries does not leave very much space for variations, since the Czech and Polish figures presented in Table 6 may already be considered as minimum figures. It is believed that the difference between the Austrian figure in Table 6 and the »minimum» figure does not exceed half a million cu.m. By strict policy decisions and by their strict application, the use of fuelwood in Romania and Yugoslavia may be reduced by some 2 mill. cu.m, together, thus leaving a total transfer of some 14 mill. cu.m. to industrial usage by 1975, instead of 12 mill. cu.m. as shown in Table 6.

64. The Mediterranean countries

Portugal, Spain, Italy, Greece and Turkey form a Mediterranean group (see Table 7), although Italy's GNP and degree of urbanization are above the group average. For similar historical reasons, wood availability is low. Italy's removals from trees outside the forest are the highest in Europe and a corresponding allowance should be made for the 1960 wood availability figure, 5.9 cu.m. per caput, which comprises only forest growing stock. With the inclusion of »outside» trees, this may exceed 10 cu.m. There are relatively large differences, among the countries within this group, in the availability of energy other than that produced from wood but, in general, per caput production is low. All these factors, especially those related to natural resources, have contributed to the low GNP. Turkey, being geographically and culturally more Asian than European, consumed as much as 0.85 cu.m. of fuelwood per caput in 1960, whereas figures of the other countries varied between 0.26 and 0.33 cu.m.

Table 7. The Use of Fuelwood in the Mediterranean Countries, 1950—1960, and some Related Facts.

Country	Use of fuelwood				GNP, per caput US dollars 1960	Urban population, % of total population in the year indicated in brackets	Growing stock, m³ per caput, 1960	Per caput production of energy except that from wood, 1960	Average annual temperature, °F
	per caput, m³			Total, mill. m³ 1960					
	1950	1955	1960						
1	2	3	4	5	6	7	8	9	10
Portugal	0.42	0.39	0.35	3.08	248	31.2 (1950)	17.7	0.11	61.5
Spain	0.30	0.28	0.29	8.70	292	37.0 (1950)	10.2	0.55	59.0
Italy	0.43	0.38	0.28	13.9	649	44.6 (1936)	5.9	0.36	58.0
Greece	0.41	0.52	0.33	2.72	383	36.8 (1951)	12.2	0.14	64.0
Turkey	1.04	0.95	0.86	23.6	185	28.8 (1955)	23.6	0.18	57.0

Turkey's high consumption of fuelwood is explained not only by its extremely low GNP and degree of urbanization but also by the fact that a little more than half of the rural population lives in about 20 000 »forest villages», each family in which has the right to take at least 10 tons of fuelwood a year at one tenth of the market price. By converting open fireplaces into simple stoves, lavish fuelwood requirements in 1960 could be reduced by about 50 % by 1975 (SINGER 1962). Considerable amounts of fuelwood are also used in towns.

In order to prevent soil erosion, annual fuelwood removals should not exceed 10 million cu.m. (SINGER 1962). If nothing is done to change the pattern of fuelwood consumption, total fuelwood use will reach 35 million cu.m. by 1975 (VON MONROY 1963, p. 5). The latter estimate seems too high in comparison with the past pattern, which shows a decrease in per caput use of fuelwood from about 1.4 cu.m. in 1900 to 0.85 cu.m. in 1960, but even if the future pattern were based on similar reductions in the per caput use of fuelwood, the rate of population increase is expected to be so high that the total use of fuelwood would increase by 1975.

Turkey has extremely large resources of lignite and it is necessary to decentralize production in order to minimize transport costs and make lignite available as a local fuel. Since this, as well as the replacement of open fireplaces by stoves, is a very realistic way of changing the pattern of fuelwood use, it has been suggested (VON MONROY 1963, p. 5) that by 1975 fuelwood use should be reduced to 30 % of the 1960 level. A reduction equivalent to 70 % in per caput use of fuelwood would result in a total use of about 10 million cu.m. a figure which was mentioned as a »sustained fuelwood yield figure». This would mean per caput use of 0.25 cu.m. in 1975. As such, the reduction looks very pronounced, but in fact it would mean that by 1975 Turkey's pattern of fuelwood use would be the same as that of the other countries in the group in 1960. Turkey's GNP in 1975 is expected to be at the same level as that of Spain in 1960.

The main difficulty in changing fuelwood use is not one of forestry or economics but of law, sociology and psychology. Though it would be difficult to take traditional rights away, it should be possible to introduce a fuel other than wood for heating and cooking if necessary alterations were subsidized and if lignite were made available at a price whereby total fuel costs would not exceed those based on fuelwood rights.

Turkey is unlike all other countries dealt with in this paper. Although it will be an aim of policy to reduce fuelwood use by 14 million cu.m. between 1960 and 1975, only 2 million cu.m. is expected to be available for industrial use.[1]

Fuelwood consumption in Italy was of the same order of magnitude as in Portugal, Spain and Greece in 1960. It is probable that differences between Italy and other Mediterranean countries will be more pronounced in 1975 than

[1] Some recent investigations show, however, that Turkey's forest resources are greater than previously known.

in 1960. Association with the EEC has already influenced Italy's economy and GNP is expected to be about the same in 1975 as it was in western Germany in 1960. The degree of urbanization was higher in Italy in 1936 than in any of the countries of this group in the 'fifties (see Table 7). This development has continued, since between 1958 and 1963 over 1.8 million people moved from agriculture to industry. It is anticipated that an additional 2 million will have moved to industry by 1975, by which year full employment will probably have been achieved. Development plans are being implemented in the underdeveloped regions of southern Italy. A special investment bank (Cassa per il Mezzogiorno) has been established to help to build up the infrastructure of southern Italy. Expansion of petroleum refining is continuing rapidly (Italien . . .).

Although the pattern of fuelwood use in Italy is already changing as a result of these policy innovations, a larger demand for small-sized industrial wood will depend on the location of forest industries. It is assumed here that per caput fuelwood use could be reduced to 0.1 cu.m. by 1975; this is equivalent to a total use of 5.6 million cu.m.

If the level of fuelwood use were dependent on GNP alone, very few reductions could be expected in Portugal, Spain and Greece; on an average, GNP in these countries in 1975 is expected to be less than that of Italy in 1960. Forest industries in these countries, however, will be expanded and large-scale afforestation programmes, already successfully under way, will ensure future supplies but, until these man-made forests are ready for harvesting, older forests must supply industry. It is possible that a per caput fuelwood consumption of 0.15 cu.m. could be achieved by 1975, in which case total use of wood for fuel would amount to about 8 million cu.m. instead of 14.3 million in 1960.

Table 8 summarizes the results of the above discussion.

Table 8. The Probable Use of Fuelwood in the Mediterranean Countries and Transfers to Industrial Uses in 1975

Country	Per caput, cu.m.	Total, million cu.m.	Total transfer, million cu.m.	Of which coniferous species
Portugal	0.15	1.6	1.4	0.5—1.0
Spain	0.15	5.2	3.5	1.0
Italy	0.10	5.6	7.0	—
Greece	0.15	1.5	1.2	—
Turkey	0.25	9.6	2.0	2.0
Total	.	23.5	15.1	3.5—4.0

Making the »minimum level» estimate for the 1975 fuelwood use in the Mediterranean countries differs from that concerning all other groups of countries. Although it is felt that the 1975 totals of fuelwood use given in Table 8 are

»reasonable», it is not quite certain whether these reductions will be absorbed by industry. Secondly, although the 1975 estimates follow, except in Turkey, more or less the trend in the 'fifties and match expectations as far as further developments in GNP, the degree of urbanization, etc., are concerned, it is felt that there still remain, in 1975, areas where per caput use of fuelwood may even increase with the increasing GNP. This holds true especially in areas where insufficient demand exists for industrial usage of wood. In spite of the fact that it is logical to try to diminish the fuelwood cut in Turkey, many traditional obstacles are bound to work against this aim. Therefore, no alternative forecasts are supplied for this group of countries in this paper.

65. Other countries

This group consists of France, western Germany, Switzerland, Bulgaria, Hungary and Albania. These countries are not homogeneous and they will be treated as a group only for practical reasons.

Table 9. The Use of Fuelwood in »Other» Countries, 1950—1960, and some Related Facts.

Country	Use of fuelwood				GNP, per caput US dollars 1960	Urban population, % of total population in the year indicated in brackets	Growing stock, m³ per caput, 1960	Per caput production of energy except that from wood, 1960	Average annual temperature, °F
	per caput, m³			Total, mill. m³ 1960					
	1950	1955	1960						
1	2	3	4	5	6	7	8	9	10
France	0.45	0.45	0.44	20.0	1275	55.9 (1954)	16.8	1.49	52.5
W. Germany ..	0.16	0.10	0.08	4.25	1193	71.1 (1950)	14.8	3.29	48.0
Switzerland ...	0.38	0.30	0.24	1.29	1581	36.5 (1950)	47.1	0.57	48.0
Bulgaria	0.70	0.38	0.41	3.23	502	33.6 (1956)	27.8	1.18	53.0
Hungary	0.18	0.20	0.20	1.96	583	39.7 (1960)	13.5	1.92	51.0
Albania	0.73	0.94	0.68	1.10	320*	28.5 (1958)	50.4	0.57	61.0

* Estimate

France, western Germany and Switzerland are high-income nations. Urbanization in western Germany is very developed but rather low in Switzerland, especially in the light of high per caput GNP. France lies between western Germany and Switzerland as regards per caput GNP and degree of urbanization. Switzerland has more forest per caput than France and western Germany. In addition, there were marked differences between these three countries in the production of energy from sources other than wood in 1960.

The French national statistics include only market fuelwood which in 1960 amounted to about 5 million cu.m. The difference, 15 million cu.m. is the estimated rural consumption which may be on the high side. Total fuelwood removals reported annually to the FAO show more or less a stagnation in per caput use of fuelwood between 1949 and 1961 and a slight increase in total use; other souces, however, show that the quantity of fuelwood sold on the market every year has declined regularly and that used in rural districts rapidly. Reported figures are usually lower than actual removals or consumption; it was therefore considered unsafe to lower the French fuelwood removals figures, although it may well be that per caput use in 1960 was closer to, say, 0.35 cu.m. than to 0.44 cu.m.

Although the French statistics may hide the development in the replacement of fuelwood in the 'fifties, it is assumed that it was not as pronounced as in Switzerland. In France, there seems to be a stronger tradition of fuelwood use than in many European countries. Fuelwood use is concentrated in certain low-income regions, such as eastern France, the mountainous areas, Normandy and Brittany, where wood is available in abundance and where there is no demand of any practical importance for small-sized industrial wood. The principal species used for fuel are oak, elm, birch and beech and as long as no industrial demand exists the most rational use is in heating and cooking.

Even with increasing demand for small-sized industrial wood, the species used for fuel will remain in a subordinate position as regards industrial processing. The most efficient way of using them industrially is in plants which, though based initially on these species, can later be adapted to species which will replace oak, elm, etc. Since poor-quality small-sized wood is costly to transport over long distances, the location of plants will play an important role in the industrial utilization of the wood used as fuel during the 'fifties. The practical application of these measures depends much on the implications of European and international economic integration, in other words whether France considers it more advantageous to buy pulp and certain wood-based panel products from outside or to manufacture these products itself. This question also depends on the attractiveness of investment in forestry rather than in agriculture, heavy industry and so on.

It is difficult to assess the development in the use of wood as fuel in France by 1975. In theory, a transfer of some 15 million cu.m. of fuelwood to industrial use seems possible; in practice, however, even 10 million cu.m. may seem too radical an estimate. It is expected that some industries using small-sized broad-leaved wood will be expanded further and that no more than 10 million cu.m. will be burnt as fuel in France in 1975. Assuming that the recorded fuelwood use of 20 million cu.m. was too high for 1960, a transfer of some 5 million cu.m. to industrial use might correspond to a total use of 10 million cu.m. in 1975.

Bulgaria used 0.41 cu.m. of fuelwood per caput at the end of the 'fifties and since GNP in 1975 is expected to increase to over 1,400 US dollars (1960 value) and also since the availability of domestic energy from sources other than wood is rather high, a per caput use of 0.25 cu.m. could be achieved by 1975. This

would mean a total of 1.9 million cu.m. and would leave 1.3 million cu.m. to be converted to industrial use.

Hungary was already using low-quality small-sized wood in industry at the end of the 'fifties. To discourage the use of wood as fuel, farmers were given coal when delivering wood for industry. Although figures for the 'fifties suggest stagnation in per caput fuelwood use, it is planned to use only 1.5 million cu.m. of fuelwood in 1975. This would mean a per caput use of 0.14 cu.m. and a transfer of 0.5 million cu.m. to industrial uses.

Albania's high use of wood as fuel is explained by the low degree of development, as well as its relatively high wood availability on a central and southern European scale. A per caput use of fuelwood of 0.40 cu.m. in 1975 would be realistic — a total use of about 0.8 million cu.m. in 1975.

It is expected that per caput fuelwood use in Switzerland in 1975 will be down to the 1960 west German level. It is assumed that by 1975 per caput GNP in Switzerland will be the highest in Europe, that the rapid replacement of fuelwood during the 'fifties will continue and that urbanization will increase. It is also expected that industry using small-sized wood will be expanded. On this basis, total fuelwood use would amount to about half a million cu.m. in 1975.

Though fuelwood use in western Germany in 1960 was extremely low, there is still room for further reductions. In certain regions fuelwood is used in abundance, mainly for irrational reasons (VON MAYDELL 1958, p. 125—226), and it is expected that the expanding particle board industry will use greater quantities of fuelwood in 1975. Total use of wood as fuel will probably not exceed 2 million cu.m. in 1975 — a per caput use of 0.03 cu.m. and a transfer of 2.3 million cu.m. to industrial uses.

Table 10 summarizes the results of the above discussion.

Table 10. The Probable Use of Fuelwood in »Other» Countries and Transfers to Industrial Uses in 1975

Country	Per caput, cu.m.	Total, million cu.m.	Total transfer, million cu.m.	Of which coniferous species
France	0.20	10.0	5.0	..
W. Germany	0.03	2.0	2.3	..
Switzerland	0.08	0.5	0.8	..
Bulgaria	0.25	1.9	1.3	..
Hungary	0.14	1.5	0.5	..
Albania	0.40	0.8	0.3	..
Total	.	16.7	10.2	1.0—1.5

The main difficulty in trying to make the alternative (»minimum») estimate for this group of countries lies in the unreliability of the French forestry statistics (see for instance, the figures in Table 10, European . . . p. 128). However, regarding fuelwood use, France is by far the most important country of the

group. One may assume that, if the 20 mill. cu.m. of fuelwood is a reliable estimate for 1960, the total reduction by 1975 (not the transfer to industrial usage) will be some 10 mill. cu.m. By strict policy decisions, which may however not be necessary, some of these 10 mill. cu.m. might be transferred to industrial use in addition to the 5 mill. cu.m. shown in Table 10 of this paper. But again, as is the case for Italy, some obstacles may prevent this. Although the difference is hardly worthwhile mentioning, one may assume that the »minimum level» estimate for this country group could be 2—3 mill. cu.m. less than shown in Table 10.

7. Summary and Conclusions

(1) It is estimated in this paper that in 1975 the use of fuelwood in Europe will be some 45—55 mill. cu.m. less than in 1960 and about 10 mill. cu.m. of this sum will consist of coniferous species. The quantity of 45 mill. cu.m. (rounded) was estimated on a »reasonable» basis and it is believed that this amount could be transferred to industrial use by 1975. The quantity of 55 mill. cu.m. is supposed to be the »maximum» reduction which might be achieved by 1975.

(2) The above estimates were based on the revised European fuelwood removal figures for the 'fifties and, in comparison to those reported annually to FAO, they were as follows:

Year[1]	Figures reported annually to FAO	Figures revised for this paper	Difference in % B over A
	mill. cu.m. solid wood without bark		
	(A)	(B)	
1950	114	157	38
1955	106	144	36
1960	107[2]	130	21

The revised figures are still supposed to be on the low side.[3]

[1] Three year averages: 1949/51, 1954/56 and 1959/61.

[2] From 1957 onwards, removals from trees outside the forest were included in the statistics and this is the main reason why the 1960 average is of the same order of magnitude as that of 1955.

[3] The extrapolation made on the basis of the revised figures revealed a valuable »by-product», which helps one to interpret the situation. If the revised figures for the 'fifties are correct estimates of the total use of fuelwood, if the degree of improvements in fuelwood recording in the 'fifties is also correct, and if the improvements in recording continue at the same rate from 1960 to 1975, then, by 1975, European fuelwood statistics would be complete. This can hardly be the case in spite of the fact that, for many reasons, development will continue in this direction. The correct interpretation is probably as follows: the rate of improvement in fuelwood recording between 1950 and 1960 may well be the correct one and the development up to 1975 may continue according to the same pattern. The revised figures for the 'fifties, however, are still too low. It is possible, therefore, that some 100 mill. cu.m. of fuelwood in 1975 may be a more correct estimate than 93 mill. cu.m., a figure which was the result of extrapolating the development from 1960 up to 1975 on the basis of the 'fifties trend. The issuing of timber trends and prospects studies is certainly a factor directing governments and other national authorities to put increased emphasis on aiming at improved recording. Those countries where special surveys have been carried out to assess the unrecorded (rural) use of wood are already shortening the intervals of such surveys and developing more modern, rapid, inexpensive and reliable methods of obtaining information. Countries where no such surveys have been conducted before have started to make them.

The above findings lead to several considerations. The most important of them is the following: the new European timber trends and prospects study (European . . . pp. 214—215) reveals a shortage of small-sized coniferous wood of some 25 to 43 mill. cu.m., depending on whether the exports from Europe are curtailed or not. At the same time, the reductions in European fuelwood removals are expected to be some 45—55 mill. cu.m. The share of coniferous wood in this amount, some 10 mill. cu.m., has almost completely been taken into account when calculating the expected deficit of 25—43 mill. cu.m. Only about 2—3 mill. cu.m. out of the 10 mill. may be considered as an addition and could be deducted from the expected deficit. The main question then is: will Europe use the extra quantity of some 45—50 mill. cu.m. of small-sized broadleaved wood, which is left as a result from the reduced fuelwood use in Europe in 1975 compared with 1960?

The basic starting point of this paper was that policy-decisions are taken to reduce the use of wood as fuel. However, even if no such decisions are taken, fuelwood use will diminish all the same, but of course less than envisaged in this paper. Also from the purely silvicultural point of view, cutting invaluable species to make room for valuable ones is a sound policy. Economically this policy is sound if the land area thus »cleared» remains productive, both from the point of view of fertility of the soil and location regarding transport, processing and marketing. Many areas are bound to remain outside the limits of these prerequisites, even during the period 1960—1975. Since, however, there still exist unrecorded fuelwood fellings in addition to those »found out» in this paper, these may be regarded — for the sake of simplicity — as taken from these »outside» areas. One may well argue that, by 1975, the infrastructure of all European countries and the transport media (in most cases trucks) will be already so developed, that the 45—50 mill. cu.m. of small-sized broadleaved wood could be economically transported if the question of usage was only that of transportation.

Another question, connected with the former one, is the cost of logging i.e. dressing and short-distance hauling. Although this kind of wood remains marginal as a raw material for the industry, because its harvesting and transporting is more costly per cu.m. than that of wood of larger sizes and better qualities, there is nevertheless much to be done in lowering the costs for small-sized wood. At present, fuelwood is cut into small pieces on the felling site and logging is poorly mechanized because most fuelwood fellings are for the farmers' own use and are done on a small scale. Productivity of »fuelwood» logging and transportation may be significantly improved by cutting trees into longer lengths of industrial wood or by shipping wood at or near felling sites. This is a more productive way of using this wood for industrial purposes than by sorting it out from fuelwood at a later stage, a procedure which has been quite common up to now (1964). Fuelwood fellings are often made on the same sites as the

fellings of industrial wood, or at least carried out by the same working teams which take care of industrial wood. Using more wood of »fuelwood» quality for industrial purposes increases the total cut of industrial wood and, although the variable costs per cu.m. increase, the constant costs per cu.m. decrease, since the management (in a broad sense roads, etc., included) does not require any expansion or only relatively small ones in comparison with the whole system. The infrastructural costs are, to a large extent, of a fixed nature and many floating routes, railways and highways are not operating at full capacity.

The most important question is: can the markets, European or overseas, absorb increasing quantities of pulp, paper and boards based on broadleaved wood, and is the stumpage price likely to remain much lower than for corresponding coniferous sizes and qualities, as has been the case up to the beginning of the 'sixties? One might be tempted to think that the greater demand of small-sized broadleaved wood (»fuelwood») for industrial usage may result in a higher price. But one should also remember that the use of fuelwood is bound to decrease in any case, and that there remains therefore a reserve, whose elimination would in many cases provide space for more productive wood crops. It is difficult to foresee, on a European scale, the attitude of the forest owners and the others concerned, and how the price policy will be conducted.

Some of the developing countries, which are dependent on imports of forest products, may be willing to satisfy their needs by buying more broadleaved-based products at the same cost as for less high-quality coniferous-based products. Whether this is advisable from the point of view of a general development policy is another question and not dealt with in this paper (Westoby 1963).

About 40 % of the potential transfer of fuelwood to industrial uses could be concentrated in the following countries: Finland (7 mill. cu.m.), France (5 mill. cu.m.) and Italy (7 mill. cu.m.). Other countries with significant potential shifts could be Romania, Spain and Yugoslavia with about 3.5 to 4 mill. cu.m. each. Whether these potential shifts will take place depends to a large degree on the different attitudes prevailing in the countries mentioned above. In Finland, for instance, the reductions outlined in this paper might well be realized by 1975 if the industry based on small-sized broadleaved wood expands heavily and if by means of propaganda people are told that by burning wood they are burning the most valuable raw material available for the exporting industries. Much can be done in Italy and France by establishing new units for small-sized broadleaved wood and by improving productivity in logging and transportation. With regard to Romania and Yugoslavia, it seems likely, in the light of recent developments, that the potential shifts from fuelwood use to industrial use will be achieved by 1975.

As far as Europe as a whole is concerned, it is extremely important to realize that by 1975 a large (otherwise unused) reserve of »fuelwood-quality» small-

sized broadleaved wood will be available, and that there are no longer any technical limitations on the use of this kind of wood for producing pulp, paper, paperboard and wood-based panel products.

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RESUME:
L'UTILISATION DU BOIS DE CHAUFFAGE EN EUROPE PENDANT 1950—1960 *ET LES POSSIBILITES DE CONVERTIR LE BOIS DE CHAUFFAGE EN BOIS INDUSTRIEL D'ICI 1975*

En 1950, la consommation de bois de chauffage en Europe totalisait quelque 160 millions de m³ (volume compact, sans écorce); en 1960, le volume était tombé à quelque 130 millions de m³. Ces évaluations qui pourraient encore être plutôt trop basses, dépassaient les volumes totaux rapportés annuellement à la FAO de presque 40 % pour 1950 et d'un peu plus que 20 % pour 1960. Calculée par tête d'habitant, l'utilisation du bois de chauffage en Europe ressortait à 0,38 m³ en 1950 et á 0,29 m³ en 1960. D'un pays à l'autre, la consommation de bois de chauffage a varié de beaucoup en 1960, la Finlande a consommé 3,00 m³ par tête, les Pays-Bas en ont consommé moins de 0,00 m³.

L'utilisation européenne de bois de chauffage a diminué depuis 1925/29. D'après ce qui ressort des statistiques, la diminution s'est poursuivie à peu près dans les mêmes proportions jusqu'à l'année 1960, bien que l'utilisation de bois industriel se soit considérablement accrue entre 1950 et 1960, de sorte que la balance du commerce en produits forestiers a montré un excédent des importations.

Etant donné qu'il n'existe plus de limitations techniques à l'utilisation des bois feuillus de petites dimensions pour des fins industrielles, il y aura lieu de transférer une réserve potentielle de bois de chauffage à des usages industriels. D'après les pronostics auxquels aboutit la présente étude, quelque 45 à 55 millions de m³ de bois feuillus de petites dimensions (considérés en 1960 comme bois de chauffage) devraient d'ici 1975 devenir disponibles pour servir à des fins industrielles en Europe, à condition que des décisions générales à cet effet soient prises.

On admet que le prix de revient du bois feuillu de petites dimensions est plus élevé par unité que celui d'un grand nombre d'autres assortiments de bois industriel, mais on reconnait aussi que l'on peut faire beaucoup en rationalisant les opérations (de débardage et de transport). Une augmentation de la quantité de bois industriel introduit un facteur de diminution du coût puisque les frais fixes représentent une proportion considérable de l'ensemble des travaux forestiers et que dans nombre de phases des opérations, il existe de la capacité supplémentaire.

Du point de vue de la sylviculture, il y aurait avantage à éliminer des peuplements ou parties de peuplements de basse qualité, un facteur qui favoriserait l'utilisation du bois de chauffage comme bois d'industrie. Le principal problème qui se pose pour l'utilisation de quantités accrues de bois feuillus dans la production de pâte, papiers et cartons semble être celui des débouchés; il est en effet douteux que les marchés voudront ou pourront absorber des quantités croissantes de produits forestiers basés sur des essences feuillues et à quels prix ils seraient disposés à le faire.

ZUSAMMENFASSUNG:
DER BRENNHOLZVERBRAUCH EUROPAS IN DEN JAHREN 1950—1960 UND DIE MÖGLICHKEIT DER INDUSTRIELLEN NUTZBARMACHUNG VON BRENNHOLZ BIS 1975

Im Jahre 1950 betrug der Brennholzverbrauch in Europa ungefähr 160 Millionen Festmeter (o. R.); im Jahre 1960 waren es ungefähr 130 Millionen fm. (o. R.). Diese Schätzungen, welche eher noch zu tief liegen, übersteigen dennoch um beinahe 40 % für das Jahr 1950 und um etwas mehr als 20 % für das Jahr 1960 die der FAO jährlich gemeldeten Gesamtmengen. Der durchschnittliche Brennholzverbrauch Europas pro Kopf war im Jahre 1950 0,38 m³; im Jahre 1960 0,29 m³. Die Verbrauchsziffern der einzelnen Länder waren äusserst verschieden voneinander: Finnlands Verbrauch pro Kopf war im Jahre 1960 3,00 m³; in den Niederlanden betrug er weniger als 0.00 m³.

Seit den Jahren 1925—29 hat der Brennholzverbrauch Europas nachgelassen. Soweit aus den Statistiken ersichtlich, hat sich die Verminderung mehr oder weniger im gleichen Masse bis 1960 fortgesetzt, wogegen die Verwendung von Industrieholz in Europa zwischen den Jahren 1950 und 1960 wesentlich anstieg, sodass die europäische Handelsbilanz für Forsterzeugnisse mit einem Einfuhrüberschuss abschloss.

Da für die Verwendung von Laubholz kleinen Durchmessers in der Industrie auf technischem Gebiet keine Begrenzung mehr besteht, wird sich daraus eine potentielle Reserve von Brennholz ergeben, die für industrielle Zwecke verfügbar wird. Dem in der vorliegenden Studie enthaltenen Ausblick entsprechend dürften beiläufig 45 bis 55 Millionen Festmeter Laubrundholz kleinen Durchmessers (im Jahre 1960 als Brennholz ausgewiesen) bis 1975 in Europa zu industriellen Zwecken frei werden, vorausgesetzt, dass die entsprechenden forstpolitischen Entschlüsse gefasst und durchgeführt werden.

Es ist eine anerkannte Tatsache, dass die Beschaffungskosten von Laubrundholz kleinen Durchmessers pro Einheit höher liegen, als die Kosten vieler anderer Holzsorten; es wird jedoch auch zugegeben, dass in diesem Belang durch Rationalisierung der Arbeitsvorgänge viel bewirkt werden kann. Eine Vermehrung von Industrieholz bewirkt den Einsatz eines Verringerungsfaktors auf der Kostenseite, da die unveränderlichen Kosten einen erheblichen Teil aller forstlichen Arbeiten darstellen und in vielen Arbeitsvorgängen zusätzliche Kapazitäten liegen.

Auf dem Gebiet des Forstwesens wäre es von Vorteil, minderwertige Bestände oder Teilbestände auszumerzen; dies würde sich auch auf die Verwendung von Brennholz als Industrieholz günstig auswirken. Die hauptsächliche Schwierigkeit, die sich in einer vermehrten Verwendung von Laubholz zur Pappe-, Papier- und Kartonerzeugung entgegenstellt, scheint in der Absatzmöglichkeit zu liegen: es ist fraglich, ob und zu welchen Preisen die Märkte für wachsende Mengen von Forsterzeugnissen aufnahmefähig sein werden, die auf Laubholz als Rohstoff beruhen.

SAMENVATTING:
GEBRUIK VAN BRANDHOUT IN EUROPA VAN 1950—1960 EN MOGELIJKHEDEN TOT AANWENDING VAN BRANDHOUT VOOR INDUSTRIELE DOELEINDEN IN 1975

Het totale gebruik van brandhout in Europa bedroeg in 1950 ongeveer 160 milj. m³ en in 1960 ongeveer 130 milj. m³. Deze schattingen, die misschien nog aan de lage kant zijn, lagen in 1950 bijna 40 % en in 1960 iets meer dan 20 % boven de totale bedragen, die jaarlijks aan de FAO werden gerapporteerd. Landelijke verschillen in het gebruik van brandhout zijn opvallend: in 1960 werd in Finland 3.00 m³ per hoofd van de bevolking gebruikt en in Nederland minder dan 0.00 m³.

Het gebruik van brandhout in Europa is afgenomen sinds 1925/29. Volgens de statistieken heeft deze afname zich min of meer volgens eenzelfde patroon voortgezet tot 1960, hoewel het gebruik van hout voor de industrie belangrijk is gestegen van 1950 tot 1960, resulterende in een negatieve handelsbalans voor bosbouwproducten.

Omdat er niet langer beperkingen van technische aard zijn voor het gebruik van klein formaat loofhout voor industriele doeleinden, is er een potentiele reserve aan brandhout, die gebruikt kan worden voor de industrie. Volgens voorspellingen in dit artikel zou 45—50 milj. m³ kleinformaat loofhout (beschouwd als brandhout in 1960) beschikbaar kunnen worden gemaakt voor industrieel gebruik in Europa in 1975, vooropgesteld, dat enige overeenkomstige »policy»-beslissingen zullen worden gemaakt.

Het moet worden toegegeven dat de verwerkingskosten van klein formaat loofhout per eenheid hoger zijn dan van veel andere industriele houtassortimenten, maar eveneens moet worden toegegeven dat hieraan veel verbeterd kan worden door meer rationele methodes. Toename van de hoeveelheid hout voor industriedoeleinden veroorzaakt een afnemende kostenfactor, omdat de vaste kosten een aanzienlijk deel vormen van alle bosbouwwerkzaamheden en er in vele stadia van de werkzaamheden extra capaciteit bestaat.

Houtteeltkundig gezien zou eliminatie van aanplanten of opstanden van lage kwaliteit een voordeel zijn en een factor ten gunste van het gebruik van brandhout voor industriele doeleinden. Het hoofdprobleem bij het gebruik van grotere hoeveelheden loofhout voor pulp, papier en board, schijnt te liggen in de afzetmogelijkheden. Het is de vraag of de markt stijgende hoeveelheden bosbouwproducten, gebaseerd op loofhout, zal afnemen en zo ja, tegen welke prijs.

РЕЗЮМЕ:
ПОТРЕБЛЕНИЕ ДРЕВЕСНОГО ТОПЛИВА В ЕВРОПЕ В 1950—1960 ГГ. И ВОЗМОЖНОСТИ УВЕЛИЧЕНИЯ ВЫХОДА ДЕЛОВОЙ ДРЕВЕСИНЫ ЗА СЧЕТ СОКРАЩЕНИЯ ВЫХОДА ДРЕВЕСНОГО ТОПЛИВА В 1975 Г.

Потребление древесного топлива по Европе в целом составило в 1950 году 160 млн.пл.куб.м (без коры), а в 1960 году — 130 млн.пл.куб.м. Хотя и не исключено, что эти цифры ниже фактического уровня, они превышают показатели, ежегодно сообщаемые ФАО, за 1950 год почти на 40 проц., а за 1960 год — несколько более, чем на 20 проц. Потребление древесного топлива в Европе на душу населения составило в 1950 году 0,38, а в 1960 году 0,29 пл.куб.м. В потреблении древесного топлива на душу населения в 1960 году между странами наблюдались чрезвычайно широкие расхождения: в Финляндии 3,00, а в Нидерландах менее 0,00 пл.куб.м.

По сравнению с периодом 1925—1929 гг. потребление древесного топлива в Европе сократилось. Судя по статистическим данным, это сокращение происходило до 1960 года равномерными темпами, несмотря на то, что потребление деловой древесины в Европе с 1950 по 1960 год значительно возросло, а это в свою очередь привело к дефнциту торгового баланса по лесным товарам.

Поскольку технологические факторы больше не ограничивают промышленного использования тонкомерной древесины, потенциальный "запас дровяной древесины" является одним из возможных источников сырьевого снабжения промышленности. Согласно перспективным исчислениям, сделанным в настоящем докладе, в 1975 году сырьевая база промышленности увеличится за счет использования тонкомерной древесины лиственных пород (т.е. древесины, которая в 1960 году шла на дрова) на 45—50 млн. пл.куб.м, при условии, что исполбзованию древесины будет придано именно такое направление.

Заготовка и вывозка тонкомерной древесины лиственных пород в расчете на 1 пл.куб.м обходятся дороже по сравнению со многими другими сортиментами деловой древесины, но имеются еще значнтельные возможности снижения этих расходов. Увеличение объема лесоснабжения промышленности уже само по себе ведет к снижению расходов по заготовке и вывозке в расчете на единицу объема сырья, поскольку удельный вес неизменных расходов во всех фазах лесоснабжения является значительным и поскольку во многих фазах еще наблюдается недоиспользование производственных мощностей.

Ликвидация низкокачественных насаждений или удаление низкосортных деревьев из насаждений являются с лесоводственной точки

зрения факторами, способствующими увеличению выхода деловой древесины за счет сокращения выхода древесного топлива. Основная проблема расширения промышленного использования древесины лиственных пород заключается в обеспечении рынков сбыта. Возможности сбыта неуклонно возрастающих количеств товаров, изготовляемых из лиственной древесины, сомнительны; если это окажется возможным, то в свою очередь нельзя с уверенностью утверждать, что их цена окажется достаточно высокой с точки зрения промышленности.

LYHENNELMÄ:
POLTTOPUUN KÄYTTÖ EUROOPASSA VV. 1950—1960 SEKÄ MAHDOLLISUUDET POLTTOPUUN TEOLLISEEN KÄYTTÖÖN V. 1975

Euroopan polttopuun kokonaiskäyttö oli 160 milj. k-m³ (ilman kuorta) v. 1950 ja 130 milj. k-m³ v. 1960. Nämä luvut, jotka saattavat vieläkin olla liian pieniä, ylittivät FAO:lle vuosittain ilmoitetut luvut lähes 40 %:lla v. 1950 ja hieman yli 20 %:lla v. 1960. Euroopan polttopuun käyttö henkeä kohti oli 0.38 k-m³ v. 1960. Erot maittain polttopuun käytössä olivat erittäin suuret: Suomessa oli käyttö henkeä kohti 3.00 k-m³ v. 1960 ja Alankomaissa vähemmän kuin 0.00 k-m³.

Euroopan polttopuun käyttö on vähentynyt vv. 1925/29 lähtien. Sikäli kuin tilastoista voidaan päätellä, vähentyminen on tapahtunut v:een 1960 saakka samaa trendiä seuraten siitäkin huolimatta, että Euroopan teollisuuspuun käyttö lisääntyi huomattavasti v:sta 1950 vuoteen 1960 ja aiheutti alijäämän metsäntuotteiden kauppataseeseen.

Koska tekniikka ei enää aseta rajoituksia pienlehtipuun teolliselle käytölle, 'polttopuuvarasto' (potentiaalinen polttopuusto) on siten yksi teollisuuden mahdollinen raaka-ainelähde. Tässä kirjoituksessa tehtyjen ennusteiden mukaan on 45—55 milj. k-m³ pienlehtipuuta (puuta, joka käytettiin polttopuuna v. 1960) saatavissa teolliseen käyttöön v. 1975 edellyttämällä, että käyttöä ohjataan tämänmukaisesti.

Pienlehtipuun hankintakustannukset k-m³ kohti ovat suuremmat kuin monien muiden teollisuuspuulajikkeiden, mutta paljon on tehtävissä hankintakustannusten alentamiseksi. Teollisuuden käyttöön hankitun puumäärän lisääminen aiheuttaa sinänsä yksikön hankintakustannusten vähentymisen, koska kiinteiden kustannusten osuus kaikissa metsätalouden vaiheissa on huomattavan suuri ja koska monissa vaiheissa kapasiteetti on vielä vajaassa käytössä.

Huonolaatuisten metsiköiden tai metsiköiden huonolaatuisen puuston osan poistaminen on metsänhoidollisesti katsottuna polttopuun teollista käyttöä edistävä tekijä. Lehtipuun lisääntyvän teollisen käytön (selluloosaksi, paperiksi sekä kuitu- ja lastulevyksi) perusongelmana on markkinointi. On kyseenalaista, pystytäänkö markkinoimaan alati suurenevia määriä tuotteita, joiden raaka-ainepohjana on lehtipuu; ja jos pystytään, onko hinta senmukainen, että teollisuus on asiasta riittävästi kiinnostunut.

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ACTA FORESTALIA FENNICA. Contains scientific treatises dealing mainly with forestry in Finland and its foundations. The volumes, which appear at irregular intervals, generally contain several treatises.

SILVA FENNICA. Contains essays and short investigations mainly on forestry in Finland. Published at irregular intervals.

Die Veröffentlichungsreihen der Forstwissenschaftlichen Gesellschaft in Finnland:

ACTA FORESTALIA FENNICA. Enthalten wissenschaftliche Untersuchungen vorwiegend über die finnische Waldwirtschaft und ihre Grundlagen. Sie erscheinen in unregelmässigen Abständen in Bänden, von denen jeder im allgemeinen mehrere Untersuchungen enthält.

SILVA FENNICA. Diese Veröffentlichungsreihe enthält Aufsätze und kleinere Untersuchungen vorwiegend zur Waldwirtschaft Finnlands. Sie erscheint in zwangloser Folge.

Publications de la Société forestière de Finlande:

ACTA FORESTALIA FENNICA. Contient des études scientifiques principalement sur l'économie forestière en Finlande et sur ses bases. Paraît à intervalles irréguliers en volumes dont chacun contient en général plusieurs études.

SILVA FENNICA. Contient des articles et de petites études principalement sur l'économie forestière de Finlande. Paraît à intervalles irréguliers.

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