TCP/CRO/3101 (A) Development of a sustainable charcoal industry

ASSESSMENT OF INTERNATIONAL CHARCOAL MARKETS

June 2008
Zagreb, Croatia

www.drveniugljen.hr

This publication is a part of deliverables of the FAO project:
TCP/CRO/3101 (A) Development of a sustainable charcoal industry

Editors:
Dr Julije Domac
Dr Miguel Trossero

Production:
North-West Croatia Regional Energy Agency

This project was launched in July 2006 within FAO Technical Cooperation Programme withthe objective to assess the current status of the charcoal production in Croatia, in order to develop a programme for the revitalisation of this industry.
Apart from recommendations and best solutions for the technological modernisation, the programme will provide guidelines for the production improvement and amplification with a holistic approach.
Ministry of Agriculture, Forestry and Water management is responsible for the project execution on behalf of the Government of the Republic of Croatia.

ASSESSMENT OF INTERNATIONAL CHARCOAL MARKETS

Project Technical Officer: Dr Miguel Trossero

National Project Co-ordinator: Dr Julije Domac

Contributing Authors: Yves Schenkel
Romain Crehay

Table of contents

Executive summary

The objective of this study is to assess European charcoal markets in the framework of the development of the charcoal production sector in Croatia. The first chapter consists in the evaluation of charcoal industry in and outside Croatia regarding charcoal production, imports and exports. The market surveyed is the European Union (27 Member States) plus Croatia, by the means of two databases, FAOSTAT and EUROSTAT, and one study (PARKER, 2007). The second chapter analyses the purchasing (imports) and selling prices of barbecue charcoal in selected EU countries (Belgium, Germany, Switzerland, United Kingdom). Additional information have been collected and presented on charcoal uses and standards (annex 1), potential investment opportunities (annex 2) and renewable energy policies and financing instruments in EU Member States (annex 3).

European market and trends in charcoal production and use have been analysed on the basis of the data available in FAOSTAT data base, with a focus on the European Union 27 Member States (EU27) and Croatia in the time frame 2001 – 2005. The FAOSTAT data have been compared with estimates proposed by PARKER (2007) for the year 2007. EUROSTAT give very limited information on charcoal trade.

While the world production of charcoal has increased by 13 % between 2001 and 2005 (the world average production of charcoal between 2001 and 2005 amounts to 43,185 kt), the EU27 production has only increased by 4 % (average 2001-2005: 2,293 kt). The major EU27 producers appear to be Poland (65 kt), France (56.6 kt) and Slovakia (37.2 kt). Croatia's average production between 2001 and 2005 is 2 kt. Data on charcoal production quantities in FAOSTAT must be considered with utmost care as many data are doubtful.

Regarding charcoal imports, the major EU27 importers are Germany (122 kt), UK (50 kt), Belgium (50 kt), Italy (47 kt), Greece (42 kt) and France (40 kt). Croatia's imports have increased by 8 % between 2001 and 2005 to reach 12 kt in 2005. The major EU27 exporters are Poland (54 kt), Belgium (32 kt), Bulgaria (30 kt), Spain (29 kt), Romania (17 kt) and France (17 kt). Belgium appears clearly to be an import/export plate-form. Croatia's exports of charcoal vary between 2 and 3 kt in the period 2001-2005. Croatia's home market amounts to 9.4 kt in average between 2001 and 2005 (production + imports – exports).

Regarding purchasing prices proposed by charcoal importers, they seem to vary a lot: from 200-250 euro/tonne in Belgium to 350-505 euro/tonne in Switzerland. The port of Antwerp in Belgium is a real hub for bulk materials such as charcoal; this may explain the very low purchase price of charcoal noticed in Belgium. But we have no other explanation on the big differences of price seen in different countries.

The selling price of charcoal varies according to its packaging. For small bags (3-5 kg), the price ranges from 0.83 to 1.3 euro/kg (average: 0.98 euro/kg). For big bags (10 kg), the price ranges from 0.70 to 1.05 euro/kg (average: 0.89 euro/kg).

Recommendations

Although charcoal uses as reductant for the metallurgical industry or for filtration are promising markets in the mid term, the major market for Croatian charcoal is the barbecue market (see annex 1 for further details on charcoal uses). The European standard EN 1860-2 gives a minimum value for the fixed carbon content of 75% mass based on dry charcoal. The consequence is that the development of further charcoal production activities in Croatia should target high quality charcoal requiring industrial charcoal techniques in order to guarantee its quality level and its homogeneity.

Target countries for Croatian producers and exporters of wood charcoal are the present ones – Switzerland, Italy, Slovenia, Austria, Bosnia and Herzegovina – to which we recommend to add major importers of wood charcoal such as Germany, United Kingdom, Greece and France. Belgium has a specific status (import/export plate-form) and should be considered as such.

1. Charcoal industry in and outside Croatia

A review of existing studies that address economic, financial and market aspects of charcoal industry in and outside Croatia has been conducted. This review focuses on Croatia, surrounding countries and the EU 27. If many studies on charcoal markets in the United States of America, in Africa, in Southern America or in Asia can be found in the literature, only a few have been conducted in Europe.

SCHENKEL and CREHAY (2005) have reviewed charcoal production, import and export within the EU 15. This review was essentially based on the FAOSTAT database and covered the years 1998-2002. This study already pointed out some problems of data reliability with FAOSTAT. We will present here an update of the study, with additional countries and data coming from other sources (EUROSTAT, INCON Group).

Production

The world production of wood charcoal has increased by 13 % between 2001 and 2005 (fig 1), to reach almost 46,000 kt. The average production of wood charcoal from 2001 to 2005 amounts to 43,185 kt.

Figure 1 : World annual production of charcoal between 2001 and 2005 (FAOSTAT, 2007)

The European production of wood charcoal is considerably smaller (Fig 2). The average production of wood charcoal from 2001 to 2005 amounts to 2,293 kt in the EU27. From 2001 to 2005, the EU27 production has increased by 4 %, but is stable since 2003.

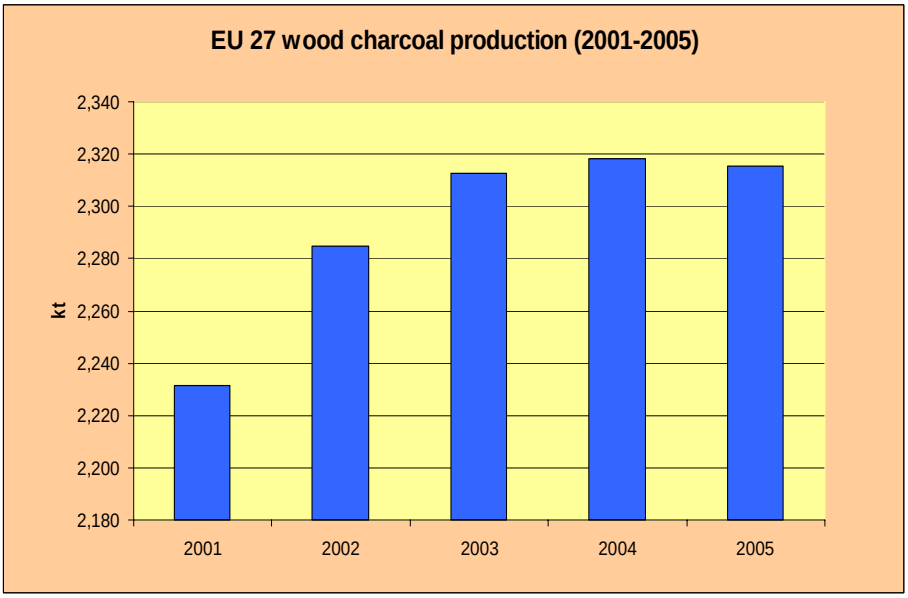

Figure 2 : EU27 annual production of charcoal between 2001 and 2005 (FAOSTAT, 2007)

Some EU Member States are large producers of charcoal (Fig 3).

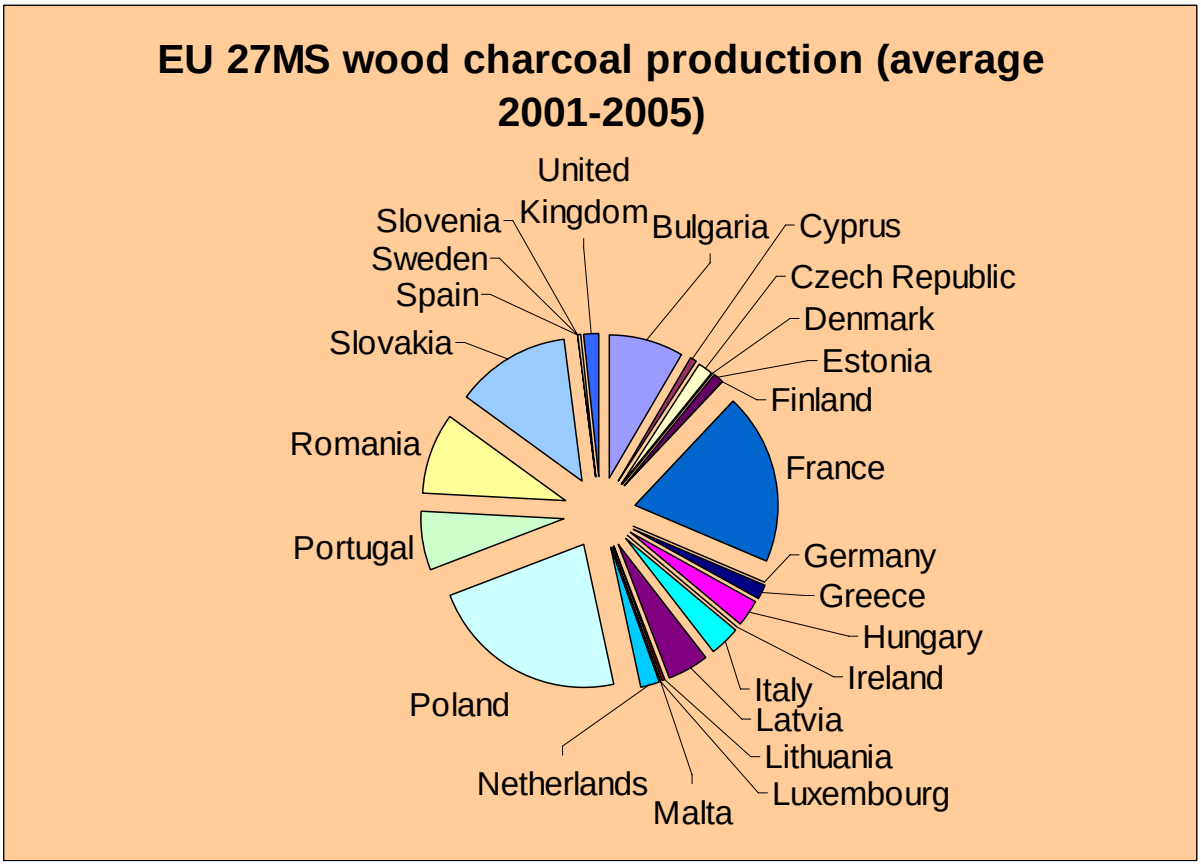

Figure 3: EU27 Member States production of wood charcoal (average from 2001 to 2005) (FAOSTAT, 2007)

The major producers are (average value 2001-2005):

- Poland (65,000 t/year)
- France (56,600 t/year)
- Slovakia (37,200 t/year)
- Romania (27,000 t/year)
- Bulgaria (23,800 t/year)
-

It is important to note that data are missing for some countries: Austria, Belgium, Germany, Luxembourg. Also, FAOSTAT data on charcoal production must be used with great care. For example, Spain was a major producer of wood charcoal until 1999, with an average production of 65,000 t/year ; this production is equal to 0 since 1999! It is hard to believe that all Spanish producers of charcoal stopped their activity the same year. Another example: the production of charcoal in Greece amounts to 3,044 t every year since 2002! However, some countries announce data rounded to the thousand ton.

In Croatia, the production of charcoal amounted to 5,000 t/year in 2001 and 2002 (Fig 4), but the production appears to be zero from 2003 to 2005 in FAOSTAT. But thanks to the study conducted by SEGON et al. (2007), we know that this is not the case. SEGON et al. (2007) estimate the wood charcoal production at 5,310 t (plus 1,270 t of grill briquettes) by the means of a survey of charcoal makers in Croatia conducted in 2006. This figure corroborates the FAOSTAT data for the years 2001 and 2002 and may thus be considered has highly reliable.

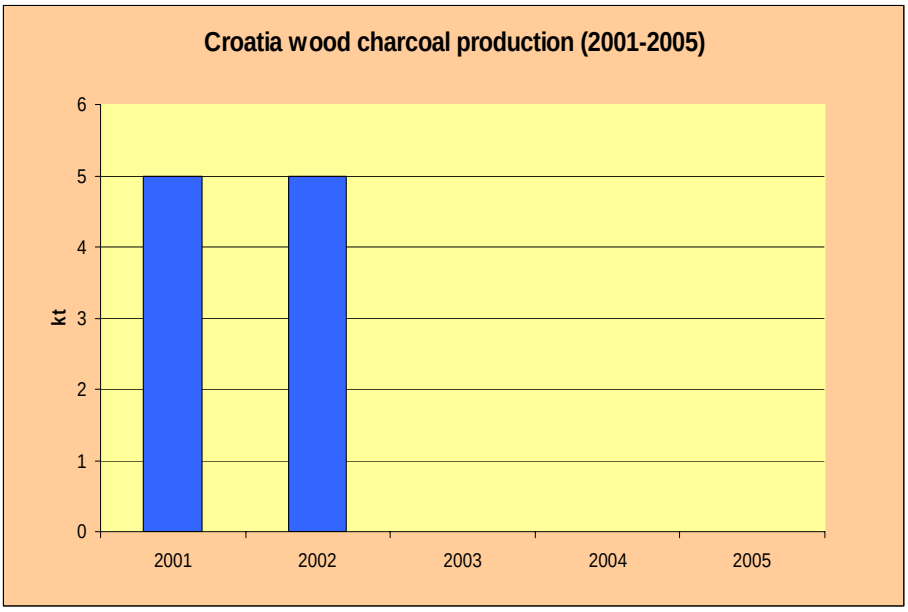

Figure 4: Annual production of wood charcoal in Croatia from 2001 to 2005 (FAOSTAT, 2007)

Imports

Many EU27 Member States are large importers of wood charcoal (table 1 and Fig 5). The 6 major importers are (average from 2001 to 2005):

- Germany: 122,000 t
- United Kingdom: 50,000 t
- Belgium: 50,000 t
- Italy: 47,000 t
- Greece: 42,000 t
- France: 40,000 t.

Table 1: Imported quantities (tonnes) of wood charcoal for the EU27 Member States from 2001 to 2005 (FAOSTAT, 2007)

	2001	2002	2003	2004	2005
Austria	10,000	10,000	12,000	13,000	11,000
Belgium	25,660	35,589	63,424	64,038	60,063
Bulgaria	0,000	0,000	0,000	0,156	0,099
Cyprus	13,800	21,490	4,343	5,630	7,868
Czech Republic	0,000	2,000	3,000	3,000	3,000
Denmark	12,000	17,273	20,462	17,006	23,753
Estonia	0,020	0,140	0,038	0,024	0,083
Finland	1,983	2,633	2,361	1,745	1,783
France	31,059	26,471	42,173	49,249	53,231
Germany	113,640	113,640	113,635	138,267	130,638
Greece	25,930	32,200	45,000	50,560	53,854
Hungary	2,000	1,000	1,000	1,000	3,000
Ireland	2,870	1,000	0,426	0,532	0,871
Italy	41,000	41,169	46,668	49,558	56,824
Latvia	0,130	0,290	0,086	0,067	0,266
Lithuania	0,040	0,200	0,110	0,150	0,190
Luxembourg	1,310	0,715	0,000	1,188	1,335
Malta	0,210	0,200	0,191	0,150	0,190
Netherlands	14,000	17,500	19,700	24,000	56,840
Poland	10,300	11,700	12,700	15,800	22,200
Portugal	11,000	15,000	18,000	27,000	18,000
Romania	0,000	0,000	0,000	0,000	0,000
Slovakia	21,000	0,000	0,000	1,000	0,000
Slovenia	0,000	0,870	0,872	1,115	1,689
Spain	16,085	28,000	33,000	42,000	45,086
Sweden	13,950	15,880	17,515	18,255	20,187
United Kingdom	41,647	43,615	54,454	57,038	53,150

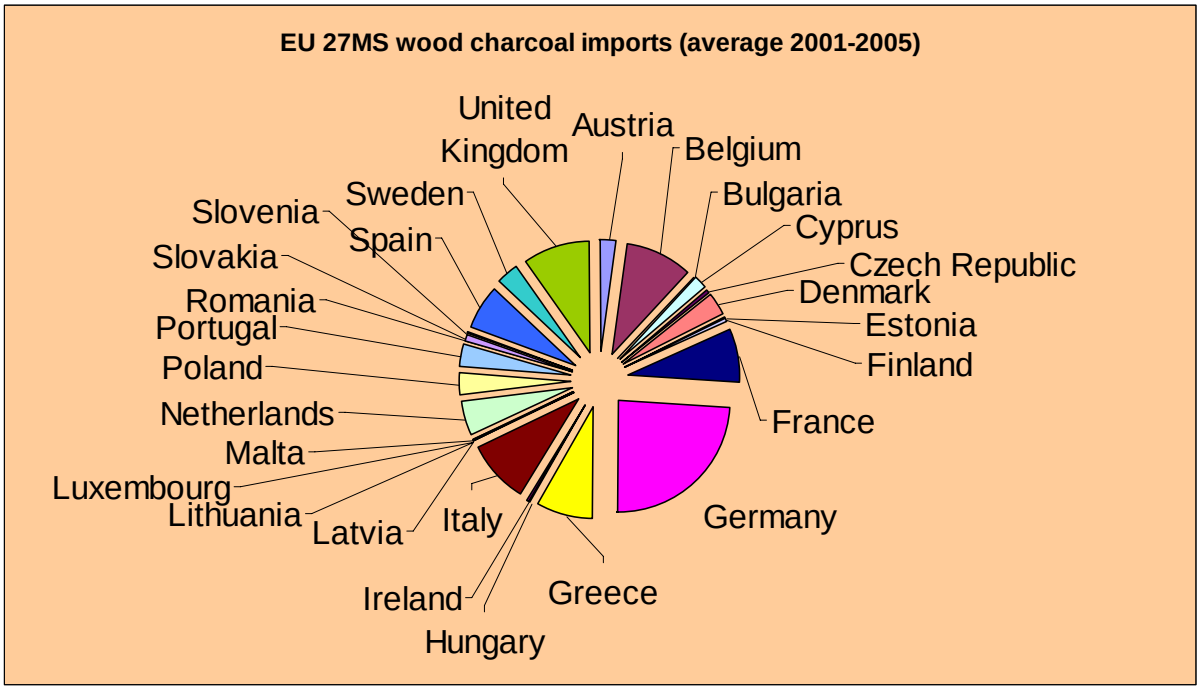

Figure 5: EU27 Member States imports average from 2001 to 2005 (FAOSTAT, 2007)

This ranking is largely confirmed by PARKER (2007) (table 2) who has calculated the estimated market for wood charcoal, including shell or nut charcoal in Europe for 2007; however, PARKER (2007) only gives a money value of the market and not the physical quantities corresponding to this money value.

Table 2: Market size for the 6 major EU27 Member States importing wood charcoal

Countries	**FAOSTAT 2005 (kt)**	**PARKER (estimates 2007) ('000 US$)**
Germany	138,267	51,768
United Kingdom	57,038	30,899
Belgium	64,038	24,210
France	49,249	23,714
Italy	49,558	16,915
Greece	50,650	16,069

Figure 6 shows the evolution of charcoal imports.

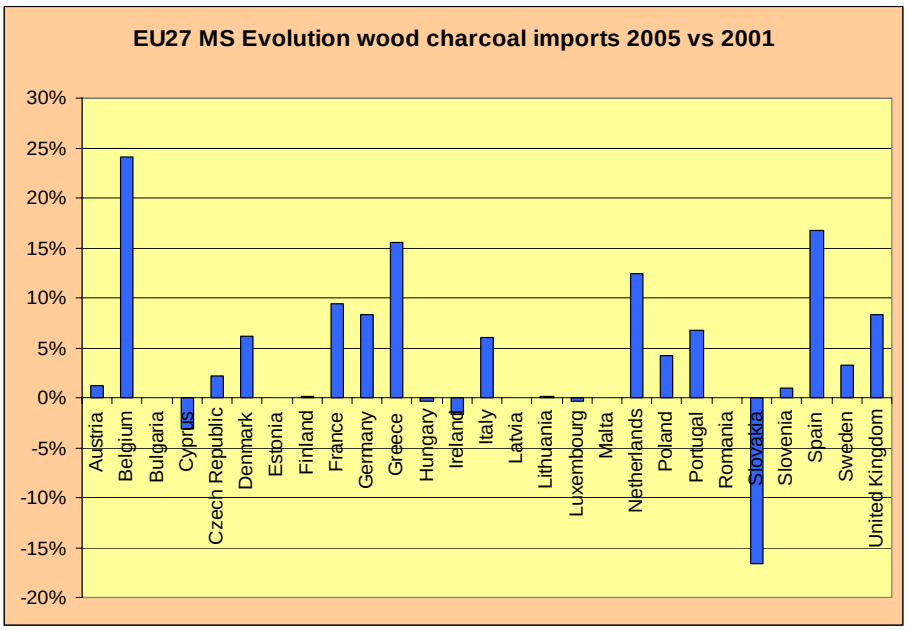

Figure 6: EU27 Member States evolution of wood charcoal imports in 2005 compared to 2001 (FAOSTAT, 2007)

All countries have seen their imports increase in a range between 3 and 16 %, the highest increase being the one of Belgium, almost 25 %. Only three countries have seen their imports decrease: Slovakia (> 15 %), and to a considerable less extent, Ireland and Cyprus. In average, with all EU27 countries included, the increase has been equal to 4 % in average between 2001 and 2005. But, again, these data must be handled with care. For example, in the case of Belgium, there is a contradiction between the quantity of charcoal imported compared to the actual size of the market. This is confirmed by the data of charcoal exports (see here below).

Charcoal imports in Croatia have increased by 8 % between 2001 and 2005, moving from 2 kt in 2001 to 12 kt in 2005 (FAOSTAT, 2007). However, SEGON et al. (2007) indicate 2.237 kt and 2.721 kt of charcoal imported in Croatia in 2005 and 2006 respectively; their data come from the Croatian customs. There is here a contradiction between the FAOSTAT database and the data collected in Croatia.

Exports

Table 3 and Figure 7 show the exported quantities of wood charcoal for the EU27.

Table 3: Exported quantities (tonnes) of wood charcoal for the EU27 Member States from 2001 to 2005 (FAOSTAT, 2007)

	2001	2002	2003	2004	2005
Austria	0,000	0,000	2,000	1,000	1,000
Belgium	8,630	13,102	41,185	55,202	43,529
Bulgaria	21,000	25,000	25,000	37,000	41,000
Cyprus	0,030	0,010	0,000	0,068	0,037
Czech Republic	0,000	4,000	4,000	3,000	2,000
Denmark	1,000	0,311	0,424	0,795	0,767
Estonia	1,800	2,990	4,133	3,489	4,836
Finland	0,003	0,034	0,004	0,031	0,014
France	16,794	16,063	15,476	18,072	17,450
Germany	3,390	3,390	3,389	2,657	2,243
Greece	0,189	0,043	0,080	0,096	0,064
Hungary	19,000	1,000	1,000	1,000	11,000
Ireland	0,000	0,054	0,008	0,008	0,090
Italy	0,000	0,436	0,397	0,550	0,403
Latvia	7,090	8,390	10,377	8,875	6,067
Lithuania	0,190	0,400	1,000	0,627	0,610
Luxembourg	0,000	0,000	0,000	0,001	0,015
Malta			0,000	0,000	0,000
Netherlands	2,100	2,080	10,320	13,600	29,080
Poland	48,600	45,000	59,000	59,900	59,000
Portugal	0,000	0,000	0,000	0,000	0,000
Romania	17,000	18,700	16,000	16,000	17,000
Slovakia	21,000	16,000	23,000	6,000	0,000
Slovenia	0,000	0,010	0,007	0,054	0,505
Spain	24,387	21,000	36,000	36,000	27,681
Sweden	0,040	0,095	0,333	0,506	0,836
United Kingdom	1,206	1,371	8,395	8,222	6,394

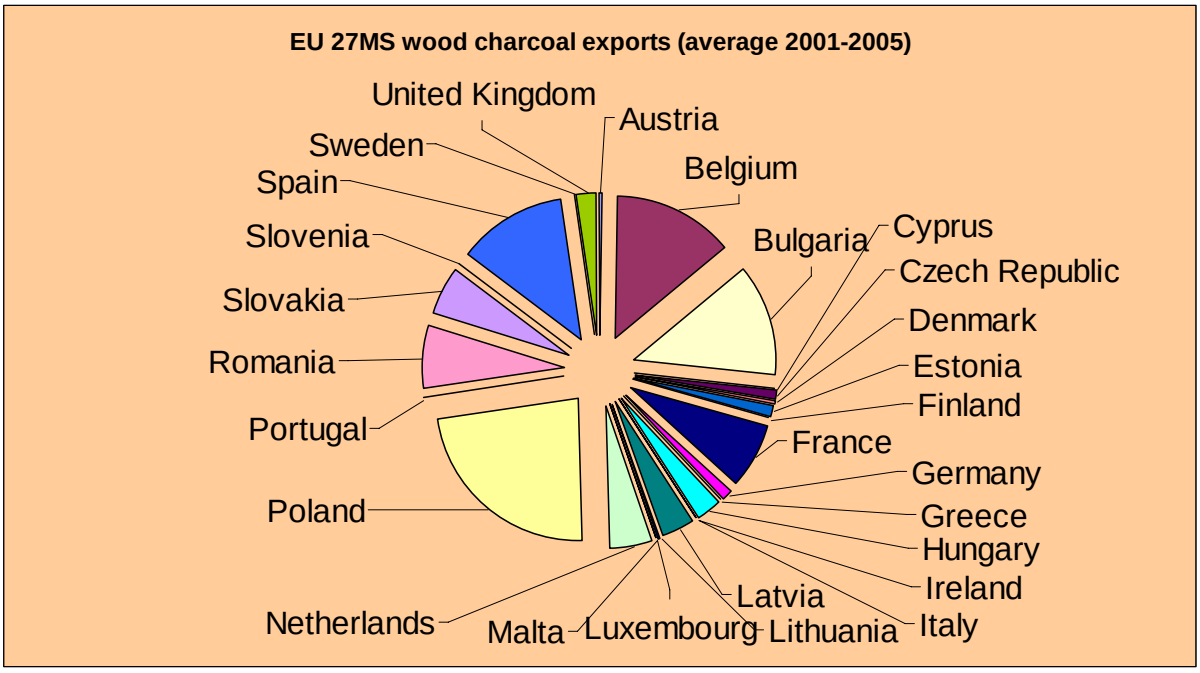

Figure 7: EU 27 Member States average exported quantities of charcoal from 2001 to 2005 (FAOSTAT, 2007)

The 6 major EU27 exporters are (average from 2001 to 2005):

- Poland : 54,000 t
- Belgium : 32,000 t
- Bulgaria : 30,000 t
- Spain : 29,000 t
- Romania : 17,000 t
- France : 17,000 t

This ranking is confirmed by PARKER (2007) (table 4) who has calculated the estimated exports of wood charcoal, including shell or nut charcoal in Europe for 2007; however, PARKER (2007) only gives a money value of the market and not the physical quantities corresponding to this money value.

Table 4: Market size for the 6 major EU27 Member States exporting wood charcoal

Countries	**FAOSTAT 2005 (kt)**	**PARKER (estimates 2007) ('000 US$)**	**EUROSTAT (sold quantities 2006) (kt)**
Poland	59,000	25,979	69,629
Belgium	43,529	11,852	-
Bulgaria	41,000	10,355	27,453
Spain	27,681	11,980	33,508
Romania	17,000	5,645	1,411
France	17,450	7,528	38,876

It is interesting to note that in 2005, the Netherlands enjoyed a big increase in their charcoal exports, from 10,000-13,000 tons in 2003-2005 up to 29,080 tons in 2005. This is also confirmed by PARKER (2007) who values the Dutch exports to 9,986,000 US$ for 2007. The EUROSTAT values are supposed to cumulate exports and national sales. The data given in table 4 appear to be consistent for Poland, Spain and France, but not for Bulgaria and Romania. Again, we have some doubt about the homogeneity of data collection within the EU Member States.

A comparison of export data with production or import data is also interesting. For example, Bulgaria produces in average 23,800 t of charcoal per year, but exports 30,000 t with almost zero imports : a big contradiction thus. Belgium is also a large exporter of charcoal : probably, large quantities of charcoal are entering Belgium through the port of Antwerp and are then distributed in other EU countries.

Croatia exports around 3,500 t of wood charcoal per year according to FAOSTAT, but the survey conducted by SEGON et al. (2007) indicates 1,061 t exported in 2005. PARKER (2007) estimates that the major markets for Croatian exports of wood charcoal would be in 2007 :

- Italy : 794 000 US$
- Switzerland : 396 000 US$
- Slovenia : 145 000 US$
- Austria : 102 000 US$

SEGON et al. (2007) point out the same countries but in a different order in 2005 (table 5) with Bosnia and Herzegovina in place of Austria.

Table 5: Croatian charcoal exports by countries in 2005 (after SEGON et al., 2007)

Country	**Quantity (t)**	**Price (US$)**	**Average price (US$/kg)**
Switzerland	557.150	228 093	0.409
Bosnia and Herzegovina	191.271	60 246	0.315
Slovenia	182.330	91 541	0.502
Italy	111.368	49 932	0.448

The evaluation of the Italian market is very different between PARKER (2007) and SEGON et al. (2007). Nevertheless, Italy, because of its proximity with Croatia, should definitely be a target market for Croatian producers and exporters of wood charcoal.

2. Costs and prices of charcoal in Europe

Charcoal can be used in several applications: fuel for barbecue, reductant for metallurgy, filtration. These uses are described in annex 1. The main use is charcoal for barbecue

It is extremely difficult to collect accurate data on purchase price for barbecue charcoal in European countries. After having contacted different operators (chambers

of commerce, fuels traders national associations, commercial attaches, International Energy Agency Bioenergy Agreement national representatives), we eventually have been able to collect data from Germany, Switzerland, United Kingdom and Belgium.

In Switzerland, charcoal is mainly imported from Poland (4 565 t in 2006), Romania (1 887 t in 2006) and Croatia (1 000 t in 2006). The average purchase price ranges from 350 euros/t for Croatian charcoal to 505 euros/t for Polish charcoal (355 euros/t for Romania). This constitutes a wide range. The average purchase price for imported charcoal in Switzerland was 460 euros/t in 2006, which is quite high.

Charcoal sold in Swiss hypermarkets or garden centres ranges from 0.84 to 0.91 euro/kg for small bags (4-5 kg) and from 0.79 to 0.98 euro/kg for bigger bags (10 kg). Charcoal briquettes are sold at average price of 1 euro/kg.

In Switzerland, the standard EN 1860-2 is recognized but not really used.

In Belgium, charcoal is bought in 40' containers (approx. 21 tonnes) with a C&F price in Antwerp of 205 euro/tonne. Light charcoal (density < 170 kg/m^3) or charcoal certified FSC receive a higher price, about 246 euros/tonne. Charcoal sold in Belgian hypermarkets or garden centres ranges from 1.3 to 1.05 euro/kg (bags of 4-5 kg and of 10 kg).

In Belgium, the standard EN 1860-2 is fully applied.

For Germany, it has been impossible to obtain information on traders/importers of charcoal. We have received some data about the selling price of charcoal in garden centres and hypermarkets: around 0.83 euro/kg in small bags (3 kg) and around 0.70 euro/kg in bigger bags (10 kg). In Germany, the standard in use is DIN 51 749 equivalent to the EN 1860-2 standard.

In United Kingdom, the top market leader supplying charcoal to trade and retail outlets is Four Seasons Fuel. British charcoal is said to have a fixed-carbon content higher than 80 % while imported charcoal is said of lower quality, around 60 % fixed-carbon content. The company Four Seasons Fuel sells charcoal in bags of 3 kg (5.37 euros thus 1.79 euro/kg) and in bags of 6 kg (10.10 euros thus 1.68 euro/kg). They sell also their 3 and 6 kg bags in pallets of 50 bags, corresponding to a price per kilo of 1.01 euro and 0.95 euro for 3 kg and 6 kg bags respectively.

We have not received any information on the Austrian and Italian markets.

ANNEX 1

Charcoal uses in Europe

Charcoal is a fuel and was used in metallurgy until the advent of coke. Today most charcoal is used for barbecue, restaurant, etc. in Europe. A small amount of charcoal is used in certain metallurgical processes (ferrosilicon) and as a filter to remove organic compounds such as chlorine, gasoline, pesticides, and other toxic chemicals from water and air. Charcoal for barbecue can be found in lump form or in briquettes.

Charcoal for barbecue

Since May 2005, a European standard for barbecue charcoal and barbecue charcoal briquettes exists (EN 1860-2). Its full title is "Appliances, solid fuels and firelighters for barbecuing – Part 2: Barbecue charcoal and barbecue charcoal briquettes – Requirements and test methods". This norm has been published officially in English, French and German and is supposed to be in application in all Member States of the CEN (European Committee for Standardization[1]).

The limit values for lump barbecue charcoal required by the EN 1860-2 standard are as follows:

- Fixed carbon content : minimum 75% mass based on dry charcoal
- Ashes : maximum 8 % mass based on dry matter
- Moisture content : maximum 8 % mass based on total matter
- Particle size distribution: . pieces between 0 and 150 mm
  . maximum 10% of pieces above 80 mm
  . minimum 80 % of pieces above 20 mm
  . maximum 7 % of pieces between 0 and 10 mm
- Volatile matter content : must be measured for the determination of fixed carbon content, but no minimum or maximum values defined
- Bulk density : minimum 130 kg/m^3

The limit values for charcoal briquettes required by the EN 1860-2 standard are as follows :

- Fixed carbon content : minimum 60% mass based on dry charcoal
- Ashes : maximum 18 % mass based on dry matter
- Moisture content : maximum 8 % mass based on total matter
- Particle size distribution : . maximum 10 % of pieces below 20 mm

Consumers burn mainly lump barbecue charcoal in Europe while they prefer charcoal briquettes in the USA. Charcoal briquettes are a uniformly sized product with uniform burning rates, perceived as a cleaner product for home and recreational use. Another advantage is the use of charcoal fines usually left behind. In the USA, lump charcoal is twice the price of briquettes per unit of mass; also, lump charcoal is lighter than

[1] Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxemburg, Latvia, Lithuania, Malta, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom

briquettes hence the consumer must store a greater volume of it to have the same mass. Lump charcoal heats hotter, which makes it easy to sear food rather than cook it. It also tends to become dusty and flake off, whereas charcoal briquette is a more compressed, dense product and has a longer burn.

However, lump charcoal is a 100 percent natural product without the additives that are used to produce briquettes. Lump charcoal heats faster than briquettes, so cooking can start very quickly. Lump charcoal can be easily ignited and can be smothered by closing off the air supply or putting it out with water, the reused at a later time.

Charcoal for metallurgy

There is some interest in charcoal as a metal reductant for the production of ferrosilicon in Europe. Solid carbon (fixed carbon) is essential for the smelting process and is needed for breaking the bonds between silica and oxygen in silica oxide (SiO_2) in the processing of silicon:

$SiO_2 + 2C = Si + 2CO$

According to GRÔNLI et al (2002), 20% of coke and coal could be substituted by charcoal in the production of FeSi 75% or of silicon hence reducing the emissions of fossil CO_2 in these metal industries in Europe. Tables A.1.1 and A.1.2 show these potentials.

Table A.1.1: Substituting 20% (fix-C) of coke and coal by charcoal in the production of FeSi 75% in Europe (after GRÖNLI et al, 2002)

Country	Production capacity FeSi 75% in 1999		Charcoal potential	CO_2 reduction	SO_2 reduction
	ton	%	ton	ton	ton
Norway	500 000	57	97 849	- 315 960	- 825
France	100 000	11	19 570	- 63 192	- 165
Iceland	80 000	9	15 656	- 50 554	- 132
Slovakia	60 000	7	11 742	- 37 915	- 99
Spain	40 000	5	7 828	- 25 277	- 66
Sweden	25 000	3	4 892	- 15 798	- 41
Germany	20 000	2	3 914	- 12 638	- 33
Italy	20 000	2	3 914	- 12 638	- 33
Hungary	15 000	2	2 935	- 9 479	- 25
Slovenia	15 000	2	2 935	- 9 479	- 25
Total	875 000	100	171 235	- 552 930	- 1 444

Table A.1.2: Substituting 20% (fix-C) of coal by charcoal in the production of silicon in Europe (after GRÖNLI et al, 2002)

Country	Production capacity silicon in 1999		Charcoal potential	CO_2 reduction	SO_2 reduction
	ton	%	ton	ton	ton
Norway	165 000	44	38 975	- 156 762	-456
France	100 000	27	23 621	- 95 007	- 276
Spain	36 000	10	8 504	- 34 203	- 99
Italy	27 000	7	6 378	- 25 652	- 75
Germany	23 000	6	5 433	- 21 852	- 64
Bosnia	10 000	3	2 362	- 9501	- 28
Serbia	10 000	3	2 362	- 9501	- 28
Total	371 000	100	87 634	- 352 477	- 1 025

The quality of charcoal to be used in the ferroalloy and silicon industry must be high: fixed-carbon content must be above 85% dry basis and the CO2 reactivity must be tested. If the industries producing ferrosilicon or silicon would substitute partially coke and coal by charcoal, this market for high grade charcoal would be particularly attractive in terms of quantities and value.

Charcoal for filtration

Filter charcoal is mainly activated carbon. The commercial literature on this subject is often confusing, using just as well filter charcoal, charcoal filtration as activated carbon. This one is a specific high grade product, made from carbon materials heated at very high temperatures (above 800 °C) and “activated” by a stream of steam resulting in a product very pure (almost 100 % carbon) and with a very high porosity (specific surface). Only few companies are producing activated carbon around the world, making this market very difficult to enter.

However, it is worth to consider high-grade filter charcoal for air-filtration and water-filtration systems. Wood charcoal contains little sulphur and can be used for air pollution control or drinking water or swimming pool water filtration. To make high-grade filter charcoal, very small cells are needed. This can be produced from a very dense wood.

ANNEX 2

Potential investment opportunities

KULISIC et al. (2007) have analysed different economic aspects of charcoal production in Croatia, considering both small scale and industrial production. In order to identify areas of project with potential investment opportunities, we have carried out a supplementary feasibility study on an industrial production of charcoal. KULISIC et al. (2007) have based their analysis on the CTR system; we have used the Lambiotte retort system for our study.

Our results are shown in table A.2.1.

Table A.2.1: Production cost of charcoal with a Lambiotte retort

	Cost (euro)	**Remark**
Infrastructure		
Excavation and road works	53 668	Depreciation : 25 y
Buildings	526 485	Depreciation : 20 y
Equipment		
Retort	1 127 031	Depreciation : 20 y
Handling vehicles	45 618	Depreciation : 8 y
Wood chipper	134 170	Depreciation : 20 y
Packaging	161 004	Depreciation : 20 y
Feeding system	61 718	Depreciation : 20 y
Varied	53 668	Depreciation : 10 y
Total	**1 583 210**	
Production costs		
Depreciation	113 736	
Financial charges	108 168	5% Investment
Maintenance	37 466	2% Equipment, 1% Infrastructure
Operation	67 085	
Personnel	172 006	
Consumables	122 363	
Wood	114 000	20 euro/tonne
Total	**734 825**	

The total annual production of charcoal is 1700 tonnes per year. The production cost of one tonne of charcoal is estimated at 415 euro. This cost is significantly higher than the cost calculated by KULISIC et al. (2007). However, there are differences in the calculation between the two studies. The feasibility studies are calculated on different bases and require first a harmonization before making any comparison between them.

ANNEX 3

Renewable energy policies of EU Member States

Charcoal is mainly used as a fuel. Therefore, we have focused this study on policy instruments supporting renewable energy development in EU.

Policies and instruments in EU Member States

EU Member States instruments for the development of renewable energy sources can be split into several categories:

- R&D and technological innovation programmes;
- demonstration programmes;
- public awareness programmes;
- measures and instruments on simplification of administrative and authorisation procedures;
- measures and instruments related to energy market regulation;
- financial (and fiscal) instruments as market deployment policy measures.

In most case, **R&D and technological innovation programmes** have been the first step of policy for RE in the Members States under national or EC funded programmes related to energy or specifically to renewables (Thermie, Altener, Intelligent Energy for Europe, etc.). Such programmes have been launched since the seventies. At present, R&D and technological innovation programmes are in operation in all Member States. They aim, among others, at reducing investment and operating costs of RE technologies and then at making theses technologies more competitive and more cost-effective with regards to conventional production technologies.

Demonstration programmes typically follow the R&D programme by putting forward their achievements. Demonstration programmes foster investors' confidence because they prove concretely the technical and economic performances of new technologies. **Public awareness programmes**, as information campaigns, supports market development by creating a multiplier effect of the other policies. They aim at modifying consumer choices and at reducing public and/ or investors' apprehension towards implementation of RES-E plants (especially for wind energy).
As mentioned in the Green Paper on energy supply, the implementation and the operation of RES-E plants are often slowed down because of the complexity and the lengthy of **administrative procedures, such as authorisations and permissions**: for instance, windfarms or small hydro plants may be subject to authorisations in the field of building, environment and land management strict regulations.

Market deployment instruments

Market deployment policies are market-based financial and fiscal instruments, which provide a level playing field for renewables. Although technological advances have generated enormous progress in recent year, present renewable energy technologies other than large-scale hydro, can only be deployed commercially if support measures as financial incentives are used. Market intervention for this purpose is justified considering that market prices for fossil fuels do not reflect the full economic costs of generation. In particular, they exclude the negative externalities of environmental degradation, which is not associated with renewable fuel sources and the positive

environmental benefits of renewable energy. This is why these forms of state aid to industry are allowed as far as they respect the EC guidelines.

Since the eighties, R&D and demonstration programmes on renewable technologies have been followed in EU countries by the launch of market deployment measures like tax measures and investment incentives. At present, series of financial instruments and mechanisms to support RES have been implemented throughout the EU:

- investment subsidies
- fiscal mechanisms

Investment subsidies aim at encouraging and favouring investment for the implementation of RES generators by the way of investment incentives to reduce capital costs and thus to overcome the barriers of a high initial investment. Investment subsidy is commonly employed to stimulate investments in less cost-effective RE technologies. Capital grants and third party finance arrangements reduce investors' risk and are generally funded out of national budget and thus compete with other public funding needs. Incentives must be of adequate size and must predictable and consistent over time to be effective. Loans accorded with a low interest can also be considered as an investment subsidy. These tools must be in line with the Guidelines for States aid on environment. Investment subsidies are generally around 20-50 % of eligible investment costs.

Fiscal measures mainly consist of tax exemptions or tax reductions as low VAT rates for project owners. For customer-owned systems, a tax credit or rebate systems allow the owner to recover a portion of the upfront capital costs more quickly after the investment is made. Provisions are sometimes made for sales tax rebates. These instruments are used in all Member States and may only concern one technology the State wants to develop preferentially (i.e. under a solar PV plan or a wind energy plan), or concern a wide range of RE technologies. All these instruments must be in line with the Guidelines for States aid on environment. Furthermore, fiscal measures can also be used to capture the external costs associated with conventional energy production and consumption, such as environmental degradation, etc. For example, the Belgian fiscal legislation allows a tax exemption of up to 13.5 % of the investment costs for investments in energy production from RES.
The IEA observed that the significant RE market growth has always resulted from combinations of policies rather than from a single policy initiative. Furthermore, in most case, the success of RE market penetration is due to the fact that local, provincial or regional initiatives, independent of the national government, strengthen the effects of national efforts by its own policy support instruments.
The longevity and the predictability of the support policy are important to overall market success by ensuring investors' confidence. In most case, financial incentives as feed-in tariffs have an 8 to 10 years time frame.
While the more the incentive is important, the more the technology deployment on market will be important, the incentives instrument must stimulate the development of the most cost-effective technologies as well as the development of R&D works to reduce the generation between renewable and conventional technologies. Then, the challenge is how to incorporate strong incentives for cost reduction and completion while ensuring longevity and predictability of support policy.

The Member States presently operate different mechanisms to support RES, at the national or regional level, form R&D to systems for technology penetration into market. In most case, Member States operate several market deployment mechanisms, typically the combination of investment subsidies, tax incentives and direct price support mechanisms, the latter being in most Member States the main promotion tool.

References

CENTRE FOR RENEWABLE ENERGY SOURCES (CRES). Financial Instruments and Economic incentives for Energy Investments. Available on: www.cres.gr.

COMMUNICATION FROM THE COMMISSION - Energy for the Future: Renewable Sources of Energy - Green Paper for a Community Strategy. COM(96) 576, November 1996.

EUROPEAN COMMISSION. Communication from the Commission. Energy for the future: renewable sources of energy. White Paper for a Community Strategy and Action Plan. COM(97) 599 final 26/11/1997.

EUROPEAN COMMISSION. Community guidelines on State aid for environmental protection. 2001/C 3/03. Official Journal of the European Communities. 3.2.2001.

EUROPEAN COMMISSION. Directorate-General for Energy and Transport 2000. Green Paper. Towards a European strategy for the security of energy supply. Brief presentation. 29 November 2000.

EUROPEAN COMMISSION. Directorate-General for Energy and Transport. 2005. WebPages. Available on: http://europa.eu.int/comm/energy. Consulted on November 2005.

EUROPEAN COMMISSION. Green Paper "Towards a European strategy for the security of energy supply". COM(2001) 679 final.

EUROPEAN RENEWABLE ENERGY COUNCIL. (EREC). EU Policy on renewable energy sources.

EUROPEAN RENEWABLE ENERGY COUNCIL (EREC) 2004. Renewable Energy Policy Review. Germany. Brussels. May 2004. 16 p.

GRÖNLI M., MONSEN B., EIKELAND I.J. (2002). Slow pyrolysis for charcoal. Introduction and overview. PyNe workshop, Graz, Austria, January 2002.

INTERNATIONAL ENERGY AGENCY (2004). Energy Policies of IEA Countries. 2004 Review. Special 30th anniversary Edition. IEA/OECD. 539p. ISBN: 92-64-10803-3.

INTERNATIONAL ENERGY AGENCY (2004). Renewable energy: Market & policy trends in IEA countries. IEA/OECD. Paris 2004.

IRISH DEPARTMENT OF COMMUNICATION, MARINE AND NATURAL RESOURCES. Communication: "*Minister Dempsey Announces New Government Support Mechanism For Renewable Energy Projects*". Available on: www.dcmnr.gov.ie.

IRISH DEPARTMENT OF COMMUNICATION, MARINE AND NATURAL RESOURCES. Renewable Energy – Policy, Technical And Planning Information. Available on : http://www.dcmnr.gov.ie.

KULISIC B., KARAN M., MEDIC S. (2007). Economic aspects of charcoal production in Croatia. Draft report, 25 p.

PARKER P.M. (2007). The world market for wood charcoal including shell or nut charcoal : a 2007 global trade perspective. *ICON Group Ltd, San Diego, CA, USA*, 108 p.

SCHENKEL Y., CREHAY R. (2005). Wood charcoal production, import and export within EU. *In Fast Pyrolysis of Biomass: a Handbook. Volume 3. A.V. Bridgwater ed., CPL Press pub., Newbury, UK*, p 173-178.

SEGON V., KULISIC B., KOJAKOVIC A., SIEMONS R. (2007). Market study: Charcoal in Croatia. Draft report, 38 p.

SPANISH AUTHORITY. Ministerio de Economia. Secretary of State for Energy, Industrial Development and SMEs Analysis and conclusions of monitoring in 2002 of the plan to promote renewable energy. October 2003.

SWEDISH ENERGY AGENCY (STEM). The Swedish Energy Market 2005. Theme: The Storm Gurund. The Energy Markets Inspectorate. 52 p. Sweden.

UK'S MINISTRY OF TRADE AND INDUSTRY. Government renewable energy policy. Available on: www.dti.gov.uk.