UDK 620.91:338.53

Energija in cene
Energy and Prices

VINCENC BUTALA

Naši raziskovalni inštituti so v preteklem obdobju končali študijo o razvojnih možnostih energetike v Sloveniji. Ministrstvo za energetiko je izdalo študijo Energija za Slovenijo, izdelana je bila študija o porabi in regulacijski moči v slovenskem elektrogospodarstvu, uvedeni so bili novi tarifni sistemi, pripravlja se morda referendum o zaprtju jedrske elektrarne v Krškem, itn. Zato ni odveč vprašanje: ali Slovenija ima začrtano energetsko strategijo. Prejšnji energetski minister je ob okrogli mizi v mesecu maju 1992 dejal: »Energetskega razvoja Slovenija nima, so pa narejeni številni projekti, na katere lahko opremo strategijo, vendar je vsak od njih različen.«

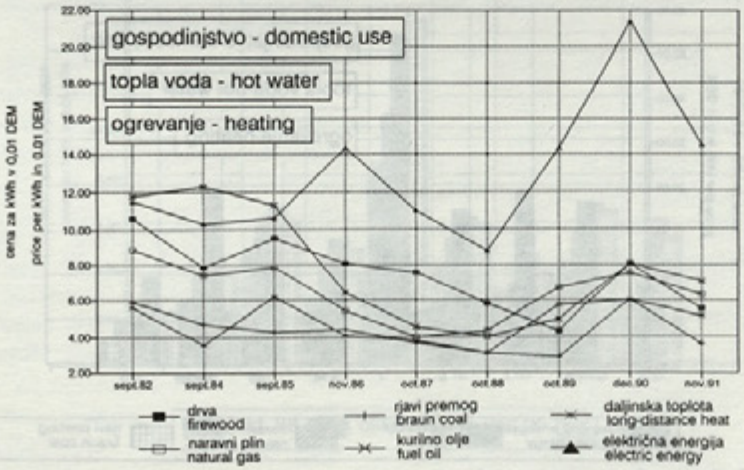
Na podlagi številnih študij je mogoče oceniti rabo posameznih vrst energije v prihodnosti, v nobeni študiji pa ni omenjena cenovna politika. Zavedati se je treba, da brez ekonomskih (cenovnih) kazalcev ni mogoč želen družbeni in gospodaski razvoj.

K strategiji energetske politike nedvomno sodi tudi cenovna politika. Ker seveda nimamo splošne energetske politike, tudi cenovne ne moremo imeti. Zaradi tega se stihijsko oblikujejo cene posameznim energentom, kar je razvidno iz diagrama 1. V diagramu prikazujemo ceno energije za preteko desetletje na ravni koristne energije v široki porabi (izračun je izdelan za objekt, katerega največje toplotne izgube znašajo 20 kW oziroma letni rabi energije 27500 kWh). Iz prikazanih cen energije, v katerih so zajeti posamezni prispevki in davki, je razvidno, da smo se v začetku 80. let ogrevali najceneje na daljinsko toploto, najdražje na posebno lahko kurilno olje, pa čeprav je upoštevana višja

During the recent period our research institutes have finished the study about the development potentialities of Slovenian power supply industry, the Ministry for Energy has prepared the study »Energy for Slovenia«. Moreover, the study of consumption and regulating power in Slovenian power supply industry has been elaborated, new tariff systems adopted, a referendum about the shutdown of nuclear power plant in Krško is probably about to be carried out etc. Consequently, one often wonders whether Slovenia has an established energy policy at all. In may 1992, our former energy secretary said in a round-table discussion: »There is no development of power supply industry in Slovenia, but there are several projects available on which our strategy could be based. However, each of them is different.«

On the basis of numerous studies, an estimate on the application of individual kinds of energy can be formed for the future, yet neither of them refers to the price policy. We simply have to realise that there can be no anticipated social and economic prosperity without economic (price) indexes.

Price policy is undoubtedly an important element of energy policy. However, having no general energy policy, we can't have a price policy. For this reason, the prices of some sources of energy are being formed arbitrarily what is clearly shown in diagram 1. The diagram demonstrates the price of energy during the past decade on the level of useful energy in mass consumption (the calculation has been made for an installation with a heat loss of 20 kW and a yearly consumption of 27500 kWh). From energy prices showh in the diagram, comprising individual contributions and taxes it appears that in the beginning of the eighties, in spite of higher



Sl. 1. *Cena koristne energije za široko porabo v Sloveniji.*
Fig. *Price of useful energy for mass consumption in Slovenia.*

tarifa električne energije. V poznejših osemdesetih letih se cenovna razmerja neprenehoma spreminjajo, le električna energija postane razumljivo najdražja. Takšna stihijska cenovna energetska politika ima seveda številne negativne posledice, npr. v večini kotlarn stanovanjskih objektov je načrtovana možnost rabe dveh, če ne že treh virov energije.

Energetika je področje, na katerem jasno odseva razvitost gospodarstva neke države. Zato so še kako zanimivi energetski cenovni sistemi razvitih držav oziroma njihova cenovna primerjava.

V naslednjih diagramih je prikazana cena energije za kWh na ravni končne energije za različne države ES in Slovenijo. Posamezni stolpci so oblikovani na podlagi letne rabe energije 30000 kWh (gospodinjstvo, topla voda, ogrevanje) v široki porabi z upoštevanjem vseh prispevkov in davkov. Pri izračunu cene električne energije je upoštevana cena porabe 20000 kWh nočne, cenejše tarife in 10000 kWh cene dnevne, dražje tarife. Stolpec »povprečje« v posameznem diagramu se nanaša na navedene države ES. Ker je poraba premoga v Italiji in na Nizozemskem zanemarljiva, cena zanju ni podana.

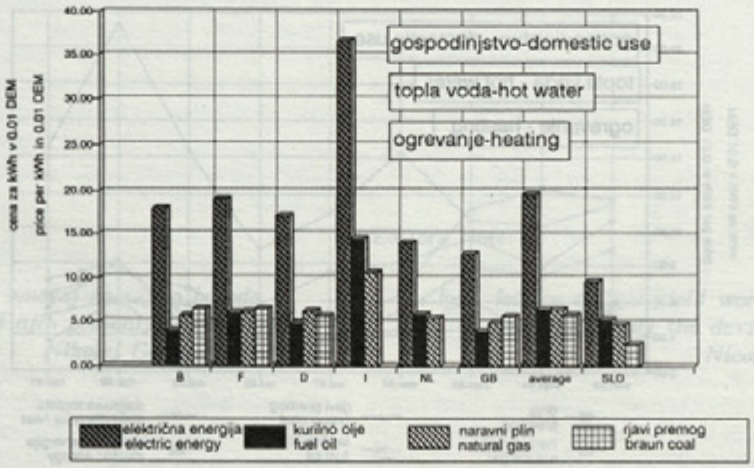
V diagramu 2 prikazujemo primerjalno za november 1991 ceno energentov in električne energije za široko porabo za posamezne države ES in Slovenijo. Iz diagrama je razvidno, da je bila, absolutno gledano, izmed navedenih držav energija v sektorju široke porabe najdražja v Italiji in najcenejša v Sloveniji. Veliko bolj kot absolutne cenovne postavke so zanimiva posamezna cenovna razmerja med osnovnimi energenti in električno energijo. Najzanimivejše je predvsem razmerje cene električne energije glede na posebno lahko kurilno olje, naravni plin in premog, kar prikazujemo v preglednici 1:

tariff-rate applied, long distance energy was the cheapest and fuel oil extra light the most expensive alternative. Through the later eighties the price situation was constantly changing, only the electric energy understandably becomes the most expensive source. Such unreasonable energy policy has of cource a number of negative consequences, as e.g.: the majority of boiler-houses of residential buildings are furnished with necessary equipment for utilization of two and even three different sources of energy.

Power industry is a sphere of activity which clearly reflects the development level of country's economy. For this reason, power price systems of the developed countries and a comparison between them are so much more interesting.

The following diagrams show the prices per kWh as final energy costs in different countries of the EC and Slovenia. We have formed individual columns on the basis of a yearly consumption of 30000 kWh (household, hot water preparation, heating), including all contribution and taxes. At the calculation of electric energy cost we have considered the price for the consumption of 20000 kWh charged at a lower (night) current rate and 10000 kWh charged at a daily (higher) rate. The »average« column in each diagram refers to the above mentioned countries, the members of the EC. As the consumption of coal in Italy and Holland is negligible, no prices for these two countries are stated in this column.

Diagram 2 is a comparative illustration of prices of energy sources and electric energy in mass consumption for some countries of Community and Slovenia, valid in November 1991. As we can understand from the diagram, absolutely speaking, the energy for mass consumption was most expensive in Italy and the cheapest in Slovenia. However, individual price relationships between the basic energy sources and electric energy seem to be much more interesting than absolute price items. The most interesting is the price relationship of electric energy in comparison with fuel oil (extra light), natural gas and coal, given in table 1.



Sl. 2. *Cena energentov za široko porabo v državah Zahodne Evrope za november 1991.*
Fig. 2. *Price of energy sources for mass consumption in West European countries in November 1991.*

Preglednica 1 — Table 1:

Država State	elektrika — electricity kuril.olje — fuel oil extra light	elektrika — electricity naravni plin — natural gas	elektrika — electricity premog — coal
Belgija (Belgium)	4,62	3,17	2,78
Francija (France)	3,13	3,10	2,93
Nemčija (Germany)	3,52	2,73	3,00
Italija (Italy)	2,47	3,43	—
Nizozemska (Holland)	2,39	2,59	—
Velika Britanija (Great Britain)	3,25	2,61	2,24
Slovenija (Slovenia)	1,79	2,04	4,00

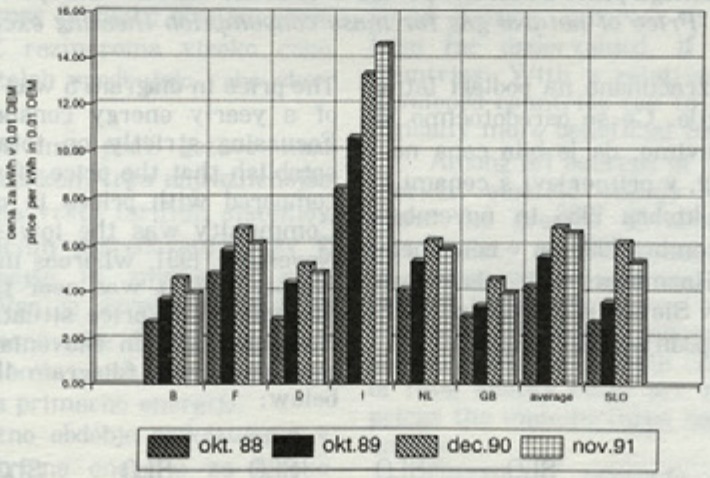
Iz preglednice nazorno razberemo, da je bilo razmerje cene električne energije v primerjavi z drugim energentom v Sloveniji podcenjeno glede na države ES, saj je bilo razmerje cene električne energije proti kurilnemu olju »samo« 1,79 in proti naravnemu plinu »samo« 2,04, kar je razmeroma nizko glede na druge države, kjer je to razmerje povprečno med 2,5 in 3,5. To lahko pomeni, da je cena električne energije pri nas prenizka glede na ceno kurilnega olja oziroma naravnega plina, ali pa sta njuni ceni previsoki glede na ceno električne energije. Zaradi takega stanja v Sloveniji skoraj »priporočamo« rabo električne energije za ogrevanje, kar je v razvitih državah Evrope nenavadno. Smo pa imeli zato najvišje cenovno razmerje med elektriko in premogom, kar 4,00, medtem ko se v drugih deželah ES to razmerje giblje med 2,2 in 3,0.

Cena posebno lahkega kurilnega olja je bila v Sloveniji razmeroma visoka, pravzaprav v povprečju cen držav ES (če ne upoštevamo Italije), kar je prikazano za pretekla štiri leta na sliki 3. Razmerja cene posebno lahkega kurilnega olja v Sloveniji glede na druge države za november 1991:

It is evident from the table above (the price ralationship of electricity towards extra light fuel oil was »only« 1.79 and towards natural gas »only« 2.04 which is relatively low with regard to other conuntries, where the relationship is between 2.5 and 3.5 in the average), electric energy has been undervalued in comparison with other countries of the European Community. The meaning of this can be that the price of electric energy in Slovenia is too low with regard to the prices of fuel oil (extra light) or natural gas. Consequently, we almost »recommend« people to heat with low-priced electricity which is very unusual for the developed countries of the Community. On the other hand, our price relationship between electricity and coal had been the highest with the value of not less than 4.00, whereas in other countries of the Community the same relationship ranges between 2.2 and 3.0.

The price of fuel oil (extra light) has been relatively high in Slovenia, as a matter of fact, somewhere around the European average (not considering Italy). We have made this clear in diagram 3 for the past four years, showing the price situation of fuel oil (extra light) prices for Slovenia with regard to other countries, for November 1991:

	SLO B	SLO F	SLO D	SLO I	SLO NL	SLO GB
razmerje: ratio:	1,37	0,88	1,10	0,37	0,91	1,37



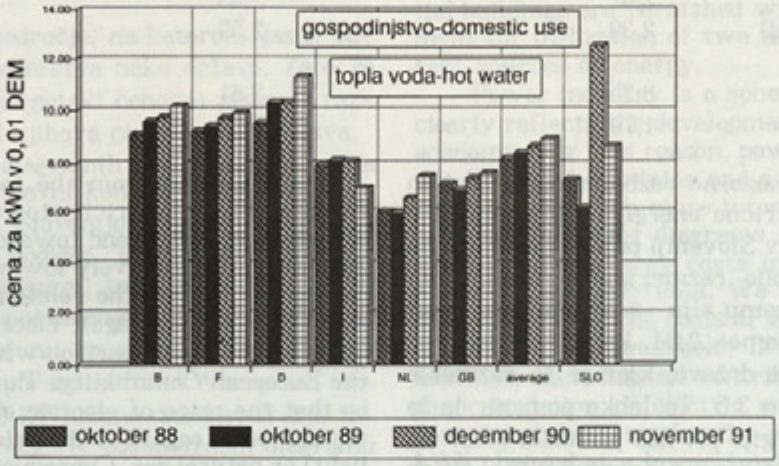
Sl. 3. *Cena posebno lahkega kurilnega olja za široko porabo v državah Zahodne Evrope.*
Fig. 3. *Price of fuel oil extra light for mass consumption in West European countries.*

Posebno lahko kurilno olje za ogrevanje je bilo v novembru 1991 cenejše v Belgiji, Nemčiji in Veliki Britaniji kakor v Sloveniji.

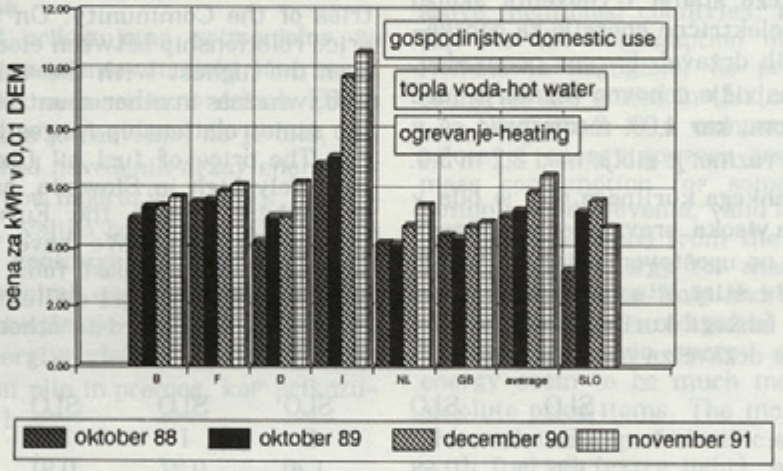
V diagramu 4 so prikazane cene naravnega plina za široko porabo v preteklih štirih letih pri porabi plina za celotno oskrbo, v diagramu 5 pa samo za gospodinjstvo in toplo vodo (brez ogrevanja).

In November 1991, fuel oil (extra light) in Belgium, Germany and Great Britain was cheaper than in Slovenia.

Diagram 4 shows the prices of natural gas for total mass consumption for the last four years, whereas diagram 5 demonstrates the price of natural gas consumed only in household and for the preparation of hot water (heating excluded).



Sl. 4. *Cena naravnega plina za široko porabo v državah Zahodne Evrope (celotna oskrba).*
Fig. 4. *Price of natural gas for mass consumption (total consumption).*



Sl. 5. *Cena naravnega plina za široko porabo v državah Zahodne Evrope (brez ogrevanja).*
Fig. 5. *Price of natural gas for mass consumption (heating excluded).*

Cena v diagramu 5 je izračunana na podlagi letne porabe 3500 kWh energije. Če se osredotočimo le na celotno oskrbo ugotovimo, da je bila cena naravnega plina v Sloveniji, v primerjavi s cenami v državah ES, najnižja oktobra 1988 in novembra 1991; oktobra 1989 in decembra 1990 pa v cenovnem povprečju držav ES. Razmerja cene naravnega plina za november 1991 v Sloveniji in državah EGS (diagram 4) prikazuje spodnja preglednica:

The price in diagram 5 was calculated on the basis of a yearly energy consumption of 3500 kWh. Focussing strictly on total supply we have to establish that the price of natural gas in Slovenia compared with prices in other countries of the Community was the lowest in October 1988 and November 1991, whereas in October 1989 and December 1990 it was near the average of the Community. The price situation for natural gas in November 1991 in Slovenia and the countries of the Community (diagram 4) is shown in the table below:

	SLO/B	SLO/F	SLO/D	SLO/I	SLO/NL	SLO/GB
razmerje: ratio:	0,82	0,77	0,75	0,45	0,87	0,97

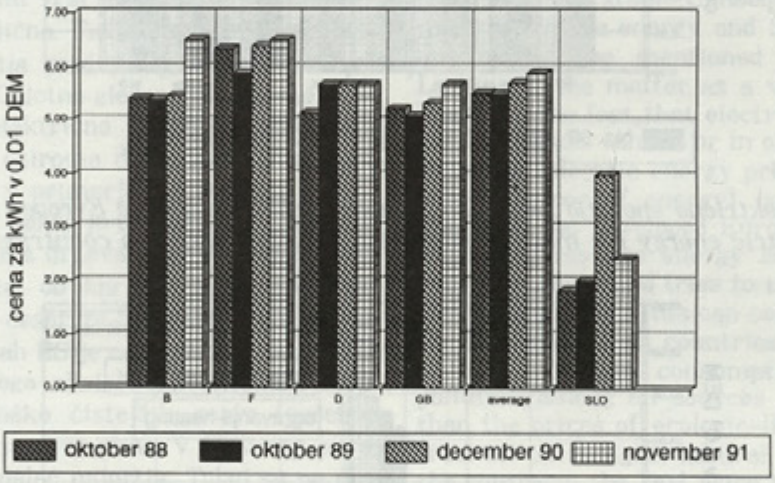
Ogrevanje z naravnim plinom je bilo od vseh navedenih držav v Sloveniji najcenejše, le v Veliki Britaniji je bila cena malenkostno višja. Če smo naravni plin rabili zgolj za pripravo tople vode in kuhanje (diagram 4), je bila njegova cena novembra 1991 v Italiji, na Nizozemskem in v Veliki Britaniji nižja kakor v Sloveniji.

Cena premoga za široko porabo v Sloveniji ni konkurenčna cenam v navedenih državah ES. V diagramu 6 je prikazana cena premoga za široko porabo na ravni končne energije za Slovenijo in države ES. Ker diagram pove vse, podajmo le razmerja cene v Sloveniji in državah (ES za november 1991:

Among all stated countries, Slovenia had the cheapest heating with natural agas except Great Britain, where the price was slightly higher. If natural gas had been used merely in household and for the preparation of hot water (diagram 4), its price in November 1991 in Italy, Holland and Great Britain was lower than in Slovenia.

The coal price for mass consumption in Slovenia doesn't meet competiton with prices in the states of the EC mentioned above. Diagram 6 shows the coal price for mass consumption on the level of final energy for Slovenia and the states of the EC. As the diagram is expressive enough, we only want to state the price situation in Slovenia and the countries of the EC November 1991.

	SLO	SLO	SLO	SLO
razmerje:	B	F	D	GB
ratio:	0,37	0,37	0,42	0,42



Sl. 6. *Cena premoga za široko porabo v državah Zahodne Evrope.*
Fig 6. *Price of coal for mass consumption in West European countries.*

Zanimivo je, da sta ceni premoga enaki v Franciji in Belgiji ter Nemčiji in Veliki Britaniji, v Sloveniji pa je bil premog prenizko ocenjen glede na navedene države. Z razmeroma visoko ceno premoga v razvitih deželah spodbujajo rabo ekološko prijaznejših goriv.

Električna energija ima prav gotovo med vsemi energenti na evropskem trgu najrazličnejše cene. V Evropi velja cela vrsta tarifnih sistemov ter tudi ogromno različnih posredovanj držav k spodbujanju enakomernejše in zmanjšane rabe (električne) energije. Vse je seveda odvisno od energetskega položaja posamezne države. Različne cene izvirajo že v različnih cenah, ki jih morajo plačevati proizvajalci za primarno energijo.

Za preteklo štiriletno obdobje prikazujemo v diagramu 7 ceno električne energije za široko porabo v gospodinjstvu in za pripravo tople vode (upoštevano: letna raba 3500 kWh, po dnevni,

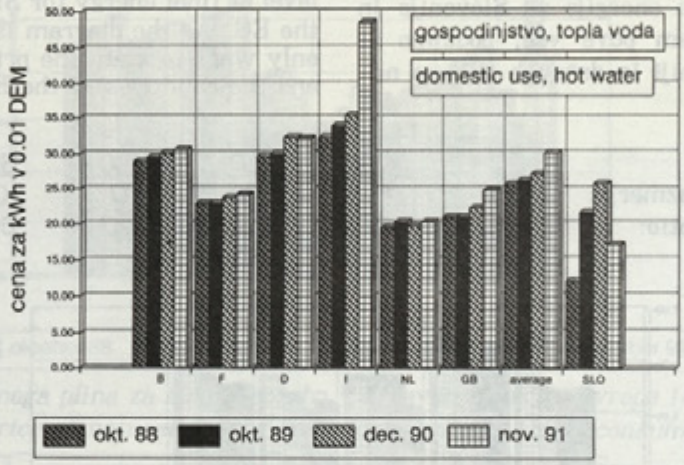
It is interesting that the coal has the same price in France and Belgium, in Germany and Great Britain, whereas in Slovenia its price had been far undervalued, if compared with these countries. With a relatively high coal price the developed countries try to foster the use of ecologically more beneficial fuels.

Among all sources of energy in the European market, electric energy prices most certainly show the greates deviations. In Europe there is a variety of rate systems and the states try to stimulate a proportional and reduced consumption of (electric) energy with numerous interventions. Of course, everything depends on the energy potential of each country. Big differences of final energy costs are the result of different prices the manufactures have to pay for primary energy.

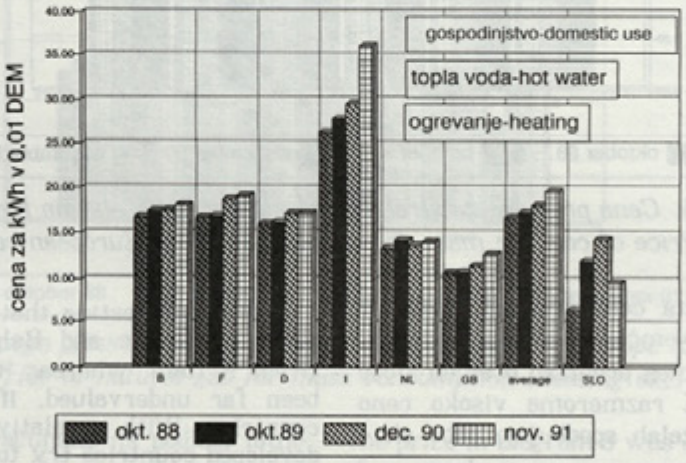
Diagram 7 presents the price of electric energy for mass consumption in household and for hot water preparation for the period of past four

višji tarifi), v diagramu 8 pa za celotno oskrbo (upoštevano: letna raba 20000 kWh nižja tarifa in 10000 kWh višja tarifa). V Sloveniji smo plačevali električno energijo leta 1988 in 1991 ceneje kakor v državah ES, medtem smo v letih 1989 in 1990 bili na spodnji meji cenovnega povprečja cen navedenih držav ES. To še posebej velja, če smo z električno energijo varčevali in smo jo rabili zgolj v gospodinjstvu in pripravi tople vode, ne pa za ogrevanje.

years, considering a yearly consumption of 3500 kWh charged at normal daily rate. Diagram 8 shows total supply, considering a yearly consumption of 20000 kWh at lower rate and 10000 kWh at higher rate. In 1988 and 1991, electric energy was cheaper in Slovenia than in the countries of EC, whereas in 1989 and 1990 the price was on the lower price average in the countries mentioned above. This especially applies if we were saving energy, i.e. used it only in household and for hot water preparation, but not for heating.



Sl. 7. *Cena električne energije za široko porabo v državah Zahodne Evrope (brez ogrevanja).*
Fig 7. *Price of electric energy for mass consumption in West European countries (heating excluded).*



Sl. 8. *Cena električne energije za široko porabo v državah Zahodne Evrope (celotna oskrba).*
Fig 8. *Price of electric energy for mass consumption in West European countries (total consumption).*

Razmerja cene električne energije v Sloveniji v primerjavi z državami ES v novembru 1991, prikazujemo glede na rabo energije:

Electric energy prices in Slovenia compared with the prices of the same in the countries of the EC in November 1991 are shown with regard to consumption in the table below:

	SLO/B	SLO/F	SLO/D	SLO/I	SLO/NL	SLO/GB
letna raba 3500 kWh yearly consumption 3500 kWh	0,56	0,70	0,53	0,35	0,84	0,69
letna raba 30000 kWh yearly consumption 30000 kWh	0,53	0,50	0,56	0,27	0,68	0,75

Glede na Slovenijo je bil v Italiji cenovni faktor 3,7 (najvišji) še zlasti, če so jo nesmotrno rabili za ogrevanje. Ne glede na dejstvo, da je cena električne energije v Italiji v letu 1991 močno poskočila, je zanimiv prikaz rasti cene električne energije za povprečje držav ES in Slovenijo (v pfenigih za kWh):

Compared with Slovenia, the price factor 3,7 was the highest in Italy, particularly if the use of electric energy was unreasonable, i.e. for heating. Apart from the fact that the price of electric energy skyrocketed in Italy in 1991, the demonstration of electric energy price development (in pfenigs for 1 kWh) for countries of the EC and Slovenia is quite interesting:

letna raba 3500 kWh yearly consumption of 3500 kWh	okt. 88	okt. 89	dec. 90	nov. 91
povprečje ES — EC average	25,66	26,22	27,23	30,04
Slovenija — Slovenia	12,02	21,55	25,78	17,02

letna raba 30000 kWh yearly consumption of 30000 kWh	okt. 88	okt. 89	dec. 90	nov. 91
povprečje ES — EC average	16,68	17,24	18,07	19,63
Slovenija — Slovenia	6,65	12,00	14,30	9,61

Cene posameznih vrst energije se v različnih državah gibljejo različno. Tako ima Italija najdražjo energijo, Slovenija med navedenimi državami Evrope najcenejšo. Celotno gledano ne smemo prezreti, da je cena električne energije v Sloveniji prenizko ocenjena, oziroma da cenovna razmerja električne energije v primerjavi z drugimi energenti niso ustrezna, kakor je to običajno v razvitih deželah Evrope. Vsaka država daje prednost določeni vrsti energenta, ob kar najrazumnejši rabi električne energije, česar za Slovenijo ne moremo trditi. V vseh državah ES je cena premoga v široki porabi, kot največjega ekološkega onesnaževalca, višja od cene okološko čistejših goriv (posebno lahko kurilno olje, naravni plin), v Sloveniji pa je prav cena premoga daleč najnižja. Torej se ne čudimo, da ob nevarčni rabi električne energije, ki jo v zimskem obdobju v pretežni meri pridobimo predvsem iz termoelektrarn pri kurjenju cenenega premoga z velikim deležem žvepla, vplivamo na čezmerno škodljivo onesnaženje okolja.

The prices of individual kinds of energy differ from state to state. Consequently, Italy has the most expensive energy and Slovenia the cheapest one among the mentioned European countries. Looking at the matter as a whole, we should not disregard the fact that electric energy in Slovenia has been undervalued, or in other words, the price situation (electric energy prices against prices of other sources of energy) is quite inappropriate, unlike in the developed European countries. Each country gives one energy source the preference over the others and tries to utilize electric energy most effectively. This can certainly not be claimed for Slovenia. In all countries of the EC, the price of coal for mass consumption, as the heaviest pollutant among all sources of energy, is higher than the prices of ecologically less harmful fuels (fuel oil extra light, natural gas). In Slovenia, on the contrary, the coal price is the lowest. Therefore, we shouldn't be surprised if our electric energy which during the winter months is being produced mostly in fossile fuelled power stations by means of combustion of low-prices coal with high sulphur content, in sonsumed uneconomically, thus causing excessive and harmful environmental pollution.

LITERATURA
REFERENCES

[1] European Energy Pricewatch, november 1991, december 1990, oktober 1989, oktober 1988.

[2] Butala, V.: »Ali je sedanja cena električne energije primerna«. Časopis Delo, januar 1992.

[3] Butala, V.: Spremljanje cen posameznih energentov v Sloveniji, lastni arhiv

Naslov avtorja: mag. Vincenc Butala, dipl. inž.
Fakulteta za strojništvo
Univerze v Ljubljani
Murnikova 2, Ljubljana
Slovenija

Author's Address: Mag. Vincenc Butala, Dipl. Ing.
Faculty of Mechanical Engineering
University of Ljubljana
Ljubljana, Murnikova 2
Slovenia

Prejeto: 2.7.1992
Received:

Sprejeto: 18.8.1992
Accepted: