

## **ENERGETIC USE OF THE WOOD - A SUSTAINABLE SOLUTION FOR THE WOOD CAPITALIZATION ON CRISIS TIME**

**Derczeni Rudolf, Iordache Eugen**

University of Transilvania Braşov, Faculty of Silviculture and Forest Engineering  
Şirul Beethoven No. 1  
Braşov, Romania  
e-mail: derczeni@unitbv.ro, i.eugen@unitbv.ro

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**Abstract:** *Third millennium began with a series of global issues related to energy resources, generated in particular by the dramatic increase of the prices of fossil fuels. If a decade ago, researches made at European level in the wood capitalization field of interest were oriented towards the production of composite materials and chemical processing of wood, in recent years, at the global level, it is the emphasis the "sustainable forest management" especially the real power potential of the secondary wood resources. The world economic crisis triggered in 2008, has created a drop in demand for wood on the Romanian market and the authorities decided that it is necessary to made investments in the field of energetic use of the wood.*

### **1. Introduction**

Biomass represents 65% of Romania's renewable energy potential. However, investments in this field were summarized, so far only 20 million Euro. For comparison, those in the wind are a more than thousand times. The main reasons for the reluctance of investors are the dependence on infrastructure (which obliges them to locate the productions capacity not more than one hundred kilometers distance from the resource) and the high cost required by the investments.

The world economic crisis triggered in 2008, has created a drop in demand for wood on the Romanian market and the authorities decided that it is necessary to made investments in the field of energetic use of the wood. In this order, we have to highlight that starting from august 2009, auctions for wood organized by National Forest Administration (NFA) in each Forest County from western part of Romania (Reşiţa, Timişoara and Arad) were closed without any stands to be awarded by any forest logging operator (source NFA). In these conditions, for each Forest County – and starting from this, for each District County – was very difficult to made the payment for their employees and also to made the payments for the economic agents are doing different works in their area. Taking into account this situation, the NFA has in intention to find another way to finance these Forest Counties. Because they could not sell the timber for sawmills, another sustainable resource for financing the NFA activities could be the timber for energy purpose (pellets).

### **2. Pellets production in Romania**

In the present days, in Romania are more than 20 enterprises for pellets production, with more 250000 tone annual production, enterprises that do not give any information regarding the total production costs. However, due of lack of domestic demands, these enterprises are working especially for export, especially in European Union.

Taking into account that in January 2006, the Romanian pellets enterprises sold 1 tone of pellets for 100 – 120 Euro on the European market, we could say that the value of the production cost is lower than the minimum in Europe (Source ProLigno). A relevant evidence regarding the processing cost is that the sawdust was sold during 2009 with prices between 1 and 3 EURO/tonne which represents less than ten times than on the European market. The Romanian enterprises sold the pellets starting from 120 EURO/tonne in January 2008 up to 180 EURO/tonne in August 2009, but the production cost certainly have not increase in the same way. A theoretical assessment of production cost in Romania in comparison with the cost for electric energy, transport and sawdust, show that the medium price for one pellet tone is around 70 EURO, price which could be different depending of the line production capacity and the distance from where the primary wood mass was brought. Taking into account these estimations, even if the acquisition price of sawdust will increase with ten than present prices, the production cost will not reach 80 EURO/tonne (Source ProLigno).

The ascendant trend of pellet utilization in EU involved different countries in promoting local and regional strategies. These strategies referred to promote some fast growing species (as “energetic willow” – 50.000 ha in Sweden). In Romania are some legislative problems to promote this kind of species – there are just few economic agents which had the licence to cultivate these species – there is no governmental regulation to subvention them. The solution of pellets utilisation has the advantage that this resource is renewable and is not limited in resources like current solutions (fossil fuels).

In these conditions, the NFA decide to invest in pellet production. In the first stage, the primary resource will be represented by firewood.

### **3. Case Study**

#### **3.1 Place of study**

To highlight the possibilities to product energy resources from wood, were taken into the studies three Forest Counties - Reșița , Timișoara and Arad – located in the western part of Romania (figure 1).The main reason of choosing this location is the nearest with the western countries of Europe in which the export could made which would not generate a significant increase in transport prices, so there are more possibilities to export the final product – pellets. Another reason was that in the Reșița Forest County is the largest forest area owned by state and this together with the forest from Timișoara and Arad Forest Counties could cover the necessity of one or probably two pellet factories.

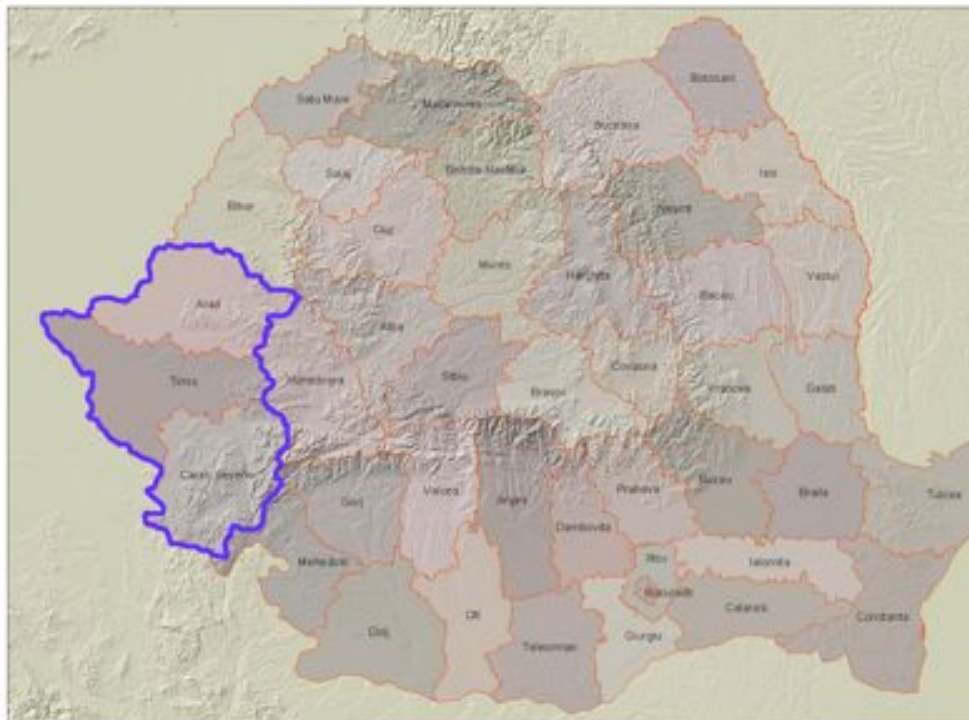
#### **3.2 Methodology**

In a first stage it was made an assessment of the firewood volume that could be obtained in each Forest County for pellet production. The amounts of firewood were calculated for stands auctioned in 2009 by the Forestry Counties and the Forest Districts. The evaluation was made – in the first stage – for firewood, because this will represents the main resource for pellets production.

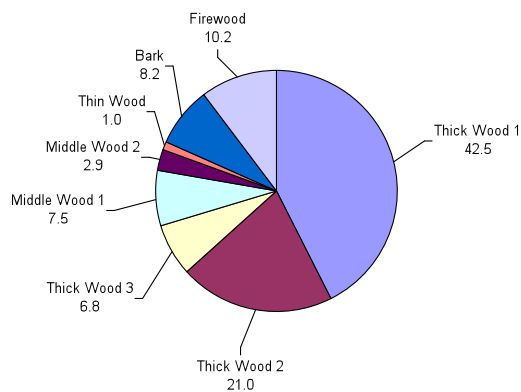
It was not taken into account in this step the timber that could be used for sawmills. Also, the firewood that is providing to peoples for domestic needs it was not taken into account.

To estimate the total firewood resource from each stand, the data were collected from inventory documents which are completed before each auction for each stand. The firewood is expressed in percent from the total volume and includes also the branches (figure 2 and 3). The branches represent 41.9% (ie 4.3% from total volume) for coniferous species and 21.5% (ie 5.4% from total volume) for hardwood species.

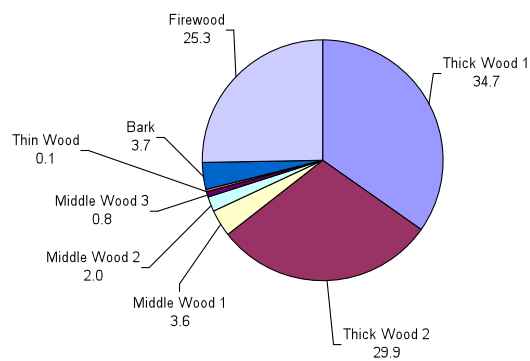
Were determined quantities of firewood for different species, because the calorific value of pellets is given by the calorific value of the wood from which is made.



**Figure 1.** Place of study



**Figure 2.** Categories of wood assortments (in %) that could be obtained in accordance with the inventory documents for conifers (Blaj, 2008)



**Figure 3.** Categories of wood assortments (in %) that could be obtained in accordance with the inventory documents for broadleaves (Blaj, 2008)

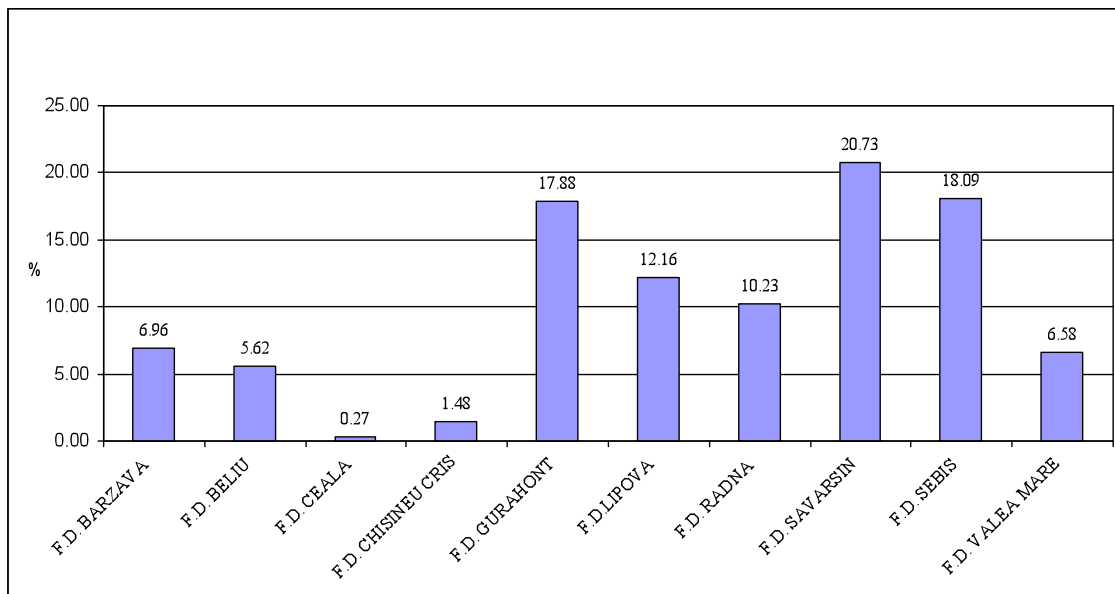
### 3.3. Results

The results regarding the firewood that was possible to be obtained in Arad Forest County in 2009 are presented in table 1 and figure 4. The total volume of firewood that was available in 2009 in Arad Forest County was around 50000 m<sup>3</sup>.

It could be observed that from the total firewood volume that was available in 2009 in Arad Forest County, there are three Forest Districts which has major participation (Savarsin, Sebis and Guragont), together totalized around 60%.

**Table 3.** Firewood possibility – 2009 Arad Forest County

| Current number | Forest District    | Number of stands in auction in 2009 | Species       |              |              |                               |                               | Total firewood mc | % from total firewood |
|----------------|--------------------|-------------------------------------|---------------|--------------|--------------|-------------------------------|-------------------------------|-------------------|-----------------------|
|                |                    |                                     | Coniferous mc | Beech mc     | Oaks mc      | Different Softwood species mc | Different Hardwood species mc |                   |                       |
| 0              | 1                  | 2                                   | 3             | 4            | 5            | 6                             | 7                             | 8                 | 9                     |
| 1              | F.D. BARZAVA       | 15                                  | 26            | 549          | 1578         | 912                           | 383                           | 3447              | 6.96                  |
| 2              | F.D. BELIU         | 21                                  | 1             | 1575         | 516          | 619                           | 72                            | 2783              | 5.62                  |
| 3              | F.D. CEALA         | 2                                   | 0             | 0            | 0            | 0                             | 136                           | 136               | 0.27                  |
| 4              | F.D. CHISINEU CRIS | 4                                   | 0             | 506          | 108          | 87                            | 34                            | 734               | 1.48                  |
| 5              | F.D. GURAHONT      | 70                                  | 322           | 5916         | 545          | 1535                          | 533                           | 8850              | 17.88                 |
| 6              | F.D. LIPOVA        | 31                                  | 0             | 111          | 4679         | 740                           | 488                           | 6019              | 12.16                 |
| 7              | F.D. RADNA         | 30                                  | 13            | 1241         | 1864         | 1325                          | 620                           | 5062              | 10.23                 |
| 8              | F.D. SAVARSIN      | 62                                  | 51            | 4119         | 2402         | 2640                          | 1048                          | 10260             | 20.73                 |
| 9              | F.D. SEBIS         | 99                                  | 181           | 5636         | 1056         | 1719                          | 362                           | 8953              | 18.09                 |
| 10             | F.D. VALEA MARE    | 18                                  | 1             | 1415         | 523          | 1044                          | 276                           | 3259              | 6.58                  |
| <b>Total</b>   |                    | <b>352</b>                          | <b>594</b>    | <b>21068</b> | <b>13270</b> | <b>10622</b>                  | <b>3949</b>                   | <b>49503</b>      | <b>100.00</b>         |



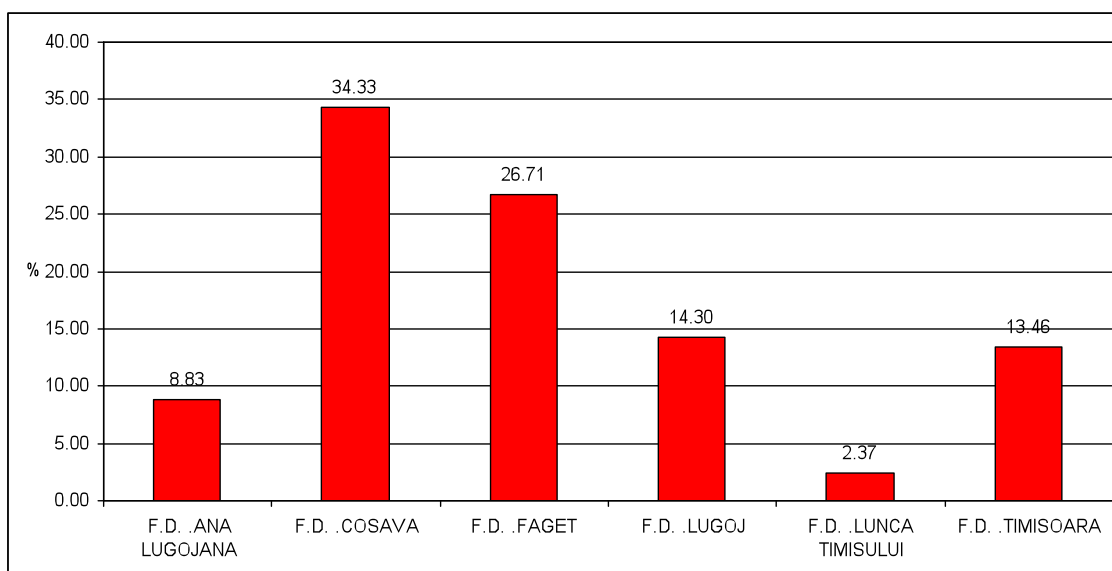
**Figure 4.** Proportion of firewood per Forest Districts (F.D) from total firewood - Arad Forest County

The results regarding the firewood that was possible to be obtained in Timișoara Forest County in 2009 are presented in table 2 and figure 5. The total volume of firewood that was available in 2009 in Timișoara Forest County was around 40000 m<sup>3</sup>.

It could be observed that from the total firewood volume that was available in 2009 in Timișoara Forest County, Covasa and Faget Forest Districts totalized around 60%.

**Table 3.** Firewood possibility – 2009 Timișoara Forest County

| Current number | Forest District      | Number of stands in auction in 2009 | Species       |              |              |                               |                               | Total firewood mc | % from total firewood |
|----------------|----------------------|-------------------------------------|---------------|--------------|--------------|-------------------------------|-------------------------------|-------------------|-----------------------|
|                |                      |                                     | Coniferous mc | Beech mc     | Oaks mc      | Different Softwood species mc | Different Hardwood species mc |                   |                       |
| 0              | 1                    | 2                                   | 3             | 4            | 5            | 6                             | 7                             | 8                 | 9                     |
| 1              | F.D. ANA LUGOJANA    | 55                                  | 26            | 549          | 1578         | 912                           | 383                           | 3447              | 8.83                  |
| 2              | F.D. COSAVA          | 103                                 | 111           | 9724         | 683          | 2468                          | 411                           | 13396             | 34.33                 |
| 3              | F.D. FAGET           | 90                                  | 129           | 3447         | 3777         | 2320                          | 750                           | 10423             | 26.71                 |
| 4              | F.D. LUGOJ           | 78                                  | 1             | 394          | 2196         | 2481                          | 509                           | 5582              | 14.30                 |
| 5              | F.D. LUNCA TIMISULUI | 23                                  | 0             | 0            | 642          | 241                           | 40                            | 923               | 2.37                  |
| 6              | F.D. TIMISOARA       | 54                                  | 0             | 0            | 3897         | 1064                          | 292                           | 5252              | 13.46                 |
| <b>Total</b>   |                      | <b>403</b>                          | <b>267</b>    | <b>14114</b> | <b>12773</b> | <b>9485</b>                   | <b>2384</b>                   | <b>39023</b>      | <b>100.00</b>         |



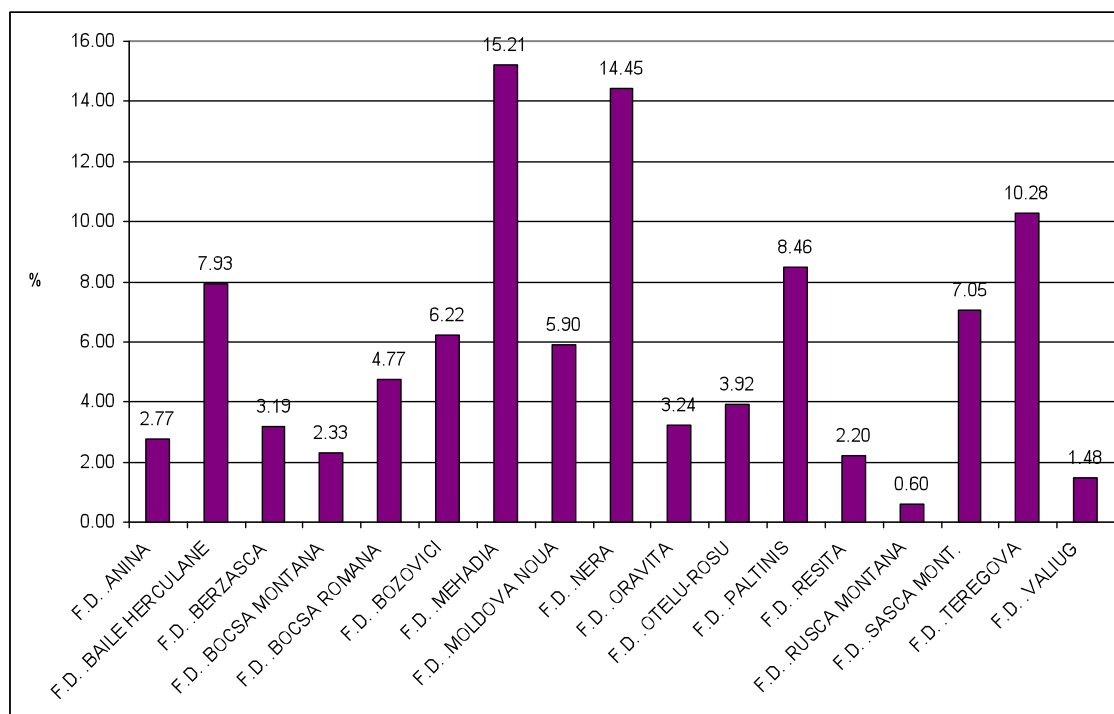
**Figure 5.** Proportion of firewood per Forest Districts (F.D) from total firewood – Timișoara Forest County

The results regarding the firewood that was possible to be obtained in Reșița Forest County in 2009 are presented in table 3 and figure 6. The total volume of firewood that was available in 2009 in Reșița Forest County was around 122 000 m<sup>3</sup>.

It could be observed that from the total firewood volume that was available in 2009 in Reșița Forest County, Mehadia and Nera Forest Districts totalized has the main participation.

**Table 3.** Firewood possibility – 2009 Reșița Forest County

| Current number | Forest District     | Number of stands in auction in 2009 | Species       |              |              |                               |                               | Total firewood mc | % from total firewood |
|----------------|---------------------|-------------------------------------|---------------|--------------|--------------|-------------------------------|-------------------------------|-------------------|-----------------------|
|                |                     |                                     | Coniferous mc | Beech mc     | Oaks mc      | Different Softwood species mc | Different Hardwood species mc |                   |                       |
| 0              | 1                   | 2                                   | 2             | 3            | 4            | 5                             | 6                             | 7                 | 8                     |
| 1              | O.S.ANINA           | 22                                  | 218           | 2118         | 0            | 695                           | 348                           | 3379              | 2.77                  |
| 2              | O.S.BAILE HERCULANE | 36                                  | 44            | 9485         | 53           | 36                            | 52                            | 9670              | 7.93                  |
| 3              | O.S.BERZASCA        | 28                                  | 0             | 3287         | 226          | 176                           | 198                           | 3887              | 3.19                  |
| 4              | O.S.BOCSA MONTANA   | 33                                  | 1             | 368          | 1104         | 604                           | 759                           | 2836              | 2.33                  |
| 5              | O.S.BOCSA ROMANA    | 34                                  | 32            | 287          | 3731         | 1004                          | 763                           | 5817              | 4.77                  |
| 6              | O.S.BOZOVICI        | 31                                  | 14            | 7136         | 113          | 114                           | 206                           | 7583              | 6.22                  |
| 7              | O.S.MEHADIA         | 59                                  | 122           | 18238        | 0            | 44                            | 140                           | 18544             | 15.21                 |
| 8              | O.S.MOLDOVA NOUA    | 43                                  | 258           | 3372         | 470          | 1691                          | 1409                          | 7199              | 5.90                  |
| 9              | O.S.NERA            | 57                                  | 69            | 17532        | 0            | 11                            | 6                             | 17618             | 14.45                 |
| 10             | O.S.ORAVITA         | 27                                  | 5             | 1558         | 1063         | 711                           | 609                           | 3945              | 3.24                  |
| 11             | O.S.OTELU-ROSU      | 37                                  | 545           | 3262         | 3            | 672                           | 294                           | 4776              | 3.92                  |
| 12             | O.S.PALTINIS        | 53                                  | 217           | 6130         | 1309         | 1939                          | 722                           | 10317             | 8.46                  |
| 13             | O.S.RESITA          | 31                                  | 47            | 1022         | 1100         | 352                           | 167                           | 2688              | 2.20                  |
| 14             | O.S.RUSCA MONTANA   | 8                                   | 161           | 515          | 0            | 23                            | 28                            | 726               | 0.60                  |
| 15             | O.S.SASCA MONT.     | 36                                  | 11            | 6037         | 840          | 1172                          | 539                           | 8600              | 7.05                  |
| 16             | O.S.TEREGOVA        | 52                                  | 425           | 11651        | 0            | 267                           | 197                           | 12540             | 10.28                 |
| 17             | O.S.VALIUG          | 19                                  | 355           | 1374         | 0            | 76                            | 1                             | 1806              | 1.48                  |
| <b>18</b>      | <b>Total</b>        | <b>606</b>                          | <b>2524</b>   | <b>93371</b> | <b>10012</b> | <b>9586</b>                   | <b>6438</b>                   | <b>121931</b>     | <b>100.00</b>         |



**Figure 6.** Proportion of firewood per Forest Districts (F.D) from total firewood – Reșița Forest County

#### **4. Conclusions and recommendations**

From the presented data it could be observed that Reșița Forest County could provide the most important firewood volume, which exceeds the amount that could be provided by Arad and Timișoara Forest Counties together. The fact that Forestry Department Reșița provide the greatest amount of firewood (because has the largest forest area), explains also the presence of two of the three pellet plants on the area of these three studied Forest Counties. Also, two Forest Districts from Reșița Forest County, respectively Mehadia and Nera, could provide together a quantity of firewood that it is almost equal with the one that could be provided by Timișoara Forest County.

Taking into account these data, it could be appreciate that there are two possibilities to develop some pellets production capacity in the studied area. The first option presume to find a location in Reșița Forest County, closer to Timișoara Forest County limit, to process the whole firewood quantity from these three Forest Counties. The second option presumes to identify two locations: one in Reșița Forest County for the timber from this area and one in Timișoara Forest County to process the wood also from the Arad Forest County. In both cases, NFA should provide more possible locations. After an economic analysis of each, which will include also the transport costs of the primary resource – firewood – the optimal solution will be chosen.

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