

JUST TRANSITION IN HUNEDOARA

**ECONOMIC DIVERSIFICATION IN A
FAIR AND SUSTAINABLE MANNER**



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CONTENT

COAL IN THE PAST, PRESENT AND FUTURE	7
1.1. The role of coal in the current energy model	7
1.2. Meeting climate objectives - challenges from the market	9
1.3. The future of coal - short, medium and long-term forecast	13
<hr/>	
JUST TRANSFORMATION - EXAMPLES OF GOOD PRACTICES AT INTERNATIONAL LEVEL	18
2.1. Introduction	18
2.2. Theoretical framework and supporting documents	18
2.3. Examples of good practices in mine restoration and post-coal transition	23
<hr/>	
THE SOCIAL-ECONOMIC PROFILE OF JIU VALLEY	26
3.1. Geographical characteristics	26
3.2. Demographic profile and workforce	29
3.3. Economic profile	36
3.4. The labour market	38
3.5. Infrastructure	40
3.6. Education	41
3.7. Social services	43
<hr/>	
ALTERNATIVE ECONOMIC DEVELOPMENT SCENARIOS	45
4.1. The inaction scenario	45
4.2. Modernisation of Paroşeni unit	48
4.3. Alternative scenarios of economic development	50
4.3.1. The primary sector	51
4.3.2. The secondary sector	55
4.3.3. The tertiary sector	68
4.4. Analysis and comparison of scenarios	73
4.4.1. Comparison inaction vs modernisation	79
4.4.2. Comparison inaction vs alternative sectors	80
4.4.3. Comparison modernisation vs alternative sectors	82
4.5. Incompatibility of alternative activities with sustaining coal based economy	84
4.6. Prerequisites to ensure a post-coal transition	85
4.6.1. Prerequisites and recommendations	85
4.6.2. Sources of funding	89
<hr/>	
CONCLUSIONS	91
METHODOLOGY	93
ANNEXES	95

ABBREVIATIONS

EIB	European Investment Bank
EBRD	European Bank for Reconstruction and Development
IBRD	International Bank for Reconstruction and Development
CEF	Connecting Europe Facility
CEH	Complexul Energetic Hunedoara
OECD	Organization for Economic Cooperation and Development
ILO	International Labour Organisation
GDP	Gross Domestic Product
ICT	Information and Communication Technology
UNESCO	United Nations Educational, Scientific and Cultural Organisation

FOREWORD

Now, at 150 years of coal mining, the Jiu Valley has to respond to the new challenges of the 21st century. The profound economic changes in the world and on the European level require the use of cheap and clean energy sources.

The exploitation of coal from the underground in the current technological conditions and lacking investments generate relatively high costs, which are later found in the cost of energy production. This phenomenon together with the decrease of the energy requirement for the Romanian economy during the last 20 years has forced the activity restriction and the closure of the mines in the Jiu Valley. The layoffs in mining started in 1997. There was no plan for creating alternative job offers and the dismissed persons were not offered a programme of conversion in the medium and long term. This has and still generates the depopulation of a region of particular beauty and with an exceptional human quality and that is shaped by multiculturalism in which we find over 20 nationalities.

In December 2017, the European Commission launched the “Platform for Coal Regions in Transition”, in order to assist the energy transition in the coal regions of Europe, of which the Jiu Valley is part of. This opens prospects for financing viable, alternative solutions for the economic development of the Jiu Valley.

For a sustainable development of these regions, an Association of local entities should be created to identify large projects designed to ensure the employment of a significant number of people, to find areas for industrial parks to attract investors, to create unitary conditions and facilities for companies that want to settle here, and to think of the Jiu Valley as a whole.

First of all, this Association would need to work on establishing a unitary vision on the development of the regional tourism, on an ecological transport system in the area, on the modernisation of the heating system, the infrastructure, etc.

The fact that the University of Petroșani operates in the Jiu Valley is a very important factor, because it can and it definitely should contribute to the development of energy research through unconventional coal recovery solutions, but also in other industrial areas, as well as to the preparation of future entrepreneurs (projects already funded for this purpose are already underway), at the formation and reconversion of the workforce according to the requirements of the companies that are investing here. And, of course, the university should actively design a strategy of the Jiu Valley that integrates into the development strategy of the Hunedoara county.

*Prof. univ. dr. ing. Sorin Mihai RADU
Rector of the University of Petroșani*

INTRODUCTION

Like many coal regions in Europe, Jiu Valley grew around coal production. Villages, cities, schools, hospitals and cultural centers have been built to host Romanians and foreigners coming to work in the coal mines of Jiu Valley in the first half of the last century. When these dominant industries decline, what is left behind is a tremendous economic development challenge.

When I first went to Jiu Valley in April 2019 I was struck by the commitment of community organizations to socially fair transition away from coal-based economy, but also by the opportunities which this transition presents to the local community. In July this year we hosted a return visit from the Mayors of Jiu Valley in Brussels during which they took a collective agreement to work together on the Just Transition of Jiu Valley. Coal mine closures in Jiu Valley present an undeniable challenge, but I also believe this is the moment for Jiu Valley to define a new chapter in its history.

This report is a great starting point for a collective discussion in Jiu Valley about its future. It identifies many viable opportunities for the development of new sectors of economic activity in Jiu Valley as the coal mining sector gradually disappears, leaving a tremendous cultural, social and architectural heritage behind.

Clean energy transition brings clear and demonstrated benefits which go beyond climate and environmental protection. Investments in modern energy systems have the potential to generate almost one million jobs over the next decade.

However, low-carbon transition is also a challenge for workers and regions

which rely on jobs in fossil fuel production. In that context, the European Union has a duty to act to make sure that this transition socially fair and brings benefits to all Europeans.

That is why the European Commission launched the Coal Regions in Transition Initiative in December 2017 as part of the Clean Energy Package for All Europeans. A dedicated Platform brings together 300 representatives of coal regions, cities, trade unions, industry, NGOs and government officials 4 times per year to identify best practices, compare notes, discuss project ideas and help match good ideas with financial support at the EU level.

I am delighted that Jiu Valley stakeholders are among our strongest participants in this discussion together with the Romanian government. As the mayors in Jiu Valley, together with the communities living in Jiu valley, and with the Romanian Government are working on a Just Transition Strategy for the Region, I am convinced that this report will be a valuable input into this important discussion.

The transition in Jiu Valley can be successful and I hope that we can continue our fruitful cooperation. The Commission stands ready to support the transition. Let us work together for a bright new future of this beautiful part of Europe.

*Klaus Dieter Borchardt
Deputy Director General at DG ENER,
European Commission*

EXECUTIVE SUMMARY

As a signatory of the 2030 Agenda for Sustainable Development, Romania has committed itself to a number of ambitious objectives regarding the energy sector, such as 43.9% emission reductions compared to 2005; at least 27.9% renewable energy in total energy consumption; at least 37.5% increase in energy efficiency by 2030.

Gradual decarbonisation of the economy involves, on the one hand, the gradual closure of coal power plants and their associated non-profitable mines and their replacement with renewable energy and, on the other hand, the creation of jobs in the primary, secondary and tertiary sectors for the workforce made redundant in mining, all included in the concept of “just transition”. This transformation process is dependent on the involvement of central and local budgets, funding from international financial institutions such as IBRD, EBRD, EIB and the private sector.

Following good practice examples of mining and post-coal transition in countries such as Australia, France, Germany, Poland, Spain, and considering the social and economic profile of Jiu Valley, this study proposes 5 scenarios of action to the decision-makers. The first two scenarios model two options for the mining sector: the inaction scenario (implying a violation of Romania's commitments and high budget costs to maintain unprofitable activities) versus the modernisation scenario of the Mintia and Paroşeni coal power plants (implying high costs of modernisation). The following three scenarios can be considered as alternative or complementary and refer to job creation in Jiu Valley, the primary, secondary and tertiary sectors, respectively. In the context of the inclusion of Jiu Valley in the post-coal transition assistance initiative *Platform for Coal Regions in Transition*, the detailed financial estimates in this report can be a starting point for the submitted projects and some sectors of interest for the area's development.



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PROJECT DESCRIPTION

The purpose of the research project in which this study is being developed is to identify and highlight the possible development alternatives of Hunedoara County as ways to replace the current mono-industrial profile based on coal and energy, according to the principles of the concept of "just transition".

The main objective of the research project is, therefore, to draw up a report on the fair transition in Hunedoara and fair and sustainable economic diversification, which contains:

- An overview of the current social-economic profile of Hunedoara County;

- Development of alternative scenarios, both in terms of intervention and lack of action of the main actors involved;

- Presentation of the foreseen trends for the coal and energy sectors at the national, European and international level, considering the actions to adapt to the impacts of climate change, the market and the investment environment. These forecasts consider the concept of a "just transition", the available European and international support, and the follow-up of examples of good practice;

- Perspectives and risks created by a of lack of action;

- Recommendations for the development of public policies.



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RESULTS

The expected outcome of the project is the present report/study, conceived as a comprehensive research report, based on international practices and in line with the main global trends, all adapted to the local context.

Therefore, the present study provides an in-depth analysis of the local environment by highlighting the exact social-economic profile of the region, illustrating cases of international best practices, and including theoretical perspectives and guiding principles of the concept of a just transition.

The most consistent part of the study includes the region's transformation scenarios, based on an input-output macro-economic modelling analysis.

Finally, the study provides recommendations for establishing a public policy that will cover the main issues that influence (or are affected by) the proposed action and inaction scenarios.

The study, therefore, has the following components:

1. The social-economic profile of Hunedoara County, detailing the main indicators, including demographics, workforce, skills, public administration, infrastructure, education, resources, enterprises, employers, political environment and existing public policies;

2. The macroeconomic model - from which three alternative development paths are developed, detailed on the primary, secondary and tertiary sectors, with the

necessary support measures, the necessary resources, the necessary investments in infrastructure, the social measures and the educational system adapted to the local context, within a short, medium and long-time horizon. The model is based on the input-output analysis that allows the estimation of the multiple effects that the implementation of these scenarios will have on the economy of Jiu Valley as a whole, both in terms of employment opportunities and local added value;

3. Comparison of the three scenarios, plus the two other scenarios - of (1) inaction and (2) modernisation of the Mintia and Paroşeni coal power plants - in terms of their chances of realisation, necessary resources and efforts, vulnerabilities and complexity in the short, medium and long term;

4. Prospects and risks of inaction, including the European environment and environmental legal framework, climate change investments and costs, the energy market, the efficiency of the coal and energy infrastructure, the European competition framework and all financial aspects;

5. Policy recommendations - Considering an integrated approach to a just transition process, the importance of engaging the public/communities, obtaining a political consensus on the just transition once agreed, engaging local leaders and leading the just transition process, as well as steps in the transition process, such as promoting the region in the international business environment and investing through the Chambers of Commerce, diplomatic missions, business fairs and forums.

The research and policy recommendations presented in the study fully follow the concept of "just transition" and its guiding principles, as illustrated by examples of international best practice and by the theoretical framework mapped during research, as well as coal energy models from the past, the present and the future, and ambitions to tackle climate change, together with market and investment challenges.

The research team that developed the study understands its purpose in a broader sense - not only to provide a report to support policy development in Hunedoara County but also to help raise awareness among decision-makers and other stakeholders at local, re-

gional, national and international level, on the importance and necessity of the fundamental transformation needed in the region in an integrated approach, triggering transformative effects at all levels of the local economy and society.

Moreover, such a research study paves the way for a new type of understanding of the necessary interventions in areas where the only effective approach is multi-level and integrated action, based on facts and figures and empirically grounded.



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COAL IN THE PAST, PRESENT AND FUTURE

1.1. THE ROLE OF COAL IN THE CURRENT ENERGY MODEL

The primary and secondary energy sector (direct energy produced from natural resources, respectively generated by a transformation process) is a vital component for the functioning of the economy, both directly, through the contribution to the GDP formation and indirectly through the support function for other industries and by ensuring the basic needs of individual consumers. In both cases, the work of this sector contributes to creating and sustaining jobs, to the state budget, but also to the development of communities directly influenced by the work of the involved chain of value.

Globally, the economy grew by 3.1% in 2017 compared to the previous year¹, maintaining the ascending tendency of recent years. At the same time, primary energy consumption followed a similar trend, with an increase of 2.2%, the fastest in 2013, with energy production following the same trend, given the 2.8%² increase. This is mainly due to developing countries, both in terms of consumption and production prospects, with China contributing the most to energy consumption. These results have inevitably led to a 1.6% increase in carbon emissions after a stagnation period, which is justifiable if we consider the considerable increase of the share of natural gas in the energy mix, especially in China.

However, this dynamic is not the main challenge for the future of economic development, but rather the quality of the global energy mix is the main point on the public agenda. The role of coal in the global energy mix is in a period of decline since 2011, contributing with 30.6% to primary energy consumption in 2016³, as shown in Image 1 below, and 27.6% in 2017, the lowest contribution since 2004⁴. This trend continues, although coal has seen a 1% consume increase and an even greater increase in production of 3.2% due to Chinese and Indian markets last year.

In Romania, the same trend is observed, as 19% of primary energy consumption in 2016 relied on coal, equivalent to 62.8 TWh, which is a decrease compared to 2011 when it was 26.4%.⁵

Instead, it is worth highlighting the increasingly important contribution of alternative energy sources such as solar or wind power, which is on an upward path in recent years. Renewable energy consumption increased by 17% in 2017 compared to the previous year, more than the average of the last 10 years.

¹World Bank, (2017), Databank

<https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2017&start=2007>

²BP Statistical Review of World Energy, (2018)

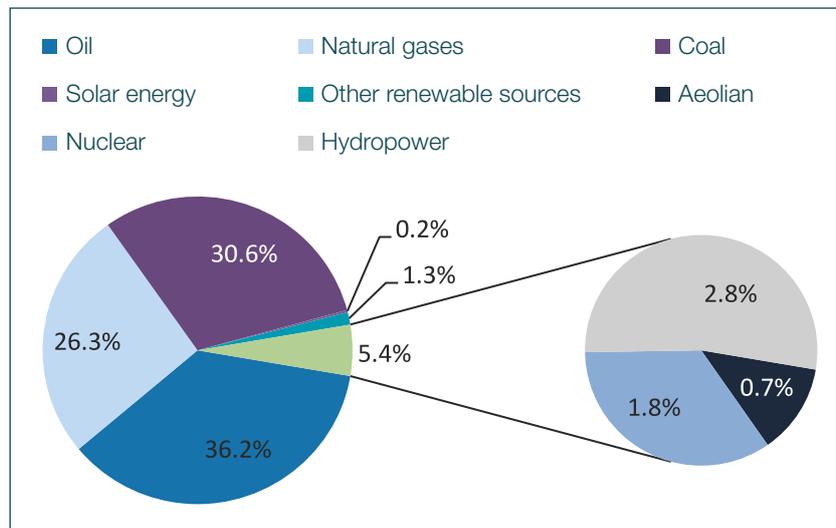
<https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review/bp-stats-review-2018-full-report.pdf>

³<https://ourworldindata.org/energy-production-and-changing-energy-sources>

⁴Idem 2

⁵Idem 3

IMAGE 1 – DISTRIBUTION OF PRIMARY ENERGY CONSUMPTION BY THE RESOURCE USED, 2016



Among the main energy consumers, the industrial sector has a significant share also in the demand for different types of energy. As it contributes almost one-third to global goods production at any level of the economy, the industrial activity requires a significant amount of energy resources, both in raw form (fuels) and in the form of raw materials. An analysis by McKinsey⁶ reveals that in 2014, 28% of global greenhouse gas emissions came from the generation of electricity used in industry, steadily increasing (2.2% per year) since 1990, while other energy-consuming sectors (such as transport), had a much slower growth of 0.9% per year. If we look specifically at carbon dioxide emissions, the industry is one of the main factors of carbon dioxide pollution, alongside residential buildings (and their dependence on heating sources) and transport.⁷

At the production level, transforming energy resources into electricity is one of the most important markets for the energy sector, using over 40% of resources in 2017⁸. Although it has been on the global public agenda for a long time, reducing the share of coal in electricity production has not made significant progress, remaining at a relatively stable level of 38% over the past 20 years. Despite the fact that considerable resources have been mobilised to encourage the use of renewable energy, the effect has not been fully felt in the energy mix because of the decrease of the share of nuclear energy. Thus, the changes did not alter the role of coal but generated permutations between the types of alternative resources. This is worrying because of the production of electricity on fossil fuels generates the highest amount of carbon dioxide.

⁶McKinsey&Company (2018), Decarbonization of industrial sectors: the next frontier

⁷<https://www.iea.org/statistics/co2emissions/>

⁸Idem 2

Like other European countries, Romania has had a long history of exploiting coal for the generation of heat, electricity and for industrial use. However, in the context of structural change, the obsolescence of extraction technology, the lack of investment and of the capacity to improve efficiency, but also the need to align with European and

global priorities, the mining sector underwent restructuring steps that led to a drop in the share of coal in the national energy mix from 40% in 2011 to 26.4% in 2017 and to a decrease of the production from 67.9 thousand tons (2012) to 46 thousand tons (2016)⁹.

1.2. MEETING CLIMATE OBJECTIVES - CHALLENGES FROM THE MARKET

1.2.1. CLIMATE CHANGE AND THE NEW ENERGY POLICY FRAMEWORK

The global community is now looking for new means and solutions to adapt to climate change and to provide viable solutions to environmental and societal challenges.

An important moment in this regard was marked by the work of the United Nations Conference on Sustainable Development in 2012 in Rio, which stressed the need to integrate the challenges regarding environment and society into the economic agenda, trying to direct the public policy framework to reducing the impact of economic activities on biodiversity, social inclusion, quality of life, natural resources and the environment as a whole. Raising awareness of the importance of deteriorating climatic factors and then their approach through integrated and solid policies is important for both developed and developing countries with more populations at risk and vulnerability due to dependence on the sectors directly affected by environmental degradation, such as the agricultural sector, air and water quality, food sources or access to energy¹⁰.

Subsequently, in 2015, 193 UN member states gathered at the Paris Summit on Development, adopting the *2030 Agenda for Sustainable Development*, a global development action program that promotes a balance between the three pillars of sustainable development: economic, social and environmental. Romania is one of the signatories to this program, equally committed to fighting inequalities and injustice, providing clean and affordable energy, starting climate action, promoting sustainable industrialisation, encouraging innovation, and other objectives of the 17 sustainability targets that have been adopted.



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⁹National Institute of Statistics, Tempo Online

¹⁰World Resources Institute 2011

As a member state of the European Union, Romania has committed itself to contributing to its objectives in the field of energy¹¹, such as: **reducing emissions by 43.9%** compared to 2005, at least 27.9% of the total energy consumption to be provided by renewable energy, at least 37.5% increase

in energy efficiency by 2030. In the long run, the European Union aims to substantially reduce emissions by up to 80-95%, turning the European community into a *low-carbon* economy with effects on economic growth, job creation and strengthening of competitiveness.

1.2.2. THE ENERGY FUTURE OF ROMANIA

Although coal exploitation may appear as a logical continuation of increasing energy independence and supporting industrial and economic development, given the existing resources, the achievement of the objective of independence must not be strictly linked to the existence of fossil resources, but also to the massive costs of coal extraction and the conditions under which it is carried out. Globally, it is increasingly evident that trends are changing and priorities are rather of an integrated nature, and national strategies will have to adapt accordingly, proposing sustainable development methods.

Thus, Romania's energy future can be seen in terms of the transition to the 2040 or 2050 horizon and of the programs and projects that would ensure this transition for the benefit of society. For example, Romania can follow the path of abandoning the stages of economic development based on the use of fossil fuels, as was the case with West European countries or other states with a tradition in mining. This leap is favoured by the accelerated growth of the renewable energy industry, which is becoming more accessible regardless of the level of economic development, unlike the carboniferous period of the first half of the 20th century. If then industrialised countries had no technological

options apart from coal dependence, and then other fossil fuels, at present countries such as Romania do have instruments, technologies and facilities based on continuous research and innovation in the alternative energy field. Moreover, while there are still significant coal resources, alternative energy proposes a model based on inexhaustible natural resources, focusing on positive effects not only on the environment but also on society, education or economy.

Such an approach requires strategic thinking on a longer-term, considering supporting research and innovation in the field of energy and industrial efficiency. The global context allows and encourages orientation towards national policies that consider the reduction of energy vulnerability and the reduction of its environmental footprint.

¹¹Integrated National Plan for Energy and Climate Change 2021-2030

An ever more common concept in the debate on the global energy future is that of *deep decarbonisation*. A big project¹² conducted by the Institute for International Relations and Sustainable Development (IDDRI) in 2015 presents some ways to achieve this ambitious goal. In short, deep decarbonisation means reducing the impact that carbon has on the economy (GDP) as a result of reducing the impact of energy in the economy. This can be achieved through a mix

of actions aimed at: (1) reducing the use of coal and fossil resources in electricity generation, (2) increasing energy efficiency at all levels, and (3) facilitating the transition to the use of alternative sources energy. These are all challenges for the transition to a clean energy economy and will be detailed in the next section.

1.2.3. CURRENT REALITIES VERSUS GLOBAL OBJECTIVES

In 2004, the Government adopted the *Mining Industry Strategy for 2004-2010* which at the time of adoption aimed at optimising the economic performance of the industry, supporting the local economy in mining areas and fulfilling the criteria for joining the European Union. It should be noted that in the mining sector, the capacity to develop, implement and monitor a strategy at international standards was also built with the mining sector restructuring projects in 1999-2005, which brought good international practices and have prepared specialists in the field of development and monitoring of strategies in the field.

In 2012, in a new attempt to combat rising production costs, the mining sector underwent a major restructuring again, a step that trained the entire industry for partial or total privatisation, anticipating a gradual decline in production nationwide by 2018.

Subsequently, the *mining Strategy of Romania 2017-2035*¹³ was developed and adopted, which has the vision for Romania to

become a "sustainable, transparent and clean mining country as a factor of economic progress". Among the general strategic objectives, we note "the repositioning of the mining sector in the perspective of providing the mineral resources necessary for the sustainable development of the country, with priority from the domestic production". Although this document shows the tendency to support the continuation of the mining activity, the Strategy does not eliminate the need for the closure of non-viable mines, which creates the premises for the opening of the mining communities to alternative economic development. At the same time, the Strategy recognises the need for interventions in the areas affected by the mining activity, drawing attention to the necessity of closing and greening works, provided that funds are dedicated to this very important process for the reintegration of communities into a diversified economy that is attractive from a point of view of job alternatives.

¹²Deep Decarbonization Pathways Project (2015). Pathways to deep decarbonization 2015 report

¹³Mining Strategy of Romania 2017-2035

Despite attempts to modernise, the argument of the continuation of mining exploitation only presents a facet of economic and political aggregate. Multiple restructuring, obsolete extraction technologies and low domestic demand have brought significant social-economic and environmental costs over the last few years. This fact was felt even more strongly by the geographic concentration of the mining activity in restricted areas, such as Jiu Valley the Ploiești Basin and the Oltenia Basin, which are quasi-mono-industrial areas, that were directly affected by the deterioration of the working conditions, the quality of the environment and of life in general, as well as the lack of openness to opportunities for diversification of social-economic and cultural possibilities. Jiu Valley, the main mining region in Romania, attracted the greatest attention at the level of the public agenda, suffering a rapid decline. In addition to the local impact, in this reforming period, financial support from state budget subsidies has begun to cover differences in production costs and incomes. This solution, disconnected from concrete actions to increase efficiency or keep operating until the exploited coal is consumed and to provide an optimal closure framework, did not achieve the expected effects since implementation did not take place in parallel with actions for the sustainable recovery of the area, but rather sequential.

However, these practices are usual in supporting the coal-based energy sector. In 2013, a total of 458 billion dollars was spent on subsidies for the fossil fuel-based energy sector, with the highest share being in developing countries. The OECD (2013) estimated that states would allocate up to 90

billion \$ a year for subsidies, of which 20% were allowed for electricity¹⁴. Such realities have the effect of discouraging investment in renewable energy or efficiency gains, instead, renouncing to them would allow for real competition.

Global climate objectives set out a completely different perspective. Financial support for coal power generation could be managed through an efficient, acceptable and credible policy package, tracking the source of carbon emissions and charging them (World Bank 2015¹⁵). From the perspective of deep decarbonisation, solutions reside in the approach of both producers and large consumers and their stimulation towards the transition to other energy sources.



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¹⁴OECD (Organisation for Economic Co-operation and Development), (2013), Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels 2013

¹⁵Fay, Marianne, Stephane Hallegatte, Adrien Vogt-Schilb, Julie Rozenberg, Ulf Narloch, and Tom Kerr (2015), Decarbonizing Development: Three Steps to a Zero-Carbon Future, Climate Change and Development, World Bank

1.3. THE FUTURE OF COAL - SHORT, MEDIUM AND LONG-TERM FORECAST

The future of coal-based electricity production and the use of coal as a primary source of energy will be dominated by the transition to other non-polluting sources of energy to meet the climate ambitions that the international community has embarked on in recent years. This deep decarbonisation process will have to consider both facilitating the transition of large industrial consumers to clean energy sources, educating society on

energy use and supply, by operating coal mining sites so that their closure has as little impact as possible on the environment, the economy and society. These are the great challenges of both the global and national energy system, and the formulation of public policies must consider the targeting of these issues at the same time in a sustained effort of transformation.

1.3.1. INCREASING THE EFFICIENCY OF ENERGY PRODUCTION AND CONSUMPTION

Decreasing energy intensity (energy consumed for a monetary unit produced) can be achieved through more efficient products and processes. If energy consumer efficiency has already been taken up among transport and residential customers (residential buildings) (improving public transport, electric vehicles, substitution of heating of dwellings through thermal power plants, solar panels etc.), with effects in the gradual decrease of prices to consumers, in industry process efficiency is far more expensive and more difficult to implement from a technical point of view. Major industrial manufacturers, such as factories, use integrated equipment and technology, whereas measures taken in certain parts to change the energy source require changes in the rest of the assembly. This rigidity, as well as the high costs involved in implementing these structural changes, slow down the possibility of transition. Furthermore, companies are not motivated to become more responsible for the use of other, less polluting energy sources, as they would

not benefit from any competitive advantage in the absence of a generally accepted standard.

Since market adaptation, in this case, is a long process with gradual changes, until the high-energy industrial products (such as steel) can be substituted with other types of advanced materials, it is essential to invest in processes that gradually reduce carbon/gas emissions with the greenhouse effect. Such processes include replacing parts of the current fossil fuel consuming processes with alternative energy resources, investing in research and innovation to identify more efficient production methods, adapting product characteristics to make the products less energy-intensive. Such measures can be supported by a regulatory framework that sets a new standard in newly established production units and transferring industry practices to older manufacturers.

In terms of consumption, interventions can also take place in the value chain, from the bottom up, starting with the consumers. Individual consumers can alter product quality expectations by identifying the carbon footprint of the product as added value. Among consumers in the B2B area (*business to business*), the creation of energy quality standards at that level can lead to upward pressure on major producers, requiring the need to adapt.

On the other hand, at the coal-based electricity production level, studies indicate abandoning the sector subsidies as a policy that is necessary to ensure the transition. Although they are a common practice in the European Union states, subsidies drain

public money to cover inefficiencies, discouraging new investments in innovative and green technologies. The cogeneration bonus is a practice designed to promote the modernisation and increase of the efficiency of coal power plants at European level, within the limits of national ceilings and granted according to the criterion of energy saving in the energy system. This practice has the role of encouraging investments to increase efficiency, but the uncertainties that govern this policy area and the transposition at the national level, as in the case of Romania, have the reverse effect, the criteria for accessing the facilities of this fiscal instrument being rather granted based on the profitability of producers¹⁶.

1.3.2. DIVERSIFICATION OF THE OFFER

Diversifying energy supply through developing new technologies and discovering new ways of using renewable energy for electricity production is the result of research-development-innovation in the energy sector, with results that have led to lower prices and increased accessibility in recent years. Supporting accelerated growth in the use of alternative energies is based on exploiting innovation in the field as much as possible and rapid scaling to the market in a legally, economically and socially favourable environment.

Renewable energies are proposing a new business model in the energy sector that is not based on the physical exploitation of other resources in the subsoil and also not on

industrial giants, so this flexibility brings new market rules. At the same time, other elements of the value chain, such as knowledge transfer, research or marketing, are interacting. At this level, investments in the alternative energy sector become a viable option for both large companies and entrepreneurs, and the regulatory, financing and strategic framework at macro level can support its development through dedicated funding lines, tax incentives to support investments based on the inclusion of these sectors in the industrial policy directions or the national competitiveness or research-development-innovation strategies. At the same time, the growth of this sector is attracting a high demand for technical specialists with transdisciplinary skills in the medium and long term pushing the border to new areas with positive effects on the diversification of the workforce offer.

¹⁶Cost of coal in Romania, (2014), Candole Partners for Greenpeace Romania

Reducing subsidies to traditional, coal-based energy can be an opportunity in terms of increasing funding available for the

development of the vertical alternative sector, from research to scaling.

1.3.3. ENSURING THE ECONOMIC AND SOCIAL SUSTAINABILITY OF MINING-DEPENDENT AREAS

The major challenge in terms of ensuring economic and social sustainability in coal mining is clearly the impact of mine closure on communities that are dependent on their activity.

In the process of transition from activities strictly related to mining to diversified economic activities, three parts are involved: mining companies, communities and authorities. From a sustainability perspective, it is important that the entire closure process and the consequences of mining activity be placed within a much longer time frame than the period assigned to mine operation. Practically, the anticipation of mine closure should be already considered from the operational phase in order to minimize the adverse post-closure effects or to prepare timely action plans related to ceasing activity under conditions that are least damaging both for the environment and for communities directly affected. In this case, the involvement of mining companies is important for the co-creation of actionable regeneration solutions already during the operation, together with the community, to minimize the risks. At the same time, responsible mining companies have the opportunity to cooperate with the civil society, whose role may be active, to increase management capacity, or consultative, by providing alternative development scenarios and coagulating communities towards common goals, but also with authorities, to ensure compliance with monitoring the action plans and to ensure a closure process with the least possible negative impact.

There is a need for pro-active involvement both from the authorities that provide the legislative framework and from local communities and actors to facilitate communication and prioritization for the benefit of society, especially as restructuring and reforms have led both to the degradation of the social-economic environment as a whole and to the deterioration of confidence and the capacity for dialogue between the various actors involved. The communities as a whole comprise the local and regional private sector, entrepreneurs, professional associations, civil society (NGOs), as well as the university and research environment. The role of these actors is fundamental both from the perspective of active participation in the dialogue with other stakeholders, and especially for the initiation of and involvement in support or central projects and initiatives aiming at relaunching the economy. The capital of knowledge and resources owned by each of these actors has the role of mobilizing the efforts in multiple complementary directions, supporting a transition from bottom to top.



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1.3.4. GOVERNANCE OF THE ENERGY SECTOR

The governance model of the coal era was centralized, based on the direct relationship between energy producers and suppliers and the regulating entity. However, the post-coal transition generates changes also in the rules, processes and practices of managing energy production and consumption.

The functional governance model at EU level to manage the transition to a decarbonised economy shifts focus on local energy governance as part of a multi-level system at regional and national level¹⁷. If we consider the decarbonisation objective as a whole, a first step can locally be taken by involving public authorities in increasing the

energy efficiency of the locality fund. However, if we focus on the process of economic regeneration after the closure of coal mines, the role of public authorities is also to facilitate the planning and implementation of community initiatives for the common social and economic benefit. At the same time, the fragmentation of the energy market through the emergence of smaller energy producers can be a locally managed opportunity if local authorities have the decision-making power to attract such producers and to connect them to the local energy system. Such a hybrid system has the advantage of flexibility and adaptability to the local context and community needs, but its adoption requires major transformations across the entire national governance structure.

1.3.5. FINANCING

Trends in asserting alternative energy sources in the energy mix as part of the energy sector's adaptation to climate ambitions are also felt in the investment area, such as the lending policy of many financial institutions. An example is the European Investment Bank (EIB), which has not included the funding of traditional energy projects on the investment agenda, announcing a new set of terms for its loans based on CO₂ emissions (550g CO₂ / kWh) in July 2013. In the same note, the World Bank, the International Monetary Fund and the European Bank for Reconstruction and Development (EBRD) have followed similar policies to significantly reduce the financing of new coal installations and plants. In the European Union, the Cohesion and Development Funds assign significant budgets to the financing of projects that aim

to contribute to the achievement of energy efficiency targets, as well as to enhance research, development and innovation activities in the field of renewable energies and the quickest possible access to markets.

While these restrictive measures can contribute to supporting the development of the alternative sector, the effort can be further capitalized in the context of favourable policies that stimulate alternative areas on the basis of efficiency and performance in improving the quality of life, to the disadvantage of subsidizing traditional non-performing companies. Moreover, other sources of funding can become viable in the context of market fragmentation through the appearance of smaller private actors with innovative technologies, funded by private investment funds or alternative funding.

¹⁷Wade et al. (2013), Local energy governance: communities and energy efficiency policy

European countries can convert these challenges into opportunities and not only in order to continue the process of decarbonisation of the energy sector in the

long run. Interventions are primarily necessary on a strategic level to determine change processes for each component of the energy system.

1.3.6. CONCLUSION

From a strategic point of view, **meeting** climate targets has announced a gradual decline in coal use in the energy sector. In practice, however, the transition to a decarbonised economy implies a set of changes in both consumption and global coal production. Closure of mines is an important step within the main goal of decarbonising economies from production, but securing post-closure transition is a challenge, especially for communities directly affected by this process, when implemented without considering a vision on the long term, involving authorities, the economic

environment, energy consumers, employees and civil society. Although each mine closure process has its own particularities, what is common is a post-coal development model based on local public policies designed to strengthen local economic resilience and reduce the negative impact on communities. In short, traditional governance principles need to be replaced by hybrid, bottom-up policies that are planned, implemented and evaluated locally, focusing on all stakeholders in an attempt to generate fair regeneration solutions for vulnerable communities.



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JUST TRANSFORMATION - EXAMPLES OF GOOD PRACTICES AT INTERNATIONAL LEVEL

2.1. INTRODUCTION

According to the presentation by Bankwatch called “Just Transition in Eight Steps“, the first one of these is the in-depth understanding of the concept before drafting the actual strategies and action plans. This first step is particularly important since the just transition in post-carbonation transition areas requires massive mobilisation from a multitude of involved actors, both at a high and at a low level. At the same time, legitimacy and confidence in the actions undertaken within the framework of the just transition can be built mainly on the basis of demonstrating knowledge regarding the defining elements of the implementation framework and of the aspects regarding intervention and impact that are illustrated through examples of good practices.

Removing coal from the global energy mix and from using it as primary energy source involves a tedious transition process that, if not properly implemented, can generate a massive negative impact on local economies through issues such as unemployment, economic vulnerability, stranded or heavily redeemable assets, especially when the state of ownership of the

mining sites is uncertain or the assets are already degraded, or a set of redundant skills in the absence of the mining sector in which they can be applied, especially when discussing the closure of mines.

Although there is no unitary framework for analysing the post-closure process and the stages of transition to a diversified economy, some elements are common among all examples of good practice and expert advice, both of mining industry supporters and of those who support the fulfilment of climate ambitions. These elements relate mainly to the early anticipation of mine operation and long and rigorous planning to ensure a gradual transition. At the same time, the role played by mining companies must be active and closely related to local factors, in addition to providing financial resources. In particular, the most relevant examples of good practice indicate either the transformation of the mining site into a natural ecosystem and the reintroduction into the natural circuit, or the diversification of economic development on several levels, or the restoration of the areas and their integration into the cultural circuit.

2.2. THEORETICAL FRAMEWORK AND SUPPORTING DOCUMENTS

This first section aims to present a series of documents that form the theoretical framework of the just transition and the mine closure process, illustrating the main elements defining the concept, guiding the just transition process and its implications for transition areas. On the one hand, the section

identifies and summarizes the documents forming the theoretical framework and, on the other hand, they capture different elements of the social-economic, natural or cultural framework upon which the post-carbonic transition is impactful.

2.2.1. CLIMATE NEUTRALITY STRATEGY EUROPE 2050

First, the *Climate neutrality strategy Europe 2050*¹⁸ aims to improve the global coherence and ambition of climate policies. Secondly, the process of developing the strategy is seen as a useful means of promoting consensus among stakeholders in national climate policies. Thirdly, the development of this strategy can provide the necessary guidance for achieving the long-

term decarbonisation implications, especially for major sectors involved in emissions. Finally, the development of strategies can contribute to a more effective and accurate assessment of the progress of public policies internally, allowing for alignment and comparison with unitary progress.

2.2.2. INTERNATIONAL LABOUR ORGANISATION

In 2013, ILO¹⁹ has adopted a resolution on sustainable development, decent working conditions and green workplaces as part of the public policy framework to facilitate a just transition. Two years later, a series of guidelines on the formulation, implementation and monitoring of the policy framework was adopted, including:

- the social consensus on the proposed objectives achieved through social dialogue at the institutional level and through permanent public consultations with all the actors involved;
- respecting, promoting and fulfilling the fundamental principles and rights regarding work;
- promoting and implementing policies and programs that provide equal opportunities;
- developing coherent policies at the intersection of economic, social, environmental, education and work agendas to ensure a favourable context for businesses, investors, consumers and employees alike;

- formulating public policies in a context that anticipates the impact of the transition on employment, social protection or skills development;
- adapting policies and programs according to the specific conditions found in each area, considering the economic sectors, the business population or the economic specificity.

The same document also provides for the main policy areas to be involved simultaneously in ensuring economic, social and environmental sustainability: macroeconomic policies, industrial and sectoral policies, enterprise and entrepreneurship policies, competence and skills development policies, safety and health at work policies, social protection, active policies regarding the labour market, the protection of rights and the social dialogue.

¹⁸https://www.iddri.org/sites/default/files/import/publications/st0317_eu-2050-long-term-strategies_os-et-al..pdf

¹⁹International Labour Organization (2015), Guidelines for a just transition towards environmentally sustainable economies and societies for all

2.2.3. WORLD BANK

As part of a mine closure project, the World Bank has conducted a series of studies addressing the effects of this process, providing a range of possible directions for the involvement of relevant actors during the transition period. At the same time, the World Bank's research presents the mine closure process as a complex one, with effects going beyond the moment of the effective stop of the activity, at the level of communities and the social-economic framework as a whole, therefore proactive management and a long-term vision are necessary.

At the level of roles and responsibilities of each relevant stakeholder group, the World Bank proposes the following recommendations²⁰:

Mining companies – Knowing in detail the potential impact of mine closures, they are best placed to take the necessary steps to reduce the negative effects on the completion of the operation in order to facilitate the transition afterwards. At the same time, they can work closely with civil society, local authorities and other actors to increase the capacity to manage negative effects, for

example by gradually transferring responsibility to various parties for assets left after the mine dismantling, offering the possibility of taking on activities to the benefit of the community.

Local public authorities – According to World Bank, their role is to anticipate measures to reduce economic, financial and social dependence on the mining activity already from the pre-closure period in order to adapt more easily during the final stage. The authorities are also responsible for engaging communities and encouraging them to become proactive in terms of transition planning and long-term planning.

The civil society – Plays a crucial role in educating the communities regarding the opportunities and the existent directions in the transition period, in increasing their degree of awareness and responsibility linked to the active participation at defining the future directions and in offering assistance (also to authorities) in order to increase the capacity to manage change and adapt to the imminent changes.



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²⁰World Bank and International Finance Corporation (2002) "It's not over when it's over: Mine Closure around the world"

2.2.4. INTERNATIONAL COUNCIL ON MINING AND METAL

ICMM²¹ proposes a comprehensive mine management guide, in the form of practical management tools intended to assist mining companies in the closure process at all stages of the process, to ensure that the process is carried out in a sustainable manner. Therefore, the proposed tools are designed for each stage of the mining cycle, with the ambition to anticipate and prepare

the closure phase still during the operating phase. Moreover, the tools are also adapted for their application over short periods, towards the end of the closure phase, providing action lines to channel the effort to the benefit of society.

2.2.5 THE RESEARCH PROJECT *COAL TRANSITIONS*

The international project *Coal Transitions: Research and Dialogue on the Future of Coal*²² was carried out between September 2016 and May 2018 and was aimed at facilitating international dialogue and transfer-ring knowledge gained through various initiatives in the field, bringing together eight organisations from six countries with a tradition in the mining industry: South Africa, Australia, China, Germany, India and Poland.

The main trends identified in the project are:

The post-coal transition is in full swing – In 2018, 36 governments and 28 global companies have committed themselves to eliminate coal power generation by the year 2030 and are implementing measures and initiatives to achieve this goal.

The post-coal transition is possible and convenient – From an economic point of view, the take-off of renewable energies in the current energy model and the increase in their competitive advantages over traditional resources allow the gradual replacement of coal at convenient costs.

The Just Transition for mining communities is feasible – In order to achieve visible results and achieve a successful transition, rigorous and timely planning is needed to increase the adapting capacity of the local economy and to develop the necessary elements to take responsibility in the absence of the predominant industrial factor.

The post-coal transition contributes to the fulfilment of climate ambitions, bringing many benefits on an economic and social level, especially in the context of early planning and an integrated bottom-up approach.

²¹<https://www.icmm.com/en-gb/society-and-the-economy/mine-closure>

²²Sartor O. (2018), "Implementing coal transitions: Insights from case studies of major coal consuming economies", IDDRI and Climate Strategies.

2.2.6. THE PROJECT *DEEP DECARBONIZATION PATHWAYS*

The *Deep Decarbonization Pathways*²³ project is a global collaborative research initiative that seeks to understand how states can contribute to a technological, social-economic and political transition to a low-carbon economy in line with the internationally agreed global warming limit to less than 2 degrees Celsius (2°C). This objective will predominantly involve the profound transformation of energy systems by significantly reducing carbon intensity in all sectors of the economy. The project

proposes three pillars underpinning interventions to ensure the decrease of carbon emissions - energy efficiency and energy conservation in products and processes, both in industry and household and transport; decarbonisation of electricity production - reducing the use of fossil fuels and replacing them with renewable energy sources; the gradual transition to an energy system that is not based on burning fossil fuels.

2.2.7. THE PLATFORM FOR COAL REGIONS IN TRANSITION

In December 2017, the European Commission launched the “Platform for Coal Regions in Transition”²⁴, under the European regional policy, in order to assist the energy transition in the coal regions of Europe. Through the two working groups, the initiative provides support in the design of projects and strategies in line with the EU's long-term vision of decarbonisation of the economy and the implementation of structural reforms in the post-coal period.

The platform facilitates dialogue at the level of government representatives, local and regional authorities in transition areas on identifying, capitalising and accelerating opportunities for economic relaunch in line with future trends - professional requalification, funding sources, equal access to opportunities. At the same time, as part of its mission to assist the transition to clean energy without denying each community member access to development opportunities, the Platform aims to provide dedicated support and technical assistance

to actors in vulnerable areas to maximise access to funding and implementing projects dedicated to economic regeneration. In addition to the European funding available, the Platform facilitates community access to international funding sources from the private sector and from financial institutions as part of the effort to mobilise actors to support the development of transition regions.



© Coal Regions in Transitions

²³<http://deepdecarbonization.org/>

²⁴https://ec.europa.eu/romania/news/20171112_lansare_platforma_regiuni_carbonifere_in_tranzitie_ro

In the initial launch phase, three pilot regions were included²⁵: Silesia (Poland), Trencin (Slovakia) and Western Macedonia (Greece). In Poland, two project lists were selected, one dedicated to structural reforms (on economic revitalisation, innovation, mobility, and air quality improvement), and the other dedicated to eco-innovation projects. In total, the projects included in the list amounted to 1.82 billion Eur. In Slovakia, 80 projects were submitted by entrepreneurs, municipalities and civil society.

Jiu Valley has been included in this initiative, alongside other 13 regions with a mining tradition in Europe, public consultations on development alternatives are currently underway (2019). Within the Platform, local actors in Jiu Valley can contribute with concrete project proposals and can receive technical assistance to improve them and European funding to carry them out.

2.3. EXAMPLES OF GOOD PRACTICES IN MINE RESTORATION AND POST-COAL TRANSITION

This section continues the presentation of the applied post-coal transition process through short case studies, illustrating examples of good practices on mining restoration and the transition process on an international level. According to the definition of FAO (UN Food and Agriculture Organisation), a good practice is not only a positive example, but

also one that has proven to work, that has been tested and validated, leading to favourable outcomes, and is therefore recommended to be taken over and implemented. Examples of good practice thus offer easy-to-handle and adaptable tools and include sustainable solutions without bringing disadvantages for the community.

2.3.1. MINE RESTORATION

Beenup – Australia²⁶

In Australia, the mine closure process mainly focused on the ecological rehabilitation of the surrounding areas, with efforts being directed to soil decontamination and repopulation with the fauna and flora

ponding to the vegetation area. One such example is the exploitation mine of the Beenup titanium in the southwest of the western region of the country, closed in 1999.

²⁵Bankwatch Briefing – The European Commission's Platform for Coal Regions in Transition: Case studies highlighting tilt toward coal companies, June 2018

²⁶BHP Billiton report (2017), "Rehabilitation of mining and resources projects", Senate Environment and Communications References Committee

The transition process started 10 years before the actual cessation of activity, through the formation of an advisory group that assessed the site's rehabilitation opportunities, proposed development scenarios, and actively supported the reconversion of the area. The challenges of ensuring a successful restoration process derived in particular from the complexity of the environment and the advanced stage of soil and vegetation degradation, which required prolonged interventions. At present, more than 140 ha of vegetation has been reproduced to the natural circuit, local flora has been restored and rare species of animals and birds populate the ecosystem now.

Wieliczka – Polonia

The Wieliczka salt mines²⁷, located southeast of the Polish city of Krakow, have a long history of approximately 900 years, being one of the first and most important industrial operations in Europe. As a result of

the excavations carried out here over nine centuries, there are 200 kilometres of galleries and 2040 different sized caverns. Since the nineteenth century, some of the galleries have been opened to the public for both tourism and medical purposes. Towards the end of the 20th century, industrial activity ceased, so the Wieliczka mines were preserved, and it is currently possible to visit about 2 kilometres of underground tunnels, between 64 and 135 meters deep. In 1978, the mines were also included in the UNESCO World Heritage List.

Being a well-known tourist attraction, in the year 2017, there was an absolute record regarding the number of tourists. More than 1.7 million people visited the routes in the Wieliczka mine, 9% more than in the previous year. Approximately 51% of this number was represented by people from outside Poland, of which 41% were adults. A calculation of visitor fees paid by tourists shows that the proceeds from this activity reached over 11 million euros.

2.3.2. THE POST-COAL TRANSITION

As Pontes – Spania²⁸

The mine operated between 1976 and 2008, when a quantity of 261 million tonnes of brown coal was exploited. The mine rehabilitation started in 2006 before the site was effectively closed, and the transition was actively supported by the mining company in a joint effort with local and regional authorities and through a continuous dialogue with the community.

The intense exploitation and the configuration of the relief have led to the creation of a basin which, in the transition period, has been turned into an anthropic lake, becoming the largest lake of this type in Spain, increasing the interest for this area from the touristic point of view. With an investment of over 250 million euros, the entire area of 2400 Ha has been transformed into a natural area populated with 217 plant species and 205 animal species. Following the diversification of economic activity, over 1200 jobs were created.

²⁷ Although the example concerns a salt mine, it still has a relevance, albeit limited, in relation to the solutions sought for the restoration of coal mines

²⁸ <https://mining-atlas.com/operation/As-Pontes-Thermal-Coal-Mine.php>
<https://www.endesa.com/en/press/news/d201709-endesa-fills-old-mines-.html>

Gelsenkirchen - Ruhr, Germania²⁹

For the Ruhr region in Germany, the exploitation of coal has become a defining element, along with the steel industry,³⁰ when the mineral resources have been discovered in the mid-nineteenth century. One century later, over 500,000 miners from different countries worked in this region, reflecting the importance of the region as an economic and social pole. Although heavily urbanised, in the region there was no higher education institution. Starting with the period of decline due to global and national economic and political factors, such as the availability of oil resources, after 1990 the need for the gradual diversification of economic activities became visible. As a result, a plan of integrated measures with institutional support for green industries and funding allocated at the regional and national level was created.

In the Gelsenkirchen area³¹, the diversification activities of the economy followed the national trend observed since the 1990s. Thus, in 1996, a scientific park dedicated to renewable energy and environmental technologies was set up, preparing the cessation of the activity long before the mine was closed in 2008. Later, in 2014, the park was turned into a cooperation platform for the development of projects regarding renewable energy, green mobility and other climate-related areas. At the same time, the diversification of the economy has also driven effects in the education sector, providing higher education for more than 200,000 students per year. The impact of transformation has been multiplied on the workforce, too, with more than 26,000 jobs being created.

Loose-en-Gohelle – France³²

Located in northern France, the town of Loose-en-Gohelle stands out through its mono-industrial character, dominated by mining and coal mining, the basic activity between the 1850s and 1980s. The prospect of mine closure and the cessation of this economic activity created the need for local mobilisation based on development scenarios aimed at either replacing the mining industry with other large industries or focusing on other economic sectors. Thus, the post-closure period coincided with a sustained effort on all levels to restore the area, with actions in many sectors, such as tourism, renewable energy and green technologies.

As a result, some of the former mining sites have become part of a UNESCO World Heritage site and since 2012, another production unit has been transformed into a resource centre for sustainable development, responding to the need to convert abandoned assets. Currently, the site hosts several non-governmental and research organisations, with an important role in ensuring the city's vitality.

Through actions carried out in the city with funds drawn from the European Union and the French government, the unemployment rate has decreased, the number of associations has doubled, 350 jobs have been created and new businesses have been attracted in the area. Loos-en-Gohelle has thus become a representative case of how a city can get rid of its dependence on fossil fuels.

²⁹<http://www.just-transition.info/life-beyond-coal-germany>

³⁰<http://politicalcritique.org/long-read/2017/a-herculean-success-managing-the-death-of-coal-mining-in-the-ruhr-region/>

³¹Erica Peterson (2015), "In Germany, A City Moves Away From Coal", WFPL

³²<http://www.energy-cities.eu/Transition-cities-there-is-life-after-coal>

THE SOCIAL-ECONOMIC PROFILE OF JIU VALLEY

3.1. GEOGRAPHICAL CHARACTERISTICS

Jiu Valley is a geographical name designating the depression area corresponding to the upper Jiu river basin and the two rivers that form it: Western Jiu and Eastern Jiu. According to geography studies, the depression that overlaps the upper Jiu Valley is called Petroșani Depression.

The Intra-Carpathian Petroșani Depression has a tectonic origin and is located in the western part of the Southern Carpathians, between the slopes of the Retezat Mountains (V-NW), Șureanu (N-NE), Parâng (E-SE) and Vâlcan (S-SW). It has a triangular shape with southwest-northeast orientation, a surface of about 260 km², about 45 km long and with a width varying between 2 km in the west (Câmpu lui Neag) and 9 km in the east (Petrila-Petroșani - Defileul Jiului/Jiului Strait). The average altitude of the depression is about 620 m, the average altitude varies between 550-650 m altitude and the lowest altitudes recorded along the main valleys decrease from northwest to southeast and south: about 780 m at Câmpu lui Neag, 740 m at Uricani, 580 m at Lupeni, 640 m at Petroșani and Petrila, 590 m at Iscroni and 560 m at the entrance into Jiului pass in Lainici. In the immediate vicinity of the depression, contact with the mountain is given by high hills and mountains with altitudes of 1300-1500 m to the north, respectively 1000-1600 m to the south, the contact being marked by steeps with altitude differences of 800-1000 m.

The relief of the depression consists of:

a) piedmont erosion pylons and ridges are of 150-200 m heights that are located at the contact with the surrounding mountains,

being the most extensive relief forms and having low slopes (3-9%), being used for pastures and meadows, crops and forests;

b) the East Jiu, West Jiu and their tributary streams, with terraces, meadows and narrow and deep valleys. The terraces represent the intermediate step between the piedmonts and the meadow, characterised by reduced fragmentation, gentle slopes, accessible ground-water layers, intensive exploitation through agricultural crops, locations of the main railways and roads and precincts of villages. The floodplains are more developed along the two Jiu rivers and in the confluence area, being floodplains (in some perimeters hydro-technical protection works were carried out), covered by grassland and meadow or used for vegetable or cereal crops (corn etc.).

At the intersection between the piedmont areas with the terraces and the meadows of the valleys, there are situated the most numerous and extended precincts of the localities of Jiu Valley (Petroșani, Lupeni, Vulcan, Petrila, etc.). On the north-west frame of the Petroșani Depression there is a Mesozoic limestone band, which favoured the emergence and development of a varied karst relief and in which the rivers Bănița, Valea Roșie and Taia have dug the quay. The Neogene deposits forming the filling of the tectonic basin have a varied lithological constitution and thickness of about 800 m, in them being cantoned approx. 20 layers of coals of different thickness, which were mined in the mines of Petrila, Petroșani, Vulcan, Lupeni, Uricani, Livezeni, Lonea, Paroșeni.

The climate of the depression is submontane, cool (average annual temperature: 6°C), with abundant rainfall (1000-2000 mm annually) and frequent temperature inversions. The tributaries of the Western Jiu and the Eastern Jiu have their springs in the surrounding mountains, short and fast trails and narrow valleys with sharp slopes (15-20%). One of the right-wing tributaries of the Western Jiu is the dam from Valea de Pești that supplies most of the nearby cities with water. Deciduous and resinous forests are the dominant vegetation elements, spread over very large areas within the depression: 58 thousand ha (47.7% of its area), of which 8.3 thousand ha are natural protected areas (13.6% of the total area of the depression) and 9.2 thousand ha are Natura 2000 sites (14.3%).

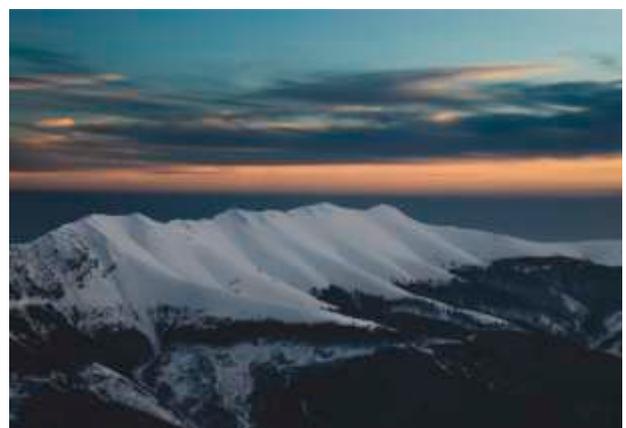
The land use of Jiu Valley ensemble highlights the dominance of forest areas (over 60%) and agricultural land (32.06% - of which the majority are pastures and meadows), the areas occupied by construction, of unproductive lands (tailings dumps and abandoned industrial sites) or those for communication routes are very low (6.8%). The area of forests is significant in Uricani (69.37%) and Petrița (66.5%), the lowest in Vulcan (43.4%), the areas with buildings are bigger in Lupeni (5.08%) and Aninoasa (4.08%) and non-productive lands occupy important parts in Aninoasa (6.19%) and Petrița (5.66%).

The current network of localities of the Petroșani Depression comprises 3 municipalities (Petroșani, Vulcan, Lupeni), 3 towns (Petrița, Aninoasa, Uricani) and a commune (Bănița). Near the villages or in the vicinity of the mines, at the end of the 19th century and early 20th century workers colonies were built that are organised by mine owners or by the state, occupied by workers

brought or coming from the Austro-Hungarian Empire (Czech, Polish, Bosnian, Transylvanian Romanians, etc.) or from the Kingdom of Romania (e.g. Colonia Lonea that became Colonia I.I.C. Brătianu after 1918, respectively N. Bălcescu after 1948 and that was incorporated into the town of Petrița).

Until 1918 all localities retained their rural status. The first place to become a town was Petroșani (1923), followed by Petrița, Lupeni, Vulcan (in 1956), Uricani (1968) and Aninoasa (1989). The geographic location of the cities in Jiu Valley, from east to west, corresponds to the succession of the coal-fields' exploitation and development stages, not to their actual demographic size.

The town of Petrița (25,229 inhabitants) is located in the eastern part of the depression, along the Southern Jiu and its tributaries Jieț, Taia and Răscoala and has 5 constituent localities: Petrița, Cimpa and Tirici, which are located 7 km along the Eastern Jiu, and the other two - Jieț and Răscoala - are located along the homonymous rivers, at a short distance from Petrița. In the middle of the 19th century, it was the most important locality of the depression (approx. 2,000 inhabitants) and is currently in the fourth position.



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The municipality of Petroșani (43,452 inhabitants) consists of the towns of Petroșani, Dâlja Mare, Dâlja Mică, Peștera and Slătinoara, the last four having precincts scattered on the heights of the surrounding area (Dâlja Mare and Dâlja Mică on the right of the Eastern Jiu along the Dâlja valley; Peștera - in the area of confluence of the Banița and the Galbena valleys; Slătinoara, on the interfluvium of Maleia and the Eastern Jiu), all of them amounting to about 1,000 inhabitants.

The town of Aninoasa (4,756 inhabitants) - located at 8 km from Vulcan and 11 km from Petroșani is a locality established in 1913 from the administrative reunion of numerous mining worker colonies, which in 1968 became an administrative-territorial unit by the administrative merging of two communes: Aninoasa (originally called Anena) and Iscroni (former Bărbătenii de Jos).

The town of Vulcan (29,076 inhabitants) - the second-largest city in the Petroșani depression, situated 12 km from Petroșani and 7 km from Lupeni - is situated on the terraces of the Crevedia River and the Western Jiu, about 10 km away from its confluence with the Eastern Jiu. It consists of 3 localities: Vulcan, Dealul Babii and Jiu-Paroșeni. In the administrative territory of the city the localities of Vaideei de Jiu, Merișoara and Coroieștii de Jiu were included. Historically, the dominant activities were agriculture and guarding the Vâlcan Pass (passage to Oltenia). Until 1870 it was the administrative and economic centre of Jiu Valley.

The town of Lupeni (27,307 inhabitants) is located 18 km from Petroșani and 7 km from Uricani, on both banks of the Western Jiu, being the endpoint of the railway derived from Livezeni (Petroșani). In its territorial development, the town also included the locality of Bărbătenii de Sus. The town is the access point to the Straja resort in the Vâlcan Mountains.

The town of Uricani (9,898 inhabitants) - originally called Hobița Uricani - is located 29 km from Petroșani, consisting of the localities of Uricani, Valea de Brazi and Câmpu lui Neag - and extends about 15 km along the West Jiu to the springs. Uricani was developed based on coal mining (coking coal), but also on the mining and quartz processing station, being the largest administrative-territorial unit in Jiu Valley and one of the main entrance gates into the Retezat National Park.

Localities with a rural character that are components of the towns can be divided into the following demographic categories:

- a) large villages: Jiu-Paroșeni, Lonea, Cimpa;
- b) medium villages: Dealul Babii, Iscroni, Jieț, Dâlja Mare, Dâlja Mică;
- c) small villages: Tirici, Rășcoala, Valea de Brazi, Slătinoara, Câmpu lui Neag.

Medium and large villages are located in the proximity of traffic arteries, towns and mining areas, while the dynamics of small villages is determined by the agricultural specificity of their economy, the isolation from the main circulation routes within the depression.



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3.2. DEMOGRAPHIC PROFILE AND WORKFORCE

Until the beginning of the 19th century when the mining operations began, the number of inhabitants living in the depression area was small and made up of peasants dealing with animal husbandry. In 1735, 405 inhabitants lived in the depression, approximately 976 in 1750, 4,145 inhabitants in 1818, and about 5,000 in 1868. Between 1850 and 1900 the mining centres attracted a high level of workforce, the cumulative population of the current towns Petroșani, Lupeni and Vulcan increasing from 3,636 to 22,939 inhabitants. In 1919, the number of inhabitants reached 48,000. In 1930 the population reached about 72,000, in 1956 it reached 95,000 inhabitants, while the population census in 1966 registered 130,000 inhabitants.

The initial population had their households scattered throughout the depression, with some small-scale grouping tendencies along the Western Jiu and Eastern Jiu rivers. The number of inhabitants increased as a result of the successive groups of population coming from Țara Hațegului (Hațeg Country), from Mărginimea Sibiului or from other neighbouring territories. The scattering of households in the depression was a dominant reality even

in the first part of the 20th century, with more than a hundred hamlets in the area, most of them located along the Western Jiu and the Eastern Jiu rivers. The process of urbanisation of Jiu Valley led to the inclusion of most of them in the new localities. In areas neighbouring the mountain there are to this day isolated houses whose inhabitants deal with specific traditional activities: animal husbandry and forestry activities.

The vast process of industrialisation and urbanisation in the second half of the communist period has led to significant migratory flows to Jiu Valley mining towns, with a clear impact on population growth. Until the mid-1970s, demographic growth was primarily due to migratory growth, and afterwards to natural growth. There were 134,075 inhabitants in 1977 in Jiu Valley, and the maximum population registered was recorded at the 1992 census (165,090 inhabitants), and the 1997 census respectively, according to the Hunedoara County Statistics Department: 169,911 inhabitants.

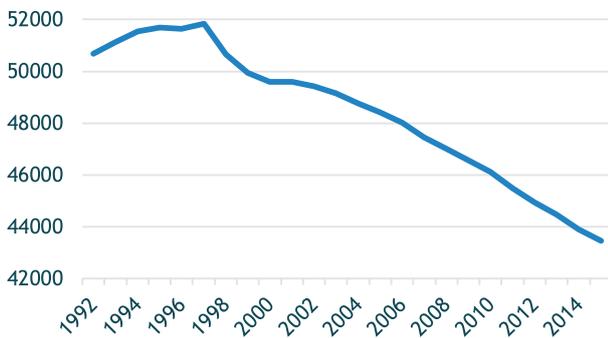


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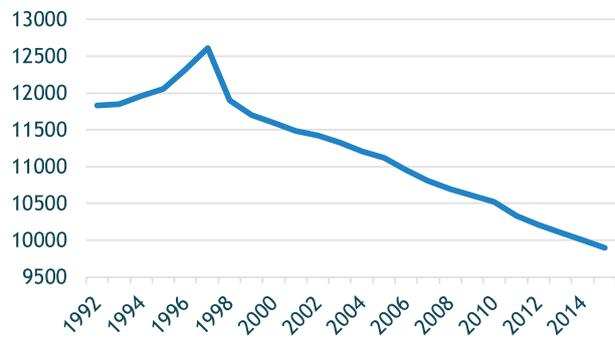
As a result of the local and national economic changes, the population of Jiu Valley decreased after 1992, reaching 158,678 inhabitants in 2002, respectively 146,200 in 2011 and 139,718 inhabitants in 2015. All the localities in Jiu Valley have registered population decreases since

1992, the most drastic being recorded in Lupeni (-6334 inhabitants, that is -23.1% of the total population), Vulcan (-5771 inhabitants, -19%), respectively Petroșani (-7224 inhabitants, -16% of the population).

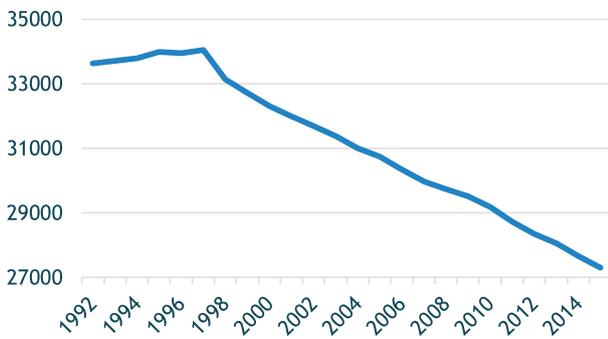
Demographic rate in Petroșani



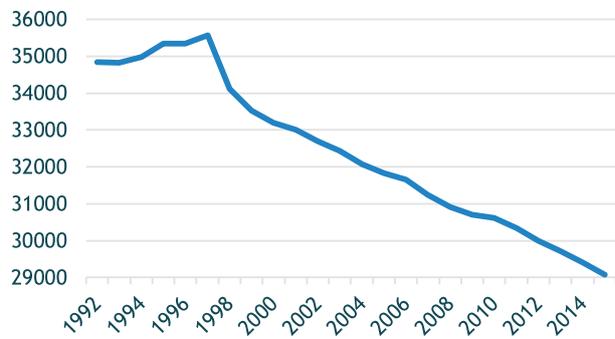
Demographic rate in Uricani



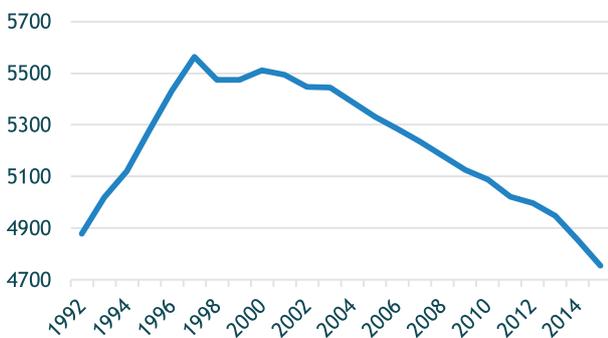
Demographic rate in Lupeni



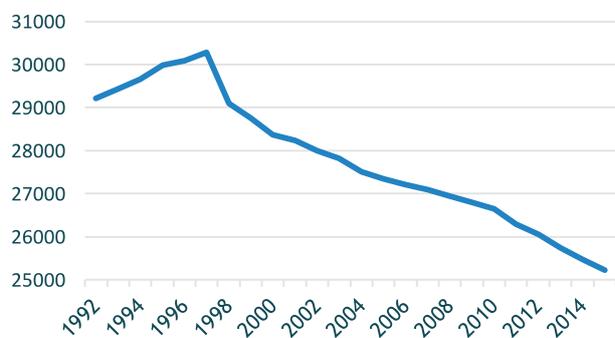
Demographic rate in Vulcan



Demographic rate in Aninoasa



Demographic rate in Petrila



Population decline is also reflected in the significant decrease in population density, both as a whole and at the level of each administrative-territorial unit and locality. In 2011, the average population density was 135 inhabitants/km², exceeding the national average (91 inhabitants/km²), the highest densities being recorded in the towns of Lupeni (357 inhabitants/km²), Vulcan (324 inhabitants/km²) and Petroșani (205 inhabitants/km²), and the lowest in Petrila (80 inhabitants/km²) and Uricani (80 inhabitants/km²) as a result of the large administrative area, respectively the tendency of scattered localities.

After 1992, the overall decline in the population of the depression was slower than the national average, which is explained by the attenuation of the impact of the general economic crises through special support for miners in the region. However, the natural population growth gradually decreased from positive values in 1992 (10.73‰ in Uricani or 8.78‰ in Vulcan) to accentuated negative values in 2014: - 6.5‰ in Aninoasa, - 4.9‰ in Petroșani or -4.12‰ in Petrila. After 1992, the birth rate recorded the most drastic decrease, due to the restructuring of the mining industry and the massive layoffs of miners, as well as to the accentuated phenomenon of regressive migration, that is, the return of a significant part of the population that had previously migrated to the Petroșani mining area back to the areas of origin. In addition, the natural movement is marked by the intensification of international migration of a large number of persons from the active population.

Migration became negative between 1992 and 2011 in all the cities of Jiu Valley. The highest values of migratory growth were recorded in small towns where the mainly mono industrial economy was more affected

by the shock of economic restructuring and deindustrialisation (-14.6‰ in Uricani, -9.5‰ in Lupeni), respectively by the social effects of this process compared to other cities and villages that had a diversified economic profile (-5.3‰ in Petroșani).

Aninoasa's negative dynamics from a migratory increase of +46.5‰ in 1992 to a -16.9‰ decrease in 2014 is surprising. Regressive migration, explaining most of these statistical values, has mobilised almost half of the first-generation population coming to Jiu Valley in the previous decades from Moldova, Oltenia and Transylvania. The highest values are registered in the cities of Vulcan and Uricani.

Mass layoffs in the mining sector which was the basis of the local economy and implicitly the field of activity with most employees, as well as difficulty in finding alternative employment, led many residents to return to the areas of origin. Towards the end of the 1990s, their massive relocations marked the urban landscape, many blocks of flats and neighbourhoods being virtually abandoned and apartments often devastated (e.g. abandonment of about 200 apartments in the Dallas district in Lupeni in 1998-1999).



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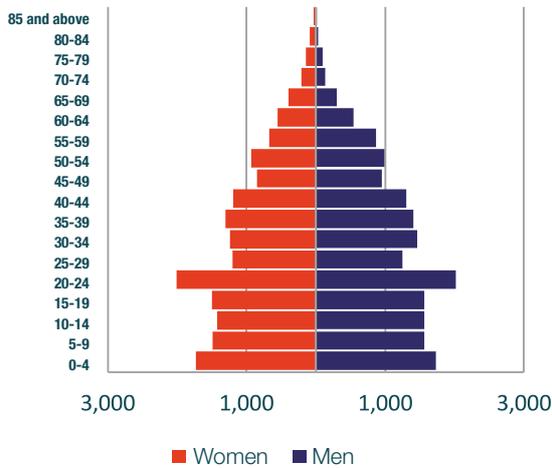
The **population structure by age groups** highlights the dynamic of the age pyramid and announces future demographic and economic crises. The analysis of age pyramids highlights the dynamic of certain population groups throughout the economic transition period to this date. Although the birth rate declined steadily between 1992-2011, the share of the young population was higher than the national average. However, demographic decrease and low birth rates show profound changes in the age pyramids, with negative effects for the next 25-30 years. Thus, apart from the generational cohorts as a result of the 1966 decision related to the increase of birth rate, namely the 45-49 age group and the 25-29 age group born after the

events of 1989, when economic welfare in Jiu Valley still favoured a sustained birth rate, the other age groups acutely decrease in numbers, thus not ensuring the biological viability of the future development of the area.

The aforementioned negative demographic dynamics have resulted in a general decrease in the share of young people in the localities of Jiu Valley (from 16.93% of the total population in 2007 to 13.60% in 2015), demographic ageing and increase in the number of elderly persons (from 9.74% in 2007 to 12.03% in 2015). These phenomena indicate a demographic imbalance and a considerable decrease in the proportion of active people.

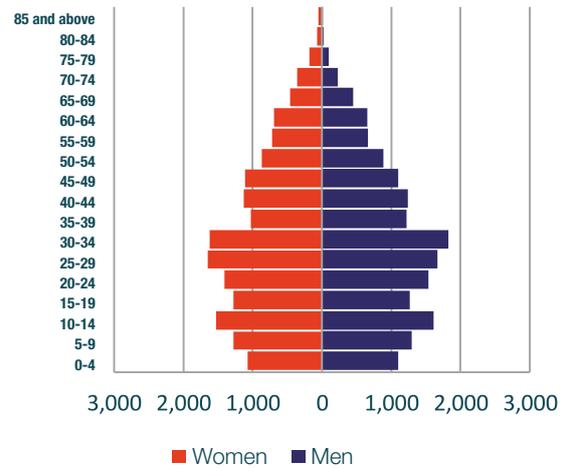
Vulcan - year 1992

Age and gender distribution



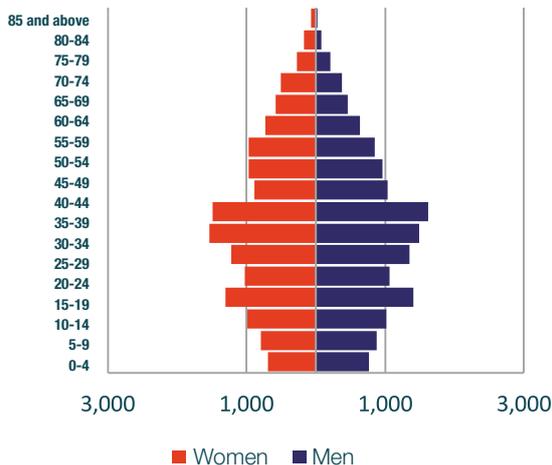
Vulcan - year 2000

Age and gender distribution



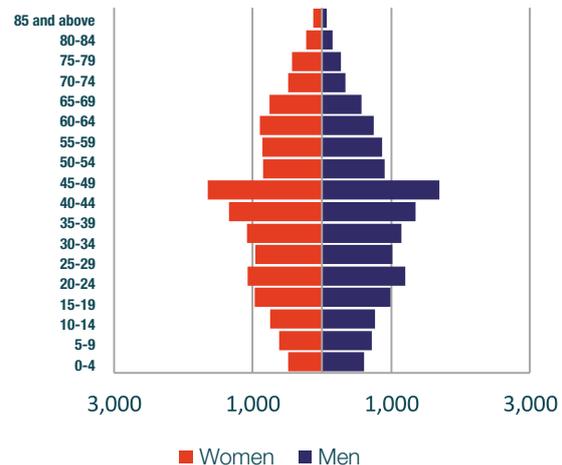
Vulcan - year 2010

Age and gender distribution



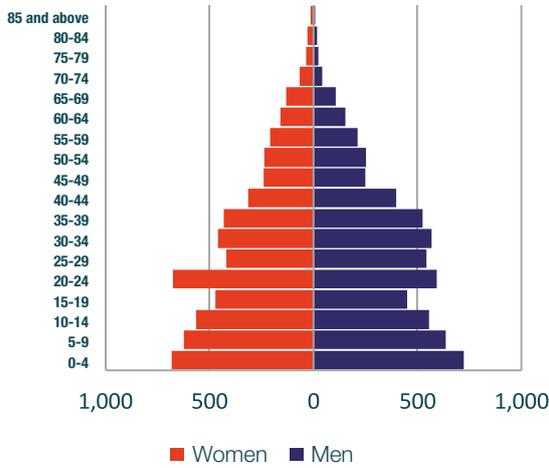
Vulcan - year 2017

Age and gender distribution



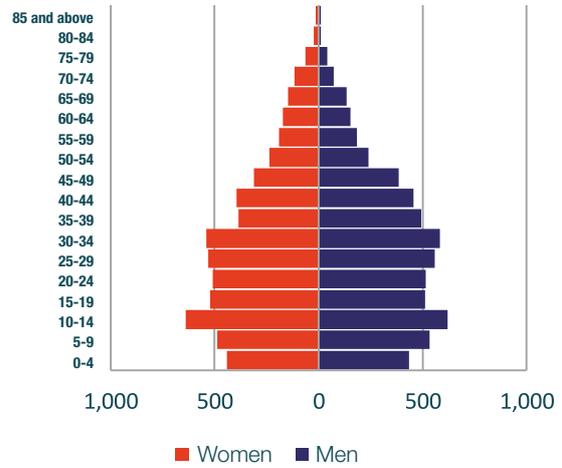
Uricani - year 1992

Age and gender distribution



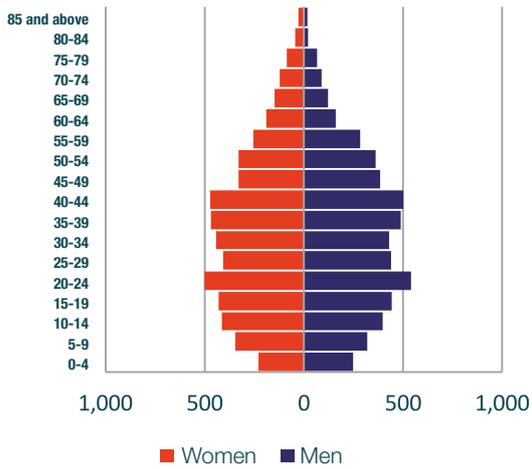
Uricani - year 2000

Age and gender distribution



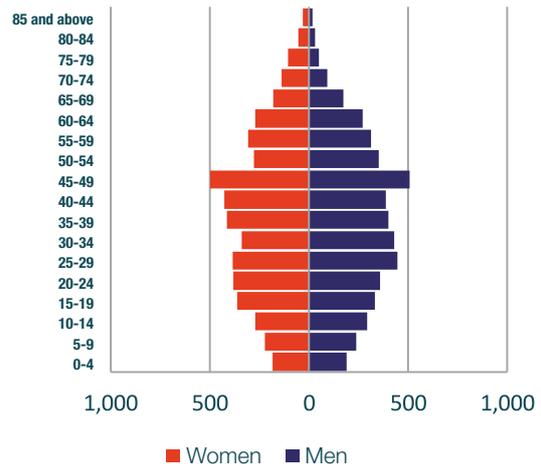
Uricani - year 2010

Age and gender distribution



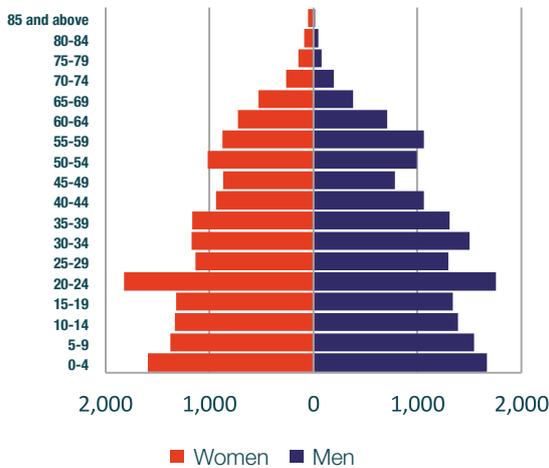
Uricani - year 2017

Age and gender distribution



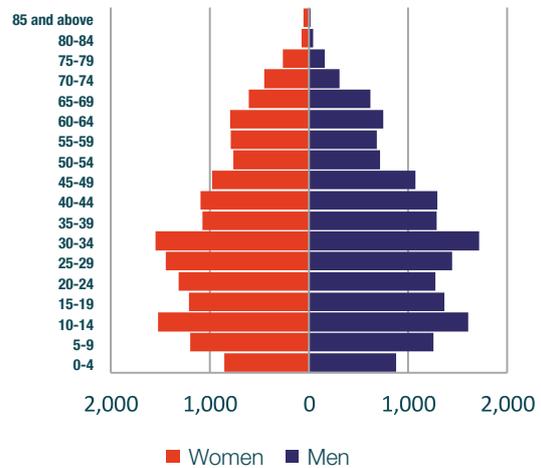
Lupeni - year 1992

Age and gender distribution



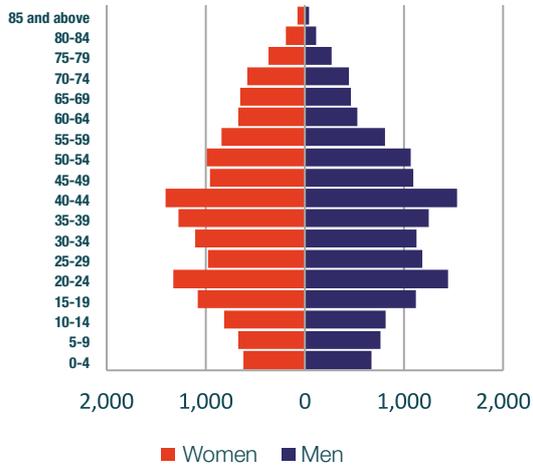
Lupeni - year 2000

Age and gender distribution



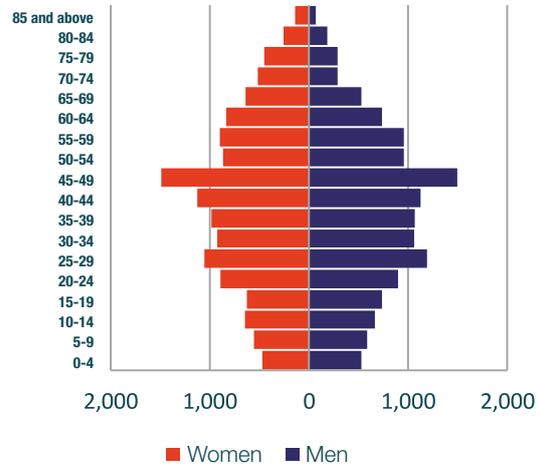
Lupeni - year 2010

Age and gender distribution



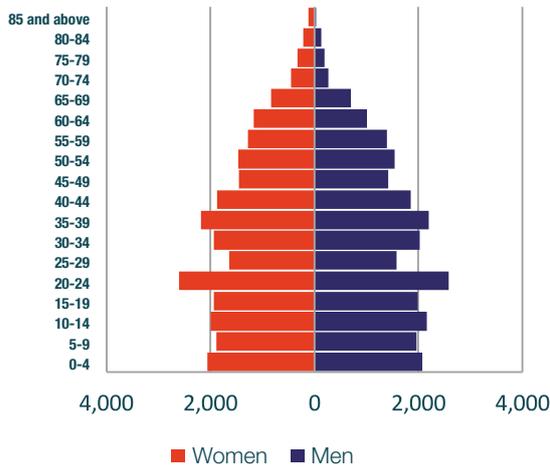
Lupeni - year 2017

Age and gender distribution



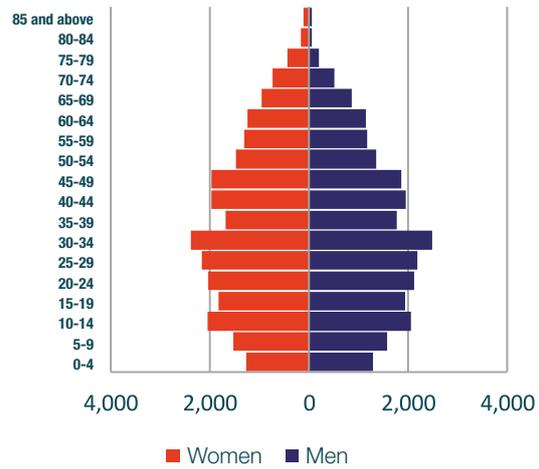
Petroșani - year 1992

Age and gender distribution



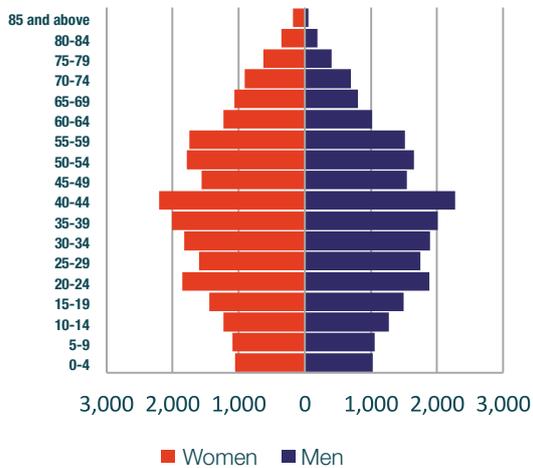
Petroșani - year 2000

Age and gender distribution



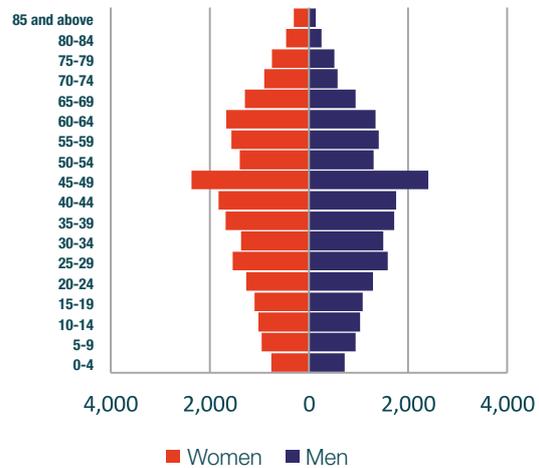
Petroșani - year 2010

Age and gender distribution



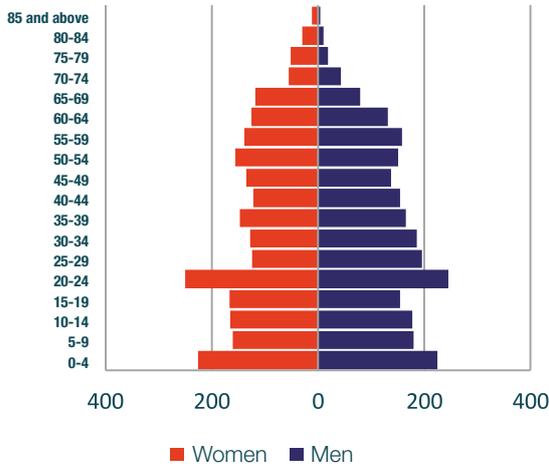
Petroșani - year 2017

Age and gender distribution



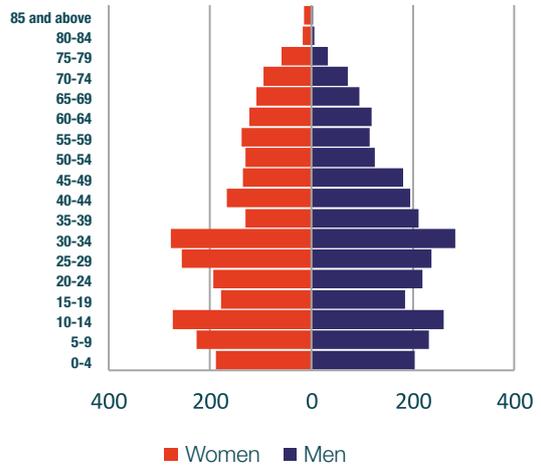
Aninoasa - year 1992

Age and gender distribution



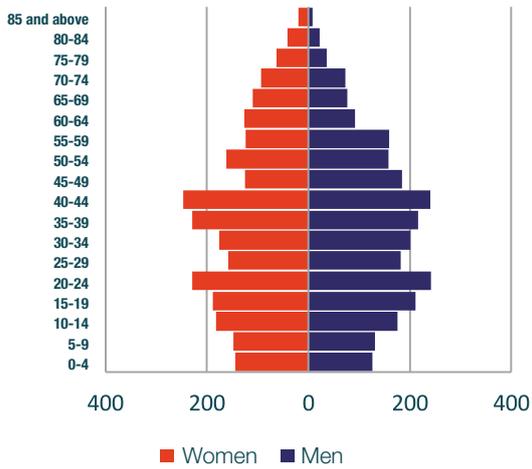
Aninoasa - year 2000

Age and gender distribution



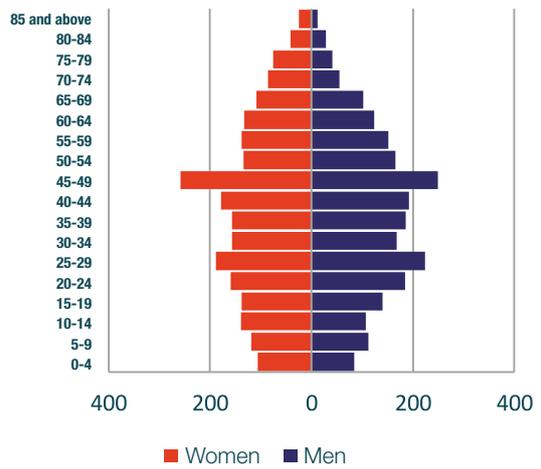
Aninoasa - year 2010

Age and gender distribution



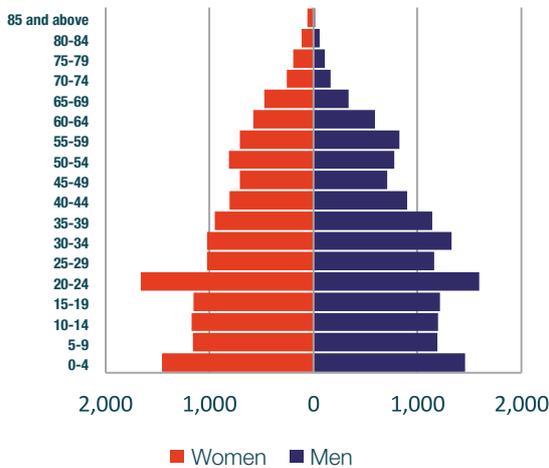
Aninoasa - year 2017

Age and gender distribution



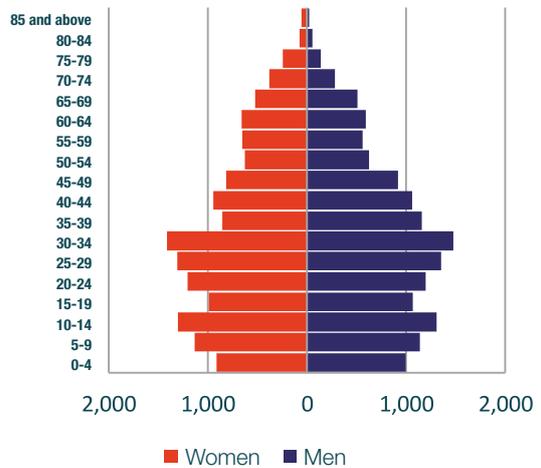
Petrila - year 1992

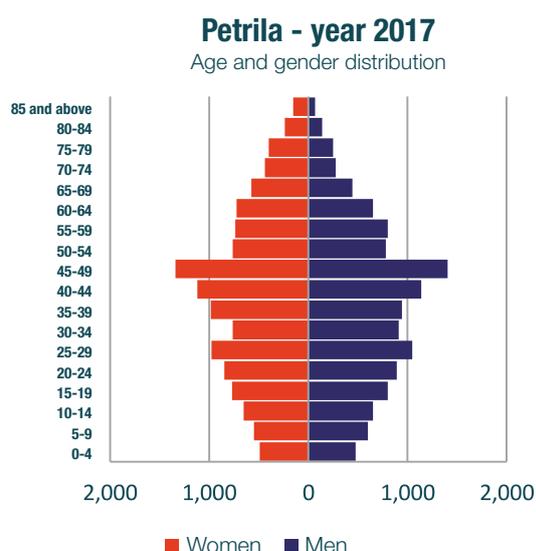
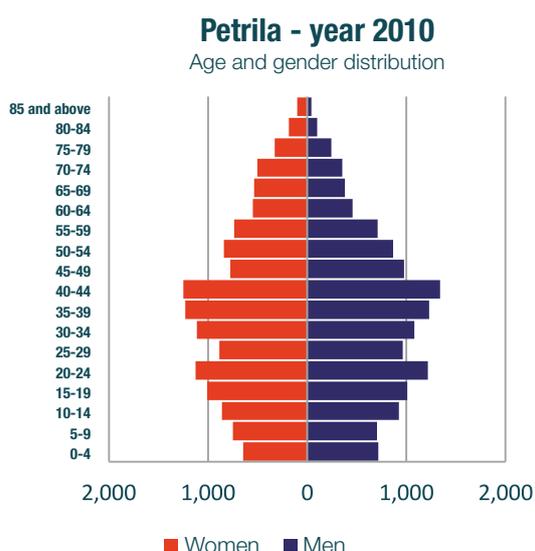
Age and gender distribution



Petrila - year 2000

Age and gender distribution





Employed population registered in Jiu Valley in 2011 is lower than the average of Hunedoara County (53.07%), the 58,888 inhabitants with a job representing 39.42% of the total population of the region. Compared to this average, higher employment rates were recorded in Petroșani (43.7%) and Uricani (40.4%), while the lowest rates were registered in Lupeni (37.9%) and Aninoasa (36.2%).

The number of unemployed persons has declined steadily in the last decade, both in Hunedoara County (from 16.4 thousand persons in 2010 to 7.8 thousand in 2017), and in the villages of Jiu Valley. At the level of administrative-territorial units, statistical data regarding the mentioned period reveal not

only the decrease in the number of unemployed persons but also wide variations from one locality to another. Thus, in 2010, the highest number of unemployed persons was recorded in Petroșani (1332), followed by Petrila (964) and Vulcan (892); in 2017 most unemployed persons were recorded in Aninoasa (834), Petrila (300) and Petroșani (259). The positive dynamics of this indicator mean, on the one hand, overcoming the profound social-economic crisis which affected the region for more than a decade and an economic restructuring from the dominance of the primary sector (mining and agriculture) to production and services, and on the other hand, relocation to other regions or countries of many unemployed persons.

3.3. ECONOMIC PROFILE

The economy of Jiu Valley is dominated by mining and pastoral activities. The economic development of the depression is linked to the exploitation of coal, starting in the middle of the 19th century, which has completely changed the entire social-economic life of the depression, but also its landscape. The pastoral activities carried out

by the “momârlani” (as the local farmers are called), but also those related to forestry, which were predominant until then, were gradually overtaken by extractive and industrial activities. The economic specificity of the depression is changing profoundly, with animal breeders being replaced by miners working in the mining industry.

Jiu Valley (Petroșani Depression) gradually became an important economic centre in the second half of the last century, turning it into the most important coal basin of Romania. In this context, the mining centres Petroșani, Petrița, Lupeni, Vulcan, Uricani grew from a demographic point of view and their precincts expanded and changed the urban structure and morphology in relation to the dynamics of the new economic functions. Most of the population is engaged in mining activities.

The activities related to the exploitation of forests were developed in parallel, as for the organisation of the mines large quantities of wood were necessary. The forests occupied very large areas, gradually decreasing, their place being taken by pastures and meadows. The majority of the “momârlani” constantly refused to work in mining, saying they were shepherds, and therefore did not accept to work in the extractive industry, continuing to carry out traditional agricultural activities with which they fully identified themselves.

Organised coal exploitation in Jiu Valley coal basin began in 1840 (the Petrița and Lonea mines) and expanded and intensified later in the other centres. The first coal mines were dug in the eastern part of Jiu Valley, in Lonea and Petrița (1840), as these were areas from which coal could be transported more easily. In 1859 the first coal extractions were carried out in Jiu Vaidei - Vulcan area. Subsequently, after the railway connection and the extension of the railway networks within the depression were finished, the exploits took place in the western part of the area. In 1870-1890 the mines in Dâlja, Lonea and Aninoasa were opened, and in 1892 the ones in Lupeni. At Aninoasa, a

wooden funicular for coal transport was made in 1890, in Petroșani a funicular of 4 km was built in 1894 and in Lupeni a power plant and a funicular were built in 1900. After 1895, the coal mines started working in the area of Dâlja, Iscroni, Vulcan, Uricani and Câmpu lui Neag.

The exploitation of coal deposits was the basis for the industrial development of the depression. After 1950, the towns of Petroșani Depression were equipped with machineries, assemblies and parts necessary for the mining industry (Petroșani, Lupeni), with hydraulic pillars (Vulcan) or with those that prepare the coal (Coroești) or those where coal was used in the production process as raw material (coal power plant in Paroșeni), but also with furniture plants and other small plant operations etc. Also, industrial activities had been developed that made use of the female workforce: the artificial silk factory Vâscoza in Lupeni, the textile factory in Vulcan, etc. The agriculture of the “momârlani” was dominated by livestock breeding (sheep and cattle), respectively potato crops, fodder plants (clover, lucerne), corn and beans.

In Romania, in 1989 mining reached the highest value (278 mines and 17.5 thousand ha), the mining sector representing a mode of life for 10% of the active population (Mironovici, Turdean, 2000). After 1990, the extraction industry continued to be an important component among the Romanian industries, as demonstrated by granting important subsidies from the state budget to most of the mining operations, although in some cases the low economic efficiency of the deposits and the poor productivity of the extraction activity was well-known. Although the restructuring of the industry had an important component of modernisation, the volume of investments gradually decreased in all branches of the extraction industry due to

the very large budgetary effort required by the maintenance of the mining and the retention of the workforce. After 1996, as a result of the restructuring measures of the mining industry at national level, there was a decline in the workforce. In the coal mining and coal preparation sector, which had the largest number of employees that year, more than half of the jobs disappeared by the year 2000.

In order to reduce the social and economic imbalances in the mining basins, but also to encourage local entrepreneurial investments and initiatives, in December 1998 the Government declared Jiu Valley, along with 25 other mining areas, a less-favoured mining area. At the time of declaring, the unemployment rate was of 26.9%. Gradually, 13 of the 15 mines in Jiu Valley were shut down, the last miners of the National Pit Coal Company being hired to guard and preserve the mining sites. In 2018, the Lonea and Lupeni mines were closed, and only the Livezeni and Vulcan mines are still functioning. The reduction in mining

activity has also led to the reduction or disappearance of factories that produced mining machinery. The coal power plant in Paroşeni has reduced its activity and uses a single power generation group.

The emergence and development of entrepreneurial initiatives have been limited, the lack of experience and the low volume of compensatory payments received by miners at the time of layoff was insufficient for developing a business. The service sector, which did not involve a high volume of investment and financial turnover or special technical skills, has become the economic alternative for an increasing number of the population of Jiu Valley. At the same time, many people have invested compensatory wages in housing construction, especially in the villages or outskirts of the towns with the largest agricultural and forestry areas, Uricani and Petriila. The Petroşani Depression is, due to its economic specificity, the variety of relief and natural and anthropic landscapes, a region with high tourist potential.

3.4. THE LABOUR MARKET

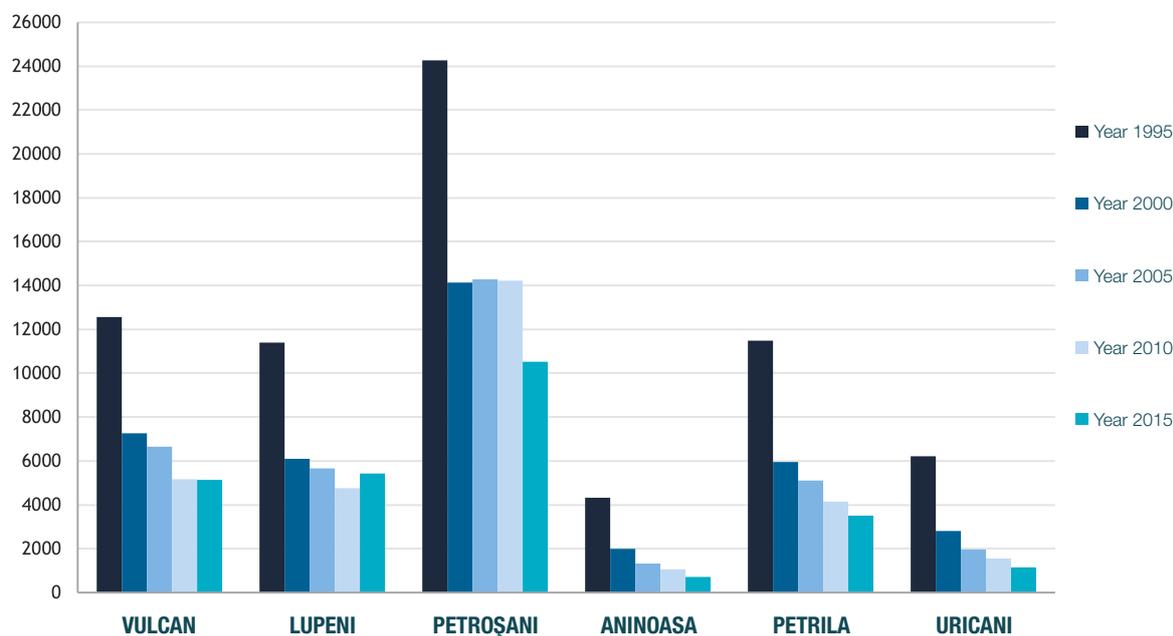
Recent statistics on the sectors and activities in which Jiu Valley workforce is being deployed now shows the profound change of the region as a whole, but also of the functional profile of the localities. As most of the localities had a mining profile, some of them with a significant mono-industrial character (Aninoasa, Uricani), the economic restructuring process required a decrease in coal production, a decrease in the number of employees and, implicitly, change of their economic profile. Thus, the economic activities have been diversified in all localities, the mixed economic character being more

obvious and diverse in the larger towns (Petroşani, Petriila, Vulcan).



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Average number of employees per localities



Even if the new sectors of activity are relatively similar, differences in share or representative character can also be identified from one locality to another. In Petroșani, the mix of functions existing before the economic restructuring period, its geographical position and its demographic size favoured the faster development of the services sector, but also the preservation of several previous industrial activities (textiles, light and food industry, and furniture). The preservation of cultural and university functions has enabled people to attract and invest both in other areas of the depression and outside it, as evidenced by the diversity of areas where the number of employees is significant. In Petrila and Vulcan, in two decades of economic restructuring, the number of employees in the primary sector (agriculture and coal mining) remained significant, but the number of employees in construction, trade, public services, etc.

increased considerably. In the villages with a rural profile (“momârlani” villages, but not exclusively - Câmpu lui Neag, Cimpa, Jieț, etc.), agro-pastoral activities have developed and diversified, the new economic activities being related to agro-tourism.

At the 2011 population census, the economic activities in which most of the active population was employed were: agriculture and forestry, mining, industry (machinery, wood and chemicals, etc.), construction, health and social work, services, etc. Agriculture and forestry are the activity sectors registering the highest number of declared employees, with Aninoasa, Petrila and Uricani registering the highest shares (over 22%). Mining activities remain an important economic sector in Vulcan, Petrila and Lupeni (over 17% of the employed population of these localities) and the lowest represented in Petroșani (10.3%).

The industrial sectors with the largest number of employees are those related to the production of machine tools (Lupeni 7.3%, Petrila 5.66%, Petroșani 4.53%), heat production, water supply and treatment (Vulcan 6.3%, Petroșani 4.6%), wood industry (Uricani 2.9%, Lupeni 2.8%), constructions (over 5% in all localities, and best represented as a number of employees in Petroșani, Vulcan, Petrila).

There are 525 people working in the hotel and tourism sector (including seasonal activities related to winter sports in Straja), most of them in Petroșani and Petrila. The services (technical and telecommunications, banking and insurance, real estate, etc.) are well represented in Petroșani, but they also

employ people from the other localities of Jiu Valley. 160 people work in the research and development sector, of which 108 in Petroșani within the research institutes and the University of Petroșani.

The public administration, education and health systems are among the most important local employers. Thus, 1856 people work in the education system, most of them in Petroșani (745) and Petrila (309). 4113 persons are employed in health care and social assistance, of which 1882 in Petroșani, 707 in Lupeni and 636 in Vulcan. The lowest number of employees in these areas is registered in Aninoasa: 66 people in education and 69 people in health care and social assistance.

3.5. INFRASTRUCTURE

Transport infrastructure

In 1867, the road and railway were built to ensure the transport of coal from the exploitation to the consumption area. The railway was constructed through the Merișor-Bănița pass (altitude of 759 m), linking the depression to the north with the Țara Hațegului and the Mureș corridor. In 1892 a railway was built that connected Petroșani to Lupeni. In 1894 the road from Jiu strait was built, ensuring communication with the sub-Carpathian area of Oltenia and the town of Târgu Jiu. In 1948 the Bumbăști-Livezeni railway was put into operation, through which the railway link between the Petroșani Depression and the south of the country was secured through Jiu Valley.

The Petroșani depression is crossed by 3 important road arteries:

- DN 66 / E79 Simeria - Petroșani - Târgu Jiu (Petroșani is 80 km from Simeria and 50 km from Târgu Jiu away);
- DN 7A Petroșani - Brezoi (on Lotru and Jiu Valley, a not modernised road of 106 km);
- DN 66A Livezeni - Câmpu lui Neag - provides access to the western part of the depression. A road designed to cross the Retezat National Park and connect with Băile Herculane and the Banat area (110 km).

The railway transport connects the Petroșani depression with the other regions of the country, both to the north (Simeria) and to the south (Târgu Jiu through Jiu strait).

Tourist infrastructure

In Jiu Valley there are 90 tourist accommodation units, most of which are situated in the administrative area of Lupeni – 53 villas, log cabins and guesthouses, followed by the municipality of Petroșani, with 25 accommodation units, among which the majority of hotels in Jiu Valley. In Uricani there are 6 accommodation units (especially log cabins and guesthouses), and in Vulcan and Aninoasa there are 3 and respectively 2 accommodation units, while in Petrița there is only one touristic log cabin registered.



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Urban infrastructure

In all Jiu Valley localities there are public water networks (between 115 and 25 km of network), sewerage (81 and 11.9 km of network) and natural gas (41.3 and 6.1 km of network), the largest networks being registered in descending order in Petroșani, Vulcan and Petrița, Lupeni, Uricani and Aninoasa. While the central areas of the localities are usually occupied by blocks of flats that have access to all mentioned public utilities, they are reduced or lacking in the peripheral districts or in the localities belonging to these towns.



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3.6. EDUCATION

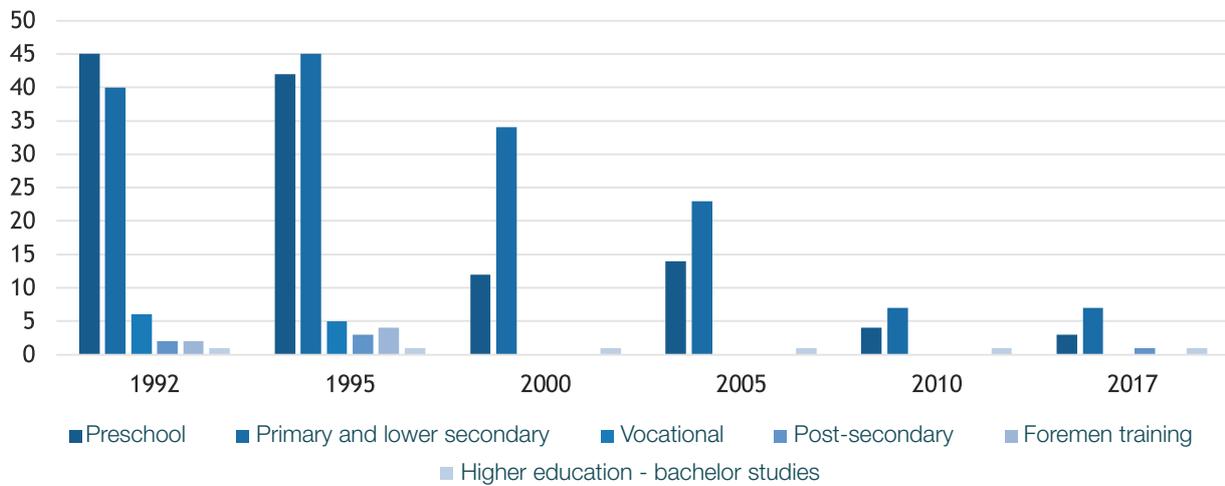
Between 1992 and 2017, the number of school units in Jiu Valley decreased by one-fifth, from 103 to 21 units of education, as follows:

- pre-school education - from 41 to 3 units;
- primary and lower secondary education - from 40 to 7;
- vocational education - from 6 to 0;
- post-secondary education - from 2 to 1;
- foremen training - from 2 to 0;
- higher education - the University of Petroșani exists to this day.

The decrease in the number of educational institutions highlights, on the one hand, a decrease in the number of young

people and the depopulation of the region and, on the other hand, the changing needs and priorities of the education system (especially the mining profession). Throughout the period of transition and economic restructuring, vocational schools and foremen training schools have disappeared amid ample national reforms in this education sector. In this extensive process of reducing the activity of educational institutions, the biggest losses occurred in Petroșani (from 37 to 10), followed by Uricani (from 10 to 1), Petrița (from 16 to 2), Vulcan (from 17 to 3) or Lupeni (from 18 to 4). Petroșani, through its geographic position, its demographic size and its role in polarising education and training activities and institutions, manages to maintain its cultural and educational function, unlike other cities where the education system is in decline.

Evolution of the number of educational institutions in Petroșani, Petrila, Uricani, Lupeni, Vulcan and Aninoasa



Preschool education institutions are only present in Petroșani (2) and Lupeni (1), with the rest of the localities not having crèches or other assimilated institutions. The number of schools (primary and lower secondary) decreased from 40 to 7, most of them having been shut down between 2000 and 2010. There are 2 lower secondary schools in Vulcan and Petroșani, while in Uricani there is no school left. Upper secondary schools has expanded from 7 in 1992 to 9 at present, of which 4 high schools are located in Petroșani and one in each of the other localities.

The Technical University of Petroșani was founded in 1950 and specialises in mining. As part of its coordination 2 research institutions have been developed (one specialised in mining research and design, the other in mining security and protection against explosion) with scientific and applied research results consistent to this day.

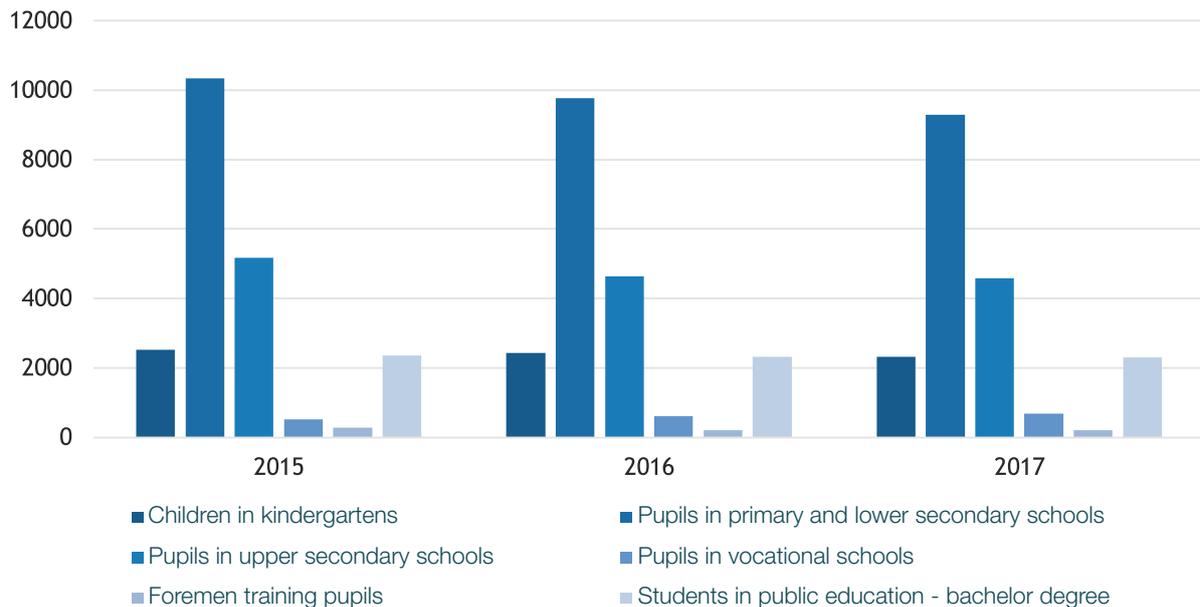
Moreover, the education system needs to be analysed based on the number of school pupils and university students. In 2015, in Jiu Valley, enrolment counted 22,911 pre-schoolers, primary, lower secondary, upper secondary school pupils and higher

education students, the majority of whom were primary or lower secondary school pupils (10,347 pupils), upper secondary school pupils and students enrolled in vocational and technical education (6799) and higher education students (3239). The small number of pre-schoolers is worrying, as it indicates difficulties in the social and economic viability of the region in the medium and long term, respectively difficulties in ensuring the optimum functioning of schools, high schools and higher education in Jiu Valley. The cities with the highest number of children enrolled in kindergartens and primary and lower secondary schools are Petroșani, Lupeni and Vulcan, and the smallest number of pupils is registered in Uricani and Aninoasa.



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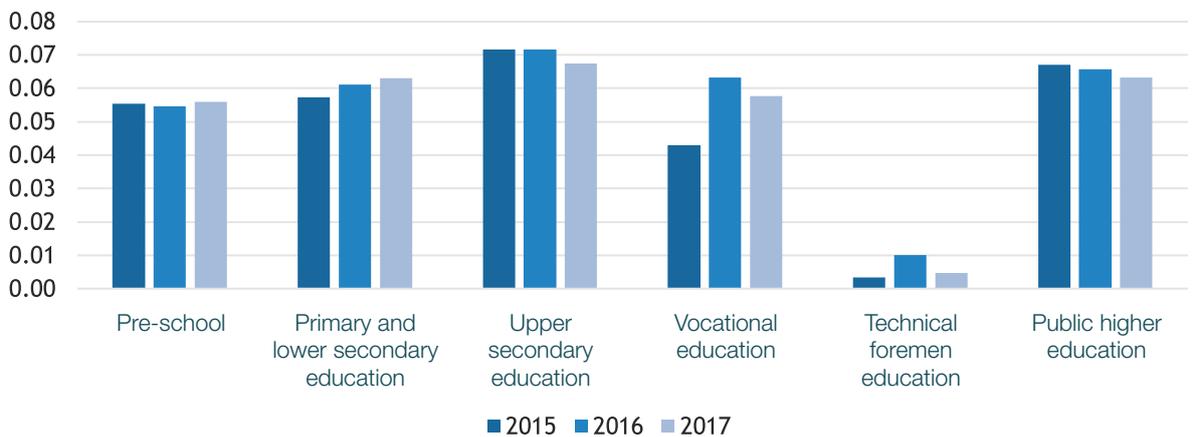
Evolution of the number of pupils and students in the towns of Jiu Valley



The total number of teaching staff is 1,385, out of which 170 are university teachers, 148 are kindergarten teachers,

while the rest are teachers in primary, lower secondary and upper secondary education.

Ratio teachers/students in the towns of Jiu Valley



3.7. SOCIAL SERVICES

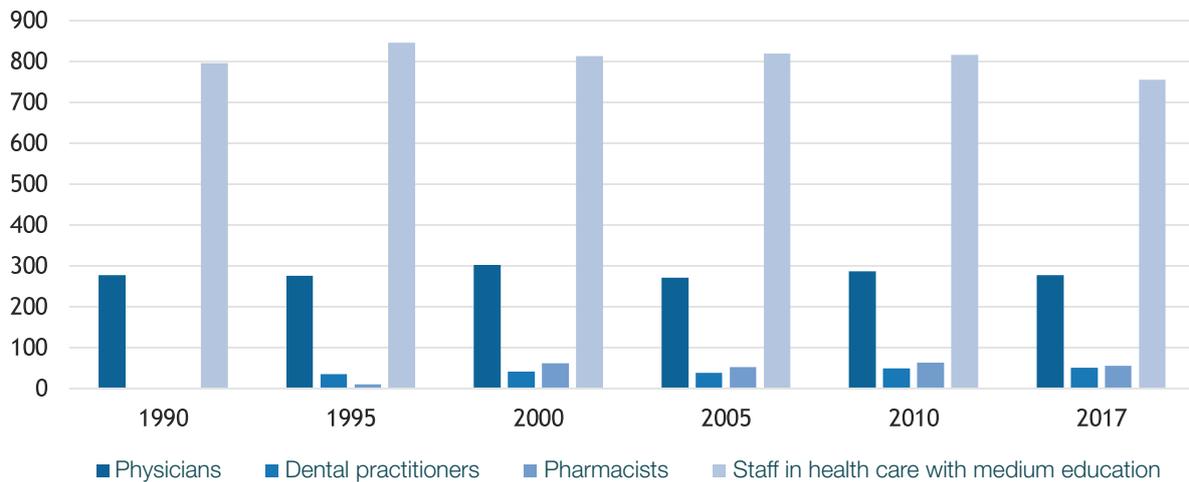
The social and sanitary services in Jiu Valley are provided by 4,113 specialists (social workers, medical staff, civil servants), of which 1882 in Petroșani and 69 in Aninoasa. Obviously, within the limits of

accessible statistical information, one can say that the social-health sector in Jiu Valley is facing the same difficulties and limitations as throughout the rest of the country. A relevant example is the low number of medical

doctors in relation to the number of inhabitants, the average value of this report being 1169 inhabitants/physician, with significant variations between Petroșani and

Lupeni (325, respectively 350 inhabitants/physician) and Uricani and Aninoasa (2001, respectively 2427 inhabitants/physician).

Evolution of health staff in the towns of Jiu Valley



Even if this human resource deficit is evident, there is an important health infrastructure in Jiu Valley, both in terms of typological diversity (hospitals, polyclinics, medical offices, etc.) and its territorial distribution, as not all of these units are concentrated only in Petroșani.

At present, the sanitary units in Jiu Valley are of the following categories:

- 3 hospitals (compared to 5 in 1992) and 3 out-patient clinics-Vulcan, Lupeni, Petroșani; the hospital in Uricani was closed in 2000 and the one in Petrila in 2011;
- 5 medical dispensaries (no longer available in Aninoasa), compared to 41 in 1992;
- 1 mental health centre, 1 specialised medical centre (both in Petroșani);
- 6 school medical consulting rooms and 2 for students;

- 61 family physician consulting rooms;
- 45 private dental surgeries;
- 39 medical speciality private consulting rooms;
- 4 public pharmacies and 22 private pharmacies;
- 20 public and 3 private medical laboratories, etc.

The spatial distribution of these sanitary units is not even, but it is strongly correlated with the size of the localities and the economic importance of the towns. Thus, Petroșani concentrates more than half of all mentioned sanitary units, followed by Lupeni and Vulcan. In Petroșani there are 2/3 of the number of hospital beds in the entire Jiu Valley. Statistics also highlight the impact of health sector reforms, such as the relevant moments when certain public health services have been privatised or have, according to the law, become an area of professional-entrepreneurial initiative.

ALTERNATIVE ECONOMIC DEVELOPMENT SCENARIOS

The previous chapter presented various perspectives on the transition to a low-carbon economy, proposing international examples of good practices indicating multiple levels of intervention to ensure the reintegration of local communities and economies into a diversified and sustainable economic circuit.

In the same note, this chapter aims to present three possible scenarios of economic development for Jiu Valley communities, based on economic impact data and estimates and two scenarios involving, on the one hand, the complete abandonment of mining operations and on the other hand the continuation of this activity on a smaller scale. The purpose of this chapter is to provide stakeholders with an overview of the costs and benefits of interventions, either on inaction or on economic development alternatives.

Thus, the first scenario measures the economic impact of the closure of all mines

and the Paroşeni Plant until 2024, and the second scenario highlights the costs generated by the modernisation activities and the continued activity of the Livezeni and Vulcan mines and the Paroşeni District until 2030.

Scenarios three, four and five reflect alternative interventions to the coal-based economic model, relying on the three sectors of the national economy - the primary (agriculture), secondary (industry) and tertiary (services) and exploring multiple economic activities. These three scenarios are presented with a time horizon of the years 2020-2030, depending on the measures and projects proposed in each case.

It is important to note that the scenarios are built on a linear basis based on working hypotheses and do not consider the various parameters specific to the investment sectors, such as price fluctuations, policies that affect the whole economy or the international economic context.

4.1. THE INACTION SCENARIO

This scenario assumes that no action is taken to compensate for the jobs and the added value lost following the closure of mines and the Paroşeni coal power plant in 2024.

The starting point on which this scenario was built includes the number of employees in the year 2017, within Complexul Energetic Hunedoara, involved in the exploitation activity. Complexul Energetic Hunedoara S.A. was set up in 2011 as a result

of the merger between Electrocentrale Deva S.A. and Electrocentrale Paroşeni S.A.



© Andrei Ducea for Greenpeace

In 2012, following the restructuring of the mining sector, the company Societatea Națională de Închideri Mine Valea Jiului S.A. (Jiu Valley National Mine Closing Company) was established, which took over the mines in Petrila, Paroșeni and Uricani, and the coal company Societatea Națională a Huilei S.A. (National Hard Coal Company), which took over the Lonea, Livezeni, Lupeni and Vulcan mines, as well as Prepararea Cărbunelui Valea Jiului (Jiul Valley Coal Preparation), Stația de Salvare Minieră (Mining Rescue Station) and

the Administrative Unit. In 2013, the newly established company Complexul Energetic Hunedoara took over the company Societatea Națională a Huilei Petroșani (Petroșani Hard Coal Company), namely the 4 mines it owned: Lonea, Livezeni, Lupeni and Vulcan, with an operating license until 2024³³.

In 2017, the situation of the employees in the mining activity was distributed as follows:

EM Lonea	EM Livezeni	EM Vulcan	EM Lupeni	Services rendered	TOTAL
777	799	675	1152	185	3588

These are supplemented by the active staff in the Mintia and Paroșeni production units (1252 employees), for a total staff of 4840 persons, according to the appendix to the financial statements 2017 CEH. Of these, 534 people represent administrative staff, and 4306 people work in production.

This scenario starts from the assumption that, by 2024, all mines will be closed, but also the Paroșeni plant, while the Mintia production unit will remain functional, whereby the foreseen investments will be made to meet environmental standards.

Scenario 1	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
Closing all mines and the coal power plant Paroșeni by 2024			-3.075
Subsidies	639,76		
Involving European funding + private sector (investments, profit obtained)	7.884	4.392	
Jobs	4840	770	-4070
Salaries paid		1.056	1.056

This scenario therefore considers the operation of the mines and the Paroșeni unit by 2024, including the completion of the investments within this timeframe so that they operate in line with environmental standards. According to the table above, this scenario involves maintaining operating budget subsidies from the state budget to cover the difference between the cost of production and the selling price, amounting to 97.6

million Lei in the year 2017, a value kept constant until closure. This amount also includes grants for exceptional expenditure³⁴. It is to be expected, however, that these subsidies needed to cover exceptional expenses will increase after 2024, considering the compensatory payments due to dismissal, the estimates amounting to 151.4 million Lei.

³³According to the Notes to the financial statements prepared for the year ended 31 December 2017

³⁴Idem 1

At the same time, on the cost side, we also consider the subsidies for finalising or starting the investments under execution or planned, as follows:

1) The modernisation of groups 3 and 4 of the Mintia coal power plant, estimated at 240 million Lei and 220 million Lei, as well as the completion of the investment regarding the collection and transportation in storage of slag, ash and depressurisation products for station 2 that is serving groups 3 and 4, for which the remaining works to be executed is 57 mil. Lei. With regard to the target for the collection and transport of slag, the execution contract was terminated in 2015 by the supplier as a result of the non-fulfilment of the payment obligations by CEH. With the rehabilitation of group 4, the situation is no better, with no major progress being made.

2) Completion of the investment objectives at the Paroşeni Plant, regarding the installation of a steam boiler of 270 t/h and of a CAF of 100 Gcal/h (execution remainder worth 151.5 million Lei), the realisation of the flue gas desulphurisation plant from group no.4 of 150 MW (execution remainder of 13.9 million Lei), and the change of the current collection, transport and storage technology of the slag and ash (the outstanding amount of 27.6 million Lei).

3) The main investments in the Mining Division mainly concern improvements in the Vulcan and Lupeni mines, totalling 8.8 million Lei. In the same category of costs, we include the recorded losses - until 2024 we assume maintaining the loss registered in 2017, and after closure of the mines and the Paroşeni coal power plant, we estimate a decrease proportional to the reduction of the activity, given the decrease in production and in revenue. At the same time, it is difficult to

estimate the impact of raw material substitution after 2024, especially under uncertainty about the future of the Mintia coal power plant that would remain functional. Thus, in total, the costs including the values of the investments to be completed and the registered losses amount to 7.88 billion Lei.

Regarding the benefits, we considered a constant level of revenues from electricity and heat supply over the period, diminished proportionally to the reduction of activity after 2024, plus the cumulative salaries paid to employees every year at the value of the average salary in the industry (3077 lei/month).

Thus, in this case, we are talking about net costs in the amount of 2.9 billion Lei, as well as a major impact on jobs of 4070 jobs lost in the medium term, between 2024 and 2030, without being replaced with alternatives in other sectors.

In the case of the economic and social impact, considering exclusively the losses resulting from the reduction of the salary and, implicitly, of the received salaries, the added value lost both directly and indirectly reaches almost 5 billion Lei. Due to the strong interdependence between the energy sector and other economic sectors, the results obtained by multiplication are significant. The manufacturing industry would suffer the most (1.57 billion Lei loss and 893 jobs), services sector (597 million Lei and 368 jobs), as well as the extractive industry (387 million Lei and 292 lost jobs) throughout the analysed period.

	Added value lost (million Lei)	Lost Jobs
Direct impact	-909	-4070
Multiplied impact	-3939	-2458
Overall impact	-4848	-6528

This situation is largely due to wage losses that are no longer contributing to the local economy, especially when both the number of dismissed workers is marked and the corresponding salary is above average. This option of inaction is not a viable solution

because, in addition to the major social impact, the economic costs of supporting the mining activity are significant, while the investments contribute more certain to compliance with environmental standards than to the efficiency of the process as such.

4.2. MODERNISATION OF PAROȘENI UNIT

The two coal power plants have undergone major changes following the decline in mining activity. In addition, according to the Law³⁵, the Member States of the European Union are obliged to refurbish the energy production units so that, starting with 2021, they will comply with the limits set by the European regulations. The production units within the Complexul Energetic Hunedoara have lost the Integrated Environmental Authorization in 2013, the coal power plant Paroșeni succeeding in renewing its permit in May 2019³⁶.

This scenario starts from the hypothesis that the Paroșeni and the Vulcan and Livezeni mines will remain functional until 2030, and the Lonea and Lupeni mines are closed in 2024. The Mintia plant also remains functional in this scenario, but without

considering investment works, given its uncertain future plans. On the one hand, a draft Emergency Ordinance considers the operation of the two power plants at a capacity of 400 MW and of the Vulcan and Livezeni mines to ensure the coal demand³⁷. On the other hand, in the latest version of Romania's Energy Strategy 2019-2030, in the case of the Mintia power plant, it is planned to build a new unit that would operate on natural gas³⁸, but also the withdrawal of all groups except unit no. 3, but there is no information on the amount of investment required or the legal framework for operation. What is known, however, is that the plans for the continued operation of the Mintia power plant exist, which is why this scenario considers keeping the jobs at the power plant.

³⁵Law 278/2013 transposes the European Directive 2010/75/EU on industrial emissions

³⁶<http://www.anpm.ro/documents/21661/2135868/AIM+PAROȘENI.pdf/7a233817-c239-4a32-82f9-f1b1b03f7ad9>

³⁷<https://www.focus-energetic.ro/inca-un-ajutor-pentru-ce-hunedoara-2-48983.html>

³⁸http://energie.gov.ro/wp-content/uploads/2018/11/Strategia_Energetica_FINAL_02_nov_2018.docx, p.54

The modernisation of the Paroşeni plant requires the completion of the already planned and ongoing investments, with a total value of 193.2 million Lei. The cost-benefit analysis considers maintaining the operating subsidies up to 2024 and granting the subsidies for compensatory salaries following dismissals, estimated at 75.1 million Lei, but also a constant level of losses and revenues when both plants are functioning.

According to an analysis made by the University of Petroşani³⁹, the annual operating costs of the coal power plant would increase

by 21.4 million Lei, requiring the procurement of material for the desulphurisation plant (limestone), as well as other variable costs. The unitary cost of desulphurisation in relation to the electricity produced would add 21.1 lei/Mwh produced and 25.4 lei/Mwh delivered, resulting in a higher production cost for the plant, contributing to maintaining very high production costs. Given that the sales price of electricity covers 30% of the cost of production, this additional cost would further exacerbate the difficulties faced by the unit.

Scenario 2	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
Preservation of the Livezeni and Vulcan mines and the Paroşeni plant until 2030 (and closure of the Lonea and Lupeni mines in 2024)			-1.648,5
Subsidies	563,5		
Involving European funding + private sector	7.367	4.772,5	
Jobs	4840	2819	-2021
Salaries paid		1.510,1	1.510,1

Wages decrease in proportion to the reduction of staff. The impact of the loss of jobs would come from the Lonea and Lupeni miners' disposal (1929 employees with wages, which can be estimated to be the loss of half of the personnel involved in the provision of services for the mines - 93 jobs for a total of 2021 lost jobs without being replaced by alternatives in other sectors.

In terms of impact, considering only wages and jobs lost as a result of mining activity, in a highly interdependent sector with other economic sectors, the induced effects of layoffs lead to losses of nearly 2 billion Lei cumulative and to another 1231 jobs in the rest of the economy, most of which in manufacturing (448), construction (73), or professional and administrative services (204).

	Added value lost (million Lei)	Lost Jobs
Direct impact	-455,67	-2021
Multiplied impact	-1973,7	-1231
Impact total	-2429,37	-3252

³⁹The economical, technical, social and environmental impact of non-finalizing the desulphurization facility at Paroşeni power plant, Marinescu et al. 2016

4.3. ALTERNATIVE SCENARIOS OF ECONOMIC DEVELOPMENT

As a former communist country located in Central and Eastern Europe, the change of regime in 1989 has brought a turning point for Romania in various fields, with the economy suffering many transformation stages, gradually reducing the share of industry and agriculture and increasing the dominance of services. Following the 2008-2009 economic crisis, the challenges continued. After 2013, economic growth was again recorded, mainly driven by exports of agricultural and industrial products, especially in the Member States of the European Union, but also by domestic measures to stimulate the growth of internal demand. In 2017, agriculture contributed 4.2% to GDP, followed by industry (33.2%) and services (62.6%)⁴⁰. Although agriculture has gradually reduced its share of GDP, Romania remained among the EU member states with a significant share of this sector, while the gross added value per employee is low compared to the similar sector from other states⁴¹.

At the same time, the economy of Jiu Valley has undergone many transformations - the old emblematic region of the coal and steel industry, with a surface of 163 square km, attracted the greatest attention, as it suffered a rapid decline in its activity. Following the impact of this transition period, the old industrial regions in the country had to adapt to this change in a weakened national economy. Since 1992, the population of Jiu Valley has declined steadily, from 169 thousand to 158 thousand inhabitants (2002), 146 thousand inhabitants (2011) and

139.7 thousand inhabitants (2015). In 2008, Jiu Valley was declared a disadvantaged area, with unemployment reaching an alarming level (26.9%). In 2017, if we consider the activity of the companies, 5% of them were active in the primary sector (2.83% in agriculture), 53.6% in the secondary sector and 41.4% in the tertiary sector, the proportions being kept in the breakdown of employment.

In this context, where the Romanian economy has made progress and there is a clear tendency to approach the structure of European economies, Jiu Valley is in a social-economical gap, being disadvantaged by the mono-industrial profile and dependence on the mining industry. Thus, this section presents alternatives for the development of the primary, secondary and tertiary sectors during the period 2020-2030 - on different types of insufficiently exploited activities in Jiu Valley. These activities are not supported by the mining industry but are based on economic activities that can contribute to the creation of accessible jobs by capitalising on initiatives already discussed at community level but remaining in the idea or project stage.

⁴⁰CIA World Factbook 2017

⁴¹<https://www.zf.ro/analiza/schimbarea-economiei-romaniei-in-ultimii-zece-ani-ce-modificari-a-adus-criza-si-ce-va-urma-10764247>

4.3.1. THE PRIMARY SECTOR

4.3.1.1. DEVELOPMENT OF FAMILY MICRO-FARMS

Based on the previously described social-economic analysis, Jiu Valley is characterised by an economic specificity based on pastoral activities, favoured by the geographic features of the area, an occupation that has been predominantly replaced by mining. However, livestock farming remains a viable alternative, which can be redeemed, due to the favourable geographical environment and the existing opportunities in terms of financing small family projects.

The scenario of developing entrepreneurial initiatives through the establishment of family micro-farms starts from the hypothesis that such a farm would need about 10-15 hectares of land to feed livestock. The initial investment for such a family farm starts from 300,000 lei, including the purchase of agricultural machinery and equipment for pasture processing, the purchase of animals,

plant production, salaries paid for two employees, and other operational expenses. Such a micro-farm can generate annual revenues of over 150,000 lei, from the sale of calves, but also from the utilisation of the surplus from the vegetal production.

Analysing the quantifiable costs and benefits of this intervention at an average project value, there is a state contribution through subsidies of 11.4 million Lei, while funding for project implementation can come from European funding worth 15 million Lei. Of this amount, beneficiaries usually have to provide 10% of the value of the investment project, and 5% of the value of the European funding is usually the state's contribution.

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
3.1. Micro-breeding livestock (50 farms)			38,8
Revenue		44,1	
Profit		16,8	
Subsidies from the budget	11,4		
Involving European funding + private sector	15,02		
Jobs		260	260
Salaries paid (10 years)		4,35	
Land area	500 ha		

⁴²The last column represents the difference between the total direct benefits (col. 2) and sum of the direct costs (col. 1)

In terms of benefits, such family businesses have the potential to become profitable income sources, which entrepreneurs can reinvest or use as income sources. In this case, an approximate calculation for an average production of calves and fodder per year, as well as a gradual increase in activity, could generate an aggregate profit of 16.8 million Lei. Also, salaries paid to employees are a constant source of income, offering the possibility for those who start such a business to secure a stable monthly income. Last but not least, the activity of micro-farms generates revenue, under the conditions of adequate management, not only at the level of the communities but also beyond the local market. Therefore, to support livestock farming, it is necessary not only to finance business start-ups but also to create opportunities for local, regional, national or international markets to integrate production into wider value chains, while ensuring continued demand for small farmers' production. An example of support measure is to encourage farmers to associate in order to access distribution and marketing channels more easily; another example may be the establishment of milk collection centres in their vicinity or the establishment of an animal slaughterhouse.

The impact on the economy, measured in three stages of development (2020-2023 - 20 farms, 2024-2026 - 20 farms and 2027-2030 - 10 farms) for the establishment of 50 family micro-farms by 2030, is given by the amounts that remain in the local economy, namely the profit and salaries paid to employees. In total, for the whole period, the direct impact is 28.6 million Lei, the investment also contributing to the creation of 260 jobs in the agricultural sector. The above table, as well as the following,

shows the impact of the measure in the long run.

The direct impact of such an intervention is not only to create job opportunities and to generate added value for the local economy - but capitalising on the potential of the area can also facilitate the strengthening of residents' confidence that income-generating activities may exist beyond mining.

Moreover, besides the direct impact of setting up family micro-farms, the impact of other economic branches stands out, which are less or more dependent on the agricultural sector, to which the direct effects contribute, but also a part of the related expenditures investment⁴³. The multiplier effect shows how the sums entering the economy through a particular sector (in the present case the agricultural one) determines effects in other sectors: in short, if small farmers use the profit obtained in manufacturing to buy a good or transport fodder with the help of a transport company, also in those sectors there is an increase in added value and jobs are created in proportion to inputs.



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⁴³For calculating the multiplied impact, we considered that half of the investment value remains in the local economy

	Added value lost (million Lei)		Jobs supported
Direct impact	21,1		260
Multiplied impact	In the own sector	In the other sectors	81
	43,2	34,4	
Overall impact	106,2		341

In this case, we notice a significant impact on the main sector (43.2 million Lei), as well as in related sectors, from which the manufacturing industry would have the most to gain (22.4 million Lei) as a result of the stimulation of the agricultural sector - a fact that can be explained mainly because of the affiliation to the same value chain as the food

industry, which is part of the processing sector, or the agricultural machinery industry. In the manufacturing industry, most jobs would be supported - 34 if we consider other economic sectors. Of the 81 jobs sustained by multiplication, 33 would also be created in the agricultural sector.

4.3.1.2. BERRY BUSH PLANTATIONS

According to data on national fruit-growing potential⁴⁴, the land areas in Jiu Valley area are suitable for the cultivation of fruit-bearing bushes, such as bilberries, raspberries, blackcurrant or blackberries. This sub-scenario deals with the opportunity to set up plantations of such bushes in a super intensive and ecological system, fitted with all the necessary equipment in order to obtain superior production. The number of employees estimated per year refers to the average number of employees, considering the seasonal character of the works.

Setting up a blackcurrant plantation of 10 hectares for a plantation bearing a 10-15 years life span requires an investment of approximately 1.1 million Lei. This includes design services, soil analyses, land preparation, plant clearing, commissioning the irrigation systems, soil fertilisation, agricultural equipment needed to maintain the plantation, but also the procurement of

seedlings and planting material. Such a plantation generates revenues, both from the sale of fresh fruits (assuming a quantity of almost 50,000 kg sold at a price of 8 lei/kg) of 335,966 lei, and from the processing of fruits, amounting to 251,975 lei.

In the case of this sub-scenario, we notice the considerable net direct benefits, considering the necessary investment value to set up berry bushes on an area of 500 hectares by 2030. The direct benefits come from a large number of paid employees, considering the intensity of work to serve the sector, but also the associated income and expenditure. The costs are rather for maintenance and relatively low if we think that such an investment has an average return of at least 10 years. At the same time, the fruit's selling price is high, and the demand for berries is high not only at national level but also internationally.

⁴⁴https://portal.afir.info/informatii_generale_pndr_investitii_prin_pndr_sector_pomicol_sm_4_1a_exploatatii_pomicole

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
3.2. Berry bush plantations (50 plantations)			381,3
Revenue		301,25	
Profit		139,9	
Involving European funding + private sector	69,3		
Jobs		500	500
Salaries paid (10 years)		9,47	
Land surface	500 ha		

Organic production also brings other benefits, such as trading in chain stores in specialised ecological departments, but access to these large stores must be facilitated at both producer and trader levels, which have become more open to small local producers, seeking partnerships with them to provide their customers with fresh products coming from reliable sources.⁴⁵ Another advantage of these fruit tree plantations is the versatility of the products - fruits can be sold fresh, but also processed, such as juices or other sweet products. A further step in the development of plantations can be to invest in processing equipment either from producers or from other entrepreneurial people in the area, making an important contribution to the diversification and development of the food industry.

Considering the economic and social impact of the investment, we notice a direct impact on wages and profit of 149,3 million Lei in the 11 years, as well as supporting 500 jobs by setting up and developing plantations. By multiplying the direct impact, to which we add half of the investment costs, assuming some of the material resources used will be local, we get a multiplied impact of 508 million Lei and 560 jobs. This is due to the effects of a new economic activity that does not take place in isolation from the rest of the economy but creates demand and supply for products and services to support the business. As with micro-farms, the greatest multiplier impact can be seen in the manufacturing industry, most likely due to the food industry that is part of this branch, which would have significant benefits from farming investments.

	Added value lost (million Lei)		Jobs supported
Direct impact	149,4		500
Multiplied impact	In the own sector	In the other sectors	560
	281,6	226,4	
Overall impact	657,4		1060

⁴⁵<https://carrefour.ro/corporate/stiri-presa/noutati/carrefour-romania-continua-programul-de-parteneriate-cu-producatorii-romani-de-legume-fructe/>

4.3.2. THE SECONDARY SECTOR

4.3.2.1. RENEWABLE ENERGY SOURCES

Exploiting the economic potential of renewable energy sources is a commitment of Romania not only to external partners but mainly to future generations, contributing to the sustainable development and aligning Romania with international practices in the field of energy consumption and production.

Jiu Valley is still heavily associated with the exploitation and production of coal for electricity and thermal energy, but current trends indicate the need to transform the area. Although an area whose course has been heavily influenced by coal reserves, Jiu Valley is viable to remain an area with a tradition in electricity production, as long as

the resources used are changed. Despite the fact that it has been insufficiently analysed and exploited, the potential of renewable sources of energy, especially solar and wind, may be a development factor, continuing to maintain Jiu Valley on Romania's energy map.

According to a Deloitte analysis⁴⁶, investment in renewable wind energy is returning 42% to the local economy, contributing to job creation and added value. In the case of solar energy, according to a study by EY and Solar Power Europe⁴⁷, just over 50% of the investment remains in the economy. Because the potential of the area in both directions requires a more in-depth understanding, estimates are based on minimum investment rates for the installation of 10 MW of solar energy and 10 MW of wind power by 2030 in three phases.

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.1. The renewable energy sector			-54,4
Subsidies from the budget			
Involving European funding + private sector	102,7	48,3	
Jobs		250	250

Thus, a total investment of 102.7 million Lei is necessary for the simultaneous development of the two sectors, considering a cost of approximately 5.1 million Lei per MW. Although the table above shows rather net costs and not direct net benefits associated with such an investment, this is caused by the difficulty of estimating actual

outcomes in terms of profitability or earnings from this activity. Therefore, given the potential for the creation of highly qualified and well-paid jobs in this sector, it is necessary to recommend feasibility studies that will analyse in detail both the technical aspects of the investment and the economic effects. Also, from the point of view of social

⁴⁶Renewable Energy in Romania: Potential for development by 2030, Deloitte, 2019

⁴⁷<http://www.solarpowereurope.org/wp-content/uploads/2018/08/Solar-PV-Jobs-Value-Added-in-Europe-November-2017.pdf>

effects, this option is becoming more realistic, with the possibility of being supported by programs for the re-qualification of miners that have been laid off also in the energy sector, namely installation and operation. Although it still is at the discussion stage, the opportunity would open new horizons to former employees in the energy industry, not only on the local market, in Jiu Valley, but also at national and international level.⁴⁸

Also, based on the aforementioned research on the impact of investments in this sector in the economy, a direct result of 48.3 million Lei is achieved, and a multiplier impact of 160.1 million Lei. Indirectly affected sectors are also the manufacturing industry and its sub-branches, but an important impact is noted in the construction sector (approximately 9.9 million Lei).

According to the ITUC methodology⁴⁹ on job creation in a green economy, in the case of investments in solar energy, 21 jobs are created in the installation phase and 1 job in the operating phase per MW. With regard to wind power, the installation involves the creation of 2.7 jobs per MW in the installation phase and about 1 workplace for operation. The three phases of the investment - the installation of 2 MW by 2023, plus 3 MW by 2026 and another 5 MW by 2030, will require jobs to be maintained from one stage to the next, with additional investment generating new jobs. Thus, a direct impact of 257 jobs is achieved.



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	Added value lost (million Lei)		Jobs supported
Direct impact	48,3		257
Multiplied impact	In the own sector	In the other sectors	164
	71,5	88,6	
Overall impact	208,6		421

⁴⁸<https://gorjeanul.ro/propunere-mineri-transformati-in-navigatori-eolieni/>

⁴⁹Millennium Institute, 2012. "ITUC green jobs assessments research project– Methodology Overview", <http://goo.gl/BdWYM8>

4.3.2.2. INCREASING ENERGY EFFICIENCY OF BUILDINGS

In Romania, the national program for the thermal rehabilitation of blocks of flats classified in a lower energy class (blocks built between 1950 and 1990 in particular) was originally launched in 2002, relaunched in 2007, and periodically modified in terms of conditions to access the funds, co-financing of beneficiaries and the rules that govern the entire programme. Initially, national funding was divided into almost equal parts between the state budget, local authorities and direct beneficiaries, but since 2008, the weighing of each stakeholder has been changed, with the state contributing 50%, local authorities 30% and the tenants 20%. This allocation put even greater pressure on local budgets, which could bear the beneficiaries' part as well, in addition to their own established contribution. In 2017, 10.5 million Lei were allocated, of which only the town of Petrița is found on the list of financial allocations, by 0.3 million Lei. In 2016, the total allocation amounted to 22.5 million Lei, of which Petroșani and Petrița received an allocation of about 1 million Lei, and in 2015, of the 50 million Lei allocated at national level, Petroșani and Petrița benefited from approximately 1.5 million Lei⁵⁰.

Another programme dedicated to increasing the energy efficiency of buildings is the thermal rehabilitation programme for housing buildings financed by bank loans guaranteed by the government for the period 2010-2016, with a total budget of 847,000 Lei and 17 credits granted amounting to 365,000 Lei. In 2017, the funds allocated to this program were worth 250,000 Lei⁵¹.

The “Casa Verde” (Green House) programme, managed by the Environmental Fund Administration, provides 90% of the cost of replacing traditional heating systems

with renewable energy plants to the beneficiaries. Although the programme initially provided funding for the replacement of heating systems with photovoltaic, geothermal, wind or other renewable energy systems, in 2019 the programme foresees a grant of 20,000 Lei for individuals wishing to install photovoltaic systems⁵². This programme is not expected to be extended after the end of this year.

According to the Final Implementation Report of the Regional Operational Programme 2007-2013, 111 projects with a total value of 198 million euro were signed at national level, contributing to the rehabilitation of 37,126 apartments for energy efficiency, resulting in 26.7 GWh/year total energy savings. In the current programming period, the objective of increasing the thermal efficiency of housing has been reassumed, with beneficiaries accessing financing ranging from 100,000 EUR to 5 million EUR at a co-financing rate of 40% of the total expenditure. Overall, over the period 2014-2020, this investment priority benefits from a 505 million EUR allocation, of which 49.9 million EUR available in the West Region.



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⁵⁰Ministry of Regional Development and Public Administration <http://www.mdrap.ro/lucrari-publice/-3144/-3692>

⁵¹Idem 16

⁵²<https://tehnomic.ro/public/documents/Prezentare%20program%20Casa%20Verde%202019.pdf>

In Jiu Valley, 28 blocks were rehabilitated in 2009, including 21 blocks in Petrila (627 apartments), 6 blocks in Petroșani (137 apartments) and 1 block in Uricani (20 apartments), the total spent amount being 3.8 million Lei. In 2017, there was no major progress in accessing the funding available to carry out rehabilitation works. In 2018 the contract for the thermal rehabilitation of the first 6 blocks in Uricani was signed⁵³, and in 2019 the financing contracts were signed for 4 blocks in Petrila (projects worth 4.1 million Lei)⁵⁴ and 5 blocks in Petroșani (a project worth 3.6 million Lei)⁵⁵. The technical conditions to be met for accessing funding and the financial co-financing barriers are impediments that have led to a low level of work execution in the area, despite demand, as most of the blocks in the area need rehabilitation works. However, it is worth mentioning that public administrations have made efforts to write and submit projects in this respect in recent years, but few have been winning, as mentioned above.

Rehabilitation of dwelling buildings does not only involve the insulation of blocks but also roofing and basement works, as well as the replacement of exterior carpentry, rehabilitation works of the heating system and modernisation of the heat distribution system,

therefore, depending on the complexity, the costs may vary significantly between 120,000 Lei/block and 500,000 Lei/block, on average. The number of jobs created was estimated from the average investment value, the number of blocks that benefit from the investment, as well as staffing requirements in relation to 1 million Eur invested, which, in turn, was estimated using the results of the study conducted by the International Trade Union Confederation (ITUC) based on two methodologies that study jobs in the green economy⁵⁶.

For the calculation of the direct impact, the salaries paid to the workers involved in the thermal rehabilitation activity were considered, depending on the need for staff relative to the investment and the average value of the wage in the construction field. Thus, with the time horizon of 2030, this scenario starts from the assumption of the rehabilitation of 500 blocks, in three stages - 100 blocks by 2023, 200 blocks by 2026, and another 100 blocks by 2030, considering that thermal rehabilitation projects have an implementation period of 2-3 years. Overall, on the basis of the estimates, an investment of 200 million Lei is required to support these projects.

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.2. Construction - energy efficiency			8,27
Subsidies from the budget	100		
Involving European funding + private sector	100	200	
Jobs		480	480
Salaries paid (10 years)		8,27	

⁵³<http://www.zvj.ro/articole-50207-Primele+6+blocuri+din+Uricani+vor+fi+reabilitate+termic+de+un+constructor+din+Lupeni.html>

⁵⁴<https://gddhd.ro/actualitate/reabilitare-termica-la-petrila-pe-bani-europeni-sunt-fonduri-si-pentru-spital/>

⁵⁵<https://www.avantulliber.ro/2019/03/07/primarul-tiberiu-iacob-ridzi-a-semnat-proiecte-ce-aduc-12-milioane-de-euro-pentru-reabilitarea-termica-a-unor-blocuri-de-locuinte-din-petrosani/>

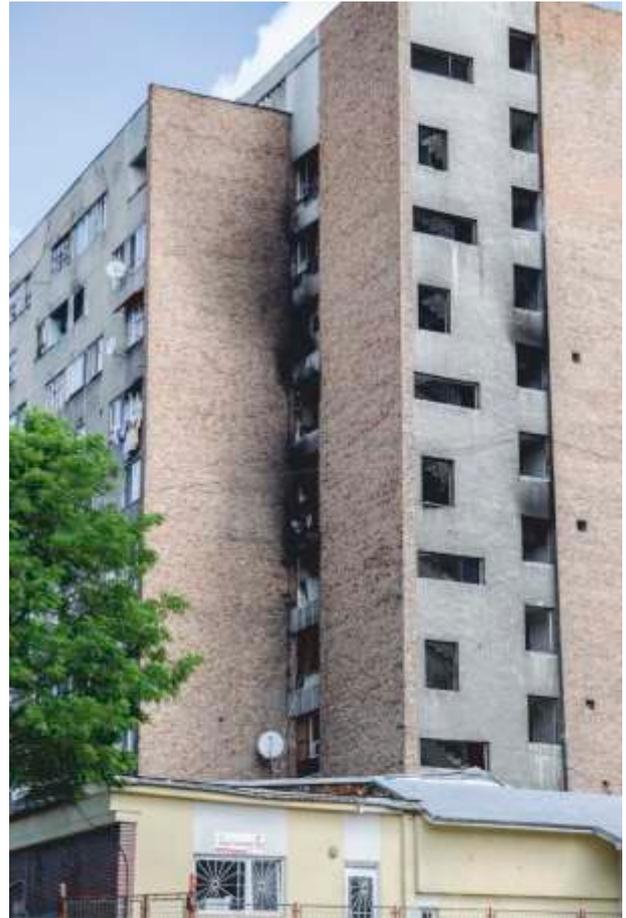
⁵⁶Millennium Institute, 2012. "ITUC green jobs assessments research project– Methodology Overview", <http://goo.gl/BdWYM8>

The quantifiable net benefits are represented both by the creation of jobs in the construction sector and the revenues of local firms in this area, assuming that local firms will ensure that the works are carried out in full. Thus, both investment and salaries paid to employees contribute to strengthening economic activity in the construction sector.

At the same time, it is worth mentioning that, under the current conditions of access to financing, thermal rehabilitation of dwellings requires both the involvement of local authorities, which must contribute to the total amount of financing, and of direct beneficiaries whose share can be covered from the local budget. The rest, usually 50% of the investment value, may come either from European funding (such as the Regional Operational Programme) or from the central budget, through programmes created for these interventions.

Regarding the impact, considering the hypothesis that local firms will become providers of thermal rehabilitation services, the value of the investment is multiplied in both its own sector and in related sectors, resulting in a total impact of 663 million Lei in the 11 years of execution. The stimulated sectors are this time the extractive industry (19.2 million Lei) - if we consider the exploitation of the rocks used in construction materials, the manufacturing industry (258

million Lei), but also the real estate transactions sector - considering that one of the benefits of increasing the energy efficiency of dwellings is the increase in their value, with potential to activate the market and services, as well as creation of jobs in these sectors.



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	Added value lost (million Lei)		Jobs supported
Direct impact	8,3		120-240
Multiplied impact	In the own sector	In the other sectors	842
	249,4	405,3	
Overall impact	663		962-1082

4.3.2.3. INCREASING THE COMPETITIVENESS OF OTHER INDUSTRIES

The structure of Jiu Valley's economy reflects the transformations resulting from the restructuring of the dominant mining activity, diversification attempts focusing mainly on sectors with low technological intensity, low technical skills and limited investment capital. Thus, the current economic profile is dominated by services (especially trade), followed by manufacturing.

Attracting investment to increase competitiveness and performance largely depends on the availability of entrepreneurs to access funding through operational programmes dedicated to improving the performance of SMEs, with benefits in terms of increasing the quality of products offered, the degree of technology, the performance of equipment and amenities, and of production capacity, later reflected in increased sales and expansion opportunities, generating additional jobs. According to the evaluation results of the Regional Operational Programme 2007-2013⁵⁷, SMEs that attracted funding of 200,000 EUR on average created and maintained 3 jobs on average, even 3-4 years after project implementation, indicating the strengthening of business management capacity and adaptation to market requirements. The degree of cofinancing by the beneficiary companies now ranges between 50% and 90% of the total project value, depending on the size of the company and the needs defined by the project.

Food industry

In 2017, in Jiu Valley there were 47 companies active in this sector, with 452 employees with a salary and a turnover of 28 million Lei, slightly decreasing compared to

2013 (-0.23%). Companies active in this industry are mainly small and medium-sized businesses with low performance, 20 of which were profitable in 2017, but they are relatively significant in terms of employment.

Developing this sector is important not only from the perspective of employment potential but also if we consider it a logical intervention to support the development of the agricultural sector.

This scenario starts from the hypothesis that already profitable firms access funds for upgrading, increasing production capacity, or improving product quality. Given the transition to a new programming period that conditions access to finance until the definition of sustained directions and allocations, in the first stage the scenario starts from the assumption of 5% industry growth as a result of transverse area development interventions, promoting the local business environment, increasing consumption generated by other industries. As of 2024, the scenario continues with the assumption that profitable companies (the minimum condition to gain access to funding) will access a minimum of 200,000 EUR per company (approximately 18.8 million Lei in total), with beneficial effects on the increase of the salary (about 3 employees per company), and the increase in sales during the project implementation period and beyond. Subsequently, starting with 2026, already-developed companies can again access funding for further development, but, given that they already have experience in managing funds and developing development directions, this funding may increase to 500,000 euros per company for a total of 47 million Lei.

⁵⁷<http://www.old.inforegio.ro/ro/comunicate-2015/644-regio-2007-2013-impact-pozitiv-major-asupra-beneficiarilor-de-finan%C8%9Bare.html>

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.3. Development of the food industry			47,5
Profit		16,6	
Subsidies from the budget			
Involving European funding + private sector	65,8		
Jobs		199	199
Salaries paid (10 years)		96,6	

Direct quantifiable benefits consider the increase in profits and wages paid by these companies, in addition to new jobs created as a result of business development. What is important to note here is that, given the vulnerability of the business environment, companies need support both to ensure co-financing of these investments and for writing and implementing projects in line with their needs. That is why the professional and technical services sector plays an important role. Through dedicated business support services in areas such as accounting, strategic consulting, financial management, it can help companies maximise the impact of funding on small businesses. Also, among the non-quantifiable benefits, we can mention the increase in the quality of products and services offered by companies in this industry, becoming more attractive outside the local market. At the same time, this sector can also contribute to the development of the hospitality sector (hotels and restaurants), giving companies in this sector access to top-quality products in the immediate vicinity.

Over the 11 years covered by the analysis, the direct impact of salaries and profit reaches 113.3 million Lei, and in terms of jobs, companies can directly employ up to 199 employees. Concerning the multiplied impact, the most important contribution is noticed in the agricultural sector (approx. 90 million Lei and 107 supported jobs), in the rest of the manufacturing industry, but also in the services sector (professional services and support).



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	Added value lost (million Lei)		Jobs supported
Direct impact	113,3		199
Multiplied impact	In the own sector	In the other sectors	527
	188,7	208,2	
Overall impact	510,2		726

Textile industry

The textile industry is characterised by the intensity of the necessary workforce, at the level of Jiu Valley, the 9 companies in the field employing 587 people. As a size class structure, Lupeni has a large company of 412 employees and the main determinant of the sector's turnover, a medium-sized firm in Aninoasa (125 employees), the rest of the companies being medium and small. Of these, 7 were profitable in 2017. Between 2013 and 2017 there was an increase of over 18% in the aggregate turnover of the domain.

The premises of this scenario start from the idea that the 7 lucrative companies in 2017 will benefit from funding in the upcoming period to meet the minimum conditions for accessing available European funds. In the first stage, companies benefit from production and sales stimulation as a result of interventions in areas that influence the market in general, access to the workforce or attracting new customers as a result of the increase in the promotion of the private environment. This result was visible in the increase of turnover by 5% above the natural growth rate. During this period, companies can access specialised support to increase attractiveness, improve customer and supplier relationships and develop new relationships, or other areas adjacent to production. Starting with 2024, we assume that the 7 companies attract funding of 200,000 EUR per company, a total of 6.58 million Lei, aimed at increasing efficiency, developing production, increasing product

quality, or investing in staff and support functions - improving competences, implementing international best practices, strengthening management activities. Subsequently, in the last stage planned to take place in 2030, we assume that these companies have already improved their funding skills, that they have identified clear development needs in line with national and international market requirements, and can make more significant investments. At a total value of investments at this stage of 16.45 million Lei, total investments reach 23.03 million Lei for supporting the textile industry.

It is also worth mentioning that, in the case of European funding, small and medium-sized companies benefit from a more convenient co-financing rate (70-90%), while large companies usually have to co-finance 50% of the projects. To support investment, a recommendation can refer to an advantageous area-wide co-financing that reduces pressure on management, leading the industry to become more competitive.

Going forward to the social-economic impact generated by investment in the textile industry, the employment potential that it determines needs to be pointed out. The textile industry implies intensive work that does not exclusively require a long stage of qualification. Directly, in the 11 years considered, up to 300 jobs can be created in textile factories. Most jobs would be supported in manufacturing (120), but also in services (50) and agriculture (24).

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.4. Development of the textile industry			210,86
Profit		87,31	
Subsidies from the budget			
Involving European funding + private sector	23,03		
Jobs		300	300
Salaries paid (10 years)		146,57	

	Added value lost (million Lei)		Jobs supported
Direct impact	146,6		300
Multiplied impact	In the own sector	In the other sectors	610
	308,4	286,2	
Overall impact	741,2		910

Wood processing

The wood processing sector was represented in the private environment of the area in the year 2017 by 25 companies, employing 105 persons and generating a turnover of 20.7 million Lei. Of these, almost a third are either unprofitable or have not recorded production activity, and the active ones are small. However, the aggregate turnover of the sector has grown by an average of 10.8% between 2013 and 2017, which, in addition to the area's forest potential, requires particular attention in terms of strengthening production capacity and supporting development companies with potential.

Net quantifiable benefits total more than 40 million Lei, resulting from the profit and salaries paid over the 11 years that remain in the local economy. The value of the investments considers access to the financing of 200,000 EUR and 500,000 EUR respectively per company, resulting in a total value of 29.6 million Lei until the end of the reference period.

However, wood processing should not only be seen as an industry serving end users but also in close connection with the furniture industry, serving the same value chain. Both in Jiu Valley and at national level, the furniture industry is growing, with large companies being integrated into value chains that go beyond the borders of the country. This leads to an opportunity for the wood industry to invest in improving the quality of intermediate products that can be used in the furniture industry. At the same time, companies in Jiu Valley benefit from the advantage of being located in a high potential area in terms of knowledge for the customisation of wooden elements, due to folk traditions and rich ethnographic history. Therefore, investments are not only needed to improve existing technological processes, but also to diversify and scale the supply of wood products with handcrafted elements or made in limited series, both for the furniture industry and for the final markets, exceeding the standard product barrier to reduced costs. At the same time, with an intense promotion and the development of skills in attracting customers, this industry has the potential to become an area trademark.

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.5. Development of the wood processing industry			11,9
Profit		10,6	
Subsidies from the budget			
Involving European funding + private sector	29,6		
Jobs		71	71
Salaries paid (10 years)		30,9	

Considering the social-economic impact, the total added value generated by this sector reaches 165.33 million Lei by 2030, with the most significant weight in

forestry, manufacturing, services and administrative activities, as well as in the energy sector.

	Added value lost (million Lei)		Jobs supported
Direct impact	41,5		71
Multiplied impact	In the own sector	In the other sectors	112
	50,8	73,03	
Overall impact	165,33		183

Furniture industry

Continuing on the value chain of wood processing, the furniture industry has a comparatively better performance than the wood industry, with 16 companies in the area being active in 2017, with a turnover of 63.9 million Lei. Two of the companies have more than 140 employees (in Aninoasa and Petrița), a company in Vulcan has 84 employees, the other companies are small firms or micro-enterprises. Since 2013, this sector has been steadily growing, resulting in an average annual growth rate of 51.4%.

The direct costs associated with supporting this industry follow a similar logic to other types of interventions previously proposed - active companies are accessing European funds of 200 000 EUR and 500 000 EUR respectively, each project has a duration

of 3 years, for a total value of 26.3 million Lei by 2030. Funds can be used both to re-technologies companies and to support business development. For example, participating in trade missions or participating in industry events, both nationally and internationally, are beneficial for discovering new trends in design and materials used in production to help firms adjust their supply to market requirements. In a dynamic, demanding sector, both durable technical elements and the materials used as well as aesthetics and design trends are important. At the same time, increasing openness to the national and international markets also facilitates the promotion of traditional local elements that can add value to locally produced products, helping to attract new customers, boosting quality and, implicitly, sales.

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.6. Development of the furniture industry			159,6
Profit		29,8	
Involving European funding + private sector	26,3		
Jobs		412	412
Salaries paid (10 years)		156,2	

The benefits are also significant if we consider newly created jobs and salaries paid to employees. Despite the development of new production technologies, furniture manufacturing remains an attractive industry from the employment perspective, not only in the low-skilled area but also in terms of quality assurance, material knowledge, technological processes and more.

From the impact perspective, both direct and multiplier effects are significant, taking into consideration the components of added value, profit and paid salaries that remain in the local economy. Ensuring profitability through advanced technology processes and efficient management ensures the perpetuation of an economic model that ensures job creation, generates income and taxes and contributes to community welfare.

	Added value lost (million Lei)		Jobs supported
Direct impact	186		412
Multiplied impact	In the own sector	In the other sectors	456
	188,1	292,2	
Overall impact	666,3		868

Principles for the responsible management of forests

Wood is a renewable resource, but the way it is used must consider the multifunctional role that forests play in the context of the global climate crisis, of the conflicts generated by the different ways of using the land, the decline of biodiversity, the production of energy, the local development etc. Within sustainable development, wood has an economic value as an ecological and renewable material, but forests grow and recover slowly, so the wood they produce must be regarded as a valuable but limited natural resource.

Forests are living ecosystems and too complex as to be truly evaluated by their structure, dynamics and functions. Only a healthy forestry system can provide long-term economic benefits and can meet both environmental as well as social and cultural needs. For a sustainable management of forests, it is necessary to apply five principles:

1. The ecological principle:

- The forest management will closely follow the natural conditions. Thus, all forest activities follow the structures and natural dynamics of the forest. Forest management supports the composition, structure and functions of local natural species associations, since they are the most adapted ecosystem, resulting from millions of years of natural selection and evolution.

- The utilisation rate and especially the wood harvesting rate will be substantially below the natural regeneration capacity of the forest, to allow the restoration of carbon reserves and biodiversity.

- Management practices need to be reduced to the strictly necessary and only those management measures will be applied that have a minimal negative impact on the forest ecosystem. Many of the current forest practices expose the ecosystem to stress, which can cause imbalances or even an ecosystem collapse, even more today, when climate change causes extreme weather events.

2. Social principle:

- The forests will be managed in such a way as to cover the demand for wood and other forest products for the rural population, and the forestry sector will provide jobs and be a source of income for the rural population. Forestry operations will maintain or improve the social-economic well-being of local communities and forestry workers. Thus, wood processing should be done as much as possible locally to maximise the benefits to local communities.

3. Economic principle:

- Respecting the ecological and social principles, the forestry sector must aim to cover the national demand for wood and forestry products, to maximise the added value and to contribute to the rural development by local and superior processing of these products. Thus, log export is not beneficial and should not be allowed.

4. The multifunctional principle:

- Forests must be managed as an integral part of responsible development of the whole country, harmonising the ecological, social, economic, cultural and other relevant functions of the forest. Management practices must, in the long term, maintain and improve the environmental, social, economic and cultural benefits of the forest, but also maintain or restore the ecosystem, biodiversity, resources and landscapes.

5. Principle of transparency:

- Consulting all stakeholders is a pre-condition of responsible forest management. All relevant activities in the forestry sector should be planned and implemented following consultation with relevant actors, experts and the interested public.

Manufacture of computers, electronic and optical products

Among the economic sectors in the IT-sphere, the computer and electronic and optical manufacturing sector stand out through the activity of a company in Petroșani that had 93 employees in 2017. It recorded an average annual growth rate of 8.8% between 2013 and 2017.

The manufacturing of electronic and optical components is an important link in multiple value chains, especially if we consider the upsurge in investment in the car industry in the region and in the vicinity, having the potential to become an important supplier

both for the big investors in the region and to attract new opportunities in the area. Study programmes in the field of ICT engineering at the University of Petroșani is a basic factor in sustaining development. At the same time, production in the ICT sector is a key area of the future, with innovative potential and easy integration into value chains. In the context of a steadily rising demand for ICT services, production has to keep pace and grow at the same time to support value-added growth in the field. Another benefit to be mentioned is represented by wages above average compared to other manufacturing sectors, offering opportunities, especially to young people.

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.7. Developing the computer and electronic products manufacturing industry			23,6
Profit		0,73	
Involving European funding + private sector	3,29		
Jobs		41	41
Salaries paid (10 years)		26,1	

Although the net benefits are not very high, supporting this emerging industry can have important effects in its own sector by coagulating an environment favourable to the development of the ICT services component with high potential regarding salary levels, employability of young people, innovation and internationalisation.

These effects, however, are visible over time with the development of the overall producing sector not only in Jiu Valley but also at regional level. In addition to well-prepared investments and human capital, a precondition for the development of this sector is represented by facilitating the development of commercial relations with big companies in the area, as well as by intensely promoting the offer of services within the events dedicated to the local business environment organised within the chambers of commerce, trade missions, inventions and innovation fairs at national and international level.

	Added value lost (million Lei)		Jobs supported
Direct impact	26,9		41
Multiplied impact	In the own sector	In the other sectors	46
	30,5	36,4	
Overall impact	93,8		87

4.3.3. THE TERTIARY SECTOR

4.3.3.1. STIMULATION OF ENTREPRENEURSHIP AND INNOVATION

Setting up business support structures

In 2017, in Jiu Valley, there were 2294 companies, of which 42% were active in the trade area. Other representative economic sectors in terms of the number of economic operators are the manufacturing (196 companies), transport (186 companies), construction (182 firms) and hotel industries (164 companies). In terms of turnover, trade has the largest share, contributing with 27.8%, followed by the energy sector, with 23.5% and manufacturing, with 19.7%. Considering the number of employees, the sector with the biggest number of staff is represented by the energy sector, with almost 5000 employees, followed by trade, with more than 3000 employees, manufacturing (2423 employees) and construction (1103 employees). Although it is significant, the manufacturing industry relies heavily on the development of the food industry, the textile industry, wood processing and furniture manufacturing.

This local business environment validates the limited capacity to adapt to the economic restructuring that has taken place in recent decades. The emergence and development of entrepreneurial initiatives

have been restricted, due to the lack of experience, insufficient entrepreneurial education, and reduced compensation of dismissed miners compared to the financing needs of potential business start-ups. Sectors accessible from the point of view of the required initial investment or solid technical skills include services, including trade, explaining the current structure of the private environment in the area.

In order to support the local business environment to become more competitive, more efficient and diversified in terms of opportunities for the workforce, entrepreneurship development is an opportunity to capitalise on human capital and assets already accumulated in either existing economic sectors, or in emerging sectors: creative industries and ICT, textile industry, furniture industry, wood processing, tourism. Although it is a short- and medium-term challenge in terms of aligning the actors involved in shaping and implementing a viable development plan, entrepreneurship generates long-term positive effects, becoming a real alternative to employment, encouraging initiatives of young people and of people from vulnerable groups.

Industrial parks and business incubators are business support facilities that act as a catalyst for the business environment at different stages of company development. Business Incubators provide first-time entrepreneurs with a range of tools, providing support at every stage of development, from idea to product or service ready to be marketed. Among the advantages compared to other types of educational services or programs, business incubators provide the infrastructure needed to operate the business, with cost-effective workspace and access to the necessary materials, so that entrepreneurs can focus on business development. In addition, entrepreneurs benefit from all the business-critical services, especially at the initial stages of development, in one place. Such initiatives not only have a direct role in the services offered but also indirectly through the impact on sustained firms that continue to work in the local economy through jobs created by start-ups, especially among young people, the paid taxes, and in a wider context, by boosting local and regional value chains, creating demand for certain types of goods and services that can be delivered locally and regionally, and by stimulating the growth of service complexity. Moreover, the business incubator can act as an active promoter of entrepreneurial education at the level of the area through partnership actions with educational institutions, so that the entrepreneurial appetite grows gradually and steadily, and the share of SMEs and micro-enterprises in fields with high added value increases.

On average, the development of a business incubator involves an initial investment of about 4.7 million Lei, of which 60% represents the amount allocated for the construction or rehabilitation of existing space and the rest for amenities, equipment, utilities, as well as the purchase of services for the incubator to become operational. At an

employment rate of over 75%, such an entity directly creates about 10 jobs for its management. Salaries paid to employees contribute directly to the local economy. These were estimated for an average salary of 3500 Lei per month, for 8 years, the first two years of the implementation of the project being destined for the construction and equipping with the necessary facilities. In the first two years of operation, it is estimated that there is a lower occupancy rate, with 4 employees being required, generating a direct impact through salaries of 336.000 Lei, in the 3rd and 4th year the employment level increases, leading also to the increase of the jobs to 7 employees and 588,000 Lei paid salaries, and in the last 4 years of operation in the time span, the number of employees reaches 10 persons, paid with 1.68 million Lei during this period.

Industrial parks, on the other hand, play an important role in supporting the development of already mature companies by providing an operating framework with specific facilities (most often fiscal facilities) both in terms of infrastructure (office, meetings, testing) as well as in terms of support services in order to capitalise on the human and material potential of the area.



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Thus, industrial parks increase the attractiveness of an area not only by facilitating the development of local or national companies but also by attracting foreign investors. These can focus on supporting a specific industry or a group of related industries by building clusters of companies, which in turn facilitates the transfer of knowledge and expertise tacitly. Industrial parks, through their managers, are promoters of international collaboration and exchange of best practices with similar entities from other countries, with the role of facilitating companies' access to much wider networks of expertise. Although these support structures usually focus on industrial production and services, they can have a well-defined role in capitalising on scientific research and technological development of companies, becoming a catalyst for innovation activity and increasing added value.

In the case of an industrial park, the assumptions are similar to those set out for the business incubator, the number of employees in the management of the park is similar, and the basic investment (land preparation and utilities) adds up to a similar amount. However, operational expenditure may be considerably higher, as is the impact on the economy. In this case, although the net quantifiable benefits are negative, it should be noted that with the operation of the two business support structures, the benefits of renting out premises, rendering services to non-residents, location of large firms and business development will exceed the investment and the revenue generated will remain largely in the local economy. Moreover, in the medium and long term, hosted firms contribute to economic activity in the area, paying taxes and creating jobs, generating profit, and having local suppliers and customers, sums that are multiplied in the economy of the area.

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
5.1. Business Support Infrastructures			-4,19
Involving European funding + private sector	9,4		
Jobs		20	20
Salaries paid (10 years)		5,2	

In addition to the direct impact generated by employees' salaries directly involved in the provision of services to residents, we assume that the operating costs of the incubator (security, cleaning,

restaurant, materials) remain in the local economy, through suppliers of products and services, and the construction/rehabilitation is achieved through local suppliers.

	Added value lost (million Lei)		Jobs supported
Direct impact	14,2		20
Multiplied impact	In the own sector	In the other sectors	47
	28,45	30,4	
Overall impact	166,85		87

4.3.3.2. TOURISM

Tourism is an area with growth potential that Jiu Valley can count on in order to ensure a fair transition to a diversified economy, especially due to the potential of the natural environment and cultural heritage. The diversity of these factors fosters the growing importance of tourism in economic activity, through initiatives both at individual and entrepreneurial level and across the whole area, through close collaboration between local actors. Strengthening tourism activity can be achieved through the concept of sustainable tourism, which is differentiated by quality, accessibility for tourists and in harmony with the natural environment. Despite the relatively low touristic activity, in terms of number of overnight stays (number of nights of accommodation) and tourism infrastructure, this sector employs more than 500 people from Jiu Valley, especially from Petroșani and Petrila, as the social-economic analysis indicated in the previous chapter.

Agrotourism

This scenario involves investments in tourism infrastructure supporting rural tourism to increase the attractiveness of the area and to capitalise on its tourism potential.

An example of investment is the construction of agrotourism boarding houses at high standards in rural agricultural households. According to Order no. 65/2013, agrotourism boarding houses ensure, besides the accommodation of tourists and conditions for preparing and serving the table, the possibility of taking part in household and crafts activities. Such activities relate to animal husbandry, cultivation of different types of plants, or to the pursuit of craft activities, offering the possibility for tourists to take part in workshops, resulting in different handicraft items.

Based on similar nationally funded projects, such an investment is estimated at 706,400 Lei, including construction, permits and authorisations, as well as its amenities and equipment for entry into operation. The estimated revenue for such a hotel unit at an occupancy rate of 65% for the four available rooms amounts to just over 100,000 Lei per year, and operational expenses, including salaries, represent about 60% of the income. These estimates consider the owner's involvement, the boarding house being set up as a family business.



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	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
5.2. Agrotourism boarding houses			30,07
Revenue		49,79	
Profit		11,53	
Subsidies from the budget			
Involving European funding + private sector	35,3		
Jobs		230	230

Thus, transforming a household into agrobusiness can directly generate at least two directly paid jobs, increasing with the development of the business, but the profit obtained is either reinvested or used for the

benefit of the family. The construction of 50 accommodation units of this type can generate added value through salaries of 4.06 million Lei, plus the gained profit, amounting to 11.5 million Lei.

	Added value lost (million Lei)		Jobs supported
Direct impact	15,6		230
Multiplied impact	In the own sector	In the other sectors	121
	33,58	52	
Overall impact	166,85		351

Tourism in nature

This subcategory requires the further development of hiking and mountain bike trails, linking the towns and villages of Jiu Valley as a summer alternative to the ski slopes in the area. Despite the relatively low performance of tourism in the area, being far from major cities and airports, this sector has economic potential, through existing and potential economic operators that can capitalise on existing resources, but especially in terms of increasing visibility of the area at the national and international level, acting as a promoter of change and assuming a new identity.

Sustainable tourism in the heart of nature offers a range of activities that can start from simple, punctual initiatives and can gradually increase in complexity to provide an increasingly solid basis for the economic profile of the area. An investment of 3 million Lei in continuing to develop existing initiatives (for example, Fundația Noi Orizonturi - New Horizons Foundation), would contribute to inclusion on the tourist map of Eastern Europe in terms of summer mountain tourism. The Foundation has already set up the first downhill route in Romania and plans to continue developing cycling routes, aiming at achieving 500 km of cross-country trails⁵⁸.

⁵⁸<https://www.noi-orizonturi.ro/comunitate-2/>

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
5.3. Tourist routes			-1,69
Subsidies from the budget			
Involving European funding + private sector	3,0		
Jobs		10	10
Salaries paid (10 years)		1,31	

Although the direct impact is not significant, the beneficial effects can be observed with the increase in the number of tourists from Romania or abroad, who can

also benefit from various services in the area - accommodation, restaurant, transport, with benefits in supporting the local economy.

	Added value lost (million Lei)		Jobs supported
Direct impact	1,3		10
Multiplied impact	In the own sector	In the other sectors	6
	3,09	2,65	
Overall impact	7,04		16

4.4. ANALYSIS AND COMPARISON OF SCENARIOS

The previous chapter presented the situation of created jobs and added value generated directly and by multiplication in the rest of the economy, as well as the cost-benefit analysis for each type of intervention.

The methodology for calculating multipliers and various assumptions requiring increased attention is presented in the following section. This chapter presents the comparison of the scenarios for the gradual

reduction of coal-mining activity, including mining and modernisation works, and proposed economic development alternatives.

The next table summarises the results of the cost-benefit analysis for the two scenarios based on the coal mining industry and the three alternative scenarios of economic development:

Scenario 1 - Shutting down all mines and the coal power plant Paroşeni by 2024			
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
Inaction			-3.075
Subsidies	7.165,6		
Involving European funding + private sector (investments, profit obtained)	639,7		
Jobs	719	4.392,3	
Salaries paid	4840	770	-4070
Scenario 2 - Preservation of the Livezeni and Vulcan mines and the Paroşeni plant until 2030 (and closure of the Lonea and Lupeni mines in 2024)			
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
Modernisation			-2.940,2
Subsidies	8.457,3		
Involving European funding + private sector	563,5		
Jobs	202	4.772,5	
Salaries paid	4840	2819	-2021
Scenario 3 - Development of the primary sector			
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
TOTAL primary sector			420,2
Income and profit		502	
Subsidies from the budget	11,4		
Involving European funding + private sector	84,3		
Jobs		760	
Salaries paid		13,8	

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
3.1. Micro-breeding livestock			38,8
Income and profit		60,9	
Subsidies from the budget	11,4		
Involving European funding + private sector	15,02		
Jobs		260	260
Salaries paid		4,35	
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
3.2. Berry bush plantations			381,3
Income and profit		441,15	
Involving European funding + private sector	69,3		
Jobs		500	500
Salaries paid		9,47	
Scenario 4 - Development of the secondary sector			
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
TOTAL secondary sector			159,09
Profit		145,08	
Subsidies from the budget			
Involving European funding + private sector	450,8		
Jobs		1.520	
Salaries paid		464,8	
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.1. The renewable energy sector			-54,4
Subsidies from the budget			
Involving European funding + private sector	102,74	48,32	
Jobs		257	257

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.2. Construction - energy efficiency			8,27
Subsidies from the budget	100		
Involving European funding + private sector	100	200	
Jobs		240	240
Salaries paid		8,27	
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.3. Development of the food industry			47,48
Profit		16,6	
Subsidies from the budget			
Involving European funding + private sector	65,8		
Jobs		199	199
Salaries paid		96,65	
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.4. Development of the textile industry			210,8
Profit		87,3	
Subsidies from the budget			
Involving European funding + private sector	23,03		
Jobs		300	300
Salaries paid		146,58	
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.5. Development of the wood processing industry			11,9
Profit		10,6	
Subsidies from the budget			
Involving European funding + private sector	29,6		
Jobs		71	71
Salaries paid		30,9	

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.6. Development of the furniture industry			159,68
Profit		29,8	
Subsidies from the budget			
Involving European funding + private sector	26,32		
Jobs		412	412
Salaries paid		156,2	
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
4.7. Developing the computer and electronic products manufacturing industry			23,6
Profit		0,73	
Subsidies from the budget			
Involving European funding + private sector	3,29		
Jobs		41	41
Salaries paid		26,16	
Scenario 5 - Development of the tertiary sector			
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
TOTAL tertiary sector			24,2
Revenue		49,8	
Profit		11,53	
Subsidies from the budget			
Involving European funding + private sector	47,72		
Jobs		260	260
Salaries paid		10,58	

	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
5.1. Business Support Infrastructures			-4,19
Profit			
Involving European funding + private sector	9,4		
Jobs		20	20
Salaries paid		5,2	
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
5.2. Agrotourism boarding houses			30,07
Revenue		49,8	
Profit		11,5	
Involving European funding + private sector	35,3		
Jobs		230	230
Salaries paid		4,06	
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
5.3. Tourist routes			-1,69
Revenue			
Involving European funding + private sector	3,0		
Jobs		10	10
Salaries paid		1,31	

4.4.1. COMPARISON INACTION VS MODERNISATION

On the basis of the cost-benefit analysis, the very high costs associated with the continuation of the activity are observed,

given the lack of efficiency that results in significant losses from all the actors involved.

Scenario 1 - Closing all mines and the coal power plant Paroşeni by 2024			
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
Inaction			-3,075
Loss	7.165,6		
Subsidies	639,7		
Involving European funding + private sector	719,06	4.392,3	
Jobs	4840	770	-4070
Salaries paid		1.056,2	1.056,2

Scenario 2 - Preservation of the Livezeni and Vulcan mines and the Paroşeni plant until 2030 (and closure of the Lonea and Lupeni mines in 2024)			
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
Modernisation			- 2.940,2
Loss	8.457,27		
Subsidies	563,54		
Involving European funding + private sector	202	4.772,5	
Jobs	4840	2819	-2021
Salaries paid		1.510,1	1.510,1

On the one hand, **the state budget** should continue to ensure the subsidisation of both alternatives until all mines are closed, in addition to ensuring the exceptional costs of compensatory salaries in the context of dismissals. The effort to compensate inefficiencies, but also to cover social risks, even partially, reaches almost 76 million Lei higher in case of the inaction scenario.

However, investment subsidies are 517 million Lei higher if in the inaction scenario we consider functioning continuation works being carried out at Mintia.

Regarding the losses, closing the Paroşeni power plant would help to reduce the loss accumulated by Complexul Energetic Hunedoara by 1.3 billion Lei.

On the benefits side, the continuation of the activity scheduled in Scenario 2 would contribute to higher revenues for CEH - however, the difference is not very big, as the Paroşeni power plant participates less in creating revenue (28% in the case of thermal energy, for example) than Mintia.

Finally, Scenario 2 keeps a significantly higher number of people employed, with a lower social impact than Scenario 1, which is also observed by analysing the cumulative value of salaries paid to staff. Overall, the upgrading scenario brings both higher costs and higher benefits, so the result is clearly in favour of this scenario. The decision on the

future of the Mintia Power Plant, in particular, the operation of a group on natural gas, can contribute to the efficiency of the electricity and heat generation process, but a technical-economic study can help deepen the impact of such an intervention.

4.4.2. COMPARISON INACTION VS ALTERNATIVE SECTORS

Comparing scenario 1 (closing the mines and the Paroşeni plant) with interventions in other economy sectors, we note the major differences between both the cost of each approach and the quantifiable and non-quantifiable benefits.

Investments in alternative sectors are almost equal only to the operating subsidies required for the functioning of CEH and to the support of dismissed workers. Even excluding subsidies for the compensatory payments completely, the amounts are comparable, but the differences in benefits cannot be neglected.

First of all, interventions in alternative sectors support a diversified economy not only in terms of economic sectors but also of the types of jobs that are created and sustained. Given the general trend towards a carbon-free economy, the future of jobs and the training and qualification of young people in this field remain a survival option rather than a sustainable one that ensures resilience to change.

Second, it is true that looking at the net result of the two options, the net benefits

resulting from a diversified economy are lower than the costs of inaction and the abandonment of coal. However, beyond this result, the development potential has to be pointed out - the continuation of the mining activity even in a near-future horizon (2024) perpetuates a major economic cost that does not contribute to the opening of new horizons and does not prepare the society for economic and broader social integration. At the same time, the development of alternatives involves revenue and profit-generating activities, contributing to the increase of local budgets from which other types of interventions can be financed to the benefit of citizens, while mining needs permanent resources from the state budget to function.



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Socially, closing the mines will have a major impact on the increase of unemployment, resulting in the disposal of just over 4,000 people by 2024. Alternative activities offer opportunities for a considerable part of them, generating directly over 2500 jobs.

However, a diversified economy is not built only through the investment projects described in the previous chapter, with a number of effects that are difficult to estimate at this time - for example, building an industrial park has the role of attracting investors to the area, contributing to the creation of jobs in various industries. This would typically imply large companies,

especially in the production, logistics and transport sectors as employers. At the same time, infrastructure development facilitates the mobility of human resources, increasing both the access of people from rural areas to towns and the ease of commuting to neighbouring areas in the county where there is already a demand for workforce⁵⁹ starting 2020. But the effects are not immediate - in time, capitalising on the opportunities described in detail in the previous subchapter involves setting up new companies to secure other links in the value chain, such as increasingly sophisticated processing units in the food industry or the development of the electronic equipment manufacturing sector, generating higher quality products and services, being more cost-effective and more attractive to other markets (national and international).

Scenario 1 - Closing all mines and the coal power plant Paroşeni by 2024			
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
Inaction			-3.075,9
Loss	7.165,6		
Subsidies	639,7		
Involving European funding + private sector	719	4.392,3	
Jobs	4840	770	-4070
Salaries paid		1.056,2	1.056,2
TOTAL alternative sectors			
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
TOTAL			603,45
Revenue and profit		708,5	
Subsidies from the budget	11,4		
Involving European funding + private sector	582,8		
Jobs		2.540	2.540
Salaries paid (10 years)		489,2	

⁵⁹<http://www.replicahd.ro/fabrica-bosch-de-la-simeria-pusa-in-asteptare-de-guvern/>

4.4.3. COMPARISON MODERNISATION VS ALTERNATIVE SECTORS

Similar to scenario 1, and in the case of the modernisation and maintenance of the Paroşeni power plant and of two mines, the costs associated with this approach are much higher than the investments needed to develop the alternative economy and the resulting benefits.

In this case, the most obvious comparison relates to social impact. On the one hand, a significant number of jobs in the energy and mining sector (2819) remain, and lost jobs can only be covered by the direct impact generated by the alternative sectors (2540 generated vs. 2021 lost). The transition is not in any way straightforward, nor are jobs perfectly substitutable, which is why an early preparation of the layoff programmes is necessary, where CEH cooperates with social services and training providers, and financially supports the re-qualification of staff already during the operation of the mines, as indicated by examples of international best practice and the transition recommendations outlined in a previous chapter. Also, despite the fact that a significant part of the jobs is maintained in the modernisation scenario, layoff of these employees is also expected after 2030 when the local economy needs to be ready to integrate the unemployed into the labour market.

Secondly, also in the social sphere, the salary level is lower between the two scenarios. The energy and mining sector have always been an attractive sector in terms of over-average wages, but risk exposure, deterioration in health, the many accidents that have taken place over time, and the limited prospects for continuing this work have to be considered, as well. The proposed interventions do not promise a higher salary, but they come together with

safer opportunities, based on the skills of the future, in an environment where development is integrated. In an area deeply affected by external migration, the increase in the quality of life of the inhabitants does not lie exclusively in the level of salaries, but also in the quality and access to basic services and in the creation of job opportunities.

The secondary sector is one of the dominant sectors in Jiu Valley, and the potential impact of proposed investments can further contribute to job creation. In addition, increasing the competitiveness of the manufacturing industries has effects that can be currently quantified only partially, with companies having the opportunity to overcome the local market by offering products and services. The multitude of the types of represented industries that currently stand out lead to the opportunity to diversify the activity, increasing the attractiveness of the area also for external investments.

As agriculture and the food industry sustain each other, interventions in the secondary sector must also be complemented by measures in the tertiary field, especially in terms of increasing the skills of employees and potential employees, but also in close connection with the support of companies in writing projects and accessing funds, in managerial skills, and in strengthening a vision to overcome the local market through competitive and sought-after products.

Although in the case of the tertiary sector interventions do not generate a significant impact comparable to the secondary one, the potential over the highly qualified workforce should not be neglected. For example, to support the business

Incubator, the Administrator needs to hire well-trained staff in a variety of business-related areas such as accounting, marketing, legal services, finance, management, innovation, which can be recruited from the local environment. In addition to the other presented scenarios, the tertiary sector has both a supporting role for various industries and a strengthening role for its own direction through rural tourism and tourism in nature. For example, tourism in nature is complementary to agrotourism, tours and circuits can include a generous offer of agrotourism boarding houses where tourists can experience area-specific activities.

In addition, the tertiary sector generates hard-to-quantify effects, visible over a longer period, especially in the case of education and business support structures. Incubated companies and entrepreneurs begin to achieve significant results, with an impact on the local economy and employment, depending on the quality of services they receive, but also in a favourable economic environment.

Scenario 2 - Preservation of the Livezeni and Vulcan mines and the Paroşeni plant until 2030			
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
Modernisation			-2.940,2
Loss	8,457,3		
Subsidies	563,5		
Involving European funding + private sector	202	4.772,5	
Jobs	4840	2819	-2021
Salaries paid		1.510,1	1.510,1
TOTAL alternative sectors			
	Direct costs by 2030 (million Lei)	Direct benefits by 2030 (million Lei)	Net direct costs (-)/benefits (+) by 2030
TOTAL			603,45
Revenue and profit		708,5	
Subsidies from the budget	11,4		
Involving European funding + private sector	582,85		
Jobs		2,540	2,540
Salaries paid (10 years)		489,2	

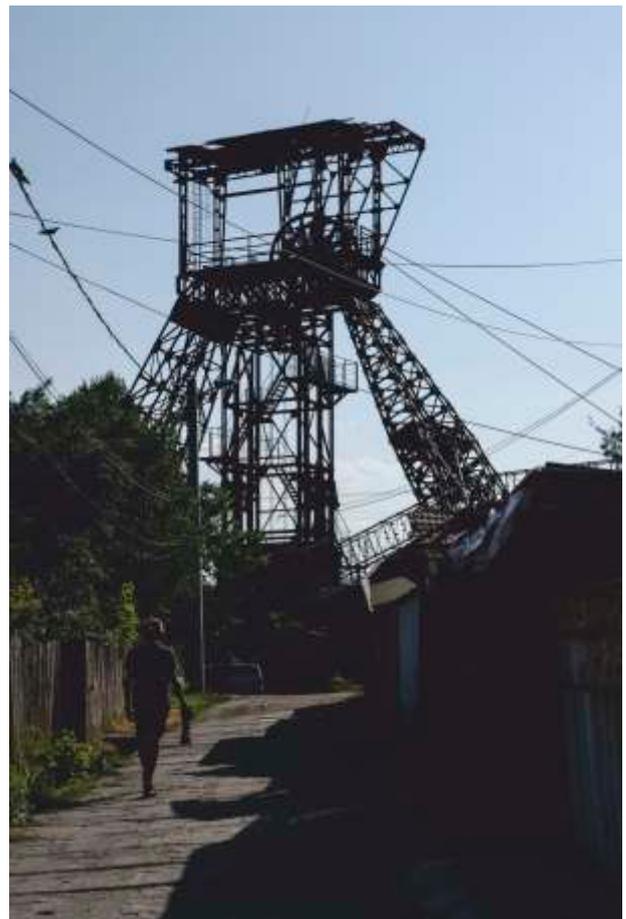
4.5. INCOMPATIBILITY OF ALTERNATIVE ACTIVITIES WITH SUSTAINING COAL BASED ECONOMY

In spite of the decline of the mining industry in Jiu Valley, supported by the deterioration of obsolete production units and technologies and the low demand for raw materials on the domestic market, the argument of continuing mining in parallel with the development of alternative economic activities remains on the public agenda. Permanent efforts have been made to restore energy production through subsidising producers and other types of interventions, but communities directly affected by this decline are becoming increasingly vulnerable to dependence on mining.

Jiu Valley's dependence on declining mining operations has significantly contributed to the deterioration of economic activity and the degradation of the labour market by maintaining a vicious circle in the absence of immediate interventions in a well-defined strategic framework of concrete recovery measures. Unemployment and migration have been boosted by the reduction of mining activity in the absence of adequate development alternatives and means of deployment, following this downward trend during the continuation of the mine closure process.

Continuing the mining activity, albeit on a smaller scale, in an area already severely affected by a profound restructuring of this activity will lead to the perpetuation of the difficulties faced by local communities - on the one hand, environmental degradation will reach alarming levels, undermining the potential for agricultural or tourism development of the area. On the other hand, this unilateral economic model will deepen

the workforce shortage, given the already uncertain future of mining, considering the imminence of the transition to a renewable energy-based energy sector. The lack of competencies necessary to support a variety of economic development can also be seen from the perspective of the inability to develop entrepreneurial initiatives despite the capital infusion from the compensating payments of the miners. In order to develop economic resilience, Jiu Valley needs activities that generate revenue, taxes and jobs, supported by diverse, adaptable competencies.



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4.6. PREREQUISITES TO ENSURE A POST-COAL TRANSITION

4.6.1. PREREQUISITES AND RECOMMENDATIONS

Rehabilitation of the affected lands and their reintroduction into the economic circuit

Areas affected by mining operations and abandoned industrial sites are a challenge for the transformation of the area. In their case, two types of intervention are needed: clarification of the property situation over the land to unlock rehabilitation projects in an efficient manner, and land preparation (especially those close to utility networks) so that they can be included in the offer of land for potential investment.

Drafting and implementation of qualification/re-qualification/training programmes

Reintegration of vulnerable groups into the labour market is an important pillar for the development of the area. Training programs can be aimed at both re-qualification of miners and qualification and training in other areas, but they must be part of a unitary plan of measures in a centralised and accessible way. Such programs should be adapted to the needs of current and potential employers to equip people with useful, applied, sought-after labour market competences. Such programs also contribute to stimulating the provision of training services, generating an impact at the level of the area, especially at the level of the university and other institutions that have the necessary competences. The NGO environment can also play a role in this process, offering new, accessible perspectives and in line with the trends regarding future competences.

Developing entrepreneurship and effectively supporting business creation

Entrepreneurship is one of the main engines for economic recovery, providing opportunities for young people in particular, and increasing their participation and involvement in economic life. The University of Petroșani, as well as public administrations, can play an important role in promoting entrepreneurship through the development of projects for the development of entrepreneurial skills, but also by supporting the frame infrastructure to provide the assistance needed to implement business ideas. In addition, a business incubator not only has the role of providing the infrastructure but also the services needed to grow ideas - attracting investment, step by step assistance at all stages of the development of a business, unlocking bottlenecks in financial management, legal or accounting nature, the necessary human resources.

Identifying key areas that can be exploited to increase people's involvement

As presented in the previous chapters, the just transition can only be achieved by assuming legitimacy and confidence in the actions taken by a multitude of actors, starting from the basic level to the central authorities or international bodies. Timely and thorough planning can lead to an increase in the capacity to adapt to the economic and social environment to take on the responsibility of the declining mining industry. Thus, as part of the strategic process of economic transformation, there is a need for an adequate understanding of the key elements that can be exploited at the natural potential or economic sectors, through a broad consultative process, but also by mapping and evaluating all the undertaken initiatives and implemented projects, to understand the causes that led to their success

or failure. In the case of such a process of transformation, both systemic problems and the poor understanding of opportunities and how best to exploit them have had an impact on the lack of real progress. For example, existing resources can be included in a presentation package for investors: local authority initiatives to stimulate the economic environment, available land for building production units, data sets relevant to understanding local dynamics, performant companies and their profile and other types of information useful for business development in the area.

Strengthening administrative capacity

Not only collaboration at the level of public authorities is essential in the transition process, but also strengthening the specific competencies among the operational staff. Employee training in specific areas of public administration, such as accessing European funds and writing projects on various priority axes, developing language skills in international languages, financial management, project management, technical expertise can unlock some existing barriers in identifying and capitalising on opportunities development.

Strengthening the role of the university and research environment

The University of Petroșani can be an extremely important factor in the development of the area, in three fundamental directions:

1) The development of research in the niche sectors in the mining and energy sectors (e.g. in the area of decontamination technologies or increasing the efficiency of production units or in the field of decontamination of land affected by the mine activity), becoming a centre connected to the European network, assisting the post-coal transition process

2) Development of research in alter-

native economic sectors, in partnership with specialised universities in the region or at national level, for the development of a base of specialists in the areas of agriculture and food, textiles, wood and furniture, electronics. One of the major difficulties faced by the University of Petroșani is the location in the sphere of influence of the University of Timișoara, failing to compete for attracting teachers or researchers in the above-mentioned fields in order to support the development of other industries. Partnership projects offer the opportunity to exchange best practices, acquire specific knowledge, and set up teams that could develop over time to serve the demands of the economic environment.

3) Education and training - The University of Petroșani has already made efforts to adapt the curriculum to labour market requirements by diversifying the educational offer, but training in diverse areas requires adaptation to the development of the economic environment. Thus, the university has the role of facilitating the access of students and graduates to internships and jobs, by establishing partnerships with the companies in the area. A niche to be exploited is the hospitality industry at the level of higher education, contributing to the training of hotel and hospitality specialists for existing or future tourist facilities.

4) Technological Transfer - In order to encourage local innovation to increase added value, the existing Technology Transfer Centre at the university needs to step up its activities, acting as a facilitator of dialogue and collaboration between research departments and the private sector. It can act as a catalyst for development as a result of research in the departments of the university, research institutes and the private sector, while strengthening the expertise and extension of the network of diverse partners such as investors, service providers, innovation training and innovation management, commercialisation of innovation, access to international markets.

Increasing the connectivity of the area by attracting investments in the field of transport

Internal accessibility, complemented by a good connection to the main European transport corridors, is a development factor by ensuring high mobility of people and goods, contributing both to attracting investors and tourists and to establishing trade and economic relations with other markets of interest. In the context of a limited internal market, increased connectivity ensures easy transfer of goods produced in Jiu Valley to foreign markets at a lower cost and in less time. Also, an important role is played by ensuring mobility between towns and rural areas, ensuring access to facilities, services and jobs available, especially in urban areas.

Developing a regional brand and promoting it internationally

In the last decades, Jiu Valley has been visible mainly through the mining tradition, contributing to a rather unfavourable picture of the development of alternative economic sectors. However, beyond the mono-industrial economic profile, the area is distinguished by a special cultural and natural heritage, whose exploitation will decisively contribute to the reaffirmation of identity. Promoting ethnographic resources, traditions, history and the natural environment must become a strategic goal for restarting local engines of the economy. This can be done by identifying the distinctive elements, shaping a coherent message of their promotion, in a participatory framework bringing together not only the public authorities and the private sector but also representative groups within the civil society - NGOs, the educational environment and academics, as well as urban and rural residents. Together, all of these actors can define the values they identify with, in order to

be able to run common projects and initiatives in the future, for the benefit of communities, starting from bottom to top. Defining this identity does not only serve to increase tourist attractiveness but can also become the brand of Jiu Valley in national and international events. In order to be positioned as an investment destination, study visits, business events, conferences or other types of events can be organised under the umbrella of promoting the area's identity.

Stimulating collaboration between local stakeholders - civil society, public authorities, the private sector, educational structures

Integrated projects, based on the cooperation between actors, facilitate the transition process. A first step could be joint participation in national and international projects to solve some difficulties of interest for the whole region, facilitating finding a common denominator regarding the tools and methods of cooperation. At the same time, an advisory forum can be set up at the level of Jiu Valley to present and discuss the experiences and knowledge accumulated by all the actors involved, as well as the individual initiatives developed by each of them.



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Diversification/enhancement of the competitiveness of products and services provided by the private sector/Company upgrading/Modernisation of Companies

The low productivity and competitiveness of the products and services offered by a large part of Jiu Valley companies is transposed into a limited critical mass to increase the added value of potential industries. In a wider economic environment, companies are, in fact, suppliers and downstream and upstream customers in local, regional, national or international value chains, having business relationships not only with local companies but beyond the boundaries of territorial proximity. Thus, the goal is to increase value-added by investing in the modernisation of production lines, increasing the quality of products through new equipment and technologies, increasing efficiency and productivity, to meet the standards required at the most bidding markets. This leap cannot be achieved easily but requires investment both in actual production and in the support service area that needs to facilitate entry into more sophisticated markets such as financial management, negotiation, exchange of good practice, qualified staff. Companies in Jiu Valley need support to meet the demand for existing products and services within a wider framework, becoming a source of confidence for larger manufacturers outside the area.

Promoting vocational and technical education

In order to support the development of the private sector, a skilled workforce is needed, equipped with the technical skills appropriate to existing equipment and production technologies. Vocational and technical education can provide opportunities for young people who cannot attend higher education, as well as vulnerable people wishing

to undertake vocational re-qualification or to acquire skills required by employers. In this respect, dual education, developed in partnership with medium or large companies, can provide benefits on both sides - on the one hand, young people benefit from applied training on machinery and equipment used in the current working environment, and on the other hand, employers have the opportunity to grow future employees according to their requirements, to increase efficiency, eliminating the search for employees in other areas.

Developing a development strategy dedicated to the post-coal transition for Jiu Valley

The just transition is based on transparency, collaboration and involvement at all decision levels of relevant actors, from communities to central authorities. A strategy dedicated to a just transition in Jiu Valley is an opportunity to provide a forum for discussion, alignment and debate on the future of the area, due to the consultative process on which such a strategic approach is based. Also, the just transition is a long process in which all actors need to be involved, in order to ensure success by requiring a long-term plan with clearly defined goals assumed at all levels.



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4.6.2. SOURCES OF FUNDING

Implementing the above-mentioned economic development alternatives as well as ensuring preconditions for the transition to a carbon-free economy requires not only the

alignment of international, national and local decision-makers but also adequate funding.

EUROPEAN FINANCING

Connecting Europe Facility (CEF) – represents the EU's 33 billion-euro plan for the development of the energy, transport and digital infrastructure sectors in 2014-2020. Within this scheme, 5.85 billion EUR is dedicated to cooperation projects in the field of energy infrastructure.

Horizon 2020 – the European Union's programme to support excellence, research and innovation. The budget for the current programming period is 75 million EUR, out of which 30 million EUR are available for the last 3 years of implementation. For the period 2021-2027, an additional amount of available funds is foreseen, up to 100 million EUR, under the new Horizon Europe programme.

Cohesion Fund – his funding scheme currently provides 366.6 billion EUR to applicants aiming to finance projects that reduce the economic and social disparities between EU member states and promote sustainable development, of which 25.2 billion EUR are allocated for Romania. For the period 2021-2027, it is foreseen to increase the amount allocated to Romania up to 27.2 billion EUR for the implementation of the projects that lead to the fulfilment of the new objectives of the cohesion policy such as, *A smarter Europe, a greener Europe, a connected Europe, a more social Europe, a Europe closer to its citizens.*

European Regional Development Fund – a funding scheme designed to reduce the economic and social disparities between European regions. Currently, a percentage of the funding allocation has to be redirected to environmental projects.

European Investment Bank – the institution finances energy projects by supporting companies with loans or other financial instruments. The EIB also provides assistance in project management and development.

Invest EU – the program aims to bring together a number of existing financial instruments under the current multi-annual fund under a common umbrella to support investments at EU level even more efficient, simple and flexible, being developed on the basis of the success of the current Juncker Plan regarding the European Fund for Strategic Investments. The program will have three components: InvestEU Fund, InvestEU Advisory Hub and InvestEU Portal. This tool to guarantee investments aims to attract 650 billion Eur in investment, supporting four thematic areas of interest: sustainable infrastructure, research, innovation and digitisation, SME development and investment in skills and the social sphere. In addition, the programme will provide technical assistance in the preparation, development and implementation of projects.

NATIONAL OPERATIONAL PROGRAMMES

The Regional Operational Programme – The new multi-annual funding framework 2021-2027 brings a number of changes for applicants. 65% of the available amount will be allocated to two thematic priorities, of which 35% for R & D and innovation for SMEs and 30% for carbon dioxide reduction. The remaining 35% will be allocated to the other priorities (mobility and connectivity, social Europe - health, education, social, employment, and integrated and sustainable development for urban, rural and local initiatives).

The transposition of European objectives into the national funding framework by thematic priorities and objectives will be completed by the end of 2019. However, to support the intervention measures proposed in the previous chapter, it is necessary to access non-reimbursable funds corresponding to the current objectives:

- Increasing the competitiveness of SMEs (current Competitiveness Operational Programme).

- Supporting the development of human capital through measures on the development of entrepreneurship, training courses and (re)qualification/professional reorientation, scholarships for pupils and students, etc. (the current Human Capital Operational Programme).

- Developing Transport Infrastructure to Increase Connectivity (current Operational Infrastructure Programme).

- Developing local public administrations and associative structures for involvement in the elaboration of public policies (current Operational Capacity Administrative Programme).

- Increasing investments in agriculture, upgrading and development of the rural environment through diverse and modern agriculture (current National Programme for Rural Development).



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CONCLUSIONS

This study aims to present a development model in a carbon-free economic environment based on the concept of a just transition and considering models of good practice in other regions affected by the decline of the mining industry, as well as proposing development scenarios on alternative mining activities.

In the first stage, the study presents the role of coal in the current energy model, both at the national level and at the level of international trends and policies in the field, assuming climate change targets and the energy future. Current realities, mirrored by global strategic objectives, highlight the deterioration in the performance of the coal-based energy sector despite attempts to modernise. The vulnerabilities that the decline of this sector generates are particularly felt among communities dependent on these activities for a long time, and where coal resources are geographically concentrated, as is the case with Jiu Valley.

The future of energy production and the global and national energy mix depend to a large extent on the assumption and achievement of key objectives and interventions, such as increasing energy production and consumption, diversifying supply by supporting renewable sources, ensuring economic and social sustainability in vulnerable communities affected by the decrease of the importance of coal in energy production, of the energy sector governance and the adaptation of existing models in different regions, and last but not least, of the funding sources that can assist the transition.

The post-coal transition is possible, as evidenced by numerous examples of mines rehabilitated and reintegrated into the

economic circuit, as well as the transformation of the economic profile of the affected regions, but it is a difficult process requiring massive involvement and mobilisation by many actors and factors decision, starting from local communities. One of the major problems faced by these communities is the lack of confidence in the possibility of transition and the transformation of the area into a prosperous one. Therefore, the proposed interventions should consider offering as many opportunities as possible for the most significant part of the population, and a number of such proposals have been presented in the chapter dedicated to alternative development scenarios.

Socially, shutting down the mines will have a major impact on the increase of unemployment, resulting in the disposal of just over 4,000 people by 2024. Alternative activities offer opportunities for a considerable part of them, generating directly over 2500 jobs.



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The secondary sector has the greatest potential for restarting the engines of the economy, but interventions cannot be done without supporting the primary and tertiary sector activities, due to the close interactions between the three. A particularly important point is to support existing industries, such as the food, textile, wood and furniture industries, the development of which can have an impact on the employment and quality of products. The University of Petroșani also plays an important role both in the development of research on various levels and in the formation of future employees and specialists. Encouraging entrepreneurship is a long-term investment in the future of the

community, with positive effects and real alternatives to employment, especially among young people.

Finally, all proposed alternatives can be carried out under the conditions of an optimal operational framework, from multiple perspectives, defined as cross-cutting priorities in the chapter dedicated to recommendations: increasing connectivity and mobility of people and goods, creating a coherent framework for education and training, increasing administrative capacity and developing an identity to promote the area to attract new opportunities.

Scenario 3 - Development of the primary sector	
TOTAL primary sector - jobs	760
3.1. Micro-breeding livestock	260
3.2. Berry bush plantations	500
Scenario 4 - Development of the secondary sector	
TOTAL secondary sector - jobs	1520
4.1. The renewable energy sector	257
4.2. Construction - energy efficiency	240
4.3. Development of the food industry	199
4.4. Development of the textile industry	300
4.5. Development of the wood processing industry	71
4.6. Development of the furniture industry	412
4.7. Developing the computer and electronic products manufacturing industry	41
Scenario 5 - Development of the tertiary sector	
TOTAL tertiary sector - jobs	260
5.1. Business Support Infrastructures	20
5.2. Agrotourism boarding houses	230
5.3. Tourist routes	10

METHODOLOGY

The methodology by which alternative development scenarios were built and presented has two main components:

1) the Input-Output tables of the national economy, the matrix representation of intersectoral flows between the branches of the economy. Based on these tables, we calculate the technical and inverse coefficients, which determine the intensity of the indirect and induced impact of the investment in an economic branch into the other branches or in a specific branch. Each proposed project is associated with an economic branch based on the corresponding NACE code. The data used is available in the statistics of the National Institute of Statistics for the last available year (2016).

The direct impact has mainly considered the effects generated by the wages that remain in the local economy as well as the profit obtained and reinvested. The salary calculations were established on the basis of the average monthly salary per branch in the year 2017 in Hunedoara County. For simplification, the multiplier impact includes both the indirect impact and the induced impact, being interpreted as follows:

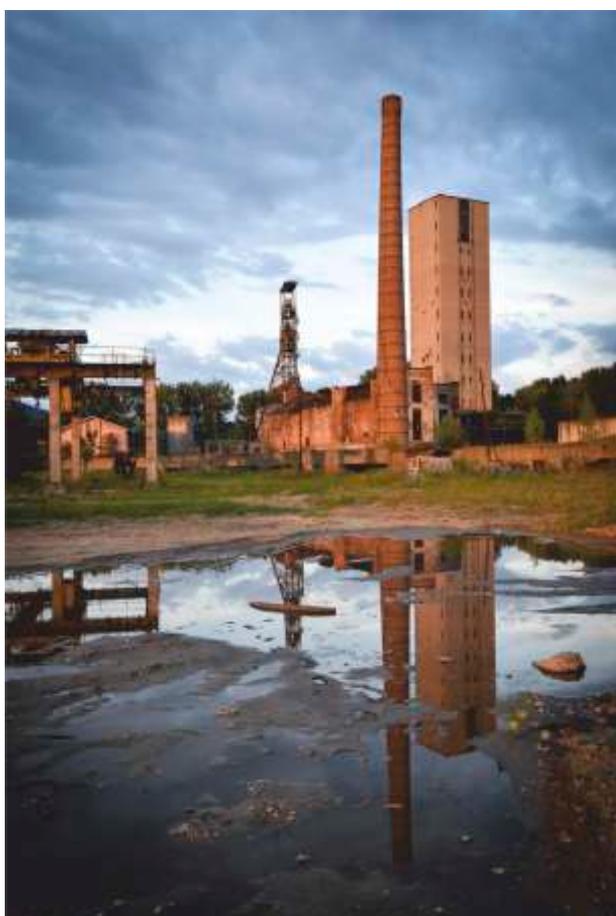
- Indirect Impact - To produce an extra Leu in a particular branch, the other branches will each have to produce a certain fraction of a Leu depending on the intensity of interdependence between them;
- Induced impact - How to multiply 1 Leu in a certain branch (for example, 1 Leu in branch A generates an induced impact of 2.3 Lei in the other sectors).

In calculating the multiplier effects, direct effects were considered as defined above, but also the value of investments in different proportions, depending on the most realistic involvement of suppliers and customers coming from the local economy.

The scenarios of intervention capture different sectors of the economy aggregated at branch level depending on the specificity of the scenario - for example, in the case of the primary sector, the branch of agriculture and its interdependence with the economic branches is highlighted. In the secondary and tertiary scenarios, specific sectors are pointed out, at the two-digit level of the NACE classification, depending on the proposed investment projects. As a matrix representation of the economy, the calculated impact is reflected in the rest of the sectors and branches considered in the scenario. The allocation of projects and interventions by branch and sector has been made depending on the activity to which the NACE classification corresponds - for example, in the case of the furniture industry, the intervention involves attracting funding by companies active in the furniture industry, while the energy efficiency of buildings is found in the constructions branch.

The areas of intervention highlighted in the scenarios were selected on the basis of development potential at Jiu Valley, analysing both quantitative data, such as the statistics of active companies, the average growth rate in the period 2008-2017 and the impact on employment (e.g. industry textile does not have a very high growth rate, but it is an important employer) or the potential to generate higher added value (e.g. production of computer components). The data used for calculating the growth rate and those used as

the starting point for the projections were adjusted to real prices using the consumer price index for the period under review. Also, the Hunedoara County Development Strategy 2014-2020 identified a number of priority interventions following extensive public consultations, specific priorities for Jiu Valley, without any progress being made in meeting them. Some of these have been detailed in this review.



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2) cost-benefit analysis - made for each project proposal; it captures the costs associated with that respective investment either from European funding or from the private sector, including the state's contribution to the funding line or grants in the case of agricultural interventions; benefits are illustrated through revenue generation, earnings and payroll; column 3 of the tables for this analysis shows the net costs or benefits that result from the difference between the sum of the items in the benefits column and the sum of the items in the cost column. It is important to note that the projections of income, expense, profit and salaries are estimated based on similar projects where such funding was attracted, on average. It also considers the dynamics of different sectors with regard to the level of revenue growth and to the share of profit as a percentage of the revenues, each industry has its own average profitability.

THE PRIMARY SECTOR

3.1. Family micro-farms	MULTIPLIED IMPACT (million Lei)	MULTIPLICATION JOBS
IN THE OWN SECTOR	43,2	33
IN THE OTHER SECTORS	34,35	48
02 Forestry and forestry exploitation	0,40	1
A - Agriculture, forestry and fishing	0,06	1
B - Extractive industry	1,13	2
C - MANUFACTURING INDUSTRY	22,39	34
D - PRODUCTION AND SUPPLY OF ELECTRICITY, HEAT, GAS, HOT WATER, AIR CONDITIONING	2,09	2
E - WATER DISTRIBUTION; SANITATION, WASTE MANAGEMENT, LAND DECONTAMINATION ACTIVITY	0,23	1
F - CONSTRUCTIONS	1,00	2
G - TRADE	0,24	1
H - SHIPPING AND STORAGE	0,45	1
I - HOTELS AND RESTAURANTS	0,20	1
J - INFORMATION AND TELECOMMUNICATIONS	0,88	2
K - FINANCIAL INTERMEDIATION AND INSURANCE	0,57	1
L - REAL ESTATE TRANSACTIONS	0,13	1
M - PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	3,58	5
N - ACTIVITIES OF ADMINISTRATIVE SERVICES AND SUPPORT SERVICE ACTIVITIES	0,72	2
O - PUBLIC ADMINISTRATION AND DEFENCE; SOCIAL INSURANCE FROM PUBLIC SYSTEM	-	-
P - EDUCATION	0,12	1
Q - HEALTH AND SOCIAL ASSISTANCE	0,05	1
R - ENTERTAINMENT, CULTURAL AND RECREATIONAL ACTIVITIES	0,04	1
S - OTHER SERVICE ACTIVITIES	0,07	1

3.2. Fruit and berry plantations	MULTIPLIED IMPACT (million Lei)	MULTIPLICATION JOBS
IN THE OWN SECTOR	281,62	227
IN THE OTHER SECTORS	226,4	333
02 Forestry and forestry exploitation	2,63	3
A - Agriculture, forestry and fishing	0,37	1
B - Extractive industry	7,27	8
C - MANUFACTURING INDUSTRY	148,20	237
D - PRODUCTION AND SUPPLY OF ELECTRICITY, HEAT, GAS, HOT WATER, AIR CONDITIONING	13,67	9
E - WATER DISTRIBUTION; SANITATION, WASTE MANAGEMENT, LAND DECONTAMINATION ACTIVITY	1,52	4
F - CONSTRUCTIONS	6,55	8
G - TRADE	1,61	4
H - SHIPPING AND STORAGE	2,95	4
I - HOTELS AND RESTAURANTS	1,30	3
J - INFORMATION AND TELECOMMUNICATIONS	5,76	7
K - FINANCIAL INTERMEDIATION AND INSURANCE	3,69	4
L - REAL ESTATE TRANSACTIONS	0,82	1
M - PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	23,63	33
N - ACTIVITIES OF ADMINISTRATIVE SERVICES AND SUPPORT SERVICE ACTIVITIES	4,69	10
O - PUBLIC ADMINISTRATION AND DEFENCE; SOCIAL INSURANCE FROM PUBLIC SYSTEM	-	-
P - EDUCATION	0,76	2
Q - HEALTH AND SOCIAL ASSISTANCE	0,31	1
R - ENTERTAINMENT, CULTURAL AND RECREATIONAL ACTIVITIES	0,23	1
S - OTHER SERVICE ACTIVITIES	0,43	1

SECONDARY SECTOR

4.1. Renewable energy	MULTIPLIED IMPACT (million Lei)	MULTIPLICATION JOBS
IN THE OWN SECTOR	71,5	35
IN THE OTHER SECTORS	88,5	129
A - Agriculture, forestry and fishing	2,4	1
B - Extractive industry (except for sector 05)	23,8	35
C - MANUFACTURING INDUSTRY	32,7	45
E - WATER DISTRIBUTION; SANITATION, WASTE MANAGEMENT, LAND DECONTAMINATION ACTIVITY	0,5	1
F - CONSTRUCTIONS	10,0	22
G - TRADE	0,2	1
H - SHIPPING AND STORAGE	1,9	3
I - HOTELS AND RESTAURANTS	0,7	2
J - INFORMATION AND TELECOMMUNICATIONS	4,4	8
K - FINANCIAL INTERMEDIATION AND INSURANCE	3,0	4
L - REAL ESTATE TRANSACTIONS	0,5	1
M - PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	5,3	6
N - ACTIVITIES OF ADMINISTRATIVE SERVICES AND SUPPORT SERVICE ACTIVITIES	2,0	5
O - PUBLIC ADMINISTRATION AND DEFENCE; SOCIAL INSURANCE FROM PUBLIC SYSTEM	-	-
P - EDUCATION	0,3	1
Q - HEALTH AND SOCIAL ASSISTANCE	0,1	1
R - ENTERTAINMENT, CULTURAL AND RECREATIONAL ACTIVITIES	0,1	1
S - OTHER SERVICE ACTIVITIES	0,2	1

4.2. Constructions - renewable energy	MULTIPLIED IMPACT (million Lei)	MULTIPLICATION JOBS
IN THE OWN SECTOR	249,37	214
IN THE OTHER SECTORS	405,8	628
A - Agriculture, forestry and fishing	6,3	5
B - Extractive industry	19,4	19
10 Food industry	3,4	5
13 Manufacture of textiles	5,2	7
16 Wood processing, manufacture of wood and cork products, except furniture; manufacture of articles of straw and other woven vegetable materials	12,2	34
26 Manufacture of computers, electronic and optical products	5,9	9
31 Manufacture of furniture	1,3	2
C - MANUFACTURING INDUSTRY	228,9	355
D - PRODUCTION AND SUPPLY OF ELECTRICITY, HEAT, GAS, HOT WATER, AIR CONDITIONING	27,8	29
E - WATER DISTRIBUTION; SANITATION, WASTE MANAGEMENT, LAND DECONTAMINATION ACTIVITY	13,9	35
G - TRADE	0,7	2
H - SHIPPING AND STORAGE	7,4	13
I - HOTELS AND RESTAURANTS	6,3	19
J - INFORMATION AND TELECOMMUNICATIONS	12,8	19
K - FINANCIAL INTERMEDIATION AND INSURANCE	9,5	11
L - REAL ESTATE TRANSACTIONS	9,8	23
M - PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	22,5	24
N - ACTIVITIES OF ADMINISTRATIVE SERVICES AND SUPPORT SERVICE ACTIVITIES	8,9	21
O - PUBLIC ADMINISTRATION AND DEFENCE; SOCIAL INSURANCE FROM PUBLIC SYSTEM	-	-
P - EDUCATION	1,5	3
Q - HEALTH AND SOCIAL ASSISTANCE	0,6	1
R - ENTERTAINMENT, CULTURAL AND RECREATIONAL ACTIVITIES	0,6	1
S - OTHER SERVICE ACTIVITIES	0,9	2

4.3. Food industry	MULTIPLIED IMPACT (million Lei)	MULTIPLICATION JOBS
IN THE OWN SECTOR	188,7	323
IN THE OTHER SECTORS	208,25	205
A - Agriculture, forestry and fishing	91,58	107
B - Extractive industry	5,66	5
13 Manufacture of textiles	2,20	3
16 Wood processing, manufacture of wood and cork products, except furniture; manufacture of articles of straw and other woven vegetable materials	0,92	1
26 Manufacture of computers, electronic and optical products	1,44	2
31 Manufacture of furniture	0,34	1
C - MANUFACTURING INDUSTRY	55,36	42
D - PRODUCTION AND SUPPLY OF ELECTRICITY, HEAT, GAS, HOT WATER, AIR CONDITIONING	10,48	5
E - WATER DISTRIBUTION; SANITATION, WASTE MANAGEMENT, LAND DECONTAMINATION ACTIVITY	0,68	2
F - CONSTRUCTIONS	6,74	7
G - TRADE	0,52	1
H - SHIPPING AND STORAGE	2,34	3
I - HOTELS AND RESTAURANTS	1,19	2
J - INFORMATION AND TELECOMMUNICATIONS	5,62	7
K - FINANCIAL INTERMEDIATION AND INSURANCE	5,91	6
L - REAL ESTATE TRANSACTIONS	0,84	1
M - PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	11,36	9
N - ACTIVITIES OF ADMINISTRATIVE SERVICES AND SUPPORT SERVICE ACTIVITIES	3,69	7
O - PUBLIC ADMINISTRATION AND DEFENCE; SOCIAL INSURANCE FROM PUBLIC SYSTEM	-	-
P - EDUCATION	0,59	2
Q - HEALTH AND SOCIAL ASSISTANCE	0,25	1
R - ENTERTAINMENT, CULTURAL AND RECREATIONAL ACTIVITIES	0,20	1
S - OTHER SERVICE ACTIVITIES	0,34	1

4.4. Textile industry	MULTIPLIED IMPACT (million Lei)	MULTIPLICATION JOBS
IN THE OWN SECTOR	20,36	247
IN THE OTHER SECTORS	266,46	97
A - Agriculture, forestry and fishing	22,37	25
B - Extractive industry	11,92	9
10 Food industry	2,59	2
16 Wood processing, manufacture of wood and cork products, except furniture; manufacture of articles of straw and other woven vegetable materials	2,32	3
26 Manufacture of computers, electronic and optical products	2,41	3
31 Manufacture of furniture	0,53	1
C - MANUFACTURING INDUSTRY	121,80	120
D - PRODUCTION AND SUPPLY OF ELECTRICITY, HEAT, GAS, HOT WATER, AIR CONDITIONING	23,35	11
E - WATER DISTRIBUTION; SANITATION, WASTE MANAGEMENT, LAND DECONTAMINATION ACTIVITY	1,72	3
F - CONSTRUCTIONS	13,52	15
G - TRADE	0,72	2
H - SHIPPING AND STORAGE	3,29	3
I - HOTELS AND RESTAURANTS	2,44	4
J - INFORMATION AND TELECOMMUNICATIONS	8,19	9
K - FINANCIAL INTERMEDIATION AND INSURANCE	8,60	8
L - REAL ESTATE TRANSACTIONS	0,81	1
M - PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	26,22	26
N - ACTIVITIES OF ADMINISTRATIVE SERVICES AND SUPPORT SERVICE ACTIVITIES	10,06	22
O - PUBLIC ADMINISTRATION AND DEFENCE; SOCIAL INSURANCE FROM PUBLIC SYSTEM	-	-
P - EDUCATION	1,58	4
Q - HEALTH AND SOCIAL ASSISTANCE	0,66	1
R - ENTERTAINMENT, CULTURAL AND RECREATIONAL ACTIVITIES	0,47	1
S - OTHER SERVICE ACTIVITIES	0,87	2

4.5. Wood processing	MULTIPLIED IMPACT (million Lei)	MULTIPLICATION JOBS
IN THE OWN SECTOR	50,8	44
IN THE OTHER SECTORS	73,0	68
A - Agriculture, forestry and fishing	13,7	14
B - Extractive industry	2,8	3
10 Food industry	1,1	1
13 Manufacture of textiles	1,1	2
26 Manufacture of computers, electronic and optical products	0,6	1
31 Manufacture of furniture	0,3	1
C - MANUFACTURING INDUSTRY	24,7	21
D - PRODUCTION AND SUPPLY OF ELECTRICITY, HEAT, GAS, HOT WATER, AIR CONDITIONING	5,7	3
E - WATER DISTRIBUTION; SANITATION, WASTE MANAGEMENT, LAND DECONTAMINATION ACTIVITY	0,4	1
F - CONSTRUCTIONS	3,1	3
G - TRADE	0,2	1
H - SHIPPING AND STORAGE	1,7	2
I - HOTELS AND RESTAURANTS	0,5	1
J - INFORMATION AND TELECOMMUNICATIONS	2,3	3
K - FINANCIAL INTERMEDIATION AND INSURANCE	2,2	2
L - REAL ESTATE TRANSACTIONS	0,2	1
M - PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	8,1	8
N - ACTIVITIES OF ADMINISTRATIVE SERVICES AND SUPPORT SERVICE ACTIVITIES	3,0	7
O - PUBLIC ADMINISTRATION AND DEFENCE; SOCIAL INSURANCE FROM PUBLIC SYSTEM	-	-
P - EDUCATION	0,5	1
Q - HEALTH AND SOCIAL ASSISTANCE	0,2	1
R - ENTERTAINMENT, CULTURAL AND RECREATIONAL ACTIVITIES	0,1	1
S - OTHER SERVICE ACTIVITIES	0,3	1

4.6. Furniture industry	MULTIPLIED IMPACT (million Lei)	MULTIPLICATION JOBS
IN THE OWN SECTOR	188,1	197
IN THE OTHER SECTORS	292,2	260
A - Agriculture, forestry and fishing	20,1	13
B - Extractive industry	10,7	9
10 Food industry	2,5	2
13 Manufacture of textiles	24,9	31
16 Wood processing	37,8	51
26 Manufacture of computers, electronic and optical products	2,4	2
C - MANUFACTURING INDUSTRY	100,7	77
D - PRODUCTION AND SUPPLY OF ELECTRICITY, HEAT, GAS, HOT WATER, AIR CONDITIONING	19,9	7
E - WATER DISTRIBUTION; SANITATION, WASTE MANAGEMENT, LAND DECONTAMINATION ACTIVITY	1,4	2
F - CONSTRUCTIONS	11,1	9
G - TRADE	0,7	1
H - SHIPPING AND STORAGE	5,3	5
I - HOTELS AND RESTAURANTS	1,6	2
J - INFORMATION AND TELECOMMUNICATIONS	8,1	8
K - FINANCIAL INTERMEDIATION AND INSURANCE	7,7	6
L - REAL ESTATE TRANSACTIONS	0,7	1
M - PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	24,1	19
N - ACTIVITIES OF ADMINISTRATIVE SERVICES AND SUPPORT SERVICE ACTIVITIES	9,2	18
O - PUBLIC ADMINISTRATION AND DEFENCE; SOCIAL INSURANCE FROM PUBLIC SYSTEM	-	-
P - EDUCATION	1,5	3
Q - HEALTH AND SOCIAL ASSISTANCE	0,6	1
R - ENTERTAINMENT, CULTURAL AND RECREATIONAL ACTIVITIES	0,4	1
S - OTHER SERVICE ACTIVITIES	0,8	2

4.7. Manufacture of computer components	MULTIPLIED IMPACT (million Lei)	MULTIPLICATION JOBS
IN THE OWN SECTOR	30,5	21
IN THE OTHER SECTORS	36,4	25
A - Agriculture, forestry and fishing	0,5	1
B - Extractive industry	1,8	2
10 Food industry	0,4	1
13 Manufacture of textiles	0,7	1
16 Wood processing	0,3	1
31 Manufacture of furniture	0,2	1
C - MANUFACTURING INDUSTRY	18,3	12
D - PRODUCTION AND SUPPLY OF ELECTRICITY, HEAT, GAS, HOT WATER, AIR CONDITIONING	2,7	1
E - WATER DISTRIBUTION; SANITATION, WASTE MANAGEMENT, LAND DECONTAMINATION ACTIVITY	0,2	1
F - CONSTRUCTIONS	1,4	1
G - TRADE	0,4	1
H - SHIPPING AND STORAGE	0,8	1
I - HOTELS AND RESTAURANTS	0,3	1
J - INFORMATION AND TELECOMMUNICATIONS	1,9	2
K - FINANCIAL INTERMEDIATION AND INSURANCE	1,4	1
L - REAL ESTATE TRANSACTIONS	0,2	1
M - PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	3,2	3
N - ACTIVITIES OF ADMINISTRATIVE SERVICES AND SUPPORT SERVICE ACTIVITIES	1,3	3
O - PUBLIC ADMINISTRATION AND DEFENCE; SOCIAL INSURANCE FROM PUBLIC SYSTEM	-	-
P - EDUCATION	0,2	1
Q - HEALTH AND SOCIAL ASSISTANCE	0,1	1
R - ENTERTAINMENT, CULTURAL AND RECREATIONAL ACTIVITIES	0,1	1
S - OTHER SERVICE ACTIVITIES	0,1	1

TERTIARY SECTOR

5.1. Business support Infrastructure	MULTIPLIED IMPACT (million Lei)	MULTIPLICATION JOBS
IN THE OWN SECTOR	28,45	24
IN THE OTHER SECTORS	30,4	23
A - Agriculture, forestry and fishing	0,5	1
B - Extractive industry (without extractive)	0,5	1
C - MANUFACTURING INDUSTRY	6,1	8
D - PRODUCTION AND SUPPLY OF ELECTRICITY, HEAT, GAS, HOT WATER, AIR CONDITIONING	1,4	1
E - WATER DISTRIBUTION; SANITATION, WASTE MANAGEMENT, LAND DECONTAMINATION ACTIVITY	0,2	1
F - CONSTRUCTIONS	16,1	3
G - TRADE	0,1	1
H - SHIPPING AND STORAGE	0,3	1
I - HOTELS AND RESTAURANTS	0,3	1
J - INFORMATION AND TELECOMMUNICATIONS	1,3	3
K - FINANCIAL INTERMEDIATION AND INSURANCE	0,8	1
L - REAL ESTATE TRANSACTIONS	0,1	1
N - ACTIVITIES OF ADMINISTRATIVE SERVICES AND SUPPORT SERVICE ACTIVITIES	2,0	6
O - PUBLIC ADMINISTRATION AND DEFENCE; SOCIAL INSURANCE FROM PUBLIC SYSTEM	-	-
P - EDUCATION	0,3	1
Q - HEALTH AND SOCIAL ASSISTANCE	0,1	1
R - ENTERTAINMENT, CULTURAL AND RECREATIONAL ACTIVITIES	0,1	1
S - OTHER SERVICE ACTIVITIES	0,2	1

5.2. Tourism - agro-touristic boarding houses	MULTIPLIED IMPACT (million Lei)	MULTIPLICATION JOBS
IN THE OWN SECTOR	33,58	35
IN THE OTHER SECTORS	52,7	87
A - Agriculture, forestry and fishing	2,2	2
B - Extractive industry (without extractive)	1,4	2
C - MANUFACTURING INDUSTRY	30,6	52
D - PRODUCTION AND SUPPLY OF ELECTRICITY, HEAT, GAS, HOT WATER, AIR CONDITIONING	2,4	2
E - WATER DISTRIBUTION; SANITATION, WASTE MANAGEMENT, LAND DECONTAMINATION ACTIVITY	0,6	2
F - CONSTRUCTIONS	2,3	5
G - TRADE	0,1	1
H - SHIPPING AND STORAGE	0,4	1
J - INFORMATION AND TELECOMMUNICATIONS	2,5	5
K - FINANCIAL INTERMEDIATION AND INSURANCE	1,0	1
L - REAL ESTATE TRANSACTIONS	0,3	1
M - PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	2,5	3
N - ACTIVITIES OF ADMINISTRATIVE SERVICES AND SUPPORT SERVICE ACTIVITIES	1,0	3
O - PUBLIC ADMINISTRATION AND DEFENCE; SOCIAL INSURANCE FROM PUBLIC SYSTEM	-	-
P - EDUCATION	0,2	1
Q - HEALTH AND SOCIAL ASSISTANCE	0,1	1
R - ENTERTAINMENT, CULTURAL AND RECREATIONAL ACTIVITIES	3,7	10
S - OTHER SERVICE ACTIVITIES	1,3	5

5.3. Tourism - Tourist routes	MULTIPLIED IMPACT (million Lei)	MULTIPLICATION JOBS
IN THE OWN SECTOR	3,09	3
IN THE OTHER SECTORS	2,65	3
A - Agriculture, forestry and fishing	0,08	0
B - Extractive industry (without extractive)	0,07	0
C - MANUFACTURING INDUSTRY	1,01	1
D - PRODUCTION AND SUPPLY OF ELECTRICITY, HEAT, GAS, HOT WATER, AIR CONDITIONING	0,13	0
E - WATER DISTRIBUTION; SANITATION, WASTE MANAGEMENT, LAND DECONTAMINATION ACTIVITY	0,03	0
F - CONSTRUCTIONS	0,28	0
G - TRADE	0,01	0
H - SHIPPING AND STORAGE	0,03	0
J - INFORMATION AND TELECOMMUNICATIONS	0,02	0
K - FINANCIAL INTERMEDIATION AND INSURANCE	0,19	0
L - REAL ESTATE TRANSACTIONS	0,10	0
M - PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	0,02	0
N - ACTIVITIES OF ADMINISTRATIVE SERVICES AND SUPPORT SERVICE ACTIVITIES	0,46	1
O - PUBLIC ADMINISTRATION AND DEFENCE; SOCIAL INSURANCE FROM PUBLIC SYSTEM	0,18	0
P - EDUCATION	-	-
Q - HEALTH AND SOCIAL ASSISTANCE	0,03	0
R - ENTERTAINMENT, CULTURAL AND RECREATIONAL ACTIVITIES	0,01	0
S - OTHER SERVICE ACTIVITIES	0,02	0

