

Beyond coal

Sustainable alternatives for the future of coalfield regions

CASE STUDY: ALTERNATIVE DEVELOPMENT FOR TERUEL COALFIELD REGION

EXECUTIVE SUMMARY

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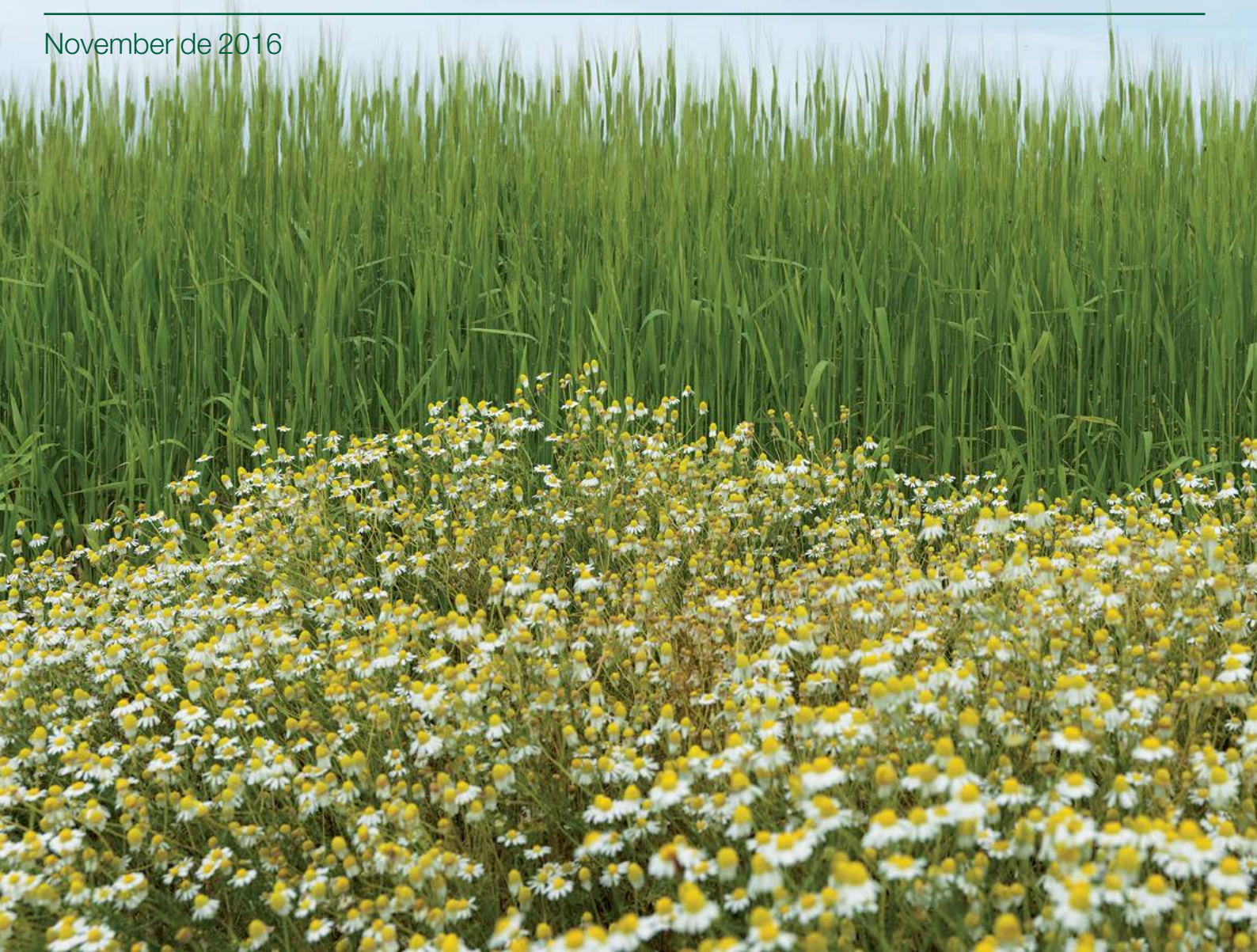


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Introduction

Coal and the Environment

Coal burning, coal storage, ash landfills, and coalmines are a threat to the environment and to our basic needs such as clean water for drinking, clean air for breathing, and a safe climate.

Coal burning, which is mainly used for heating and electricity, is the main contributor to carbon dioxide emissions (CO₂), and other air pollutant substances. Mining is also a source of methane, a greenhouse gas more potent than CO₂.

Human activities and lifestyle, our thirst for coal, oil and gas, the melting of the Arctic, the destruction of forests and oceans, and ultimately how poorly we care for our planet are the leading causes of increasingly extreme temperatures. The last report of the Intergovernmental Panel on Climate Change (IPCC) highlighted that polar ice cap is melting much faster than predicted, sea-level rise and ocean acidification is taking place at a record rate, and heat waves and extreme weather events are increasing. The IPCC also concludes that consequences will worsen as GHG emissions increase.

Several studies have quantified the financial impact of climate change¹ and the health problems due to air pollution. According to a recent study by the World Bank, air pollution cost the world economy \$225 billions in 2013, and it is the fourth leading cause of premature death in the world².

Urgent action is needed on every front to speed the transition to an intelligent, efficient and 100% renewable energy system in order to ensure worldwide temperatures do not increase over 1.5°C, and to reduce health effects. All government agencies, businesses and social agents must commit and comply with the Paris Agreement and European laws.

However, between 2014 and 2015, Spain has seen an increase in the use of technologies dependent on fossil fuels, this has resulted in an 15.1% increase of CO₂ emissions from electricity production.³

While in 2015 coal worldwide demand fell 1.8% compared to the previous year, in Spain it increased by 23.9% for that same period. **Spain was the country with the highest consumption increase⁴**, thus the number of total emissions increased by over 4% compared to the previous year.

Again data shows the urgent need for Spain to implement policies to abandon coal as other countries such as Portugal, Austria, United Kingdom and Finland have done, and to guarantee a just transition to sustainable employment.

State agreements that promote the use of coal and grants allotted to big electricity companies (which receive billions of Euros) to keep burning fossil fuels do not observe neither climate international laws nor European laws on state aids. In addition, they neglect our health and are an obstacle to a more environmental and socially friendly country.

Case Study: The Andorra-Sierra de Arcos Region. Teruel

Based on the assumption the road to sustainable alternatives is not only possible but necessary, the present document pretends to show the financial, environmental, and social reality Spanish coalfield regions face, areas which were key in the development of Spain but have already left their golden years behind.

This study focuses on the coalfield region of Andorra-Sierra de Arcos as defined by the Government of Aragon territorial division. The Andorra region is made up of 9 municipalities: Alacón, Alloza, Andorra, Ariño, Crivillén, Ejulve, Estercuel, Gargallo, and Oliete; it was established by Law 11/2002 on the Creation of the Andorra Sierra de Arcos Region.

Understanding how challenging might be changing the economic model of the Andorra-Sierra de Arcos region, a number of strengths and peculiarities were identified which would make the transition possible. Social rights conquered by the mining sector were also taken in account. In order to change the energy model and to create alternative sustainable jobs it is necessary for these areas to participate and to be taken in consideration.

There are not many successful examples in which the coal sector has been able to restructure with mining funds. Presently, the sector has no shutdown plan which is just and inclusive, this leads to fear, frustration and indignation, and thus the only solution put forward is to extent the coal mining activity.

The Andorra-Sierra de Arcos region's surface and underground mines are property of Compañía General Minera de Teruel, S.A. and SAMCA. The latter is expected to close in 2016 due to lack of coal and profitability. The existing thermal power plant is property of Endesa-Enel

and was awarded grants while the Royal Decree 134/2010 was in force; the end of subsidies probably means the company will have trouble operating beyond 2020. The thermal plant in Andorra is a huge source of air pollution, in 2015 CO₂ emissions came to over **four and a half tons**⁵ Air pollution from coal burning knows no borders, and impacts our health and that of our neighboring countries. The thermal plant in Andorra is **among the ten European thermal power plants with higher sulphur dioxide emissions**, it is related to 400 premature deaths, 260 cases of chronic bronchitis, 360 hospital admissions, the loss of 150,370 working days, 11,970 asthma attacks in children, and a health average cost of €1.1 billion⁶ (for 2013 emissions).

Many of the concepts outlined in this report can be extrapolated to other coalfield regions, and can serve as guide and inspiration when dealing with the process to ensure a transition towards a more just and sustainable employment. Nonetheless, the reality and context of each coalfield area is different and thus has to be dealt with individually.

About the Study

The present study has two clearly defined sections, each one is based on the report Greenpeace commissioned to two different entities. The reason behind this was to have the point of view of two different experienced experts in the field when writing a report on the feasibility of sustainable alternatives in the Andorra coalfield region in a coal-free future. The Union Institute of Work, Environment and Health (ISTAS), a self-managed trade union's technical foundation supported by the Spanish Trade Union Confederation *Comisiones Obreras* (CCOO), studied the problem from a historical perspective. They reviewed the coal mining situation in Spain and Teruel, the legal framework, and the characteristics shared by coalfield regions. They also compile international examples of just and sustainable reconversions in coalfield regions, and draw conclusions from these processes⁷.

Abay Analistas specifically analyzed possible sustainable alternatives for Andorra's mining region in Teruel. They reviewed the ongoing transition in the region, and analysed socioeconomic factors to propose possible economy diversifications⁸.

SECTION I. COAL MINING IN SPAIN AND INTERNATIONAL JUST TRANSITIONS

Coal in Spain

Spain still produces coal. Despite major efforts of recent Coal Plans to promote alternative options in coalfield regions, areas in Aragon, Castile-La Mancha, Castile and Leon, and the Principality of Asturias depend economically on coal mining, yet at the same time in these same regions coal mining needs to be funded publicly.

The current coal plan *Plan de Cierre de la minería del carbón 2011-2018* specifies that coal mines which want to be eligible for financial aid must present a project of their final shutdown and closure that is to be effective no later than end of 2018. If not, mining companies must return the aid granted.

The coal sector has undergone several reconversion programs since the 70s. Competing on international markets has proven difficult for Spanish and European coal, the former has required government support via different channels.

Over the last decades, restructuring plans have resulted in significantly lower employment. This sector has gone from employing 100,000 people in the 50s; to 45,000 in late 80s; and 3,407 in 2012. In 2014, the number of people who paid social security under the special scheme for coal mine was 5,029, this included people still actively working as people under an early retirement pension scheme.

Support programs for this sector have evolved noticeably. The financial aid provided by the initial programs was meant to address gaps between loss-making national coal and the much cheaper foreign coal. In **1987 electricity companies get involved, they were offered guaranteed payments in exchange for buying national coal; this type of aid was available till 2014**.

It was not until 1990, at the request of the European Union, when coal aid schemes were destined to decrease compensatory measures for the coal sector, and develop a plan to ensure its competitiveness. This meant improving their productivity and lowering labor costs. In exchange for the aid granted mining companies had to lower production to at least 40%.

The Plan 1994-1997 to modernize, rationalize, restructure, and reduce the operations of Spanish coal industry was conditioned by Decision 3632/93/CECA of December 28th 1993 which acknowledged the need to restructure the coal industry but not to overlook the social situation of coalfield regions. As a result of the Decision, the Plan established a set of aids to financially restructure coalfield regions, and to foster non-coal businesses and industries to absorb jobs lost in the sector. The succeeding plan, *Plan de la Minería del Carbón 1998-2005*, introduced a great reduction in coal personnel, reducing workers from 45,122 to 8,219 by 2005 when the Plan concluded.

The next plan, *Plan de reserva estratégica de carbón 2006-2012*, was passed under the European Council Decision on government aid to facilitate closure of non-competitive coal mines. The Decision stipulated government coal subsidies should end by 2010. However, as the Spanish Government and trade unions requested the European Commission, aids were prolonged till 2018. In line with the previous Plan, the objective was to organize the sector taking into account social and regional aspects, while keeping a certain amount of national coal production as strategic reserve. Special emphasis was placed on the need to promote non-coal employment by supporting alternative business projects. Personnel was reduced by 3,785 persons and at the end of 2011 the coal sector accounted for 4,434 jobs.

The actual Plan in force is the *Plan de Cierre* (Closure Plan). As notified to the European Commission, this Plan officially covers the period between 2013 and 2021, yet it also includes relevant information on aid (both for closure and exceptional costs) granted by Spanish authorities in 2011 and 2012⁹.

The aid totals over €2.1 billion for production losses and exceptional costs relating to the Plan de Cierre 2011-2021.

According to communication from the European Commission on *Plan de Cierre*, as of May 2016 the following companies were included in the Plan: Bierzo Alto, S.L. (prior to 2014), Carbones Arlanza, S.L., Carbones San Isidro y María, S.L., Carbonar S.A., Carbones del Puerto, S.A., Cía Gral Minera de Teruel, S.A., Cía Astur Leonesa S.A. (prior to 2014), Encasur, S.A., Endesa Generación, S.A., Hijos de Baldomero García, S.A., La Carbonífera del Ebro, S.A., S.A. Hullera Vasco Leonesa, S.A. Minera Catalano Aragonesa, Unión Minera del Norte S.A., and Hullera del Norte, S.A.¹⁰

Spanish authorities are obliged to recover state aid money

granted to production units during the period covered in the *Plan de Cierre* that are not closed by the date established in the notified *Plan de Cierre* (December 31st 2018). This also applies to aid granted in 2011 or 2012. Equally, Spanish authorities can't grant aid to cover costs resulting from mining sites breaking environmental policies.

Prior, the Secretariat of State for Energy together with coal union trades and business organizations agreed the Framework for Action 2013-2018. However, **for it to be valid it had to be reviewed by the European Commission**. After the review, the Commission notified Spanish authorities on May 2016 that coal aids granted for the period 2011-2015 were considered illegal since they were executed prior to the Commission adopting a decision on that respect. However, the Commission considered the aid granted under the notified *Plan de Cierre* compatible with European policies on government aid destined to facilitate the closing of non-competitive coal mines, and therefore the European Commission decided not to raise objections to the notified measure.

According to the *Plan de Cierre*, coal mines must submit a final shutdown and closure project in order to be eligible for funding.

Coal Industry in the Andorra-Sierra de Arcos Region in Teruel

In the region of Andorra-Sierra de Arcos, coal mining (lignite) is the activity that contributes the greatest Gross Value Added to the industry sector. The worldwide coal industry restructuring process during the 60s, was especially intense in the Andorra region (Teruel) during the 90s.

There are two mining companies in the region of Andorra-Sierra de Arcos with three active mining operations, two surface and one underground.

Today, underground mining is almost non-existent, except for the Santa Maria mine in Ariño which belongs to SAMCA (the company announced its closure by the end of 2016. At the time of the announcement there were 200 workers). Most operations are surface mining, the level of production per worker is almost ten times that of underground mining.

SAMCA (S.A. Minera Catalano-Aragonesa) operates in Ariño and is the main coal producer in the region. Followed by the Compañía General Minera de Teruel which operates in Estercuel. The coal extracted is shipped to ENDESA's thermal power plant in the county of Andorra.

Presently, the sector employs approximately 440 people

in the Andorra-Sierra de Arcos region, jobs in both mining and outsourcing companies are included.

How Enel-Endesa Thermal Power Plant in Andorra Affects Local Coal Mining

Mining activity in Andorra is linked to the Andorra thermal power plant owned by Enel-Endesa. The coal extracted from the mines is shipped and used by the power plant. If coal were to be transported to other power plants, transportation costs would make the mining operation economically unviable. Therefore, closing the thermal power plant will inevitably mean closing the mines in Teruel, and viceversa. This would have an extremely negative socio-economic impact. The thermal power plant in Andorra owned by Endesa employs around 136 people, directly hired by Endesa, and around 100 additional persons sub-contracted for maintenance, transportation, and other activities.

There is no guarantee the power plant will operate beyond 2020. According to the 2010 EU Industrial Emissions Directive, the power plant in Andorra (Teruel) must implement SOx and NOx emissions-reduction technology before June 30th 2020 to continue operating.

So far Enel-Endesa has not revealed whether they will invest the estimated €230 million in environmental improvements needed to adapt the power plant to the European policy on polluting emissions. If no investment is made the company will lack the permit to keep operating.

The decision must be made under a complex energy scenario. There are serious challenges like the overcapacity of the Spanish electricity system, the need of renewable energy power plants to greatly improve their profitability, and the fact that electricity generating companies will receive a lower retribution for electricity produced. Plus, **the Paris Agreement on Climate Change, clearly states the need for all economic sectors to dramatically speed the reduction of greenhouse gases, including the energy generation sector.**

Furthermore, on June 2016, the Aragon Government passed a Decree to "promote the production of electricity via wind power in Aragon" as a means to encourage investment in wind power for around €2 billion. This Decree puts an end to more than five years of standstill in regional wind investment. The Autonomous Administration will process the projects submitted by electricity development

companies with access permit and connection to the electricity grid.

The fact that on August 2016 Endesa bought renewable assets from Enel Green Power in Spain for €1.2 billion is crucial as this might mean Endesa is more interested in installing wind power than in modernizing the thermal power plant.

Also worth mentioning is the business diversification SAMCA¹¹ has undergone since it began as a mining company in 1967. The organization has diversified into different economic sectors including renewable energies.

How Will Mining Restructuring Plans Affect the Andorra-Sierra de Arcos Region

On March 2011 the CCOO's Industry Federation in Asturias pointed out how implementing mining funds had not been transparent, their distribution had not been speedy as there had been delays, small and medium businesses had had no access, results had not been followed-up, and local political interests had predominated at the expense of a centrally managed plan.

In general, it is complex and costly for coalfield regions to stop depending on coal. The erratic Energy Policy of recent Spanish Governments has done little to clear their future. In 2010 the decision was made to prolong coal funding, and although coalfield regions felt relieved, it only postponed the inevitable economic restructuring of local economies.

However, the Teruel region has exploited reasonably well MINER funds (Spanish state aids for the coal sector); especially compared to other areas where funds have been misused.

Although it is extremely difficult to evaluate the quantity of funds spent, the number of jobs created by funds, and the different restructuring aid plans and programs for coalfield regions, mining funds have generated economic activity and thus created jobs in mining regions.

It is also clear that funds have not been fully optimized, especially in the initial stages when they were used primarily to construct unproductive buildings or infrastructures than to promote businesses and economic activity to generate stable employment. The economic crisis and delays in implementing renewable energies and related industry has also contributed to the failure of aid programs.

Spanish Evolution on the Use of Coal

According to the latest data published in 2015, while coal world average consumption increased by 1.9%, Spanish consumption increased by 23.9%, the greatest increase in the world. Coal generated by Spanish mining companies in 2015 was used to generate 18.1 TWh of electricity in 2015 which approximately satisfied 7% of total electricity demand in the country. For that same period, renewable generation decreased by a 4%, while worldwide it increased by an average of 15.2%, while the use of gas went up 16% for that same period. As a result, the electricity sector increased emissions by 6.8% in 2015, well above the 1.3% increase experienced in the European Union for that same period.

In 2014 and 2015, coal burning amounted for approximately 70% of greenhouse emissions from electricity generation. In comparison with historically coal countries like China and the United States which reduced their production and consumption. China lowered it by 1.5%, and the United States by 12.7%. Coal consumption increase in Spain was not of domestic origin as Spanish coal production decreased by 24.5% for that same period. This decreasing trend is in line with the objective of *Plan de Cierre* approved by the European Commission.

In 2014, over 80% of the coal consumed in Spain for electricity generation was imported.

Common Aspects of Coalfield Regions

Coalfield regions have a number of peculiarities which make economic diversification significantly difficult. Although each has its own economic, social, cultural, and political uniqueness, often they share several of the following aspects:

First, the mining sector is on many occasions the only industry in the region. Therefore people in those areas have very similar jobs and professional training, but very few persons have training in more technological or innovative industries. A system with only one industry does little to foster an entrepreneurial mindset, hindering the development of any other activity. Given the limited number of alternative employment, recent graduates move to other regions leading to population ageing and depopulation.

As a result, the level of unemployment increases drastically once the above mentioned programs to reduce coal mining production are introduced.

Coal mining (and extractive industries in general) is a male dominated¹² market. This, together with how little economic alternatives exist in coalfield regions, leaves women with few working opportunities.

Despite reductions in average wages over recent years, benefits are still much higher than the average in the region or industrial sector, this is especially true for underground mining. The hazardousness inherent to this type of work explains partly such high salaries. Usually it is extremely rare for other industrial sectors to equal benefits, and as a result workers in the mining sector seldomly move to other fields.

Normally, coalfield regions close to the thermal power plant they supply have limited transportation infrastructure given how little need they have to communicate with the outside world.

Mining regions typically have poor local environment due to dams and remaining old exploitation sites not being recuperated.

Coalfield regions (and in general regions or zones where a big percentage of their GDP and employment comes from one sector) are characterized by the population unwillingness to seriously consider an alternative way of living as they feel their identity is somehow linked to mining¹³. Consequently, most cases of successful transitions in other countries have taken place when mining activities have ended and all options to continue supporting the sector (usually through state aid) are extinct.

An additional aspect of mining regions is how supportive communities are, probably encouraged by an industrial past that has left a mark in the population, the economy, and the land. In some cases, an industrial background has been decisive in other countries to attract foreign and national investment to develop alternative industries.

Towards a Just and Environmentally Sustainable Transition in Spanish Coalfield Regions

One of the main conclusions derived from the negotiations celebrated under the International Labour Conference (2013)¹⁴ between worldwide business associations, union trades, and governments, was the need to base the

transition towards a more sustainable means of production and consumption on social justice criteria.

Two years later on November of 2015, the tripartite Governing body of the International Labour Organization (ILO) unanomously adopted the policy guidelines for a just transition towards environmentally sustainable economies and societies for all¹⁵. This transition policy framework is particularly relevant for coal mining regions.

The 194 countries of the United Nations Framework Convention on Climate Change also agreed to include just transition policies in climate action measures in order to make our means of production and consumption more sustainable. On December 2015, 21st Conference of Parties decided the implementation of the Paris Agreement had to take into account how climate policies will affect a just transition in the labour market¹⁶.

In conclusion, it is costly and complex for coal mining regions to stop depending on coal. There have been some interesting cases in Spain but globally the implementation of reconversion plans in mining zones have seen more downs than ups. The erratic Energy Policy of recent Spanish Governments has done little to clear the future of coalfield regions. In 2010, to the relief of mining regions, the decision was made to prolong coal aids, but in reality it only postponed the inevitable economical restructure of local economies.

It is not an easy task. Traditionally, coalfield regions have not diversified their economy. A major part of their economic and social life revolves around the extraction and use of coal, little space is left to develop alternative sectors, plus the region identity is linked to coal activities. In order to change the situation and rely on other economic sectors to generate medium and long term employment and wealth in the region, the regional identity must evolve, this can only happen if every party involved agrees. However, the need for new ways of developing regionally is not new. In recent decades, mining regions in many parts of Europe and the United States had to close businesses and lost jobs due to several factors: and increase in renewable source production, with lower environmental impact, together with less need for manpower to extract coal due to more efficient extracting methods.

In order to make the necessary transition, coalfield regions must change every aspect related to regional development -infrastructures, environment, promote cultural heritage, financial development, and training-. However, an analysis of examples in mining regions provides ideas on how

to make a succesful transition at a financial, social, and environmental level (Table 1).

First of all, mining communities must acknowledge the end of the coal era as well as the need to promote new economic sectors that have a direct and positive impact in the life of the community. Therefore, it is necessary to agree on a plan to develop the region, a plan with long-term objectives and ambitious enough to change the present course; it should include everyone, from local to regional governments, and have the support of national governments. In order to be successful it is imperative for different regional organizations to participate and dialogue, and for local authorities and trade unions to agree on a social, environmental and financial development strategy.

Another key element in succesful transitions has been national level approval of goals for a cleaner energy generation. In the United States, Germany, and France an energy policy with a stronger role of renewable energies was crucial; it trigger the post-coal transition. In some instances, change was possible thanks to the leadership of regional governments (Canada, North Rhine-Westphalia in Germany) that made possible a regulatory change that brought innovation and bussines development to the affected regions.

Another common denominator among countries that have experienced a post-coal transition is the promotion of sectors relating to environmental protection. China, the United States, and Germany have opted to support alternative sectors such as renewable energy generation, energy saving, electrical mobility, and waste management. One positive aspect highlighted by people in coalfield regions is how the environment improves and pollution remits once mining activities have decreased. Transitions have helped changed how people perceive mining regions, now they are seen as technology development hubs, green technology manufacturers, or renewable energy generation centers. It is only logical for Spain to develop a plan to increase renewable energy power plants (wind, solar, biomass, biogas, geothermal, etc.), this alone can reactivate the manufacturing industries linked to these technologies. It is also important to try to establish these industries in coalfield regions, taking advantage of the financial aid granted to reactivate them. If, on the contrary, the energy transition is halted, employment opportunities for this sector will be limited.

Optimize coal workers training by implementing training and integration programs that are not general but specific

to the type of economic activities to be implemented in the region. Otherwise, new businesses might not take advantage of professional skills of workers laid off the mine or salaries might be much lower than in the mining sector, these factors can only lead to the discontent of mining populations. The creation of vocational schools is another common aspect among succesful transitions in coalfield regions.

It is crucial to implement programs and policies to achieved the desired goal. A key element in regions where transitions has been succesful has been to integrate programs to reduce mining productivity with already existing programs, and with other objectives not directly linked to mining. In several cases, it has been linked to the promotion of green investment (mainly renewables but also energy efficiency for buildings). Many of the examples studied have greatly promoted research and new technlogy development. Partnerships with universities and technology development centers have been formed or strengthen, thus basing development on knowledge. As a result of these projects many new businesses relate to the use of these new technologies. The Research Centre for Energy Resources and Consumption (CIRCE) of the University of Zaragoza could play a crucial role in this sense.

In conclusion, to ensure coalfield regions have a just and succesful transition to more sustainable means of production and consumption is essential to guarantee a set of requirements that will encourage a more efficient, effective and fair use funds (public or private) for everyone involved. Some of these elements are: local support for a non-coal lifestyle; everyones participation and dialogue to formulate proposals for future business and social regional development; local, regional and national governmental support through new energy policies that allow for cleaner production methods, and programs for business development. It is vital to establish technical and innovation training programs to close the gap in vocational training in mining regions, and therefore allow the development of new manufacturing sectors. In many of the cases analyzed, sectors linked to green economy have played a major role in the transition.

Table 1. International Examples of Transitions in Coalfield Regions

Source: prepared by authors

Location	Starting Year	Measures Implemented	Results	Key Factor
United Kingdom	1970	No previous transition strategy	Social conflicts, unemployment and depopulation	No dialogue with employees or union trades.
Loos-en-Gohelle (France) ¹⁷	Mines were closed in the 80s. Transition started in late 90s.	Created a Resources for Sustainable Development Center; Created an Eco-Business Center; Improved housing energy system; City council implemented a green purchasing policy and solar energy generation; Training Center	350 new jobs created; Lower unemployment in the region; New businesses opened in the region; Number of associations doubled, from 60 to 120 Funds from the European Union and the French Government	Local government leadership; Analyze the situation and from there develop a collective strategy to transform the county into an environmentally sustainable one; Collective decision making; Promote research and development.
Ontario (Canada) ¹⁸	The campaign to close thermal power plants begun in 1997. (on 2014 it was decided to end the use of coal)	The decision to close coal fueled thermal power plants affected 1,400 workers in 5 separate thermal plants; The coal plants which were closed generated 25% of the electricity in the province; Management company had an ongoing dialogue with workers and union trades from the plants; Workers who wanted to relocate to a different power plant of the company were offered an alternative post; Early retirement plan; Training program for workers.	Since 2007, the region has cut GHG emissions by 17%. In 2009, the Green Energy and Green Economy Act was passed, among many clauses it includes renewable energy generation to substitute the electricity generated by coal. Coal was substituted mainly with gas, although a few projects used renewable energy (mostly biomass) for electricity generation.	All political parties committed to closure, thus sending a clear message to society and businesses of where the future of energy in the county was heading; Collaboration between different social groups, environmental organizations (Ontario Clean Air Alliance), medical associations (Ontario Medical Association), and political parties; As regional government had jurisdiction over energy policies, this body made the decision to close the mine.
Development Plan for As Pontes (Galicia, Spain) after closing the mine ¹⁹	2007 the mine was closed. Restoration takes place between 2006-2011	Environmental restoration of the dump and the hole left by mining activities, an artificial lake was created that collects water from local rivers and runoffs. €250 million investment.	Three million cubic meters of topsoil were used, 130,000 kilos of seeds were sown, 600,000 trees were planted, and 60 km of dirtroads and unpaved tracks were created; 180 different animal species; 1,200 new jobs were created (along with business projects as an alternative to coal industry).	Support from the company in charge of managing the mine (Endesa), from local and regional institutions, and dialogue with employees and trade unions.
Tula (Russia) ²⁰	2006	Urban waste treatment plant.	70 direct jobs, Use of new technologies; Improved transportation network.	

Gelsenkirchen (Ruhr Coalfield Region, Germany) ²¹	2008 the mine is closed; In 1996 began the first alternative activities.	In 1996 a science park was created specialized in developing new technologies relating to the use of solar energy, green fuels, and energy efficiency technologies; In 2014, the center was renamed Climate Alliance, and serves as a platform for information, project development and cooperation in renewable energy, electromobility, energy efficiency in buildings, and other measures to mitigate climate change.	Ruhr coalfield region built eight higher education centers and over 30 research institutes for material transportation and logistics. Over 26,000 persons were hired for the 831 companies within the logistic sector; This mining region has gone from having no universities to accepting over 220,000 students at universities and technical centers within the region.	Design comprehensive planning projects that integrate measures to satisfy different county needs; Institutional support to those businesses with objectives for regional "green" transition; Dialogue with employees and trade unions; Regional and national funding.
Boitrop (Ruhr Coalfield Region, Germany) ²¹	2010	Citizens agreed to halve CO ₂ emissions by 2020; The homes of mine workers were modernized using energy efficiency criteria; Program to promote photovoltaic self-supply in homes; Contribution from research centers in the local university.	Over 70 businesses in the Ruhr region launched the 'Ruhr Initiative Group'; Over 125 projects relating to energy efficiency and the use of renewable energies were set up; Over 100 cogeneration units were installed in homes and businesses	In order to get ideas for improvements to be made in the city, residents were consulted via workshops, briefings, and additional events; Innovation and developing new technology was the heart of this initiative.
Cornualles Coalfield Region (Cornwall County) (Wales, United Kingdom) ²²	Mining begins to decline mid 80s; Mining stopped in 1998.	In 2006, the new board of directors of the heritage site decided to carry out a public consultation on the use of its over 19,710 hectares; As a result of the consultation it was decided to promote the mining heritage and use it to attract tourism; Work is being done to restore and maintain the mines, machinery houses, ports, and hydraulic energy systems.	Declared a World Heritage Site in 2006; Eleven interpretation centers were created, strengthen existing mining attractions and created new uses for mining facilities; Hundreds of tourism businesses are implicated with the location, and its innovative cultural program has received over 25,000 spectators; Government promotes green technology development.	Residents' ideas were integrated in a five year plan; Protecting the area was the main strategy of the plan; Cornwall County's geological wealth now holds educational value; Partnerships between public and private entities.

SECTION II. TRANSITION PROCESS IN THE COALFIELD REGION OF TERUEL

Regional Transition from Coal to New Economic Markets

The coalfield region of Andorra has been no exception to the economic decline of the coal sector. In the past two decades the region evolution has been shaped by plans and state aid to mitigate coal negative effects and to search for alternatives, as well as by public participation processes and the progress made in the economic transition.

Plans and Aid to Support the Transition

One of the biggest obstacles to evaluate the effectiveness of the policies implemented in the area is the lack of data on plan execution (final budget, number of projects, number of subsidized business projects that have survived...). It has been impossible to know how much money was granted to the different plans and programs executed in the coalfield region of Andorra-Sierra de Arcos. Obstacles encountered to obtain a total sum of regional public funds granted in the last two decades include: non-centralized information, in some cases data was not classified by region; and especially the lack of collaboration and transparency.

Despite the lack of data, a review of the plans and subsidies promoted in recent decades to mitigate regional job unemployment and depopulation, reveals how numerous and extensive they must have been.

Aid has come primarily through the MINER Plans²⁴ described above. Other lines of aid, although not all specifically for the mining region, have played an important role in attracting new investments, including: the program to reindustrialize and strengthen industrial competitiveness *Programa de Reindustrialización y Fortalecimiento de la Competitividad Industrial (REINDUS)*; investment fund for Teruel, the Fondo de Inversión de Teruel (FITE), financial aid to develop competitive industrial activities in Aragon, *Programa de Ayudas para el desarrollo competitivo de la actividad industrial en Aragón (ADIA)*; funding for local development in the regions of Bajo Martín and Andorra-Sierra de Arcos (LEADER), and a financial plan for Andorra, *Plan Económico de Andorra (PEAN)*.

Public Participation Was Significant but Divided

In the last two decades many participatory processes have taken place, it is worth mentioning how decisive the role of the groups promoting the event (Local Action Groups, union trades, and government representatives) has been for their coordination and success (in some meetings over 100 people participated).

These processes have highlighted, a priori, the agreements and disagreements of the people of Andorra, and the contradictions between propositions put forward by some groups to preserve the environment and other local interests. And although participants have not always committed to a coal-free "just transition", participatory processes have been positive as they have identified the potential of the Andorra region and its people. However, it is also true that although for years part of the population has supported a sustainable diversification of the regional economy, it has never come to fruition. Therefore, despite the positive consequences pointed out, a given number of participatory process might run the risk of future lethargy.

An analysis of the main participatory mechanisms employed in recent years shows the suitability of these mechanisms to facilitate the discussion stage, and to bring out different opinions and perspectives when deciding a sustainable future for the region. Nonetheless, processes should have placed more emphasis on establishing a road map towards a regional free-coal scenario, a scenario a great percentage of the population has yet to come to terms.

Phasing Out Dependency on Coal Economy

To what degree has the coalfield region of Andorra made a economic transition to new activities? In the last decade and a half, the coal sector (including both extraction and energy markets) has determined the evolution of the local economy. However, the local economy has progressively lessen its dependency on this sector.

In the past fifteen years the regional economy has change its structure significantly. While in the year 2000, the extractive-energy coal sector accounted for 77.5% of the regional Gross Value Added (GVA) and 23.9% of employment, these percentages have decreased to 47.3% and 17.9% respectively for the year 2015 (Table 2 and 4). In that same period, the manufacturing industry

has become significantly important (it has gone from accounting 2.8% to 10.7% GVA; and 8.1% to 14.4% of overall employment), the service industry has also seen an important expansion, it is the main employment sector (53% overall employment). However, agriculture and construction have had a very negative impact and together they account for the loss of 600 jobs (double the number of jobs lost in the coal sector).

Given the sectorial structure of the economy in the mining region of Andorra, **the economy has diversified significantly in the last fifteen years, thus compensating the slump of the coal sector in GVA terms.** Additionally, if the construction and agriculture sectors had not had such a negative effect, the economy diversification would have also compensated in employment terms. Nonetheless, a more inclusive diversification strategy, taking into account the food and agriculture sector and promoting to a greater extent the development of the service industry would have yield better net employment results.

In view of the data, we can say MINER Plans had a positive effect on the reindustrialization of the area. Despite some of the funded projects related to the construction industry,

which was extremely affected by the deep crisis this sector suffered starting 2008 (some projects were not launched), data shows the area has attracted industrial investment and improved the economic weight of the industrial sector in the region. More questionable is whether the plans have served to improved the qualifications of the labor force, something that is key for the future of the region.

Regional Socioeconomic Situation Today

The above mentioned economic changes took place along major demographical and social structural changes. Below are mentioned those considered crucial given their influence on the regional transition towards a more diversified and sustainable economy.

Growing Gap in the Educational Level of the Population

The local **educational level** is low compared to Teruel, and even lower compared to Argaron. 31% of the population has not completed any type of education, while 44.8% has completed primary education. Therefore, 75.6% of the population left the educational system when they finished

Table 2. Sector-by-Sector Gross Value Added Evolution in the Region of Andorra-Sierra de Arcos. Period 2000-2015.

Fuente: Instituto Aragonés de Estadística

	2000	2015	Period 2000-2015
Gross Value Added (Euros in thousands)			
Extractive, Energy, and Water Related Industries	217,260	134,741	-38.0%
Other Sectors	62,962	150,351	138.8%
Agriculture	5,267	5,415	2.8%
Manufacturing Industry	7,792	30,624	293.0%
Construction	14,143	17,248	22.0%
Public Services	35,760	97,064	171.4%
Regional Economy Total	280,222	285,092	1.7%
Gross Value Added (%)			
Extractive and Energy Industries (% over total)	77.5%	47.3%	-30.3
Other Sectors	22.5%	52.7%	30.3
Agriculture	1.9%	1.9%	0.0
Manufacturing Industry	2.8%	10.7%	8.0
Construction	5.0%	6.0%	1.0
Public Services	12.8%	34.0%	21.3
Regional Economy Total	100,0%	100,0%	

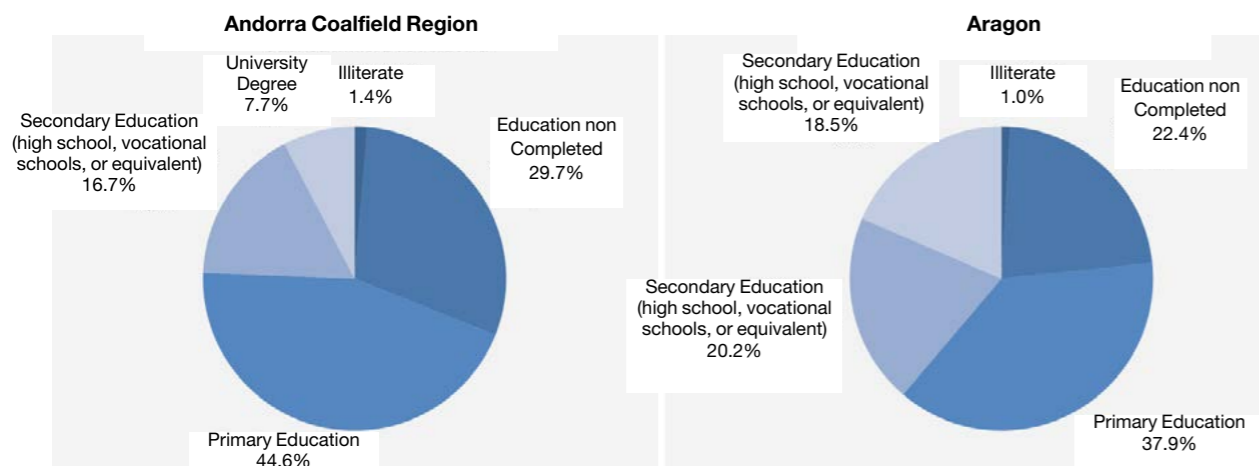
Table 3. Sector-by-Sector Employment Evolution in the Region of Andorra-Sierra de Arcos. Períod 2000-2015.

Source: Aragon Statistic Institute

	2000	2015	Period 2000-2015
Employment (in numbers)			
Extractive, Energy, and Water Related Industries	830	540	-290
Other Sectors	2,649	2,474	-175
Agriculture	368	176	-192
Manufacturing Industry	283	434	151
Construction	664	268	-396
Public Services	1,334	1,596	262
Regional Economy Total	3,479	3,014	-465
Employment (%)			
Extractive and Energy Industries (% over total)	23.9%	17.9%	-5.9
Other Sectors	76.1%	82.1%	5.9
Agriculture	10.6%	5.8%	-4.7
Manufacturing Industry	8.1%	14.4%	6.3
Construction	19.1%	8.9%	-10.2
Public Services	38.3%	53.0%	14.6
Total economía comarcal	100.0%	100.0%	

Graph 1. Population Distribution by Educational Level. Year 2011. Andorra and Aragon Coalfield Region. Percentage over Total.

Source: National Statistic Institute. Population census 2001 and 2011



compulsory schooling, and a significant percentage with no degree. 16.7% of the population has completed secondary education, and only 7.7% has a university degree or post-secondary education degree (Graph 1). The difference with the whole of Aragon's population is significant, especially for the university degree group (18.5% more than double that of the coalfield region).

An analysis of the educational level by group age shows the educational gap for the regional youth group is still significant, especially at university level, either because they remain within the educational system for a shorter period of time or because the population with university degrees moves out of the region, or both.

Fewer Women in the Labor Market

The most significant aspect of the regional labor market is the increase in female participation. **The rate of female participation** (percentage of working-age female population working or actively looking for work) has increased almost 26 percent points in the decade under the study (2001-2011). Nonetheless, and although the gap is shortening, is much smaller than the one in Aragon (65.3% compared to 77.1% for the year 2011).

Shortage of High-Skilled Employment

Grouping occupations by high, medium, and low qualified jobs shows clearly how the Andorra mining region is less capable of creating high-skilled employment. This type of employment only represents 20.6% of total employment, while in Aragon represents 30.4% of total employment. This is extremely significant as it highlights the difficulty in keeping highly qualified young people in the region.

Entrepreneurial Level is still Limited

Entrepreneurial level should also be considered when analysing the possibilities to change the production system. In light of the number of non-agricultural businesses¹ per resident, it is safe to say the entrepreneurial level of the mining region is extremely low, lower than in Teruel (6.7 businesses per every 100 residents compared to 10.7 in Teruel).

Strong Depopulation in the Smallest Population Centers

The entire coalfield region has seen a moderate depopulation in the past thirty years (2,707 residents, 14.4%), the province and Autonomous Region have also

seen a depopulation. However, the most noteworthy element of the demographic evolution is the strong depopulation in the smallest counties, in towns such as Crivillen or Esteruel the rate of depopulation is around 50%-60%. Although depopulation is not specific to the region, also happens in many towns in Teruel, Aragon and rural Spain, it is an additional destabilization factor.

Many Job Opportunities in Andorra

An analysis of employment distribution by counties shows most job offers are located in Andorra, 45% of total employment opportunities. The biggest next two counties, Alcorisa and Albalate del Arzobispo, provide almost 40%, and Ariño 10.2%. Together, these counties provide 91.2% of employment opportunities in the coalfield region.

Proposals for Economic Diversification

Major Investments and Small Business Initiatives

As mention before, the policies to support the mining region of Andorra have helped grow the industrial sector significantly. Attracting industrial investment was one of the main objectives of the funding program MINER. This type of projects are interesting because on average their size is usually bigger than in other sectors, and because of the type of jobs they require. In theory, skills required are more similar to the ones needed in the coal sector than to the ones needed in other industries. Therefore, industrial projects are attractive not only because they generate a greater number of new jobs but also because the skills and experience of coal extractive and energy industry workers equate the abilities needed for these new jobs.

A common element to coalfield regions is their lack of small and medium businesses probably because of the mining industry model (single industry supported by big companies) and because this type of model hinders the development of an entrepreneurial culture in mining regions²⁶. Yet developing a network of small and medium businesses is key to diversifying the economy.

Therefore, an economic and social sustainable development must not only rely on industrial projects but also on the harmonious development of other sectors and of small and medium industries. A greater development of the food and agriculture sector, as well as the services sector, will have positive effects in the mining region of Andorra as it will generate a more heterogeneous employment with greater distribution among counties.

Andorra's Potential in Emerging Sectors

In order to analyze **how possible it is for the coalfield region to effectuate a lasting re-specialization** it is necessary to establish the regional potential in the so-called **emerging sectors**²⁷ since it is foreseeable they will generate most employment in the following decades. The economy of these sectors include economic activities based on new products, services, technologies, and ideas that are in their initial development stages; they are also characterised by a future high development rate and numerous potential markets²⁸, including: creative industry, eco-industry, experience industry, maritime industry, mobile services industry, mobility industry, and personalized medicine industry.

An analysis of the present situation of the mining region and of structural factors that condition its economy shows regional workers are at a disadvantage in labor markets that demand high or extremely high qualified employees and that depend highly on information and communications technologies (ICT). On the other hand, possibilities in the eco-industry or experiences industry are more promising. A more in-depth analysis allows to identify activities in both sectors which, *a priori*, have potential in the region, such as renewable energy, sustainable agriculture and ranching, pollution control, experiences tourism, or entertainment services.

Additionally, it is nice to consider if the **population in the region has any preference in regards to the activities** within the eco-industry or experience industry sectors. An analysis of opinions and proposals conveyed during different participatory processes in past decades shows no activity is clearly rejected, but the experience industry (tourism, culture, and entertainment) is more appreciated.

Diversification Lines to Complete the Transition to a Coal-Free Economy

The analysis established three lines for economic diversification that, although different in experiences, have not been sufficiently explored, and *a priori* have potential and are accepted by the population. Plus, as already mentioned, they have the added bonus of how they complement industrial projects.

The Food and Agriculture Sector

As we have seen, in recent decades the regional primary sector has lost relevance in the regional GVA and lost many

jobs. The decline in dry farming and traditional ranching has not been compensated by the development of new non-traditional products or exploitation.

Good quality agriculture and ranching, agroecology, and small and medium processing businesses of related products (cereal flakes, flour, almond by-products, oil by-products...) were some of the proposals that came out during the participatory processes and that are preferred by the population in the region.

The transformation of the food and agriculture sector must have ample R&D&I support to develop new crops and new ways to sustainably exploit traditional crops (cereals, olive trees, almond trees, extensive sheep farming...). Along this line, it would be useful to sign agreements with different public or private national scientific or technology organizations, and to use public land for experimental trials²⁹.

Experiences Tourism

In recent years, conditions have evolved to support the development of tourism in the region, the main reasons being: a wider variety of services, especially in Andorra; several entities have developed strategies to actively support the sector and promote heritage resources (Chamber of Commerce, ADIBAMA, and business associations); and infrastructures built under the MINER Plans, some relating to social health that may become a source of employment to drive the sector.

However, the region still lacks an organized touristic offer, and the ability to reach regional and national markets. Plus the offer is clearly insufficient, both in number of businesses as in variety of touristic services, especially in the so-called supplementary activities.

Presently, a master plan is needed to organize touristic scope and offer, and to help articulate the activities to be developed by the sector. The master plan should also:

- Advance the development of specific tourism related goods and services;
- Support the consolidation of cultural heritage entrepreneurial initiatives;
- Generate entrepreneurial initiatives nationally and internationally renowned;
- Supplement already existing attractions with new activities, for example the Ariño spa;
- Improve the sector's potential in the region to

encourage entrepreneurship and investment.

- Improve marketing channels and build structures to be used by all commercial activities.

Renewable Energy

Many other areas that have changed from a coal based economy to alternative commercial activities have oriented their respecialization towards renewable energy.

If the coalfield region of Andorra was to consider this option there are several factors working in its favor: specialization in the energy sector, already existing evacuation infrastructures, power transmission grid, and energy resources like wind and solar, and to a lesser degree biomass³⁰. In addition, the two biggest industries in the area, which manage coal extractive-energy activities, have lines of business in the renewable energy sector.

A recent proposal³¹ deals with the possibility of installing wind energy in the area in the realm of 1,000 MW. Other entities consulted also point out the possibility of small-scale biomass and/or biomass for heating, always under sustainability criteria³², which will increase the state and protection of mountains. Likewise, there is potential for photovoltaic solar energy installations, especially given the Spanish shortage in solar energy generation, particularly for self-supply.

Other Lines of Activity with Good Prospects

In addition to the lines of action mentioned, there are also good prospects to develop specific industrial activities in the mining region. There are several factors why this area might have a competitive advantage. First of all, the region's industrial past and qualification of human resources. Second, the region has plenty of industrial land available, a great percentage of it made suitable with funding from the MINER Plans, as well as transportation infrastructure to distribute goods by road or train, including the possibility to access Tarragona's port. Last, those projects to be executed in the area are eligible for significant funding.

The region also has dozens of closed mining areas waiting environmental restoration. Decontaminating and restoring land for alternative uses, which must be carried out in all coalfield regions, is another possible line of specialization for local businesses.

Lessons Learned during the Transition in the Coalfield Region of Andorra

A Transition Hindered by the Failure to Accept a Coal-Free Scenario

The economy of the region has already gone through an important structural change where the progressively diminishing influence of the coal extractive-energy sector over the GVA has been compensated by a greater industrial advancement, and an even greater development of the services sector. Nonetheless, three years to the end of coal aid (2015) and almost 48% of regional GVA still depends on coal extraction and on the thermal power plant using it to generate energy. Therefore, the economy transition has not been fast enough and is incomplete.

An analysis of the actions performed at resident and political level, and of results achieved shows that **failure to accept a coal-free scenario has hindered significantly the transition process towards an economy based on alternative economic activities**.

Less coal in the energy mix is not only due to environmental reasons, it has been coming for decades due to technology and financial reasons. Coal price evolution in international markets, and more recently the irruption of renewable energies, providing energy resources at an extremely low marginal cost, have created a very complicated future for national coal. In addition, transposing environmental regulations, and the recent agreements to stop climate change have only speed things up. Yet, different groups, including different levels of the Administration and social actors, question the credibility of said scenario and have outlined different alternatives to postpone or avoid the collapse of the coal sector. The denial strategy has only made things worse for the economic transition needed in the region of Andorra:

- Prevent a realistic evaluation of the situation and deadlines;
- No implication or unanimous commitment of all actors to what is an inevitable transition;
- Not establishing medium and long term objectives based on the competitiveness and sustainability of local economy; or developing strategies to achieve them;
- Postpone searching for economic alternatives and not furthering those actions that need it (specially to keep

qualified youth, improve professional qualifications and entrepreneurial spirit, or incorporate R&D&I);

- Participatory processes were less efficient as residents did not have a clear strategic line of action;

- No medium/long-term objectives, or definitive strategy was developed for public and private investments.

The Need to Plan the Transition Towards a Coal-Free Economy

International case studies of successful transitions in regions or areas highly dependant on coal emphasize the importance of planning the transition with ample time¹. Transitions take long because their success depends greatly on structural changes. And plans to change the structure must revolve around a Transition Plan, an strategic, global, and integrated tool.

The transition in the coalfield region of Andorra would probably be further along if the Transition Plan had been negotiated and agreed, and the different actions and resources framed under an strategy to develop the potential of the region in a coal-free scenario. Nonetheless, currently there are a good number of infrastructures built with mining funds, a big social movement, and many actions supporting local development that could be unified and integrated under this tool.

The Transition Plan should be led by an organization with a global vision of how the plans impact the area, with the ability to dialogue with national entities, and capable of mobilizing and reassigning public funds and different lines of funding. The Plan should at least include the following:

1. An analysis of the consequences of abandoning coal that includes an proper evaluation of what part of the local economy and employment depends on this sector. The analysis must quantify direct employment (in extractive and energy activities), indirect employment (activities that are part of coal value chain), and induced employment (those that depend on the income generated directly or indirectly by coal). It is crucial this analysis provides extremely detailed information on where will the consequences be felt geographically and on what groups of the population. Additionally, it is necessary to provide a detailed analysis of what skills workers have that may find themselves unemployed to identify potential jobs for them.

2. Analysis of local economy and identification of potentialities. Although coalfield regions share many key elements given their common past, each's region

potential is different since it is determined not only by internal resources but also by geographic location and socioeconomic background. Therefore, an adequate analysis of the potentialities of each coalfield region will help identify the strategic lines on which to focalize resources and activities.

3. Plan social protection for employess, and **information** channels, to help them organize in advance their new life stage or give a new direction to their professional career path.

4. Social dialogue and participation of every local actor to overcome any resistance to change; turn social actors into agents of change, proactively easing their clients into a just transition.

5. Training and advancement programs for concerned employees to facilitate their relocation in sectors that demand skills and experience similar to theirs.

6. Policies and funding sources to advance and speed the transition.

7. A proper **administration coordination** to promote synergies and avoid conflicting goals between different actions executed in the area; and direct or indirect intervention of up to six administration levels (European, national, regional, province, county and local).

Greenpeace demands

A responsible government that acknowledges the urgent need to fight climate change, is concerned about health issues, and guarantees just and sustainable employment must:

- Specify a just plan to transition from coal to sustainable employment that includes:

- Progressive closure of all Spanish coal power plants by 2025; .

- Gradual decrease of use of coal in all sectors;

- End coal mining and coal imports;

- Just transition to new sustainable productive activities for employees in the coal sector and for those counties whose economies highly depend on said sector.

- End funding for dirty and inefficient energies, including public incentives granted to electricity companies to invest in the environment as this mechanism is contingent on using fossil fuels

- State agreements should not promote the use of coal by granting subsidies that allow big energy companies (which receive billions of Euros) to keep burning fossil fuels as this would breach international climate agreements and European policy on State Aid.

- No more aid to thermal power plants as capacity mechanisms. Information on payments already allocated to each installation must be transparent and easily accesible. Although, allegedly, the sole purpose of these mechanisms is to guarantee electricity supply, and despite the excess of electricty installed in Spain, coal power plants are granted billions, thus promoting a dirty, polluting and unnecessary energy.

- Establish a long-term plan in order to supply total final energy demand with 100% renewable energy by 2050, and to at least halve final energy demand compared to pre-crisis consumption.

- Increase transparency and government control over funds for transitions in coalfield regions. It is crucial they are not only properly audited but that information on their execution (initial and final budget, number of projects funded, subsidy granted, number of failed projects...) is public.

- Analyze the transition in Spanish coalfield regions to assess how much local economies have limited their

dependence on coal, and how much have MINER funds contributed to that respect.

- Involve regional developmet agencies in leading and coordinating all Administration levels to plan a short and long term controlled transition that includes:

- Analysis of socioeconomic impact of abandoning coal;

- Analysis of local economies and identification of potentialities;

- Social dialogue and implication of social actors;

- Training and advancement programs;

- Policies and funding sources to advance and speed the transition.

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