

THE POTENTIAL OF RENEWABLE ENERGY AND ASSOCIATED INDUSTRIES IN ASTURIAS



Trade Union Institute for Employment, Environment and Health (ISTAS)

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The report has been completed by way ofdocumental and bibliographic research, as well as on the basis of information and criteria provided by the experts interviewed and the participants in the Seminar on *"Employmentpotentialand alternative economic development in renewable energies in Asturias"*, held in Langreo (Asturias) on the 30th of January 2019 and organised by ISTAS in conjunction with the Local Nalón Energy Agency (ENERNALON).

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1. Introduction

Asturias as a region has been hugely reliant on the energy industry, particularly in relation to the generation of electricity based on the coal extracted from its mines. For more than a century this has been the driver of economic development, riches and employment, especially in the most rural areas.

The context of a global energy transition which is being carried out in inexorable fashion on an international level for climate, technological and economic reasons and which for Spain is also inevitably conditioned by European regulations, poses both an enormous challenge and a fantastic opportunity.

Asturias also possesses two key characteristics which mean its energy transition may be carried out while still maintaining its prominence in the energy sector, its economic activity and levels of employment. The first is the fact it is a region with a strong industrial foundation which will serve as a support for the manufacture of equipment and components for renewable technologies. The second characteristics is its abundance of renewable resources, particularly in regard to wind, biomass and geothermal energies which allow for the construction of facilities to harness these energy sources.

The collaboration of the European Climate Foundation (ECF) has allowed the Trade Union Institute for Employment, Environment and Health (ISTAS) of The Workers' Commissions (CCOO) to stress the importance of renewable energies and their future prospects in Asturias, both in terms of existing facilities such as the manufacturing industry, and in bringing together the various key actors (institutional, business and social) to coordinate actions and promote development policies. This project aims to delve into an analysis of the situation and explore the potential that renewable energies hold in terms of industrial and energy development and job creation in Asturias.

Mariano Sanz Lubeiro

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2. The energy situation in view of Horizon 2030

The 2030 Climate & Energy Framework contains the following policy objectives on a European Union-wide scale for the period 2021-2030: reduce greenhouse gasses by at least 40% on 1990 levels, to have at least a 32% share for renewable energy and see at least a 32.5% increase in energy efficiency. In order to achieve these targets, the European Union has adopted the "Clean Energy for all Europeans" package which includes four regulations, four directives and eight communications.

Furthermore, Member States are obliged to adopt integrated national energy and climate plans (NECPs) for the period 2021-2030.

The Spanish Government has already compiled and sent a draft of its Integrated National Energy and Climate Plan 2021-2030 (NECP) to Brussels, which is expected to be approved towards the end of 2019.

Among the Plan's objectives are reaching 42% renewable energies over end-use energies (currently 17%), and some 74% of electrical generation by the year 2030, up from a current 38-40%. In order to achieve the target, plans are to install 57 GW of additional renewable power (27 GW wind, 32 GW photovoltaic, 5 GW thermo-solar, 1 GW biomass) and 6 GW of storage across a range of renewable technologies.

The NECP is estimated to command a total investment of 236 billion euros - some 80% of which is expected to come from the private sector, leading to a positive impact on the economy, pushing GDP up 1.8% and creating between 250,000-364,000 new jobs.

Parque de generación del Escenario Objetivo (MW)				
Año	2015	2020	2025	2030
Eólica	22.925	27.968	40.258	50.258
Solar fotovoltaica	4.854	8.409	23.404	36.882
Solar termoeléctrica	2.300	2.303	4.803	7.303
Hidráulica	14.104	14.109	14.359	14.609
Bombeo Mixto	2.687	2.687	2.687	2.687
Bombeo Puro	3.337	3.337	4.212	6.837
Biogás	223	235	235	235
Geotérmica	0	0	15	30
Energías del mar	0	0	25	50
Biomasa	677	877	1.077	1.677
Carbón	11.311	10.524	4.532	0-1.300
Ciclo combinado	27.531	27.146	27.146	27.146
Cogeneración carbón	44	44	0	0
Cogeneración gas	4.055	4.001	3.373	3.000
Cogeneración productos petrolíferos	585	570	400	230
Fuel/Gas	2.790	2.790	2.441	2.093
Cogeneración renovable	535	491	491	491
Cogeneración con residuos	30	28	28	24
Residuos sólidos urbanos	234	234	234	234
Nuclear	7.399	7.399	7.399	3.181
Total	105.621	113.151	137.117	156.965

Evolution of installed electrical energy capacity (MW) according to the NECP



Installed capacity – renewable technologies (MW)

The NECP forms part of the Strategic Energy and Climate Framework approved by the Council of Ministers, which also includes the draft Climate Change and Energy Transition Law and the Just Transition Strategy, a particularly important document for the *Cuencas Mineras* or coal mine regions of Asturias. The primary aim of the Just Transition Strategy, which is still only in its draft version at this stage, is to maximise employment opportunities and minimise the impact of energy transition. It therefore identifies and aligns with the parts of the NECP which hold the most potential in terms of employment, such as refurbishment of buildings, renewable energies (tenders, repowering, promoting self-sufficiency in consumption) and the development of storage, electric mobility or development of alternative fuels such as biomethane and hydrogen.

Another crucial element in the future of Asturias' mining areas is the "Framework Agreement for a Just Transition from Coal Mining & Sustainable Development in the Mining Regions for the Period 2019-2027", (Acuerdo Marco Para Una Transición Justa De La Minería Del Carbón Y Desarrollo Sostenible De Las Comarcas Mineras Para El Período 2019-2027) reached in the autumn of 2018. This document has been compiled as a planning instrument for public policies related to restructuring the coal mine sector and fostering the growth of alternative economies in the Spanish mining provinces. The expected figure for financial aid aimed at driving the economy and reviving these regions sits at 250 million euros for the period 2019-2023 and includes the implementation of energy diversification projects with renewable energies being used in public buildings, among other places.

The Framework Agreement also sets out a complementary urgent Action Plan with three basic elements, which include a renewable energies development and energy efficiency plan for 2018-2023 for all the mining territories, the creation of "just transition agreements" and the possibility of specific tenders for new renewable energy within these territories.

The Government has also adopted other policies which will have hugely positive effects on the development of renewable energies in Spain, such as measures to promote closed distribution systems, the Royal Decree-Law 15/2018¹ which removes the "sun tax" and Royal Decree

¹ The Real Decreto-ley 15/2018, of the 5th of October on urgent measures for the energy transition and consumer protection, establishes that self-consumed energy from renewable sources, cogeneration or waste will be exempt from all charges and tolls.

244/2019 on energy self-sufficiency². The latter simplifies the administrative procedures related to electrical self-sufficiency, sets out a compensation system for energy not instantly consumed and paves the way for collective self-sufficiency, thereby fostering this approach for communities of neighbours or business parks across the country.

Furthermore, we are expecting the creation of an Electro-intensive Consumer Statute, something which will have a significant impact on an industrial region like Asturias.

As a result of this string of measures approved by the socialist government and the calls for tenders for new renewable power by the previous administration, Spain is once again attracting investment in renewable energy. Investment reached 6.84 billion euros in 2018, seven times higher than figures of the previous year according to data from Bloomberg NEF. Following years of stagnation and destruction of the business and employment fabric, Spain has reinstalled itself in the world's top ten in terms of investor efforts in clean energy projects and is the fastest-growing country in Europe in terms of investment in renewable energies.

² *Real Decreto 244/2019, regulating the administrative, technical and economic conditions for the self-consumption of electrical energy.*

3. Current situation and development prospects for the renewable sector in Asturias

One of the most notable characteristics of the Principality of Asturias in energy terms is that, while at global, European or domestic levels, petroleum plays a hugely significant role in the primary energy consumption structure, Asturias is predominantly reliant on the consumption of coal more than any other primary source (63.4%). This comes as a result of its availability in the local area, the high rates of thermoelectric generation and the steel industry's use of coke.

Another feature of the Asturian economy is the importance of its industrial sector, which contributes some 22.52% of Gross Value Added and 14% employment, while consuming 68.8% of end-use energy in the region.

Industry in Asturias currently employees almost 48,000 people in more than 3,500 companies whose activities are focused across three main subsectors: 30% in extraction industries, energy, water and waste; 42% in metallurgy, steelworks and manufacture of metallic products, and 10% in food, drinks and tabaco.

Thus far there has been tremendous synergy between the energy and industrial sectors and this has meant the energy sector has adapted itself to the needs of the industrial activities prevalent in the regional economy. As such, the 7 existing thermoelectric plants (five coal and two gas) have generated three quarters of the region's electricity and have been absolutely crucial in providing a high-quality power supply to Asturias' core industries. Indeed, one of the most significant social concerns present in the public debate is whether the energy transition and technological replacement processes will be able to guarantee quality electricity production for major industry, given Asturias' limited electrical interconnection capacity and the lessor availability of renewable resources in the region compared to the country as a whole.

In demographic terms, Asturias is characterised by an increasingly aging population and has a certain tendency towards losing inhabitants as a consequence of negative vegetal growth and significant internal territorial imbalance. Its central area covers 20% of the territory but houses some 80% of the population and the majority of services, facilities and both economic and industrial activity.

In Asturias, renewable energies represent approximately 30% of the installed electrical capacity and around 17% in the electricity generation mix. The Asturian renewable energy sector is currently operating throughout the supply chain and enjoys significant international involvement in major projects.

From a planning point of view, there is currently no renewable energy development plan on a regional level, although the next autonomous regional government is expected to compile one in alignment with the objectives and principles of the state Government's National Energy and Climate Plan.

Installed Electrical Capacity Asturias. 31.12.2017 (MW)			
Coal	2,221.9		
Combined Cycle	866.0		
Cogeneration	97.9		
Wind	518.5		
Hydraulic	778.0		
Bio-Waste	78.0		
Biogas	13.6		
Photovoltaic solar	0.8		
Total	4,574.7		





Generación Electricidad Asturias (GWh) 2017



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3.1. Wind Energy

Onshore Wind Power

Some 11.3% of the installed capacity (518.5 MW) corresponds to onshore wind power. There are currently 19 wind farms in operation and several more in the planning phase following the most recent renewable energy bidding process. We estimate there are approximately 850 MW of onshore wind energy projects currently in the pipeline.

In terms of generation, the regional growth perspectives are related to the installation of new farms, but fundamentally to the repowering of those which are already in place in the areas with the greatest wind resources. Elsewhere, the greatest growth potential lies in the mid to low-power wind farms, absolutely ideal for an industrial consumer profile or a distributed and communal electricity generation approach.

Offshore Wind Power

Asturias has historically been home to significant associated metal industries and is in a strong position in terms of offshore wind power. Despite not having an offshore wind farm within its territory, nor indeed in Spain at all, it is currently Europe's second largest hub for manufacturing components for this sector.

There are currently 37 companies manufacturing components and providing services for plants in other parts of Europe. The products and services provided by the Asturian companies include: marine grade steel production; manufacturing of large pieces and components for offshore wind towers; manufacturing of foundations and substructures for offshore wind turbines; constructing services boats for offshore wind farm maintenance; engineering services; design, modelling and manufacture of energy exploitation devices; testing and simulation of new steel performance; training services specialised in safety.

This is also a sector with a significant technological component and high levels of investment in Research, Development and Innovation (R + D + I), meaning it creates qualified jobs.

The Asturian Energy Foundation (FAEN) has conducted a study into infrastructures and capacities in Asturias³ in which it has identified the following companies currently working in the sector:

³ "Infraestructuras y capacidades industriales del Principado de Asturias para la industria energética offshore" Fundación Asturiana de la Energía, Gobierno del Principado de Asturias, 2016.

N°	Empresas con experiencia en el offshore
	Segmento 1. Fabricantes de buques y estructuras flotantes
19	ASTURFEITO S.A.
2º	ASTILLEROS GONDÁN S.A
3º	INGENIERÍA Y DISEÑO EUROPEO S.A. (IDESA) (GRUPO DANIEL ALONSO)
49	WINDAR RENOVABLES S.L. (GRUPO DANIEL ALONSO)
Segmento	2. Fabricantes de equipamento, componentes y proveedores de servicios
59	AISLAMIENTOS SUAVAL
69	AFROM by GAM
79	ARCELORMITTAL ESPAÑA S A
89	AST INGENIERÍA ST. (ADVANCED SIMULATION TECHNOLOGIES ST.)
92	ASTURIANA DE GRANALI ADOS Y PINTURAS, S.A. (AGRAPISA)
109	
119	DACERO (GRUPO DANIEL ALONSO)
129	FERIOVI
139	FLUNOR
149	GRUPO MARCEUNO ERANCO
150	GRUPO NAVEC
169	GRUPO SEM
170	
189	HIERROS CANTÓN
199	
209	INFOLSO
20-	
222	INSUMA INVESTIGACIÓN DE SUELOS Y MEDIO AMBIENTE
239	ISOTRON S A LL (GRUPO ISASTUR)
249	
259	
269	MECANIZADOS CAS
279	MEEASA
289	METÁLICAS SOMONTE
299	
309	PROYECTOS INGENIERÍA Y MECANIZADOS (PROINMEC)
31º	SPANSET S.A.
32º	TALLERES JESÚS ALVAREZ
33º	TAXUS GESTIÓN AMBIENTAL, ECOLOGÍA Y CALIDAD
35º	TUINSA
	Segmento 3. Sectores finales
36º	EDP RENOVABLES ESPAÑA S.L.
	Segmento 4. Actividades de I+D+i y formación
37º	CENTRO DE SEGURIDAD MARITIMA INTEGRAL JOVELLANOS
38º	ESCUELA EUROPEA DE MAQUINARIA ROXU
<u>39</u> º	FUNDACIÓN CTIC
40º	FUNDACIÓN PRODINTEC
419	ITMA MATERIALS TECHNOLOGY
42º	MANZANA DEL ACERO
43º	SGS FORMACION
449	UNIVERSIDAD DE OVIEDO
	Segmento 5. Infraestructuras y organismos de soporte
459	
469	CLUSTER DE FABRICACIÓN AVANZADA DE LA INDÚSTRIA DEL METAL DE ASTURIAS METAINDÚSTRY4
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48≌	CLUSTER TIC
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Source: FAEN

The majority of these companies' activity is not dedicated exclusively to the offshore wind power sector, many also have other business areas.

The diagram below shows at which point the companies based in Asturias are currently involved in the industrial chain:



Source: FAEN

According to data from the Asturian Energy Foundation (FAEN), there are currently about 900 jobs in the sector, the majority of which are focused on the manufacture of components and boats.

Employment related to this technology is concentrated in the so-called Asturian industry triangle (Avilés, Gijón and Oviedo) and is, as mentioned above, heavily linked to the steelworks industry. It also represents a good opportunity for the shipyards and ports at Avilés and Gijón to diversify their operations.

It is a sector with a significant technological component and high levels of investment in R + D+ I, meaning it creates highly qualified jobs.

Across Europe there are currently more than 4,500 turbines with a total power output of approximately 19GW. More than 80% of these are located in the United Kingdom, Denmark and Germany. Forecasts indicate that this technology will continue to grow in the upcoming years. Capacity is expected to double in Europe over the next four years (19% per year), this taking into account only projects in the pipeline. Technology is advancing to allow offshore wind parks to be constructed at increasing sea-floor depths, meaning the number of potential locations for these parks is on the rise. According to forecasts by the International Energy Agency, by 2050, offshore wind energy could account for half of the current electrical power output in Europe⁴.

In Spain there are some 6,000 kilometres of available coastline but the offshore wind resources are difficult to exploit given the Spanish coastline's unfavourable characteristics on the continental shelf (extreme depths). One viable solution would be to promote floating offshore wnd power technology, something which is still in the research and development phase. There are currently two floating wind farms in Europe, with a further 4-6 projects under

⁴ IRENA (2018), Nurturing offshore wind markets: Good practices for international standardisation, International Renewable Energy Agency, Abu Dhabi.

construction. In view of Horizon 2030, rapid development and maturing of the offshore floating wind power is expected in Europe, reducing costs for this technology from the current 180-200 EUR per MWh to 40-60 EUR per MWh by 2030⁵. In any case, it is the development of floating wind farms which will lead to the success of wind energy given the characteristics of the continental shelf along the Spanish coast.

3.2. Biomass

Biomass has a growing role in the energy context of the Principality of Asturias. Biomass resources from forestry and livestock waste are readily available across the region.

According to FAEN the following biomass resources are present in Asturias:

Forestry biomass:

Residual biomass available	218,000 tonnes/year
Residual bioenergy available	61,000 toe/year

Livestock biomass: 15,600 toe/year

To a lesser extent there are also resources available via agricultural biomass and the agri-food industry, garden waste, WWTP sludge, etc.

In terms of the industrial infrastructure, there are currently 3 solid and liquid biofuel production plans:

- Pellet production plant owned by Pellets Asturias, S.L. in Tineo with a capacity of 30,000 tonnes/year.
- Woodchip production plant owned by Agroforestal Nava, S.L. in Nava with a capacity of 50,000 tonnes/year.
- Woodchip production plant owned by Tinastur, S.C.L. in Tineo and by HUNOSA in Lieres.
- Wood pulp manufacturing plant owned by ENCE in Navia with a capacity to produce 620,000 tonnes/year of black liquors for self-consumption in their cogeneration plant.

Electrical power plants:

□ Electrical power plant of 9 MW at the central Asturias dump (Vertedero Central de Asturias) (COGERSA) [Gijón].

⁵ "Floating offshore wind energy. A policy blueprint for Europe". WindEnergy, 2018

- Fuels: Biogas generated by the organic waste in the dump and the digested sludge from the biomethanization plant.
- □ Cogeneration plant of 0.2 MW (Biogas Fuel Cell) [Tineo].
 - Fuels: Biogas from livestock, meat and dairy waste originating from the digesters.
- Cogeneration plant of 4.3 MW (Biogastur) [Navia].
 - Fuels: Biogas from livestock, meat and agri-food industry waste originating from the digesters.
- Cogeneration plant and electrical power plant of 77 MW (ENCE) [Navia].
 - Fuels: Black liquors and paper industry wood treatment waste.
 - Cogeneration plant of 1 MW (Pellets Asturias) [Tineo].
 - Fuels: Forestry and wood processing industry waste.

Domestic thermal biomass facilities:

	2012	2013	2014	2015	2016	2017
TOTAL NUMBER OF FACILITIES	529	575	603	617	633	649
ACCUMULATED POWER (MW)	36.2	40.6	46.3	48.0	48.8	50.2

Industrial use facilities:

- The 78 MW of residual biomass installed correspond to the plants owned by ENCE (77 MW) and Pellets Asturias (1 MW).
- The 13.5 MW of biogas installed correspond to the COGERSA plant (9 MW), the Biogas Fuel Cell plant (0.2 MW) and the Biogastur plant (4.3 MW).

Current direct employment in the biomass sector according to FAEN:

- Forestry biomass collection: 600 jobs
- Biofuel production and electricity generation plants forestry biomass: 220 jobs
- Installation and maintenance of technical systems: 60 jobs
- Waste Management and industrial biogas plant operation: 150 jobs
- Training and R+D+i: 40 jobs

In terms of the potential for biomass, projects currently in the pipeline are renewable electrical energy plants using:

- Biogas: 0.1 MW

- Biomass: 27.4 MW
- Some of these projects are currently waiting on upcoming renewable energy bidding procedures to be convened by the Ministry.

Heating networks:

- Expansion of the Villayón City Council heating network with a 65KW boiler.
- Heating network associated to the residential neighbourhood of Ecojove in Gijón with an 800 KW biomass boiler to satisfy the heating demands of 2,000 homes.
- Heating network of the Ibias City Council with a 900KW boiler.
- Heating network of the Laviana City Council
- Heating network of the Riosa City Council
- Consumption self-sufficient Caso neighbourhood

The biomass industry is currently the most important renewable energy subsector in terms of employment figures.

The promotion of energy generation originating from biomass will have a particularly significant effect on Asturias' south-west region, which is home to the mines of Cangas de Narcea, Ibais, Degaña and Tineo. It is a particularly rural and mountainous area which does not have the same levels of industrial development that exist in the central part of the province. It possesses vast forestry resources and already houses several facilities both for biomass energy generation (cogeneration and heat) and the production of biomass fuel.

Despite the fact the south-west region does have potential from a forestry perspective, with the sector producing renewable and sustainable resources (wood, biomass, etc.), and the fact there exists a demand for forestry products and production possibilities in the region, Asturias still imports both wood and raw materials to produce pellets. Biomass can and must take on an increasingly significant role as an energy source in Asturias but in order to achieve this, it is fundamental that sustainability criteria are established which will guarantee the harnessing of that potential without causing other environmental problems. Production must be oriented towards the reasonable exploitation of these local resources, prioritising those which will be of more value for biomass and the use of lower carbon-content biomass as an energy source. In order for that to happen, forestry must be fostered alongside the good maintenance of the forest mass, whether fully-grown or the fruit of replanting of recent years. This would aid the development of a local biomass industry for energy-generation purposes which would in turn contribute to job creation and help retain the population, keep the countryside clean and monetise its maintenance, as set out in the 'Special Plan for Local Councils in the Asturian Southwest' (*Plan Especial para los Concejos del Suroccidente Asturiano*).

Elsewhere, state company Hunosa is contemplating undertaking projects which will allow for the use of forestry biomass on account of its own forest resources. It is planning three business lines aimed at industrial or institutional clients for the future: thermal energy supply in the form of heating and sanitary hot water, thermal energy supply in the form of saturated steam for industry and management of heat systems based on biomass.

3.3. Hydraulic Energy

Some 17.0% of the installed capacity (778 MW) is contained in 39 large hydropower plants and other small-scale hydropower plants.

There is also the noteworthy development of some innovative micro-hydropower facilities by equipment manufacturing companies and projects promoted in collaboration with FAEN. However, the loss of employment in the small hydropower sector has been a constant trend since 2009. The fundamental causes are the lack of new projects and the automation of some of the existing small hydropower facilities. If the current conditions which tax concessions are not amended, this loss of employment will be exacerbated.

One of the most innovative initiatives included in state company Hunosa's business plan is the strategy to exploit the natural drainage patterns of the pitheads of the former mountain mines to generate electricity. The aim of these mini hydro plants would be to produce energy for self-consumption so the well pumps could use this electricity and save on the costs. Should excess energy be produced, this could be dumped on the network and even create revenues.

Hunosa is currently developing a study to distinguish geological and mining elements as well as the condition of the pitheads, their links, their drainage flow rates and quality of the water. It is also assessing the possibility of implementing a model project of this type which could be funded through the European Platform for Coal Regions in Transition framework.

3.4. Geothermal

A particularly unique feature of Asturias is the presence of 282 low-temperature geothermal energy facilities with a total power output of 7.5 MW.

Given its relevance, the thermal exploitation of waters from mining operations is a standout element, in particular the mine water heating network of Mieres, the largest geothermal heating district in Spain.

The urban heating network in the town of Mieres has its source at the Pozo Barredo mine and currently supplies the Álvarez-Buylla Hospital at the Asturian Energy Foundation (FAEN) headquarters, as well as other campus buildings, with a total power output of 4MW. The network is being expanded to take power to the centre of Mieres, supplying the Polytechnic School (EPM), the secondary school Bernaldo de Quirós (iBQ) and a group of buildings located in the Vasco-Mayacina area, containing a total of 248 homes. The expansion will add a further 2MW of installed capacity.

Mieres urban heating network



Source: Hunosa

Using the same methodology, Hunosa has presented a further project in Langreo to supply heat to a total of five buildings spread across the town centre through the geothermal exploitation of the Pozo Fondón mine. The total expected investment is 1.7 million euros.

Growth prospects for geothermal energy are heavily linked to the exploitation of pumped water from the mining wells. This is the case with the projects underway in the Nalón region, but also at other locations which are not linked to decommissioned mines and would therefore require the support of an infrastructure based on the completion of collection samples. This strategic approach of expansion will be reflected in the new diversification plan published by state company Hunosa for 2019-2027. The energy contained in the Hunosa group's mine water is equivalent to that consumed in heating 21,900 homes and 87,600 inhabitants.

3.5. Solar Thermoelectric Energy

As is the case with the offshore wind farm technology, despite there being not a single MW of installed capacity in Asturias using this type of generation, the region does have significant activity and employment revolving around the manufacture of equipment and components for thermoelectric technology.

Asturian companies are featured throughout the industrial chain with involvement in: engineering, research and development, manufacture and supply, services (installation, assembly and maintenance) and EPC companies who implement 'turnkey' contracts for installation.



Source: Protermosolar

Again as is the case with offshore wind power, in the manufacturing phase the strong presence of the metal sector in Asturias has provided the structures for a significant proportion of the plants constructed in the rest of Spain.

Other companies, such as TSK, manage the project, engineering, assembly and maintenance of thermosolar plants both in Spain and internationally.

Activity in Asturias in this regard reached its highest level in the period between 2011 and 2013 with the installation of several thermosolar plants across Spain.

Spain boasts the best conditions of any European country in terms of the implementation of thermosolar plants, being able to set far more ambitious and less costly decarbonisation targets than the central European countries. From an economic perspective this would have a hugely positive impact, not to mention the fact Spanish companies could position themselves as setting the benchmark for the emerging world market in this sector.



Thermosolar plant locations: Under construction or in budgeting stage by TSK

Source: CSP Today Global Tracker, January 2019

Within Horizon 2030, thermosolar plants could have a significant role to play against fossilsupport technologies. Their current electricity production costs, according to the evidence of the latest international contracts awarded, put them very close to the costs of combined cycles.

All the activity in this subsector is currently oriented towards exportation, though future scenarios in order to comply with the new National Climate and Energy Plan appear to indicate the potential for national orders. The thermosolar plants could provide the network with a storage service⁶ in the face of dumps deriving from the expected high increase in power in uncontrollable energies, with far less investment than in batteries or pumps.

In this context, the installation of new thermosolar plants in Spain would represent a case of activity recovery and would bring with it the employment witnessed in the years 2011-2013, given the majority of the companies linked to this sector have not closed down but rather moved into other business areas.

⁶ The new thermoelectric solar plants have systems to store energy in molten salts. The molten salt will be used to store the heat obtained from the solar park which will then be able to be recovered to produce steam and generate electricity in the absence of solar radiation, extending the plant's operational capacity after sundown and on cloudy days.

3.6. Photovoltaic Solar Power



There are currently 102 facilities of this kind connected to the network (851 kWp), 12 of which are for self-consumption, and 541 off-grid (230 kWp). Projects in the pipeline at this stage would add some 2.4MW of power.

Asturian companies are present throughout the photovoltaic technology value chain in the transformation of raw materials (steel and aluminium), the manufacture of the profiles (shaping or extruding), in galvanization and in transport.

Some of the largest and best solar structure production plants are located in Asturias, both in terms of manufacturing processes and treatments. As such, despite solar production being far inferior to the Spanish average, there is a significant concentration of activity and employment in the region. Approximately 90% of local production is exported to the rest of Spain or internationally. It would be fair to asset that many of the greatest solar parks in the world are built with Asturian metal.

The sector's business association, the *Unión Española Fotovoltaica* (UNEF), has identified 23 companies related to photovoltaic technology in Asturias. In 2017 they compiled a report⁷ on the industry's impact on employment, estimating the sector directly provides 1,575 jobs.

⁷ "El impacto de la energía solar fotovoltaica en el empleo en Asturias" UNEF, 2017.

	Número de
Actividad	empleos
Ingenierías	88
Fabricación de estructuras y/o seguidores 671	671
Instalación	305
Venta de equipos solares	65
Transporte	118
Comercializadores	41
Venta de equipos electrónicos	27
Recubrimientos metálicos	47
Fabricantes de metal/materia prima 213	213
Total empleos directos	1575

Source: UNEF

Accounting for some 20% indirect job creation across the industrial value chain, UNEF estimates total employment of 1,890 people working in the photovoltaic sector throughout Asturias⁸.



Distribution of photovoltaic-related Jobs by activity

Source: UNEF

Regulatory reforms and retroactive cutbacks experienced by the sector have had an extremely negative impact, destroying part of the industrial fabric and relocating several companies. However, there a recovery in employment terms is now being seen within the photovoltaic sector thanks to the fostering of self-consumption and the revival of the sector following the tendering procedures launched. The recently approved Royal Decree on collective self-sufficiency, the closed networks regulation and the announcement of specific renewable energy tender processes for the mining regions, added to a continued fall in the cost of photovoltaic technology, have all added to increasingly positive growth prospects for the region.

⁸ These UNEF figures are similar to the data provided in the following section, although the latter come from consultations with experts who were interviewed for this project.

3.7. Solar Thermal Energy

There are some 2,088 registered facilities of this kind, with a total surface area of almost 37,900 m². The rollout of these plants comes as a result of the obligatory installation regulated by the Technical Building Code which came into force in 2006, establishing that at least 30% of hot water consumption in Asturias must be provided by solar panels.

As a result of public grants and the building regulations, the total surface area of solar thermal installations has grown by more than 50% since 2006.

Estimates believe the majority of these facilities are in poor condition or are performing at far from optimum levels.

In terms of growth prospects, the solar thermal market is heavily linked to the Technical Building Code and as such, the construction of new-build homes.

Likewise, energy rehabilitation programs for older buildings will also contribute to the establishment of new installations. It must however be understood that these actions will not necessarily be the most beneficial in energy efficiency terms given the limited number of sunshine hours in Asturias compared to other areas of Spain.

At this stage, companies which manufacture the components are prioritising the exportation of their products to other areas.

3.8. Marine Energy

Beyond the aforementioned offshore wind power, there are also other types of marine energy such as tidal power, wave power, marine current power, ocean thermal energy obtained through the difference in temperature between the surface water and deep sea, and blue energy or osmotic power, which is obtained by the difference in salt concentration between sea water and fresh water of the rivers through osmosis.

The potential for tidal energy in Spain and particularly on the Cantabrian coast is among the best in the world.

The marine energy sector is currently extremely technological and is in an innovative stage, meaning the majority of related jobs are highly qualified and are focused in the areas of research, development and innovation.

In this sense, the University of Oviedo is making a notable contribution to the field research into renewable energies and marine power in particular. Indeed, the University's participation in the *Portos* project was recently announced alongside eighteen European institutions. The project aims to assess and develop the integrated use of renewable energy resources at ports, setting out a road map towards a more competitive and sustainable sector. The Asturian academic institution will evaluate the available resources and the production capacity of renewable marine energy sources in the areas around ports in Ireland, Portugal, France, the United Kingdom and Spain and look at how mechanical conversion systems may be integrated into the port infrastructures.

Asturias' technological, industrial and naval capabilities make it extremely well placed to take a leading role in this promising area.

The regional government has included renewable marine energies in its Regional Intelligent Specialisation Strategy (RIS3), giving its firm backing to the exploitation of wave power as an energy source and taking advantage of the regional's favourable characteristics in order to develop this area.

Furthermore, the Integrated National Energy and Climate Plan envisages the installation of 50MW of marine energies in Spain by 2030.







La Energía undimotriz (kW/m)
0
0 - 3
3 - 6
6 - 9
9 - 12
12 - 15
15 - 18
18 - 21
21 - 24
24 - 27
27 - 30
30 - 33
33 - 36

4. Socio-economic impact: employment, successful companies and training and research centres

4.1. Employment estimation for the sector

Below we provide a selection of approximate figures for existing jobs in the renewable energy sector in Asturias for the year 2018. This information should not be considered as an *ad hoc* quantitative analysis but rather as an estimate by which to profile the probably size of the sector at this time. The information has been gathered through the office's efforts and interviews with experts.

In 2018 renewable energies directly employed some 5,400 people within the Principality of Asturias.

By technology, estimates give about 1,800 jobs in photovoltaic, 1,400 jobs in wind power, 1,200 in biomass, 200 in biogas, 400 in solar thermoelectric and 300 in solar thermal energy. Of the total number of jobs in wind power, 900 are related to offshore technologies in 2018, giving levels well above the average – around 600 jobs⁹ – for that year.

In terms of jobs per activity type, around 2,200 are estimated to be dedicated to the manufacture of equipment and components for renewable technologies. In the photovoltaic field in particular there are an estimated 800 jobs, with 100 in thermoelectric and 1,300 in wind power.

A further 2,600 jobs are related to engineering services and turnkey construction projects (Engineering, Procurement and Construction companies) as well as the management and operation of working renewable plants and parks. Of these, some 1,100 jobs are linked to the biomass sector, including staff in the plants themselves, the logistics and transport chain and the workforce who are employed in the countryside. A significant proportion of these Jobs are related to ENCE's activities.

Lastly, there are an estimated 500 jobs associated to the assembly of small-scale and selfconsumption renewable energy facilities in solar thermal and photovoltaic power, heating networks, etc.

Photovoltaic	1800
Wind	1400
Biomass	1200
Biogas	200
Thermoelectric	400
Solar Thermal	300
TOTAL	5300

Jobs per technology in Asturias 2018:

⁹ Specific employment estimates have not been made in other renewable areas such as marine or geothermal energies.

Ma	2200	
	Photovoltaic	800
	Solar Thermal	100
	Wind	1300
Ind	ustry & Plant	
Μ	anagement	2600
	Biomass	1100
	Photovoltaic	800
	Mini-hydro	60
	Solar Thermal	300
	Biogas	200
	Wind	100
	Other	40
Small	500	
	Solar Thermal	300
	Other	200
	TOTAL	5300

Jobs per activity in Asturias 2018:

4.2. Leading Asturian companies in the value chain and supply of renewable technologies

The importance of industry in Asturias, especially in the metal sector; manufacture of capital goods, naval equipment, electrical components and facilities, etc., is heavily linked to the manufacturing capacity required to construct large-scale power facilities. It is for this reason that it's proved a strong strategic hub for the rollout of marine wind technology or thermoelectric power generation. Below is a brief description of a range of leading companies based in Asturias present across the value chain and in the supply of renewable technologies, or which provide strategic value for the growth of the industry and local business undertakings.



TSK is a leading business group in engineering development and the supply of facilities. It currently enjoys turnover of more than 1 billion euros per year, with 35% of its business focused in photovoltaic and thermosolar energies. This Asturian company employs more than 1,000 people, more

than 51% of whom are dedicated to engineering. It carries out 97% of its activity on an international scale with projects in over 50 countries. It recently expanded its Science and Technology Park with a facility in Gijón, adding to its bases in Madrid, Vitoria and Cologne (Germany), which monitor its power plants across ten countries 24 hours a day and in real time. This is a company which implements turnkey or EPC projects, with the capacity to take on national orders should the installation of thermosolar plants be revived in the context of the Integrated National Energy Plan.

WINDAR Renovables is an Asturian company which sets the global benchmark in onshore and offshore wind farms thanks to its over 60 years of industry experience. They produce towers for wind turbines and offshore foundations and have production plants around the world, with locations in Europe, Asia and America.

The alliance formed by Asturias' Windar Renovables and state-run company Navantia – a leader in the design and



construction of high-technology vessels – has proven a real business cooperation success, adding to both companies' strengths in terms of knowledge and human capital allowing them to continue leading and implementing a range of international projects.



Praxia Energía has worked with designing and manufacturing structural systems for photovoltaic solar plants since 2006. During those 12 years it has been involved in photovoltaic projects totalling power of more than 1,000MW spread across Europe, Africa, America and Asia.

Business expectations are positive given the favourable conditions for the dynamization of the Spanish market as part of the increasingly ambitious state policies for energy and climate. In fact, Praxia has recently supplied photovoltaic structures for a 50MW park, the first large-scale

project in Spain following the stagnation of the sector in recent years. The company has also just signed an agreement with Audax Renovables to supply the structures required for the installation of projects totalling 100MW, particularly self-consumption facilities for companies on a domestic level over the next three years (equivalent to the consumption of over 56,000 homes).

Alusín Solar works in the design, manufacture and installation of aluminium systems and metal structures for a wide range of solar



photovoltaic systems. Since 2010 it has undergone rapid international expansion, supplying more than two hundred projects across fourteen countries. It recently moved its headquarters to the industrial heart of Asturias in Avilés in order to consolidate its business growth. It is currently collaborating with another renewable energy company specialising in photovoltaic power, **Electricidad Llano S.L.** on a project to open the largest self-consumption facility in Asturias for the Alimerka supermarket chain. The park will house more than 7,500 photovoltaic panels producing 2.41MW and will provide clean energy for the two warehouse units covering over 46,000 square metres at the Asturian supermarket chain's logistics centre.

Electra Norte was founded in 1923 in Carbayín, right in the heart of Asturias' mining region to provide electrical energy. The company became the first in Spain to start selling green power, and throughout its existence it has been a pioneer in connecting photovoltaic parks to the grid, setting up wind



farms, exploiting new renewable energy resources and participating in the funding of power generation plants. It is currently focused on distribution, generation and providing services to third parties, both in Spain and abroad. Alongside other electrical companies such as Viesgo, EDP, Iberdrola, Electra Norte and Endesa and public bodies such as IDEPA and the University of Oviedo, it is part of the Regional Round Table for the Promotion of Electrical Mobility coordinated by the Directorate General of Mines and Energy.



Galvanizados Avilés, S.A. is involved in the galvanization process in order to prolong the service life of metallic products exposed to the destructive and expensive effects of corrosion. In recent years, the need for this service has grown in several sectors, such as construction, renewable energies and the production of capital goods, structures and industrial components in general. Their plant is entirely

automated and stands out for its employment of the latest technology. It also has a significant international presence as a result of the work it carries out for renewable energy projects. The company has completed renewable energy implementation projects in England, France, Italy, Romania, Russia, Austria, Chile, Mexico and Peru, Morocco, Siberia and Saudi Arabia.

The **HUNOSA Group** is a state-owned business organisation in the energy-mining sector with business in Spain and Latin America, 100% owned by Sociedad Estatal de Participaciones Industriales (SEPI). Although its origins and main business activity is mining – the extraction and



sale of coal – as well as operating a thermoelectric plant, it also has a business line in renewable energies, specifically geothermal and biomass. In fact it is a market leader in the exploitation of low-temperature geothermal energy from mine water. The recent agreement between the Hunosa Board and the syndicate organisations for the adoption of a new business plan adjusting the group's activity and guaranteeing its viability, will accentuate its role in and contribution to future renewable energy development in the region. The Business Plan 2019-207 is expected to guarantee the group's activities through the transition from a mining company structure to one focused on the fields of power, energy and environmental services. As part of its diversification measures, Hunosa plans to intensify the existing business lines related to energy resources (geothermal, biomass, biogas, etc.) and the creation of a group of activities related to biomass in the Central Asturian Basin among other areas. It is also set to assess the possibility of building a biomass plant in that very location.



IMASA, INGENIERÍA Y PROYECTOS, S.A., with its headquarters in Oviedo, was founded in the 1970s as a company dedicated to the implementation of projects and the maintenance and assembly of industrial facilities. It

currently leads a group of companies with activities across a range of fields and has a workforce of around 1,200 people. It has been awarded international projects in countries including Mexico, Colombia, Ecuador, Peru, Bolivia, Chile, Uruguay, Brazil, Morocco, South Africa, Qatar and Israel. IMASA has consolidated its position within the renewable sector with the completion of diverse energy projects in Spain. It is currently carrying out the construction of two biomass plants in Coruña (Galicia) and León (Castilla y León) with a total of 50MW electrical power output, investing 110 million euros in each. They are both contracted under the EPC model, which includes the Design, Engineering, Supply, Construction and Implementation of both facilities. The company will also conduct the operation and maintenance of both plants for a 15-year period. The biomass plant in Galicia will be the largest in Southern Europe using tree and bush clipping and waste eucalyptus wood, which will be collected in a one-hundred-kilometre radius.

The company is also involved in the implementation of five photovoltaic solar plants in Aragón, as well as other renewable projects.

Biogastur is an Asturian company with its headquarters in Navia, focused on managing the region's livestock waste. It has developed an agro-industrial biogas plant with a capacity of 4.5MW, making it the most powerful of its kind in Spain. Every year, the facility handles 400,000 tonnes of livestock waste from more than 25,000 cows which is converted into biogas and solid and liquid fertilizers, generating enough energy to feed 1,500 homes annually.



The group has dedicated over five years to engineering and developing the technology before constructing and putting the plant into service. Biogastur works with Central Lechera Asturiana SAT as a strategic partner, Lonjas Tecnología SA, as a technology partner and the remaining capital is shared between the executive team and financial investors. It currently has four projects in the pipeline all at different stages of implementation.



Efinco is a company located in Mieres dedicated to the design and construction of high energy efficiency buildings specialising in EECN (Energy Efficient Construction) and NZED (Nearly Zero Energy Buildings), in which it is a national market leader. It develops projects focused on improving the envelope of the building and managing the energy

within the whole construction efficiently. The firm has completed the refurbishment and extension of a country hotel in Asturias, as well as a lot of work on nearly zero energy homes. Of particular note is its participation in the NeHogar project. which came about through the Asturian Energy Technology Consortium as an initiative led by a group of companies which decided to carry out a model project. The aim was to design and build a "nearly zero energy" single-family home – a house which consumes less than half the energy of a conventional home based on each country's norms and regulations. The project integrated existing working techniques and technologies to optimise the energy performance of the home at costs accessible for any users. Now the house is complete, it is being monitored to assess its performance whilst inhabited.

4.3. Existing training and research centres

Training

The University of Oviedo offers several courses in line with the European Higher Education Area which provide degrees covering the majority of knowledge areas. Some 30% of their over 18,200 registered students are studying technical degrees.

The University of Oviedo's Energy, Environment and Climate Change cluster strengthens research, development and innovation in fields like clean energies (generation, transport and storage) and energy efficiency.

The following degrees offered by the University of Oviedo related to the energy sector are of particular interest in this regard:

- Erasmus Mundus Master's Degree in Sustainable Transportation & Electrical Power Systems
- Master's Degree in Electrical Energy Conversion and Power Systems
- Master's Degree in Energy Engineering

There are some 15,000 students registered on regulated vocational training courses, more than 35% of whom are studying technical subject areas. They complete the Asturian labour force technical qualification, combining theoretical training with practical in-company work experience.

Also worth highlighting is the Hunosa Training Centre, a reference point in terms of training efforts related to mining projects, works and safety which boasts more than 45 years' experience and takes on more than 4,000 students every year. This centre is also a vital resource that could play a huge role in reorienting the production model in Asturias and contribute to the training of the professionals who will be required for the success of the

energy transition. Indeed, the company's business plan sets out as part of its diversification strategy that it will promote the centre in the coming years as a training and education space for renewable energies, waste management and environmental techniques.

Lastly, we ought to mention the efforts being made by state-owned company Valnalón Ciudad Tecnológica in training contributions to an entrepreneurial culture. This public company was founded in 1987 dependent on the Regional Council for Employment, Industry and Tourism. Its primary objective has been to design and implement a regeneration, promotion and dynamization plan for the Nalón Basin.

The Ciudad Tecnológica Valnalón carries out initiatives to encourage training and an entrepreneurial culture and along that line it has started the *La Cadena de Formación Para Emprender* or "Training Chain in Entrepreneurship" made up of different educational projects in a chain-like structure throughout the education system.

The first link is made up of projects undertaken at Primary Education level (as it is fundamental to begin at school) with the final link comprising entrepreneurial projects at Baccalaureate and Vocational Training Cycle level.

Furthermore, since 1992 they have led the *Semillero de Proyectos de Valmalón* or "The Valmalón Project Hotbed" through which they support enterprising individuals who wish to assess the viability of their business idea. The Project also helps companies in their start-up and development by providing them with the necessary tools and skills to thrive and gives them the support and infrastructures they require to consolidate their growth should they decide to locate in the Mining Regions.

Technological Centres and R+D+i Institutions

The **Asturian Energy Foundation** (FAEN) is the Regional Energy Agency for Asturias. It acts as a collaborative organisation for regional energy industries, with its scope extending to the electricity, gas, renewable energies, oil sectors and associated areas, the energy and financial markets related to energy as well as other related sectors.

FAEN collaborates with the regional administration, businesses and Technological Centres to develop training and awareness schemes and also participates in European projects in the fields of energy saving and efficiency and the use of renewable energies.

The **Asturian Energy Technology Consortium** (AINER) has been set up with the idea of being a "common-interest" element to foster the cooperation of businesses specialising in the energy sector. AINER has obtained the Bronze Label of the European Cluster Excellence Initiative (ECEI) and is coordinated by the Asturian Energy Foundation. Its work areas are electricity, fossil fuels, construction and renewable energies.

The **Centro Tecnológico del Diseño y la Producción Industrial** (PRODINTEC), is a technology centre specialised in design and industrial production. Its principal line of research is focused on the design and development of Pilot Lines for the advanced manufacturing of high added value products and as such it concentrates its efforts in Factory of the Future technologies.

The **Centro Tecnológico de la Madera** (CETEMAS) is intended to promote research, development and innovation in the Vegetation-Industry value chain. Their working areas are developing sustainable forestry, technology related to wooden structures and construction. It is a highly competitive centre in terms of renewable energy, forest industrial biomass and intensive energy biomass farming.

The **Information & Communication Technology Centre** (CTIC) and the **European Centre For Soft Computing**, are R+D+i organisations which provide support across a range of fields related to "smart-grid" management, the main foundation for Smart Cities. The application of ICT to these fields and data analysis translate into solutions for mobility, energy and sustainability, government, habitability and quality of life.

The **Technological Materials Institute** (Fundación ITMA) is a technological centre specialised in research and development projects into Advanced Materials for high value-added products and laboratory technology and compliance assessment services. Its specialisation areas are steel and metallic materials, plastics, nanomaterials, ceramics, refractory raw materials and photons. ITMA coordinates the Refractories Cluster in Asturias made up of the main companies in the sector.

The **Centro de Investigación y Desarrollo de Avilés** (ARDC, Avilés Research and Development Centre), belongs to Saint-Gobain Glass, whose central R+D+i department is located in France. The Centre works on extremely innovative glass projects, such as the development of glass for solar energy.

5. Conclusions and proposals for the development of renewable energies and associated industries in Asturias

The future of the renewable sector in Asturias will be determined on the one hand by the very increase of renewable power generation in the region and on the other, by the possibility of consolidating and expanding the production capacity of local industries to respond to the growth of the Spanish and international renewable markets in Horizon 2030.

Among the most interesting local renewable development opportunities are launching an onshore wind farm repowering plan, promoting closed networks and photovoltaic self-consumption (or in hybridisation) especially for industrial consumers, promoting the use of biomass in the agro-food industry and fostering the urban heat networks and the use of thermal biomass in the rural area. Experts and investigators in marine energy are identifying new business opportunities in the development and commercialisation of floating structures for offshore wind farms, among others.

In order to maximise the opportunities for growth in the renewable energy industry in Asturias, a series of action lines are suggested here below:

5.1. Promote the planning and development of renewable energy in Asturias

As has been made clear in the above sections, despite the fact that renewable energies are a significant reality in Asturias, both in terms of companies associated to the value chain (manufacture of components) or the exportation of these technologies and in the presence of several renewable generation facilities (biomass, wind, hydro...), at this stage there is still yet to be specific and adequate planning for development in the region.

Compliance with European decarbonisation targets for 2030 obliges administrations to plan measures for carrying out the energy transition. In February of this year, in parallel with public consultation the Spanish Government presented a draft of its Integrated National Energy and Climate Plan (NECP) to the European Commission, in which it pledges to reduce CO2 emissions by 20% by 2030 compared to levels in 1990 and to cover 42% of its end-use energy demands using renewable sources. For renewable electricity, the penetration goal is 74% by 2030.

The Principality of Asturias must compile its own **Renewable Energy Plan** in which it establishes its contribution to these state objectives and approves measures for the promotion of different technologies. To accompany this Autonomous Community plan, we propose the development of specific studies on the potential for job creation related to the expected renewable energy scenarios.

This renewable energy planning in Asturias must be coherent and run in harmony with the Renewable Energy and Energy Efficiency Development Plan for the mining territories (2018-2023) which sets out an Urgent Action Plan for the mining regions which has been included in the Framework Agreement for a just transition from coal mining and sustainable development in the mining regions for 2019-2027. Said Renewable Energy and Energy Efficiency Development Plan is pending drafting by the Institute for the Diversification and Saving of Energy (IDAE) of the Ministry for Ecological Transition.

The very mechanisms set out in the mining Framework Agreement (2019-2027) must be actively exploited in order to drive renewable energy in these areas, specifically by way of grants envisaged for the funding of new business facilities (which may be renewable) and the mining region alternative development grants (carried out via agreements between the IRMC and the CCAA). The projects which are eligible for the latter can include the improvement of equipment in transformation and electrification centres, the renovation and provision of energy diversification lines or forest recovery and treatment projects for eradicated areas.

These potential grant lines for renewable energies derived from the mining Framework Agreement may be complemented by the grants regu-framework of subsidies for renewable technologies (electrical and thermal) being prepared by IDEA and which may possess specific funds for mining areas pursuant to the aforementioned plans.

Evidently, renewable energies are currently being developed on a global scale and in Spain as a result of improving technologies and falling costs over recent years, as well as the regulatory framework established by the European Union to support this. The future Integrated National Energy and Climate Plan (INECP) set to be approved by the Government before the end of 2019 will have a notable impact on development but autonomous administrations must go along with this transition process by planning measures to drive it, according to the administrative competencies and financial resources at their disposal.

Furthermore, in terms of electrical generation, the closure of the Asturian thermal plants envisaged for 2020-2030 will leave significant gap, resulting in what would be an underdeveloped electrical purchase and distribution infrastructure, should it not be replaced by new renewable power.

Following the recent tender processes for new renewable energy in which contracts were awarded for more than eight thousand megawatts in renewable power, it looks as though only a small proportion of this will take place in Asturias. This is largely due to the fact that, in free competition, the Asturian location simply cannot compete with other Autonomous Communities in terms of renewable resources. In order to promote growth for future contracts, the following measures are proposed:

- Specific tendering processes by region according to renewable resources available
- Give priority to the mining regions or those in which closure of coal power plants is expected
- Specific tendering processes by technology and scale. In Asturias, the smaller facilities are the more viable options. In terms of technologies, the biomass or hybrid plants are the most appropriate and in the previous bidding process design, there was no room for these.

It is also vital to promote the repowering of existing wind farms. The Wind Energy Association (AEE) calculates that by 2020, half of the 23,100 MW of plants currently in place will be over 15 years old and 2,300 MV will have exceeded the 20-year period for which they were designed. Repowering entails several advantages given that this farms are housed in the best locations with optimum wind resources. Replacing old, low-power wind turbines with more modern versions results in a significant increase in a wind farm's total power output, improved efficiency and performance, more operating hours, etc. and minimises its environmental impact. This growth method is particularly convenient in Asturias, where there are few new locations available. In 2020, more than 20% of existing wind farms in Asturias will be over 15 years old.

For all these reasons, specific tender processes or other strategies for the repowering of existing farms are required.

5.2. Boosting distributed generation and self-consumption

Alongside tender processes for higher capacity installations, a significant upturn in distributed and self-consumption facilities is expected. Thanks to the Royal Decree-Law 15/2018 on urgent measures for the energy transition and consumer protection and the Royal Decree on energy self-sufficiency pending imminent approve, several barriers which existed to self-consumption have been removed and it has suddenly become extremely viable both for domestic and industrial consumers alike.

New regulatory conditions and the falling costs of photovoltaic technology mean selfconsumption facilities no longer require grants in the majority of Spain's regions. However, given Asturias has less solar resources (an average of 900 sunshine hours per year, compared to the Spanish average of 1,200), public aid is indeed justified. The association of companies in the sector (UNEF) estimates that the return on investment period is two years longer than in the rest of Spain.

The majority of autonomous communities have support in the form of subsidies for selfconsumption facilities, but Asturias has never had any kind of assistance system for selfsufficiency as such, but only for isolated installations (not linked to the electrical grid).

These subsidies should be aimed at municipal, domestic and industrial installations.

The industrial sector, as has already been explained, is intensive in its energy consumption in Asturias and as such, self-consumption could well be a good tool in bringing down the energy bill. Closed networks and shared self-consumption across industrial estates must also be encouraged. For cases of higher levels of consumption, small and mid-power wind farms could also be an appropriate choice.

It's important to promote shared self-consumption facilities in the case of local organisations. These have two crucial benefits: on the one hand is the cost-saving advantages for municipal councils, who can then spend that money elsewhere; meanwhile they can also act as a tool against energy poverty since vulnerable consumers can be provided with free or discounted electricity from council-owned facilities housed in schools, health centres or other public buildings.

Furthermore, public administrations can establish measures to support self-consumption by setting relief from local taxes (IBI - Property Tax and ICIO – Tax on buildings, facilities and works) and simplifying and streamlining the paperwork related to works licenses or other council authorisations.

In terms of job creation, several studies¹⁰ indicate that renewable facilities for distribution and self-consumption generate more employment opportunities than centralised powerplants. These jobs are also more evenly spread over the territory and help to retain the population in rural areas.

¹⁰ "Autoconsumo de energía y generación distribuida renovable como fuente de empleo", ISTAS, 2014.

5.3 Promoting Thermal Use Renewable Energies

Biomass

The implementation of a sustainable energy model requires a commitment to promoting the development of biomass, one of Asturias' prime energy sources. The goal must be to foster sustainable and environmentally friendly ways of harnessing biomass, restricting other methods which may be detrimental to the environment. Therefore, we propose support aimed at the development of biomass providing the energy balance of the production-use system is positive and respects carbon neutrality. Agricultural and forestry waste, as well as energy crops themselves, must be linked to local and sustainable agricultural processes and cultivation with regard to water, fertilisers and mineral balance in the soil, and be free of transgenics. Furthermore, we should prioritise the exploitation of those resources which are surplus to requirements, nearby production centres and run on a small scale..

As we have outlined above, Asturias is home to abundant biomass resources, particularly forest waste.

Aside from the generic data provided by the Asturian Energy Federation (FAEN), the state-run company HUNOSA¹¹ has evaluated the surface area of its own forests (3,864 hectares) of which they calculate 1,565 are suitable for energy yield. They also have forestry projects underway in land recovered from mines in Mieres and Langreo.

Regardless of the fact new biomass plant projects can be set up in Asturias to generate electricity, fundamentally by way of the new power tendering processes envisaged, biomass development prospects in Asturias look to be headed down a thermal use line. In any case, it is important to scale the power output of new electrical biomass plants appropriately in order for them to take advantage of the wood resources within a reasonable geographical area, since making them profitable does not mean they'll be in competition with other biomass uses.

Beyond abundant biomass resources, we've also seen that Asturias is already home to bioenergy production companies and several facilities that could be replicated across other towns and regions.

Just like in other renewable energy fields, the promotion of facilities to exploit biomass has to come not only from the business sector but must also count on specific support from the administrations, essentially in two ways:

- Promoting, assisting with funding or facilitating installation projects from an administrative perspective (cogeneration, heating districts with heating networks, thermal, domestic biomass)
- Planning forestry policy in order to exploit forest waste biomass and that originating from other woody crops (apple trees, ...). This establishes not only a clear demand in the business and social sectors in Asturias but also on a national level because to this point, with a few exceptions, forestry policies have been few and far between and have failed to address measures for removing the main barriers to developing sustainable forest management. As such, it is vital to take advantage of the vast

¹¹ The HUNOSA Group is a state-owned business organisation dedicated to mining – the extraction and sale of coal – and the operation of a thermoelectric plant. HUNOSA Group is also present in the renewable energy business, in areas such as geothermal and biomass energies, as well as participating in world-leading research into modern CO2 capture and storage and co-combustion technologies.

technical knowledge existing in Asturias, provided by universities, technological centres and other experts.

A particularly important element is the use of biomass (or biogas) to promote the integration of renewable sources for thermal uses in industry. This field currently uses vast amounts of natural gas and it is important to start working towards its replacement. There are already several biomass facilities which supply steam for the food industry: conserves, the dairy sector, cereals, etc. It is a proven and profitable technology which can be easily replicated with the proper support.

The Principality of Asturias currently provides subsidies up to 35% for the installation of thermal generation through biomass for industry and it is vital that this support continues.

<u>Biogas</u>

It is well-known that Asturias has significant livestock numbers and that the waste from this industry represents an issue which is tough to manage. Livestock is one of the main fields in the south-west region of Asturias, where the development of alternative activities to mining presents greater difficulties. Energy recovery from livestock waste on the one hand helps to solve an environmental problem and on the other, improves the financial profitability of the industry.

Support for biogas in Spain has been somewhat lacking and subject to regulatory changes which have thwarted many existing biogas plants. The main regulatory framework must come from the state administration and the draft Integrated National Energy and Climate Plan presented by the government envisages explicit support for biogas, fundamentally for converting it into biomethane and injecting it into the gas network for thermal uses in industry at high temperatures or as a renewable energy source for transport.

In any case, given the abundance of livestock waste in the region, the Asturian administration must take measures for its collection and energy exploitation.

As indicated in the 'Special Plan for Local Councils in the Asturian Southwest' (*Plan Especial para los Concejos del Suroccidente Asturiano*) compiled by the University of Oviedo,¹² one measure for supporting industrial activity in the region is to: *"Support the development of an internal distribution network and biogas energy exploitation at the La Curiscada industrial park (Tineo), generated in the existing plant on site in order to promote the optimum use of a local, renewable resource".*

<u>Geothermal</u>

State-owned company HUNOSA already has a business area focused on geothermal exploitation from abandoned mines (Mieres University Campus, Alvarez Buylla Hospital and a project to extend it to other buildings).

The exploitation of mine water in Asturias still has some way to go in developing geothermal projects via heating networks for public or commercial buildings and homes. According to HUNOSA, in the central area of Asturias alone, the mines produce an annual minimum water flow of 36 Hm3. This is equal to an annual capacity of 267GWht, using heat pumps to take advantage of the low enthalpy geothermal energy of the mining works waste water. This

¹² "Plan Especial para los Concejos del Suroccidente Asturiano" Observatorio del Territorio, Departamento de Geografía, Universidad de Oviedo. 2016

harnessing of geothermal energy from mine water could provide heating for 87,000 inhabitants in these areas.

This would require not only significant commitment by HUNOSA, but also active collaboration with local administrations to boost and facilities these kinds of projects.

Beyond thermal exploitation, the disused mines can also be used to introduce pumped-storage hydroelectricity, mainly for the purposes of storing energy. This takes advantage of height disparities in the mines and the mine water contained within. In the context of the transition to renewable energies in which we find ourselves, with many new sources so intermittent, energy storage systems are naturally gaining increasing importance.

There is already a project of this type in León, based in the old Navaleo mine, which has been classified a Project of Common Interest (PCI) by the European Union, meaning it is in line for European funding. Furthermore, the pumped-storage hydroelectricity plant has a water purification system in order to avoid heavy metals filtering into the supply and resolving a serious environmental problem.

5.4 Energy Rehabilitation

Energy rehabilitation must go hand-in-hand with increased renewable energy integration in the cities. Reducing buildings' energy consumption is the first step in appropriately scaling the renewable energy generation facilities, not to mention best choosing the renewable resources to be used in accordance with demand. In this regard, with the nearly zero energy buildings, a significant electrification of demand in the domestic sector is expected.

According to the most recent housing census by the *Ministerio de Fomento* in 2011, just 6% of homes in Asturias have been built after 2008, the date from which the Technical Building Code came into force stipulated minimum energy efficiency requirements for new build homes. Furthermore, some 38% of housing in the region was built between 1960 and 1980 when energy efficiency standards were particularly low.

As such, an Energy Rehabilitation Building Program must be set up in Asturias, with ambitious funding available in particular for the comprehensive rehabilitation of neighbourhoods of old housing with insulation deficiencies and a population at risk of energy vulnerability. Energy rehabilitation is extremely job-intensive¹³ and aside from the improvement in climatization, it would allow the incorporation of renewable thermal energies.

5.5 Promotion of the renewable energy equipment manufacturing industry in Asturias

As we have previously mentioned, Asturias already has a significant fabric of companies in place associated to the manufacturing of equipment and components for a range of renewable technologies (wind power, thermoelectric solar, photovoltaic...) which supply both the domestic renewables market and have a strong export trade.

The Workers' Commissions (CCOO) are weighing into the debate during the drafting of the Integrated National Energy and Climate Plan and the Just Transition Strategy, impressing the

¹³ "La generación de empleo en la rehabilitación y modernización energética de edificios y viviendas", ISTAS 2011.

need for specific coordination between the Ecological Transition Ministry and the Industry Ministry in order to develop the manufacturing industry for renewable energy equipment and components to ensure it is sufficient to deal with the demands of newly constructed renewable power facilities in Spanish factories. There now appear to be plans in place to establish a Working Group between the two ministries.

A measure to ensure a certain percentage of capital goods for new facilities built in domestic territory are also produced in Spain is that this requisite must be articulated as mandatory when it comes to launching renewable energy tendering processes. Demands should be in place whereby companies participating in the bidding must guarantee the equipment and components will also be produced in Spain. Another potential formula is, using green and responsible public adjudications, to promote this kind of demand in public renewable energy project tenders. This scheme is already being applied in several countries, such as Brazil, Mexico or Australia, and within the European Union, in Great Britain, where one of the conditions imposed on companies in order to be considered in the bidding is that a proportion of the capital goods installed have been manufactured in the same country.

Administrations in Asturias competent in industry and energy should assess this issue and contribute to the implementation of measures. They must also engage in constant and fluid dialogue with the production companies of the sector and renewable energy developers, alongside their associations, in order to aid facilities in Asturias being built using a large percentage of products from the region.

5.6 Exemplary efforts by town councils

The Autonomous Community of Asturias and the region's town councils can have an active role to play in incorporating renewable energies and the energy management of their buildings and facilities which, beyond contributing to the energy transition, can also foster local industry and employment. Actions they could take are related to:

- Incorporating renewable energy facilities into their existing buildings (biomass, geothermal, solar thermal, solar photovoltaic, mini-hydro, etc.). In some cases they could even provide thermal or electrical energy to homes in the surrounding areas. This is a case of building on the experiences which already exist in certain towns in Asturias, many of which have been mentioned above.
- Implementing energy management systems in public buildings, including measures to monitor power and energy consumption in their facilities.
- Energy rehabilitation programs for public buildings, improving insulation and the building envelope in order to reduce climatization consumption.
- Promote the integration of renewable energies in cities, both in private buildings and urban public spaces through:
 - State support in the form of public grants and tax incentives for companies and citizens which promote innovative measures for architectural and urban integration.
 - Assessing the potential surface area available in order to increase the installation of renewable energies in the city. Uncovering primarily roofs and large-dimension spaces with the intention of obtaining facilities with the best possible cost-benefit ration.

• The creation and adoption of town planning legislative measures will contribute to the expansion of these facilities in cities.

Asturias is home to public bodies like the Asturian Energy Foundation and state-owned company Hunosa which play a crucial role in the growth of renewable energies in the region. Boosting their contribution could help to increase investment and the implementation of model and experimental projects – particularly for fledgling technologies – leading to a subsequent "pull effect" on the market.

5.7 Industrial and Business Environments

The implementation of renewable energies in industrial activities, which are large power consumers, increase the financial competition and facilitates employment retention.

Industrial and business parks are ideal places to promote distributed generation and selfconsumption. Primarily because they have large surface areas available (land, on warehouse roofs...) to house their own renewable facilities. These also provide a defined space where large energy consumers are grouped together and closed networks can be developed, smart management grids which boost business relationships.

In an industrial region like Asturias, the regulation and implementation of Smarts Grids or microgrids will be vital in expediting the energy transition in these activity centres and favouring industrial symbiosis.

Local organisations could lead strategies to coordinate public and private stakeholders and establish mechanisms to incentivise the integration of renewable energies in high-activity centres in peri-urban areas like shopping and leisure centres and industrial or business parks.

Another key element in supplying renewable energy to industrial environments will be the promotion of direct purchasing by way of PPAs (Power Purchase Agreements). In Spain, this way of buying green energy has not become quite as widespread as in other European countries and could be a model which caters for the energy-intensive industrial consumer profile.

Lastly, it would be extremely useful for bodies such as FAEN to compile assessments of wind and photovoltaic resources present in industrial estates and business parks in order to promote industrial self-consumption. They also have a big role to play in driving industrial heat recovery projects.

5.8 Education and Training

The energy transition does not only refer to the substitution of certain technologies by other cleaner alternatives, but rather involves a large-scale economic, social and cultural transformation. Energy transition requires a shift in mentality towards more sustainable energy-use trends, as well as active participation by citizens, businesses and new stakeholders in a community energy model. It is also vitally important to create a bridge between the past and the future of Asturias, between the historic mining identity and the new society and sustainable economy project which will favour the economic and social progress the region requires.

In order for this to succeed, we will have to launch initiatives designed to raise citizens' awareness and provide them with information, we will need to educate those in charge of making the decisions and retrain and upskill the local workforce for new economic activities.

Indeed, training must be one of the crucial strategic lines in facilitating the alternative economic development in the mining regions.

Across all the energy technology subsectors assessed, we have encountered the need for a qualified workforce. This applies particularly to photovoltaic and wind energy in the installation and assembly tasks, and also in the facility engineering and design phases. In every sector, there is also a demand for qualified staff in areas of electricity, plumbing and machine operation, etc.

However, there is currently no vocational training on offer (data for 2016-2017)¹⁴ specifically related to renewable energies, with only one advanced diploma available in Energy Efficiency and Solar Thermal Energy at this stage.

As such, we propose increasing the **regulated training** on offer, specifically in terms of training cycles for the renewable energy sector.

With regard to **occupational training**, we propose replicating a training program which has enjoyed success in the construction sector, bringing it to the renewable energies and energy rehabilitation industry. This would entail vocational training courses at the Professional Training School (*Escuela de Formación Profesional*) developed by the Construction Labour Foundation of the Principality of Asturias. These courses were run within the framework of the FORMIC Program through collaboration agreements between the Foundation for the Development of Training in the Coal Mining Regions and the Construction Labour Foundation of the Principality of Asturias from 2001 and 2004. The FORMIC Program was financed by funds from the Coal Mining and Alternative Development Plan for the Mining Regions.

A total of 354 unemployed people benefitted from training through this program across several mining towns, focusing on professional profiles for which the sector had detected a shortage, for instance in form work, steel fixing, excavation machinery, crane operation, etc. Several relevant factors stand out in an analysis of the results of the experience:

- 66% of the people trained are between 16 and 25 years old, which is in line with the most significant segment of local unemployment figures.
- 51% have attended school up to the end of obligatory education (EGB or ESO), demonstrating that many young people choose vocational training as a means of direct access to employment.

¹⁴ "Memoria de la Formación Profesional en Asturias – 2016". Consejo de Asturias de la Formación Profesional, 2018.

- 86% of the people trained have some association with the mining sector (either as unemployed workers in the sector or as children of active workers in the industry)
- Employability of students trained (2001-2002): 86% in the construction sector; 14.6 in other sectors; 3.3 remain unemployed.
- Employability of students trained (2004-2005) 79%

One of the key elements of this program's success was the fact the training was delivered by the companies themselves (through the Construction Labour Foundation) and as such they were well aware of the sector's workforce qualification requirements. This basic vocational training was ultimately far more effective than the training models financed by the mining funds for the descendants of mine workers, many of whom have not remained in Asturias.

In terms of **university education**, the board of the Polytechnical School of Engineering (EPI) of Gijón has approved the transformation of the degree in Electrical Engineering in order for it to include a specialisation in renewable energies and electrical smart grids. The content to be taught include photovoltaic systems, wind warms, energy storage, microgrids and geothermal energy.

Meanwhile, the Mining School of Oviedo has also proposed to the Management the idea of providing a Degree in Renewable Energies.

On the other hand, there is a definite social demand to support the activities at the Mieres University Campus. This local campus was the result of a more than 130-million-euro investment from mining funds and represented the first step in the implementation of a strategic project. The goal was to generate activity and employment opportunities associated with innovation which so far have been left undeveloped. The campus began with average occupation and activity levels but is now losing students and has failed to establish effective collaboration channels with the local business network. In 2001 it had 1,600 registered students but by 2016 that number had fallen to barely 700. It is currently offering just four qualifications and currently accounts for just 8% of the total volume of the University despite having more modern facilities.

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