

# *Asturias-Spain: Current Situation and Strategic Proposal*

COAL REGIONS IN TRANSITION PLATFORM

Working Group Meetings and High-Level Dialogue on Financing and Investments

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Principado de Asturias Government

Brussels - 12th 13th july 2018

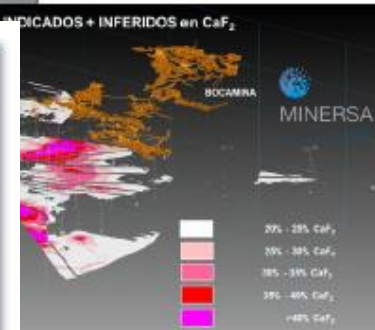
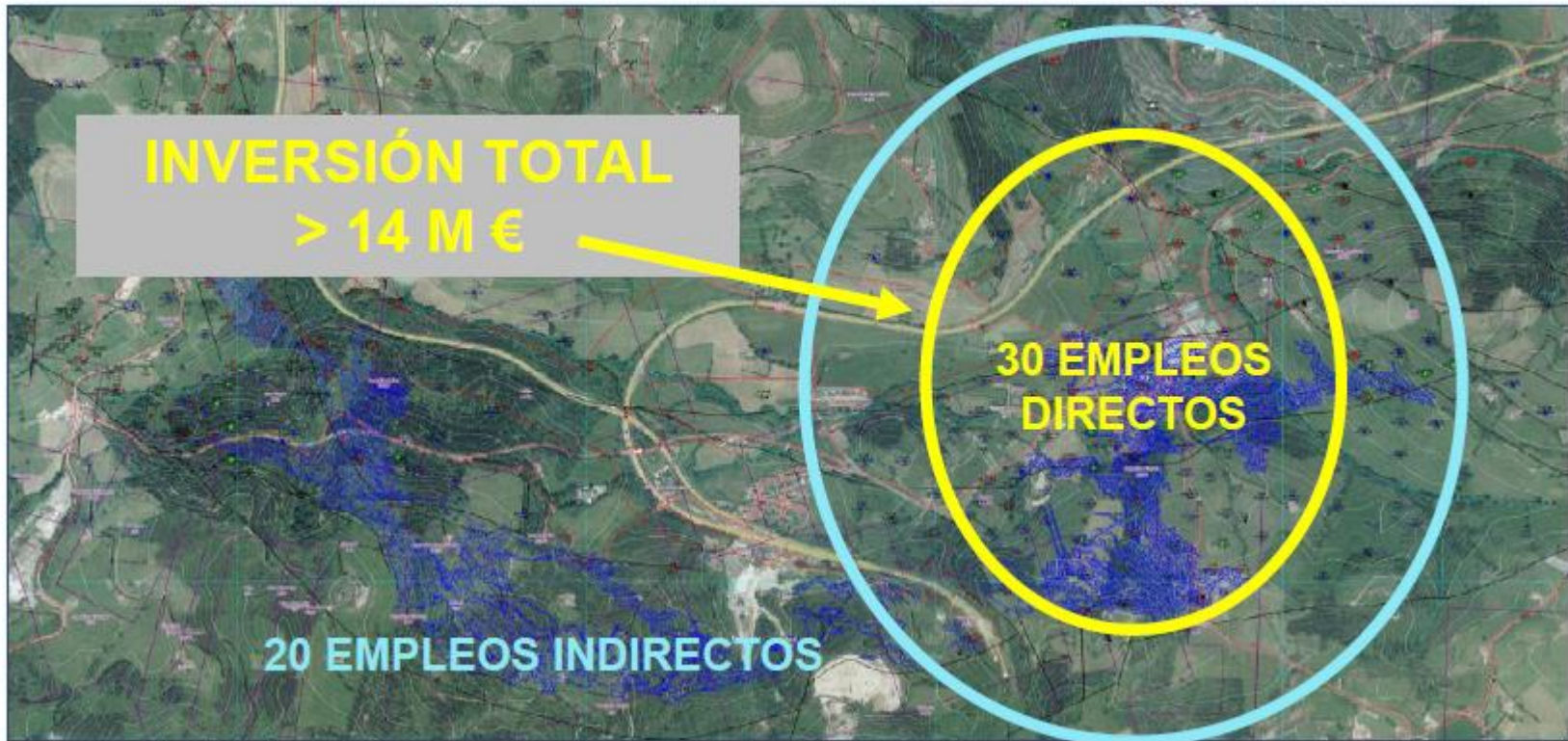
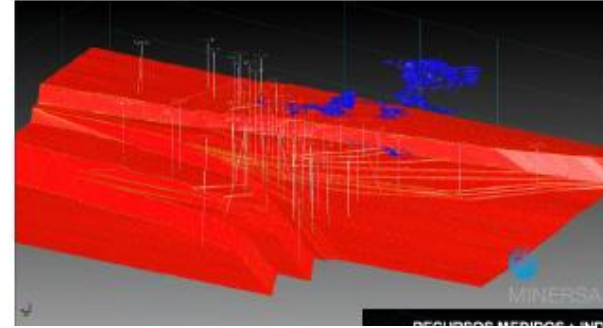
## WHAT??

# EFFICIENCY+ NEW ACTIVITIES + SUSTAINABLE INDUSTRY+ TECHNOLOGICAL DEVELOPMENT+ ADDED- VALUE PROJECTS + GREEN CIRCULAR ECONOMY

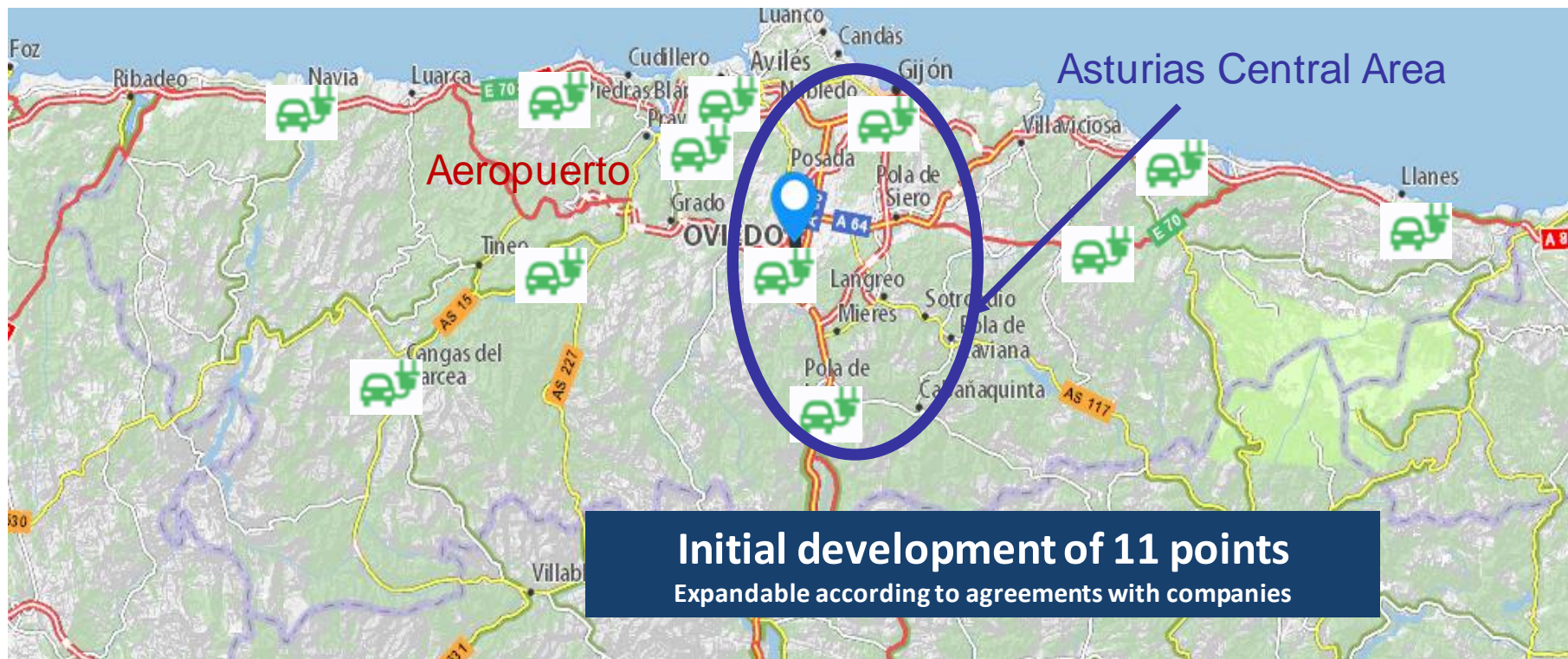
- Promoting the use of residual energy from industrial processes.
- Recovery of surplus industrial heat flows, with the aim of improving the process performance.
- Dual perspective: recovery of heat in origin (generation from Power Plants) and in final use (industrial processes).



# WHO ARE WE?? TOWARDS MINING 4.0 AND INDUSTRY 4.0



## Development of the basic network for fast recharging points



Universal, public access network



Payment through mobile APPS

Network of fast charging points



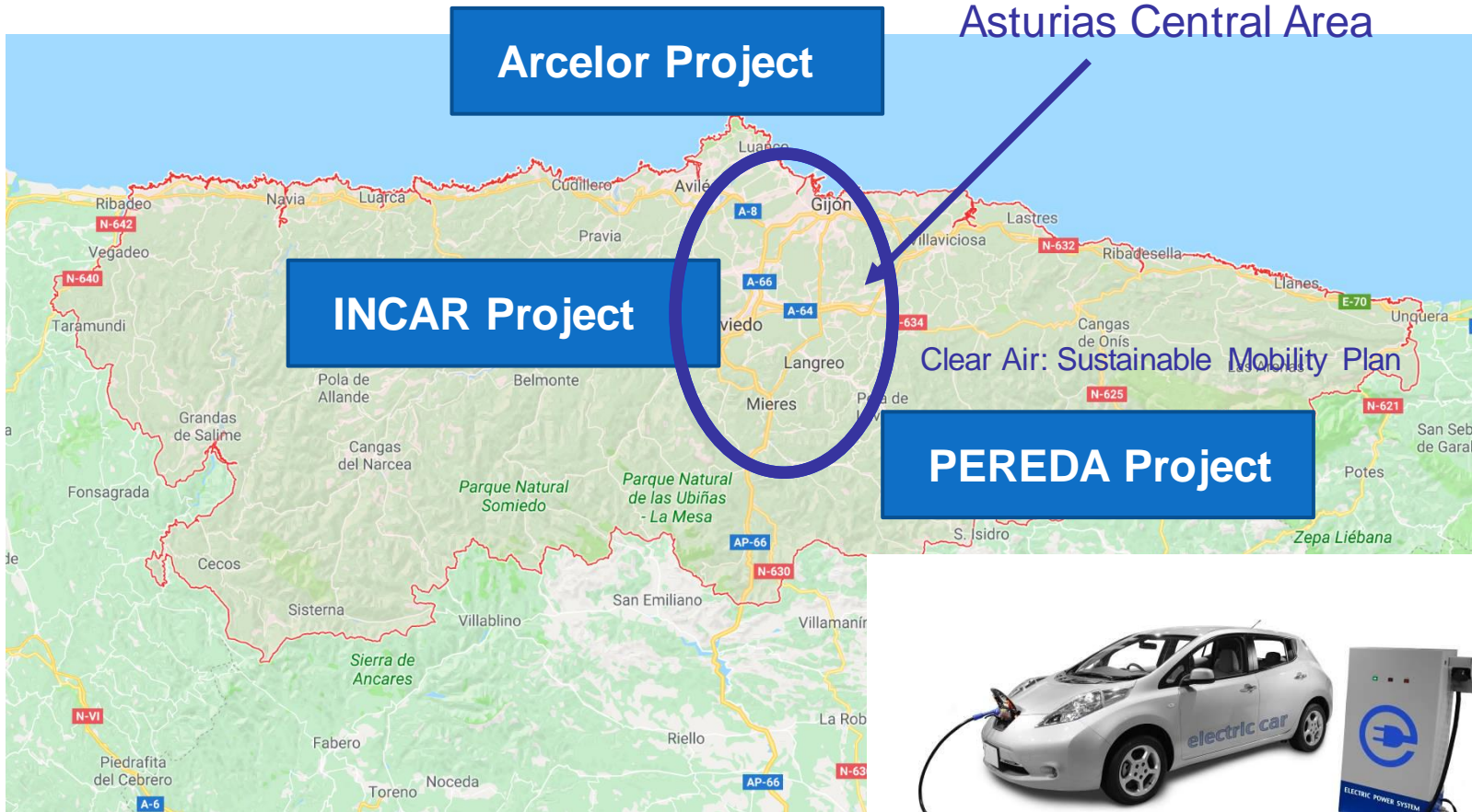
Fast charging (80% battery in 30 minutes)

Accessible locations: main roads



3 Axis 1central area, Asturias coast, SW-SE

# Strategic Proposal: HOW???

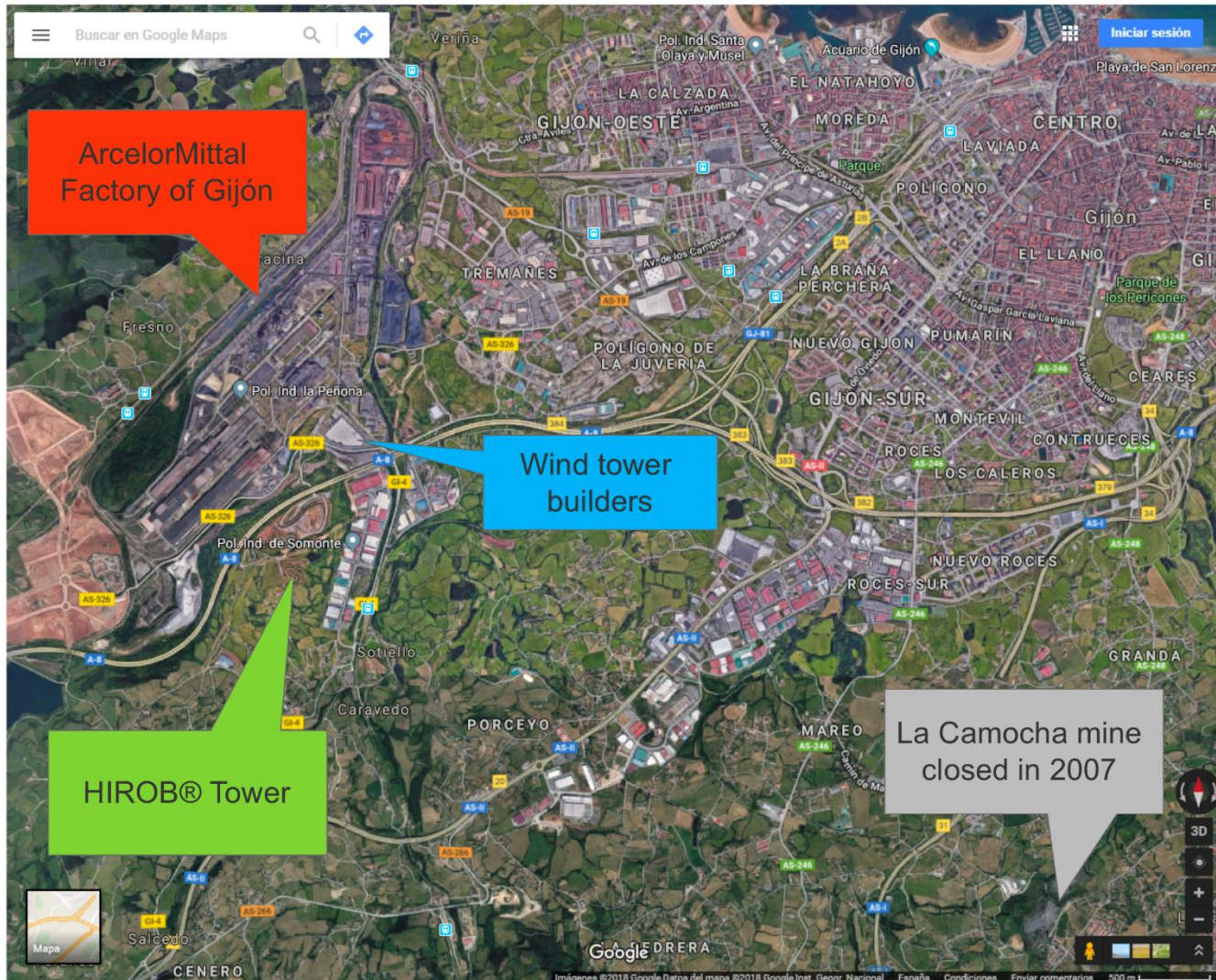


# Not only miners... Metal workers



ArcelorMittal

## The Location HIROB® Tower



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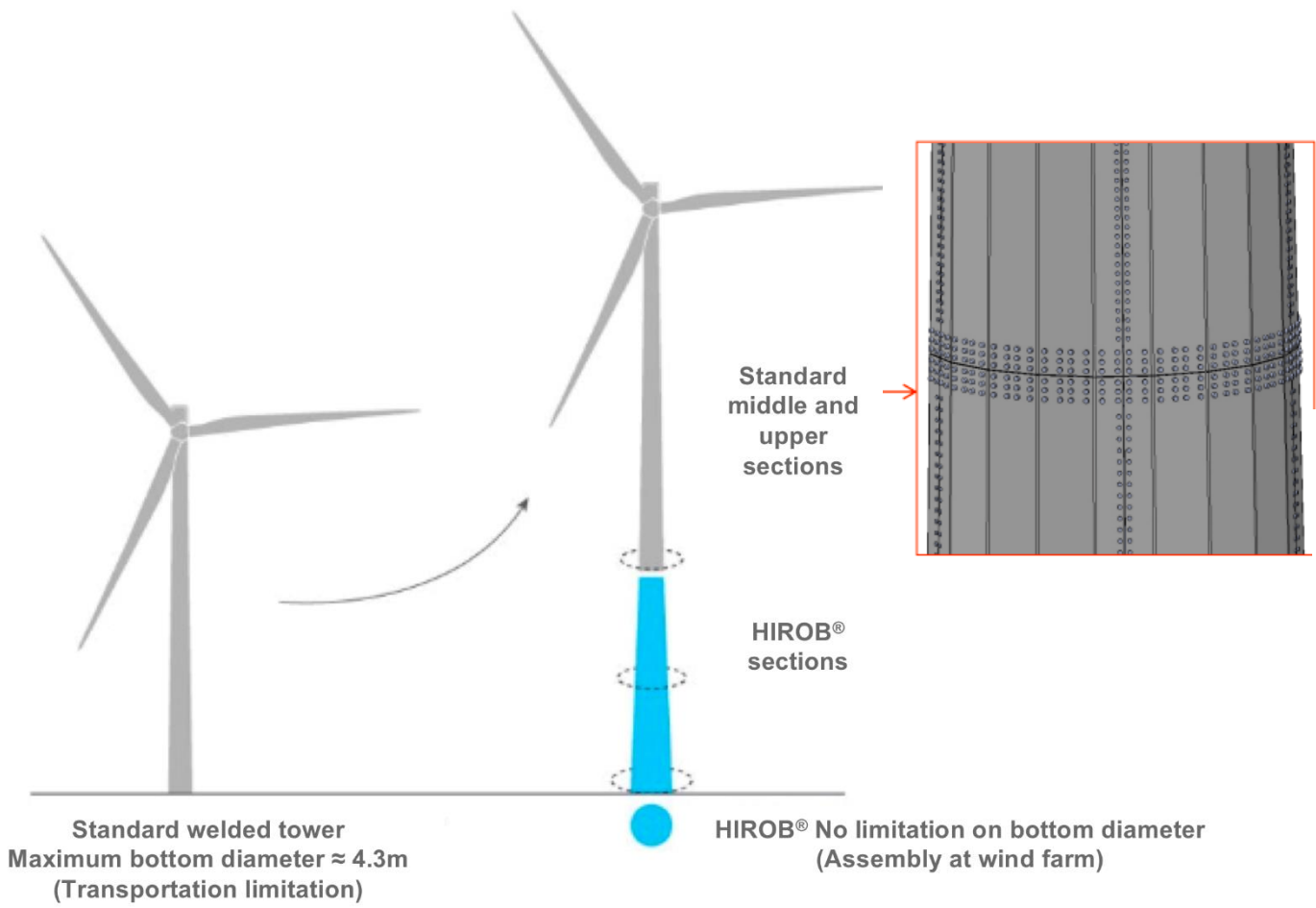


Date



# ArcelorMittal High Tower Solution

HIROB® Tower



### Tower main characteristics

- ❖ Tower fully made of steel
- ❖ Tower fully connected with bolts
- ❖ Polygonal cross section (bended plates)
- ❖ Composed by several segments
- ❖ Assembly on site

- Smart Grid control
  - Control of fluctuations
  - Energy storage solutions
    - Salts
    - Hydrogen

# ArcelorMittal High Tower

## HIROB® Tower

ArcelorMittal



ArcelorMittal

SIEMENS Gamesa  
RENEWABLE ENERGY



DACERO  
tratamiento integral del acero



WINDAR  
renovables



Hierros Cantón, S.L.

Circular Economy

Technology for Replication

Fully Recyclable

Local Supply Chain

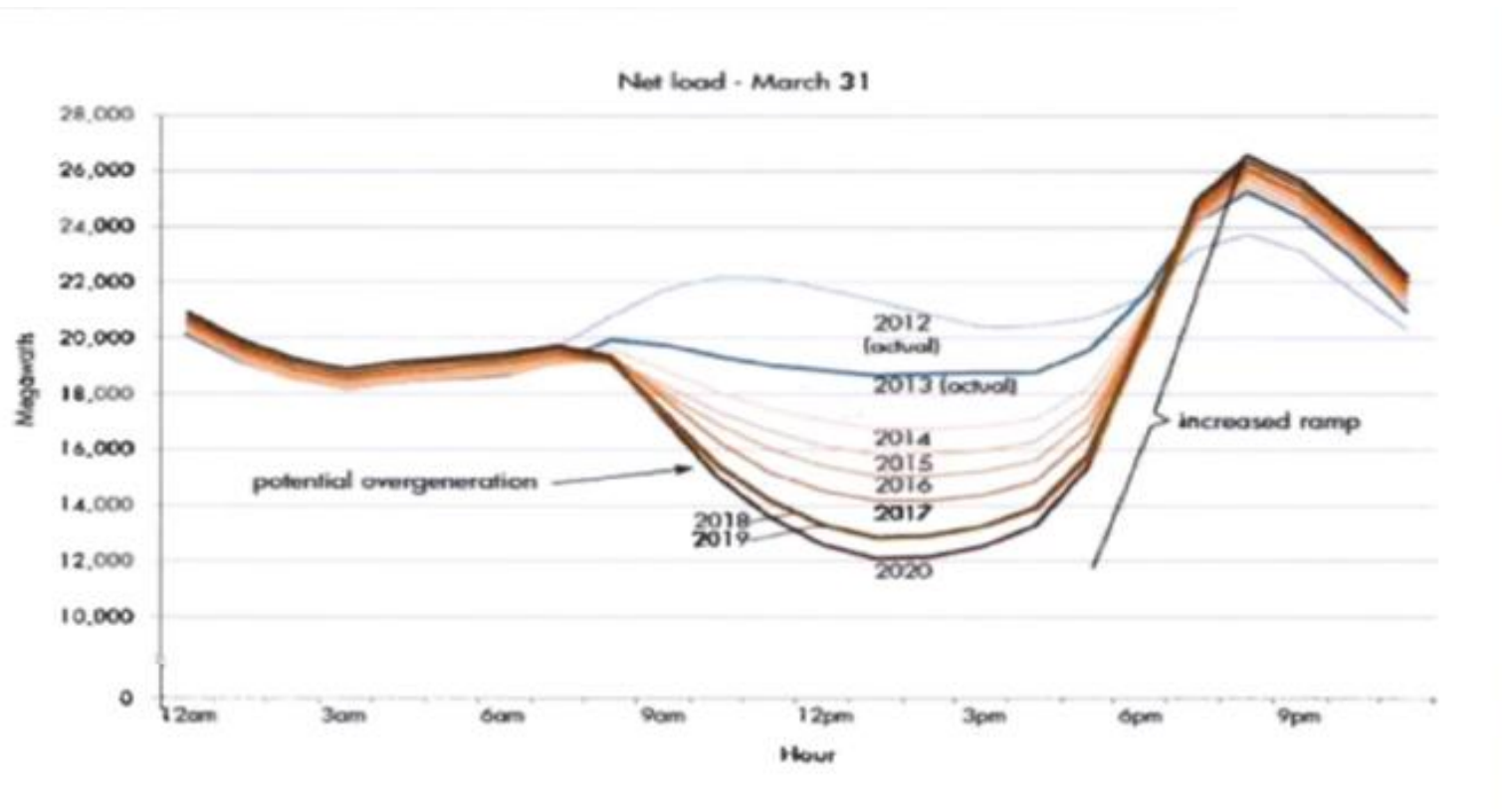
Specialized Jobs





## UNCONVENTIONAL STORAGE FOR RENEWABLE ENERGY

Increasing presence of renewable energy, particularly solar photovoltaic and wind generates a need for energy storage...

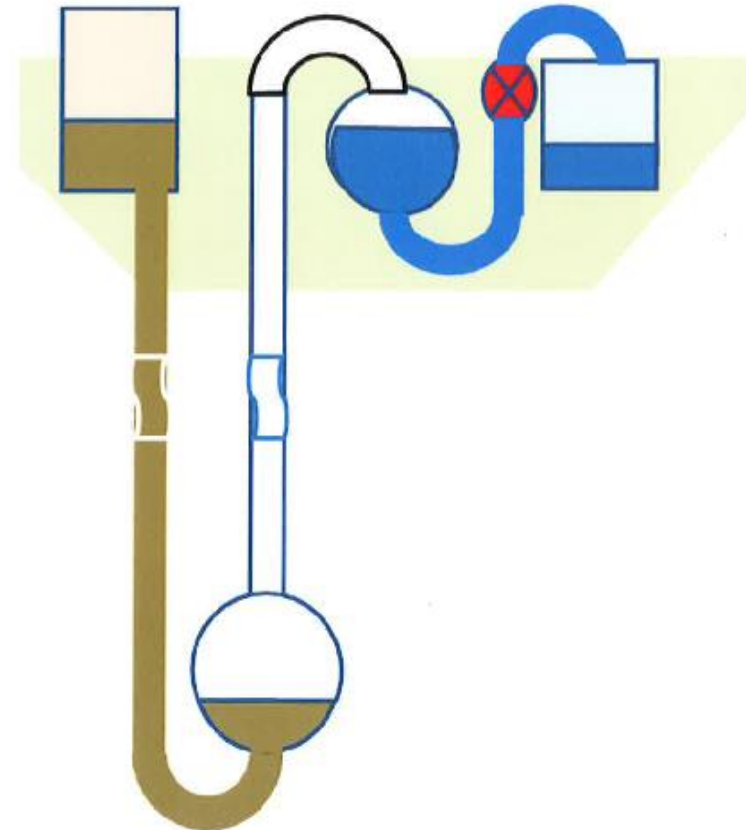


...in California there is a new valley time at 14 p.m.!!!

## UNCONVENTIONAL STORAGE FOR RENEWABLE ENERGY

Pumped hydro is by far the main storage option, but it is nowadays very difficult to displace population or even wildlife from flooded valleys. Unconventional options !!!

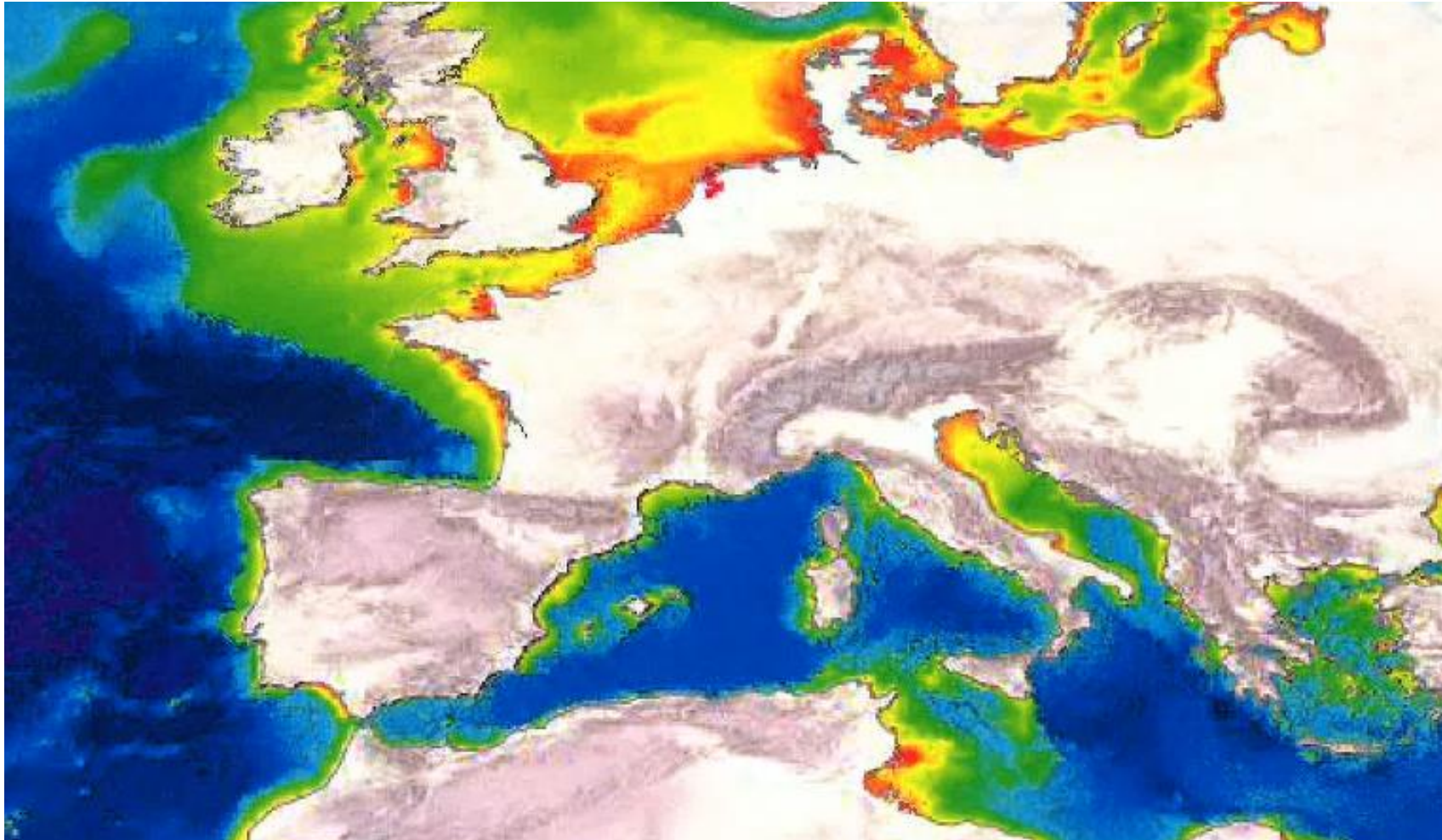
These projects with space and hydrostatic head constraints would benefit from using a dense working fluid in several ways, such a more compact equipment and reservoirs higher equivalent head



# UNCONVENTIONAL STORAGE FOR RENEWABLE ENERGY



All we need is topographic head on land or sea depth offshore. In southern Bay of Biscay, some 20 miles from shore in Asturias, northern Spain, depth is 4,700 meters (Aviles Canyon):



## **UNCONVENTIONAL STORAGE FOR RENEWABLE ENERGY**

Singular project in Asturias: *Please NOTE!!*

- ▶ Underground mines close to mining valleys that can provide 2,000 meters of difference of height.
- ▶ Industrial companies and working force with a wide experience in mining, manufacturing, pumping, materials,...
- ▶ Gijón & Avilés port facilities.

# Strategic Proposal: WHY???



ENERGY TRANSITION of the Central Asturian Mining Area

Project  
Proposal



Coal Regions in Transition Platform

CIRCULAR  
ECONOMY



▶ CoalAst360Economy



In the future scenario, all the mentioned activities will be integrated in a process of **Circular Economy** for the generation of **Clean Energy** with the aim of **keeping employment and industrial activity in Asturias**.

Nevertheless, the region requires a transition period (2019-2021) in which it is essential **to continue having only one mining well in production in order to keep on carrying out research in the area of eco-combustion by CO<sub>2</sub> capture**. During this period of transition, it will also be **necessary to adapt La Pereda Power Plant for its new uses**.

The Project **CoalAst360Economy** is supported by the Government of the Principado de Asturias through the Ministry of Employment, Industry and Tourism, which is a member of the Coal Mining Regions in Transition Platform

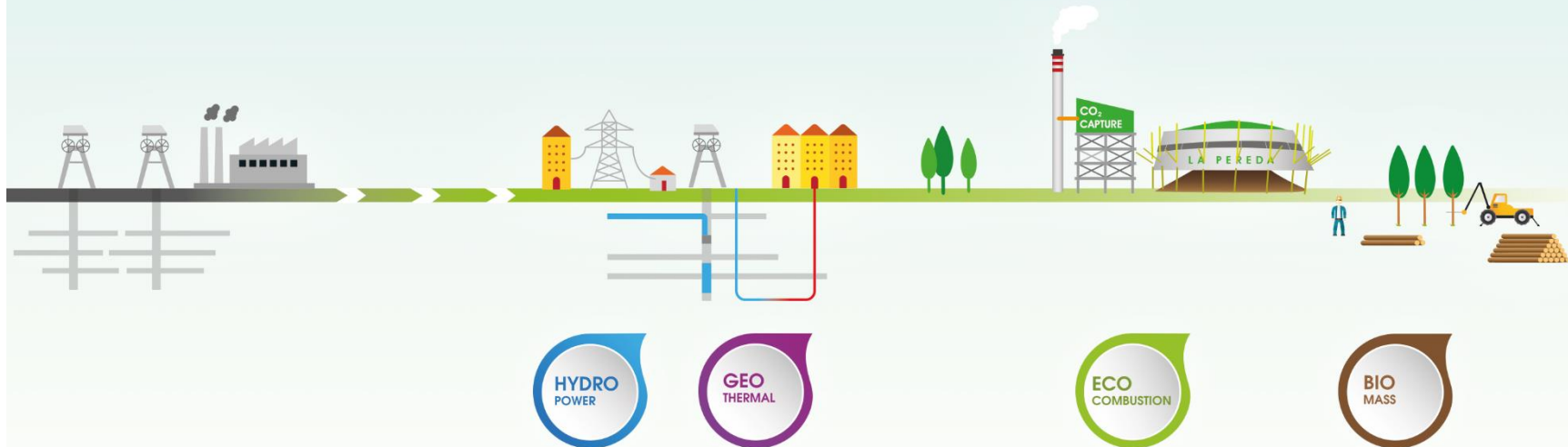


ENERGY TRANSITION of the Central Asturian Mining Area



# Transition to Clean Energy

2019 - 2021





## Future Scenario

2022



## Strategic Proposal: WHEN???



**La Pereda Power Plant** will receive solid waste, sewage sludge, regional production coal, mine waste material and byproducts from the coal washery aiming to produce **Clean Energy**.

This will be possible by means of the reduction of atmospheric emissions derived from the substitution of up to 50 % of coal by other cleaner fuel, together with the **CO<sub>2</sub> Capture Plant**.



### INPUTS

- Solid Recovered Fuel
- Regional Coal
- Mine Waste
- Sewage Sludge
- Byproducts from Coal Washery

### OUTPUTS

- Clean Energy
- Ash Recovery





# Motivation and objective of the project

## Use of alternative fuels in Calcium looping CO<sub>2</sub> capture systems for back-up power plants

Coal power plants undergo flexible operation with load changes and partial load operation. Even, there are expected to operate as back up in markets with a large share of renewable energy.



### OBJECTIVE

Development of CO<sub>2</sub> capture systems able to follow the operation modes of back up power plants

The transition to a more circular economy requires actions on the waste management area and the efficient energy recovery from waste



### OBJECTIVE

Use refuse derived fuels in power plants with reduced environmental impact

## La Pereda pilot plant



### European projects:

- CaOling**: Development of post-combustion CO<sub>2</sub> capture with CaO in a large testing facility operating conditions equivalent to large-scale industrial units and integrated in a commercial plant (2009-2013)
- ReCaL**: Novel calcium looping CO<sub>2</sub> capture process incorporating sorbent reactivation by recarbonation (2012-2015)
- CaO<sub>2</sub>**: Calcium looping CO<sub>2</sub> capture technology with extreme oxy-coal combustion conditions in the calciner (2014-2017)
- FlexiCaL**: Development of flexible coal power plants with CO<sub>2</sub> capture by Calcium Looping (2016-2019)

## Example: La Pereda power plant

### Assumptions:

#### Power plant:

- Installed thermal input in La Pereda power plant:  $150 \text{ MW}_{\text{th}}$
- Capacity factor: 0.15
- $\text{CO}_2$  specific emissions:  $0.9 \text{ kgCO}_2/\text{MWh}_e$  ( $0.3 \text{ kgCO}_2/\text{kWh}_t$ )
- Annual  $\text{CO}_2$  produced in the power plant  $\approx 80\,000 \text{ t/year}$

#### Calcium looping system:

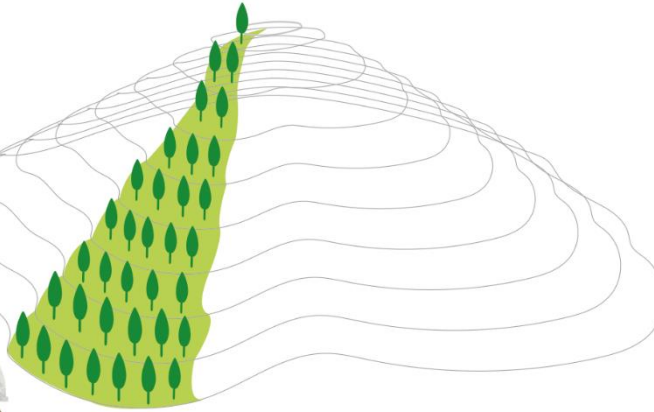
- $\text{CO}_2$  capture efficiency in the carbonator: 0.9
- Thermal input in the oxy-fired calciner:  $20 \text{ MW}_{\text{th}}$  (thermal input to the calciner respect to power plant = 0.13)
- Limestone consumption:  $45\,000 \text{ t/year}$  ( $F_o/F_{\text{CO}_2}=0.25$ )
- Annual  $\text{CO}_2$  produced by fuel combustion in the calciner  $\approx 70\,000 \text{ t/year}$  (fuel  $\text{CO}_2$  emissions:  $0.4 \text{ kgCO}_2/\text{kWh}_t$ )
- Annual  $\text{CO}_2$  produced in by fresh limestone calcination  $\approx 20\,000 \text{ t/year}$

**Total  $\text{CO}_2$  geological storage capacity  $\approx 160\,000 \text{ t CO}_2/\text{year}$**

**Capacity of silos  $\approx 6\,000 \text{ t}$  (assuming a sorbent with a capacity of 0.25)**



The land owned by **HUNOSA** provides **Biomass** to supply vapor, sanitary hot water and heating to the buildings and industries that are located in the central Asturian area.



Biomass Logistic Centre in Lieres  
(under construction)



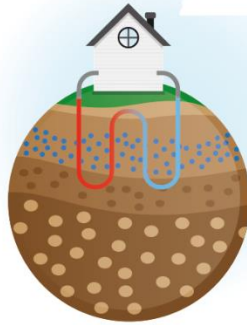
HUNOSA Forest



HUNOSA Energy Crops



**HUNOSA** is already taking advantage of the existing underground mining infrastructure after the closing of the mining activity in order to carry out successful **Geothermal Projects**.



**Current Geothermal Case Studies:**

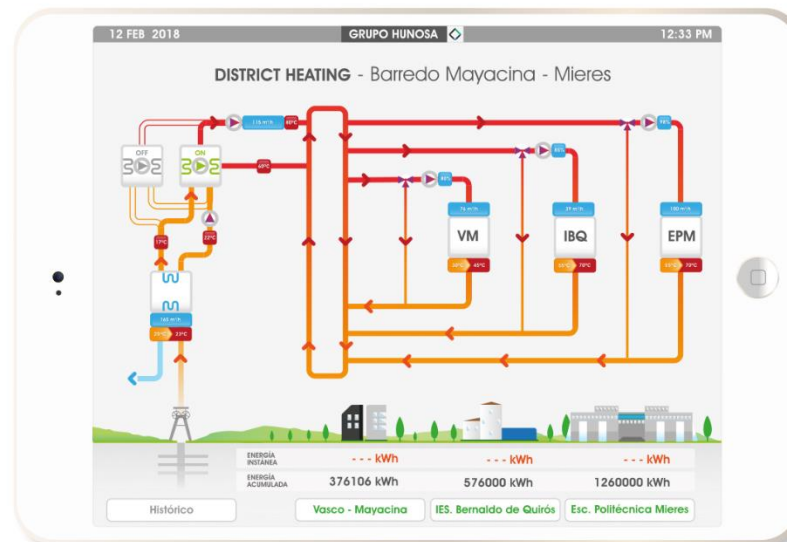
- Research Building of The University Campus of Mieres
- Alvarez Buylla Hospital in Mieres
- Energy Asturian Foundation

**New Projects (under construction):**

- Distric Heating in Mieres.



Research Building of The University Campus of Mieres





1- Hospital Álvarez-Buylla



2- Edificios Campus Universitario



3- Fundación Asturiana Energía



4- Instituto Bernaldo Quirós



5- Edificio M9 - Mayacina



6- Edificio M10 - Mayacina

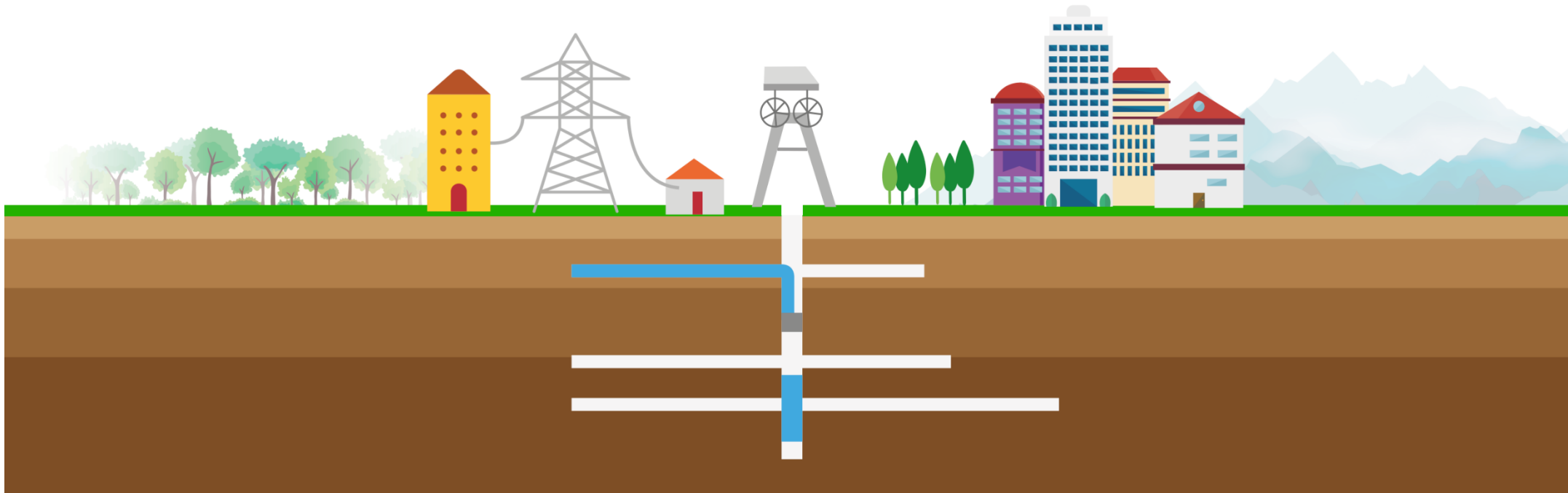


7- Escuela Politécnica Mieres





**HUNOSA** also intends to develop **Hydraulic Power Plants** associated with the mining wells.



# FROM NOW ON.....



**Core network corridors (high density in center of Europe):  
connecting Asturias to main electrical corridors**

**Connecting Asturias with their neighboring regions**

**Creating a Cantabrian corridor that connects with the electrical corridors in Europe**



- Financiable por Europa
- No Financiable por Europa

**Public-private collaboration in Asturias for its implementation**



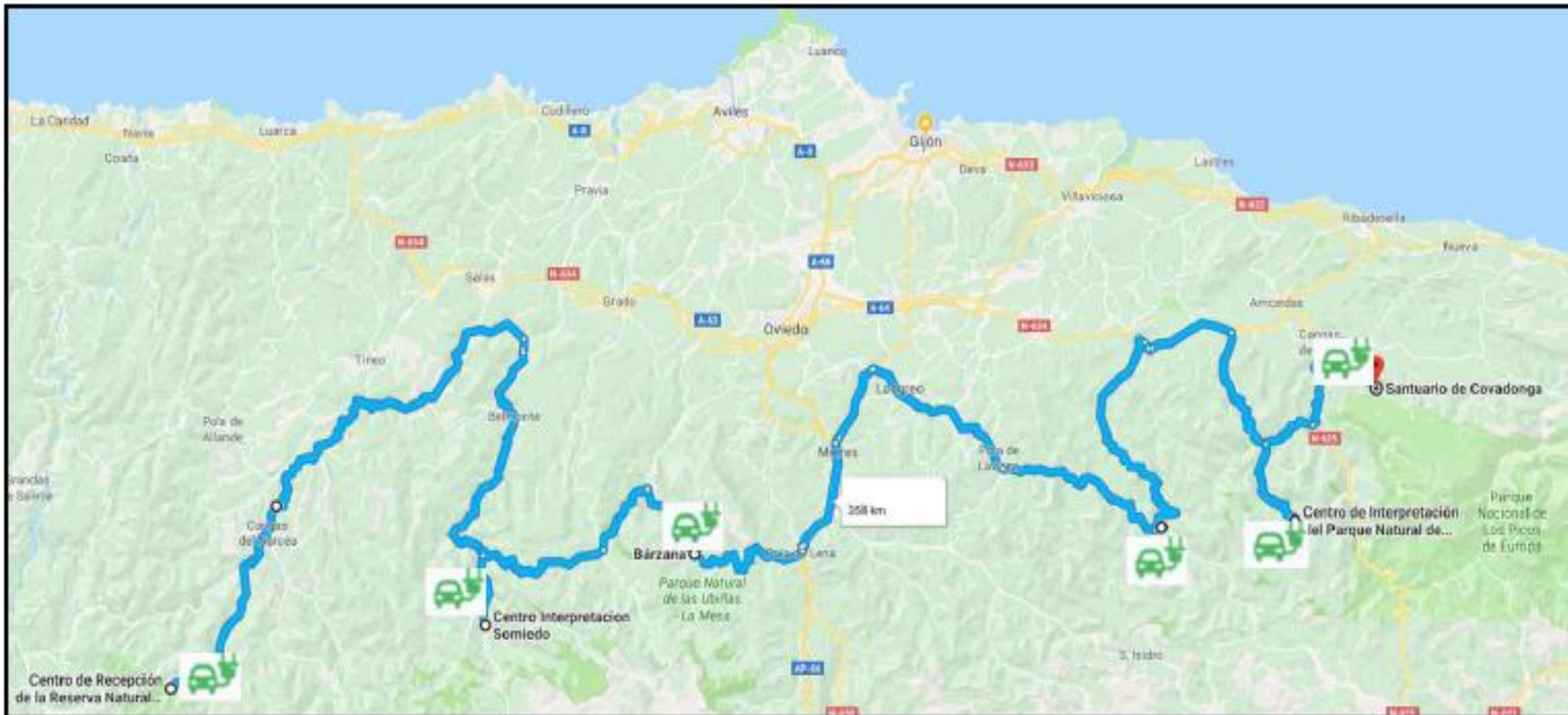
CIRVE project: 40 high velocity charge stations



- ▶ Project: 25 new high and ultra high velocity charge stations (20 in the North of Spain and 5 north of Portugal, to interconect with France and Portugal)
- ▶ 1 M€ in 2 years.
- ▶ New models of business, new capacities, formation
- ▶ Specific singular projects with new employments.



- ▶ In the following map it is showed : route to link the Natural and National Parks. The charging points will be sited in their interpretation centres. This route is of 358 Km.



# NATURAL RESOURCES.....



Reception Center of the Muniellos Nature Reserve



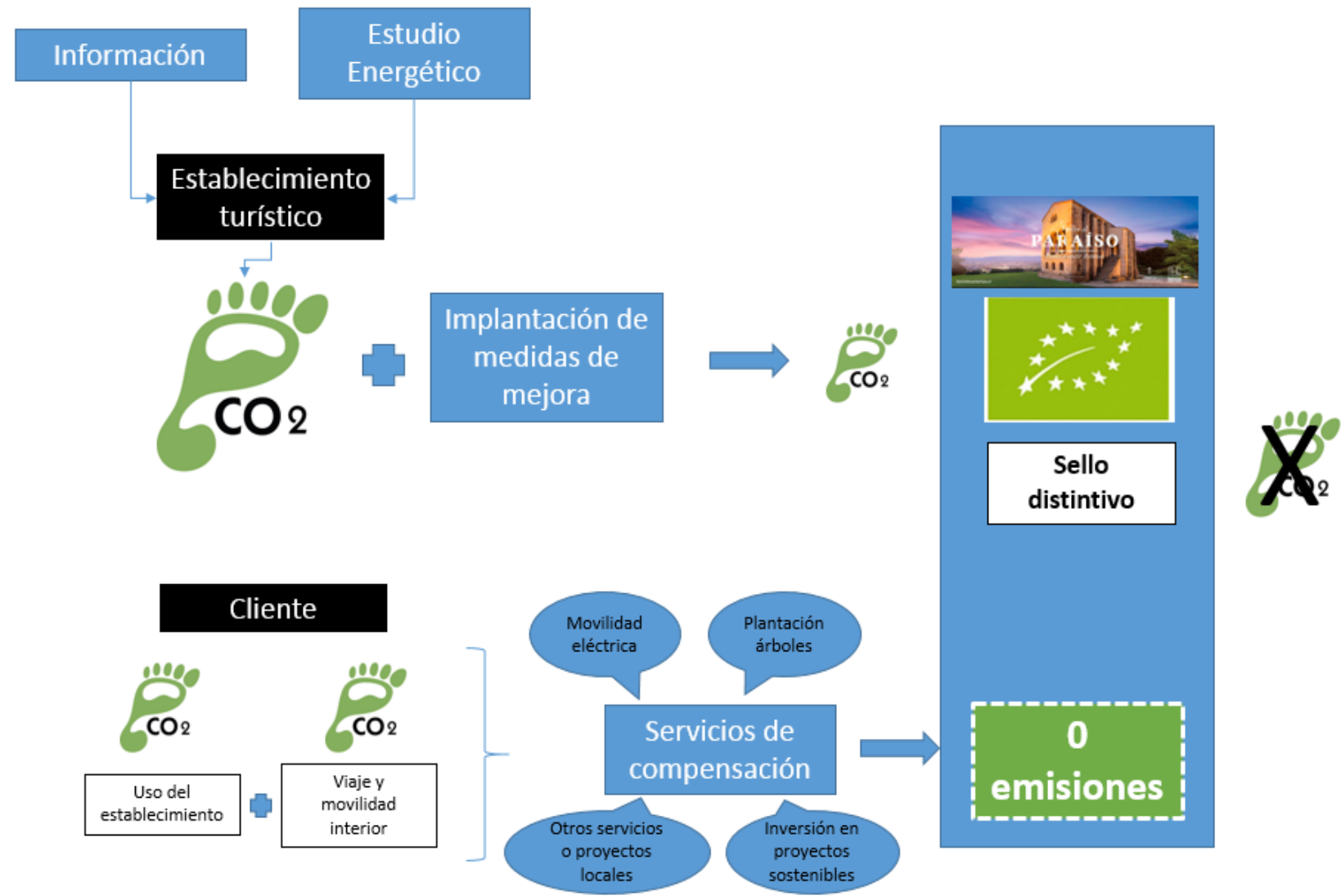
Covadonga Sanctuary



Interpretation Center of the Redes Natural Park



### ► Zero carbon tourism



## FAEN Proyecto Carbon...

Alojamientos Rurales  
Turismo Activo  
Agroturismo y Restauración  
21 vistas

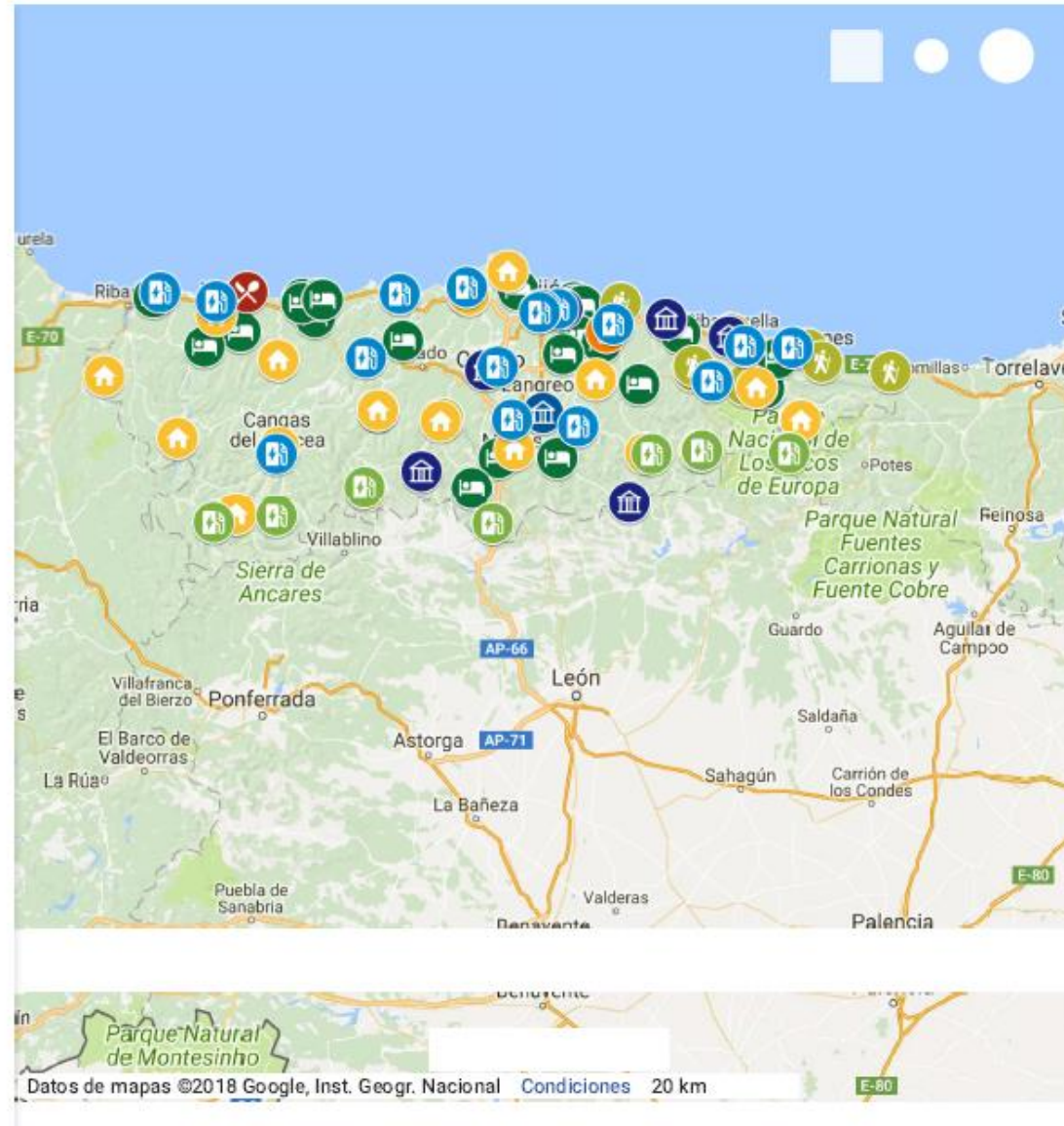
COMPARTIR

### Socios ASTURAS

- ALOJAMIENTO
- TURISMO ACTIVO
- AGROTURISMO
- AGENCIA DE VIAJES
- MUSEOS
- RESTAURACIÓN

### Equipamientos SRT/RECREA

- Museo del Jurásico de Asturias
- Centro de Recepción e Interpretación del...
- Centro de Arte Rupestre de Tito Bustillo
- Parque de la Prehistoria de Teverga



# Regional Administration

Museum  
infraestructure

Natural  
spaces

Equipments of  
touristic interest



Charging points network for electric vehicles

# *THANK YOU FOR YOUR ATTENTION*

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