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FROM DUST TO GOLD: PIJOVA ROCLA – A NATIONAL FLEDGLING PHOENIX

Cristina Cefai

Introduction

One would be forgiven for believing that Pijova Rocla is currently on its way to reclaiming its mid-twentieth century status as a modern urban environment in Central Europe. The city centre is looking fresh following intensive refurbishment. Trendy cafes are abuzz with young professionals and multilingual entrepreneurs teleworking their way through the day.

Yet, the picture a few kilometres away tells a different story of a city struggling to rediscover itself after its coalmines closed down and the last handful of dust-covered workers exited their shafts for the last time. Pijova Rocla has registered significant progress in recent years, but the shadows of the mounds of coal dust loom long over the city's poorer suburbs where unemployment is high and crime is rife. The city and its residents can rest assured that Pijova Rocla's future is bright once the issue of the disused coalmines is tackled.

This paper proposes an ambitious project that centres on the regeneration of Pijova Rocla's coalmines; that takes advantage of the city's natural environment; and that profits from the city's relative proximity to the country's capital Rovasburg, where the demand for energy is high. It proposes using the foundations for the city's past success for its future glory by filling the disused mines with water and using electricity from national wind farms to use them as Pumped Hydroelectricity Storage (PHS) facilities, setting the country on course to reach its renewable energy targets with the assistance of the European Energy Efficiency Fund.

Rather ambitiously although in concrete terms, it will also help turn the tide of local politics thriving on discontent and social tensions. By aiming to channel European funding to one of the poor regions of the European Union, the national government can use this regeneration project to boost local employment in the region in a whole range of sectors, from construction to specialist engineering, over an estimated five-year period.

Bringing Pumped Hydro Storage to Pijova Rocla

An analysis of post-mining in France reveals that gas migration to the surface of a coalmine is one of the greatest risks of disused coalmines that can lead to risks of explosion, suffocation or poisoning. The literature on this subject points to a number of accidents provoked by releases of built-up mine gas that tend to occur through direct paths between old workings and the surface such as faults; a build-up of gas in confined or semi-confined spaces; or unintentional contact between post-mining voids and the atmosphere.[1]

The dangers posed by gas migration are two-fold: it severely limits the possibilities for re-using the abandoned coal mines in Pijova Rocla and it poses a particular health hazard for residents living in cheap accommodation close to the abandoned sites. In Germany, Poland and the Czech Republic, coalmine gas migrations are more concentrated at the surface. Methane and carbon dioxide are two of the products of the carbonisation of or-

1 Pokryska et al (2005), pp.1-2.

ganic substances to coal. Improperly sealed coal mines continue to leak these two gases into the atmosphere, which was also highlighted as a climate change contributor at the Kyoto Conference.[2]

IIt is increasingly believed in the engineering community that the future of abandoned coalmines lies in their reclamation as giant batteries as part of a system of Pumped Hydro Storage (PHS). The idea, which is currently being studied by Dominion Energy Inc, is to fill mines with water and then use electricity from renewable energy sources to pump it up to a higher altitude. When utilities need power, the reservoir's floodgates are opened to allow the water to flow back into turbines creating electricity with its descent.[3]

This technology is not new; it was mostly used in the 1960s and 1970s when a solution was required to store surplus nuclear energy. The renewable energies boom and the inability of renewable energy sources to provide a steady flow of electricity are pushing engineers to look at this technology from a fresh perspective.[4] The innovation lies in putting abandoned coalmines to use again and filling ravaged land with millions of gallons of water. Pijova Rocla offers the ideal landscape for coalmine regeneration to be implemented. The mountainous district close by offers potential for high altitude reservoirs to be constructed at a higher altitude than ground level to maximise flow rate and increase the power plant's efficiency, pending the results of an environmental impact assessment.

Given its size and the length of time over which pumped hydro storage can be used, PHS is predominantly considered long term storage with discharge windows of a maximum of around 10 hours. It can substantially lower peak loads on the power system by pumping water to the upper reservoir during low demand (and therefore, low cost) intervals and then release the water during high demand (and high cost) intervals to reduce the peak load to be met from a conventional plant.[4]

The development of this technology and the large number of operational projects with detailed documentation about its capabilities show that a PHS plant has energy storage ratings in the Gigawatt hour (GWh) range and power ratings ranging from hundreds of Megawatts (MW) to 1-2 GW. On average, the efficiency of PHS lies at around 75 per cent. PHS also has a lifetime that is considerably longer than most other types of energy storage.[5]

Pijova Rocla: A Fledgling National Phoenix

The benefits of this infrastructural project of national scale are numerous. It will help the country reach its goal of increasing the share of renewable energy to around 27 per cent as identified in the EU's 2030 Climate and Energy Framework.[6] It will create jobs across a whole range of sectors including construction, machine operation, logistics, technicians, transport and engineering amongst others, thereby attracting former Pijova Rocla residents back to their homes with better job prospects.

Most importantly, it will place Pijova Rocla firmly on the national map as not just another city 70 kilometres away from the capital, but a centre in its own right with its regenerated coalmines linked to wind farms across the country. The ripple effect will likely include better transport links to the rest of the country by rail and by road as materials and human resources make their way to Pijova Rocla.

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2 Backhaus, Mroz & Willenbrink (2002), pp.33-34.
3 Ryan (2017), ONLINE. [4] ibid.
4 Infield & Hill (2014), p.34.
5 ibid..
6 European Commission (n.D) [8] Infield & Hill (2014), p.2.

Estimated Capital Costs

Capital costs and site selection are two of the most important limitations to take into consideration.[8] The possibility of PHS using Pijova Rocla's abandoned coalmines merits consideration for the reasons mentioned above. Given that this paper proposes that Pijova Rocla's coalmines be integrated into a national infrastructure project, but the national population is not mentioned in the briefing paper provided, it is impossible to give an accurate estimation of the capital costs.

However, information available on PHS systems in Scotland, which has a total population of 5 million people and a total power demand of 3GW annually (that is not fully met by PHS plants), shows that the cost of installation stands at approximately $1500 to $4300 (€1220.65 to €3,499.21) per KW installed, costing between €122 million and €349.9 million for a plant that will meet a 3GW per annum demand. Storage costs per KWh range between $250 and $430 (€187 and €350).[7]

These costs are only an indication of how much this national infrastructural project may be expected to cost roughly. Judging by Pijova Rocla's population of 263,015 inhabitants and its ranking as the country's 7th largest city, it is likely that the national population is greater than that of Scotland, and therefore the national power demand is greater than 3GW in total. However, the final costs will depend on the proportion of power produced through the proposed Pijova Rocla system in relation to national demand. Budgeting for this project should also take account of the costs incurred to protect the natural environment to the greatest extent possible, following the results of the environmental impact assessment mentioned above.

The European Dimension

One of the issues mentioned in the briefing paper on Pijova Rocla is the rise of populist politics that find fertile ground in poorer and neglected communities. Central Europe has recently witnessed a surge in Euroscepticism and a decline in voter turnout at the European Parliament elections of 2014 with the lowest turnout registered in Slovakia standing at only 13.05 per cent of voters.[8]

Populist parties across the European Union find a comfortable target in the European institutions, with elected and unelected officials considered far removed from local realities, as some residents in Pijova Rocla's poorer neighbourhoods might believe. The Pijova Rocla project is an opportunity for political parties to engage in a debate about a possibility for tangible benefits for the community that includes a European dimension and a place for Pijova Rocla on a map that goes beyond the national borders.

The European Energy Efficiency Fund contributes to combatting climate change through a layered risk/return structure to enhance energy efficiency and foster renewable energy through private-public partnerships. It provides dedicated financing through direct finance and partners with financial institutions. Investments have to contribute significantly towards energy savings and promote the environmentally friendly use of energy, which the proposed project does through the reclamation of land that has an extremely limited range of other uses.[11]

Given the scale of the investment involved, it is unlikely that the national government will be able to shoulder the costs independently. A public-private partnership supported by the EEEF is a viable way forward that merits due consideration, with likely positive effects on local political debates in Pijova Rocla.

7 Infield & Hill (2014), p.10.
8 European Parliament (2014), ONLINE.
11 EEEF (n.D), ONLINE.

Conclusions

This paper proposes an ambitious project for Pijova Rocla (within the limits established by the briefing note on the city) that sees beyond mitigating the city's needs in the short term and sets out a plan for the city to reclaim its former glory through using its disused coal mines in a manner befitting the 21st century.

Reclaiming the coalmines and integrating them in a system of Pumped Hydroelectricity Storage is a costly infrastructural project that will see benefits reaped on a national level over the medium to long term.

However, while the costs in question require budgetary prudence, this project is not wholly out of the country's reach. Moreover, unlike the previous projects undertaken in Pijova Rocla that have brought the city some successes, this project will benefit and energise all of its residents, including those born and bred there that have become marginalised over the years.

Most importantly, this project will put Pijova Rocla on the national and regional map and give the city and its citizens a wider sense of purpose and national recognition. This will be achieved through the city's contribution to the whole country reaching its renewable energy targets (and related benefits deriving from cleaner energy) and ripple effects that might just include Pijova Rocla becoming a centre of excellence for education, employment and research in the field of renewable energy.

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