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THE TURIN-LYON HIGH-SPEED RAIL: AN ECONOMIC, ENVIRONMENTAL AND ENERGY ASSESSMENT

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ABSTRACT

One of the best known cases of struggle for the commons in Italy, characterized by bitter controversies over the last 20 years, is the popular opposition to the construction of the High Speed Railway line (HSR, "TAV" in Italian) between Turin and Lyon, designed to cross the Susa Valley (at the Italian-French border) and the Alps. This HSR project still carries, in spite of twenty years of continuous updating and reworking, a great deal of environmental and economic issues. An issue of insufficient cost-benefit balance has recently come to clear evidence, especially in view of the non-negligible passenger and freight traffic decrease along the Turin-Lyon direction. The most important aspects dealing with economic costs and claimed benefits, energetic considerations, legal constraints, environmental impact, health impact potential, and the negative experience of other projects, are discussed: they all suggest that the High-Speed Train Turin-Lyon is not a priority for Italy and France, and its construction should be immediately stopped.

INTRODUCTION

The construction of the High Speed Railway (HSR, TAV in Italian) line Turin-Lyon in the Susa Valley (Italy) has long been surrounded by bitter controversies about the most significant and technical aspects of the proposed project. Beyond the claims and positions in favor or against HSR implementation, this paper aims to explore some of the critical aspects of the proposed project. The HSR project brings with it, after more than twenty years of strenuous and continuous reworking, a large number of environmental issues. Main pollution problems dealing with the railway construction have been put into evidence by several studies and official reports. For instance, the presence in the Susa Valley of geological formations with asbestos and uranium is a particular concern, also considering the final destination of the extracted inert [1]. Aspects related with local hydrogeology and its perturbations, and noise, are also of huge concern [2]. The insufficient cost-benefit balance, especially in view of the significant passenger and freight traffic decrease along the Turin-Lyon direction [3], has come to better evidence when the French Government (as of July 2012) announced a spending review that could stop the construction of the HSR Turin-Lyon and other ones on the French side [4]. Beyond the technical problems related to the HSR, the Susa Valley has become in the recent years the most famous episode of the struggle for the Commons in Italy. In this Country, the concept of Commons as resources shared among communities and for which everyone has the right to be involved in decisions that expose them to risk or damage is still far from being widely accepted, even by some scholars that are strongly against this project. These scholars think that local resistance can be easily manipulated in order to demonstrate an "egoistic" attitude of the opponents, of the "NIMBY" type (Not In My BackYard). The No-HSR movement ("Movimento NOTAV" in Italian)[1] has put this question into evidence to the

[1] The first HSR proposal dates back to the end of the eighties, and soon after the opposition in the Susa Valley started. In 2011, the new site for the HSR surveys was chosen in the Chiomonte village (Val Susa). After that, many

eyes of the Italian public opinion: beyond the question "HSR yes/no", the opposition movement puts forward its struggle as a legal/social/political strategy for reclaiming the Commons (land use change, water availability and quality, hydro-geologic stability, biodiversity affected by the infrastructure, quiet) and protecting them from privatization, claiming for a different concept of democracy and public participation. Last but not least, the concept itself of financial investment is under deep review, since the huge amount of public money invested or planned in support of such development does not appear to be justified by a sufficient economic return on the investment. In other words, not only a sequestration and degradation of the Commons is going to take place, but also there is no advantage at all in economic terms, except for the companies involved and, very likely, the banking system. Getting back to the technical questions, we believe that the usual appeal to the Precautionary Principle, in the case of HSR project, is not even necessary. Economic data, energetic considerations, legal questions, environmental impact, the health impact potential, the negative experience of other projects, and especially the common sense, suggest that the High-Speed Train Turin-Lyon is not an actual priority for Italy, and its construction should be immediately stopped.

The HSR Turin-Lyon, a brief description of problems

Let us examine why the HSR project [3,5] has been proposed and why it is still at a preliminary stage after more than 20 years from its beginning. Concerning freight, the central problem is that freight transport in Italy occurs at an average speed of 19 km per hour [3], since trains are often diverted and parked in transit stations, to provide priority to passenger trains. This is the main bottleneck requiring improvement. It's a nonsense for commodities to arrive from France at a speed of 150 kilometers per hour and have to stop and spend most of their time in a transit station when they arrive in Italy. Concerning passengers, it makes sense to talk of High Speed when the journeys are longer than 250-300 km. In Italy, if we look closely at the rail transport statistics [3,6], we can see that 80% of the demand for passenger transport is for short journeys, less than 100 Km. It's true that Italian trains are overloaded with passengers on certain routes but only very few people go from one end of the country to the other, taking real advantage of the high speed.
A study commissioned by the Mountain Community of the Susa Valley carried out by a Transport Engineering Company shows that the line would be justified only by a 40 million tons of freight traffic per year, translating into a total of 350 trains per day, one train every 4 minutes at the speed of 150 km/h**,** alternating with passenger trains at 300 km/h.
The costs that are officially foreseen are for the entire line, not just the basic tunnel. Official estimates are around 22 billion euro, but previous experience shows that forecasts are much lower than real costs. The Italian Milano-Salerno high speed train line, already implemented, cost three times more than the forecast [6]; the benefits for long-distance passengers in terms of time saved cannot be disregarded, but it is balanced by a much higher travel cost in terms of individual ticket and, more than that, in terms of global investment. An ex-post cost-benefit assessment published by Beria and Grimaldi [5] in 2011 shows that even the high ticket prices on the Milan-Salerno HSR line do not pay back the long-term investment and daily operation costs. The case of the Turin-Lyon would be even worse, since the expected number of passengers is very low: the line should thus be essentially used for the transport of commodities, a modality that has been declining in the last 10 years (REF) and that seems to have limited growth perspectives, due to the future competition by the new Gotthard tunnel at the Italy-Switzerland border, expected to attract the large majority of traffic in the North-South direction. Moreover the existing line, recently renewed and improved, can carry up to 20 million tons [3], a capacity that is much far from being saturated in the short-medium time. Proponents of the Turin-Lyon HSR foresee 14 trains a day, while the line capacity is presently 250. Moreover, commodity traffic on rail is declining Europewide with very few exceptions, due to the fact that mature economies do no longer exchange heavy raw materials (bricks, wood or coal) as two centuries ago. Today's goods (highly manufactured and technological items, such as fashion, electronics, fine

manifestations took place, while the actual work for the HSR construction has not begun yet. The Association of villages of the Susa Valley (Comunita' Montana della Val Susa e Val Sangone: CMVSS, www.cmvss.it) has – during the years – set up a team of scientists and experts, many of them from Italian universities. This team has performed technical analyses and produced reports and papers, which have been briefly summarized here: the cost-benefit analysis, the environmental impact assessment and many other studies have been used by the CMVSS for its action of legal opposition to the HSR construction.

chemicals) are much lighter per unit of economic value, and it is very difficult to carry them by rail, due to a variety of structural, management and distribution reasons. Their amount, however, would not justify a huge HSR investment.
The environmental impact for any new construction project is pretty high: if the project were really very useful, then perhaps the benefits could offset the environmental impact from the construction work. But in this case, given the large uncertainty about the usefulness of the project (very small, if any, shift of road traffic to the rail modality) and given the high investment cost, the question if the environmental impact is justified by the benefits cannot be avoided.
Concerning construction and operating costs, at the beginning it was estimated that the whole Italian High-Speed network (and not just the Turin-Lyon HSR project) would pay back for 60% of its costs. Then this came down to 40% and finally it was established that the 40% would not include the costs for the "nodes" near the cities, (really expensive). According to simulations in [6], the final estimate would be around 20%. Concerning the Turin-Lyon HSR, even that 20% is not achieved, and the State is supposed to pay 100% of the costs. The Turin-Lyon is therefore a monument to dissipation: it will cost 3 or 4 times the planned (and always postponed) bridge over the Strait of Messina (and would be equally useless).
Actually, to develop innovation, we need to focus on technology rather than on cement. As far as employment is concerned, nowadays, the massive projects have a modest multiplier effect: manual workers are not employed as they were in the 1800's. And it is also well known that Italy has a great tourist value in the future, which prevents from implementation of further landscape degrading infrastructures. Thus, there are more fruitful ways of investing public (and private) money.

The energy cost-benefit analysis

One of the main ecological justifications of the HSR projects would be the energy savings and the expected decrease of pollutant emissions, associated to the shift of a fraction of freight and passenger traffic from road (fuel driven trucks and private cars) to electricity driven railway.
The claimed virtuosity of the train is not always confirmed in real cases, and heavily depends on the energy investment for infrastructure, including the energy embodied in the materials and the necessary management and maintenance over the entire infrastructure life cycle. The ridership is also of paramount importance: in the presence of a small or decreasing traffic, the investment per unit of passenger and commodity transported would never be competitive with other transport modalities (or with a decreased transport demand driven by more local consumption, when such option exists). In the case of a big infrastructure project, such as the Lyon-Turin line between France and Italy, energy and environmental costs require a special attention and a careful analysis of the energy and material flows involved over the entire project life cycle.
Rail transport, however less versatile than road transport, may cause less local impacts. But this is only true if society uses and/or improves an existing network to the optimum possible extent and capacity. Instead, if a new line is designed, with over 70 kilometers of tunnels, 10-20 years of construction work, thousands of trucks trips for transportation of materials to and from the site, million tons of excavated material to be disposed of, thousands of tons of iron and concrete requirement, heavy interference with underground and surface water, to mention only a few aspects, in addition to the energy necessary to keep the system operating, the consumption of raw materials and energy and related emissions could be so high as to completely nullify the potential advantage of the transport modality shift. A detailed assessment of these aspects is provided for instance in [7-8] and [9]. Concerning passenger transport, we can compare the total energy spent to carry a passenger for one kilometer, expressed in units of megajoules (MJ/p-km) through different transportation patterns. A bus has the lowest energy consumption (and related GHG environmental impact), with only 0.33 MJ/p-km. A car with one person on board is no doubt the worst solution, with 1.87 MJ/p-km. A conventional intercity train shows a much better energy performance (between 0.62 and 0.77 MJ/p-km, depending on load factor), while the HSR is characterized by a much higher energy demand and indirect GHG emissions (between 1.02 and 1.44 MJ/p-km). For freight, the best solution is represented by truck transport (1.25 MJ/p-km), while conventional train modality shows a consumption between 1.79-2.5 MJ/p-km. The HSR shows consumption ranging from twice to three times (2.17 to 3.09 MJ/p-km). Of course, results are affected by ridership and load factors. Calculations from [7-8] are based on present load factors from official statistics. A decreasing traffic would only have the effect of increasing the unit transportation costs and emissions. Claims of HSR proposers foresee increasing traffic in the next 30-50 years, which is not

supported by present trend data and may rather be ascribed to fairy tales books. By the way, the present offer from the Italian railway companies (FS and NTV) is about improving comfort for a limited category of users (business and executive class coaches), with about 40% decreased number of seats. Decreasing ridership inversely affects energy and environmental costs.
Last but not least: the Frejus highway in the Susa valley is presently used by approximately 3000 big transport trucks per day. The estimates supporting the HSR realization claim that there would be such a traffic increase that – as a result – there would be more than 2300 more truck transits per day , with a clear environmental pollution and traffic impact: therefore, in front of a future benefit that we have seen difficult to evaluate and ultimately not convenient, the final result would be, if the traffic forecasts were realistic: more trucks on the Valley roads. Actually, all the results show that the traffic previsions used to support the HSR construction are unrealistic.
It seems therefore very hard to support the claim that the construction of the HSR Turin-Lyon would be consistent with the requirements of the Kyoto Protocol and future similar agreements.

Environmental impact analysis

The HSR construction carries a number of environmental problems, that have been highlighted by several studies [1,3,6,10,11].
We limit here to point out the presence, in the Susa Valley, of geological formations with asbestos and uranium: a case of particular concern, also considering the final destination of the extracted inert. The tunnel excavations will be more than 100 km in total, and will pass through zones with high presence of asbestos and uranium, interacting with the hydrogeological environment. Concerning Uranium, it is foreseen that a fraction of the resulting material from excavations will be disposed of in two open-pit mines in the Valsusa, Meana and Caprie [12]. This would imply the dispersion into the environment of about $3.3\ 10^9$ Bq of radioactivity, with likely water and soil contamination. Due to the action of meteorological agents, resuspension, and wind, such a dispersion of radioactive pollutants would expose the local population to collective doses of several thousands of Sv/person [10,12].
Recently, a down-sized project was presented by the Italian Government [13], costing one third of the original one, and limited to the base tunnel, i.e. without any improvement of the existing line outside it ("Low-Cost Solution"). In practice, this makes the overall time savings very modest, eliminating any possible relevance for the passenger traffic. No analysis has been presented yet, but for sure this downsizing is the consequence of the local opposition, the lack of public funds, and the widespread skepticism of the academic world.

CONCLUSION

Can the opposition against HSR be defined as "against Progress" [10]? Not at all. Progress and wellbeing must not be confused with infinite growth. The territory of Italy is small and over-populated. Natural resources (water, agricultural land, forests, minerals) are limited. Pollution and waste are increasing. Fossil energy supplies are coming to an end. Progress means understanding that physical limits exist to our mania to construct and transform the face of the planet. Progress means optimizing, increasing the efficiency and durability of already existing infrastructures and built environment, cutting out what is superfluous and investing in intellectual and cultural growth more than material one, using minds more than muscles. The HSR represents the exact opposite of this idea: wasting resources for no benefit.

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