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Connecting Mediterranean countries through electricity corridors: New Institutional Economic and regulatory analysis

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ABSTRACT

A super grid connecting the two shores of the Mediterranean could help Europe meet its targets for integrating renewable energy. This paper assesses the business models for building a platform for wholesale renewable energy trade via electricity corridors linking the two regions of the Mediterranean basin. We demonstrate that the optimal framework for designing the corridor project is a long-term contractual agreement to coordinate bilaterally the necessary investments. Furthermore a hybrid governance structure requiring only limited regulatory adaptation seems to be the most efficient structure for facilitating investment in the corridor's infrastructure.

1. Introduction

Under the terms of the Kyoto Protocol, the European Union (EU) is committed to reduce overall greenhouse gas emissions of its Member States by 20% by 2020 compared to 1990 levels. For 2050, EU Member States have also endorsed the goal of reducing the Union's greenhouse gas emissions by 80%–95% compared to 1990 levels.[1] Large sums have been spent in recent years to encourage local renewable-energy projects in Europe. However, in order to completely decarbonize the EU energy system, additional options and solutions will be needed. In particular, there has been lively debate about the need to build a super grid[2] connecting the two shores of the Mediterranean basin[3] (Battaglini et al., 2009). Not only would European countries benefit from such infrastructure, but North African countries would also benefit, with scope for improving the efficiency of their system and enjoying access to more diverse energy sources.

The two regions desire to achieve at least two common energy goals in the near future. The first is security of supply. Conventional energy sources constitute a substantial part of the energy mix of most EU countries.[4] A predominant share of energy is imported from outside Europe. North African countries also rely heavily on

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[1] "The Roadmap for moving to a competitive low carbon economy in 2050" (COM/2011/112) adopted by the Commission proposes to extend these objectives to 2050.

[2] A super grid is a high-voltage transmission infrastructure designed for long-distance transmission of electricity connecting remote systems which may have different characteristics.

[3] Two super-grid projects are currently under study. Desertec, a consortium looking at the technical and economic feasibility of creating an interconnected electricity network reaching from North Africa to the Middle East, and crossing southern Europe, which would supply 15% of EU electricity consumption by 2025. MedGrid aims to explore the feasibility of investing in 20 GW renewable capacity in the south and east of the Mediterranean region. 5 GW would be exported to the EU.

[4] In 2013 44% of the generation mix in ENTSO-E members countries was provided by fossil fuels, 26% by nuclear power, 18% by hydro and 13% by other renewable (ENTSO-E 2014).

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such energy sources to fuel their power plants (Bugaje, 2006). Even if this energy, primarily natural gas, is sourced locally and readily available in the short and medium terms, it is accepted that this resource will become rare in the long term and should be used for purposes other than generating electricity, as more climate-friendly alternatives can be developed to sustain security of supply. Both regions are therefore seeking alternative energy sources.

The second joint goal, following on from the first, relates to the climate-policy targets that the two regions have established and should attain in the near future. Successive EU directives and regulations[5] have set a mandatory target designed to ensure that the Union meets its ambitious climate and energy targets by 2020. Similar targets have been set in some North African countries, including Morocco, Algeria and Tunisia (Brand and Zingerle, 2011; Komendantova et al., 2012), emphasizing the need to invest more in renewable energy as well as facilitate its deployment and integration.

The complementarity between systems north and south in terms of market conditions and, in particular, energy mix would reinforce the opportunities for interconnection infrastructure. System complementarity is more apparent when looking at the energy resource mix characterizing the two regions. On the one hand scope for using renewable resources to generate electricity in North Africa is much greater than in the EU. Sunlight is twice as powerful as in France or Germany, for instance.[6] Wind speeds are much higher too. On the other hand, the energy mix in Europe is more varied than in North Africa. At present the energy mix south of the Mediterranean depends mainly on gas and fuel oil (Bugaje, 2006), whereas the EU uses nuclear power, coal, and hydropower to diversify the energy mix.

This review of common energy-policy objectives and system complementarity suggests that both regions would gain from building energy infrastructure to link the two sides of the Mediterranean. Such infrastructure would facilitate investment in renewable energy in North Africa. Given the region's significant potential in terms of solar and wind energy (Battaglini et al., 2009; Komendantova et al., 2012), the EU could achieve its target by importing such energy on a large scale from North Africa.[7] Demand in North Africa is relatively low compared to its renewable resource potential. Thus, after covering local needs, the surplus could be exported to Europe. Support from European investment funds would facilitate such a large capital outlay, without requiring massive support by national authorities or local investors in the region's difficult financial context.[8] Furthermore such infrastructure would facilitate wholesale trade in energy between the two regions, primarily renewable energy as explained above. Some regulatory constraints will nevertheless need to be removed,[9] as discussed in the following sections, in order to facilitate such trade. Lastly, thanks to this infrastructure, supply security would be increased and dependence on fossil fuels would be decreased. Traditional energy sources are currently either contracted with controversial partners such as Russia, in the case of the EU, or becoming increasingly scarce, as with natural gas in Algeria, so they are no longer the preferred choice in the energy mix.

This paper aims to assess, from the point of view of New Institutional Economics and regulation, the optimal business model for connecting the two shores of the Mediterranean via electricity corridors. The electricity corridor would comprise two investment facilities: an interconnector linking the two shores of the Mediterranean; and the renewable power plants, which are already available or need to build to cater to local and European demand. The focus is on the export potential of the renewable supplies that North Africa could offer Europe as an additional option for decarbonizing the EU energy system over the long term. Given North Africa's considerable renewable-energy potential, establishing an optimal regulatory framework would encourage capital investment, creating a win–win situation for both regions. Demand in North Africa could be completely covered by power generated from renewable sources. The EU would benefit from the residual energy to achieve its own climate policy objectives. On the assumption that substantial investments will be made in renewable energy in North Africa, it is unlikely that North African countries would import substantial amounts of conventional energy from the EU. Countries in North Africa are also looking for ways of decarbonizing their systems. Moreover, their markets are plagued by the lack of a regulatory framework for trading energy with foreign countries. Currently, only the incumbent operator can import energy, subject to restrictive conditions. Even if reforms are introduced, with real energy markets being set up and opened to competition, large-scale deployment of renewable resources would in fact make available sufficient energy resources to satisfy local demand.

To assess the optimal regulatory framework, our regulatory analysis, starts with diagnosing the current situation and identifying the main obstacles to integration. We propose various ideas for regulatory adaptation, with regard to a range of possible governance structures. Regulatory analysis completes the study by highlighting how potential risks for the corridors should be managed and how potential revenues should be shared among partners in the corridor scheme.

2. New Institutional Economics analysis of the electricity corridors

In this section, we assess potential revenue and the risks faced by stakeholders in the corridors. We also determine the optimal framework for the contractual arrangements governing the corridors. We focus in particular on the extent to which investments are mutually dependent and whether a long-term bilateral contract is required. Our analysis addresses (i) market and network risks and hazards, and (ii) the degree of asset specificity for the various investments. New Institutional Economics (NIE) has the potential to offer much insight to the energy sector. Applications of the NIE to the electricity sector put into the light transaction costs that make contracts and norms incomplete and imperfect. Thus, such analyses look to the understanding of sectors dynamics and how to deals with international transaction, thus how to integrate different components of the coordination.

For the gas industry, it has been shown that in some cases, long-term contracts would provide a robust framework for protecting the interests of both up-stream and down-stream partners (Hubbard and Weiner, 1991). For instance, Hallack and Glachant (2009) assesses long-term Take-or-Pay (ToP) gas contracts between Brazil and Bolivia from an NIE perspective and examine empirically the robust nature of the ToP framework over time. The case of an electricity corridor connecting the two sides of the Mediterranean is an opportunity to apply this NIE perspective to

[5] Notably Directive 2009/28/EC of the European Parliament and the Council of 23 April 2009 on promoting the use of energy from renewable sources.

[6] Dr Gerhard Knies, a German physicist and founder of the Trans-Mediterranean Renewable Energy Cooperation (TREC) network of researchers says that: "The world's deserts collect more energy from the sun in six hours than mankind consumes in an entire year."

[7] The technical success of such a huge programme would however depend on the ability of the European electricity network to accommodate large electricity imports from North Africa (Brancucci Martínez-Anido et al., 2013). We note that the analysis disregards the technical issue of the super grid.

[8] Notably in Tunisia, a problem which is has become more acute since the revolution of spring 2011.

[9] Note that the politic instability of North African countries is a geopolitical risk which could influence the long-term viability of the project.