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Model based evaluation of electricity network investments in Central Eastern Europe

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ABSTRACT

The paper analyses the complex welfare impacts of proposed transmission investments in the Central Eastern Europe (CEE) region with the application of the EEMM electricity model. This assessment is made at regional level, as new transmission lines have significant spill-over effects over third countries. We carry out a cost-benefit assessment (CBA) focused on the CEE region and demonstrate, that the EEMM model is a suitable tool to carry out such assessment that can satisfy the EU requirements in the field. Using a simplified cost-benefit analysis – limited by the available information on the projects – we mimic the process of identifying those transmission lines that increase the regional welfare the most. In addition, the paper also identifies those methodological and policy issues, that have significant impact on the results, and must be applied consistently during the evaluation process in order to gain robust results in the applied CBA method. Our results indicate that new infrastructure elements cause significant and asymmetric wealth redistribution among group of stakeholders and between countries as well. Interactions between planned transmission line developments must be identified, as they could significantly change the benefits of those lines connecting the interlinked markets.

1. Introduction

The Third Energy Package (2009), in force since 2011, and the Electricity Target Model (see Ref. [26] for an overview) laid down the new directions and institutional architecture of the Single European energy market for the coming years. The 2009/72/EC Directive [15] on the common rules for the internal market in electricity, Regulation 713/2009 [16] Establishing ACER (Agency for the Cooperation of Energy Regulators) and Regulation 714/2009 [17] on network access conditions and cross border exchanges in electricity set the specific rules and directions for this development. This later regulation created the European Network of Transmission System Operators for Electricity (ENTSO-E), the European organisation of TSOs. While regulation of cross-border infrastructure is under the competence of national authorities, ACER has some influence where these authorities fail to forge agreements.

All of these legislative and institutional developments show that the EU is taking a more proactive attitude in electricity market development since 2009. One specific aim of this policy package is to increase the pace of new interconnector developments in order to harvest benefits of more intensive trade: increased competition and trading opportunities leading to lower wholesale prices for the energy consumers [12,25].

The European energy infrastructure still needs significant investments, and the speed of development is less than optimal.[1] There are significant underlying barriers to building new transmission lines between countries. One of the most important issues preventing faster development in this field arises from the complexity of the new infrastructure developments. Electricity production could be optimised over a larger geographical area amongst power plants with different marginal production costs if stronger interconnection capacities allow the pooling of power plants among the participating countries. As typically there are

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[1] See also: Energy Policy for Europe (COM 2007/12 [14]), the Long Term Infrastructure Vision for Europe [19] and the Commission report: Progress in creating the integral gas and electricity market (SEC-2008-460), and [30]. Based on the 2012 ENTSO-E Ten-Year Network Development Plan (TYNDP) electricity infrastructure developments till 2022 needs 104 billion € excluding 40 billion € for smart grid developments.

individual stakeholder groups – producers or consumers – that are worse off from the resulting wealth redistribution, such a group can easily obstruct the development of a new line even if it would bring significant benefits to the region as a whole. The assessment of benefits arising from this more optimal production scheduling is the main focus of our paper. With the application of the EEMM electricity model – developed at the Regional Centre for Energy Policy Research – we analyse the complexity of the welfare impacts of the transmission investments in Europe. This assessment must be made at regional level, as new transmission lines have significant spill-over effects over third countries. We carry out a cost-benefit assessment (CBA) focused on the CEE region and demonstrate that the EEMM model is capable of providing a comprehensive assessment that meets the EU requirements in the field. Using a simplified cost-benefit analysis (see section 4 for details) we mimic the process of identifying the transmission lines that would maximize regional welfare with the limited available project information. Previous studies (introduced in the literature section) were mainly focused on the bilateral impacts of these infrastructure developments. With this modelling exercise we would like to fill the gap in an important area: by assessing more projects from a region with the same methodology, we are able to grasp the crucial inter-linkages between the project developments across the whole of Europe. As the results show, this is an important step forward in understanding the complex welfare effects of these infrastructure developments.

The recent developments of the European Energy Regulation make our research question timely. The Energy Infrastructure package guides the development of future trans-national energy infrastructure developments in this direction. Regulation 347/2013/EC [18] requires the use of CBA for the identification of the Projects of Common Interest (PCIs) in the field of electricity and gas transmission. A similar selection process is carried out in the Energy Community (2013) [11] for the selection of Projects of Energy Community Interest (PECI projects). The current European model of transmission planning is a bottom-up approach: Members States propose projects according to their national or regional interests that are collected in the ENTSO-E Ten-Year Network Development Plan (TYNDP 2012). Some of these projects received the PCI status, which signals that these projects have significant positive impacts on a wider regional basis. Some specific instruments are already attached to the PCI status: e.g. fast-tracked licensing and a feasibility study that could help project promoters later to secure more readily available funding and quicker regulatory decisions.

In the case of a complex welfare redistribution, a trans-national funding scheme (e.g. through Trans-European Energy Network programme (TEN-E) or through the inter-TSO compensation mechanisms) should be used to accommodate the arising cost sharing and related tariff setting issues.[2] In the European energy regulation scheme, ACER could play an important role in managing this issue. The underlying prerequisite for such a compensation scheme is agreement over a commonly accepted methodology for measuring and sharing the cost and benefits of the infrastructure developments. (Think Report [29]) Applying economic models of the electricity system together with a commonly accepted cost benefit analysis (CBA) would serve as a solution, as impacts on wholesale prices and the resulting trade effects of a new transmission line could be quantified. If additional impacts are included in the CBA assessment – e.g. security of supply impacts, increasing GHG emission costs or increased reliability of the system – this methodology could serve as a basis for establishing compensation schemes between the concerned countries and the stakeholders within the countries as well. Several studies analyse the redistribution effects in specific geographical locations (see Refs. [6,25] and [34,36]).[3]

Consequently our main focus is not purely on the redistribution effects, but also the methodological and policy issues themselves. The weighted CBA criteria will have a significant impact on the results and must be applied consistently during the evaluation process in order to provide the best results. The methodological and policy considerations can be clustered around the following fields:

- Inter-linkages of projects: due to the interrelated nature of the transmission system in the CEE region the welfare impact of a given line depends on the realisation of other newly built infrastructure elements. Welfare might change positively in the case of complementarity projects or negatively in the case of competing projects.
- Scaling problem: determining the correct capacity size for a future transmission line is a crucial element because a capacity level surpassing a certain limit might actually reduce social welfare.
- Boundary conditions: the welfare impact depends on the boundary conditions of the reference case of the applied model. Amongst these conditions, CO_2 and fuel prices might play a crucial role.
- Right of project initiation and project financing: in the present EU bottom-up approach TSOs propose transmission projects. What approach should be followed if a regionally advantageous project is not promoted by either of the TSOs? And if these opportunities exist, what are the main reasons they are not promoted? With respect to the financing of new transmission lines, the main question is whether the typical approach that places the financial burden on the two constructing countries is viable in the long term. Or, if the redistribution effect with third parties is significant, should the present practice be supplemented by some additional measures (common EU funding or more pronounced burden sharing) to reach a more optimal level of financing? An additional question arises with the commercially financed (merchant) lines: to what extent should they be promoted, as they demonstrate viability in isolated markets and their benefits across integrated markets is questionable.[4]

The paper is structured as follows: The next section provides a literature review of welfare analyses of network developments and is followed by a brief model description of EEMM. The main analytical section presents a welfare analysis of the planned CEE cross-border infrastructure developments (listed in the TYNDP 2012), and the assessment of the main distribution effects, followed by a conclusion section.

2. Literature review

Increasing interconnection capacities has many beneficial

[2] The Inter-Transmission System Operator Compensation (ITC) mechanism is defined by the Commission Regulation (EU) 838/2010.

[3] For details on their assessment see section 2.

[4] The impacts of commercially financed (merchant) lines on the electricity markets are analysed in many papers. [24] showed that in many cases merchant lines would be advantageous in isolated markets, but many problems arise if they are built in a location where an interconnection line already exists. In these cases, merchant lines would be built at a suboptimal level, and the arising loop-flows would cause problems in the accountability of trade as well. As the assessed lines in this paper do not apply for commercial (merchant) status, we do not deal with this issue in detail.