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When regulators do not agree: Are merchant interconnectors an option? Insights from an analysis of options for network expansion in the Baltic Sea region

C. Gerbaulet[a,b], A. Weber[a,*]

[a] Berlin University of Technology, Workgroup for Infrastructure Policy (WIP), Straße des 17. Juni 135, 10623 Berlin, Germany
[b] German Institute for Economic Research (DIW Berlin), Department of Energy, Transportation, Environment, Mohrenstraße 58, 10117 Berlin, Germany

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ABSTRACT

Despite the ongoing appetite of financial investors and project developers for merchant investments into the European electricity network, the European Commission is reluctant to approve such undertakings, thus implicitly favoring regulated investments. Based on a two-level model, we analyze the impact of profit-maximizing merchant transmission investment as compared to both welfare-maximizing regulated transmission investment and the absence of enhanced (direct current) interconnection between different synchronous areas. We apply the model to the Baltic Sea region, which is historically subject to rapid interconnector development and would benefit from increased interconnection. We obtain stable results indicating that merchant investment may well positively contribute to overall welfare, but at the same time, "the merchant takes it all," i.e. in many cases merchant profits are close to the overall efficiency gain. This implies that, depending on political objectives, building no interconnector may be superior to building a merchant interconnector if a regulated solution does not seem to be feasible, such as in a case of inter-jurisdictional coordination issues. This underlines that distributional aspects, beyond mere welfare arguments, should be taken into account when analyzing the impact of merchant transmission investment.

1. Introduction

European electricity policy, driven by market integration and decarbonization targets, sets a strong impetus for expanding transmission networks: European transmission companies identified in their 2016 plans (ENTSO-E, 2016, p. 3) investment needs of roughly 150 bn € until the year 2030, which does not even cover national 'internal' reinforcements. Most of the investment in question can be expected to be regulated: The projects are financed by fees raised via grid tariffs and are overseen by a regulator. However, regulatory arrangements can be subject to diverse deficiencies, within a country but also between countries. Especially in the case of cross-border lines, regulated solutions require an agreement between the regulators of the to-be-connected jurisdictions, covering cost and revenue sharing rules. Reaching such an agreement can be difficult and may take a long time, as welfare and distributional impacts of transmission projects are often challenging to forecast and therefore might be subject to dispute.

If this is the case, merchant interconnectors can be an option: Merchant lines must be financed from the earnings of arbitrage between electricity prices in the interconnected areas. They require little regulatory decision-making and oversight, and open the domain of primarily regulated transmission investment to profit-oriented and unregulated investors. If price spreads are high enough, transmission projects can be expected to be triggered swiftly.

Merchant investment is possible within the current legal and institutional framework of the European Union (EU), but needs to be approved on a case-by-case basis by the European Commission (EC). Often, and as is the case in the EU, this status is awarded for a limited period of time; and in practice re-financing of the investment will take place within that period. In light of the large investment needs in

* Corresponding author.
E-mail addresses: cfg@wip.tu-berlin.de (C. Gerbaulet), aw@wip.tu-berlin.de (A. Weber).

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Nomenclature

Sets

bz, bzz	Bidding zones
l	Lines in the electric grid
lm	Subset of l, merchant lines
lr	Subset of l, regulated lines
n, nn	Nodes
s	Power plant technologies
t	Hours

Parameters

B_l	Line susceptance
C_s	Marginal production cost of plant type s
$D_{n,t}$	Residual demand at node n in t
$Exp0_l$	Initial line expansion level
$\overline{Exp}_l$	Maximum expansion level of line l
F_l^{max}	Thermal limit of existing line l
$Hflf_{bz}$	Hydro full load factors, by bz
I_l	Investment cost per MW on line l
$Inc_{l,n}$	Incidence matrix
M_l^{ζ}	Upper bound on line due to parallel line limits
$Q_{s,n}^{max}$	Maximum generation of plant s at node n
$Slack_n$	Slack bus
W_t	Relative weight of hour t

Variables

$\delta_{n,t}$	Phase angle
$\zeta_{lr,t}$	Flows through endogenously added AC lines
$\zeta_{lm,t}$	Flows through DC lines
exp_l	Expansion on line l
$p_{n,t}$	Price at node n in t
$pD_{lm,t}$	Price difference on merchant lines in t
$q_{s,bz,t}$	Generation of plant s in bidding zone bz in t

Europe, some see this option increasing in importance (Cuomo and Glachant, 2012; Mann, 2013; Makkonen et al., 2015; Rubino and Cuomo, 2015). What, however, remains unclear is the role merchant transmission investment can or should play in this context given diverging goals of regulators and investors.

With the backdrop of the potential problems of regulated solutions, the objective of this paper is to understand the welfare and distributional impact of "market"-driven transmission investment as compared to both socially optimal (regulated) transmission investment and its absence. We study the problem at the example of the Baltic Sea region, where systems of different energy planning paradigms provide a case for increased interconnection. We find that, somehow contrary to some more stylized analyses, and although merchant investment is lower than in the welfare-optimal case, welfare contribution of merchant investment is roughly 70% of the maximum improvement possible. However, this welfare increase does mainly accrue to the merchant investor as a rent. The argument that merchant investment may be a desirable option if regulated transmission investment is not possible seems to be weakened: From a perspective of distributional aspects, policy-makers might not want to pursue a solution that does not bring any (or very little) benefit to established actors or even reduces their welfare.

1.1. Background on regulated and merchant transmission investments

Ideal regulated and merchant transmission expansion are extreme counterparts of transmission expansion governance of which many varieties exist in between. In the following Section 1.1.1 we will first discuss what potential problems of regulated transmission expansion schemes are and how merchant or merchant-type schemes could eliminate these problems. Potential problems of regulated transmission investment are outlined in Fig. 1. On the other hand, also merchant (or merchant-type) schemes are associated with difficulties which we discuss in Section 1.1.2.

1.1.1. Regulated transmission expansion

Information Asymmetries. Starting off from an entirely national setting, where a single transmission company (TransCo) is subject to control by a regulator, the regulator would ideally be able to completely oversee the TransCo's transmission expansion activities, i. e., he would be able to fully understand (and alter) line expansion decisions. This, however, is somewhat opposed to the presence of information asymmetries between the regulator and the TransCo. Under the assumption that the TransCo possesses a relevant information advantage towards the regulator, and that this barrier cannot be overcome (at least not at

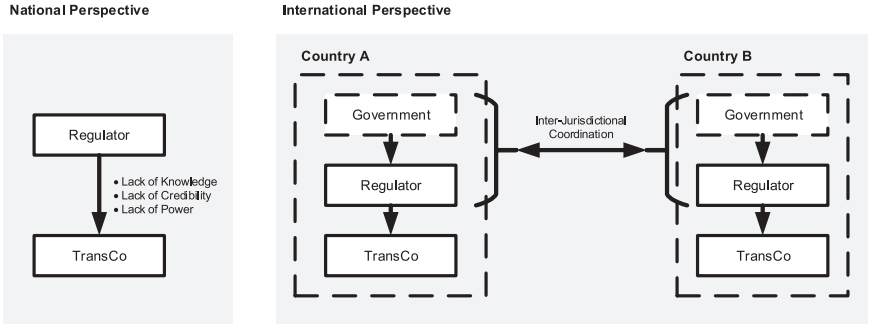

Fig. 1. Potential problems of regulated transmission expansion. Source: Own depiction.