Overview
We apply a merchant transmission expansion model to the trilateral market coupling arrangement among the Netherlands, Belgium and France. In this framework, the system operator allocates financial transmission rights (FTRs) to investors in transmission expansion depending on their preferences and revenue adequacy. We study the incentives for investors depending on the network topology. Till now the cross-border trade among these countries has been managed by explicit auctions, but from November 21, 2006, the daily auctions have been transformed to a market coupling arrangement (implicit auctions). This causes more efficient trade. There is a discussion of introducing FTRs as a part of the market coupling arrangement, and development toward flow based transmission and open/multilateral market coupling. The allocation of cross-border capacity is currently based on available transfer capacity (ATC) which in the case of flow based transmission will be based on power transfer distribution factors (PTDFs) and border capacities. The PTDFs take physical electrical flow paths into account and maximizes the use of transmission capacity. Conversely, a meshed network makes it more difficult to link the implicit and explicit auctions employed in the daily and monthly/annual auctions. Therefore, there might be a need for FTRs (including daily settlement in implicit auctions between power exchanges) and a clarification of the roles of transmission system operators and power exchanges. Likewise, appropriate risk-sharing and regulatory incentives are needed.

Figure 1. The trilateral market coupling arrangement the Netherlands, Belgium and France

Methods
This paper uses a bi-level programming of Hogan’s proposal (Hogan, 2002; Kristiansen and Rosellón, 2006) for allocation of long-term FTRs to investors in small-scale transmission expansion in meshed networks. The problem structure
takes the form of a bi-level program that is analytically solvable by using a Lagrangian function approach. The Kuhn-Tucker conditions give the necessary conditions for a local optimum that we also find are a global optimum in the cases provided.

Results
We present expansion alternatives under different assumptions and demonstrate the use of FTRs and their impact on the market. Further we study the impact of linking the trilateral market coupling arrangement to the German market.

Conclusions
This paper has presented bi-level programming of Hogan’s proposal for allocation of long-term FTRs to investors in small-scale transmission expansion in meshed networks including an evaluation of what the use of FTRs in the Benelux countries would be.

References