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CHALLENGES AND OPPORTUNITIES OF AN INTERCONNECTED EUROPEAN AND RUSSIAN ELECTRICITY NETWORK

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Coal and oil, in limited form also gas, are traded over long distances. A single coal and oil world marked exist, with in principle one price. In case of gas four independent markets developed in the world. In case of the secondary energy carrier electricity, the situation is different. Various independent or only loosely coupled markets exist and even in Europe which is covered in large parts by a physical connected network still markets and market prices have not yet converged, mainly due to a lack of transport.

A set of motivations exist to create energy networks. So Peak capacity can be reduced by smoothing of the demand curve by an increasing number of consumers. Also there is a reliable back-up capacity for cases of unforeseen outages or maintenance work. Beyond this a stronger link between Western Europe and the GUS offers more advantages. While the first ideas were driven by the opportunity to connect the huge hydro potential of Siberia and Russia’s east with the demand centres of Western Europe, the Russian motivation is to get access to the attractive Western European markets with high electricity prices. Also the overall demand curve will be smoothed by the fact that the area includes 13 time zones.

The study will focus on three items:

- Fraction of base load plants in larger networks
- Increased opportunities to integrate renewable electricity sources in larger networks
- Effects of price and environmental standard differentials in networks

To answer these questions a simple linear model of the infrastructure was introduced. The modelled area, including Western Europe and the member countries of the GUS, was divided in 31 intersections. Most of the intersections represent a single country. Russia is divided into seven areas. A daily demand curve was assigned to each of the intersections. Neighbour countries are linked in the model by today’s capacities. To meet the requirements it is possible to install peak, middle and base load production capacities in each intersection. The model was optimised for minimal overall costs for installation, production and transport.

Several scenarios, which differ in transport capacities, installed wind capacities and primary energy costs were optimised.

The results indicate that an increased network would still promise advantages. The power plant capacities can be better utilised, expensive peak capacities can be reduced. Larger networks are also better suited to integrate intermittent electricity sources like wind energy. Price differentials would certainly lead to enhanced trading activities and as a result to lower electricity prices in the high price region. This might lead to an increase in CO_2-emissions.