

# **Electricity and natural gas interdependency: comparison of two methodologies for coupling large market models within the European regulatory framework**

M. Gil, P. Dueñas, J. Reneses

**Abstract—** Power generation growth based on natural gas fired power plants (NGFPPs) has lead to increasing interactions between electric power and natural gas industries. More companies are progressively and simultaneously participating as big players in both markets. However, each company has traditionally been settled in one side, holding a particular competitive advantage: electric power generation companies mainly know how to operate their generation assets, whereas gas companies mainly know how to manage their gas supply contracts and make use of often regulated gas assets. Multi-product energy companies have even created independent departments which decisions are usually taken uncoordinatedly. In any case, companies (or departments) usually support their decision-making process in mathematical tools which represent each market with detail. This paper presents two methodologies for coupling two interdependent electricity and gas market models formulated as optimization problems. Each methodology fulfills different department wishes. The "electricity-perspective" methodology maximizes electricity market profits after calculating equivalent gas contracts with the gas market model. In contrast, the "gas-perspective" methodology minimizes gas operation costs after obtaining the relationship between the marginal revenue and the gas consumption with the electricity market model. This coordinated solution would allow companies to obtain synergies, resulting in a competitive advantage over other companies that operate uncoordinatedly in both markets

**Index Terms—** Electricity market; electricity-gas interaction; natural gas market; optimization models;

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