Mechanism design and allocation algorithms for network markets with piece-wise linear costs and quadratic externalities

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Motivated by pricing issues in network markets with externalities and the paper *Cost-minimizing regulations for a wholesale electricity market* [1] in which we introduce a mechanism design for wholesale electricity markets, we present now an extension to multi agent setting with piecewise linear cost. In [1] the setting is limited to simplified markets made of two agents with linear production cost functions. The mechanism reduces the producers margin to the ISO benefit.
We consider a geographically extended market where a divisible good is traded. Each market participant is located on a node of a graph, and the nodes are connected by edges. The good can travel from one place to another through those edges at the cost of a quadratic loss. A central operator has to match locally production and demand at the lowest expense. As argued in [1] this setting is relevant to describe some real electricity markets. There is a clear antagonism between the market participants: the operator wants to minimize its cost while the producers want to maximize their benefits.
In a standard procurement auction, the market power resulting from the quadratic online losses allows the producers to bid above their true value (i.e. production cost).
We propose a mechanism to reduce the producers margin, to the operator benefit. Our main results are the expression of the mechanism design and two algorithms for the allocation problem. Those algorithms make it possible to numerically compute a Nash equilibrium for the procurement auction (important to compare the optimal mechanism and the standard auction setting).

Références

[1] N. Figueroa, A. Jofré, and B. Heymann. Cost-minimizing regulations for a wholesale electricity market. *working paper.*

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