

Market dynamics driven by the decision making power producers

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Introduction

- Electricity markets are composed of decision making agents.
- We propose an agent based approach to study electricity markets.
- Each agent is modeled by a set of rules and the characteristics of the market are analyzed through simulations.

Why an agent-based approach to electricity markets ?

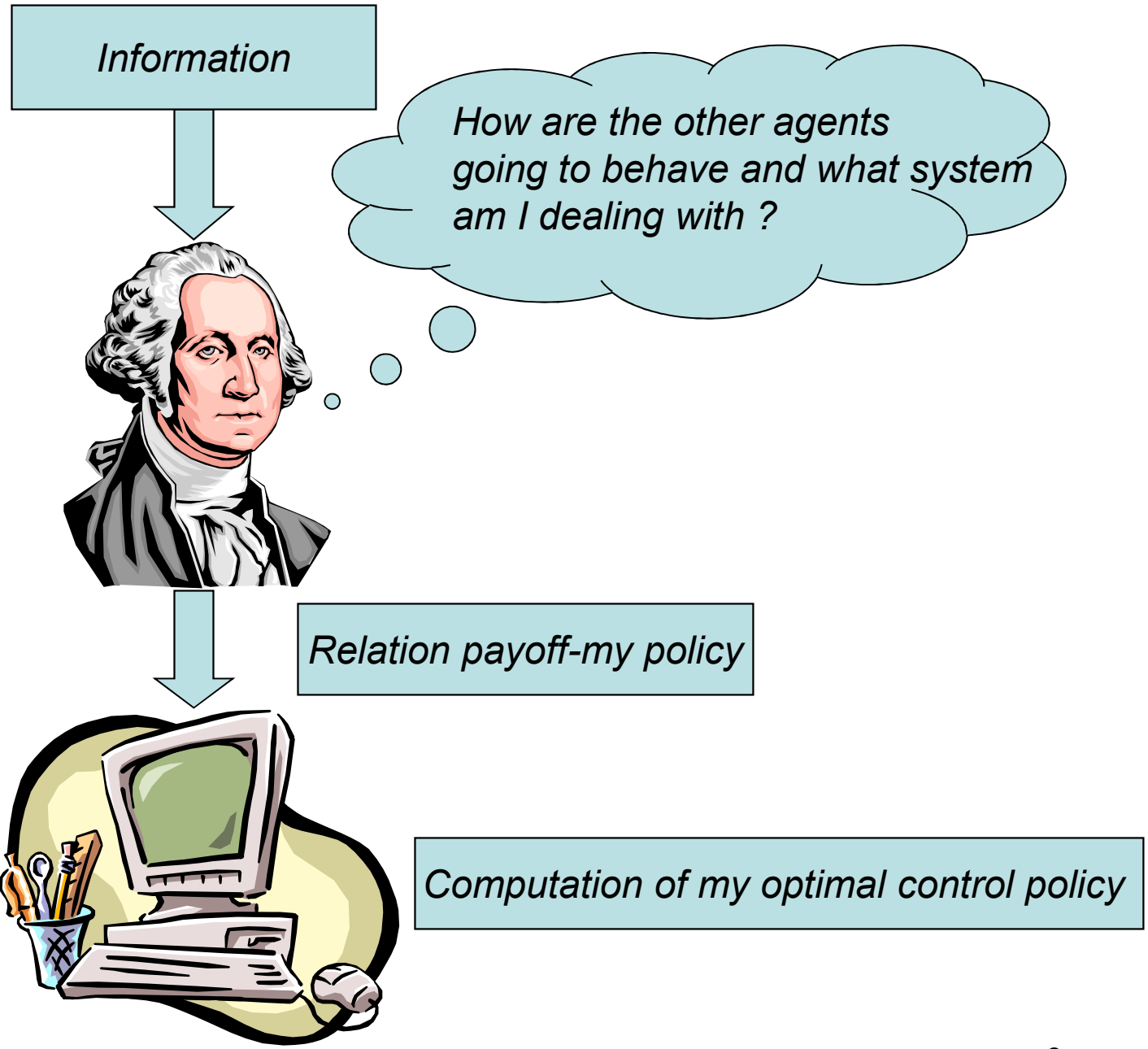
- Can deal with complex market structures (capacity constraints, price caps, etc)
- Can take into consideration the more complex behavior the different market participants may have (willingness to form a coalition, participation in negotiation processes, etc)

Two main contributions of this paper

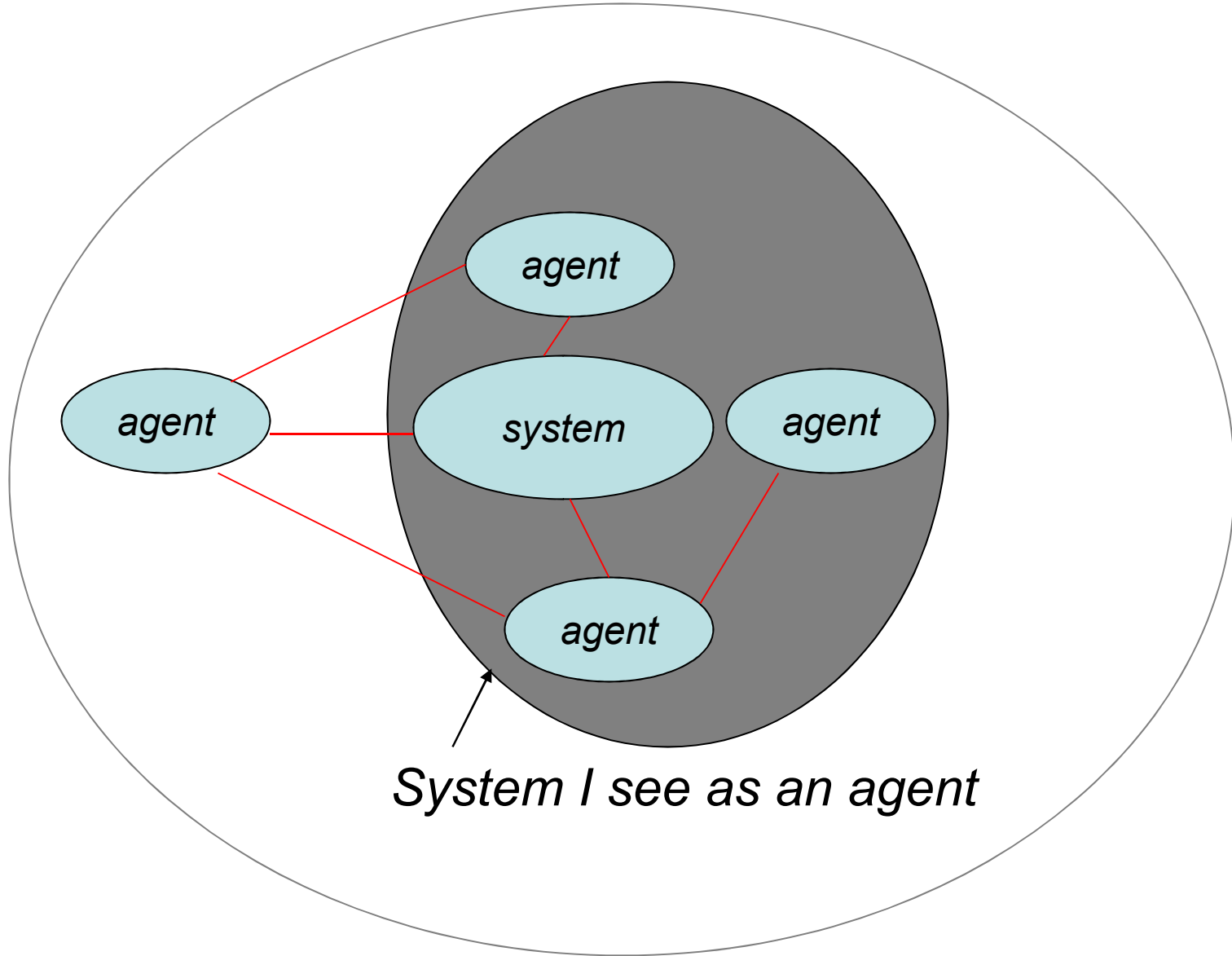
- Propose a new strategy for agent modeling.
- Use these models to simulate and study markets : we compute for each stage of the market the payoff of each agent and study the influence of several factors like congestion, new generation and portfolio on these payoffs.

New modeling approach

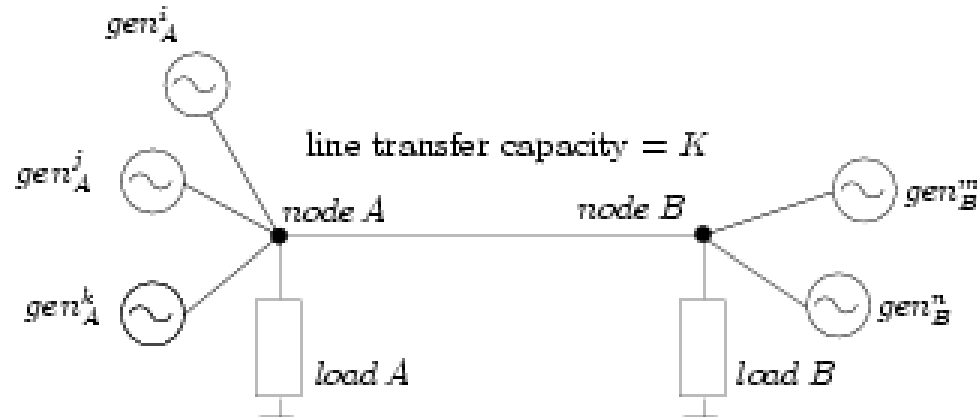
- Each agent makes assumptions about the behavior of the other agents and the system.
- Its behavior is the one which maximizes its payoff if the other agents were indeed behaving according to these assumptions and if the system was correctly modeled.
- It implies for each agent to solve internally a potentially optimization problem.



Overall system

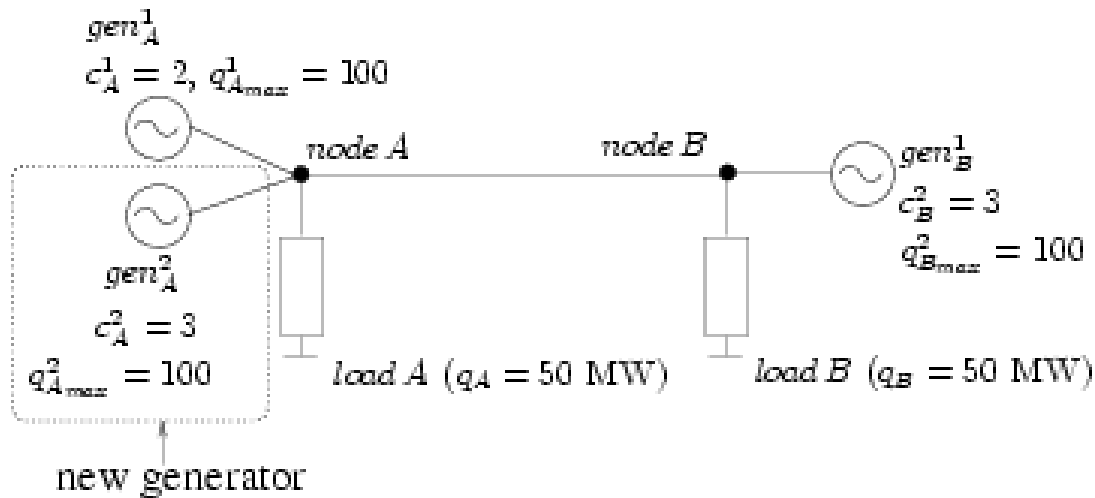


Application of these concepts

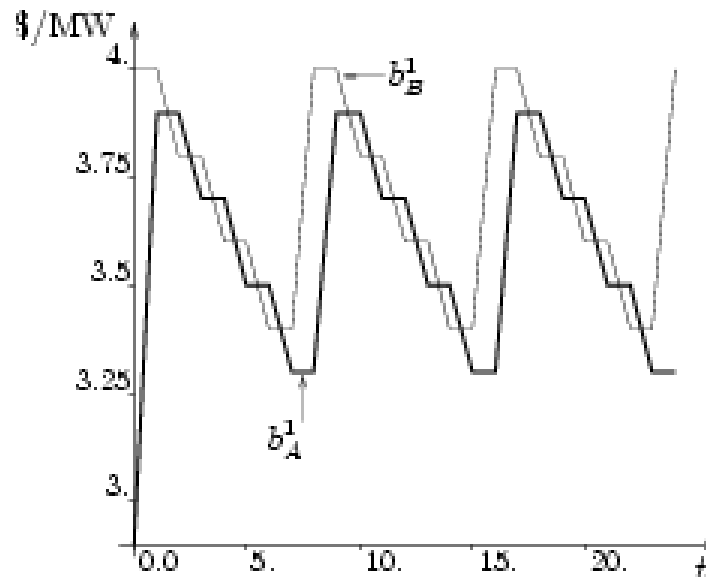


- Each agent supposes that the other agents submit the same bid as at the previous market stage.
- According to these assumptions, each power producer agent determines the value of its own bid.
- Rewards obtained are going to be summed over 25 cycles.

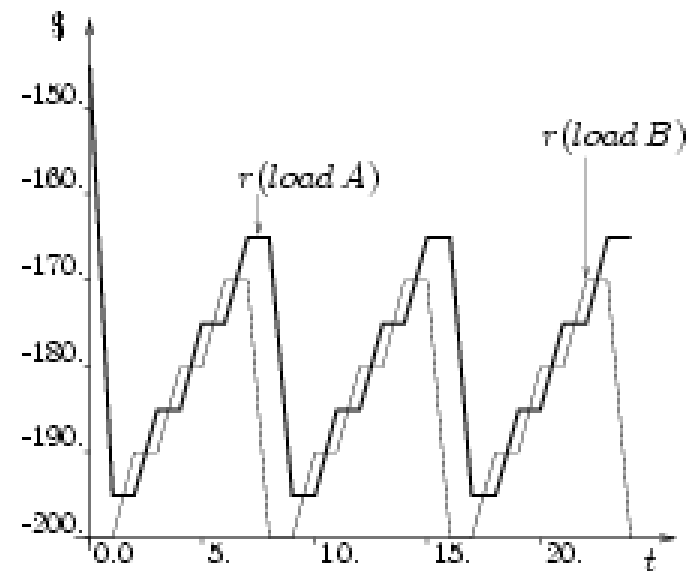
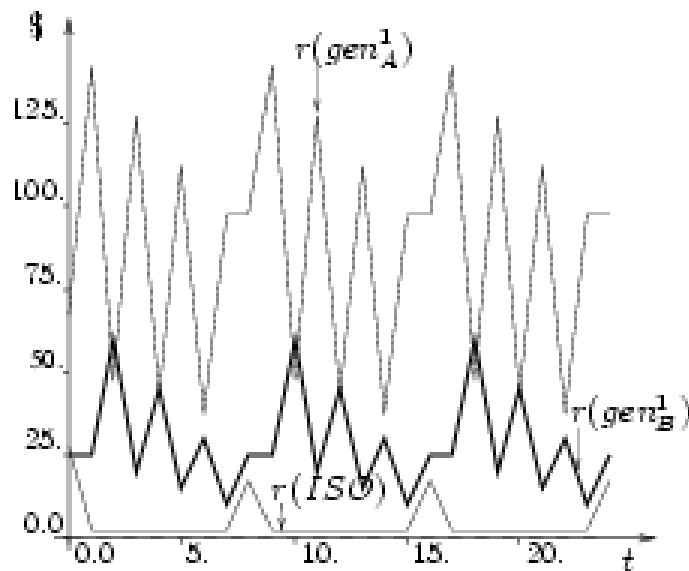
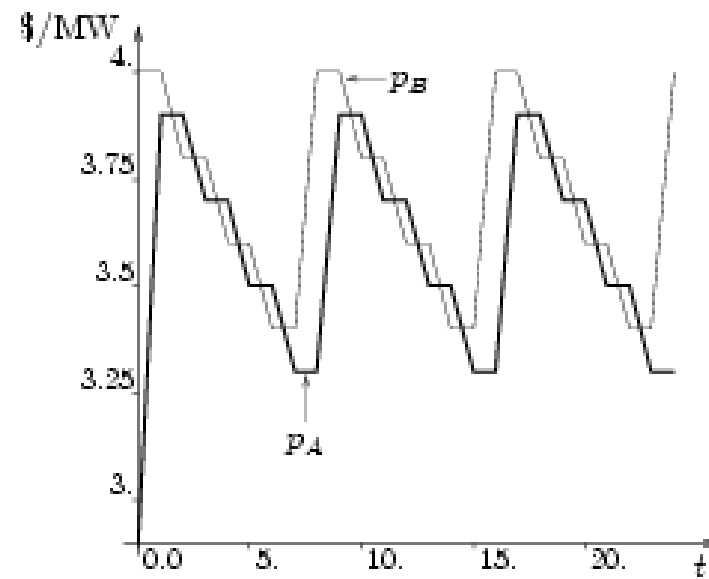
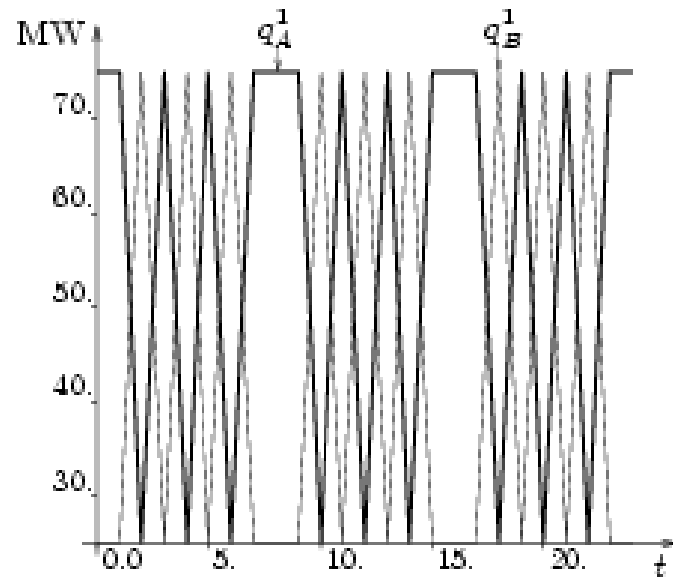
Influence of a new generator



Input of the market (the bids):



Output of the market (nodal prices, quantities, rewards):



Two generators and different values for K :

	<i>Rewards obtained over 25 stages</i>				
K	gen _A ¹	gen _B ¹	ISO	load A	load B
25	2,182	715	132	-4,465	-4,640
50	2,250	0	0	-3,625	-3,625

Three generators and different values for K :

	<i>Rewards obtained over 25 stages</i>					
K	gen _A ¹	gen _A ²	gen _B ¹	ISO	load A	load B
25	0	0	625	1,250	-2,500	-5,000
50	0	0	0	0	-2,500	-2,500

Conclusions

- Agent approach to electricity markets analysis and design is the right approach.
- Designing models for these agents is feasible.
- It will provide a tool to **compute** what are going to be the characteristics of a market rather than **guessing** them.