modeling the gas market in the netherlands in the new balancing regime

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goals - to understand

- A. the dutch gas market
- B. the new balancing regime
- C. how to approach the problem
- D. a real example
A. dutch gas market - physical flow I

A. Dutch gas market - physical flow II

- from suppliers to consumers (power plants) - high pressure distribution network
- to consumers (households - me, you) - local distribution network
- interest: high pressure network
A. Dutch gas market - market perspective I

- supply ↔ demand (+ some extra players)
- suppliers (groningen), consumers (us, power plants), shippers
- transport service operator (TSO)
- gas is traded
- currently no balancing
A. dutch gas market - market perspective II

new market design - april 2011

- bid ladder and near real time information
- each player is party responsible (PRP)
- each PRP must balance its own portfolio (POS), and all PRP’s balance the network (SBS)
- incentives for “helpers” and penalties “causers”
B. new balancing regime - zones

- real - 4 zones: light green, dark green, orange, red
- model - 2 zones: good and bad
C. problem

- very complex, many players
- physical flow, social interaction, market evolution
- different behaviors and interests
- must be broken into smaller pieces → ABM
C. problem

- new situation, don’t know how it will evolve
- tension: idea about how people think it will work
- truth: nobody knows
  - Q: why model?
  - A: to investigate this emerged situation
C. first step

- study the bid ladder mechanism
- look at imbalances in the market

how does this mechanism influence the operation of the market?
C. first step

- a pure market model
- no physical flow considered
- assumptions made
- under development
D. model

- actors:
  - 3 suppliers
    - supplier Groningen
    - supplier small gas fields
    - supplier import
  - 3 consumers
    - commercials
    - households
    - industry
  - TSO (transport service operator)
  - shippers
D. model

- actors interact
- imply their behavior using decision rules \(^1\)
- study and analyze their interaction
- decisions of players influence the whole system
- explore the operation of the new balancing regime

\(^1\)ontology = a formalization of existing concepts, a common language
D. ontology
D. model

START

PRP's buy or sell gas

perturbation

perturbed quantity IMBALANCE

TSO sends the POS and SBS to each agent

system is in balance?
GREEN ZONE?

YES

compute the capital of each agent and make the plots

NO

TSO takes action. depending on imbalance the system is short long
call the BID LADDER* compute the capital of each agent and make the plots
D. model

- Check which agent is "helper" and which one is "causer"

- TSO buys gas from helpers and sells it to causers (or vice-versa depending on the system)

- System is balanced
D. model
/**
 * Buy resources based on the current operational configuration of the technologies of this agent
 * check the technology, amount and product, then look for providers
 */
@override
public void buyResources()
{
    say(" **** " + this + " is buying resources for balancing");

    // pick the next technology
    for (Technology technology : this.getTechnologies())
    {
        // pick all inputs
        for (ComponentTuple tuple : technology
             .getcurrentOperationalConfiguration()
             .getOperationalInputs())
        {
            // for each input ComponentTuple get the Goodname
            GoodName wantedGoodName = tuple.getGoodName();

            // get the amount
            Float amount = amountTotalToBalance();

            // get the unit for this amount
            UnitName unit = tuple.getUnit();

            // print how much the agent wants to buy
            say(" " + this + " is looking for " + amount + " " + unit + " of " + wantedGoodName + " to balance the market");
            say("\n");
            say("---> transaction to be made");
            say("the needed quantity of " + wantedGoodName + " to balance the market is " + amount + " " + unit + ", buy it from suppliers!");
            buyResourceSuppliers(wantedGoodName,amount,unit,technology); // first time buy gas from suppliers to balance the market
            buyResourceToBalance(wantedGoodName, amount, unit, technology); // then buy or sell to helpers or causers

        }
    }
}
D. results

- good: the model runs
- bad: runs with bugs @TODO
- how the market operation works
- how the market is influenced by decisions and behavior or players
- bid ladder mechanism doesn’t work properly @FIXME
- \( \frac{\text{imbalance}}{\text{supply/demand}} \) gives different curves which influence the price
D. results
thank you for listening

questions, comments?

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