

# Emerging issues associated with alliances and mergers in network industries.

## Energy

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# Outline

1. Prolegomena
2. Agreements, contracts and mergers
3. Conglomerate mergers

# 1. Prolegomena

- basic principle in modern IO: all agents behave strategically within the set of constraints imposed by
  - competitors
  - consumers
  - environment
  - ethics
  - law
  - public opinion
  - technology
  - ...

## is it good or bad for society?

- "Good!", Adam Smith says.
- But in network industries the Smith's hand is more invisible than in any other industry because of market failures.
- All forms of regulation are required to complement the liberalization process:
  - *ex ante* control of M&A
  - *ex ante* industry-specific regulation
  - permanent supervision
  - *ex post* competition policy
  - ...

# why pure market mechanisms cannot work in the electricity industry

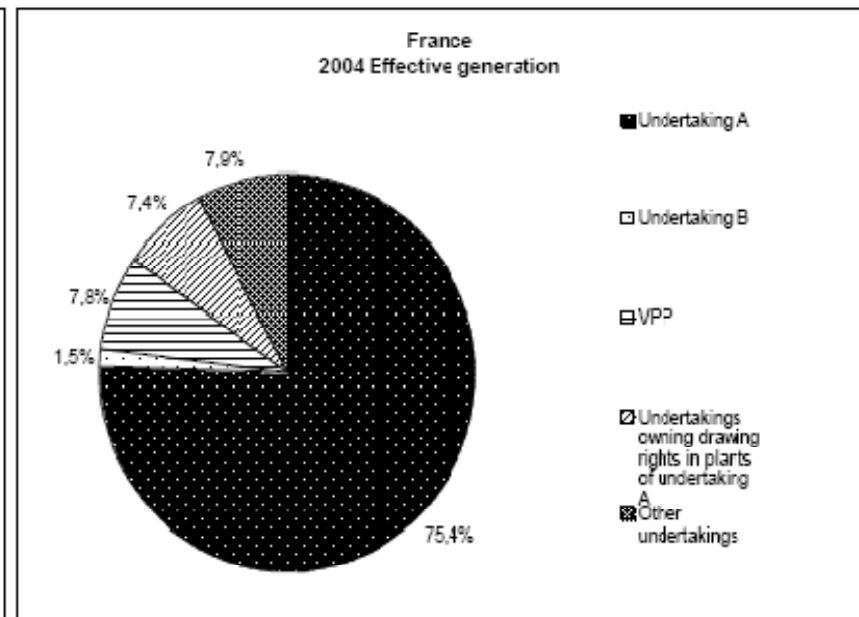
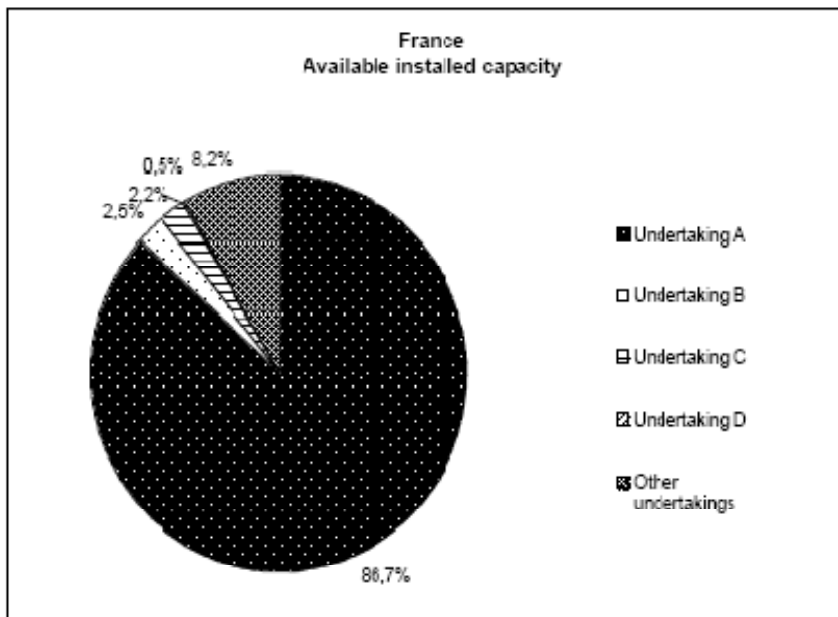
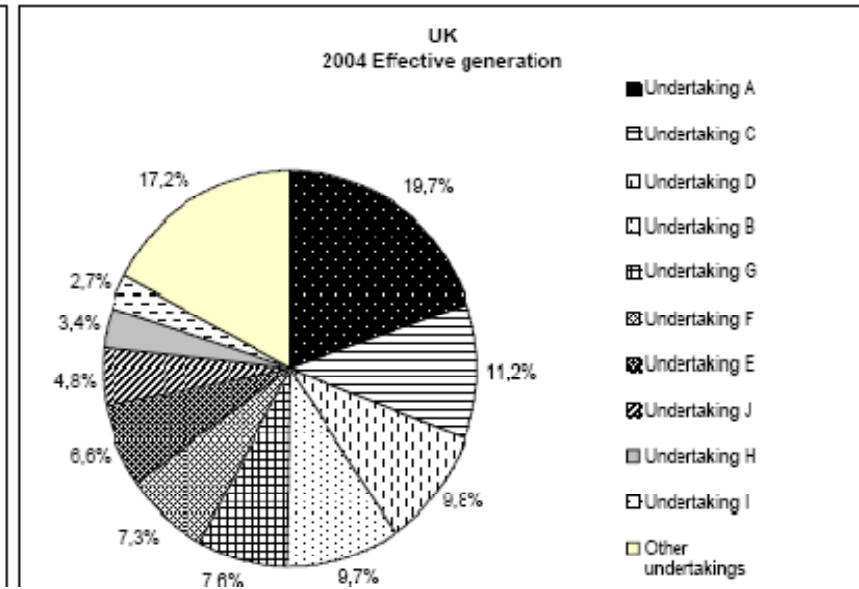
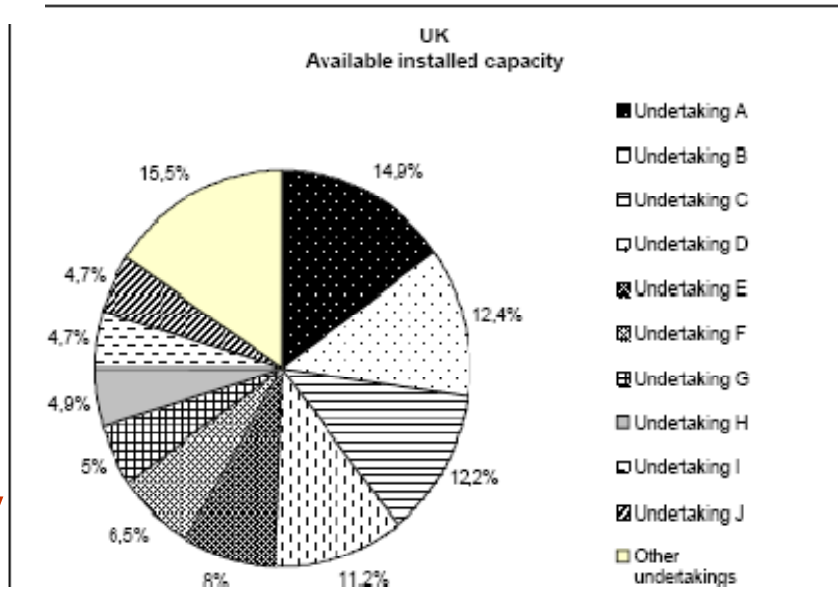
- non storability
- demand inertia
- externalities
- public good features
- loop-flows
- burden of the technology mix
- combined with
  - political concern about fairness and reliability
  - social demand for green electricity ... which is unreliable (rain, wind, crop, ...)
- lower prices vs. energy saving
- ...

# consequences

- the EC and the national authorities try to reallocate all the tasks formerly done by the incumbents through
  - market design
  - legal obligations
- since central planning cannot make it all
  - either the agents resist,
  - or they adapt by means of legal or illegal forms of integration.

# structural resistance

Energy Sector Inquiry 2007



## 2. Agreements, contracts and mergers

- two electricity producers, one in country A, the other in country B; A and B are interconnected by a line.
- for decades, the line has been used by the two firms for mutual assistance: formal or informal *agreement*.
- under liberalization, the line must help in promoting cross-border competition: explicit *contracts* (e.g. auctions)
- unbundling can result in the *merger* of the two TOs.



# on contracts

- a soft form of integration
- the longer the term, the more parties can commit efficiently
- drawback: a long term contract limits the opportunity of entry
- Commissioner Kroes very critical against LT contracts

# a variety of LT contracts

- energy swap (*eg.* Poweo/EDF)
- energy sale to suppliers without production plants (*eg.* Direct Energie/EDF)
- supply to (group of) final consumers (KalibraXE)
- long run options (VPP for more than 10 years)
- gas supply
- long run reservation of interconnection capacity

# criteria

- surplus production and surplus sharing
- specific investment and risk of hold-up
- risk sharing
- barriers to entry, foreclosure
- effects on spot and forward markets

# synthesis

	A. surplus	B. investment	C. risk	D. entry	E. effects on spot and forwards
1. swap	++	-	+	0	0
2. sale to retailer	++	-	++	+	+
3. contract with consumer(s)	++	+	++	--	-
4. VPP	++	--	++	-	+
5. upstream contract for gas	0	++	+	--	+
6. interconnection	+	++	+	--	-

## 3. Conglomerate mergers

- need for formal and quantitative analysis of real mergers and quasi mergers
- hereafter, some results from an ongoing work
  - "Strategic incentives to merge in the energy industry", with Alejandro Hernandez

# the EC complains about the lack of competition in gas and electricity

- like in all industries, the EC tries to increase competition in the gas and electricity markets.
- but many things are going wrong:
  - see "Report on progress in creating the internal gas and electricity market" {SEC(2005) 1448} and the 2007 "Energy Package"
  - in particular ...

# the EC complains about acquisitions

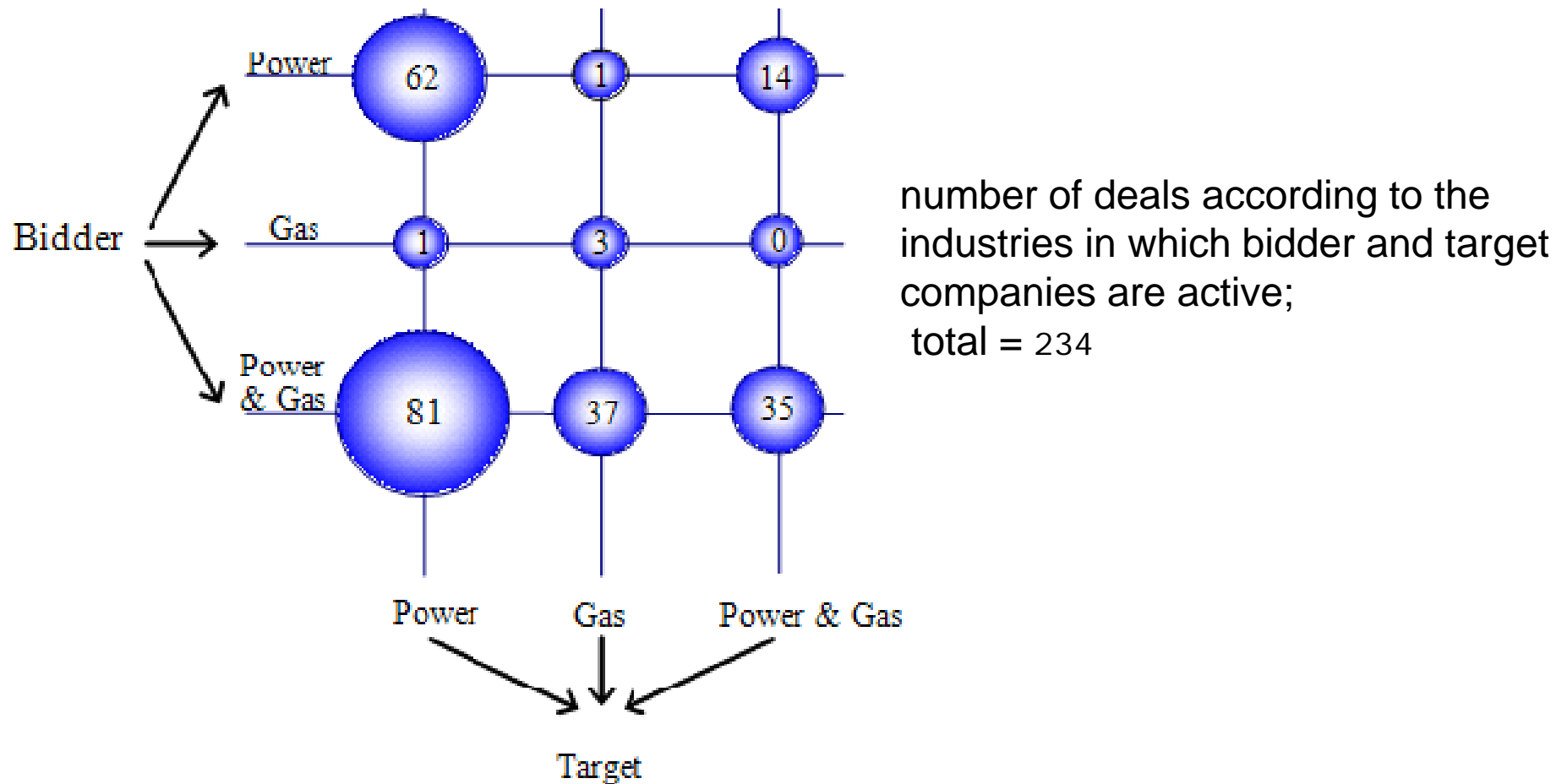
- "In addition to the high levels of concentration in national markets, an increasing number of cross-border acquisitions can be observed. (...)
- Furthermore there have been attempts by incumbent gas and electricity companies to merge. These mergers can reduce incentives for competitors to build new gas fired plants.
- The Commission is monitoring these developments carefully and – to the extent applicable – strictly applies its merger rules."

# a frenzy of mergers and takeovers in the European energy industry

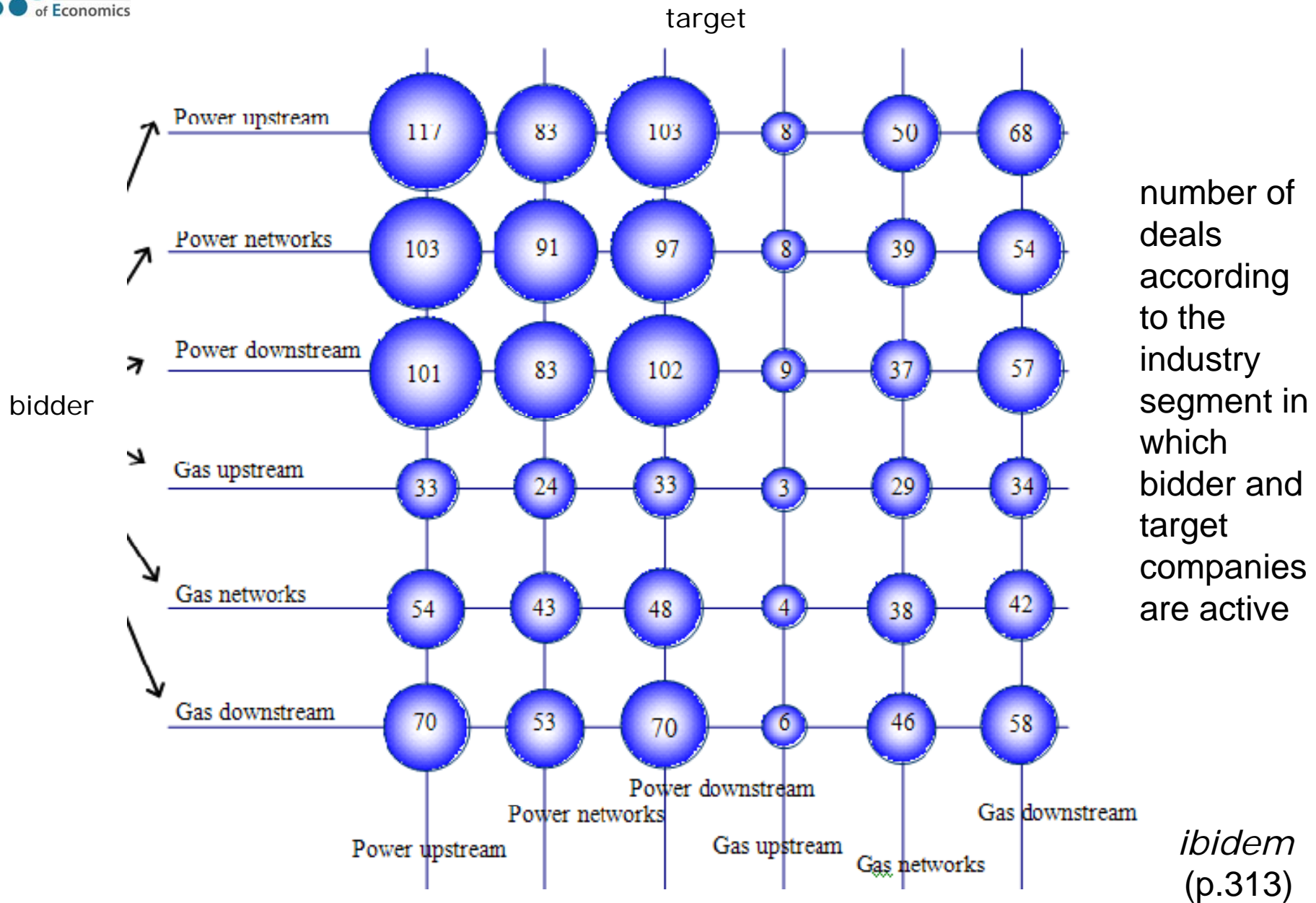
- New Council Regulation 139/2004
- mergers submitted to national authorizations
  - E.ON-Rhurgas: cleared (despite regulators' opposition)
  - Endesa-Iberdrola: cleared under conditions, withdrawn
  - Gas Natural-Endesa: cleared under conditions, abandoned.
- submitted to European authorization
  - EDF-London Electricity: cleared under conditions
  - EDF-EnBW: cleared under conditions (VPP)
  - EDP-ENI-GDP: blocked
  - Endesa-E.ON: cleared, then abandoned
  - GDF-Suez: cleared under conditions.



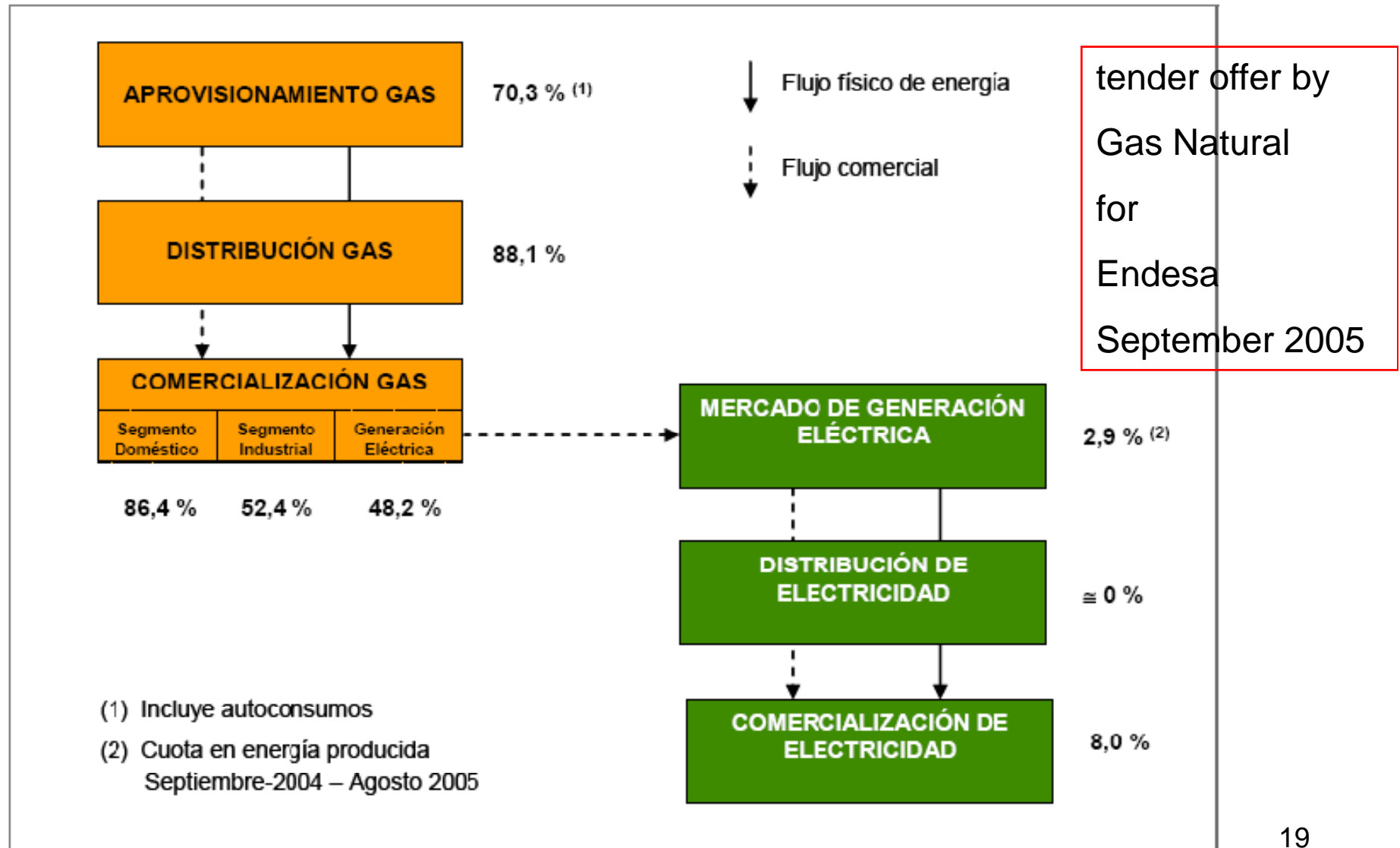
## M&A deals between energy companies in the European Union from January 1998 to December 2007



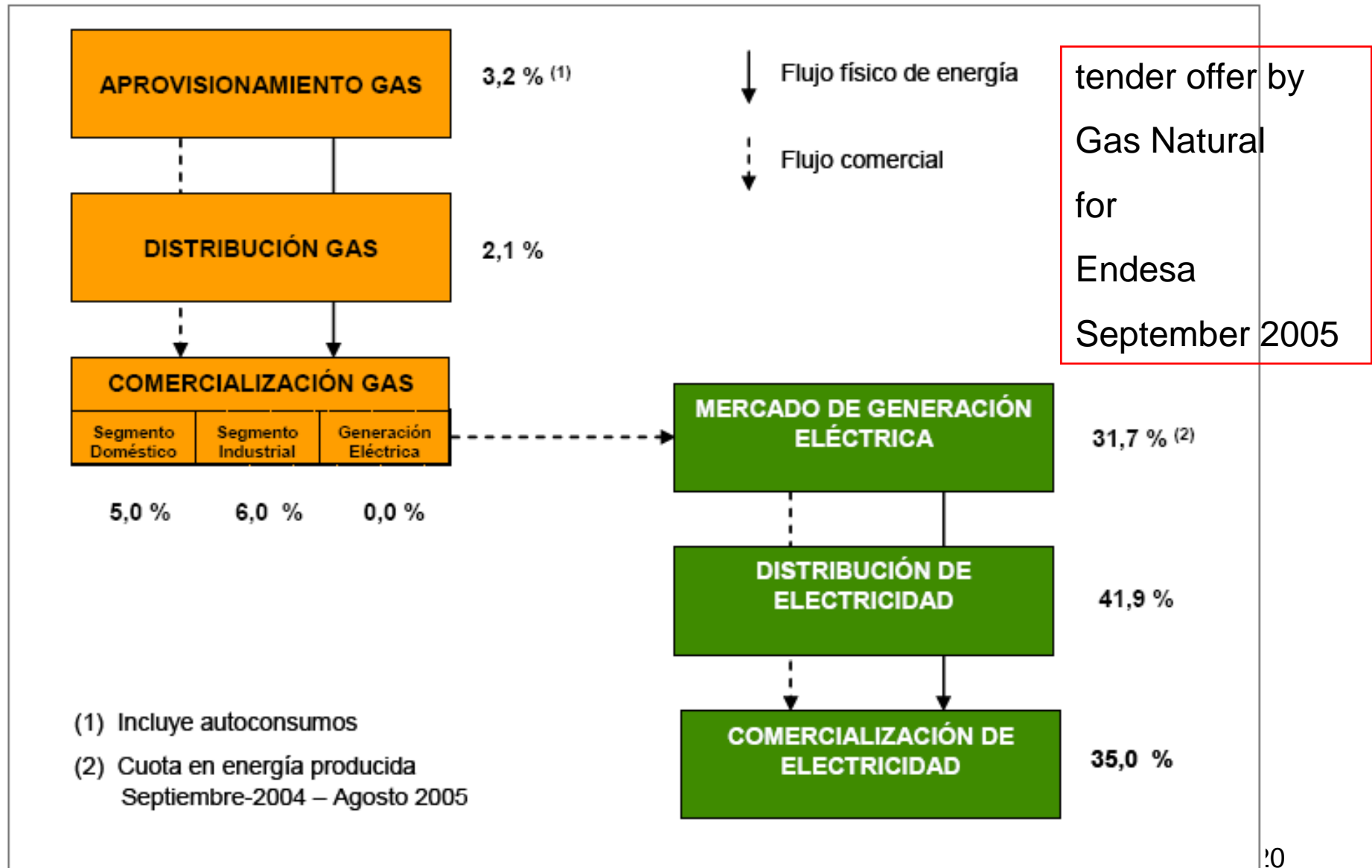
source: Leveque and Montorus (2008), "Mergers & Acquisitions within the European Power and Gas Sectors. Cases and Patterns" (p.311), Cerna, Paris



Cuadro 149 Resumen de las cuotas del grupo **GAS NATURAL** en los distintos mercados relevantes de los sectores de la electricidad y del gas natural (datos en términos de energía a finales de 2004).



Cuadro 150 Resumen de las cuotas del grupo **ENDESA** en los distintos mercados relevantes de sectores de la electricidad y del gas natural (datos en términos de energía a finales de 2004)<sup>88</sup>



# family feud

- because of the complexity of this type of mergers, it is hard to identify, measure and balance the social costs and advantages
- no agreement among economists
- need for adapted tools:
  - hereafter, a brick to an operational model

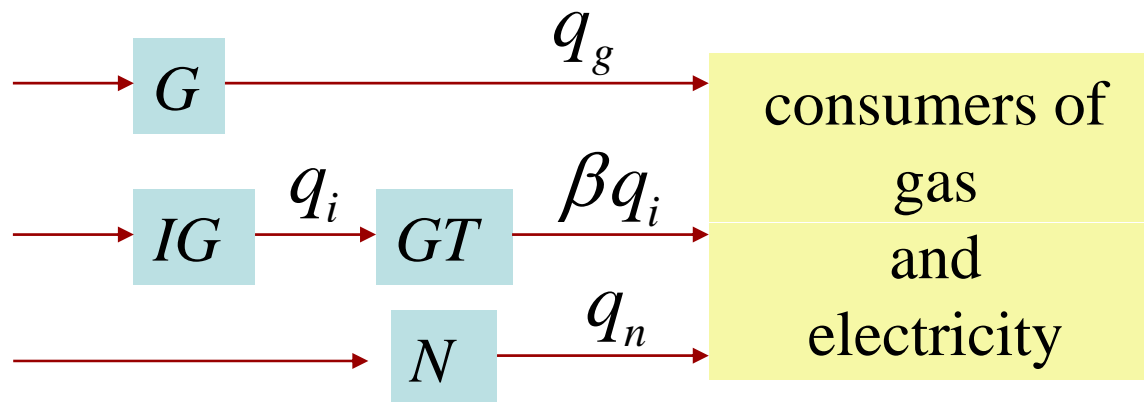
# basic model

$G$  : importer of natural gas for sale to the final consumer

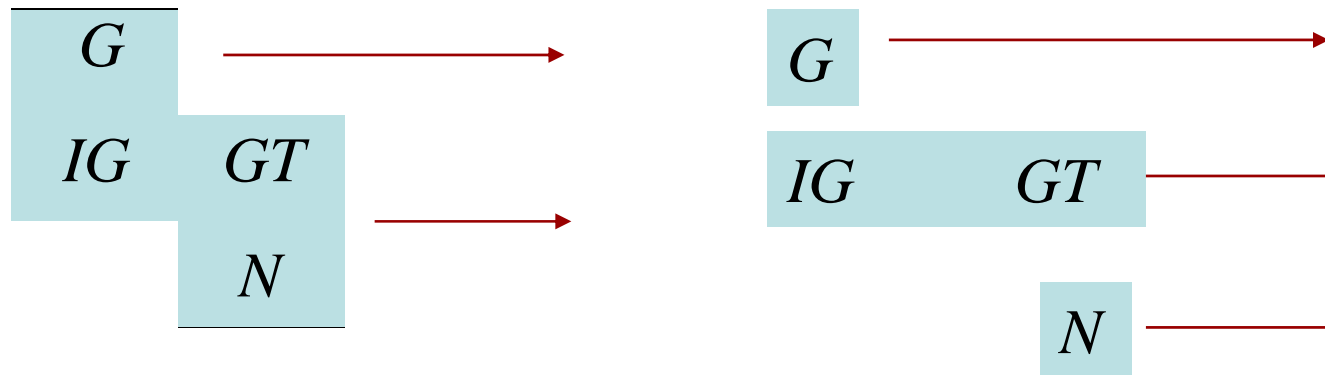
$IG$  : importer of natural gas for sale to gas turbines

$GT$  : producer of electricity using a gas-fired turbine

$N$  : producer of electricity using a primary fuel different from natural gas

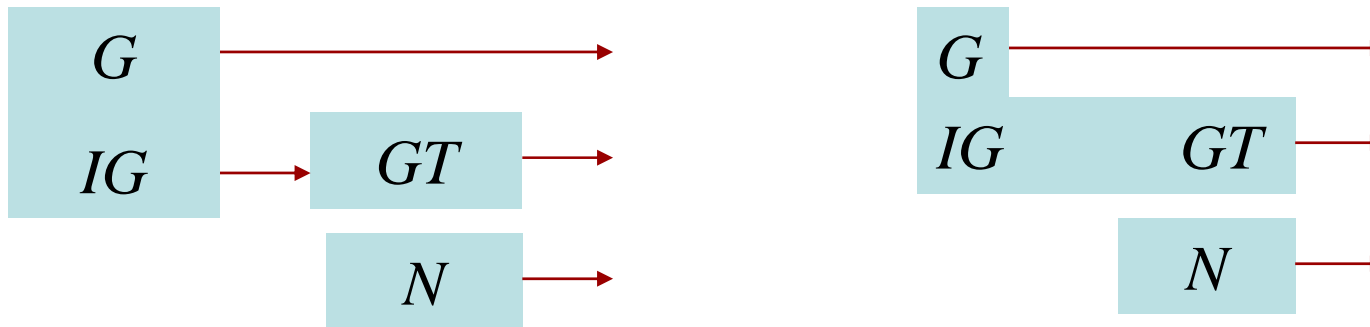


## alternative configurations of the industry



- social planner
- private monopoly
  - ✓ France after the merger of EDF and GDF ;-)
- oligopolistic benchmark
  - ✓ Spain after the merger GN/Endesa and assets sale of non gas electricity and gas retail :-)

# vertical integration when the downstream electricity technologies are competitors



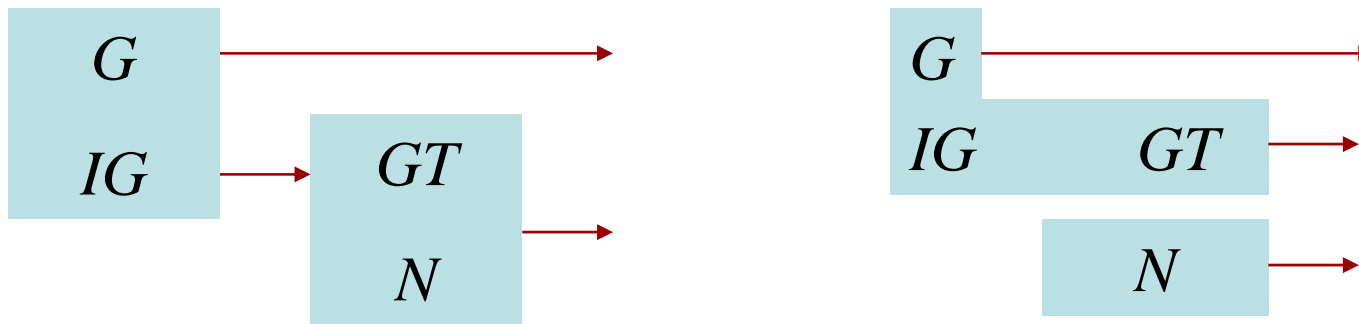
before

after

✓ the UK



# vertical integration when the downstream electricity technologies are not competitors



before

after

✓ France

## the model

- Consumers' surplus

$$S(q_e, q_g) = a_e q_e + a_g q_g - \frac{1}{2} (q_e^2 + q_g^2 + 2\gamma q_e q_g)$$

where  $\gamma = -\frac{\partial^2 S}{\partial q_e \partial q_g} > 0$ , substitutability index.

- Production cost for non-gas electricity

$$C_n(q_n, K) = \begin{cases} 0 & \text{si } q_n \leq K \\ \infty & \text{otherwise} \end{cases}$$

- Production cost of electricity from natural gas paid at cost  $c$

$$C_g(q) = cq / \beta \quad \text{where } \beta < 1.$$

## A. First best

It is the solution to

$$\max_{q_e, q_g, q_i, q_n} S(q_e, q_g) - c(q_i + q_g)$$

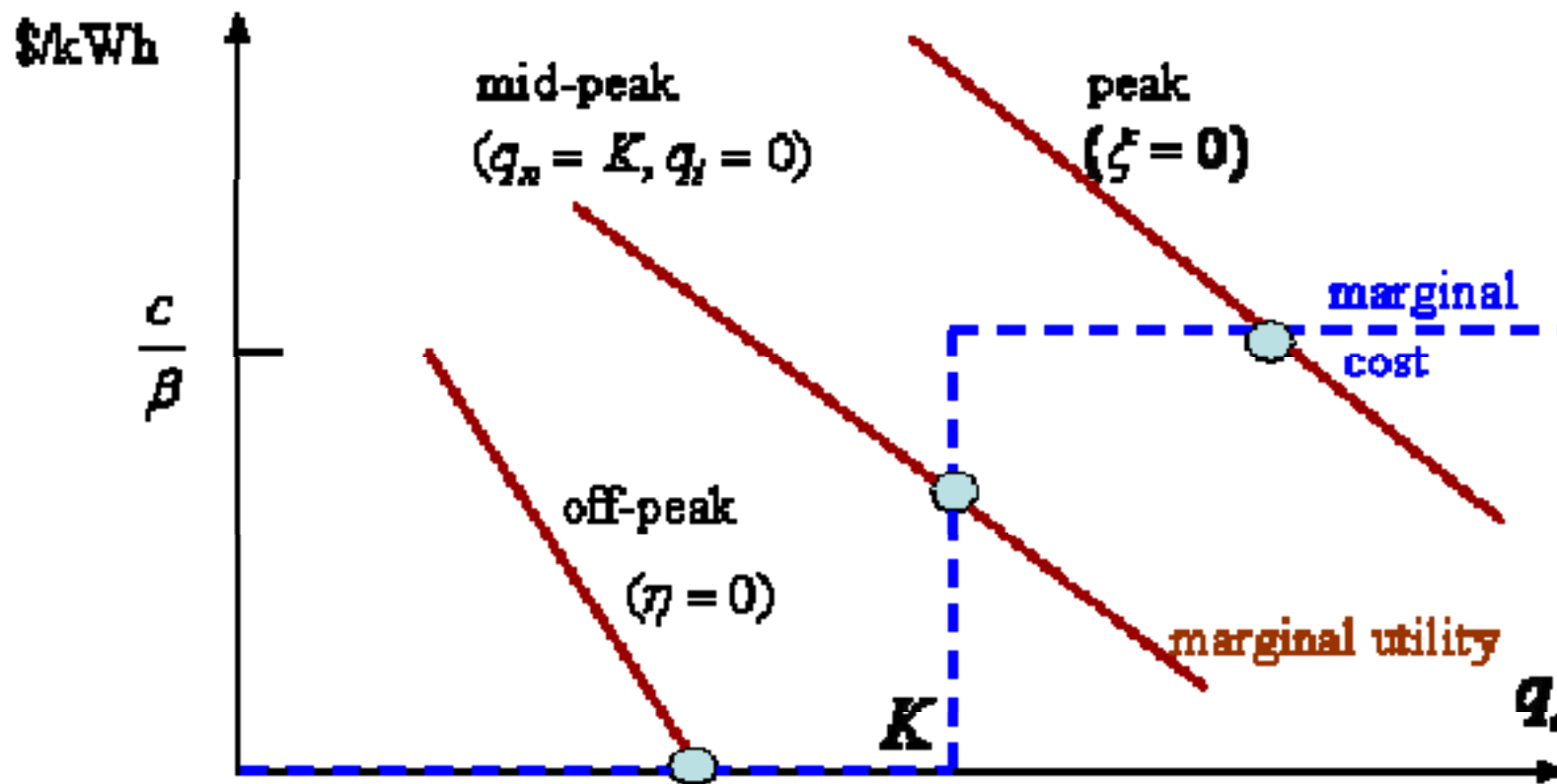
$$\text{subject to} \quad q_n \leq K \quad (\eta)$$

$$q_i \geq 0 \quad (\xi)$$

$$q_e = q_n + \beta q_i$$

Difficulty: where does the marginal utility of electricity intersect the merit order ?

As  $\gamma > 0$ , the whole allocation must be solved simultaneously.



## peak hours

$$q_n^* = K \qquad q_g^* = \frac{\beta(a_g - c) - \gamma(\beta a_e - c)}{\beta(1 - \gamma^2)}$$

$$q_i^* = \frac{(a_e \beta - c) - \gamma \beta (a_g - c) - \beta(1 - \gamma^2)K}{\beta^2(1 - \gamma^2)}$$

Conditions :  $K$  is small, and/or ...

When  $\gamma$  can be neglected

$$q_i^* = \frac{a_e - c\beta^{-1} - K}{\beta} \quad , \quad q_g^* = a_g - c$$

## first best decentralization

- hypothesis: end-users are price-takers

$$\max_{q_e, q_g} S(q_e, q_g) - p_e q_e - p_g q_g$$

gives

$$p_e = a_e - q_e - \gamma q_g \quad \text{or} \quad q_e = \frac{a_e - p_e - \gamma(a_g - p_g)}{1 - \gamma^2}$$

$$p_g = a_g - q_g - \gamma q_e \quad \text{or} \quad q_g = \frac{a_g - p_g - \gamma(a_e - p_e)}{1 - \gamma^2}$$

where  $q_e = q_n + \beta q_i$

## first best decentralization

The prices that implement first best are

	Off-peak	Mid-peak	Peak
$p_e^*$	0	$\eta(K)$	$\frac{c}{\beta}$
$p_g^* = p_i^*$	$c$	$c$	$c$

## B. full monopolization of the energy industry

$$\max_{q_n, q_i, q_g} p_e(q_n, q_i, q_g)(q_n + \beta q_i) + p_g(q_n, q_i, q_g)q_g - c(q_i + q_g)$$

$$s.c. \quad q_n \leq K \quad , \quad q_i \geq 0$$

- the private monopoly uses marginal revenue

$$p_e + q_e \frac{dp_e}{dq_e} \text{ et } p_g + q_g \frac{dp_g}{dq_g} \text{ instead of average revenue}$$

$$p_e \text{ et } p_g \Rightarrow \text{supply restriction}$$

- the private monopoly optimizes on technological choices: efficient mix of technologies for a given output.



## Conditions for profit maximization

$$q_g : (p_g - c) + q_g \frac{dp_g}{dq_g} + (K + \beta q_i) \frac{dp_e}{dq_g} = 0$$

$$q_i : (p_e \beta - c) + \beta q_i \frac{dp_e}{dq_i} + K \frac{dp_e}{dq_i} + q_g \frac{dp_g}{dq_i} = 0 \quad \text{from which}$$

$$q_e^M = K + \beta q_i^M = \frac{a_e - \gamma a_g + c(\gamma - \beta^{-1})}{2(1 - \gamma^2)} \quad \text{and} \quad q_g^M = \frac{a_g - \gamma a_e + c(\gamma \beta^{-1} - 1)}{2(1 - \gamma^2)}$$

obviously smaller than the first best levels  $\Leftrightarrow$  deadweight loss

$$\text{prices : } p_e^M = \frac{a_e + \frac{c}{\beta}}{2} > \frac{c}{\beta} \quad p_g^M = \frac{a_g + c}{2} > c$$

## C. oligopolistic benchmark

G

IG

GT

- hypothesis :  $q_n = K$
- the firm that sells natural gas to final customers solves

N

$$\max_{q_g} [p_g(K, q_i, q_g) - c]q_g$$

$$\Rightarrow FOC_g : (p_g - c) + q_g \frac{dp_g}{dq_g} = 0$$

- the manager of the gas turbine solves

$$\max_{q_i} p_e(K, q_i, q_g)\beta q_i - cq_i$$

$$\Rightarrow FCO_i : (\beta p_e - c) + \beta q_i \frac{dp_e}{dq_i} = 0$$

## differences with the monopoly case 1

- $G$  does not internalize the effect of its decision on  $p_e$  (therefore on the revenues of  $GT$  and  $N$ )
- compare

$$\text{duopoly } FOC_g : (p_g - c) + q_g \frac{dp_g}{dq_g} = 0$$

$$\text{monopoly } FOC_g : (p_g - c) + q_g \frac{dp_g}{dq_g} + (K + \beta q_i) \frac{dp_e}{dq_g} = 0$$

## differences with the monopoly case 2

- *IG/GT* internalizes neither the effect of its decision on  $p_g$  ( $G$ 's revenues) nor the side effects on  $p_e$  ( $N$ 's revenues);
- compare

$$\text{duopoly } FOC_i : (\beta p_e - c) + \beta q_i \frac{dp_e}{dq_i} = 0$$

$$\text{monopoly } FOC_i : (p_e \beta - c) + \beta q_i \frac{dp_e}{dq_i} + K \frac{dp_e}{dq_i} + q_g \frac{dp_g}{dq_i} = 0$$

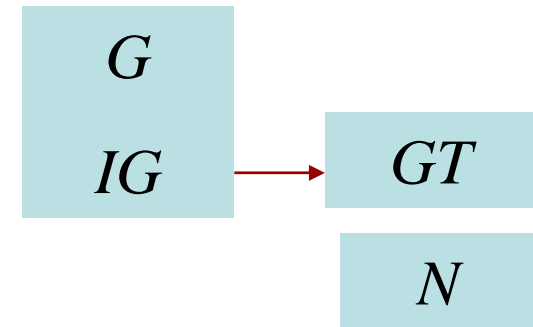
## differences with the monopoly case 3

- case not considered here : at the off-peak oligopoly equilibrium, we can have

$$q_n^c < K \quad \text{et} \quad q_i^c > 0,$$

which means, an inefficient combination of primary fuels.

## D. gas monopoly



Instead of the cost  $c$ ,  $GT$  must pay  $p_i$  for each  $\text{m}^3$  of gas from firm  $G/IG$ .

$$\max_{q_i} p_e(K, q_i, q_g) \beta q_i - p_i q_i$$

gives the demand for gas by  $GT$  as well as the supply of electricity from the gas turbine as functions of  $q_g$  and  $p_i$  (and  $K$ ).

Hypothesis:

$G/IG$  first chooses  $p_i$ , and then plays à la Cournot against  $GT$  to fix  $q_g$  simultaneously with  $q_i$ .

## downstream Cournot equilibrium

Downstream competition opposes  $G$  that pays  $c$  for each imported  $m^3$  and  $GT$  that pays  $p_i$  per  $m^3$ .

At the Cournot equilibrium,

$$q_g^c = \frac{2a_g - \gamma a_e - \gamma K - 2c + \gamma p_i / \beta}{(4 - \gamma^2)} \quad q_i^c = \frac{2a_e - \gamma a_g - (2 - \gamma^2)K + \gamma c - 2p_i / \beta}{\beta(4 - \gamma^2)}$$

which gives the price of gas to the final customer

$$p_g^c = \frac{2a_g - \gamma a_e - \gamma K + c(2 - \gamma^2) + \gamma p_i / \beta}{4 - \gamma^2}$$

## Choice of the delivery price $p_i$

The gas-imports monopoly  $G/IG$  solves

$$\max_{p_i} (p_i - c)q_i^c(p_i) + (p_g^c(p_i) - c)q_g^c(p_i)$$

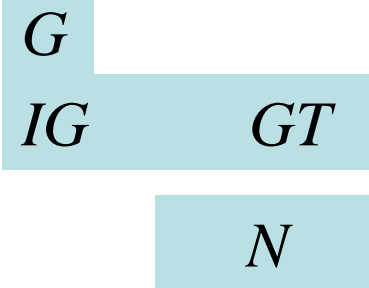
$$\Rightarrow q_i^c + (p_i - c) \frac{dq_i^c(p_i)}{dp_i} + q_g^c \frac{dp_g^c}{dp_i} + (p_g^c - c) \frac{dq_g^c}{dp_i} = 0$$

(-)
(+)
(-)
(+)

- When  $\gamma = 0$ ,  $\frac{dp_g^c}{dp_i}$  and  $\frac{dq_g^c}{dp_i}$  are nil  $\Rightarrow p_i > c$ : usual distortion
- When  $\gamma > 0$ , additional distortion: by increasing  $p_i$ , the group  $G/IG$  tries to exclude  $GT$  and to poach clients that switch from electricity to natural gas.



## Downstream gas integration



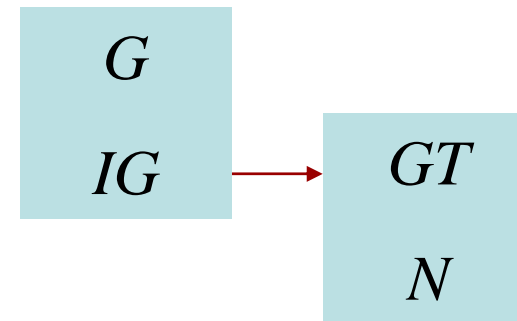
If  $G/IG$  merges with  $GT$ , the company solves

$$\max_{q_i, q_g} [p_e(K, q_i, q_g)\beta - c]q_i + [p_g(K, q_i, q_g) - c]q_g$$

Differences :

- with the energy monopoly: the company does not internalize the effects of  $q_i$  and  $q_e$  on  $p_e K$ .
- with the gas monopoly: no distortion  $p_i > c$  (efficiency defense), but two competitors instead of three on the final market; the net effect on welfare is ambiguous.

# E. gas vs. electricity

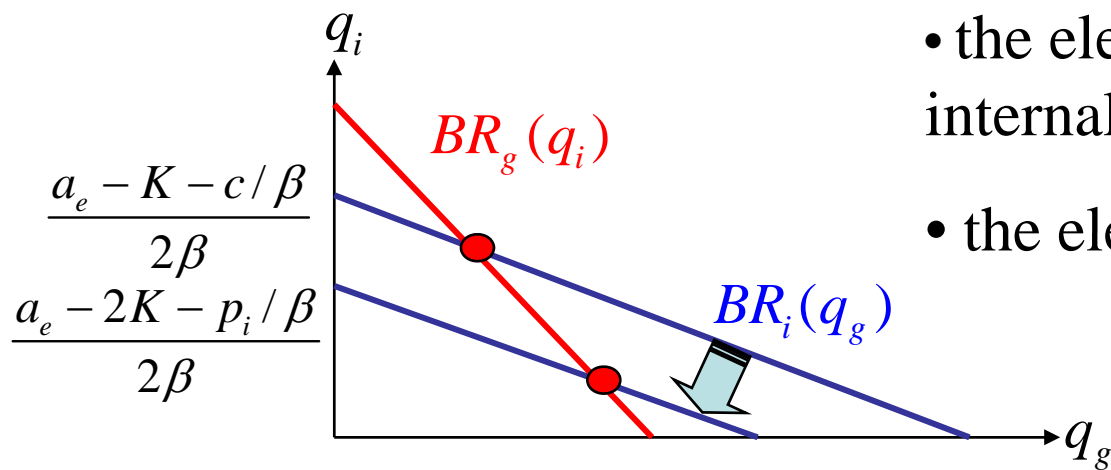


The electricity firm solves

$$\max_{q_i} p_e(K, q_i, q_g)(\beta q_i + K) - p_i q_i$$

Its best response is  $BR_i(q_g) = \frac{a_e - 2K - \gamma q_g - p_i / \beta}{2\beta}$

As compared with the oligopolistic equilibrium, there are two restrictive effects:



- the electricity company internalizes the effects of  $q_i$  on  $p_e K$ .
- the elec-comp pays  $p_i > c$ .

## downstream Cournot equilibrium

$$q_g^c = \frac{2a_g - \gamma a_e + \frac{\gamma P_i}{\beta} - 2c}{4 - \gamma^2} \qquad q_i^c = \frac{2a_e - \gamma a_g - 2\frac{P_i}{\beta} + \gamma c}{\beta(4 - \gamma^2)} - \frac{K}{\beta}$$

$$p_g^c = \frac{2a_g - \gamma a_e + \frac{\gamma P_i}{\beta} - c(2 - \gamma^2)}{4 - \gamma^2}$$

Here also, company *G/IG* has a strong distortion power thanks to the control of  $p_i$  :  $dq_g^c / dp_i > 0$  and  $dp_g^c / dp_i > 0$ .

What the model does not show: reaction of the electricity company that can substitute  $N$  for  $TG$ .

## Downstream gas integration



- Without remedies, the merger would create an energy monopoly
- Under the obligation to divest the non-gas electricity plants  $N$ , we are back to the former merger case; the merger results in
  - weakening in the gas / electricity competition
  - more efficiency upstream (intermediary gas sold at price  $c$ )
  - competition improvement in the electricity market: two active producers instead of one.

# preliminary conclusions

- conglomerate mergers require much more careful analysis than vertical and horizontal mergers.
- downstream integration by the gas provider has strong anticompetitive features
- the control of the intermediary market is a strong substitute to ownership bundling

# Extensions

- bundling of gas and electricity to final consumers
- non-binding capacity for the N-technology
- off-peak/peak cycles
- upstream substitutability between energy sources
- more firms, some not concerned by the merger
- calibration