



Measuring the non-cooperation costs of the European countries in energy policy (case of electricity)

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Introduction : advantages of cooperation

- Separated European countries are too small to succeed facing energy stakes
- The rise of interdependences of economies and energy systems in Europe increase cooperation benefits and non-cooperation costs

**How to measure these non-cooperation costs
due to interdependences ?
(the case of electricity in Europe)**

Plan of the presentation

- 1- Electricity policies in the European Union
- 2- The non-cooperation costs due to interdependences of the energy networks
- 3- Measuring the non-cooperation costs with an Energy Performance Index (EPI)
- 4- EPI of the domestic electricity generations (results)
- 5- EPI of the domestic electricity supply (results)
- 6- Examples of interdependences
- 7- Conclusion

1- Electricity policies in the EU

No global common energy policy in EU :

- Energy is a shared competence between the Union and the Member States (Treaty of Lisbon)
- Different energy policies by type of energy and by challenge
- National sovereignty of the energy security of supply policy

1- Electricity policies in the EU

Since 1996, emergence of an european power market, but electricity policy remain at the national level

- Regulated prices
- National support schemes of electricity from renewable energy sources
- Different priorities of the national electricity policies
- Bilateral relationships with non EU suppliers
- ...

2- Non-cooperation costs due to interdependences

- **The non-coordination costs of the energy policy priorities**
 - **Contradiction policies**
- **The costs of free riding**
 - **Import rather than production**
 - **Congestion benefits rather than interconnection capacity investment**

3- Measuring the non-cooperation costs

- **How to measure a multidimensional and interdependent phenomenon with qualitative and quantitative dimensions ?**

=> Construction of an Energy Performance Index (EPI)

- 1- Measure of the triple main goals of the european policy :
to a competitive, sustainable and secure energy
- 2- Convert results into indexes with the base 1000 for the best score
- 3- Transform index values to standardized index values with a mean of 500
- 4- Build the EPI = arithmetic average of the different indexes
- 5- Calculate for each country the difference to the best performance
(the best score = the max = 1000)

3- Measuring the non-cooperation costs

Measure of the three main goals for electricity policy :

COMPETITIVENESS

- 1- Calculate average costs of electricity gross domestic production (€/KWh)
- 2- Convert results into index values with the base 1000 for the best score
- 3- Transform index values to standardized index values with a mean of 500 to build the **energy competitiveness index**

3- Measuring the non-cooperation costs

Measure of the three main goals for electricity policy :

SUSTAINABILITY

1- Calculate :

- CO₂ emission of electricity gross domestic production (g/KWh)
- Share of electricity gross inland consumption produced from renewable energy source (%)
- Electricity intensity of the national economy (MWh/millions of €) :
electricity gross inland consumption / GDP

2 & 3 – Second and third steps

4- Build the **energy sustainability index** : arithmetic average of the different indexes

3- Measuring the non-cooperation costs

Measure of the three main goals for electricity policy :

SECURITY OF SUPPLY

1- Calculate :

- HHI of the sources of the electricity gross domestic production
- Fuel import dependence for electricity generation (% of gross inland consumption of the fuel)
- HHI of the non EU country suppliers of fuel used for electricity generation

2 & 3 – Second and third steps

4- Build the **energy security of supply index** : arithmetic average of the different indexes

3- Measuring the non-cooperation costs

=> Build the Energy Performance Index of the domestic electricity production

Arithmetic average of the :

Energy competitiveness index

Energy sustainability index

Energy security of supply index

=> Making costs comparison of different policies (cooperative and non-cooperative in € for a same score improvement of the EPI)

4- EPI of the domestic electricity productions (results for UE in 2007)

Energy competitiveness index of the domestic electricity production (difference to the best performance)	Energy sustainability index of the domestic electricity production (difference to the best performance)	Energy security of supply index of the domestic electricity production - Uranium importations included (difference to the best performance)	Energy security of supply index of the domestic electricity production - Uranium importations excluded (difference to the best performance)
France (0)	Switzerland (0)	Netherlands (0)	Czech Republic (0)
Switzerland (92)	France (187)	Germany (47)	Germany (29)
Belgium (207)	Luxembourg (256)	Spain (187)	Switzerland (53)
Germany (450)	Belgium (301)	Switzerland (227)	France (231)
UK (513)	Italy (301)	UK (230)	Spain (252)
Spain (554)	Spain (332)	Italy (382)	UK (270)
Luxembourg (622)	Germany (343)	Belgium (514)	Belgium (356)
Italy (705)	UK (348)	France (587)	Italy (593)
		Luxembourg (1047)	Luxembourg (1294)

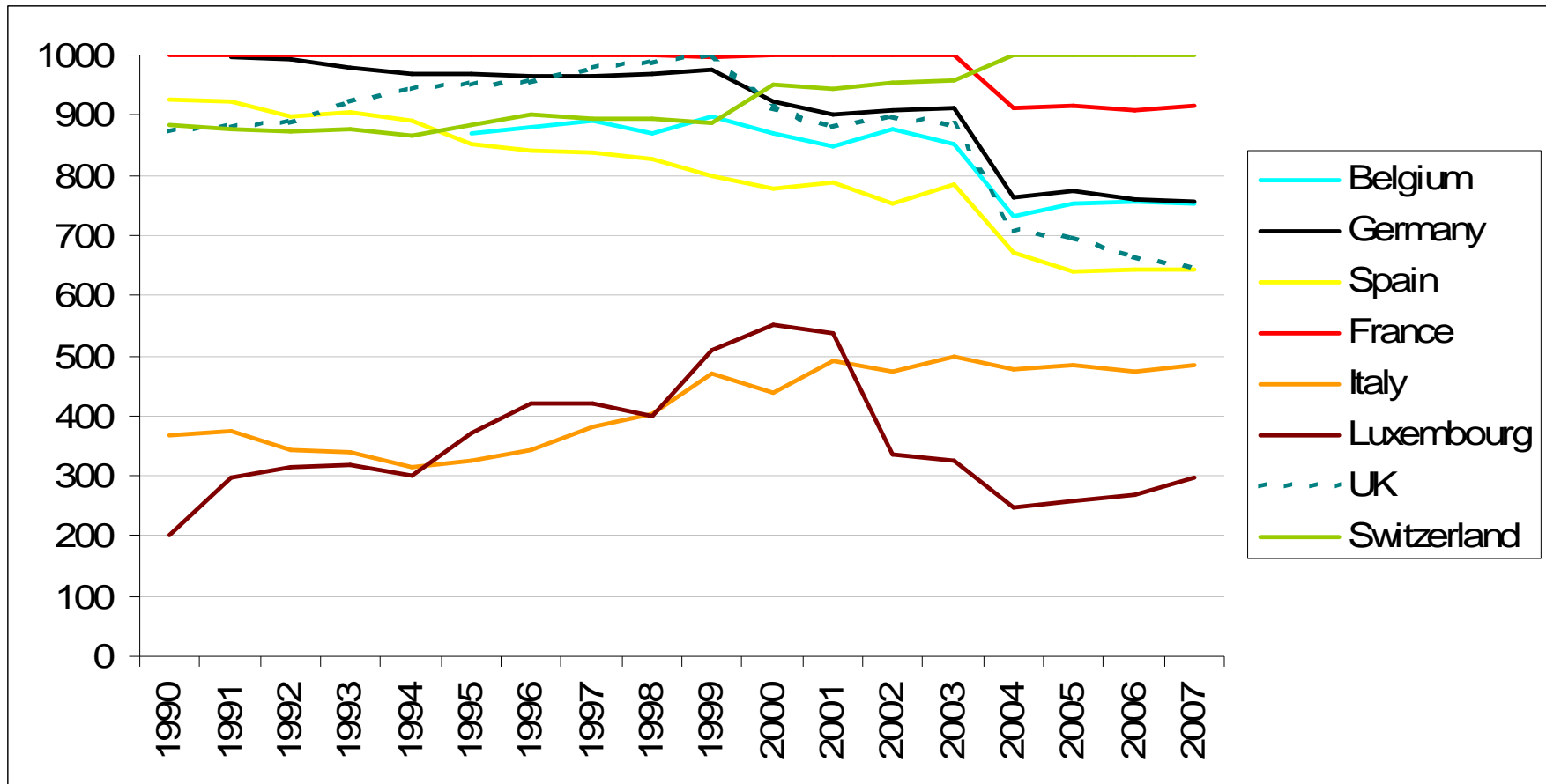
4- EPI of the domestic electricity productions (results for UE in 2007)

Rank	Energy performance index of the domestic electricity production - Uranium importations included (difference to the best performance)
1	Switzerland (0)
2	Sweden (71)
3	France (151)
7	Germany (211)
10	Belgium (253)
15	Spain (298)
16	UK (302)
24	Italy (416)
29	Luxembourg (592)

Rank	Energy performance index of the domestic electricity production - Uranium importations excluded (difference to the best performance)
1	Switzerland (0)
2	Sweden (60)
3	France (86)
8	Germany (246)
9	Belgium (246)
15	UK (352)
16	Spain (356)
24	Italy (517)
29	Luxembourg (702)

4- EPI of the domestic electricity productions (results for UE)

EPI base 1000 = best score



5- EPI of the electricity supply (UCTE west synchronous zone)

Take electricity trading and interconnections into account :

- Theoretical estimation of the sources of the electricity supply

Fuel mix in electricity generation of the gross inland consumption = fuel mix of the domestic generation + average fuel mix of the net exporting countries of the zone

=> Weighting in accordance with the share of net imports from UCTE member countries in the electricity gross inland consumption of the country

5- EPI of the electricity supply (UCTE west synchronous zone)

Take electricity trading and interconnections into account :

- Theoretical estimation of the security of supply and reliability of the system

Fuel mix in electricity generation circulating on the grid = fuel mix of the domestic generation (power injection to the grid from domestic electricity generations) + average fuel mix of the member countries of the UCTE west synchronous zone (Power injection from other UCTE member countries)

=> In accordance with the weight of electricity total imports from UCTE member countries compared to the electricity gross domestic production

5- EPI of the electricity supply (UCTE west synchronous zone, 2007)

	Opening degree of the grid = (total imports from the zone / gross domestic production) x 100	Net imports (GWh) from UCTE west synchronous zone
Belgium	17.8	6779.0
Germany	6.9	-17419.0
Spain	2.9	-2010.0
France	1.5	-49877.0
Italy	15.6	46283.0
Luxembourg	100.0	3960.0
Switzerland	51.2	-2062.0

Sources : Eurostat database, 2010

5- EPI of the electricity supply (UCTE west synchronous zone)

Measure of the three main goals for electricity policy :

EPI of electricity supply

- **Energy competitiveness index**
 - Average costs of electricity gross inland consumption (€/KWh)
- **Energy sustainability index**
 - CO2 emission of electricity gross inland consumption (g/KWh)
 - Share of electricity gross inland consumption produced and imported from renewable energy source (%)
 - Electricity intensity of the national economy (MWh/millions of €) :
electricity gross inland consumption / GDP
- **Energy security of supply index**
 - HHI of the sources of the electricity circulating on the grid
 - Fuel import dependence for electricity generation circulating on the grid (% of gross inland consumption of the fuel)
 - HHI of the non EU country suppliers of fuel used for electricity generation circulating on the grid

5- EPI of the electricity supply (UCTE west synchronous zone, 2007)

Rank	Energy performance index of the domestic electricity production - Uranium importations included (difference to the best performance)
1	Switzerland (0)
2	France (139)
4	Germany (283)
7	Belgium (314)
11	Spain (412)
18	Italy (620)
20	Luxembourg (880)

Rank	Energy performance index of the electricity supply - Uranium importations included (difference to the best performance)
1	Switzerland (0)
2	France (178)
4	Luxembourg (266)
7	Germany (297)
8	Belgium (343)
13	Spain (449)
18	Italy (645)

6- Examples of interdependences (UCTE west synchronous zone, 2007)

- How Poland can reduce CO₂ emission ?

Goal : reduce the CO₂ emission index of 30 points

=> Gas option : reduce electricity generation from coal to 10 000 GWh and increase electricity from natural gas

=> Nuclear option : reduce electricity generation from coal to 7 000 GWh and generate electricity from nuclear

6- Examples of interdependences (UCTE west synchronous zone, 2007)

	Emission CO2 index of the electricity supply (difference to the best performance)	HI of the non EU country suppliers of fuel used for electricity generation index of the electricity supply - Uranium importations included (difference to the best performance)	Energy performance index of the electricity supply - Uranium importations included (difference to the best performance)
Present situation	Poland (930)	Poland (0)	Poland (503)
Fictive situation with gas option	Poland (900)	Poland (266)	Poland (533)
Fictive situation with nuclear option	Poland (901)	Poland (0)	Poland (461)

Conclusion

Will the development of the EU power market force member states to strengthen cooperation ?



Thank you for your attention!
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