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EUI Working Papers

RSCAS 2009/37
ROBERT SCHUMAN CENTRE FOR ADVANCED STUDIES
Loyola de Palacio Programme on Energy Policy

THE DESIGN OF THE INTERNAL ENERGY MARKET IN RELATION TO ENERGY SUPPLY SECURITY AND CLIMATE CHANGE

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EUI Working Paper **RSCAS** 2009/37

ISSN 1028-3625

Printed in July 2009
European University Institute
Badia Fiesolana
I – 50014 San Domenico di Fiesole (FI)
Italy
www.eui.eu/RSCAS/Publications/
www.eui.eu
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This series of working papers aims at disseminating the work of scholars and practitioners on the above-mentioned energy policy issues.

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Abstract

The Clingendael International Energy Programme (CIEP), the Loyola de Palacio Chair on EU Energy Policy of the Robert Schuman Centre of Advanced Studies (European University Institute), the Fondazione Eni Enrico Mattei (FEEM) and Wilton Park Conferences (WPC) organize a four-tier program for discussing the potential for a smart EU Energy Policy. The Florence workshop is then the first one in a series of four where academics will discuss the various interactions between the three objectives of the EU Energy Policy with stakeholders from governments, regulators and the industry. This workshop addressed the internal energy market design and its consequences for energy supply security and climate change policies. The workshop gathered over one day and a half 42 experts to discuss current problems and possible solutions for a smart EU Energy Policy.

Keywords

Smart energy policy; 3d EU directive; Market design; Renewable energy; gas reform

WORKSHOP ORGANIZED BY THE LOYOLA DE PALACIO CHAIR,
ROBERT SCHUMAN CENTER FOR ADVANCED STUDIES
EUROPEAN UNIVERSITY INSTITUTE
IN COLLABORATION WITH CLINGENDAEL INTERNATIONAL ENERGY PROGRAMME,
FONDAZIONE ENI ENRICO MATTEI & WILTON PARK CONFERENCES

Florence, 28-29 April, 2009

Summary and Conclusions

Until now, the EU Energy policy is made of three separate objectives, namely 1° competition in the internal energy market, 2° security of supply, and 3° climate change. Balancing the three objectives in an integrated and smart approach is challenging and difficult. *To what extent is the market approach consistent with the other two policy packages? And introducing a climate package with tradable emission rights and non-tradable targets for green energy, what impact does it have on the market designs for gas and electricity? Are the necessary investments in new pipes & wires for securing our energy supplies sufficiently coming under the prevailing regulatory framework? Or, put it differently; are we smart enough in the way in which we are making implementing steps in order to meet our stated objectives?*

The Clingendael International Energy Programme (CIEP), the Loyola de Palacio Chair on EU Energy Policy of the Robert Schuman Centre of Advanced Studies (European University Institute), the Fondazione Eni Enrico Mattei (FEEM) and Wilton Park Conferences (WPC) organize a four-tier program for discussing the potential for a smart EU Energy Policy. This workshop is then the first one in a series of four where academics will discuss the various interactions between the three objectives of the EU Energy Policy with stakeholders from governments, regulators and the industry. This first workshop addressed the internal energy market design and its consequences for energy supply security and climate change policies.

Issues for discussion have been:

- o The interaction between the existing market and regulatory designs on the new challenges: grids & Renewable Energy Sources (RES); power generation investments and fuel mixes; gas imports and gas transits.
- o The regional market initiatives and their impacts on RES-policies & targets, on RES & Cross Border Trades, on Emissions Trading Schemes and Energy Efficiency Rights.

The workshop gathered over one day and a half 42 experts to discuss current problems and possible solutions for a smart EU Energy Policy under the "*Chattam House rule*[1]". The workshop has been organized in six working sessions and three conclusion sessions. Each of the six working sessions focused on a specific topic:

- The first session discussed Competition Policy and long term energy contracting.
- The second session dealt with Adapting Market Design to massive renewable.
- The third session addressed Smart market design and Regional Initiatives.
- The fourth session treated Toward a smart EU "GSM-like" infrastructure for smart metering, demand response and retail competition.

[1] The Rule allows people to speak as individuals, and to express views that may not be those of their organizations, and therefore it encourages free discussion. Speakers are then free to voice their own opinions, without concern for their personal reputation or their official duties and affiliations.

- The fifth session is devoted to the Framework for the operation and development of the EU energy grids.
- At last, the sixth session is dedicated to Gas storage and Gas balancing cross-country rules.

The three conclusion sessions have respectively focused on

- 1° The interaction of market design and cross-border issues with the climate change policy components (EU ETS, "green" and the RES-directive, energy efficiency requirements, technology push),
- 2° The interaction of market design and cross-border issues with "power supply security", power generation investments and transmission infrastructure developments, and,
- 3° The interaction of market design and cross-border issues with "gas supply security", gas imports, infrastructures and transits.

Key conclusions from the debate among regulators, competition authorities, the IEA, lawyers, industry, financial and academic delegates are reported here.

The first session discussed long term energy contracting and competition policy.

Two different perspectives are opposed on how to design efficient long term contracts. On the one hand, there is a fairly wide consensus between workshop participants about **the need for long term contract in the Energy Market** considering the long lifespan of infrastructures and the need for coordination tools for such sunken investments. Long term contracts allow safeguarding investments, from the perspective of either producers and or consumers. Long term contracts have also the advantage of providing cash to investor while giving ways to support industrial policy. Long term contracts are of importance too because producer and consumer highly value price stability and predictability while new uncertainties currently arise or will arise in the future, whatever the reasons about fuel or CO^2 prices, regulation and political framework of the energy sector, slow pace of market integration or the current economic crisis.

On the other hand, **long term contract with incumbents and not related to new investments raise a number of problems** as they tighten the market without providing any new capacity. They can foreclose the market with clauses such as exclusivity (but not only), when they cover high part of the market or when they have a long duration. Long term contracts can then endanger liquidity on wholesale markets. Several solutions have been thought and implemented by competition authorities to deal with these drawbacks from long term contracts such as limiting their duration from two to four years or limiting their market share to 20%.

However, it is unclear until now, **how to design precisely efficient long term contracts** to promote both long run investment and short run competition and operation. Even if producers and consumers have more ability to build good long term contracts as they are the interested parties. Considering the extent of what we do not know about long term contract in the traditional rather national electricity sector, we still have rooms for research about how to build long term contract adapted to a true pan-European electricity market with possibly long term reservation of transmission capacity and also forthcoming innovations such as massive amount of renewable energies or smart grids.

The second session was dedicated to Adapting Electricity Market Design to massive renewable.

There is again a fairly wide consensus between workshop participants about the features of the market design adapted to massive renewable. First of all, specific support schemes are needed to promote renewable since these technologies are not competitive yet with conventional ones. Until now, feed-in-

tariff is the most popular support scheme in EU and the most successful in terms of renewable investment capacity. However, efficient support schemes must be designed such that not only they give incentives to investments, but also receive market signals so that these generators are operated and located in an efficient way from the whole system point of view. Indeed the renewable support schemes must then be permeable to market signals. All the market participants also agree on the market design that sends efficient market signals. This is the textbook market design. It sends efficient short run and long run locational signals to guide efficient location and operation of generators, in particular renewable ones. The balancing, intraday, day-ahead markets are designed and articulated in a way such that generators, in particular the renewable ones that are intermittent, have the appropriate incentives to forecast their production and balance it in real time. Priority access is then of no use since renewable energies such as wind or photovoltaic power is dispatched first because of its zero marginal cost and redispatched last if the congestion or balancing problems occur.

Incentivizing Transmission System Operator's (TSO) and Distribution System Operator's (DSO) is also important to accommodate large amount of renewable energies with efficient transmission and distribution grid operation and investments. Regulator and system operator must also take care of the technical requirements for the connection of renewable power plants so that these generators can support major power supply shortage and help the power system in such a tense situation. The adaptation of electricity market design to massive renewable should take into account the specificity of different cases. **Offshore wind in North Sea** seems one of the most promising energy sources to achieve the goal of a sustainable development. And it requires thinking of developing a DC[2] ocean grid in North Sea to bring this energy back to shore and load centers. These investments of offshore wind farms and large DC grids need low perception of risk (regulatory or any other) so that investors can borrow enough money for such an ambitious plan. But the condition of risk on the capital market is not currently adapted for such biggest debts for electricity utilities.

From a pure efficiency point of view, efficient market design and renewable support schemes should be developed at the European scale. However, the European law and regulatory framework does not allow reaching such a goal. Second best solutions must be found in the current framework: each country choosing its own efficient market design and support scheme. For instance, Spain is a good example of a support scheme with market signals for an efficient development of wind power. But this European market through national implementation cannot lead to an integrated European market. And session 3 gives some elements to have integrated European markets.

The Third session has taken the challenge of facing the slow pace of market integration; the European Commission first seeks to reach market integration with European regions and Regional Market Initiatives.

However, **the concept of EU market design was and is still missing from the European Policy for energy markets**. Even the third package only wanted to repair shortcomings and failures and mainly focuses transmission unbundling. Of course, transmission unbundling has beneficial consequences. It provides more incentives to invest in transmission, and incentives to overinvestment can be handled with incentive regulation with endangering quality of supply.

But structural problems about the European market design are not resolved yet. Worldwide experiences of market design show that success shall be based on coordinated power pools with a central dispatch operator. From this point of view, the Regional Initiatives are already improvements compared to the past situations to ensure a more efficient use of transmission infrastructures. And the large scale implementation of flow-based congestion management schemes and cross-border intraday allocation process should then give further improvements. But they are also some problems. It is not clear what the incentives for TSOs to cooperate in regional initiatives are. Besides, considering the

[2] Direct Current

global need for coordination in Europe, it is unclear what the priorities for coordinating regional initiatives by themselves are. A project team is coordinating the regional initiatives. But the problems encountered in coupling Germany with NordPool show that this is a complex and difficult process that should need for a top down approach in handling these issues. It is also unclear if regional initiatives could lead at the end to a wide area energy pricing, such as nodal pricing in some parts of the US.

Europe also faces a challenge for cross-border transmission investment. Such investment is needed not only to achieve European integration of energy markets but also to foster competition, which an undervalued consequence of increase interconnection capacity. The 3rd package begins to handle this challenge requiring a 10-year transmission investment plan. However, there are still questions about how TSOs will have information about generation investment plans to develop efficient grids. Besides, the current ITC[3] for cross-border tariffs of the European grid does not send good incentives neither for TSOs for to develop cross-border investments not for generators to locate efficiently.

The EU Commission has put much emphasis on "*unbundling*" as the most important tool to increase the cross-border transmission investments. However, there is consensus that unbundling cannot solve alone this problem: there is a need of more coordination between national transmission operators. So, Regional ISO has been presented as an alternative to organize cross-border transmission investments. However, recent experience of Regional ISO (without full unbundling) in Scotland has shown that conflict of interests of suppliers owning transmission facilities (TO) and generation (G) can still create problems for transmission investments.

Even if the abovementioned problems are real to bridge the missing cross-border links in Europe or between Europe and neighboured systems with MedRing for instance, **the ultimate barrier to major power lines remains the opposition they face due to environmental constraints**. The example of interconnection between France and Spain shows that the TSOs and grids elements manufacturers shall propose innovative solutions for future cross-border investments and work to make the cost of such investments decrease.

Several technical solutions are then arising for easiest transmission investments. HVDC[4] is a well-known solution because the required rights of way are thinner and these types of lines can be buried more easily than the common AC technology. Other types of power flow controllers are also of great interest because they introduce new flexibility in the transmission grid by controlling flow with only a local impact compared to the wide geographic impact of common power lines. The technology of power flow controllers is of major importance for Europe as it is the basic blocks to build an offshore grid for integrating massive offshore wind power in the European network. However, as itself, this technology is THE solution since introducing network elements to control power flow will require more coordination between TSOs to deal with the effect on the whole European system of such a control of flows and to draw a maximum of benefits from these devices. The key issue here is how to incentivize TSOs for using the most efficient transmission technology of each particular case.

For the framework of operation of the EU power grid, balancing is also becoming central with an increasing amount of intermittent generation.

Of course, intermittency is not new for the power system if we look at load for instance. But balancing market and operation has to be reengineered to cope with the new intermittency from wind or photovoltaic. First, there is a need for EU level coordination center for technical coordination of TSOs. This can avoid the possibility of black out, as the systems are interconnected. Second, balancing markets will need to be more and more coordinated with gate closure closer to real time and more

[3] Inter TSO Compensation Mechanism

[4] high-voltage direct current

coordinated and liquid intraday markets. This may need trading platforms with broader geographical scope. Moreover, the renewable supports schemes must be designed such that renewable generators are considered as any other types of generation in balancing.

The fourth session was dedicated to define a smart EU "GSM-like" Infrastructure for smart metering demand response and retail competition is also part of the solution for an efficient integration of intermittent renewable power plants.

Implementing smart grid means to expand intelligence in the power system until distribution system and end-user to control the highest possible number of devices and make then react to price signals. It worth the cost to note that intelligence is currently limited to the transmission level only. However, smart grid will not emerge from simply introducing information and communication technology. Smart policy requires a hierarchical analysis of the power system to have smart end-user consumers (or *prosumers* = producers + consumers) in smart building connected to smart grids. Since smart grid is mainly related to the distribution level, a national-specific solution will be needed to take into account the national specificities in the use of electricity in itself and compared to other sources of energy. To foster competition in this new area, interoperability will be required to avoid entry barrier. The existing players are making money from the existing business model and thus they tend not to be innovative. However, new entrants know that it may be their room for entry.

The large scale implementation of **smart grids still raises a lot of unanswered questions about the adapted business model** to extract it a maximum of benefits with minimum costs and without introducing a new source of uncertainty from the end-users' reactions to price. The key issue here is the design of regulatory framework that allows the development of innovative and efficient solutions under a context of highly dispersed costs and benefits among different stakeholders. These questions are related to the organization of the "metering" activities as a market or as a monopoly activity (for a discussion about these topics, refer to the workshop about smart metering given at the FSR-EUI in February 2009)

The fifth session was devoted to Storage and Gas balancing cross-country Rules.

Until now, this workshop has mainly focused on electricity. Considering the interdependency between electricity and gas system and the share of gas in the global energy mix, it is needed to focus on the gas system too. What makes gas system different from the electricity sector is the possibility to store gas. This makes great difference in the operation and the investment of the gas network compared to the electricity system. Storage gives the gas system a supplementary degree of flexibility and as so introduces more complexity. In the restructured gas sector from an either global or EU point of view storage can have different uses to provide flexibility, promote competition and enhance security of supply.

As a consequence, this is of great concern as there is no working commercial (& competitive) market for storage except for UK and that there is a lack of storage capacity in many countries. As a result, the storage capacity can be used strategically to hinder future competitors in the production of natural gas. This strategic activity can happen when there is a preemptive action by the storage system operator. But, of course, gas storage can also have advantages since it can provide security of supply.

There is not only one market for storage because there are different kinds of storage depending geology. And these different kinds of storage correspond to different activities (balancing, seasonal storage or longer term storage). Considering the varied geology between the different countries, access to storage and interconnection capacity in Europe has to be considered for optimizing the European gas system. Some types of storage can then make balancing constraints quite loose in the gas system. The TSOs and shippers can also use the linepack (stored and pressured gas in the pipeline) to balance.

Nevertheless the gas system has to remain balanced on a more or less daily basis to avoid a too important and dangerous decrease of gas pressure in the pipelines.

The **balancing gas markets** in Europe have a central role for the network operation and in fostering competition in Europe. The balancing markets are not currently harmonized in Europe as each national (or even local) TSO implemented different balancing rules with different balancing periods (from hours to a day) and different penalties. ERGEG has then issued guidelines for good practices for gas balancing to relieve what it has identified as barriers for entry. These guidelines ask for fair and non-discriminatory balancing with cost-reflective imbalance charges so that gas balancing regimes in Europe are more harmonized. Besides, the increased interdependency of electricity and gas systems through the development of combined cycle-gas turbines raises the question about the need for coordination of balancing between these two sectors. There is no unique answer as it depends on the national development of gas power producers. But this question may be of increasing importance as there is an increasing use of gas power producers to replace coal power producers and balance the system against the wind and photovoltaic intermittency.

Given the previous sessions of the workshop, now come the conclusion sessions.

The first conclusion session focuses on market design to achieve an efficient reliable power supply with efficient operation and investments for both generation and transmission while internalizing cross-border interdependencies in interconnected power systems.

There is quite a consensus about the theoretical superiority of day-ahead, intraday and real time nodal pricing for short run efficient scarcity and locational pricing, even if there is debate about the relative practical efficiency of zonal pricing. In the long run, indicative planning reports in particular generation adequacy report and transmission development plan are needed to help coordination of generators' investment and between generation and transmission investments. Long run locational signals with zonal tariffs for grid access can also help coordinate the location of generation investment with current and future grid capacity.

There is also a consensus about the need and the role of long term contract for efficient generation investment even if as we have seen it previously, there is no clear idea about how to design efficient long term contract. But there is still question and debate about the need for generation capacity market (or other kind of capacity mechanisms) for incentivizing generation investment. This efficient market design is what the EU is trying to implement since the beginning of restructuring. There is now a discrepancy with what is feasible in reality, which leads to an inefficient European market. This is because of the institutional obstacles we know in Europe to have an integrated and coherent EU energy policy.

However even the current European institutional framework lets rooms for further improvements of the European market designs.

Now, balancing in Europe is neither harmonized nor coordinated, which creates distortions on all the other wholesale prices from intraday, day-ahead to future prices. However, there are projects of coordination of European balancing markets under the umbrella of ETSO and some projects for coordination of network operation such as the CORESO initiative (with the coordination of RTE, Elia and National Grid). All this could result in a quite near future in a small number of European coordination centers. For wholesale markets, there are already regional flow-based market couplings on the way. Even if these initiatives to coordinate wholesale power markets also raise some questions, in particular about how the TSOs will build the zonal economic vision of the network. It was also noticed previously in the workshop that we don't currently know how to prioritize the coordination of regional initiatives and coupling between market couplings. Moreover, there is now some movements for mergers of Power eXchanges (PX), which, coupled with an increased integration of PX with TSOs

could result in European markets closer to the pool models. The role of long term contract for efficient generation investment is widely recognized and the EU policy about long term contract is currently in construction, even if we must know understand how to do an efficient policy for long term contract. As for long run locational signals, it is a well-known and old problem in Europe but with no solution in the current framework. To end, the planning of generation and transmission investments is on the way to be coordinated at the European scale with more and more refined process to take into account the long run effect of intermittency from renewable investments. However, as mentioned in previous sessions, there are still some questions about the incentives for TSOs to invest in cross-border investments.

Market design has also some interactions with the climate policy components, namely carbon policies, renewable energy and technology policies (related to technologies other than the RES) and lastly energy policies.

The interaction between market design and carbon policies stem from The European Union Emission Trading System (EU-ETS) which modifies the price of power internalizing the effects of CO^2 emissions. If an efficient level of emissions is set with adequate rules for grandfathering and new entrant's rights, the CO^2 price should lead to a change in merit order making coal more expensive than gas to produce power. But this also raises questions about pass-through of CO^2 price that should lead to the wanted change in merit order but that raises inherent windfall profits. The implementation of a single exchange scheme all over Europe to trade emission rights has removed an important part of the possible cross-border problems if the scheme had not been unique and harmonized. However the merit-order change from the implementation of the EU-ETS might introduce change in power flows as the countries generally have specialized energy mix which may make more salient some grid issues.

It has already been noticed during the previous session of the workshop that it is not that bad to expose the renewable to the market even if it is necessary to keep the balance between exposing them to the market and protecting them from excessive market risks, as it is the case in Spain for instance. Renewable energies can then develop while considering efficient balancing in the short run and efficient location in the long run. Moreover, if a broader technology policy is implemented to promote CO2 Capture and Storage (CCS) or nuclear, we can wonder what will leave to the market. However, as there is neither one single renewable policy nor any single technology policy in Europe while there are interdependencies between countries through their interconnected grids, cross-subsidies can emerge with a consequence not only in economic transfer between countries but also and more importantly in efficient operation and investment in the power sector.

Energy Efficiency is the last component of the EU climate policy. The main interaction with market design is related to the retail market. The well completion of market liberalization is then of great importance for energy efficiency so that end-user receives price signals that incentivizes him to participate in demand response program. The regulation of DSO is also crucial so that the DSO has the good incentives to install needed infrastructures for the development of energy efficiency. At last, even if energy efficiency is related to national policy first, a European coordination is needed to avoid associated cross-border cross-subsidies and in particular the efficiencies that may emerge from these cross-subsidies. In brief, the Europe must equip itself with an efficient cross-border market design to achieve the goal of climate policy.

At last, the workshop ends with a conclusion session about the interaction of market design and cross-border issues with "gas supply security", gas imports, infrastructures and transits.

The European gas system currently faces little competition because of a wide use of long term contract in the gas industry, and also because of little interconnection capacity which limit transit through Europe while gas producers are located in with different and remote areas. At the same time, the European gas system faces a lot of uncertainty for several reasons: because of changes in the location of gas sources (as the indigenous gas sources are declining), because of the growth of gas market in particular with Combined Cycle Gas (which also modifies the way the gas network

infrastructures are used as the CCG are used in mid or peak load), because of the development of peak gas sources as Liquefied Natural Gas (GNL), because of increasing competition, and because of some increasing concern about security of supply.

To cope with this context, there is an increasing need for more transit of the gas network, which means either a higher rate of utilization or new gas network infrastructures. Of course the cost of gas transmission network is relatively small compared to the rest of the cost of gas system. However, this infrastructure can bring high value to the gas system through the management of uncertainty and its role in competition it allows. An efficient level of gas transmission capacity is so needed to have an efficient gas market.

The remuneration of the gas network infrastructure through regulated tariffs does not seem the best fitted way to incentivize the development of this infrastructure. This is because with such tariff, existing shippers and national end-users have to pay for network expansion on behalf of new transit shippers and the entry-exit tariff on wide areas induces cross-subsidies between long and short haul transport. Besides, the duration of regulatory period (between 3 to 5 years) is not adapted to investment with a so long lifespan. At last, as the regulators are outside the market, they are not well suited to judge the appropriateness of expansion of the system. And their national tropism, as for the TSOs, does not ease their evaluation of investment in transit countries. On the contrary, long term contract has shown its ability to give right incentives to underpin gas network investments. The Market from gas producers and consumers then decides where, when and how much capacity to build. Long term contracts have also the advantages that they may cover investments and shift a considerable part of the market risk to shippers. The ACER and the national regulators should then create a framework where such long term contracts for gas transmission (for instance exemptions) can emerge with a limited size for entry-exit areas and with stability of tariffs as the best incentives for TSOs to invest.

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