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A report on final recommendations about technical and regulatory measures

Fondazione Eni Enrico Mattei (FEEM)

Table of Contents

1. Introduction

The purpose of this work is to group the regulatory and technical recommendations developed separately for the Gas, Oil and Electricity sectors.
We present here a list of the main topics treated in the text.

Gas

- Internal dimension of vulnerability of supply (interruptions to final customers).
- Impact of gas modeling and forecasts on long term gas supply security.

Oil

- Configuration of the European refining sector.
- Fuel quality specifications.
- Import policies of refined products.
- Technological options for biofuels.
- Price transparency for price formation
- Data transparency for security purposes
- Management of stocks

Electricity

- Long term generation adequacy
- Capacity payments
- Fuel mix
- Fuel shortages
- Scenario developments for generation and demand
- Permitting procedures of transmission investments
- Investment plans for transmission infrastructures of European interest
- Regulatory coordination at European level
- Congestion management
- R&D for transmission networks
- Smart Grids deployment
- Demand Response
- Energy efficiency

2. Recommendations for Natural Gas

From 1990 to 2008, as a result of a steady increase of the demand in parallel with a decline of the production, EU-27 net imports of natural gas doubled from 135 Mtoe to more than 270 Mtoe. Over the same period gas import dependency increased from almost 46% to over 61%. This situation is not expected to be reversed even if EU gas demand remained the same simply because by 2030 EU's gas production will be approximately one third of today's level.

Natural gas dependency within EU member states is high and continues to increase; both net import level and share of imports in total gas consumption are increasing. However the situation varies a lot from one country to the other. The largest gas importers of the EU have a less concentrated import sources. In none of those large importers, Russia's share is more than 40%.

Insecurity of supply is generally understood as a vulnerability to an external threat and that the internal dimension is mostly neglected. Indeed, security of supply does not stop at the border but extends to the final consumers.

These long neglected risks to the EU gas security are now rapidly mounting. Internal dimensions of vulnerability, such as customers' flexibility to adapt to disruptions (defined as the share of interruptible customers over total demand), availability and magnitude of storage, existence of reversible network with loops etc, are equally important.

People in Europe thought that a severe disruption could not happen and when happened it was expected not to last any period of significant duration so at to cause severe impact. The January 2009 gas disputes between Russia and Ukraine, were landmark gas security events due mainly to their potentially far reaching consequences. The crisis seriously affected many countries which are heavily dependent on Russian gas supplies. Central and Southern European countries were seriously affected by the supply disruption. The disruption revealed serious shortcomings in the European energy security architecture.

There is no single response to supply disruption. Instead the solution is in the implementation of a set of forward looking policies and measures. Some of the most effective ways for the EU to lessen severe impacts, eliminate vulnerability, strengthen resilience and reduce risks of significant disruptions in the future, which could also be interpreted as a prerequisite for ensuring secure supply of natural gas, include:

- Facilitating and encouraging investment in gas storage and import infrastructure to maximize the diversity of available gas supply sources and routes;
- Promotion and realization of minor interconnection developments with significant gas security improvement impact, so as to enable gas to be delivered more efficiently and timely to where it is needed;
- Increased awareness of energy efficiency and conservation, and encourage more efficient use of energy;
- Establishing an effective transparency in gas markets,
    - Transparency in reporting and monitoring of gas flows and storage in high frequency or on a real time basis;
    - Clear definition of the roles and responsibilities of stakeholders.
    - Revising and harmonizing national energy regulations, policies and measures;
- Establishing an emergency response mechanism to gas supply disruptions;
- Government policy and action in terms of providing a stable regulatory framework, removing barriers and perhaps providing incentives;
- Increase of demand flexibility (e.g. through fuel switching by power stations or large consumers) in order to minimize the risk of supply being unavailable;

- Improved dialogue and constructive cooperation with producer and transit countries.

Last but not least, the role of long term energy modelling in long term gas supply security should not be neglected. Considering the fact that energy investments take a long lead time with substantial cost, investors need a light at the end of the tunnel before making their decision.
Contradictory signals from several models concerning the EU's gas production, net imports and demand over time complicate the issue further. Wide ranging estimates concerning future import/export requirements are surely not a proper signal to investors, especially to the ones in upstream and infrastructure business. Enhanced dialogue and cooperation among modellers and policy makers to produce credible forecasts that would give the right signals to market participants is a must.
There is enough gas around Europe to secure the EU gas supply to 2030. The main question relates to investment in the upstream sector and infrastructure development, as well as favourable conditions for such investments in major supplier countries, to achieve the desired production level. Beyond 2030 there will simply not be many suppliers who will be able to export large quantities of gas either because many current suppliers will have hit or will have passed their peak production or because their increasing domestic demand will prevent them from exporting significant amount of gas. Iraq and Turkmenistan will probably remain the only exceptions. Therefore, the major challenge after 2030 will be whether the EU is ready for the post gas peak of most of its current suppliers, and whether it is prepared to bring additional supplies from new supply sources and new routes.

3. Recommendations for the Oil Sector

Refining sector

Present configuration of European refineries is insufficiently complex to deal with a wide variety of crudes. European refineries are also not appropriately configured to produce the product slate that is needed by the European market today and in the future.
Fundamentally the threat that presently exists from a security of supply perspective is that Europe is increasing its reliance on imported fuel products, principally middle distillates, whilst existing European refineries ability to export excess gasoline to other markets looks set to diminish considerably. Regulators or the EU need to provide incentives to make the right investments.
Europe is expected to face a refining challenge in the short to medium term. Further they are facing gasoline surplus with no market and a worrying diesel deficit with not enough supplier. Therefore rationalizing gasoline production and favouring investments to increase gas/diesel oil production and deep conversion, as well as holding refining sector in Europe are key issues. Standardization at EU level of environmental measures and rules adopted by individual Member States together with promotion of innovative solutions and R&D activities should be encouraged.

Greater coordination is needed between refineries and legislators in the setting of targets for the industry and the safeguarding of the refining industry in the EU. The challenges created by legislators such as the bunker fuel product specifications have not been thorough enough in assessing impact on Europe's ability to produce such a product at a profitable level. If legislators continue to pursue aggressive mandates on fuel quality specification without regard to the feasibility or costs of such measures to the refining industry then the level of imports will increase and security of supply will be impacted upon.
When looking at vulnerability to crude oil supply versus vulnerability to refined products supply trade-off, further importing refined products at the expense of crude seem to further diminish security of supply in Europe. Favouring a policy for importing refined products more than crude would give Europe less diversification in the areas it could import from.
There must also be more transparency in the long term pricing of carbon. If there were to be a global carbon price there would be less of a disadvantage to invest in Europe and greater levels of certainty in the refinery investments. If Europe wishes to maintain operations within its own borders such regulation will need to be reviewed.

Biofuels
Feedstock used to produce biofuels should not compete with food. Therefore, new technologies to produce biofuels should be given more importance and priority in policy formulations.

Gasoline/Diesel taxation
Reduction of differential in taxation of gasoline and diesel could be an option. Currently there is a substantive differential in the taxation levied on diesel and gasoline automotive fuels. Diesel is approximately 20% cheaper than gasoline at the pump. If the differential were to be reduced this would result in increased consumer demand for gasoline cars and subsequently alleviate the demand constraints for diesel over time.

Bosporus bypass projects
Terrorist threat is often quoted as the main concern with regards to closure of chokepoints. In the case of the Bosporus Straits involuntary shortage due to navigation accidents is a major concern. The Straits are the main outlet for oil exported from Russia, the Caucasus, and Central Asia through terminals located on the Black Sea. Implementation of Bosporus bypass projects to create alternate routes to bring Caspian oil to European and international markets are necessary.

Transparency (price)
The recent extreme price fluctuations are a concern for all, politicians and experts. Efforts to reduce short term volatility and achieve greater reliability of oil prices should be encouraged. Although there is no easy recipe, several options could be envisaged:

- Stronger regulation of the financial market;
- Encourage the freer trading of major crude oil streams, notably those from the Gulf to enhance the physical base for price discovery;
- Increase reliance on long term pricing. Those prices are in general more stable and less influenced by the short term imbalance of demand and supply. In

deliverable D5.1.4a, it is proposed to implement a set of regulations that would encourage systematic hedging;

- Although already tried several times, a price band system agreed by all, importing and exporting countries, may be effective. This band would need to be adjusted on a more or less regular basis depending on the objective, dampening short term volatility or improve investment environment.

Transparency (data)
Initiative like the Joint Oil Data Initiative to improve oil market data transparency should be further encouraged. The EU should encourage submissions from key partner countries through dialogue and information sharing on oil security policies and measures. Facilitating wide release to all of information about oil stocks especially from non-OECD countries would definitely improve overall security of supply.

Managing stocks
Holding strategic stocks is the principal measure to prevent EU member countries from any physical oil supply disruption. Strategic stocks should be considered as a limited short term response. The possibility of using intervention stocks in addition to strategic stocks, or some hybrid formula of strategic/intervention stocks could be envisaged. If well used and appropriately regulated, such stocks are likely to have a positive effect on the stability of oil prices, especially if holding physical stocks is encouraged. Those stocks could be owned by private investors and storage facilities could be built where needed. Obviously installing storage facilities at sensitive logistic locations would be of the greatest interest.

4. Recommendations for the Electricity Sector

Electricity security of supply has implications along the whole chain, from generation, to transmission/distribution, to demand.

As far as generation is concerned, the main issue is to ensure both in the short and in the long term its *adequacy*, i.e. its capability to keep the supply/demand balance (taking into account network constraints).
Generation adequacy is mostly related to the availability of an installed capacity sufficiently larger than the expected peak load, i.e. the availability of a sufficient *reserve margin*. Nevertheless, the sole amount of installed generation capacity is not sufficient to ensure adequacy, since in addition the generation set must be well *adapted* to the load, as well as to the increasing penetration of intermittent renewable sources: this means that the composition of the generation set in terms of base-load, mid-merit and peak-load power plants (characterized by different operating flexibility), as well as in terms of dispatchable and non-dispatchable ones, must be correctly balanced.
In this respect, it is widely recognized that electricity price signals coming from the market are, by themselves, not sufficient to ensure generation adequacy, mainly due to informative asymmetries and to lack of sufficient competition that make market players unable to collectively obtain an “optimal” development of the generation set, both in time and in space (i.e. in terms of location in the network).

Moreover, the often long and uncertain permitting procedures, as well as investors' risk aversion that makes them wait until they can be pretty sure of the profitability of new investments, introduce significant delays between the moment when a new power plant is needed and the moment when it becomes available.
This could cause the so-called *boom-and-bust cycles*, where periods with high reserve margins and consequent low electricity prices that do not incentivize new investments, due to subsequent progressive load increase and to decommissioning of old power plants, alternate to periods with low reserve margins (therefore with low security of supply) and consequent high electricity prices, that could lead to a new wave of investments, thus restarting the cycle.
To tackle the aforementioned problems, in several electricity markets worldwide, regulatory authorities, under the approval of Governments, defined and/or implemented specific instruments such as tendering procedures for new capacity, capacity payments, capacity markets/obligations, call options, etc.
We recommend the implementation of such instruments to push investors to pursue the "optimal" development of the generation set and to avoid the above mentioned capacity "bust" situations, but we also recommend to rely only on "market based" mechanisms able to get the most efficient solution through competitive procedures (e.g. fixed capacity payments administratively defined should not be taken into account).
According to Regulation (EC) no. 714/2009, Transmission System Operators (TSOs) are in charge of assessing the present and future adequacy of the power system both at the national level and, through ENTSO-E, also at the European level. In doing so, TSOs should not only "passively" try to envisage the future generation development according to market players' investment behavior, but they should support the implementation of the aforementioned adequacy instruments being "proactive" and providing a technical evaluation of how much new generation capacity of the different types is needed, when and where (the location in the network is very important), on the basis of scenario analyses concerning in particular demand evolution, intermittent renewable sources penetration and network development.
Of course, it would be desirable that this whole process be coordinated and harmonized at the EU level to increase its effectiveness and to avoid market distortions.
Furthermore, it must be taken into account that a generation set that is adequate in terms of installed capacity and in terms of composition could again be insecure if its fuel mix is not sufficiently diversified, so that a large amount of capacity could become unavailable in case of a fuel supply shortage (this kind of risk has been analyzed in Deliverable 5.6.2).

As for the most interesting remedies from the policy point of view, as far as the power system is concerned, the most obvious remedy to a fuel supply shortage in the long term is to pursue a greater primary source diversification in the generation set. In this respect, a further sustainable development of Renewable Energy Sources, supported by Directive 2009/28/EC, is a must not only for security of supply, but also for several other reasons. Nevertheless, as above mentioned, RES intermittent nature requires an adequate backup capacity, made of conventional dispatchable power plants.
In fact, the objective of a greater primary source diversification could be reached using the same above mentioned regulatory instruments concerning capacity adequacy; of course, the highest political levels responsible for the overall energy policy are in charge of the quantitative definition of the objective itself: in this case TSOs could only play the

role of consultants for technical aspects concerning the implementation of the objective and its impact on system adequacy.

Another important remedy to the risk of fuel supply shortage concerning the power system is the increase of cross-border transmission capacity, so that foreign power systems can help more the country affected by the shortage: we will be back to this later on, when discussing specifically of transmission issues.
Of course, effective remedies to a fuel supply shortage can also be put in place outside the power sector: in particular, the results of the study reported in Deliverable 5.6.2 showed the importance of the availability of a significant amount of gas storage, both for modulation and, especially, for strategic purposes, that is the best insurance for all gas consumers. The development of an adequate amount of gas storage infrastructures both at the European level and, especially, in the countries where natural gas has a large share of primary energy consumption, should have a high priority in the overall energy policy.
Another important remedy to a fuel supply shortage is the diversification of both suppliers and of supply infrastructures: the former reduces the counterpart risk, while the latter reduces the risks related to accidents and, for example, in case of new pipelines with different paths, can reduce the risk of shortages caused by transit countries. As for natural gas, LNG terminals are the most flexible way to implement diversification, since their supply is tied neither to a single supplier nor to a single pipeline.
In this respect, the main policy recommendation is therefore to prioritize new energy supply infrastructures at the European level according to their diversification capability.

As far as the transmission part of the electricity supply chain is concerned, in Deliverable 5.6.1 we assessed the impact of a non-optimal development of the European cross-border transmission capacity.
Needless to say, the main remedy to a non optimal development of the European cross-border electricity transmission network is to invest in new interconnections, so that the reduction of bottlenecks makes easier to transport cheaper energy where it is needed, increasing security of supply, but also allowing for a greater integration and for a more efficient operation (with reduction of local market power) of the Internal Electricity Market and, in the end, for a more optimized operation of the generation set, with significant economic benefits.
This remedy is of course not so easy to implement, neither by TSOs, nor by private investors interested in merchant lines projects. In fact, such investments are typically affected by several uncertainties[1], mainly due to:

- complex legal and regulatory contexts, especially for permitting procedures, stemming from a multitude of different authorities, with different administrative levels (European, national, local) that may differ from one country to another and that may have different priorities;
- the lack of social acceptance that severely delays or jeopardizes the realization of such projects;
- due to the long-term time horizon that characterizes network projects, the inherent uncertainty in predicting the future location, amount and type of generation and load.

1 As a general remark, one of the main barriers to long term investments in the energy sector (that usually are quite capital intensive) is regulatory and legal uncertainty: it is fundamental to guarantee investors with some basic key conditions under which they will have to operate, in order to let them correctly assess their risks.

To reduce such uncertainties[2]:

- the establishment of the *Agency for the Cooperation of Energy Regulators – ACER* foreseen by the 3rd Energy Package should be a significant step towards a more harmonized regulatory framework at the European level;
- as for permitting procedures, it is necessary[3]:
  - to act on the legal framework:
    - ⇨ simplify and rationalize the procedures (reduce the number of entities involved, the number of phases, etc.):
      - in case of strategic infrastructure projects, the procedures should be centralized at one (national) level;
      - upgrading of existing lines should require simplified procedures with a shorter duration;
    - ⇨ set reasonable maximum time limits for the completion of procedures;
    - ⇨ harmonize the procedures and criteria for authorization at the EU level, through binding guidelines;
    - ⇨ get an early binding pre-approval of the projects as reported in TSOs' development plans, to avoid TSOs spending time to justify the need for the projects during permitting procedures;
  - to designate an "arbiter" / "facilitator" (e.g. ACER) promoting compromises, dealing with controversies and speeding up the realization of strategic projects in trans-national cases;
- as for the lack of social acceptance, it is necessary:
  - to provide a clear and objective vision of benefits and costs bound with the new infrastructures (also in order to prioritize investments to select which ones are worth to be funded by EU);
  - to clearly state the cost for the society deriving from inaction or from sub-optimal actions;
  - to clarify the relationship between RES integration, security of supply and grid development;
  - to clarify the relationship between costs and different technical solutions (e.g. overhead lines vs. underground cables);
  - to promote a cultural action dealing with all the key issues related to the public perception of a new transmission line (negative impacts on human health, landscape, property value, noise, migratory paths, etc.; feelings like *"burden to me, benefits to others"*, *"home invasion"*, *"lack of democracy"*, lack of *"serious"* information, etc.), opening a discussion on a clear and sound scientific basis with the help of independent and competent bodies, in order to allow for an informed comparison between the "cons" and the "pros" of the projects;
  - to promote a thorough evaluation of property value, so as to bring about a fair compensation (including "immaterial" aspects) that can be agreed by all the parties;

[2] Some of the following policy recommendations are being further discussed within the EC REALISEGRID project, coordinated by RSE.
[3] Additional detailed recommendations that can be shared are reported in the recent *"ENTSO-E position paper on permitting procedures for electricity transmission infrastructures"* of 29 June 2010.

- generally speaking, the economic side of the problem is very important to gain consensus among the involved populations: they must know that the realization of the projects will reduce their electricity bills (either by imports of cheaper energy or by direct compensations), otherwise the *nimby* attitude would be their first and easiest choice; we will be back on this point later on discussing "locational signals";

- as for the uncertainties concerning the future developments of generation and demand:
  - they can be effectively tackled by carrying out adequate scenario analyses, just like it has been done in the study reported in Deliverable 5.6.1, based on POLES scenarios; this approach is supported also by ENTSO-E that states that *"scenario analyses at national, regional and pan-European levels are key elements in order to decide on grid extensions and to adequately assist political reasoning"* taking into account *"fuel prices, economic and monetary conditions, geopolitical developments, meteorological conditions, technological breakthroughs, market mechanisms, regulatory and legal frameworks"*;
  - moreover, generation companies should be discouraged (with economic penalties) from initiating permitting procedures if they are not strongly committed to realize the investments;

- finally, the use of appropriate technology solutions (e.g. FACTS) can increase transmission capacity of the existing infrastructure, thus avoiding the need for investments in new lines; these faster and less expensive solutions must be adequately incentivized and remunerated by regulation.

Up to this point we have discussed the problems related to *each generic* development of the European cross-border transmission network (and most of the above mentioned issues are relevant for expansions of national transmission networks, too), but it is very important to end up with an *optimal set* of developments, according to the considered reference scenarios.
Again, this is exactly what has been done in the study reported in Deliverable 5.6.1, following an approach supported also by ENTSO-E, that in its recent *"Research and Development Plan"* endorses the development of *"Advanced tools for analyzing the pan-European network expansion options according to energy scenarios for Europe (i.e. expansion optima that must be searched to maximize European welfare)"*, specifying that optima are to be searched at the EU level and no longer only at the national level.
As it is desirable to harmonise generation and transmission development, it is important that regulation foresees the provision of "locational signals", i.e. the spatial (zonal/nodal) differentiation of electricity prices (due to maximum transfer capability constraints and losses on the lines) and of transmission charges (calculated on the basis of how much each agent uses the network).
Locational signals can therefore provide adequate economic incentives to market players about the dependency of the energy supply costs on the physical location of production/consumption facilities, thereby leading to a more efficient system operation in the short term and promoting a more optimized siting of new generators and loads in the longer term. Moreover, as above mentioned, consumers that are exposed to locational electricity prices may directly benefit e.g. from price reductions due to the installation of

a new power plant nearby or of a new transmission line[4], so that they get correct incentives not to assume an a priori *nimby* attitude.

As far as distribution network is concerned, the main challenge is its progressive transformation from a "passive" to an "active" network, due to the increased penetration of distributed generation. In this respect, Directive 2009/72/EC states that *"Member States should encourage the modernization of distribution networks, such as through the introduction of smart grids, which should be built in a way that encourages decentralized generation and energy efficiency"*.
Generally speaking, current distribution networks have some margins to host a limited amount of distributed generation but, over a certain level, the quality and reliability of service can no longer be guaranteed, so that additional measures, ranging from simple changes in protection or control settings to massive network investments, are needed.
Therefore, the development and deployment of new communication and control technologies is the key to make distribution grids "smarter", i.e. able to *"cost efficiently integrate the behavior and actions of all users connected to it – generators, consumers and those that do both – in order to ensure economically efficient, sustainable power system with low losses and high levels of quality and security of supply and safety"*, as stated in the ERGEG's *"Position paper on smart grids"*.
From the technological point of view, cooperation among international, European and national standardization bodies, regulatory authorities, grid operators and manufacturers should be encouraged to further improve open communication protocols and standards for information management and data exchange, in order to achieve interoperability of smart grid devices and systems so as to avoid any technical barrier to their deployment.
Another key point is, from a regulatory point of view, how to support distribution network companies in their investments in such innovative technologies, to ensure that their deployment provides a cost-effective solution to the needs of network users.
To this aim, we share ERGEG's view that regulators must not attempt to choose or impose specific solutions – they must remain technologically neutral – leaving network companies to manage their business which they have ultimate control over in the most appropriate way: regulation should focus on the benefits for network users and not on the technical details to get them.
Therefore, regulatory schemes for promoting improvements in performance of electricity distribution networks require the quantification, through appropriate indicators, of the effects and benefits of such investments in "smartness".
The definition of performance targets and indicators should be accompanied by clear, transparent and objective measurement rules that allow to observe, quantify and verify such targets. Moreover, performance targets should be benchmarked to define their expected values and should be strictly related to the pursued objectives: they should therefore be cleansed of external effects outside the control of network operators. Then, having defined targets and indicators, it is possible to use either incentive regulation, where regulated entities are either rewarded if they overperform or penalized if they underperform with respect to such targets, or minimum requirements regulation, where a minimum performance level must be accomplished by the regulated entity, or a combination of both. In the above mentioned ERGEG's position paper a set of indicators is proposed.

[4] Nevertheless, it must be taken into account that increasing transmission capacity along a congested path reduces prices in the importing area, but increases them in the exporting area.

The last (but not least) ring of the chain is demand, for which the two main issues related to security of supply are "demand response" and "energy efficiency".
Demand response is related to the capability of consumers to respond to price signals or to signals concerning the criticality of system operation with a variation of their consumption profiles.
Demand response's main beneficial effect is to reduce demand in peak load / high price periods, possibly moving part of it to less critical / lower price hours. A lower peak load:

- increases reserve margin (thus increasing security of supply) and, in the longer term, reduces the need for investments in new generation capacity;
- reduces the stress (and possible congestion) on both transmission and distribution networks, delaying the need for network expansions;
- reduces the necessity of dispatching costly and low efficiency power plants during peak hours, thus reducing also fuel consumption and CO_2 emissions;
- by making demand more elastic to price, reduces the possibility of exercising market power by producers and also reduces price volatility.

In fact, electricity demand has always been quite inelastic and an increase of its flexibility requires:

- a way to communicate the price/criticality signals to consumers;
- a strength of such signals (or of the rewards for the response) significant enough to convince consumers to respond;
- the real possibility of consumers to respond to the signals, according to their way of life and to the electric devices they can manage manually and/or automatically.

The aforementioned communication requirements and the necessity to measure and record the amount and the time of the response entail the availability of "smart meters", which is endorsed also by Directive 2009/72/EC, that, given a positive economic assessment of their long-term costs and benefits, states that at least 80% of consumers shall be equipped with intelligent metering systems by 2020. The timing of such requirement does not seem very much ambitious, taking into account best practices in countries like Italy.
As for the strength of the signals, we stress again that it is very important for the success of demand response programs: simple peak / off-peak tariffs with limited price differences that allow consumers to spare some tenths of euros per year with their response will not have any significant success. Moreover, the signals must be simple and easily understandable by consumers, so that they can correctly respond to them.
Finally, provided that the proper communication and metering devices are in place and that there is a substantial economic convenience in participating to demand response programs, information campaigns are necessary to enroll as many consumers as possible.
As far as "energy efficiency" is concerned, in the EU energy policy its implementation is foreseen as an important means to reach the mandatory targets concerning CO_2 emissions reduction and RES development (whose objective is proportional to gross final consumption).
To this aim, several European directives (such as Directive 2006/32/EC of 5 April 2006 on energy end-use efficiency and energy services, Directive 2009/125/EC of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products, Directive 2010/30/EU of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products, Directive 2010/31/EU of 19 May 2010 on the energy

performance of buildings, etc.) and national laws and regulations (such as the National Energy Efficiency Action Plans) have been issued and are being implemented.
Generally speaking, it is clear that a lower energy consumption reduces the stress on the whole supply chain, thereby increasing security of supply.
Moreover, most of the actions that can be carried out to increase energy efficiency have a "negative" cost, i.e. they repay by themselves, therefore they are more economically efficient than actions to support RES development and to reduce CO_2 emissions (such as Carbon Capture and Storage technologies).
Nevertheless, some promotion is necessary, typically with fiscal incentives together with obligation schemes, such as White Certificates, and minimum standard requirements, in order to overcome possible barriers, such as the financial capability of customers to invest in more efficient appliances, the impact on their way of life of the implementation of such actions, the short-term views of some industrial management, that would avoid to reduce the profits of the current financial year (by investing in more efficient technologies), in exchange for future lower production costs, etc.

5. Concluding Remarks

This report compiles the sets of technical and regulatory recommendations from the three sectors that has been developed separately in the SECURE project. There was no purpose of comparison or benchmarking as it would have been an unsuccessful exercise as the starting points are too heterogeneous. We would like then to make two simple general comments.
Regulation unfortunately is very sector specific, therefore simple general principles cannot easily copied from other sectors even if apparently very similar. This can create issues if there is a need to have sectors or different legislations on the same sector interacting. One example is competition policy[5], there is a real struggle to match it with Energy markets given the binding network effects and the overall investment process that is not modular. It is then difficult to define the size of relevant markets. The current process in Electricity markets correctly starts to address transparency on transmission investments and provide common market rules that will allow to detect more clearly uncompetitive behaviors.
It is also necessary to develop general policies taking into account regulatory bottlenecks in terms of implementation. It has been often the case that general policies could create contradictory situations as they were not developed taking into account what could be achieved with the specific legislation. As an example Regulators could not have the adequate tools to monitor or these could be too expensive. The danger is that the bad outcomes could be very costly as investments are extremely expensive, long lasting and often non reversible.

[5] Competition policy can be compared to regulation given the specificity of rules and tools utilized.