

Energy security: a market oriented approach

Frederic Jenny

Chair OECD Competition Committee

Professor of Economics , ESSEC

Judge, Cour de cassation

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Issues to be addressed

- 1) Energy security an evolving concept:** (quantity disruption, price disruption, psychological factors, blackmail, the political economy of oil and gas, differences of perceptions, 1973 and 2005 episodes)
- 2) Keys to energy security:** (diversification of supply, promotion of investment, increased resilience)
- 3) The Swedish and British experiences in gas:** (short term responsiveness to price signals and long term diversification of sources of energy)
- 4) Conclusion:** the contribution of competitive market forces to energy security

Energy security an evolving concept¹

Energy security means different things to different people at different times.

For decades, energy security was concerned with the physical supply of oil. It now encompasses natural gas and electricity and extends along the supply chain.

The concept now includes the price and not just the physical availability of these fuels.

Energy exporters concentrate on security of demand, that is, on stable revenues, and energy resources and export facilities are often under political control. Energy users seek reliable supplies at “affordable prices,” with developing countries also concerned about the balance of payments effects of energy price changes.

Countries’ specific foci reflect their specific situations. For example, Japan has very few domestic energy resources so it

Energy security: 1) Supply disruptions

Supply disruptions are the classic energy security concern.

Physical disruption is translated into a price spike where markets can flexibly operate to re-allocate physical fuels. (Consumers who are exposed to price spikes reduce their consumption, thus reallocating fuels toward those consumers who value it more highly.)

But where energy markets are unable to flexibly re-allocate fuels the shortfall is allocated by some other, nonprice mechanism such as an emergency plan agreed with the relevant regulator.

Energy consumers and downstream firms and ultimate consumers bear the costs of adjusting either to high prices or, for some users, to no availability. No availability can result in power blackouts and the economy grinding to a halt.

Support for a supply disruption risk-based definition is provided by the European Commission's recent Green Paper on Energy. The Green Paper refers to "risks from natural catastrophe and terrorist

Energy security: 2) Price disruptions

If energy security is about the level of price during non-emergency periods, then producers and consumers have different interests..

Support for a definition that includes the level of price during non-emergency periods comes from the **IEA's most recent *World Energy Outlook***. While energy security is not directly defined, the *Outlook* refers to “**consuming countries' vulnerability to a severe supply disruption and resulting price shock,**” dependence on imports, and the increasing market dominance and ability to impose higher prices of a small number of countries. [IEA 2006, pp. 38-39] Later, the *Outlook* refers to “**the perceived risk of disruption and the risk that some countries might seek to use their dominant market position to force up prices,**” as oil and gas production become more concentrated in fewer countries.

Decreased imports are seen as mitigating these risks. [*ibid.*, p. 186⁵]

The inflexibility of demand for oil for transport is seen as

Energy security: 3) Psychological factors

A third possible element in a definition of energy security is psychology.

One observer makes this explicit: “The phrase, ‘security of supply’ embraces a hard and a soft concept: the economic fact of a *quantity of a good or service* delivered at a *price* and the psychological notion of security, which is a *feeling*...Supply quantity and the degree of dependence can remain unchanged, yet the feeling of security can increase or decrease with time. It becomes clear that the particular political relationship between the trading parties defines the sense of security of that trade.”

[Skinner 2006, p. 6; emphasis his]

It is often implicitly assumed that domestic sources are more secure than foreign sources. But some informed observers argue that domestic sources provide no greater security than foreign sources. A survey of gas security incidents in Europe since 1980

Energy Security: 4) Blackmail

Another possibility is that **energy security is about the threat of using the price or quantity of energy to cause changes in non-energy policies.** In principle, consumers could threaten a boycott of particular suppliers or suppliers could threaten a boycott of particular consumers.

A boycott is more credible when it is less costly, holding constant the benefit of success, which would be the case if substitute counterparties to those being boycotted are almost as profitable to supply.

A boycott is more credible, for example, if a producer threatens to withdraw a special low price or a consumer paying an above-market price threatens to take its custom elsewhere. If psychology is as important as economics in this context, then perhaps even a threat that, upon examination, is not credible would have a political effect.

1) Roundtable on energy security and competition policy:
background note, Competition Committee, February 2007

The political economy of gas and oil supply

In **Russia**, though partially privatized, **Gazprom's board of directors consists overwhelmingly of Russian political personalities**. Of the eleven members, the Chairman is the First Deputy Prime Minister and the members are two current ministers, two former ministers, the special representative of the president on international energy cooperation, a former deputy minister, and a member from E.ON Ruhrgas (which owns a stake in Gazprom).

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In **Iran** “Currently, **overall responsibility for the Iranian energy sector lies with the Supreme Energy Council**....The Ministry of Petroleum controls the activities of all state-owned oil and gas companies from upstream to petrochemicals.” [IEA 2005, pp. 336, 341-2]

In **Qatar** “**State-owned Qatar Petroleum (QP) was established in 1974 and is responsible for all aspects of the oil and gas industry in Qatar**.” [IEA 2005, p. 460] **Foreign investment in gas 1907 through**

The political economy of gas and oil supply

In Algeria, “Up to now, **Sonatrach has effectively acted as an arm of the Algerian government, negotiating licences and contracts with foreign companies and monitoring the performance of each production-sharing contract.** This role will now be performed by a new entity...Alnaft...which will report to the energy ministry.

In Kuwait, “By virtue of Kuwait’s constitution, the state now owns and controls all oil resources.... though several **majors**, including BP, Shell and Chevron, continue to work in the country under **limited service contracts...**

In Norway, Statoil (70.9% state-owned) has neither political figures nor civil servants on its board of directors.

In Mexico, PEMEX has a monopoly on much of the oil and gas

Political economy of gas and oil supply : dependence of supplying countries on sales of oil and gas

Algeria: “Oil and gas combined accounted for more than 36% of GDP in 2004 and 98% of export earnings.” [IEA 2005, p. 282] “The hydrocarbons sector is the backbone of the economy, accounting for roughly 60% of budget revenues, 30% of GDP, and over 95% of export earnings.” [CIA World Fact Book]

Saudi Arabia: “Oil contributed 40% of GDP, around 90% of total export earnings and three-quarters of the central government budget in 2004.” [IEA 2005, p. 487]

Kuwait: “Petroleum accounts for nearly half of GDP, 95% of export revenues, and 80% of government income.” [CIA] “In 2004, oil accounted for around 50% of Kuwait’s GDP, over 80% of government revenue and around 95% of export earnings.” [IEA 2005, p. 412]

UAE: “Reflecting [a shift toward other sectors], the share of the hydrocarbon sector in GDP declined from around 60% in 1980 to

Energy security: differences of perception

Not all customers are concerned to the same degree about continuity of energy supplies.

In particular some businesses elect to be on ‘interruptible’ contracts which allow for interruptions to their supply in exchange either for an overall lower price or compensation at the time of interruption.

Some businesses also choose to have back up fuels available in order to reduce their gas demand in response to price movements.

**OECD ROUNDTABLE ON ENERGY SECURITY AND
COMPETITION POLICY , OECD COMPETITION COMMITTEE:
Wednesday 21 February,,2007 Joint submission by the UK Office of Fair
Trading and UK Office of Gas and Electricity Markets**

Energy security episodes: 1973

Available Arab oil in early October (before the embargo) was 20.8 mbd (million barrels a day) and in December (at the nadir) was 15.8 mbd. Production increases elsewhere meant that oil available in the “free world” was down about 4.4 mbd as compared with a total of 50.8 mbd in October.

This 9% reduction had a severe effect. **“America’s spare capacity had proved to be the single most important element in the energy security margin in the Western world, not only in every postwar energy crisis but also in World War II. And now that margin was gone.”** [Yergin, p. 614]

The effect of the cuts was made worse by the recent demand growth of 7.5% per year, poor information at the time about how much oil was available, as well as uncertainty about future cuts and embargoes. Panic buying increased demand and thus prices.

Tensions among countries were engendered were exacerbated by

Energy security episodes: 2005

In 2005, Russia/Gazprom supplied over a quarter of gas demand to Western Europe.

On 1 January 2006, following a lengthy commercial dispute, Gazprom markedly reduced gas supplies to Ukraine.

This reduced deliveries to many Western European countries as well, for about 1,5 days. In OECD Europe, the shortfall was made up relatively easily because the duration of the interruption was short. “The dispute and consequent interruptions did cause serious concerns over security of supply and gas dependence on Russia in many European countries.

A number of measures were discussed in the aftermath of the dispute, including increased strategic gas stocks, diversification of the fuel mix (with higher dependence on coal and nuclear

being the most prominent options), diversification of gas supply

Keys to energy security: 1) diversification of supply

Diversification is a key to energy security, however defined.

First Lord of the Admiralty Winston Churchill, explaining how he proposed to maintain a secure supply of oil after switching British warships to insecure Persian oil from safe Welsh coal, said **“Safety and certainty in oil lie in variety and variety alone.”**

Recently the IEA has said:

“Reducing dependence on oil and gas through diversification of fuels and their geographic sources and more efficient use of energy must be central to long term policies aimed at enhancing energy security....It is not the proportionate dependence on any one fuel type which counts, but the extent of alternative sources of that fuel and the practicability of switching fuels in a crisis. In that respect, the prospects for consumers are worsening.” (IEA 2005, pp. 267-8)

**1)Roundtable on energy security and competition policy:
background note, Competition Committee, February 2007**

Means of achieving diversification of supply

Diversity of primary fuel types, and investing in more fuel switching capacity.

Electricity generation is another mechanism for diversifying fuel types. Electricity generated by coal or nuclear or wind or falling water is usually a perfect substitute for electricity generated by gas.

Better integration of electricity systems, e.g., across European borders. If, for example, gas deliveries to generators in one country are interrupted, then other generators fueled by uranium or coal or other gas suppliers can replace at least some of the missing electric power if the transmission systems are robust to such transfers. **Requires the appropriate transmission design,**

capacity and use, and the spare generation capacity.
1) Roundtable on energy security and competition policy: background note, Competition Committee, February 2007

Diversity of sources of energy is necessarily linked to

Strategies to diversify sources and infrastructure

Various strategies may be available to diversify sources and infrastructure:

Larger storage capacity near users can provide some insurance against short term disruptions in production and long distance transport. But gas reserves are expensive, and licensing is time-consuming and difficult. Most existing gas reserves buffer the seasonal swings in demand and are not designed as strategic gas reserves.

Higher capacity interconnections among users may help diversify sources, but their value depends on different consumers having different sources with uncorrelated supply difficulties, and those sources having some spare production capacity available within the relevant time frame.

Higher capacity of pipelines and LNG regasification terminals can also increase diversity, but like the larger interconnections

Keys to energy security: 2) promotion of investment to develop energy sources and to increase transportation capacity

Government is involved, both directly through national oil companies (in some countries) and indirectly in providing an appropriate framework for private investment.

The **competition policy stance** toward sharing of infrastructure, vertical separation of natural monopoly from potentially competitive activities, and more generally reducing barriers to entry into these markets are particularly relevant. But other policy areas such as economic regulation, taxation, and the more general **“investment climate”** are also relevant.

Whether the needed investment will be forthcoming is uncertain. The IEA states that “it is far from certain that all the investment¹⁷ needed [for gas-supply capacity additions] *beyond 2010* will in fact

Is the profit incentive useful and sufficient to achieve appropriate investments?

Returns to induce the appropriate investments must exceed the returns of alternative actions.

Price spikes increase the returns to investments; limiting them reduces returns although can relieve consumers in the short run. Also, returns to incumbent generators/transmission owners may be higher if they retain market power made possible *inter alia* by transmission design and generation capacity that limits the flow of electricity across traditional service areas, rather than investing in transmission that increases flow across borders.

One question is how the regulatory environment can encourage appropriate investments. Recently, the European Commission DG-Competition has addressed this in its Energy Sector Enquiry and finds that the investment for cross-border

Is the profit incentive useful and sufficient to achieve appropriate investments?

Essential facilities such as pipelines, storage, and LNG regasification terminals can constrain downstream competition.

The essential facilities can limit the quantities the incumbent and rivals can sell in the downstream market.

Increasing the capacity of the essential facilities may erode the first source of market power—after expanding capacity the incumbent will have incentives to expand its usage—and expanding the capacity combined with granting access to rivals erodes the second source of market power.

While there is precedent for mandating access to rivals', there is little for mandating expanding capacity.

Is the profit incentive useful and sufficient to achieve appropriate investments?

Non-discriminatory access to infrastructure is easier to ensure when the owner has neither the incentives nor the ability to discriminate.

Common ownership with a company active in a potentially competitive vertically-related market can provide incentives for discrimination.

While some argue for operational separation between the monopoly and potentially competitive activities to reduce the ability to discriminate, ownership separation eliminates both the incentive and ability to discriminate.

The infrastructure operators are suspected of discrimination,²⁰ including making operational and investment decisions in the

Competition policy and investment for energy security:

“It is also plain that existing legislation has failed to create a competitive market....Current legislation has allowed many incumbents to maintain dominant positions, often justified by appealing to the need for security of supply. This is short-sighted and wrong-headed. Competition and security of supply are not mutually exclusive. In fact, it is only full competition across a unified market that will deliver the efficiencies and investment to keep energy secure, affordable and sustainable.” [Conti 2006]

The European Commission’s Energy Sector Enquiry supports this: “[T]he creation of a competitive internal market will allow the Union’s energy companies to operate in a market of a larger dimension, which will improve their ability to contribute to security of supply.” [EC 2007, p. 5]

Keys to energy security: 3) increased resilience

The second standard response to increase energy security is to increase resilience, e.g., through spare capacity, surge capacity and emergency stocks.

Emergency stocks of oil are required to be held by members of the **International Energy Agency**. Under the 1974 Agreement on an International Energy Program (IEP), members must “hold oil stocks equivalent to at least 90 days of net oil imports and [agree] to release stocks, restrain demand, switch to other fuels, increase domestic production and share available oil, if necessary, in the event of a major oil supply disruption.” [“About the IEA,” on iea.org] **Thus, spare capacity and emergency stocks have been important in oil supply security.** Skinner, in remarks before the Finance Deputies of the G20 in 2006, says his “**core recommendation to governments is that strategic stocks should be increased.**” [Skinner, p. 10]

But spare capacity in gas presents greater challenges. The

The importance of spare capacity: the example of uranium

Uranium provides a recent example of how an absence of a safety margin increases price variability. In 2005, global demand outstripped global supply (180m pounds versus 108m pounds) and demand continues to grow. Prices had more than tripled between the end of 2003 and November 2006.

On October 23, 2006, a new mine, Cigar Lake, expected to supply about 15% of the global mine supply, experienced technical difficulties that delayed its expected opening. The news increased spot prices to the highest level in the market's 38 years. "There is almost a perfect storm forming with supply delays." [*Financial Times*, "Uranium prices set for further increases," 6 November 2006, p. 15]

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Necessity to recognize interdependence

In Europe, it is recognized that one country's increasing use of natural gas to generate electricity combined with greater interconnection between electricity grids increases the exposure of consumers in the second country to gas supply disruptions. Similarly, **one country's increasing use of nuclear power generation combined with greater interconnection between electricity grids reduces the exposure of consumers in the second country to gas supply disruptions.** [EC 2006, 2.3]

Thus policies in one market affect other markets (convergence). **If the effect is sufficiently large, coordination of policies will make the objectives easier to achieve.** For more than a quarter century, the IEA has also been involved in governments and regulators coordinating over cross-border energy issues.

The EC's Energy Sector Enquiry finds one fundamental

How to increase resilience: increase the responsiveness of price to market conditions

Competitive markets naturally increase resilience in the sense of inducing other producers to increase output and consumers to cut back during a shortage. But a regulatory requirement for a certain degree of resilience, universal service obligations, needs to be altered when a sector is switched from legal monopoly to competition.

Resilience would also be increased if LNG markets were more liquid and, therefore, better able to respond to local supply disruptions. But, for example, LNG is an illiquid market. Overwhelmingly, LNG is sold under long-term take-or-pay contracts. (...) This suggests that LNG does not provide the resilience that, say, trade in oil provides in the oil market. This raises the question of whether financial innovations and the development of markets for short-term transactions and true spot transactions could increase the liquidity of LNG markets.

How to increase resilience: The role of regulation in increasing resilience

Universal service obligations often included a responsibility to ensure reliable supplies. **Legal monopolists thus were compelled to invest in capacity that was excess under normal conditions but which would be available to be used during emergencies. Regulators ensured that they were compensated for these investments in the revenues monopolists received from users.**

Where competition rather than regulation determines prices and suppliers are profit seeking, suppliers who do not invest in excess capacity can offer lower prices and enjoy higher profits. Further, it may be difficult for a regulator to assign responsibility for supply shortfalls on any particular supplier. **Hence, under competition, regulators must design an explicit means of paying for capacity to be used during emergencies and an explicit obligation to provide it. This traditional regulatory requirement for a certain degree of**

How to increase resilience: The value of energy security

Users have a value for uninterrupted electricity supply.

Investments that increase reliability sufficiently below a certain cost should be undertaken; others should not.

Estimating the value of lost load is difficult. Surveys of customers are often used to form an estimate. One type of survey asks users what mitigating actions they would take to avoid interruption. The cost of the mitigation is taken as the cost of the interruption. Another type of survey provides customers with a menu of prices and reliability and asks which choice they prefer. For industrial or commercial customers, observing the cost of investments actually undertaken by users to improve reliability, e.g., for electricity, the cost of installing emergency generators, could be useful. **Not all investments to improve energy security are worth undertaking and determining a value of a given improvement in energy security will help to identify economic investments.**

How to increase resilience: secondary trading

Increased secondary trading and capacity for secondary trading can also increase resilience to some disruptions.

Where there is secondary trading and a capacity to support it, e.g., spare transport capacity and trade in capacity, local disruptions can be addressed by diversion of supplies from neighbouring areas.

In principle, a local disruption would result in a price spike; traders would rush to buy gas where it is cheaper and arrange capacity to transport the gas to the high-priced location.

But incumbents may have limited incentives to expand secondary trading and gas transport capacity, particularly capacity that facilitates rival supply.

How to increase resilience: Timely information exchange

Information changes the effectiveness of markets. Consumers who are confident that they can buy tomorrow do not need to hoard today. Information about future market conditions can help potential investors make economically rational decisions.

During the 1973 oil embargo, shortages were exacerbated by panic buying—oil users taking independently rational actions to buy available oil beyond their immediate needs in the fear that oil would not be available later.

It is thought that accurate, timely information provided to the broader market may be able to reduce such conduct.

The International Energy Agency provides a forum for the regular exchange of information among governments of energy consuming countries. This helps to develop coordinated energy policies and responses in energy emergencies. During an energy emergency, the IEA is a forum for real-time exchange of information

The importance of timely information for security of supply : the case of Sweden's electricity market

In electricity markets the consumer does not always know the price at which she is trading. This is particularly true for households and small businesses which make up the bulk of the seasonal and temperature driven variation in Sweden.

The present legal requirement is for household consumption to be read (or metered) on a yearly basis, as of July 2009 the requirement changes to monthly meter reading. Thus, there are very weak incentives for reducing usage in peak load/peak price situations.

The role of market response to ensure security of supply: the British experience

Recent events provide a number of good examples of how the market has been shown to respond to price signals to ensure security of supply is maintained in both the short-term and the long-term.

**OECD ROUNDTABLE ON ENERGY SECURITY AND COMPETITION POLICY ,
OECD COMPETITION COMMITTEE:21 February, 2007 Joint submission by the UK
Office of Fair Trading and UK Office of Gas and Electricity Markets**

The role of market response to ensure security of supply: the British experience

Last winter presented a number of challenges for the British gas market, not least the incident at Rough in February 2006 when there was a fire on an offshore platform which was used to inject and withdraw gas from the storage facility. This led to the complete shut down of the facility for the remainder of the winter and the loss of a major supply source (in the 3 months leading up to the outage supplies from Rough accounted for 5 per cent of gas supplied to the market and for 10 per cent on the peak demand day in winter 2005/06). Following this incident, the UK experienced a cold snap leading to high levels of demand.

1) OECD ROUNDTABLE ON ENERGY SECURITY AND COMPETITION POLICY , OECD COMPETITION COMMITTEE: Wednesday 21 February, 2007 Joint submission by the UK Office of Fair Trading and UK Office of Gas and Electricity Markets

The role of market response to ensure security of supply: the British experience

Supply side and demand response in the short run

As a consequence of **tighter supply-side conditions**, **prices rose significantly**.

The market responded to these prices with a combination of **higher flows from other storage facilities, flows from liquefied natural gas (LNG) storage and, unprecedented levels of demand-side response**.

Over winter 2005/06, gas-fired power stations provided over 40mcm/day of additional gas supplies by switching to coal or distillate in response to the high and volatile prices experienced. This provided storage deliverability equivalent to the Rough storage facility.

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The role of market response to ensure security of supply: the British experience

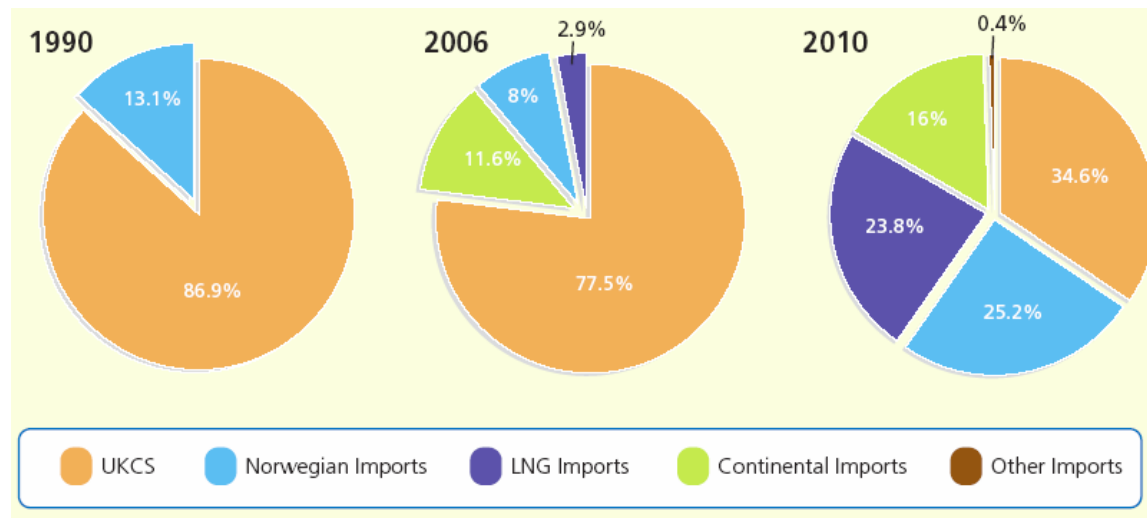
Combined cycle gas turbine power station operators provided unprecedented levels of demand-side response.

These parties demonstrated that in response to commercial incentives they were able to run their power stations more flexibly than ever before.

Smaller commercial and domestic gas users reduced demand by 8 per cent in response to higher prices, indicating that such customers are less willing to pay high prices for secure supplies than previously thought.

The role of market response to ensure security of supply: the British experience

Contribution of the Market to Diversity of Gas Supply in the U



By diversifying its sources of gas supply, the competitive gas supply market in Great Britain is increasing its capacity to withstand supply shocks and so is enhancing security of supply.

The role of market response to ensure security of supply: the British experience

Supply side response in the long run in the gas market

The United Kingdom Continental Shelf is in long-term decline. As a consequence, the UK's security of supply depends upon ensuring that sufficient additional sources of gas are brought on-stream in time to meet the future requirements of gas consumers. **In response to this, the UK market has responded with unprecedented levels of investment in gas supply infrastructure including:**

- around £6.4bn in additional offshore infrastructure investment to bring new supplies to the UK;
- investment in new LNG importation capacity (43 bcm/year by 2010); and
- investment in new storage facilities (5.4 bcm of additional capacity by 2010 - effectively doubling Great Britain's gas storage

The role of market response to ensure security of supply: the British experience

-In addition, the UK has also seen the market respond in new and innovative ways to increase the supply of gas. In particular this has included the ExceleRate project at Teesside (due to start commissioning later this month) - and other technologies where older LNG ships are being converted into floating storage facilities.

Together, these projects will add a further 255mcm/day to gas import capacity to the UK by 2010. This is equivalent to **49 per cent of peak demand during a very cold (1-in-50) winter**. A significant proportion of this new infrastructure is backed by long-term gas supply contracts.

What this means in practice is that we could have a serious disruption to supply (such as a repetition of the fire that occurred at the Bouch storage facility in early 2006) and still have sufficient

Conclusion

1) What are the main short term and long term energy security risks?

- 1) Lack of diversification of energy sources**
- 2) Lack of investment in energy sources and transportation capacity**
- 3) Lack of resilience**
- 4) Lack of information**

Conclusion

2) What role can business, government and international cooperation play in managing these risks ?

Economic Responses:

Governments can :

- 1) Provide an appropriate framework for private investment including via control of market power and vertical separation.**
- 2) Ensure excess production capacity and storage capacity**
- 3) Provide for liquid markets, secondary trading, information exchanges**

Conclusion

Business contribution

- 1) Respond to market incentive both in the short run and in the long run
- 2) Develop innovative ways to overcome obstacles to increased capacity

International cooperation (with control of market power)

Will help achieve sufficient capacity of interconnection to take into account interdependence

Conclusion

3) What can be done to boost investment in energy infrastructure, as well as research into more efficient energy production and use ?

1) Ensure that price signals are effective

2) Non discriminatory access to essential facility (ex Russia)

Thank You

frederic.jenny@club-internet.fr