

## SOME KEYS FOR OBTAINING A SECURE AND SOLID ENERGY SUPPLY IN EUROPE

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**Abstract-** Almost all European countries, and the European Union as a whole, are energy dependents. In some cases, this dependence is total or almost total. Particularly for petrol and gas, there are very strong dependences, and from the viewpoint of electricity, the necessity of interconnecting supply networks increases the dependency. If we also take into account political affairs among countries, economical crisis, peak of values of weather variables related to climate change, increment of the electric consumption, nuclear disasters, and other factors, security of energy supply is a very important point in the European energy system. In this paper, energy generation and grid interconnections for Europe and surroundings are studied highlighting the security of energy supply.

**Keywords:** Secure Supply, Energy Generation, Energy Dependency, Grid, Interconnections.

### I. INTRODUCTION

Energy demand is again increasing in Europe and in other countries that have suffered the biggest economical crisis in the last 5 - 6 years. At the same time, social awareness of people is increasing about the necessity of change the way of consuming, being more responsible with the environment. The sectors of the society that at the beginning, now 15 years ago, maintained positions against the acceptance of the global climate change, nowadays they recognize that it exists. Renewable energies are increasing, slowly, their quote in the energy production of several countries. And new models are being developed for different renewable energies or taking more importance, such the wave energy generation, solar concentrate or off-shore wind farms.

On the other hand, some regional conflicts are showing the importance of the redundant lines and grids for energy supplies. That is, in the last year there are arm conflicts in Libya, Egypt, Syria and Ukraine. Some of these conflicts have been able to be predicted in some way because the previous political situation, but other of these conflicts were not predictable. But not only the arm conflicts, but we have to take into account the economical conflicts, too. In this way, economical relations between Europe and

Russia have been stressed due to the stagnation of the European economical system and to the potential of the Russian system, part of the BRIC group of countries (Brazil, Russia, India and China) that are the new big markets for all types of companies.

### II. INTERNATIONAL ENERGY SOURCES FOR EU

The EU is Russia's biggest trading partner, accounting for 41 percent of all its trade. Trade between the two economies has grown steadily and reached record levels in 2012, up to 267.000 million euro.

Dependency on Russian energy, however, varies widely across the 28 states members of the EU. Some EU countries, such as Britain, have little exposure to Russia's oil and gas sector. Others, such as the Baltic states and Poland, rely heavily on such sales. Lithuania, for example, gets 99 percent of its oil and 100 percent of its gas from Russia. In the other corner, Spain takes a 0% of its energy from Russian sources, that is, nothing.

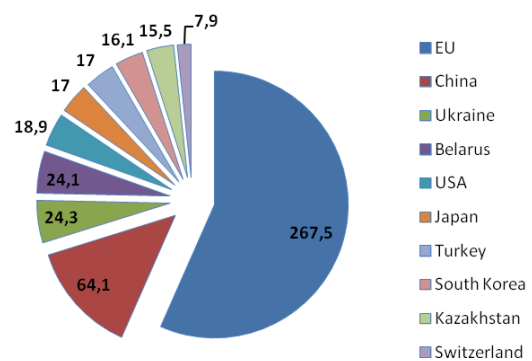


Figure 1. Russia's top trading partners 2012, Unit: billions €

Imports to the EU from Russia are dominated by crude oil and gas. According to the Energy Information Administration (EIA), European countries import 84% of Russia's oil exports, and about 76% of its natural gas. In 2013 the total volume of gas imported from Russia reached 130.000 million cubic meters (130 bcm). In 2012, total EU imports of oil and gas from all sources amounted to

400.000 million euro (3,1% of EU GDP) when the average of the last twenty years was less than half that now [1]. European states with higher levels of dependence on gas are, logically, nearby or neighboring with Russia, and their dependence decreases as their relative distance increases.

According to Morgan Stanley (2013), the relative dependence on gas supplies from Gazprom, as a percentage of consumption, is as follows: Finland, Belarus, Czech Republic and Bulgaria (100%), Serbia (95%), Latvia, Lithuania, Macedonia and Moldova (85%), Poland and Slovenia (80%), Estonia (75%), Greece (70%), Austria (68%), Turkey (65%), Hungary (60%), Ukraine (55%), Germany (48%), Italy (28%), France (19%), Romania (18%), UK (15%), Switzerland (8%) and the Netherlands (5%).

Gazprom exports its gas to Europe through four pipelines, as it is shown in Figure 2: two by Northern Europe (Nord Stream and Yamal) with 95 million m<sup>3</sup> day through Germany and Poland, and two by the south through Ukraine (175 million m<sup>3</sup> day) [2].

Regarding electricity, normally each country has developed its own grid and balanced its system with the concepts of self-management and autarky. International connections of the different electric systems have been promoted with the aim of security of supply. But in the last years, liberalization of energy markets has given a leading role to the cross-border connections with the creation of the Internal Electricity Market (IEM), in order to promote competition, trade, and an increase in overall welfare (and ultimately, it is hoped, lower electricity prices).

Other impulse for the electric interconnections among European countries is the massive expansion in renewable energy sources that probably will occur under the 20-20-20 agreement. When the EU decided in 2008 to cut its

greenhouse gas emissions, it showed its commitment to tackling the climate change threat and to lead the world in demonstrating how this could be done.



Figure 2. Natural gas pipelines from Russia to Europe [2]

The agreed cut of 20% from 1990 levels by 2020, together with a 20% renewable target, was a crucial step for the EU's sustainable development. Several of these renewable projects will involve the creation of new international electricity transmission capacity and will also require extensive coordination between different national electric systems if they want to develop to their full potential.

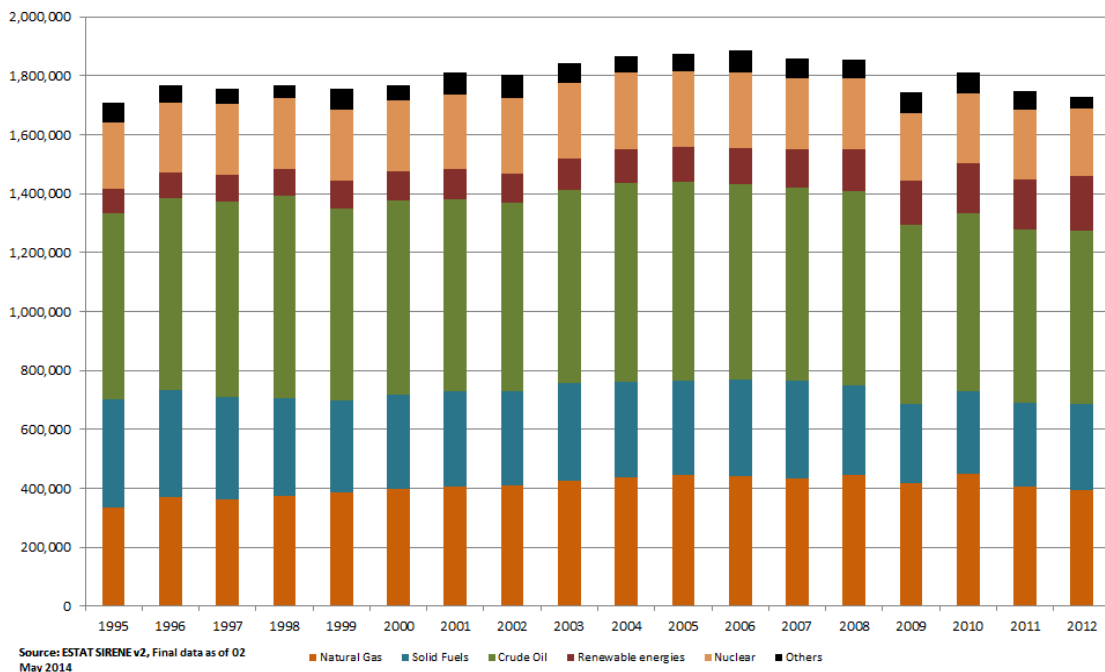


Figure 3. Total energy demand, EU28, ktoe [3]

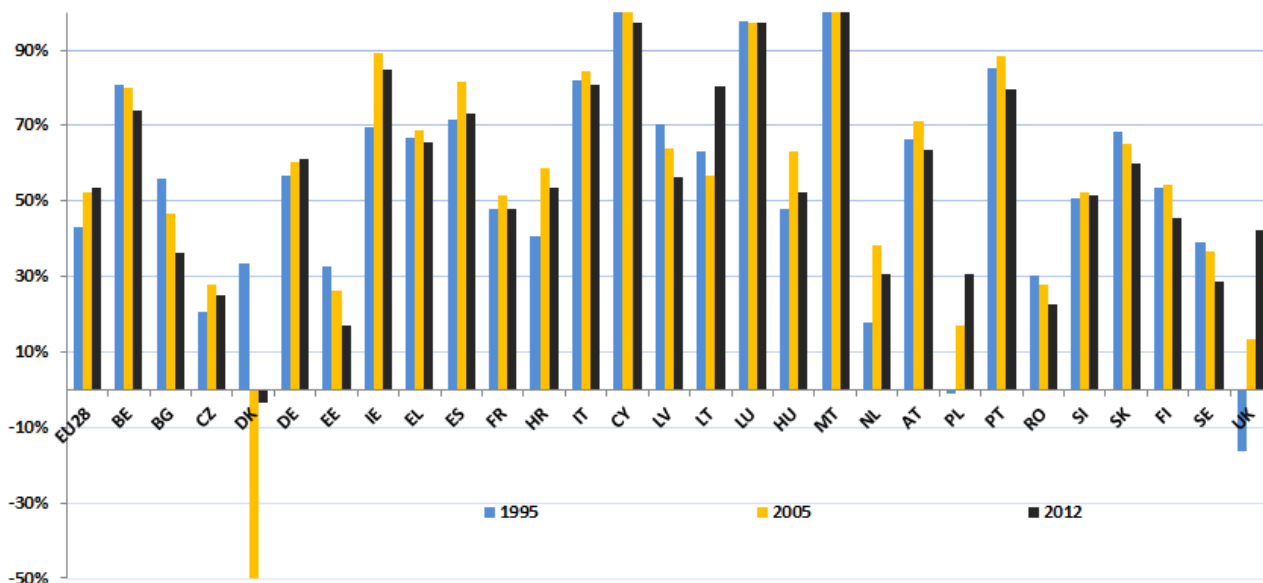


Figure 4. Energy import dependency, all products [3]

The composition of consumption in Europe has shown a slow as it is shown in Figure 3, but persistent change over time with the share of gas going up from around 20% to 23% of gross inland consumption between the mid-1990s and 2012 and the share of renewables more than doubling to almost 11% in 2012. On the other hand, the shares of solid fuels declined from around 21% to 17%, oil from 37% to 34%, whilst nuclear remained stable in relative terms at 13%.

Figure 4 shows the energy dependency of the 28 countries of the European Union. Almost all the big economies are above 50%.

### III. BASIS OF SECURITY

The main important concept about security of energy supply is related to the reduction of energy external dependence, especially giving priority to the generation capacity and in a second level the reserve of energy. Obviously, the transmission infrastructure must be well interconnected and distributed. Diversification of supply, for the different types of energy such as oil, gas or just electricity, is other key point to take into account when security of energy supply is related to. Normally, this concept has to include the answers to the question what will happen if a sudden energy disruption occurs.

Two open questions is who has to implement the measures to achieve the security supply, that is, the government or the facilities, and how develop these measures. Nowadays, from European Union it says that it is essential that these efforts do not undermine, but supplement the overall liberalization of the national energy markets. But we have to ask that the liberalization does not undermine the guarantee process for a secure energy supply.

### IV. SOME KEYS FOR OBTAINING A SECURE SUPPLY

It is urgent to take measures aimed at safeguarding security of electricity supply so as to ensure the proper functioning of the internal market for electricity and to ensure [4]:

- an adequate level of generation capacity;
- an adequate balance between supply and demand; and
- an appropriate level of interconnection between countries for the development of the internal market.

For these purposes, we have to take into account many drivers governing the secure supply of energy [5].

#### A. Diversification of Generation Capacity

A well-balanced energy system, comprising various power generation technologies, and with suitable capacity, enables the advantages of each to be maximised, allows prices to remain reasonably stable, and ensures a continuing supply to the consumer.

#### B. Prices

The provision of affordable energy to the consumer is dependent on the cost of generation, transmission and distribution. The interruption of supply networks can negatively impact prices and create economic difficulties for countries exposed by over-reliance on one energy source. Sustained price rises and short-term spikes in oil, gas or electricity can trigger inflation and recession.

#### C. Levels of Investment Required

Significant investment is needed to meet the forecast growth in energy demand. The availability of that investment – particularly problematic in many developing countries – will be a significant factor over coming years.

#### D. Ease of Transport

Energy must be readily available, and thus the ease and safety with which fuels and electricity can be transported is a key driver for energy security.

### **E. Concentration of Suppliers**

The reliance on imported fuels from a limited number of suppliers may increase the risk of adverse market influence. Where suppliers are from politically unstable countries, there may also be an increased risk of supply disruption.

### **F. Availability of Infrastructure Expertise**

To achieve a diverse energy mix, countries must have access to different energy sources, requiring both infrastructure and expertise, whether in generation technologies, fuel handling, access to delivery systems such as pipelines, ports or electricity interconnections and transmission lines.

### **G. Interconnection of Energy Systems**

The interconnection of energy systems, particularly electricity, must also be considered in terms of security. A limited market or connection increases the risk of supply disruption by reducing the options available to meet demand.

### **H. Fuel Substitution**

Diversification in the uses of fuels may also be important for energy security. Fuel transformation – such as coal to gas, gas to liquids and coal liquefaction – can meet demand even when conventional supplies may be affected.

### **I. Political Threats**

The energy supply system can be vulnerable to disruptions caused by political interests and even terrorist attacks.

## **V. CONCLUSIONS**

To provide solid economic growth and to maintain levels of economic performance, energy must be readily available, affordable and able to provide a reliable source of power without vulnerability to long- or short-term disruptions. Interruption of energy supplies can cause major financial losses and create havoc in economic centres, as well as potential damage to the health and wellbeing of the population.

European energy grid is not ready for the next future predicted demand because the collapse of some points due to the overload in some seasons, the few interconnections among countries grids, especially for electricity, the age of some generation power stations and the type of these power stations, particularly those using uranium and coal, and the increasing of the total energy demand and the collapse of some of the sources that can increment the prices of the energy.

Therefore, Europe should improve its energy grid and generation and boost the surroundings interconnections and possible generations such as oil and gas pipelines from North Africa and Near East and solar and wind generation from MENA countries, Caucasian countries and those from Caspian Sea.

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