The Impact of the Russia–Ukraine Gas Crisis in South Eastern Europe

Oxford Institute for Energy Studies

Aleksandar Kovacevic

March 2009

NG 29

The contents of this paper are the author's sole responsibility. They do not necessarily represent the views of the Oxford Institute for Energy Studies or any of its members.

ISBN
978-1-901795-86-8

Aleksandar Kovacevic is an energy economist based in Belgrade. He has provided consultancy services to international companies and institutions in Balkan and CIS countries for almost 20 years. Mr. Kovacevic assisted the UN coordination of international assistance for rapid reconstruction of energy infrastructure in Serbia after the war in 1999/2002. He was principal author of the comprehensive analyses of energy and poverty: *Stuck in the Past* (UNDP, 2004) that is recognized as the standard work on the subject as well as the energy policy study *Energy in the Western Balkans* (IEA, 2008).

Contents

Preface

During the first three weeks of January 2009, as it became clear that by far the most serious impacts of the loss of Russian gas supplies through Ukraine were being suffered in south east Europe, I spoke almost every day to Aleksandar Kovacevic. During our conversations he explained to me not only the hardship being caused by the crisis, but also severe shortcomings in the utilisation of fuels and networks throughout the region which were being revealed by these events. Such problems exacerbated what would anyway have been a serious situation with the loss of the predominant – and in the case of many countries the only – source of gas supply, and the lack of interconnections which would have allowed the region to receive gas from available supplies elsewhere in Europe. In South Eastern Europe the crisis therefore defined an energy efficiency and energy interconnection agenda for European utility stakeholders and policymakers.

As events unfolded, it became clear to me that aside from a general assessment of the crisis[1], we needed a paper which focussed specifically on South Eastern Europe which Aleksandar agreed to write. His study on natural gas in the region, which we published in 2007[2], has already become a landmark in the literature and we are very grateful to him for producing this paper so quickly.

Jonathan Stern March 2009

[1] *The Russo-Ukrainian Gas Dispute of January 2009: a comprehensive assessment,* Simon Pirani, Jonathan Stern, Katya Yamfimava, February 2009
http://www.oxfordenergy.org/pdfs/NG27.pdf

[2] *The Potential Contribution of Natural Gas to Sustainable Development in South Eastern Europe*, Aleksandar Kovacevic, March 2007
http://www.oxfordenergy.org/pdfs/NG17.pdf

1. Introduction

At the beginning of 2009, South Eastern Europe (including Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Former Yugoslav Republic (FYR) Macedonia, Montenegro, Romania, Serbia and Kosovo) was simultaneously hit by three external shocks: an extended period of cold weather, disruption in natural gas supply from the Russian federation and financial crisis.

The disruption to natural gas supply from the Russian Federation was particularly important for all countries with gas infrastructure, but also affected other countries in the region.[3] The region is supplied by natural gas from Russia from three different directions and three geographical sub-regions are served by three different sets of gas infrastructure (see Map 1). Romania, Bulgaria, Greece and FYR Macedonia are supplied by a system of transit pipelines from Ukraine. Serbia and Bosnia and Herzegovina are supplied from Ukraine via Hungary, while Croatia is supplied via Austria and Slovenia. These three supply systems are not connected which is, in itself, a security problem.

Romania and Croatia have sizeable domestic production with gas imports as supplementary supplies. Local gas prices are below import prices with consumption being subsidized by domestic resources.

Serbia produces less than 10% of its gas needs and relies on Russian supplies to cover the bulk of domestic demand. Bulgaria, Bosnia and Herzegovina and FYR Macedonia are almost entirely dependent on imports of Russian gas, while Greece imports gas from Russia, Turkey and LNG supplies.[4] Table 1 demonstrates the main characteristics of the South Eastern Europe gas markets. However, these import dependence figures are annual averages. Seasonal fluctuations in gas demand in all countries are exceptionally high. Since domestic production (if any) has a flat (constant) profile throughout the year, import dependence during periods of high demand becomes much more significant.

For this reason, disruption of gas supplies during the winter (high demand) season (even in countries where the fuel accounts for a modest share in energy balances) is likely to have serous consequences for domestic energy, economic activity and even the well-being of the population. In countries with such high seasonal demand fluctuations, conventional analyses of import dependence are not sufficient.

[3] Albania, Montenegro and Kosovo / UNMIK have no gas infrastructure. Gas infrastructure in the FYR of Macedonia and Bosnia and Herzegovina is limited to a single spur line crossing the border and approaching the capital city. Other countries in the region (Romania, Bulgaria, Croatia, Serbia) have developed infrastructure

[4] Greek "imports" from Turkey almost certainly originate from either Russia, Azerbaijan or imported LNG since Turkish production is minimal.

Table 1: Natural Gas Markets in South East European Countries

	Market size (2006)	Market size annual change 2003-2006	Share of gas in primary energy (2006)	Import Dependence	Large or dominant industrial customers	Share of population covered by district heating services	Retail gas distribution
Bosnia and Herzegovina	0.36 Bcm	26.0%	8.0%	100%	Steel works	>10% (0ver 50% in capital city)	Minor
Bulgaria	3.33 Bcm	4.6%	n.a.	92%	Fertilizers	19%	Considerably large
Croatia	2.88 Bcm	2.9%	24.5%	48%	Fertilizers, food processing, power generation	10%	Most of households covered. 38 distribution companies
FYR Macedonia	0.08 Bcm	-10.1%	2.2%	100%	Steel works	~ 10% entirely in the capital city	Minor
Romania	17.26 Bcm	-1.9%	36.4%	33%	Fertilizers, steel works	20%+	Market dominated by 2 large companies out of 33 total
Serbia	2.30 Bcm	1.2%	15.0%	92%	Fertilizers, steel works, food processing	25%	34+ distribution companies, supplying less than 10% of households

Source: ECRB, Energy Community Secretariat, South Europe: Regional Gasification Study, news articles

Map 1: South Eastern Europe Gas

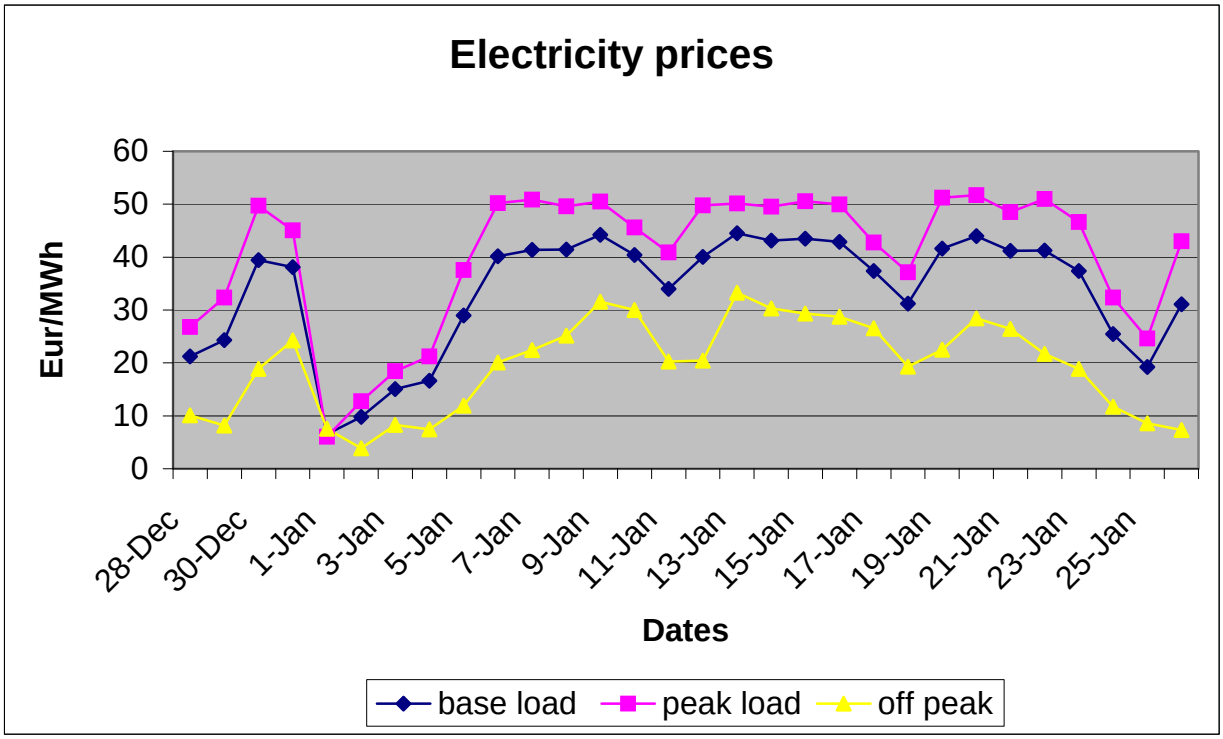
Source: Gas Transmission Europe – GTE Excerpt from GTE Map 'The European Natural Gas Network'

Infrastructure[5]

Natural gas supply to the region was entirely disrupted during the period 6-20 January 2009, coinciding with a period of cold weather throughout the region. Even though the possibility of such a disruption had long been recognised, countries enacted emergency measures only after the crisis had already developed. It took several days to organise alternatives fuels. While low temperatures resulted in additional demand for heating in continental parts of the region, cold weather over the Dinaric Mountains created exceptional rainfall. Water levels in hydro power plants in Montenegro, Albania, Bosnia and Herzegovina and Croatia were far above historical averages. In Montenegro, hydropower production hit record levels during January 2009. Oil refineries in the region had considerable reserves of heavy fuel oil, while some deliveries from outside the region (including from Ukraine) were recorded. As a consequence, alternative fuels, both electricity and heavy fuel oil, were available in the region.

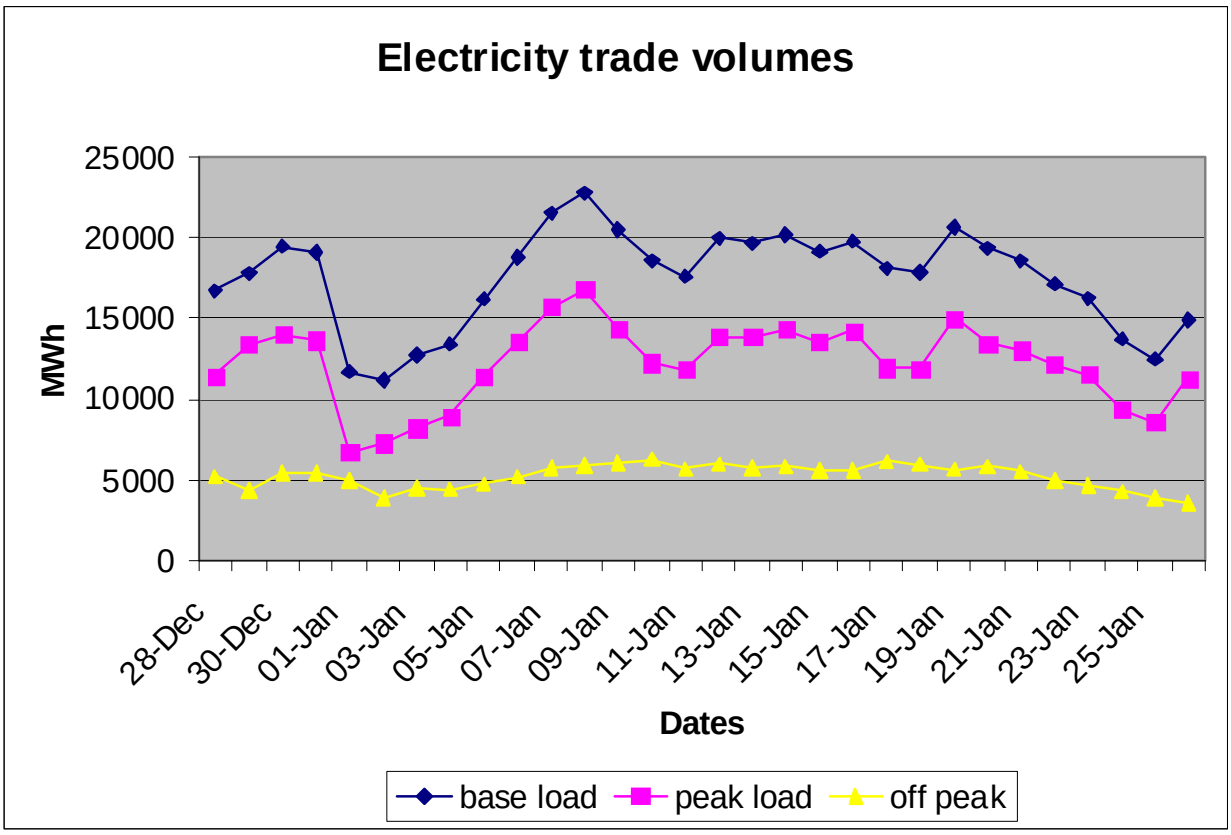
During 6-20 January 2009, minimal, if any, changes in prices of alternative fuels – electricity and heavy fuel oil – were recorded. The average price of heavy fuel oil in the region was stable at about $230 per ton, similar to Mediterranean prices. However, during this period, some countries introduced a ban on the export of heavy fuel oil. Wholesale electricity prices recorded at the largest regional electricity exchange OPCOM in Romania are shown in Charts 1 and 2.

Chart 1



[5] Natural gas is delivered from the Russian Federation to South Eastern Europe via entry point (78); to Romania (gas network via additional entry point (80) for domestic supply); Bulgaria (ring-shaped gas infrastructure); FYR of Macedonia (spur) and Greece (spur); via entry point (68) to Serbia and Bosnia and Herzegovina (spur); and via entry point (69) to Croatia gas network. These three gas systems are not interconnected.

Chart 2



Source: Author-produced graphs based on OPCOM daily reports available at www.OPCOM.ro

While base load and peak load prices followed traded volumes, supplies of off-peak electricity remained stable over the period, despite considerable increase in prices. This demonstrates the need for power utilities in the region to maximize available capacity during daily peaks utilising abundant hydro resources while obtaining off-peak electricity from the market.

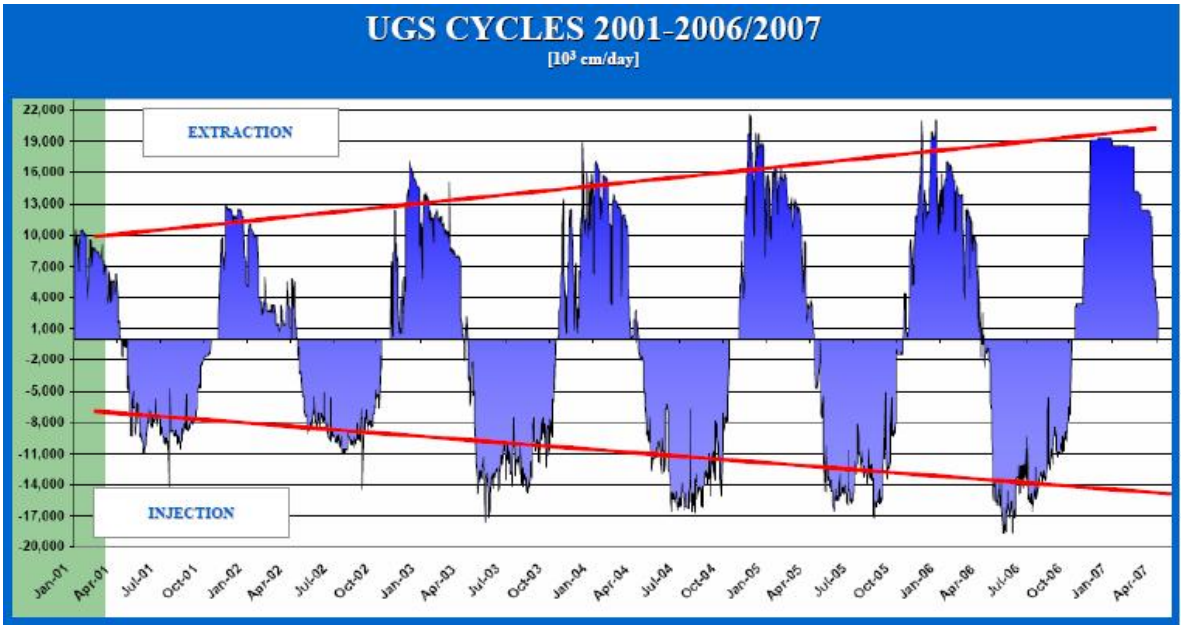
2. Gas supply and demand situation

The gas situation of most countries in the region has worsened over recent years in terms of seasonal fluctuations, infrastructure utilization and the decline of domestic production where it existed (see Table 1 above).

In Bosnia and Herzegovina, gas demand growth averaged 26% year during 2003-2006. In particular, winter peak demand increased from year to year both in absolute and relative terms. The main market of the city of Sarajevo consumes over fourteen times more gas in winter than in

the summer. Despite modest demand growth in Serbia, Bulgaria and Croatia as well as slight demand decrease in Romania, seasonal fluctuations have increased everywhere. During the winter of 2007/2008, seasonal gas demand in Croatia increased by about 27%, while annual demand growth remained in single digits. All countries have instituted reductions in gas supply to some large industrial consumers during winter months (scheduling annual maintenance works, closures, extended holidays, etc) in order to retain gas supplies for domestic heating. In recent years, tight supplies in January have caused a reduction in industrial output in Serbia. In Romania, stored gas has increasingly been used to maintain supplies during winter, and winter peaks continue to grow despite the fact that large industrial consumers in Romania (for fertilizers) scheduled their annual shutdown for winter. (Chart 3 shows the use of underground gas storage in Romania).

Chart 3

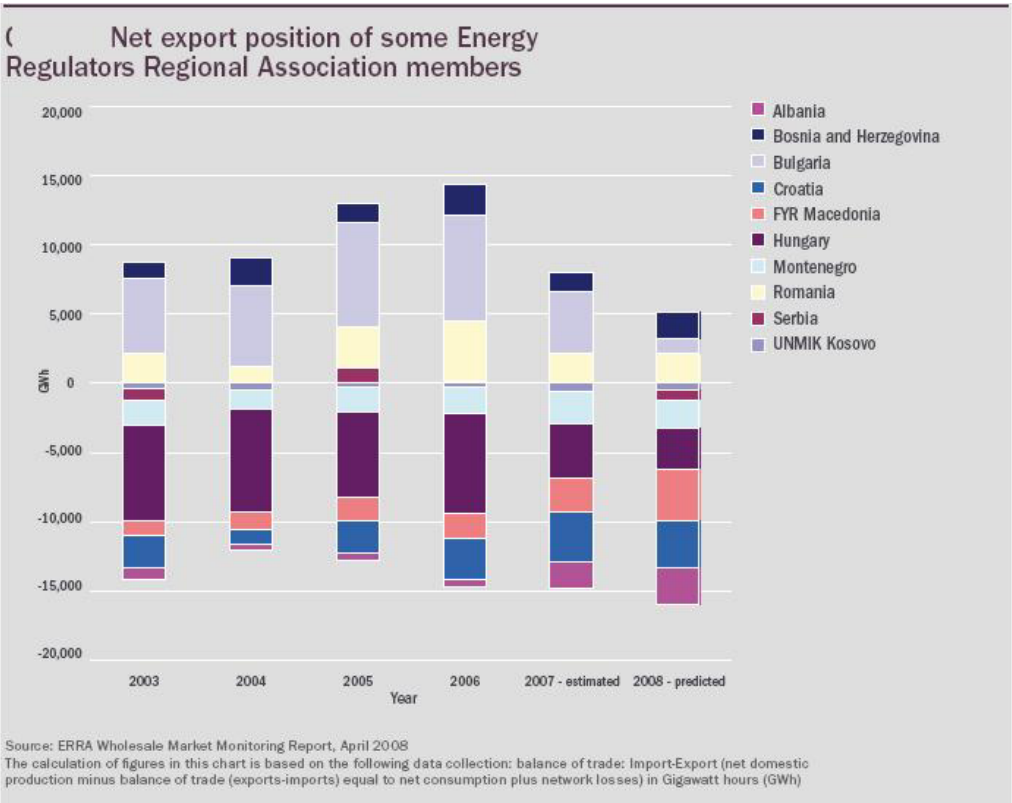


Source: Florian Tobescu, Storage Facilities in Romania, Presentation to the Energy Community Treaty Mini Gas Forum, May 11, 2007

3. The Energy Background to the Crisis

Similar trends can be observed in electricity demand. The most recent, UCTE (Union for the Coordination of Transmission of Electricity) System Adequacy Report (1 July 2008) reports that South Eastern Europe does not have appropriate capacity margins. During the past two years, the overall export position of the region has deteriorated and the region is moving towards becoming a net importer of electricity (see Chart 4 below). The fact that electricity supply in January 2009 was available because water levels were exceptionally high was a fortunate coincidence. Without increased demand caused by the gas crisis, high hydro generation would have driven wholesale electricity prices down to much lower levels.

Chart 4



Source: Gabor Szorenyi,[6] 'The Energy tango: energy reforms and regulation in Central and Eastern Europe', *Law in Transition*, EBRD, October 2008

In addition to the deterioration of supply, the structure of demand – the increase in winter peaks and at best, limited upgrades in infrastructure – both for electricity and gas, provides the general background to the January 2009 crisis.

Three additional aspects of this situation should be examined:

First, the use of electricity for space heating makes a critical contribution to winter peak demand. However, over-sensitivity of demand to outside temperatures suggests that electricity is supplementary to the 'base load' fuels: natural gas, district heating and fuel wood. If natural gas, heat and fuel wood are not sufficient, or are not price-competitive (against regulated electricity prices), consumers will switch to electricity and create additional load. When outside temperatures fall, the need for extra heat provision increases, as does the likelihood that electric heaters will have to cover the increased heat demand. Some countries adopted multi-stage tariffs for electricity that further discourage the use of electricity as a main source of heating. The fact that the introduction of these tariffs has failed to decrease electricity consumption during winter further confirms that electricity is viewed by consumers as a secondary or back-up fuel. During the winter of 2008-9, electricity in Serbia became less expensive than natural gas as gas prices

[6] Dr Gabor Szorenyi is the Chairman of the Energy regulators Regional Association (ERRA)

followed oil prices to higher levels in 2008. Nevertheless, retail consumption of natural gas remained at almost same level as in the previous winter. During the gas supply crisis, government officials in Serbia, Bulgaria, Bosnia/Herzegovina and elsewhere were concerned about the availability of electricity, since their experience confirmed its importance as a fuel of last resort. Fuel wood market prices are obviously related to prices of alternative widely available fuels: natural gas in Croatia, northern Serbia and parts of Bulgaria and Romania, or electricity elsewhere in the region. However, the amount of fuel wood stocks at any one point in time, and the number of weeks left till the end of winter, determine the price of fuel wood and its interrelation with electricity prices, and consequently, the degree of actual electricity usage during periods of high demand. A sequence of cold days in January will create a spike in fuel wood prices and therefore a very high incremental demand for electricity.[7]

Secondly, district heating systems increase the weather sensitivity of energy demand. District heating systems that are supplied by heat-only-boilers, where heat distribution is regulated by temperature with fixed or semi-fixed flow, tend to have considerable network losses and low efficiency at below optimum utilization rates. In practice, utilization rates will rarely be optimised. Furthermore, the 'free rider' problem in district heating use further reduces the average energy efficiency of buildings. The increasing sensitivity of the building stock to low temperatures is magnified by district heating systems. Losses get worse when operators increase the volume of energy delivered via pipes by raising the temperature of circulating water and deploy older and less efficient boilers to maximize supply.[8] If a district heating system uses natural gas as a main fuel, demand spikes will be reflected in the load factors for the gas network. As a consequence, gas demand will be more temperature-sensitive than if the same heat demand is supplied by direct gas heating. Some heat for district heating systems is sourced by steam extraction from turbines in power plants. While waste heat is exhausted from the plant, heat extracted from the original steam cycle results in a decrease in power output. The same comments above on weather sensitivity then apply. The increase in weather sensitivity and the problems of capacity of district heating systems in the region, observed during last years, have increased the strain on gas infrastructure and added to seasonality in gas supply.

Thirdly, since 2000, countries in the region, with the notable exception of the FYR of Macedonia, experienced a dramatic increase in credit, growth of imports, and a devastating deterioration of current account balances (see Table 2). Financial services and retail trade emerged as large

[7] It is interesting to note that fuel wood in Balkans is exceptionally expensive, comparable to the prices of good quality industrial wood elsewhere in Europe. Used in low efficiency devices, fuel wood is generally more expensive than natural gas. However, if used in modern appliances or masonry stoves, fuel wood in this region can be considered competitive with natural for space heating.

[8] Both boiler and network loses are increasing disproportionally when external temperature decreases at the same time as circulating water temperature increases. As a consequence, the higher heat demand of buildings is transformed into disproportionally higher fuel demand of district heating system. A similar effect can be observed with the basic direct heating gas stoves that are used by many rural gas customers. With direct and simple exhausts, these stoves consume disproportionally more gas during very cold periods. Further, heat demand is a critical component of gas demand in countries where industrial activity is relatively low. In most countries, energy statistics does not provide proper distinction between gas demand by district heating systems and overall gas consumption labeled as 'industrial' or 'energy' consumption. As a consequence, a swing in gas demand during cold weather periods could go several times above annual average – over twice as much weather sensitivity than in most of Western European markets.

contributors to GDP. Such unsustainable GDP growth has had a significant impact on energy intensity/efficiency ratios and created the impression (sometimes cited by local governments and some international donors) that countries were making progress in terms of their energy use. Financial and retail service growth gave rise to substantial construction of modern business premises and shopping malls. International real estate companies reported these trends in their market reports.[9] Taking into account high interest rates and risk premiums, these construction projects minimised capital expenditures and as a result, were exceptionally energy intensive with considerable weather sensitivity.[10] Even if energy expenditures could be limited in financial terms these new developments contribute to peak loads for district heating, gas and electricity networks.[11] In most cases, integrated network and energy providers who had previously faced falling energy sales were happy to grant network access without charging the full costs of use for their infrastructure. When networks became overloaded,[12] capacity was upgraded using public funds or international assistance.[13] This process is confirmed by the development of the load configurations in gas and electricity networks described above.

Table 2: Illustrative economic figures resulting from growth in financial and retail industries

	Domestic credit to private sector in 2000 (% GDP)	Domestic credit to private sector in 2006 (% GDP)	Import growth (%) 1996-2005	Import growth (%) 1996-2005	Current account balances in 2005 (%GDP)
Albania	4.6	14.9	17.3	20.0	-7.6
Bosnia and Herzegovina	40.8	47.9	12.0	18.4	-18.1
Bulgaria	12.6	44.5	14.2	20.6	-11.3
Croatia	37.4	61.2	9.2	17.6	-6.6
FYR Macedonia	17.8	25.9	6.4	11.6	-1.4
Romania	7.2	20.0	14.1	23.0	-9.0
Serbia and Montenegro	-	-	10.4	20.1	-7.5

Source: World Bank, 'Western Balkan Integration and the EU', 2008, various tables

[9] King Sturge, 'Retail World, Central & Eastern Europe Special' Summer 2008; *Colliers International*, 'Southeast Europe Real Estate Review', 2006; further confirmed by IntelliNews Southeast Europe Emerging Europe Construction and Real Estate Report, November 2008

[10] This could be linked with various factors: limited investments in insulation; lack of thermal mass in buildings even if modern insulating materials are used; undercapitalized, very intensive ventilation services; minimized heat distribution equipment designed for round-the-clock operation;, use of concrete as the main construction material regardless its specific thermal properties, etc.

[11] Pricing of energy in these countries is still inadequate. Apart from directly subsidized prices of energy commodities, capacity charges are often insufficient or time-limited and there is little coordination between urban planning / building charges and energy service providers.

[12] In most cases, during winter peak demand only.

[13] During peak demand periods only. However, peak demand in business and retail premises corresponds to peak demand from residential consumers. Maintaining appropriate services to residential consumers then emerges as a social and, in many cases, local political priority.

4. The Legal Background to the Crisis

Countries from South Eastern Europe are members of the EU (Romania, Bulgaria, and Greece), signatory parties of the Energy Community Treaty (EnCT) with the EU (Albania, Bosnia and Herzegovina, Croatia, FYR of Macedonia, Montenegro, Serbia and Kosovo/UNMIK) or observers to the EnCT (Moldova). This legal position has facilitated their participation in the EU Gas Coordination Group[14] and allowed some assistance from EU member countries in case of supply crisis.

The Ministerial Conference of the Energy Community Treaty (EnCT) for South Eastern Europe from December 2007 extended the Treaty (that introduces European Union *Acquis Communitaire* in energy to South Eastern Europe), to cover application of the Council Directive 2004/67/EC of 26 April 2004, concerning measures to safeguard security of natural gas supply by the parties starting from 31 December 2009.

5. The Crisis

From January 6, 2009 all natural gas supplies from Russia flowing to South Eastern European countries via Ukraine were cut off. Different markets were affected differently but there were some common features for some countries.[15]

Greece had a separate and different crisis path compared with other countries. Russia meets about 82 percent of annual gas demand in Greece. Around 9 Mcm of gas per day are required for domestic supply of which about 5-6 Mcm were scheduled to come from Russia. When Russian gas supplies were halted, alternative supplies of gas from Turkey were below the contract level with low pressure on the pipeline.[16] While Greece does not have underground storage there is an LNG regasification terminal at Revithoussa near Athens – the largest gas demand centre. The country does not have district heating systems; heating is decentralized using a variety of fuels and technologies. Greece responded to the crisis by purchasing additional volumes of LNG, by stepping up electricity supply and using alternative fuels in some industries. By 19 January, the country was able to offer 2.5 Mcm per day to Bulgaria from its LNG supplies. Waterborne LNG reported that:

> 'Since the Russian pipeline gas was cut off via Ukraine at January 6 countries such as Turkey and Greece have been seeking supplemental supplies in the form of LNG "buy" tenders. Thus far we understand that Vitol has sold an Omani spot cargo into Turkey, which was apparently re-routed from Spain on the Omani tanker the "Sohar LNG". BG has responded by sending an Egyptian sourced cargo to Greece on its own tanker the "Bluesky". Meanwhile an increase in Algerian supply to Turkey has been detected with two consecutive deliveries within a week on the Algerian controlled "Bachir Chihani" and the "Larbi Ben M'hidi". GdFSuez's "Mara Gas Coronis" delivered a cargo to Greece earlier in January from Egypt, also suspected to be the result of the gas shortages there.'[17]

[14] See European Commission press release IP/09/30 of January 9, 2009
[15] Immediate response to the crises is indicated in the Table 3 while further responses are indicated in the Table 4.
[16] These "alternative supplies" probably also physically originated from Russia via the Blue Stream pipeline.
[17] Waterborne Energy Inc. *The U.S. Waterborne LNG Report*, Volume 6, January 14, 2009

Table 3: South Eastern European Countries' Positions and Responses on 7 January 2009

Country	Shortfall*	Diversification	Gas storage	Alternative fuel	Fertilizer plant	District heating	Fuel reserves
Bulgaria	100%	No diversification, renegotiated with Greece	Gas storage for 2-3 days, >8% production	Alternative fuel for 20 days	Two plants, stopped	Massive, mostly dual fuel	Not allocated to consumers
Serbia	100%	12% renegotiated with Hungary and Germany	1mcm, less than 1 day, 8%covered by production	3 weeks of fuel oil	Stopped, Bankruptcy procedure	Massive, mostly dual fuel	Not allocated to consumers, logistical problems
Bosnia and Herzegovina	100%	No diversification, Hungary, Germany emergency deliveries	No storage	Fuel oil only for 20 days	No	Capital City, dual fuel	Not allocated to consumers
FYR of Macedonia	100%	No diversification	No storage	Fuel oil stocks need only for industry	No	Capital City only, dual fuel	Allocated
Croatia	40%	Diversification to Italy, renegotiated diversion of gas from Italian concessions	Increased domestic production (43%) and storage withdrawal, 500mcm stored	Fuel oil for industry	One plant, stopped, annual maintenance	CHP dual fuel	Allocated
Moldova (observer)	100%	No diversification	No storage	No alternative fuel	No	Massive, mostly dual fuel	No data
Romania	34%	No diversification	Increased domestic production (60%) and withdrawal from storage	Yes, abundant	Plants stopped	Massive, mostly dual fuel	Allocated, strong logistics
Greece	80% BG and TR	Only LNG terminal, fully capable, booked more ships	Only in LNG terminal	One gas power plant switched to oil, sufficient till end of January	No	No	Not applicable

* % of gas supply disruption arising from the crisis.
Source: European Commission, news articles

As Table 3 shows, **Romania** is only dependent on Russian gas for just over a third of its annual supplies. Gas supply to some industrial consumers was restricted and a number of large companies were not operating when supplies were cut on 6January. Simultaneously, the country stepped up domestic gas production and its withdrawals from underground storages. As the crisis developed, it was possible to offer additional quantities to industrial consumers. Romania has

considerable penetration of district heating systems but gas prices have been kept below European market levels because of its domestic resources.

Moldova was heavily affected by the supply interruption since there were no significant stocks of alternative fuels, underground storages or alternative supply routes. From the start, critical consumers such as district heating in Kishinev (the capital city) were cut off. Ukraine was able to provide some gas supply from its own storages to Moldova during the course of the crisis although far below regular supply. It was a life-saving measure at minimal level of supply: after a few days of complete disruption when heating services failed for a number of people, minimal supplies of district heating and gas were restored.

Bulgaria has been considered for many years to be a country with most favoured status in relation to Russia gas supply and pricing. When supply to Bulgaria was cut on 6 January, the Government was forced to take emergency measures. The availability of alternative fuels was limited and most public utilities (district heating companies and CHPs) lacked even the level of emergency stocks of heavy fuel oil prescribed by regulations. Although fuel oil was readily available from the largest oil refinery in Burgas (owned and operated by LukOil), there were considerable logistical obstacles to transportation to cities in need. This provoked public protest in some locations. Most major gas consumers – such as the fertilizer industry – were closed down even before the crisis. Electricity supply from about 240MWe from CHP plants was lost. Coal fired units at the Varna power plant were brought back into service, and lignite-fired units in Bobov Do (shut down due to the EU environmental restrictions) were restarted. Bulgargaz was able to negotiate gas supply from offshore fields (operated by Melrose Resources of UK and closed in preparation for conversion to storage) and to extract maximum withdrawal capacity from its only UGS facility in Chiren. As noted above, gas imports of 2.5Mcm per day from Greece were arranged just prior to the restoration of Russian supplies. Government immediately stopped all exports of alternative fuels and pushed for re-start of nuclear power units at Kozloduy (closed as a condition of accession to the EU). In response to public pressure, the Government reportedly pledged itself to a diversification of gas supply sources and asked the European Commission for financial assistance to build gas interconnection lines with Greece, Turkey and Romania as well as to increase storage capacity.

The Former Yugoslav Republic of Macedonia experienced 100% gas supply cut. Industrial consumers immediately stopped using gas while district heating companies in the capital Skopje – supplied with over 500MWt of heat-only-boiler capacity district heating system – shifted to heavy fuel oil, in the knowledge that emergency stocks of this fuel were in place. The national energy regulator ordered a reduction in district heating tariffs since heavy fuel oil prices were below the price of natural gas.

Serbia is almost entirely dependent on gas supply from Russia. Due to problems with quality and compression, even the smallest volumes of domestic production become difficult to deliver without external supplies. Serbia has high and growing weather sensitivity of gas demand as most of 7000MWt installed capacity of heat-only boilers for district heating use natural gas as their main fuel. There were small emergency stocks of heavy fuel oil available because of the budget constraints of local district heating companies. Some heavy fuel happened to be available at two refineries; because of limitations of refining capacity these residual products are not competitive

on the regional energy market. However, there were serious logistical obstacles to delivery of these alternative fuels to priority consumers. Industrial consumers were disconnected from the gas network, while district heating companies imposed restrictions on heat supply to commercial consumers and public buildings. The main crisis period covered the public holidays of Orthodox Christmas and New Year's Day.[18] Daily demand for heavy fuel oil exceeded refinery capacity even for high priced poor quality product as the country's stocks were depleted. It is something of a paradox that on 14 January (the midpoint of the crisis), the Belgrade district heating system added another heat-only-boiler of 116MWt capacity and pledged to add another 140MWt. Following a meeting of the EU Gas Coordination Group on 9 January, Serbia arranged emergency imports of 4.7Mcm per day from MOL and EoN. These deliveries allowed domestic production to continue and the loss of gas supplies to be compensated by domestic heavy fuel oil. These emergency supplies continued until the end of the crisis. There was no official public discussion of security of supply or diversification of imports. The National Anti-Monopoly Commission ruled that Gazprom Neft's acquisition of the Serbian oil industry (including both refineries and most storage capacity) did not fall within its mandate, despite the fact that this acquisition places the supply of both natural gas and alternative fuel (heavy fuel oil) under the same ownership.[19] The import of 25,000 tons of heavy fuel oil from Bosnia[20] was arranged on 19 January.

Bosnia and Herzegovina was severely affected by gas supply disruption on 6 January. Its capital city, Sarajevo, is served by a district heating system that was left without any alternative fuel supply while direct gas consumers in the Sarajevo suburbs were entirely disconnected from supply as well as all industry. According to local gas distributors, seasonal fluctuation in gas demand in Sarajevo area has peaked at an incredible 15 to 1 over the past few years and gas demand growth has increased to 26% per annum. Both rises were consequences of the construction boom in hotels, business premises and shopping malls. Winter conditions and traffic problems limited the ability to supply large quantities of heavy fuel oil across the mountains. More than 70,000 apartments in Sarajevo were without heating, and hundreds of thousands people in suburban settlements were forced to find alternative sources or to relocate to relatives in other cities. Demand for electricity and fuel wood spiked. Emergency gas imports of 1.5 Mcm per day arranged with MOL and EoN from 12-13 January consolidated the situation and the crisis became more manageable[21]. The government entered into discussions with Croatian counterparts about diversification of supply.

Croatia was left without gas supply from Russia on 6 January. (Table 3) shows that the country only needs to import around half of its gas needs on an annual basis. The government immediately proclaimed a state of emergency and pledged to control the crisis according to its Decree of early 2008.[22] Alternative fuel stocks (heavy fuel oil and light heating oil) stocks were made available. District heating companies and electric utilities shifted to alternative fuels while gas supplies to industry were disconnected. The fertilizer industry was shut down for planned

[18] 7 January and 14 January respectively
[19] The acquisition was concluded in early February 2009 according to 2008 agreements.
[20] Brod Oil Refinery was acquired recently by the ZarubezNeft of the Russian Federation. Delivery has been arranged by barges along the River Sava.
[21] Restoration of gas supply to retail customers caused some human casualties due to problems with gas installations.
[22] The Government of Croatia, Decree on security of natural gas supply of 30 September 2008.

annual maintenance. Domestic production and withdrawal from Croatia's only storage facility were increased. Local gas distribution companies were wrestling with exceptionally high winter demand and problems of disconnections with their commercial and retail customers. Additional supplies were arranged from MOL, EoN, GdF and ENI (see Table 4). Despite reductions, there were some record levels of gas demand in major cities.

Montenegro has no gas infrastructure. Its major electricity consumer – the RUSAL owned aluminum smelter in Podgorica[23] – cut its production by more than half from December 2008. At the same time, hydropower production reached its historical maximum so that Montenegro was able to supply peak electricity to Serbia, and withdraw from some electricity import arrangements, allowing more electricity to flow to the regional market. For similar reasons, **Albania** was able to deliver electricity to Greece. **Kosovo** had a shortage of electricity and suffered blackouts, as it could not source sufficient imports**.**

[23] Accounting for about 43% of Montenegro electricity demand if working at full capacity.

Table 4: South Eastern European Countries' Responses during the Crisis

	Import capacity via Ukraine	Domestic gas production	UGS withdrawal	Emergency gas imports arranged	Alternative fuels	Disconnection of consumers	Price of alternative fuel vs. gas price
Bosnia and Herzegovina	1.9Mcm/d	-	-	1.5Mcm/d from MOL, EoN as of 10 Jan.	Not arranged, no public stocks, no obligations to district heating providers.	Massive disconnections forced during first 5 days. Industry disconnected throughout the crisis period.	HFO price below price of gas.
Bulgaria	Technical: 4.8–24 Mcm/d 12Mcm/d contracted	Melrose Resources extended production from closed field up to 1Mcm/d	UGS capacity: 0.524Bcm 4.2Mcm/d available off-take.	2.5Mcm/d arranged from Ukraine from Jan.10 but not confirmed. 2.5Mcm/d from Greece as of 19 Jan.	HFO widely available to DH providers. Few emergency stocks in place. Logistical problems.	Industry disconnected. Some further forced disconnections.	HFO price below price of gas. Major HFO vendor LukOil owned refinery Burgas.
Croatia	Technical 4.8Mcm/d Contracted 3.2Mcm/d	7.2 Mcm/d plus 0.72Mcm/d shifted from INAgip offshore concession intended for Italian market.	UGS capacity: 0.55Bcm 4.8Mcm/d available off-take.	1Mcm/d MOL/EoN, 0.96Mcm/d GdF Suez.	HFO and LFO available in prearranged emergency and regular stocks with public energy utilities.	Industry disconnected according to the Government regulation. Organized disconnections of some commercial customers at gas distributions.	Gas price below price of alternative fuels. Below market price for domestic production.
FYR Macedonia	2.2 Mcm/d	-	-	-	HFO available in prearranged emergency and regular stocks with public energy utilities	Industrial customers disconnected.	HFO price below price of gas.
Romania	Technical 29-33Mcm/d	27.4Mcm/d	UGS capacity: up to 4.4Bcm 24Mcm/d available off-take.	-	HFO available. Some quantities made available for export to neighboring countries.	Major industrial consumers not working	Gas price below price of alternative fuels. Below market price for domestic production
Serbia	11Mcm/d	0.7Mcm/d	Negligible	4.7Mcm/d MOL, EoN	HFO available to 10.6Mcm/d gas equivalent, stock for 3 weeks, production drop 30%. Minimal stocks in place. Import from Bosnia arranged. Logistical problems.	Industry disconnected. Some further forced disconnections. Disconnections from district heating services.	HFO price below price of gas.

Source: news articles, author communications

6. Lessons learned

The following lessons can be drawn from the 2009 gas supply crisis:

- Cash-constrained local energy utilities with inadequate price and cash flow control were unable to make maximum use of available gas supplies and energy infrastructure during the crisis, or to secure appropriate reserves of alternative fuels. There were serious shortcomings in preparations for a crisis which had been anticipated.

- Growth of weather sensitivity and seasonal fluctuations of gas and electricity demand fatally undermines the ability to deal with supply crises. These phenomena also reduce average utilization rates of energy infrastructure, causing additional financial problems for utilities.

- Countries with national emergency plans (Croatia, Romania and FYR Macedonia) who prepared well in advance and were supported by emergency stocks fared much better than others.

- Problematic but functioning markets in electricity, heavy fuel oil and LNG were able to supply even at the peak of the crisis. While security of supply arrangements based on Government-to-Government agreements[24] failed, markets supported by multilateral arrangements[25] performed well.

- Low income households were the most affected both in the short and longer term. They were forced to shift to more expensive fuels (electricity, fuel wood) and to maintain inefficient (undercapitalized) appliances to cope with alternative modes of heating. Inefficiency and insecurity of energy use devastated their budgets. Even if not connected to natural gas, these households were affected by electricity blackouts and fuel wood price spikes. No government was prepared to assist these social groups. Such consumers go largely unrecognized by national statistics, the Energy Community Treaty Social Protocol, and by international donors and other parties.

- Distributors of gas, electricity and district heating that are also retailers of gas, electricity and heat have serious conflicts of interest and have sacrificed reliability, utilization rates and economic rationale of energy networks for the additional commercial opportunities of connecting new customers. These utilities failed to take appropriate demand side and supply contract management measures.

- Inter-network impacts – district heating to gas and district heating to electricity – have not been properly examined by national energy regulators. As a consequence, district heating companies are not paying the full cost of the seasonal load they create on gas networks, or

[24] Bulgaria and Serbia expected regular supplies based on their agreements with the Russian Federation despite global supply disruption. To what extent provision of heavy fuel oil from oil refineries owned by the Russian companies could be associated with these agreements more than regular commercial use of opportunity to sell residual products is not known.

[25] Such as legal framework with the EU, EnCT and international maritime regulations.

of the security of supply burden they create for electricity networks. Instead, these costs are imposed on all consumers.

- There was little intervention by national energy regulators before and during the crisis to ensure reliability of networks and quality of service. In many cases, there was no regulation of district heating operators (although the latter are obvious natural monopolies). District heating, electricity and natural gas tariffs are not properly regulated to reflect the full costs of high weather sensitivity and seasonal demand fluctuations.

- Energy subsidies made the crisis response capability smaller than it should have been taking into account available physical infrastructure. In most cases, these are implicit subsidies not reflected in public budgets but come from the resources of public companies. This practice affected revenue generation, increased depletion of domestic production capacity (Croatia, Romania, Serbia), limited financial capacity to maintain alternative fuel stocks, and delayed gas infrastructure and UGS developments while facilitating inadequate demand side management. These factors contributed to the crisis and further, to its effects.

- The shift to alternative fuels is associated with serious environmental impacts.[26] SO_2 and particulate emissions in many cities around the region exceeded maximum allowed levels. Poorer people, most of who are not customers of district heating or natural gas networks, were adversely affected by these environmental problems and suffered further health-related impacts.

- Countries that were dependent on only one source of supply, and whose Governments assured the public that only one source of supply was available, have been successfully supplied from additional gas sources, despite limitations in their infrastructure capacity.

- Governmental concern about security of supply is focusing on smaller and more practical steps to increase underground storage capacity and to develop short interconnections with neighbouring gas systems. These measures are a more immediate and practical response, compared to engagement with very large international cross border pipelines.[27]

- Governments generally failed to make substantial improvements in: energy statistics, energy policies, and energy efficiency, quality of service and other important but challenging aspects of energy security. Available energy efficiency policies proved

[26] Direct use of high sulphur alternative fuels (heavy fuel oil, lignite) will be questionable from 2017 when region will be required to apply the EU Large Combustion Plants Directive (LCPD) to all plants. During the 2009 crisis, Bulgaria was able to use plants closed down due to LCPD compliance. If this practice is deemed acceptable, it could become a serious precedent for other countries in the region in approaching their obligations in context of the Energy Community Treaty and EU accession process.

[27] Interconnections between Bulgaria and Greece, Bulgaria and Romania, Bulgaria and Turkey, Romania and Hungary, Hungary and Croatia, Croatia and Italy were all discussed during the crisis. Decisions on underground storage projects have been speeded up. The Croatian Government acquired storage facility Okoli from the oil company INA and transferred it to Croatian transmission system operator Plinacro. Bulgaria made arrangements for another offshore UGS with Melrose Resources as well as to further exploration / production concessions. Bosnia and Herzegovina as well as Croatia have discussed a re-gas terminal on the Adriatic Sea coast while partners in Krk LNG have also stepped up their efforts.

insufficient and irrelevant in the context of managing winter demand peaks and weather sensitivity.

7. Conclusions

The disruption in natural gas supply to South Eastern Europe during the January 2009 Russia-Ukraine crisis revealed serious shortcomings in the security of supply architecture in the region. The adequacy of electricity, gas and district heating infrastructure has deteriorated over recent years. During periods of high demand, supplies and infrastructure operate at full capacity and countries become vulnerable to supply disruptions. At their current level of economic development, the countries in this region have considerable energy infrastructure and should be able to ensure security of supply in other circumstances similar to those of the January 2009 crisis.

During the crisis, the weather was cold, but not exceptionally cold, throughout the region. Most large industrial customers were not operating for different reasons. Not a single fertilizer plant in the region was working at full capacity. Aluminum smelters and steel works were largely shut down. There was considerable reduction in commercial and public sector demand as a result of holidays and deliberate disconnections due to gas shortages. However, the supply of gas and alternative fuels was considerable and mostly provided more energy than the missing gas supplies. The worst consequences resulted from the recently increase in weather sensitivity of demand, which must be considered a serious policy and regulatory failure.

Low efficiency of district heating systems including: high weather-sensitivity of fuel requirements, high dependence on secure provision of electricity and high fuel-to-service rates created significant strains on gas infrastructure. These systems serve influential social groups and commercial players in these countries which put pressure on governments to ensure that they receive energy supplies – both gas and electricity – that creates heavy burden on both gas and electricity networks.

Demand in these countries is becoming increasingly weather-sensitive. The deadline for the implementation of the EU Large Combustion Plant Directive, not only for lignite-fired power plants but also for heat-only-boiler plants, is approaching. Seasonality in energy demand undermines the rationale for massive investment in energy infrastructure. Investment risks (from a range of causes including inadequate energy pricing) limit both investments in energy supply and demand side efficiency. In the medium term – up to five years, countries are facing serious energy security challenges. In the longer term – beyond five years, a stream of incremental developments could facilitate both the emergence of a regional natural gas market, and gas linkages with western and central European markets. In the short term, local energy providers and network operators need to prepare for the 2009/2010 winter; improve functionality of networks; build up stocks of alternative fuels or natural gas (where UGS capacity is available); enter into robust and realistic commercial arrangements; adapt tariff systems and apply appropriate demand side management.

A high degree of good luck contributed to resolving the gas supply crisis throughout South Eastern Europe. Exceptionally high water levels facilitated very large hydropower production.

While most of the region was hit by cold weather, temperatures in the Dinaric Mountains were still warm enough to allow flow to rivers and accumulation lakes, while cold enough to cause condensation of moist Mediterranean air inflow. A significant share of industrial energy demand was reduced due to holidays, financial constraints, adverse patterns of international commodity prices and other reasons. For most import-dependent countries, the shift from gas to alternative fuels was financially beneficial as these fuels were – unusually – priced below gas. This allowed local utilities to procure alternative fuels (in many cases delaying payment) and source gas from other suppliers. In countries with large domestic gas production, additional domestic supplies were available. All of these measures were used for the first time in many years.

Nevertheless, the contraction of economic activity was substantial in Bulgaria, Serbia, Croatia, FYR of Macedonia, Bosnia and Herzegovina, and had a considerable financial impact that is likely to become more complicated with any recurrence or spread of financial crises[28]. Many countries are seeking assistance from international financial institutions. There is little indication that financial assistance arrangements would include or even be conditional on improvements in energy security of supply and appropriate security arrangements. A future crisis in energy supply – with a bit less good luck – could easily devastate the financial standing of a number of countries in the South Eastern Europe, wiping away eventual short term gains from financial assistance. Forecasts on the considerable fiscal risks[29] arising from inadequate energy sector structures have been confirmed by this crisis.

Comprehensive short, medium and longer term energy security planning is still lacking. The crisis created momentum for better regional cooperation, but whether this can grow into useful and mutually beneficial action, capable of withstanding similar future events, remains to be seen. One such initiative is the Western Balkans Gas Ring (promoted by the World Bank) and accompanied by the NETS initiative for better coordination between gas transmission system operators (promoted by MOL of Hungary). These initiatives have yet to be coordinated with investment options for power generation, district heating systems and energy efficiency and solutions for vulnerable social groups, to form some kind of regional energy development agenda. They will then need to be implemented.

[28] Publication Monthly Analyses and Trends (MAT) of the Belgrade (Serbia) Economic Institute published at the beginning of March 2009, attempted to separate impacts of gas shortage and financial (ie. liquidity) crisis to industrial output. Apart from already (almost regularly during last few years) experienced contraction in industrial output during cold moths (January), further decrease in output is attributed to financial crisis. Taking into account availability of gas from alternative sources and alternative fuels, these findings further support argument that non-industrial energy demand during cold periods plummets. However, in different circumstances (less favorable weather conditions, lover availability of alternatives, etc) prolonged energy supply crisis could bring national industry to stop. Therefore, devastative potential of external gas supply shock should be taken into consideration in designing financial assistance, ensuring liquidity to energy providers and structuring both energy and financial policies.

[29] See, for example, the World Bank Public Expenditure and Institutional Review for Serbia and Montenegro, the World Bank, 2003