ROME G7 ENERGY INITIATIVE FOR ENERGY SECURITY

IMPLEMENTATION REPORT

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The Energy Ministers of Canada, France, Germany, Italy, Japan, the United Kingdom, the United States, and the EU Commissioner for Energy, following The Hague Declaration of G7 Leaders of March 24th, met in Rome on May 5th and 6th and discussed ways to strengthen collective energy security. The joint statement of the Rome G7 Energy ministerial was sent to G7 Leaders and endorsed during the Summit held in Brussels on June 4-5, 2014.

The Rome Energy Security Initiative, as part of the joint statement, also provided for a number of immediate actions to be taken and the establishment of a working group to develop the Rome Initiative as a whole and to report back to Ministers within six months.

The following report intends to offer to G7 energy Ministers a concise yet comprehensive picture of these actions six months after the G7 Leaders' endorsement of the Rome initiative. The Report is structured as a short and punctual description of activities carried out in response to each of the four action items of the Rome Initiative by each G7 delegation, including the European Commission, and the IEA. This Report is complemented by a series of annexes that the described activities have resulted in.

As the situation in Ukraine is in constant evolution from an energy security perspective, the G7 working group will continue to convene as appropriate and to implement the actions provided for in the Rome Initiative. Updates to the present report will be prepared as deemed necessary and presented to Ministers during the Hamburg G7 Energy Ministers' Meeting in May 2015.

Rome Initiative – Action Item N° 1

"G7 members will work to complement the efforts of the European Commission to develop energy emergency plans for winter 2014-2015 at a regional level."

Canada and the United States

The United States deployed a small team of experts to Ukraine in August 2014 to survey and assess how the USG might offer a response to a potential energy crisis facing Ukraine during the winter of 2014-215. This team found that, not only did Ukraine face potential energy supply shortages over the winter, but that the government of Ukraine (GOU) did not have a documented, executable plan to address this potential energy crisis. The team also assessed that the concerns related to energy situation were much broader than natural gas shortages, but also involved shortages of coal, nuclear fuel vulnerabilities, and the stability of the electric power grid.

On 29 September, a multi-agency, U.S.-Canadian contingency planning support team arrived in Ukraine for a 2-week effort to **assist the Government of Ukraine to develop their own winter energy contingency plan**. The team provided technical expertise to the GOU and assisted them in developing a step-by-step guide to curtailing energy usage and responding to escalating crises that may occur during this winter heating season. This technical assistance culminated in the drafting of an interagency winter contingency plan by the GOU, which was later tested at a tabletop exercise, chaired by the Deputy Prime Minister and including 15 Ukrainian government ministries.

Despite the conclusion of an interim natural gas deal with Russia, Ukraine still faces significant energy uncertainty this winter, including continuing concerns related to coal and nuclear. Canada, the United States and the European Commission conducted a follow-up visit to Kyiv during the week of December 15 to further discuss implementation of the plan.

Annex 1
Support to winter energy contingency planning in Ukraine

Italy (also as EU Presidency, with the European Commission and contribution from France, Germany, the UK and other EU Member States)

As part of the preparations for the October 2014 European Council meeting, the Council was asked in June 2014 to further analyse other medium and long-term measures to enhance EU energy

security, based on the Commission's Communication (of May 28, 2014) on a European Energy Security Strategy ('EESS'). Italy as both host to the G7 Energy Ministerial in May 2014 and the EU Council Presidency launched in July 2014 the preparation of a **Report on short, medium and long-term measures for energy security**, which provided input to the October 2014 European Council Conclusions. The Report is based on extensive input provided by Member States as well as on inputs received during the Rome G7 Ministerial, where a list of possible measures to enhance energy security at the global level were outlined. The European Commission, France, Germany and the UK, along with other EU countries have provided valuable input that contributed to finalizing the Report. While the European Commission has focused on short term analysis that originated the "Stress Test Report"1 for the Winter 2014-2015, the Italian Presidency Report has aimed to further refine the measures highlighted by the European Council in order to render them operational. It proposes a series of short and medium to long-term measures, organised along four main objectives 1) decarbonisation and diversification of sources, 2) development of energy infrastructures, 3) completion of the internal energy market, 4) strengthening the external dimension of the energy policy.

ANNEX 2:
EU Presidency Report on short, medium and long-term measures for energy security

Rome Initiative – Action Item N° 2

"G7 members will conduct assessments of their energy security resilience and enhance their joint efforts, including on critical infrastructure, transit routes, supply chains and transport." [Brussels G7 Leaders' Declaration 3-4 June 2014]

The European Commission, EU Member States, Energy Community Contracting Parties and Georgia, Switzerland and Turkey and non-EU G7 Countries

On 28 May 2014 the European Commission adopted the European Energy Security Strategy Commnication providing a comprehensive plan to strengthen our security of energy supply. Against the background of the situation in Ukraine and the possible related risk of a disruption in gas supplies to the EU, the Strategy encompassed measures to be taken immediately in order to increase the EU's resilience to a major gas disruption in the upcoming winter. As part of those immediate measures, the European Council endorsed on 27 June 2014 the Commission's proposal to launch the so-called **stress test exercise** with the purpose of assessing Europe's resilience to the

[1] see Action Item N° 2 of the present report

possibility of the full halt of Russian gas supplies , or a halt of gas supplies via the Ukrainian transit route fo the period of one and six months in the winter 2014/15. EU Member States, Energy Community Contracting Parties and Georgia, Switzerland and Turkey and non EU G7 Countries all contributed to the exercise, resulting in the most comprehensive energy security analysis conducted in recent years.

ANNEX 3:
EU COMMISSION COMMUNICATION
on the short term resilience of the European gas system

G7

Following the Brussels G7 summit on June 4-5 and the endorsement of the Rome Initiative, continued coordination among the G7 was provided through a several conference calls convened until August by Italy and thereafter by Germany in order to prepare for the stress test exercise with specific regard to non-EU G7 member states and to examine further the general follow up to the Rome Initiative.

Specifically, the status of energy supplies to Ukraine and Eastern Europe were examined and the results of recent meetings in Ukraine and updates on trilateral Ukraine-Russia-EU negotiations were shared. The consistency with European market rules of "destination clauses" in contracts delivering gas in the European single market was clarified during the regular contacts of G7 members. The European Energy Security Strategy and the subsequent "energy stress tests" were discussed with specific regard to the contribution of the non-EU G7 countries. And finally the G7 energy security workshop (October 15-16, Paris) took place.

G7, Hungary, Poland, Slovakia and Ukraine and regional organizations

Continued coordination with G7 partners and invited parties, including Ukraine, Hungary, Poland, Slovakia and other regional organizations have culminated in one joint workshop in Paris in October 15-16 2014.

The first part of the workshop saw participation of official delegations only and underlined the need and timeliness to communicate with Ukraine and with Eastern European countries in order to assess the possibilities to supply Ukraine with gas from Europe through several "reverse-flow" arrangements with various neighboring countries, notwithstanding the "winter gas package" agreed on 30th November between Russia, Ukraine and the European Commission. The second part

of the workshop was open to academia and regional associations. In that context the European Commission also presented the results of the stress test exercise.

United States

The Quadrennial Energy Review (QER) is a multi-year process to develop an integrated, comprehensive energy strategy through interagency dialogue and active engagement of external stakeholders. The initial phase of the QER will focus on energy infrastructure and analyze the impacts of transformations in energy supply, markets, and patterns of end use; issues of aging and capacity; impacts of climate change; cyber and physical threats; and vulnerabilities related to growing interdependencies of energy systems and water, telecommunications, transportation, and emergency response systems. The QER will provide a multiyear roadmap that outlines Federal energy policy objectives, legislative proposals to Congress, Executive actions, an agenda for RD&D programs and funding, and financing and incentive programs.

This initial phase of the QER will be completed by January 31, 2014.

Rome Initiative – Action Item N° 3

"We ask the International Energy Agency, in close relation with the European Commission, to present within six months options for individual and collective actions of the G7 in the field of gas security."

IEA

The 2014 May G7 summit requested the IEA to formulate recommendations to enhance gas supply security. The analysis has drawn upon the IEA's energy security mandate and it was developed in cooperation with the European Commission. They are consistent with the IEA recommendations made during the In Depth Review of EU Energy Policy in 2014. Natural gas has a growing role in the global energy system and is crucial for maintaining both electricity security as well as residential winter heating in temperate climates. Resources are sufficient for decades, but infrastructure constrains lead to more rigid and less connected markets than oil. Given the significant regional discrepancies, the recommendations the IEA formulated should be seen as menu of policy options of which some might not be justified in some countries given the local geographical and policy context. Due to the regional rather than global nature of supply security exposures a coordinated strategic stockpile policy modelled on oil is not justified. The increasing

use of gas as a balancing fuel for renewables and the depletion of conventional reservoirs create additional infrastructure need. The first set of recommendations aims to enhance flexibility and market functioning: An adequate pipeline infrastructure with reverse flow capability and market based capacity allocation has a key contribution to supply security. Regulatory measures should encourage demand side response and storage utilisation.

While the analysis was not narrowed exclusively on Russian gas dependency, it is relevant that under IEA baseline projections Europe's gas imports from Russia will increase further. The growth of renewables is significant but fails to compensate for the simultaneous decline of coal, nuclear and domestic gas upstream. The second set of recommendations aim at more effective diversification. LNG as the only intercontinental gas transportation option plays a crucial role. Policy efforts to create a more transparent and liquid LNG market should be continued and completed. LNG importing regions should ensure adequate internal infrastructure from the terminals to demand centres. For pipeline gas, the Middle East and the Caspian could potentially play an important role, but it depends on a deeper energy diplomacy engagement and investment facilitation, especially in Iraq and Turkmenistan. There are mutual benefits in enhancing energy efficiency and deploying renewables in key gas exporters.

Given the strong interactions of gas across the energy system the third set of recommendations moves beyond gas supply and aims to address gas supply security concerns by promoting an efficient energy system with diversified primary energy use. The most important is the transformation of the building sector which is the largest and most rigid gas demand source in both Europe and North America by accelerated energy efficiency retrofits as well as renewable heating. In countries that chose to use this option nuclear power could play a major role in reducing gas import dependency, but policies need to be designed that facilitate investment. Wind and solar deployment could constrain power generation gas demand to the balancing minimum (around half of the current in Europe) for which a flexibility oriented redesign of the power system and better transmission links are essential.

The IEA does not advocate and would not support policies that enhance gas supply security at the price of jeopardising climate change targets. In fact given the strong contribution of energy efficiency and low carbon energy sources in reducing gas dependency the IEA gas supply security recommendations overall have a significant negative impact on CO2 emissions compared to the baseline, although insufficient for a 450ppm stabilisation that requires additional policy action.

Rome Initiative – Action Item N° 4

"Working with institutions such as the IEA, the International Renewable Energy Agency and international financial institutions, we will supply technical assistance, including leveraging the private sector, and facilitate exchanges with Ukraine and other European countries seeking to develop their indigenous hydrocarbon resources and renewable energies, and improve energy efficiency."

Canada

In cooperation with Ukrainian authorities, a geological reconnaissance mission was organized by Canadian and US Geological Surveys to assess and assist in developing Ukraine's oil and gas potential. The first five-day joint mission to Kyiv was completed on 15 September, 2014. It assessed Ukraine's capacity for collection, management, access, and distribution of geological data for its petroleum resources, including unconventional oil and gas. Information was provided to the Ukrainian Government, e.g. key legislative changes, ways to improve geological data quality and collection, geological software. Next steps include a study tour of Ukrainian geologists to Canada and the US in Spring 2015 as well as a second assessment visit to Ukraine in late March or April 2015 by officials from the Canadian Geological Surveys.

ANNEX 4:
Report on the Canada-U.S. joint assessment mission to Ukraine
in the field of geological and geoscience capacity

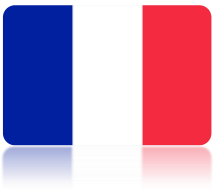
The Alberta Energy Regulator (AER) took part in a Canada/UK/Shell Conventional Energy Resource Regulatory workshop in Kyiv on 4 December 2014. Prior to the workshop, AER officials undertook a 3-day scoping mission to gain a better understanding of the Ukrainian regulatory framework and areas which could be adapted to improve its competitiveness, clarity and transparency. As a follow up to this workshop, Canada and the United States are planning a joint mission to Ukraine in 2015 to share expertise and knowledge on policy for unconventional energy resource development, e.g. identify necessary regulatory modernization, identify key barriers to oil and gas industry investment.

The United States and Canada, in coordination with Ukrainian authorities, are developing Unconventional Gas Workshops to assist the Government of Ukraine in the development of its regulatory, fiscal and environmental framework in support of sustainable unconventional natural gas development. A government-to-government only workshop with the Ukrainians tentatively scheduled for March 2015 intends to share the North American experience with establishing regulations and putting into place strong environmental protection best practices in support of sustainable unconventional natural gas development in Ukraine.

ANNEX 5:
Report on Canada's initiatives to support Ukraine's Reform of its regulatory framework to stimulate development of its domestic oil and gas resources

At the invitation of the Federation of Canadian Municipalities (FCM), the Department of Natural Resources Canada (NRCan) participated in a mayors' forum in Odessa in mid-September 2014. At the request of their Ukrainian counterparts, FCM created an agenda item at the forum on energy efficiency as a means to improve energy security, economic development and environmental performance. NRCan's objective was to use interaction with Ukraine's mayors, federal, regional and aid group officials to gather facts on how Canada might assist Ukraine to improve responsible energy use through energy efficiency in the short and longer term. Ukraine has many fundamental issues which need to be resolved before energy efficiency can provide benefit on a large scale (e.g. ownership of residential buildings is split between many parties; laws make natural gas replacement difficult). However, there are a number of ways NRCan could support Ukraine, including twinning Canadian and Ukrainian cities to encourage exchange of energy efficiency best practices, two-way actual or virtual trade missions on efficient technologies and providing low cost-no cost energy saving packages for dissemination to municipal energy managers.

ANNEX 6:
Report on the Canada's assessment mission to Ukraine in the field of efficiency measures and follow up



France

France has been providing bilateral technical assistance in the field of energy efficiency (capacity building, district heating) for several years. A project for district heating in Kiev is still ongoing with Kiev Energo. France gives priority to coordinated action at European level. She has actively

contributed with Germany to an EU twinning project of capacity building in energy efficiency policies, which was completed in late 2013.

France contributes to programs conducted by IFIs. In particular France has recently contributed EUR 1M€ to the creation by EBRD of a dedicated technical assistance fund, to support the Ukrainian authorities reform efforts.

Germany

The cooperation in the energy sector is one of the 3 strategic pillars of the German bilateral cooperation with Ukraine. Together with the Ukrainian authorities it has been decided to focus thereby on the field of energy efficiency, renewable energies as well as on the revitalization of damaged infrastructure related to energy production and transport in the Eastern part of the country. The cooperation combines technical and advisory assistance with financial support for investments, pilot projects and revitalization of energy related measures. Currently implemented projects focus in particular on capacity building to scale up energy efficiency and the use of renewable energies.

The German government supports the reconstruction in the Eastern part of Ukraine with an untied loan scheme of additional EUR 500 M€. The amount of EUR 300 M€ thereof will be used for infrastructure projects and – to a large extent – in particular for the rehabilitation of energy related infrastructure that has been damaged or destroyed in the course of the conflict in the Eastern part of Ukraine.

Lately, the German government together with the Ukrainian Government and supported by EBRD has elaborated a concept for an investment program for "turning subsidies into investments", which shall contribute to scaling up energy efficiency in the municipal heat supply, reducing gas consumption and related subsidies.

ANNEX 7:
Germany: Report on Activity: technical support to Ukraine

Italy

In cooperation with Ukrainian authorities, as agreed between Vice Minister De Vincenti and Minister Prodan during the Energy Community Ministerial in September 2014 in Kiev, the Italian Ministry of Economic Development, together with a team of experts, visited Kiev between 29th September and the 2nd October 2014. The assessment mission was designed to **gather qualified information about the needs for energy efficiency**, specifically in the public and residential sectors and, leveraging the private sector, in order to assess the possibility for market based operations consistently with the ESCO (energy services company) model. The structural deficit in the national energy balance and the complex geopolitical situation has stimulated interest in Ukrainian authorities in developing renewable energy systems, possibly through the introduction of support schemes. Strong interest of the Ukrainian counterparts in technical assistance on efficiency measures have prompted **a technical mission from Ukraine to Italy in early 2015**. Technical assistance was requested mostly in energy efficiency obligation schemes (so called White Certificates), renewable energy heating and cooling supporting schemes, establishment of an energy services industry, management of incentives and tax relief, monitoring of installations and production of electricity from renewable energy sources.

ANNEX 8:
Italy: Report on assessment mission to Ukraine
in the field of efficiency measures and follow up

Japan

Based on the Joint Statement between Mr. Toshimitsu Motegi, Minister of Economy, Trade and Industry and Mr. Yuriy Prodan, Minister of Energy and Coal Industry signed in A *Action Item N°4* has been working along with Ukraine on the following two cooperation projects.

Energy Master Plan Project - Japanese Ministry of Economy, Trade and Industry (METI) and the expert team from the Institute of Energy Economics Japan (IEEJ) will work together with the Ukrainian Ministry of Energy and Coal Industry to develop a long-term Energy Master Plan towards 2030 reflecting Ukrainian requests that intend to revise their energy strategy towards 2030. Japan and Ukraine held a kick-off meeting in December 2014 in Kiev. The development of the Energy Master Plan will be completed by mid-2015.

Clean Coal Technology Project - A team of Japanese expert engineers on the coal fired power plant visited Ukraine in July, October and November 2014. They have given diagnoses to Tripulskaya Power Plant of Centralenergo and Burstin Power Plant of DTEC. The team will finalise a report on the diagnoses by first half of 2015 with concrete technical proposals to upgrade those plants. Japan will also provide a financial support to retrofitting those plants based on the diagnosis outcome.

Both projects involve hosting workshops and inviting Ukrainian experts to Japan for mainly capacity building purpose, in order to transfer not only the technology but also the knowledge.

United Kingdom

UK Government officials visited Ukraine in September at the invitation of the Ukrainian Government to explore potential areas of support on energy. UK assistance to date includes: (1) **Public sector reform**: the UK's Department for International Development (DFID) is taking forward a programme focused on technical assistance to support the policy reforms needed to stabilise the economy and improve accountability and transparency, including measures relevant to the reform of the Ukrainian energy sector. (2) **Energy efficiency**: within the above DFID programme, the UK is contributing £500K to the European Bank for Reconstruction and Development's multi-donor account in Ukraine, which includes work on energy efficiency. It is also contributing £175k towards a two year IEA project "Tapping Energy Efficiency Potential in Ukraine", which will aim to build the capacity and increase the expertise of Ukraine's government to develop effective energy efficiency

governance, policies and programmes, with the focus on improving energy security. (3) **Indigenous hydrocarbon resources**: the British Embassy in Kyiv is working with the UK Department of Energy and Climate Change to provide technical cooperation in the energy sector, including on regulation for unconventional gas exploration. (4) **Renewa** *Action Item N°4* contributions to the Clean Technology Fund (CTF) will assist the Ukraine Government in reaching its goal of increasing the deployment of renewables from 400MW to 1.6GW by 2020. The Ukraine Government will access US$350m from the CTF to finance greater investment in new renewable energy capacity, waste heat generation, transmission and grid upgrades, and energy efficiency. (5) **Technical expertise**: the UK has identified technical experts who are available to participate in the European Commission's provision of technical experts from EU Member States to support the Ukraine Government in developing transparent and effective emergency planning and monitoring gas flows.

The UK is also developing a possible further project to provide financial assistance to the Energy Community Secretariat, which is assisting Ukraine to implement the Energy Community Treaty acquis and ensure that the Ukrainian legal framework and in particular its electricity laws are compliant with the **Third Energy Package**.

United States

The U.S. Department of State (DOS) is providing an expert advisor team that began work in October 2014 on establishing best practices on laws, regulations (e.g., environmental protection) and public communication strategies, with the ultimate goal of developing a strategy for sustainable unconventional gas development. DOS also is supporting separate visits by a legal team and will contract an expert independent engineering team to assess gas field surface processing facilities and to make recommendations on ways that near-term production increases could be achieved through infrastructure debottlenecking, upgrades and operational improvements.

The U.S. Agency for International Development (USAID) is providing technical assistance to Ukraine in a variety of areas, including upstream natural gas regulation, renewable energy investment; energy efficiency regulation and investment; contingency planning support to Ukrenergo and electricity sector reform; and public messaging. USAID is also providing support to humanitarian relief efforts, including cash, vouchers, and in-kind assistance for winter relief items. The U.S.

Department of Commerce (DOC) will conduct training for energy efficiency auditors and establish an industry-led energy working group in early 2015.

The United States also continues to provide support and technical assistance to contingency planning (see Action Item 1). *Action Item N°4*

European Commission

Since the summer, the European Commission has established a Support Group for Ukraine which includes energy sector expertise designed to identify the energy sector reform priorities and the support necessary to advance the reforms to ensure that immediate benefits can be obtained from the Association Agreement with the EU. In addition the European Commission brokered, on 30 October 2014, a "winter package" agreement between Ukraine and Russia targeted at ensuring the security of the transit of gas to the EU and the security of gas supplies to Ukraine for the winter period. Under this agreement, Ukraine would settle its debts to Gazprom based on a preliminary price of USD 268.5/thousand cubic metres by making payments in two tranches: USD 1.45 billion in early November and USD 1.65 billion by the end of the year 2014, and also permit Ukraine to order as much gas as it needs, on a prepayment basis, and not subject to take-or-pay obligations foreseen in the current contract during the winter period. Ukraine paid the two tranches during 2014 and order gas in both December 2014 (US 378 million) and January 2015 (USD 150 million) under prepayment conditions in line with the "winter package".

The European Commission has also facilitated the physical flow of gas to Ukraine from its EU neighbours. In December 2014 this amounted to some 35 million cubic meters per day, with the prospect that, with a technical upgrade on the Slovakian interconnector point, this could be increased by a further 8.5 million cubic metres per day.

Moreover, the European Commission continues to support the reforms of the energy sector in line with the commitments undertaken by Ukraine within the framework of the Energy Community Treaty. This support is rendered via development assistance projects (including budget support programmes, Twinning projects, Technical Assistance, as well as regional projects in the field of energy). The Commission has also continued to facilitate the initiative to modernise the Ukrainian gas transmission system and this resulted, on 1st December 2014, in the signature of a first loan agreement between the EIB and Ukraine for this purpose. This was complemented the signature on

15th December 2014 of the first loan agreement between the EBRD and Ukraine and the launch of the European Commission-World Bank Trust Fund project on the reform of Naftogas.

Action Item N°4

IEA

The IEA has been actively engaged to support Ukraine's energy policy reforms. A milestone was the publication of the Ukraine 2012 Energy policy review, which called for an energy revolution in Ukraine aiming at reducing energy import dependency by intensifying domestic production and maximising energy efficiency gains potential. IEA cooperation with the government of Ukraine is framed by three agreements: a Memorandum with the Cabinet of Ministers of Ukraine (2007), a Memorandum of Understanding with the State Statistics Service of Ukraine (2010);; and a recurring Biennial Join Action Plan, signed by the IEA Executive Director and Minister of Energy and Coal Industry of Ukraine in 2012, which is automatically renewed unless terminated by one of the parties. In 2014, the IEA Secretariat conducted a 2014 energy policy review under the INOGATE Programme (report to be released in early Q2 2015 as part of a compendium publication on energy policy reviews of countries in Eastern Europe, Caucasus and Central Asia), and handed over a detailed set of energy policy recommendations to the Ministry of Energy on how to address short and medium term energy policy challenges. The Agency organised a policy dialogue event on Energy Efficiency Policy and Technologies in Kiev (5 November 2014), where amongst other presentations, detailed presentation on saving electricity in a hurry was delivered, based on best examples of electricity shortage emergency responses worldwide. IEA has also provided training to a group of ministry and regulator officials as part of an overall MBA course covering general renewable market and policy options as well as more details on renewable energy statistics and calculation methods. IEA's work with the State Statistics Service of Ukraine on energy statistics submissions and training is regular, in particular on capacity building and assistance to produce energy balance according to international standards in order to establish a sound basis for energy policy. Key IEA further work includes activity on Energy Efficiency improvements of Ukraine under the project: "The Hidden Fuel – Tapping Energy Efficiency Potential in Ukraine", based on a voluntary contribution provided by the United Kingdom, as well as support and training in the area of energy efficiency indicators under the voluntary contribution provided by Poland.

Rome Initiative – Action Item N° 1

"G7 members will work to complement the efforts of the European Commission to develop energy emergency plans for winter 2014-2015 at a regional level."

Canada and the United States - Activity: Mission to support the Government of Ukraine develop a comprehensive Ukraine E*nergy Contingency Plan (U-ECP) for winter 2014-2015*

The joint Canada-U.S. delegation tasked with assisting the Government of Ukraine (GOU) in developing the U-ECP was comprised of representatives from the U.S. Department of Energy (DOE), the U.S. Federal Emergency Management Agency (FEMA), U.S. National Labs (Pacific Northwest and Argonne), Natural Resources Canada (NRCan), and Canadian consultant who was formerly an executive of a Canadian natural gas distribution company recommended by the Canadian Gas Association (CGA).

Following an initial set of questions and requests for information by the sub-groups in the Canada-US team, the Ukrainian side assigned appropriate officials to write and assemble the plan. The U-ECP consisted of four main areas: Electricity, Natural Gas, District Heating and Humanitarian Assistance. Plan writing was coordinated by the State Emergency Service of Ukraine (SESU). SESU was assisted by U.S. FEMA subject matter experts, who organized individual tasks in the plan using their planning phase methodology.

Concurrent with the U-ECP plan writing, the Canada-U.S. team developed four scenarios for a tabletop exercise: natural gas, electricity, district heating and emergency response. These scenarios were designed to test the preparedness of various GOU ministries, agencies and national companies to implement the U-ECP in the event of an energy crisis and assess the ability of agencies to work collaboratively to respond to challenges. The four scenarios were prepared for a tabletop exercise which involved all the relevant Government of Ukraine ministries, agencies and national companies.

The Exercise was led by former Deputy Prime Minister Groysman with DOE Deputy Assistant Secretary William l. Bryan, acting as Deputy. GOU ministries, agencies and national companies were represented by their Vice Ministers or Deputies. The Ambassadors to Ukraine from Canada (Mr. Roman Waschuk), the U.S. (Mr. Geoffrey Pyatt) and the European Union (EU) (Mr. Jan Tombiński) also attended.

The Gas scenario discussions focused on the need to enforce the GOU Resolution #296, which was designed to curtail natural gas in the face of potential shortages due to the cut-off of Russian deliveries in June 2014.. The Electricity exercise discussed the critical importance of grid stability to protect Ukraine's nuclear power plants. Participants noted that some coal-fired thermal power plants were experiencing fuel (anthracite) shortages. The participants also discussed fuel switching possibilities, increasing access to anthracite stockpiles in eastern Ukraine, securing supplies from Russia and Kazakhstan, as well as continuing seaborne imports of anthracite from South Africa.

Since the tabletop exercise, the GOU concluded an interim agreement with Russia on delivery of supplies of natural gas through March 2015. This agreement would ensure access to supplies through the heating season. The U-ECP underscored other vulnerabilities with respect to the stability of the country's electric grid and nuclear power plants, and so remains a valuable tool for the GOU.

Council of the European Union

Brussels, 8 October 2014

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NOTE

from:	General Secretariat of the Council
to:	Delegations
Subject:	Follow-up to the European Council of 26-27 June 2014 - Energy security

Delegations will find in Annex a report produced under the Presidency's responsibility, for which the Presidency received a broad support, resulting from the latest consultations with delegations.

ANNEX

Report on short, medium and long-term measures for energy security

The 26-27 June 2014 European Council[1] agreed on the strategic agenda of key priorities for the next five years. The pursuit of an Energy Union with a forward looking climate policy is among these priorities.

The European Council (EC) also held two strategic debates on energy and climate policy, at its March and June 2014 meetings.

The 20-21 March 2014 European Council[2] called on the Commission to conduct an in-depth study of EU energy security and to present by June 2014 a comprehensive plan for the reduction of EU energy dependence. Following the call by the March European Council, on 28 May the Commission presented a Communication on a European Energy Security Strategy ('EESS')[3] which the June EC welcomed and on which it held a first discussion.

1 See doc. EUCO 79/14.
2 See doc. EUCO 7/1/14 REV 1.
3 See doc. 10409/14.

The 26-27 June 2014 European Council supported the immediate implementation of a set of most urgent measures to strengthen Europe's resilience and increase its energy security in the short term, before the winter of 2014/2015. The Commission is currently carrying out the assessments of short-term supply disruption risks together with Member States, regulators, Transmission Systems Operators and operators, as well as with the Energy Community and other partner countries, in order to improve the Union's preparedness[1].

As part of the preparations for the October European Council meeting, the Council was asked to further analyse other medium to long-term measures to enhance the EU's energy security, based on the EESS.

The European Council also reaffirmed that the EESS is closely linked to the 2030 policy framework on climate and energy[2]. This reflects the fact that the transition to a competitive, low-carbon economy together with the achievement of a well-functioning and interconnected internal energy market and the strengthening of the external dimension of EU energy policy will reduce the dependence of the EU on imported fossil fuels by moderating energy demand, and by increasing the energy supply from safe and sustainable low-carbon technologies, especially renewables and other indigenous resources.

The European Council concluded that interconnectivity must be increased through appropriate measures, including with regard to the Iberian peninsula and the Mediterranean area; progress must be made in order to accelerate further diversification of energy supply. It also underlined the importance of fostering missing infrastructure, to put an end to any isolation of Member States from European gas and electricity networks by 2015. The European Commission proposed in its EESS Communication to extend the current 10% interconnection target to 15% by 2030 while taking into account the cost aspects and the potential of commercial exchanges in the relevant regions; the EESS Communication furthermore stressed the dependence of some Member States on a single gas supplier and identified short and medium-term key projects for security of supply; the EU should help those most vulnerable countries to diversify their sources and supply routes, as a matter of priority.

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1 *To be adapted in light of the outcome of the risk assessment.*

2 "The European Council will take a final decision on the new climate and energy policy framework, including on further measures aimed at enhancing Europe's energy security and on specific 2030 interconnection objectives, no later than October 2014."

Useful discussions, supported by valuable contributions, already took place in the first semester on possible lines of actions on Energy security and enabled a broad convergence of views on the measures highlighted by the EC. Furthermore, reflecting the fact that energy security has been one of the aims of the EU energy policy for many years, the Council Reports of December 2013 on the completion of the Internal Energy Market[1] and on the external dimension of the EU energy policy[2], both drawn up as follow-up to the May 2013 EC, contain many elements that are of high importance to energy security, including priorities for further efforts. Lastly, it should be noted that the G7 Energy Ministerial meeting on 6 May 2014 in Rome evaluated a list of possible measures to enhance energy security at global level.

This report aims to answer the call from the European Council, by providing input to the October 2014 European Council Conclusions. The report is based on extensive input provided by the Commission and Member States. It aims to further refine the measures highlighted by the European Council in order to render them operational and, to that effect, proposes a series of short and medium to long-term measures. The listing of measures does not necessarily reflect any priority ordering and may be subject to further in-depth analysis by the Council in the upcoming months.

It should be borne in mind that:

- several actions are already under way, including the short-term risk assessments referred to above, the preparatory process for the next Ministerial Council of the Energy Community, as well as implementation of existing legislation, such as the preparation of the second list of Projects of Common Interest ('PCIs');
- a well-functioning and fully integrated energy market is a prerequisite for the implementation of many measures aimed at the strengthening the EU energy security; therefore, the timely construction of key interconnections, the full, effective and consistent implementation of the Third Internal Energy Market Package, as well as of legal, economic and technical measures for effective functioning of regional gas and electricity markets are of the highest urgency;

[1] See doc. 17755/13.
[2] See doc. 17756/13.

- whilst market-based measures should be the primary mechanism for coping with emergency situations, there may be cases where markets fail to deliver proper solutions; in these circumstances, non-market interventions may be needed on a temporary basis to address severe crisis in the short term, as provided in Regulation (EU) No 994/2010. At the same time, continuous efforts should be made to address identified market failures;
- some measures need to be carried out also in the context of the external dimension of the EU energy policy, (e.g. diversification of routes, sources or supplies); indeed, the EU, while continuing to be a reliable trade partner, can take advantage of a coherent and effective external energy policy in order to decrease its own vulnerabilities in case of crises and ensure the availability of alternatives to the existing supplies when emergency situations occur;
- the proposed measures respect Member States' rights as regards national energy choices, and are underpinned by the principle of solidarity, as outlined in Article 194 TFEU;
- the choice of measures actually pursued by Member States will have to take due account of national circumstances and energy mixes, and of the economic impact of each measure; therefore, not all measures will be suitable for all Member States;
- without prejudice to European Commission's right of initiative, the measures listed below should be implemented, as far as possible, within the existing legislative framework.

SHORT-TERM MEASURES (IN ADDITION TO THE RISK ASSESSMENTS):

In the short term, the EU has the following overriding priority: to ensure that the best possible preparation and planning improves resilience to sudden disruptions in energy supplies, in particular during the coming winter, and that the most vulnerable Member States are collectively supported, if necessary.

Therefore the following short term measures are important:

1. Reach the 3 December 2014 deadline, as required by Regulation (EU) No 994/2010 on the security of gas supply, by which Member States must be able to meet peak demand even in the event of a disruption of the single largest infrastructure asset. In addition, reverse flows must function on all cross border interconnections between Member States, except those for which an exemption is provided in the same Regulation.

2. Continue the work of the Gas Coordination Group, which has proven to be an effective EU-wide platform to exchange information and coordinate action, also taking into account the conclusions drawn by the Commission in its report to the Council and the European Parliament on the implementation of the Regulation on security of gas supply and on the overall consistency of Member States emergency measures[1]. In particular, considering the speed at which decisions need to be taken and implemented in case of emergency, the development of regional emergency plans[2], as well as preventive action plans, as foreseen under Regulation (EU) No 994/2010, should be further supported and encouraged, in order to ease the coordination of Member States' action in case of emergency situation or disruption, including with Energy Community contracting parties. In particular, regional cooperation requires a better sharing of relevant information among Member States, such as, *inter alia,* the level of peak gas demand and supply.

3. Monitor and improve arrangements for a better use of regasification and storage capacities in the gas system if, in emergency situations, the normal functioning of the market has not led to the optimal use of those facilities, meanwhile avoiding unnecessary market distortions; in this context promote, also through coordinated emergency regimes, more detailed information with regard to the level of gas injection in the gas storages in EU Member States and in the Energy Community contracting parties.

4. Swiftly implement 'TEN-E' Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure, which will play an important role in relation to *inter alia* the 2015 target of ending the energy isolation of individual Member States, including implementing the projects of common interest complying with the criteria set out under Art. 4 of the same Regulation.

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1 *Note for the delegations: in accordance with Art. 14 of Reg. 994/2010, this report shall be provided by the Commission by December 2014.*

2 For instance, CZ-HU-PL-SK regional emergency plan, as well as EE-LT-LV regional emergency plan under preparation, inter alia.

5. Harmonise the main rules for electricity and gas exchange and transmission grid operation, through the urgent and thorough development and implementation of electricity and gas network codes, also to improve the operation of a network with enhanced interconnection. The urgency of this task requires the utmost efforts from all parties involved.

6. Support the Commission in its obligation to review the implementation of Regulation (EU) No 994/2010 with the aim further to enhance the security of supply, also with regard to preparedness and solidarity in the EU with a special focus on EU and/or regional coordination in preventive action and in emergency situations.

MEDIUM-TERM AND LONG-TERM MEASURES

The suggested actions that can enhance EU energy security in the medium and long term are listed under the four goals below[1]:

A. Making progress towards decarbonization of the energy sector and diversification of sources of supply

1. Facilitate cost effective energy efficiency interventions through a full implementation of measures provided in the energy efficiency directive, taking due account of the assessment provided in the July 2014 Commission Communication "Energy efficiency and its contribution to energy security and the 2030 Framework for climate and energy policy"[2]. In this context, it is worthwhile to analyze in each Member State strategies to exploit the potential of reducing consumption of imported fossil fuels, notably in the building sector, where appropriate through increased use of renewable energy sources and modernization of heating and cooling.

[1] Some actions may be relevant to more than one goal.
[2] See doc. 12212/14.

2. Promote the development of all domestic resources in a sustainable manner and make the best use of safe and sustainable low carbon technologies in full respect of national policy decisions and duly taking into account medium and long term climate and energy objectives[1].

3. Strengthen the electricity grids, taking into account the growing share of Renewable Energy Sources (RES), to enhance network security and generation adequacy and consequently reduce the use of imported fossil fuels for power generation. This can be achieved notably through the increase of transmission, distribution and storage capacity, whilst encouraging demand-side management and regional network balancing with special attention to loop-flows. In this regard, the decision on specific 2030 interconnection objectives[2] should be based on a thorough assessment of costs and benefits, as well as of relevant national specificities, including notably geographical factors, the generation mix, the level of national peak demand and the potential of commercial exchanges in the relevant regions, when evaluating the optimal level of interconnection capacities between Member States.

4. Reduce the EU's oil dependency, including notably in the transport sector, and achieve the 10% target for renewable energy in the transport sector by 2020 by application of both sustainable and cost-effective measures while making efforts to preserve the competitiveness of EU refinery industry**.** To that effect, a rapid and adequate transposition in national legislations and policies of the 'Clean Power for Transport' Directive on the deployment of alternative fuels infrastructure is essential[3]. In this regard, continued efforts will be needed post 2020 to increase efficiency and extend use of alternative fuels in the transport sector.

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1 This report does not prejudge in any way the final decision on 2030 climate and energy policy framework which will be taken by the European Council, as provided in paragraph 23 of doc. EUCO 79/14 of June EC conclusions

2 This report does not prejudge in any way the final decision on specific interconnections objectives, which will be taken by the European Council, as provided in paragraph 23 of doc. EUCO 79/14 of June EC conclusions.

3 See doc. *XXX*/14, (*to be published in the OJ during the autumn 2014).*

5. Prioritise energy security and the transition to a safe and sustainable low carbon economy in the implementation of the EU financial instruments in the period 2014-2020, in particular using the European Regional Development Fund, the Cohesion Fund, the Connecting Europe Facility, Horizon 2020 and the European Neighborhood Policy Instrument.

6. Ensure investments in energy research and innovation from the EU and Member States, in order to ensure further development of energy technologies[1] aimed at meeting medium and long-term needs for the transition to a low carbon economy. Energy security should be mainstreamed in the implementation of the Horizon 2020 and it should be ensured that the Integrated Roadmap of the Strategic Energy Technology Plan[2] is in line with the European Energy Security Strategy and the long-term climate and energy targets.

B. Speeding up the construction of gas infrastructures, in order to achieve a better diversification of external gas supplies and build a fully integrated internal market, whilst maintaining significant import volumes from reliable customers

1. Support a better coordination among EU transmission system operators for the realization of gas transportation corridors, as identified in the TEN-E Regulation; in this context, it must be ensured, within the existing legislative framework and in close cooperation with all actors involved taking into account the technical and economic feasibility and market conditions, the fastest possible implementation of the most urgent infrastructure projects, especially those set out in Annex 2 of the EESS.

2. Overcome identified bottlenecks and lack of interconnections to avoid that gas networks are supplied by only one entry point, and ensure that Transmission System Operators provide reverse flow capacities in all new cross border interconnections, except those for which an exemption is provided in Reg. (EU) No 994/2010.

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1 Such as Clean Coal Technologies including Carbon Capture and Storage.

2 AT recalls its statement to the minutes of the Council on 28 February 2008 regarding the Strategic Energy Technology Plan (See Annex of doc. 7033/08).

3. Promote the diversification of supplies, sources and routes, through the availability of strategic infrastructures, such as storage, import and transport facilities, as well as LNG plants, that can facilitate enhanced supply when emergency situations occur. Under normal market conditions, these infrastructures may not be fully economically and commercially feasible; therefore they may be supported by means of specific regulatory arrangements and/or public funding as provided by the 'trans-European energy infrastructure' Regulation (EU) No. 347/2013 and the 'Connecting Europe Facility' Regulation (EU) No. 1316/2013.

4. Improve and, where appropriate, build LNG infrastructures and related port facilities, as well as storage capacities and interconnections within the Union, so that LNG, also from outside the EU (e.g. from Northern America, Australia and Qatar), can reach EU regional markets and contribute to ending energy isolation in concerned Member States.

C. Ensuring the full integration and well-functioning of energy markets and competitive and affordable prices for EU energy customers

1. Promote energy exchanges at regional level ('regional approach')[1], such as market coupling for electricity market and gas exchange, that would allow the energy to flow where it is more needed and facilitate the integration of additional capacity; to this end, price monitoring in the EU energy markets, especially the gas market, via the Regulation on Energy Market Integrity and Transparency (REMIT), is a useful tool for ensuring that energy flows according to price signals.

2. Explore the possibility for coordinated procedures and simplified regimes for the allocation of virtual reverse flow capacity for its usage in non-neighboring Member States, taking into account existing and contractual capacities at the interconnection points among Member States. In this regard, a swift adoption and further development of network codes on the allocation of capacity in gas pipelines could be relevant.

[1] For instance, BE-DE-FR-LU-NL Pentalateral cooperation and CZ-HU-RO-SK market coupling.

3. Ensure the full application of the EU internal energy market and competition rules for all infrastructures and promote flexible gas markets, notably ensuring the removal of clauses contrary to the EU law, such as destination clauses, especially with regard to gas imports through LNG.

4. Promote in the supply contracts the adoption of gas pricing formulas linked to hub prices in the destination markets, instead of oil indexation.

5. Seek to improve the bargaining power of EU buyers vis-à-vis external suppliers and transparency on the gas market; in this context, the Commission is encouraged to assess options for voluntary demand aggregation and cooperation among buyers, in full compliance with EU trade and competition legislation.

6. Continue to ensure the compliance with EU's internal market and competition rules of new energy infrastructure investments, including those involving third countries, also through a high degree of transparency in the intergovernmental agreements.

7. Make use of RES in a way that is more market-based. To this aim, their increased deployment, including interconnection reinforcements, should also take into consideration issues of market integration, cost-efficiency and grid stability. National support schemes should be in compliance with the new Guidelines on State Aid for environmental protection and energy 2014-2020 with the view to promote a more cost-effective achievement of the 2020 national renewable energy targets.

D. Strengthening the external dimension of EU energy policy and the link between energy security and foreign policy

1. Reinforce the coordination and synergies between energy and foreign policy activities and objectives, and ensure, especially in crisis situations, the coherence between energy-related actions and the wider EU response.

2. Support the opening of the Southern Corridor as a route for the diversification of supply for Europe and the Balkan region, also connecting it to the Interconnections Greece-Bulgaria, Turkey-Bulgaria, Bulgaria-Romania, Romania-Hungary and Ionian–Adriatic pipeline, and ensure the possibility for sources from other potential suppliers (e.g. Iraq, Mediterranean Sea and Turkmenistan) to have access to this route toward the EU.

3. Encourage actively the upstream[1] developments in new regions, in particular in the Mediterranean Sea (Cyprus, Israel and other countries in the area), in the Black Sea (Bulgaria, Romania and other countries in the area), in the North Sea and in North Africa, with the aim to export these resources to EU markets.

4. Promote EU attraction to competitive LNG flows by enhancing relationships with gas producing countries, including emerging new suppliers, thus contributing to increase flexibility and liquidity in the gas market.

5. Further strengthen the cooperation with EU's neighboring countries on building an integrated energy market in order to enhance Europe's collective energy security, notably by enhancing the Energy Community.

6. Strive for full transparency in the transit conditions of gas in the networks outside the EU by undertaking coordinated actions in this regard.

The Council will review the above list of medium and long-term measures, no later than [*end 2015*].

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[1] In this context, the Commission plans to assess and map where appropriate Europe's resources of unconventional gas and oil, in cooperation with national geological surveys and in full respect of national policy decisions.

EUROPEAN
COMMISSION

Brussels, 16.10.2014
COM(2014) 654 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

on the short term resilience of the European gas system

Preparedness for a possible disruption of supplies from the East during the fall and winter of 2014/2015

{SWD(2014) 322 final}
{SWD(2014) 323 final}
{SWD(2014) 324 final}
{SWD(2014) 325 final}
{SWD(2014) 326 final}

1. INTRODUCTION

On 28 May 2014 the Commission adopted its European Energy Security Strategy providing a comprehensive plan to strengthen our security of energy supply.[1] Against the background of the situation in Ukraine and the possible related risk of a disruption in gas supplies to the EU, the Strategy encompassed measures to be taken immediately in order to increase the EU's resilience to a major gas disruption in the upcoming winter. As part of those immediate measures, the European Council endorsed on 27 June 2014 the Commission's proposal to launch a so-called stress test exercise with the purpose of assessing the resilience of the European gas system to cope with a severe disruption of gas supply to the EU this winter.[2]

At the beginning of July the Commission requested Member States, Energy Community Contracting Parties and Georgia[3], as well as Switzerland and Turkey to model the impact of various possible disruption scenarios on gas deliveries in their countries this winter and to describe measures in place to address supply shortages. The Commission also requested Norway to inform of its ability to respond to such a disruption by increasing its gas supply. The Commission proposed three "focus groups" to specifically cover the regions where the impact of the disruptions was likely to be most prominent. These were the South East region of the EU (Bulgaria, Croatia, Greece, Hungary and Romania), the Baltic States and Finland and the Energy Community Contracting Parties. National authorities have worked hard over summer to collect the data and carry out assessments within short deadlines and presented their national reports[4] to the Commission in August and September 2014. The European Network of Transmission System Operators for gas ('ENTSOG') has equally modelled the impact of supply disruptions on the EU-wide gas system and several industry associations, the International Energy Agency[5], the G7 and other key partner countries have provided contributions as well.

Methodology and scenarios of "stress tests"

The scenarios proposed by the Commission to all participants in this exercise covered the disruption of the Ukrainian gas transit route as well as all Russian gas flows to Europe for periods of one month and six months (September to February), supposing average winter conditions in each case. In addition, a 2-week February "cold spell" sub-scenario was also developed by ENTSOG to cover the effect of peak demand on an already strained supply

[1] Communication from the Commission to the European Parliament and the Council, 'European Energy Security Strategy', COM/2014/0330 final.
http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0330&from=EN

[2] European Council Conclusions of 27 June 2014, EUCO 79/14
http://www.consilium.europa.eu/uedocs/cms_Data/docs/pressdata/en/ec/143478.pdf

[3] The Contracting Parties are the Republic of Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Republic of Moldova, the Republic of Montenegro, the Republic of Serbia, Ukraine and The United Nations Interim Administration Mission in Kosovo pursuant to the United Nations Security Council Resolution 1244. The Republic of Georgia is an Accession Candidate to the Energy Community.

[4] National reports were replaced by a joint report for the three Baltics States and Finland.

[5] The IEA has provided a comprehensive analysis of the LNG market.

system. These proposals were based on past experience and the need to put to the test our energy systems under very demanding conditions, i.e. the disruption of all the flows from Europe's main external supplier of natural gas.

The effects of the Ukraine transit or the full Russian supply disruption scenarios on the South-East European countries, being supplied largely via Ukraine, is very similar and the Baltic Member States and Finland are unaffected by the modelled Ukraine transit disruption. Therefore the Commission refers throughout the report mostly to the effects of the 6-month Russian gas disruption scenario under normal winter conditions and a cold spell.

This exercise has already been very valuable insofar as this is the first time that such a complete picture was provided on the possible impacts on and readiness of the European gas sector as regards a possible serious gas supply disruption from the East.

In the present Communication, the Commission reports on the main findings of this stress test exercise and formulates a number of specific recommendations. In parallel to this Communication, the Commission services have prepared staff working documents which contain the reports of the three "focus groups", a report on the cooperation with G7 and other partner countries as well as a report on the review of the Security of Gas Supply Regulation[6]. In addition, the Commission is also adopting its Recommendation for the application of internal market rules for the Energy Community.

2. RESULTS OF THE STRESS TESTS

2.1 Situation of transit flows

In parallel to the stress test exercise and starting already in the spring of this year the European Commission has made considerable efforts to broker a compromise solution between Ukraine and Russia in their dispute over gas payments and debts with the aim of ensuring sufficient deliveries of gas to Ukraine and stable transit to the EU and other Energy Community Contracting Parties. Over the year a number of meetings have been held between the European Commission, Ukrainian and Russian authorities, including at ministerial level. At the last trilateral ministerial meeting on 26 September in Berlin the Parties came closer on key points of a compromise proposal tabled by the Commission. This "winter package" is currently under consultation in Moscow and Kiev and a next trilateral meeting is foreseen ahead of the October European Council. An agreement would secure gas deliveries to Ukraine throughout the winter.

Overall the stability of Russian gas supplies to the EU and transmission through Ukraine depends on many factors, of which only some are in the EU's control. Hence, it is prudent to

[6] Regulation (EU) No 994/2010 of the European Parliament and of the Council of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC, OJ 2010 L 295/1.

consider all possible scenarios including major disruptions of gas supply. In this regard, the projections detailed below should not be seen as a prognosis but merely as a possible scenario and a basis for contingency measures.

In September and October 2014, flows of Russian gas to the EU were at times lower than expected which, in the view of the Commission, is worrying. Notably, during September reductions in Gazprom deliveries to a number of EU companies have been reported, albeit these reductions have not had an adverse impact on supply security in the EU or its neighbouring countries. Physical reverse flow from Slovakia to Ukraine was stable. Reverse flows from Poland to Ukraine were temporarily interrupted for two days but resumed quickly. Furthermore, deliveries from Hungary to Ukraine were indefinitely interrupted on 25 September due to larger volumes of gas entering Hungary en route to the storage facilities. The Commission is closely monitoring the situation with the cooperation of the Gas Coordination Group.

2.2 Europe's supply situation in case of a disruption

At the request of the Commission, ENTSOG has modelled various supply disruption scenarios. The model shows that in the different six month disruption scenarios the EU and the Energy Community Contracting Parties without Ukraine would, after reshuffling the supply mix, altogether still be missing between five and nine billion cubic meters (bcm) of gas[7]. It also shows – assuming maximized use of infrastructure and normal market conditions[8] – that when such six-month disruptions occur Russian volumes are replaced particularly through the import of additional volumes of LNG.[9,10] Although ENTSOG has not modelled the price effects of the supply disruptions, the need to replace volumes will be accompanied by price increases triggering the import of significant additional volumes of LNG. It is those price signals, to the extent allowed by the interconnection capacities or direct access to LNG import facilities that move gas to markets where it is most needed for the purposes of e.g. heating, electricity production. The higher prices will also trigger intense storage withdrawals and voluntary demand reduction.

The modelling exercise also shows which countries would be most affected by the gas disruptions.

[7] This is roughly equal to 1-2% of annual EU consumption.

[8] It should be noted that these premises are in reality unfortunately not always fulfilled.

[9] LNG in the supply mix would increase in the most extreme scenario by 130% from 24 bcm to 56 bcm.

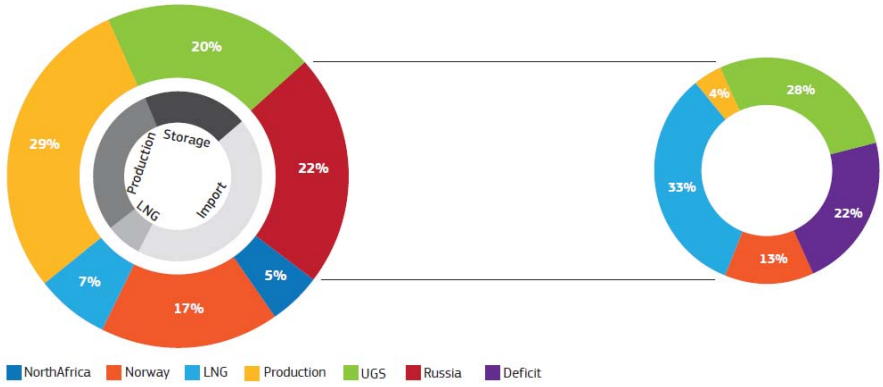
[10] Importantly, according to the ENTSOG analysis, increasing the capacity of the OPAL pipeline (which is one of the extensions of the Nord Stream pipeline, running from Greifswald in northern Germany to Brandov on the German-Czech border) to 100% from its current 50% will not have an effect of reducing the missing gas volumes in the Eastern Member States due to existing infrastructure constraints towards the east. The effect of increasing the capacity to 100% will be limited to replacing LNG volumes in Western Europe.

Table 1 – Missing gas volumes per affected country over 6-months period in Russian supply cut and cold spell scenario (total shortfall in mcm and largest relative monthly shortfall in %)

6-month Russian disruption with 2-week February cold spell	BG	EE	FI	EL	HR	HU	IT	LT	LU	LV	PL	RO	SE	SI	BiH	fYRoM	SRB
Total shortfall BEFORE national measures (mcm)	670	204	2255	109	41	2170	26	693	8	39	890	1361	13	21	139	126	631
Largest relative monthly shortfall in %	100%	73%	100%	18%	12%	35%	<0,1%	59%	5%	15%	28%	31%	6%	17%	100%	100%	64%

Source: ENTSOG

Figure 1 – Replacement of Russian gas in the 6-month Russian supply disruption scenario



Source: ENTSOG

ENTSOG has modelled both a "non-cooperative" and a "cooperative" scenario for the purpose of this exercise.[11] The main differentiating feature between the two is that the "cooperative" scenarios of ENTSOG presuppose the crucial element of **equal (relative) burden sharing** by which solidarity between Member States is applied to such an extent that shortfalls in gas are spread equally between neighbouring Member States. By contrast, in the "non-cooperative" scenario Member States would reduce or stop gas exports between each other and to Energy Community Contracting Parties when their domestic demand can no longer be fully satisfied. The "cooperative" scenario assumes that Ukraine and Moldova[12] are continuously supplied with gas from Member States via at least Slovakia at full capacity while the "non-cooperative" scenario assumes exports at 50% of Slovak reverse flow capacity.

[11] In its report to the Commission ENTSOG refers to these two scenarios as "optimal" and "sub-optimal".

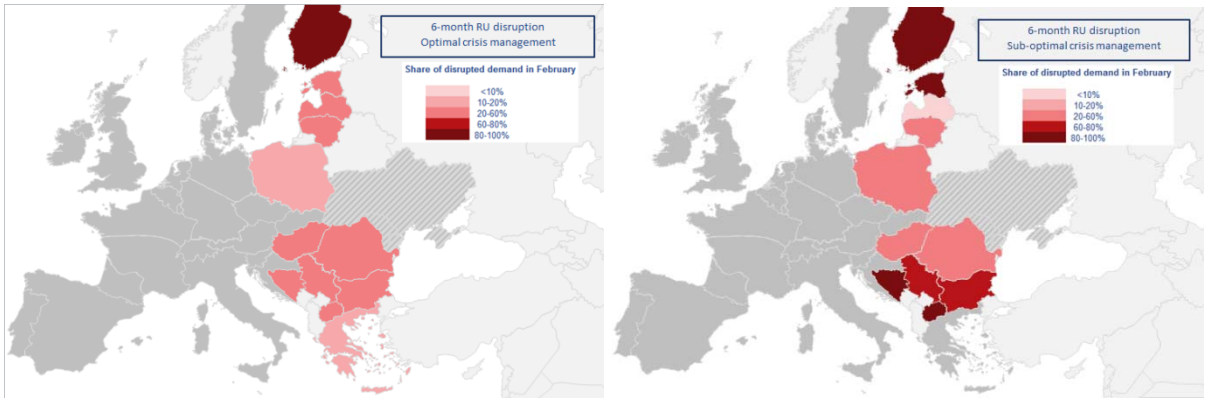
[12] In the case of Moldova, ENTSOG's assumption of deliveries notwithstanding, commercial and regulatory (licencing) issues prevent the Iasi-Ungheni interconnector from Romania to Moldova from operating even though it has been officially opened and is technically functioning. Therefore, unless the issue is resolved and subject to a disruption happening there will be a 100% shortage of gas in Moldova.

In the absence of cooperation between Member States and of additional national measures, serious supply shortfalls of 40% or significantly more[13] could materialise, at least towards the end of the 6-month disruption period, for Bulgaria, Romania, Serbia, the former Yugoslav Republic of Macedonia and Bosnia and Herzegovina (in both Ukraine transit and full Russian supply disruption scenarios). Shortfalls of similar magnitude would apply for Lithuania, Estonia and Finland in the scenario of a total halt of Russian supplies to the EU. Hungary and Poland[14] would also be substantially affected, albeit to a lesser degree, by shortfalls of 30% and 20% respectively. The headline effects of the disruption can be seen in Figure 2.

In the cooperative scenario the effects of the disruption are significantly dampened in those Member States and Energy Community Contracting Parties most affected and most particularly Bulgaria, Estonia, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia and Serbia. At the same time Greece and Latvia would likely also experience some non-negligible shortfall[15]. Based on their existing gas supply infrastructure and gas sourcing Member States shaded in grey on the maps would, according to the simulation, not be directly affected.

Figure 2 – Maps of likely supply interruptions – before further national measures – in February at the end of the 6-month Russian gas supply disruption scenario in cooperative and non-cooperative scenarios under average winter conditions[16]

Cooperative Scenario *Non-cooperative scenario*



Source: ENTSOG

13 Up to 100%

14 Poland is only affected in the total Russian supply disruption scenario.

15 The position of those two Member States is affected by the "cooperative scenario" because both are surrounded by Member States with a very high exposure to a supply disruption but themselves have infrastructure – storage in Latvia and LNG regasification terminal in Greece – which provides them a buffer. In allowing such infrastructure to be shared their supply-demand balance changes.

16 Both maps illustrate the effects in February of a 6-month Russian supply disruption. Any national measures relating to e.g. demand response, obligatory switching, etc. take this likely deficit as a starting point. Consequently Member States appearing to be without options from a pure gas network infrastructure point of view – as is the case in Finland –, may have recourse to other specific national measures such as the elaborate system of obligatory switching in place for gas-fired power generation and heating units.

Effects of a continued supply disruption on Ukraine

Ukraine is in a rather unique situation among the Contracting Parties of the Energy Community. It developed transmission and storage capacities, albeit in need of modernization, give Ukraine tools to address the challenge of a supply disruption in a more differentiated way than other Contracting Parties. Ukraine normally consumes about 50bcm/year, of which about 20 bcm are domestically produced and most of the rest imported from Russia. However, gas supplies from Russia for consumption in Ukraine have been halted since 16 June 2014.

The stress test assessment of Ukraine indicates that domestic production and storages can cover 50%-70% of demand if demand response measures are applied. Imports from the EU would help to partially cover the shortage of gas in the optimistic scenario foreseen by Ukraine[17]. An important step in this direction was the Slovakia-Ukraine reverse flow, which became operational in early September and which can ship up to 27 mcm of gas per day, two-thirds of which on a firm basis.

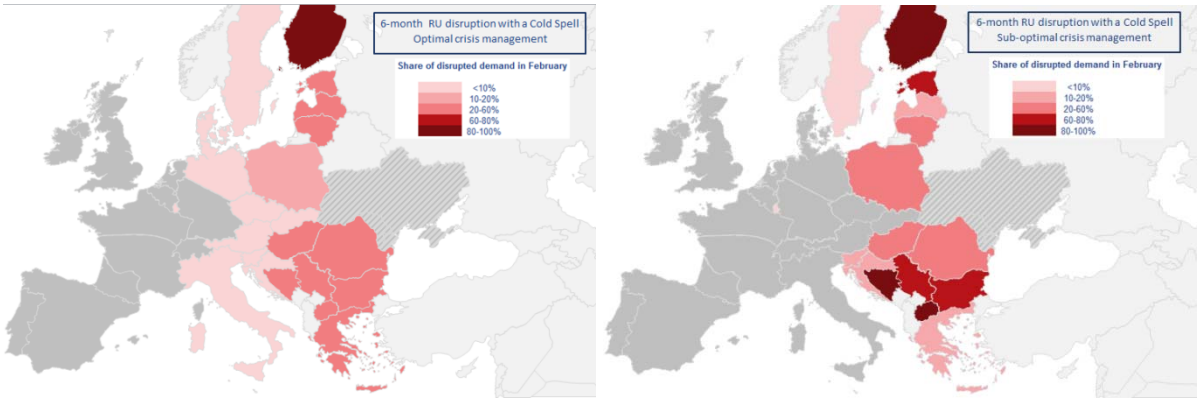
A hypothetical 2-week cold spell towards the end of the 6-month disruption would certainly aggravate the security of supply situation. As can be seen in Figure 3, according to the ENTSOG model, here too a cooperative scenario would allow shortfalls in the most affected countries to decrease from the dramatic level that would result from an uncooperative scenario. In the cooperative scenario other Central Eastern and Western European Member States such as Austria, Czech Republic, (northern) Germany[18], Italy and Slovakia would however also be affected as a result of gas flowing to countries where the shortfalls are higher. Such shortfalls would, on the basis of the model, be of a level below 10%. This is normally a level within which price-induced (natural) demand reduction would take place without the need for additional measures.

[17] Such a scenario foresees in particular full capacity reverse flow from Slovakia, Hungary and Poland as well as reductions in district heating and industrial consumption.

[18] The so-called NetConnect Germany market area.

Figure 3 – Maps of likely supply interruptions – before further national measures – in February at the end of the 6-month Russian gas supply disruption scenario in cooperative and non-cooperative scenarios during a cold spell

Cooperative Scenario *Non-cooperative scenario*

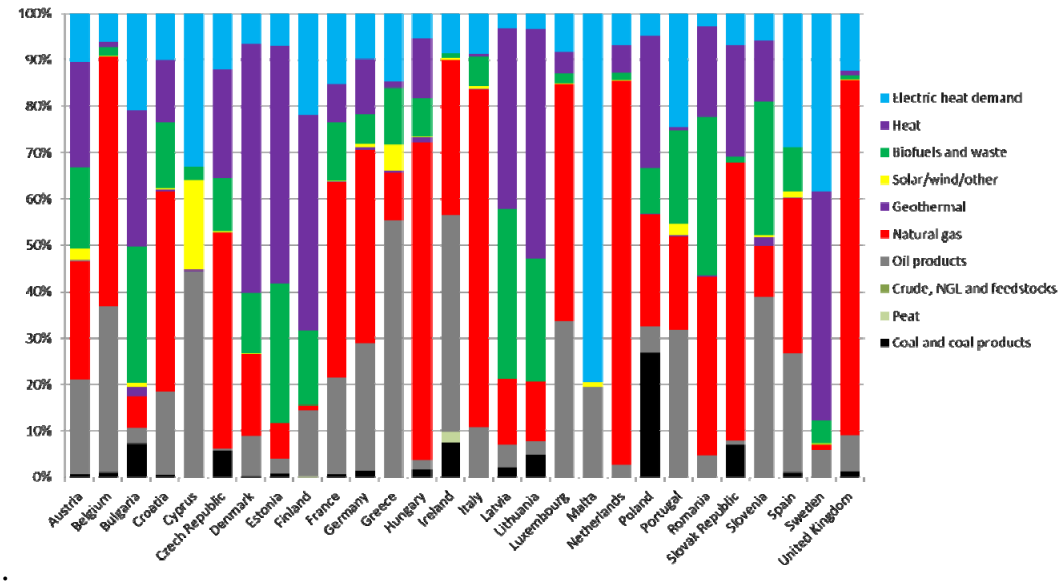


Source: ENTSOG

Exposure of the heating sector to gas a disruption

Around half of the EU's primary energy consumption is used for space and water heating in the residential and tertiary sectors and for process heat in industry. Space and water heating in buildings is particularly gas-intensive in Hungary, Italy, the Netherlands and the United Kingdom as shown in Figure 4 below.

Figure 4 – Member State distribution of end-use heat demand for space heating and hot water preparation in residential and service sectors, by fuel type and energy carrier.



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Source: Stratego EU28 Heat Market Assessment for year 2010

Most of the space and water heating (88%) in the EU is performed by individual boilers for self-consumption while the share of district heating is 12%. This average however covers large differences as in the Northern, Baltic, Central and Eastern European Member States district heat supplies between 14% and 56% of the heat[19] serving between 10% to nearly half of domestic consumers.[20] On average, 44% of district heating runs on gas with a share of up to 80% in the countries where district heating is well-established such as Latvia, Lithuania, Slovakia, Bulgaria and Hungary. Consequently, in the Baltics and Finland, gas consumption in district heating and in combined heat and power plants typically represents around 50% of total gas consumption.

Gas-fired district-heating plants (unless they have fuel-switching capabilities) and distributed heating customers are generally regarded as protected customers[21] and are the last ones in line to be affected by any possible supply cut. In addition, many Member States have imposed fuel switching obligations to heating plants although the share varies greatly from essentially 100% in Finland to below 20% in Romania and Bulgaria.

2.3 Assessment of the measures proposed in the national reports

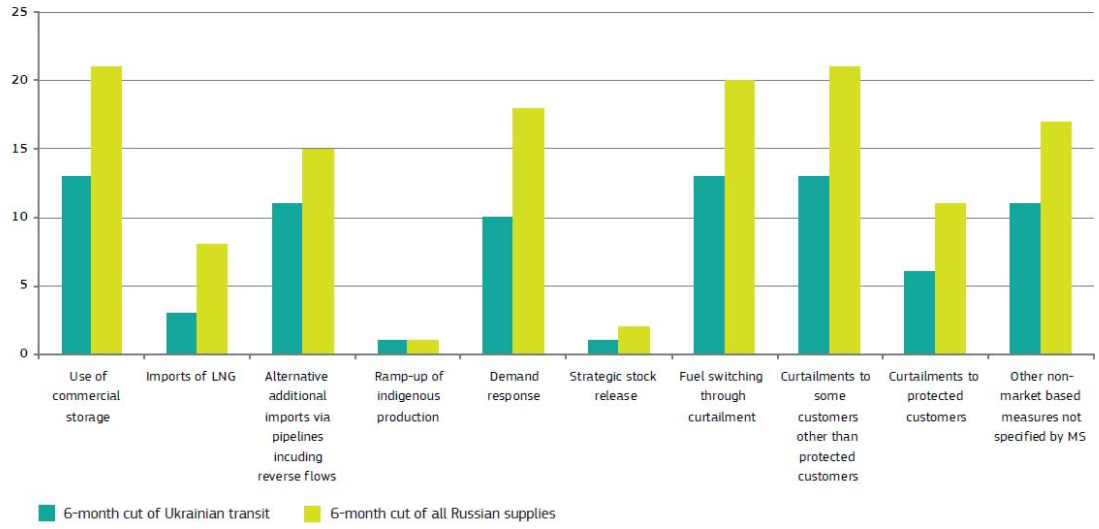
As shown in the ENTSOG scenarios, Member States would be impacted very differently by possible supply cuts of Russian gas, depending on both their geographic location and gas sourcing options. Those varying degrees of impact are also reflected in the measures which Member States and Energy Community Contracting Parties have listed in their stress test reports to the Commission. While some of the most vulnerable countries may have to resort to radical measures (such as supply curtailments or strategic stock releases) rather quickly during the modelled period, other Member States allow their gas sector operate on the basis of market fundamentals. It is important to note that a calm, market-based management of the supply crisis in Member States less affected will have an overall beneficial effect for the whole EU and the Energy Community in resolving the shortfalls.

[19] In Sweden, Denmark and Slovakia this percentage for example is, 56%, 53% and 54%, respectively, in Finland is 47%. In Romania, Bulgaria, Slovenia and Austria this share is between 14% and 19%.

[20] In Sweden, Denmark, Finland, Latvia, Lithuania, Poland and Slovakia more than 40% of domestic consumers have their home heated by district heating. District heating supplies heat for 10% to 40% of consumers in Germany, Austria, Hungary, Slovenia, Bulgaria, Croatia, Romania and the Czech Republic.

[21] The Security of Gas Supply Regulation established a category of so-called protected customers which includes households and, when the Member States so decides, essential social services and SMEs, within a certain limit, and district heating installations that cannot switch fuels and that deliver heat to other protected customers.

Figure 5 – Overview of the count of different measures envisaged by Member States in their reports supposing a 6-month cut of Ukrainian transit and of all Russian supplies respectively.



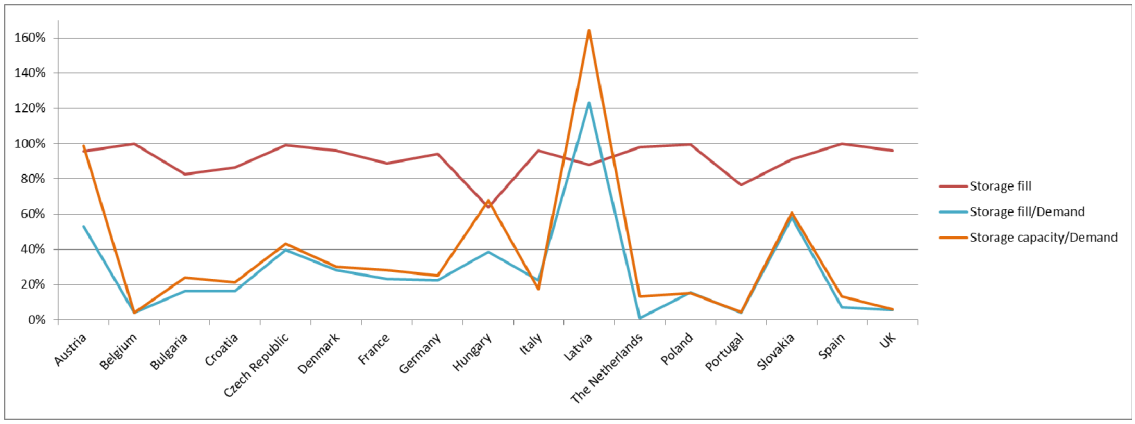
Source: National Stress Test Reports

2.3.1 Storage

Storage, where available, is a key tool to balance the supply-demand situation in all Member States and Energy Community Contracting Parties[22]. As of early October, storage filling levels in the EU were very high at around 90%. Only two Member States (Hungary and Portugal) had storage levels under 80% but, due to its large storage capacities, Hungary already has an above average storage fill-to-demand ratio.

[22] Nota bene, storage use has generally been considered in a national context.

Figure 6 – Storage levels (%) per Member State, storage fill as share of domestic demand (%) and storage capacity as share of domestic demand (%), October 2014[23]



Source: GSE IGSA transparency platform and Eurogas; Commission analysis

Nevertheless, according to the figures provided in the national reports and the ENTSOG analysis, a long-lasting crisis or simply a cold winter could empty the storages quickly and thereby necessitate resorting to other security of supply measures in order to ensure the supply of customers.

In assessing the various national plans on the use of storages, a number of important observations are to be made. First, there is little to no room to physically increase storage capacity in the short term. Secondly, where countries rely on a short term increase in withdrawal rates – unless measures are taken subsequently to avoid emptying storages too rapidly –, these countries have to face the repercussions later in case the disruption endures, including that withdrawal rates at low storage levels decrease substantially.

Filling storages beyond usual filling levels and ensuring that the withdrawal pace has regard to the possibility of an enduring winter period can prove to be important preparatory measures in the Member States most exposed in the case of a crisis. Storage can be used to secure supplies in more and less market-based ways. Several Member States have implemented preventive measures to ensure security of supply in the form of supply-related storage obligations (e.g. Bulgaria, Denmark, France, Italy, Poland, Portugal, Slovakia and Spain) and strategic storage (e.g. Hungary). Furthermore, some national plans, such as that of Hungary, foresee measures that make it more attractive to fill storages by reducing the transmission tariffs, which can account for a significant portion of the storage costs. Special care should be taken that the perfectly legitimate activity of facilitating the filling of storages – using often imported gas – does not come at the (explicit) expense of cross-border transactions aimed at delivering gas out of the country.

[23] By now essentially only Gazprom Export and Romanian storage system operators are not reporting storage levels to the Gas Storage Europe AGSI transparency site.

2.3.2 Replacing missing volumes by ramping up domestic production or buying more gas from another source

An obvious way to replace missing gas volumes from one source is to import from another source or increase domestic production.

In general there is little to no scope for increased domestic EU gas production to have a significant effect in the short term, in particular due to technical constraints in the systems.

As regards imports, the scope for additional deliveries through pipelines from North Africa is currently limited and Norwegian production is close to capacity. LNG is clearly the import source with the biggest potential as LNG terminals in the EU have sufficient capacity to allow new LNG volumes to be shipped in.[24] From a commodity perspective, the global spot LNG market is large enough to provide additional volumes and so is the shipping sector. In addition, recent drops in Asian LNG prices have made LNG a more economic alternative for the EU. Nevertheless, given that in times of disruptions and scarcity the price of LNG will rise, acquiring spot cargoes may be expensive[25]. Moreover, it may require at least one week for a shipment to arrive in the crisis area.

2.3.3 Using the Demand Side

Reducing the need for gas will mitigate the impacts of a disruption. As a general observation, a large majority of the national reports – particularly in the most affected regions – have not assessed the effect of possible demand reduction (from industrial customers or potentially gas-fired power generation) resulting from price increases in case of a supply disruption. Demand with high price elasticity – estimated in the range of 10% – is likely to leave the market first by shutting off units on economic grounds or switching, in case that is economic, to alternative fuels (biomass or oil). Market-based, incentive-driven measures relating to the demand side have only been laid out in very few national stress test reports and there is no experience of implementation in the most affected countries.

The ultimate demand-side tool in the hands of authorities – which all of them are ready to make use of also in the light of the provisions of the Security of Gas Supply Regulation – is curtailment according to a set sequence of user groups. Such plans usually start with the most flexible industrial users and end with the protected customers, mainly households. As regards such demand side curtailment, the Commission notes that many plans do not quantify or specify the exact effects of foreseen curtailment measures on individual customer groups,

[24] Altogether EU regasification capacity stands at around 200 bcm/year but most of it is concentrated on the Mediterranean and Atlantic coast. Consequently interconnection constraints limit many individual LNG terminals' ability to supply every region of disruption.

[25] The IEA estimates that prices may rise by up to 100%.

resulting in some lack of clarity as to the precise extent of possible consequences of a disruption for various customer groups.[26]

2.3.4 Fuel switching

District heating systems in many affected Member States run predominantly on gas. In addition, the share of gas-fired power generation was at or above 25% in 2012 for Croatia, Greece, Hungary, Latvia and Lithuania.[27] An increase in gas prices may result in some temporary fuel-switching driven by economic considerations in a crisis situation. In addition, the national plans of all countries faced with a likely supply cut foresee the possibility to force fuel switching. Under such measures, users that have dual fuel capabilities are generally required to switch. Member States have reported obligations for the on-site stocking of alternative fuels (such as biomass or oil) for a given – relatively short – number of days[28]. In general, no serious logistics or supply-related problems were expected by Member States as regards arranging for fuel-switching within the national compulsory supply periods. Nevertheless long periods of disruptions and corresponding switching durations remain untested. Where needed, use strategic oil stocks can be used to fuel power plants and central heating units in line with the legislation[29].

The Commission notes that in some Energy Community countries, difficulties may arise due to a lack of oil and coal stocks dedicated to heating. For example in Serbia, or in Bosnia and Herzegovina, although one third of district heating plants are capable of switching from gas to oil, the oil stocks would run out quickly. Also in the case of Moldova, a switch from gas to coal for the production of electricity might not be fully possible when storage of coal is not ensured in due time.

Several national reports mention the possibility of a switch from gas consumption, in particular for heating purposes, to electricity consumption, including using renewables (locally grown sustainable biomass, heat pumps, etc.) and availing of the thermal storage possibilities in district heating systems. Whilst electricity may be an effective measure to alleviate gas shortages to a considerable extent, careful consideration must be given to e.g. the role of gas-fired power generation facilities in the provision of system reserves and balancing

[26] It is worth pointing to a specific plan of Ukraine which, in order to reduce domestic demand, envisages the introduction of a new law requiring consumption to be cut by 20-30%, mostly by reducing demand of district heating, households and chemical industry and by introducing measures in the public sector. Although such cuts are enforceable, the impacts on consumers are difficult to predict.

[27] Gas use for power generation has decreased over the past years however due to low or negative profit margins compared particularly to coal-based electricity production.

[28] Typically the stocking obligations are around 5 to 15 days. Finland is a notable exception with fuel stocking obligations of up to 5 months.

[29] Directive 2009/119/EC of 14 September 2009 imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products

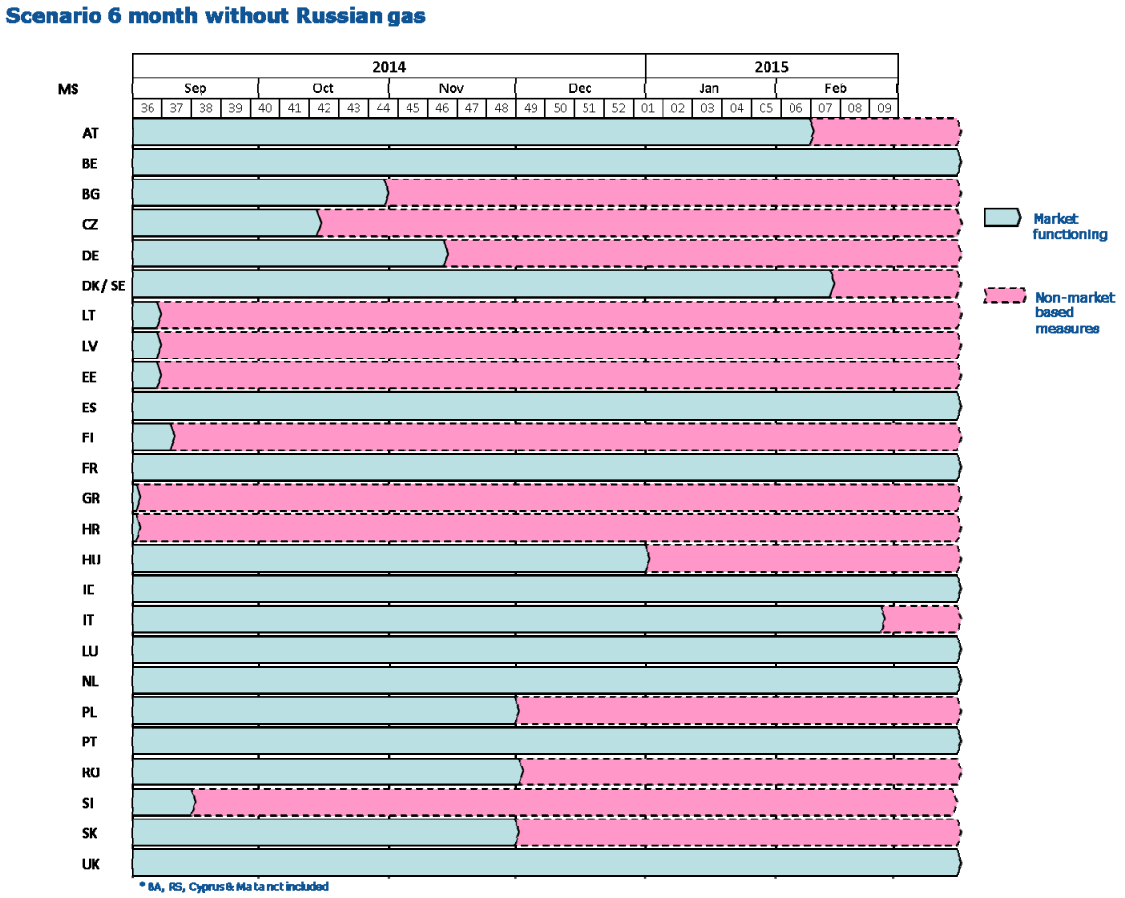
and the limits of the network to cope with extraordinarily high demand sustained in time.[30] The discussions between the Baltic States and Finland, as well as between other countries such as Greece and Bulgaria, point towards cooperation and some joint consideration of the interplay between the two sectors. Overall, however, the national reports and the assessment done by the European Network of Transmission System Operators for Electricity (ENTSO-E), on the basis of best-available data, do not provide the necessary full view of the spill-over effects of a gas disruption on the power sector.

2.3.4 Timing of non-market-based measures

Figure 7 below shows a Commission analysis of the potential timing of the introduction of non-market-based measures throughout the 6-month full Russian supply disruption period. Some of the differences – beyond differences in levels of exposure – are likely also due to policy-level decisions in Member States regarding the approach to a supply crisis. Some, such as Czech Republic and Germany which, on the basis of the ENTSOG "cooperative scenario" calculations, are likely to be affected to a smaller degree only during a cold spell, are indicating the introduction of non-market-based measures at a very early stage in a pre-emptive manner to ensure supply to protected customers. Other differences are shown by the early move to non-market-based measures by e.g. Greece and Croatia compared to an apparent emphasis for market-based measures on the part of e.g. Bulgaria, Hungary and Romania as long as possible. Furthermore, cross-reading these national analyses with the ENTSOG maps of the areas and levels of affectation in a supply crisis, it may be observed that, under the cooperative scenario, the introduction of non-market-based measures can be significantly delayed. This suggests scope for improving the overall situation on the basis of closer coordination.

[30] E.g. it is unclear to what extent in some states in the Balkan region an extensive switch to electricity in conjunction with the effects of floods of spring 2014 and the decrease in supply of gas to thermal power plants will cause serious electricity supply deficits. These concerns have not been examined in detail in the national reports.

Figure 7 – Chart of temporal introduction of national measures



Source: National Reports, Commission analysis

3. CONCLUSIONS

3.1 Assessment of Member State measures

A prolonged supply disruption of the Ukraine transmission route and *a fortiori* of all Russian gas supplies to the EU will have a substantial impact in the EU, with the Eastern EU Member States and the Energy Community countries being affected most.

The national reports reveal two main weaknesses in the EU's short term security of supply situation. First, several infrastructure projects launched with the explicit purpose of increasing security of supply after the 2009 supply crisis have – due to a variety of issues ranging from a lack of political support to unsatisfactory project management and lack of cross-border cooperation – not yet been (fully) commissioned.[31] Second, many of the national security of

[31] These include in particular the Greek-Bulgarian, Romanian-Bulgarian, Bulgarian-Serbian, Moldavian-Romanian and Hungarian-Slovakian interconnectors as well as the Romanian reverse flow project. Furthermore,

supply strategies are either unilateral in nature, insufficiently coordinated and/or insufficiently cooperative. Overall this leads to a sub-optimal level of efficiency in dealing with security of gas supply in the Union as will be further detailed below.

The ENTSOG analysis shows that cooperation based on optimized infrastructure use and relative burden-sharing ensures the supply of protected customers in Member States and Energy Community Contracting Parties as well as significant exports to Ukraine.[32] Nevertheless, in addition to the optimization of domestic and cross-border gas flows, Member States in the Baltic States, Finland, as well as in Central and South-Eastern Europe and Energy Community Contracting Parties will need to employ a broad array of additional measures to ensure that "unserved" or missing gas to non-protected customers is kept to the minimum. As sourcing of additional gas from possible national production, external sources or storage has already been taken into account in the ENTSOG model, the most likely next measure – in addition to other types of demand-side measures – is price-induced or compulsory fuel switching. A good example is Finland, which at first sight may be the most vulnerable Member State with up to 100% unserved or missing gas during the modelled disruption scenario of a 6-month Russian supply cut. However, firstly the share of protected customers being supplied by gas is minimal. Furthermore, due to its obligatory switching mechanism and high alternative fuel stock obligation it would – with well-executed logistics – in all likelihood be able to replace all the gas volumes without the need to curtail demand. The most affected Baltic, Central and South East European Member States and Energy Community Contracting Parties[33] are however very likely to have to undertake curtailment of non-protected customers, particularly towards the end of the modelled period.
All national reports present measures to address a possible supply disruption. The sequencing of those measures is important and it is crucial that the market functions as long as possible. Where the market works, price signals will attract new deliveries of gas – mainly LNG – to the EU and within the EU to those countries where scarcity is highest provided that the necessary infrastructure exists. Price signals will promote the commercial use of storage as a tool to ensure the demand-supply balance and incentivize demand reduction and fuel switching driven by economic considerations. Member States should not prevent gas to flow across borders. A price increase is not a supply crisis and not a justification for intervening in the market under the pretext of security of supply.

This however does not release vulnerable Member States from the obligation to design and sequence well the measures they would resort to in preparing for and responding to an

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some interconnectors are not yet able to physically pump gas bi-directionally and therefore limit the overall flexibility of the system.

[32] Supply shortfalls will in all likelihood not be large enough to reach protected customers. In the "non-cooperation" scenario protected customers are particularly endangered in Bosnia and Herzegovina and the former Yugoslav Republic of Macedonia and curtailment of non-protected customers is likely to be markedly higher in other affected countries as well.

[33] Estonia, Lithuania, Latvia, Poland, Hungary, Romania Bulgaria, Greece, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia and Serbia.

emergency. Vulnerable countries too should exploit market based measures first and in full, but where they are no longer sufficient, non-market based measures may have to be resorted to when an emergency is declared. Where non-market based measures have to be applied, it is very important that the least distortive and most proportionate measures are applied before the more intrusive ones and that this is done taking duly into account the effect of the measure across borders.

3.2 Need for increased cooperation and coordination

As mentioned, in general, the national reports are more oriented towards *national approaches* rather than looking at the regional dimension when conceiving security of supply strategies. Thus many Member States have made assumptions in their national reports about the lack of certainty of deliveries from certain borders prompting them to have recourse equally to assumptions about no exports which weaken security of supply on a broader regional and EU-wide scale. Cooperation is therefore key as, for instance, in the Baltic region the position of the Inčukalns storage is so crucial that, if it cannot rely on it, Estonia would run out of gas to even supply its protected customers within five days.

The lack of coordination is reflected in a number of discrepancies in the measures indicated by different, often neighbouring, Member States. Such discrepancies include either the inclusion in several plans of the same external suppliers increased capacities or the different assumptions of flows across shared interconnectors. This is clearly a harbinger of inefficient outcomes, particularly in a crisis situation with tight markets, and can lead to a false feeling of security. While it is clear that some coordination has taken place before the stress test exercise and has been further reinforced by new discussions, the comparative analysis of the reports shows that there is still scope and a need for closer cross-border coordination to ensure – as a basic objective – realistic assumptions as regards the expected gas flows across the interconnection points.

In the light of the above, it is evident that cross-border cooperation must go beyond the mere cross-border consistency check of national measures and be extended to include the *identification of cross-border synergies* and agreeing on how to implement solidarity measures. Such an approach would fundamentally result in efficiency gains, not only in economic terms but also in terms of ensuring very short term security of gas supply.

There are examples of such cooperation between Member States and the Commission welcomes those as an effective first step to improve security of supply on a regional level. An example is the envisaged agreement between Estonia and Lithuania on the basis of which the protected customers of both countries will be served ahead of the non-protected customers in either country. Another example can be found in the Hungarian-Croatian Intergovernmental Agreement on security of supply, which, though it still needs to be implemented, reflects a constructive approach towards cooperation. Furthermore, cooperation can also manifest itself in the common use of infrastructures, for example storages, or in the increased power

generation in a certain Member States to allow other Member States to use the thus freed-up gas for the supply of protected customers. An interesting example in that regard is the developing cooperation between Greece and Bulgaria which foresees an exchange of gas and electricity to stabilize both systems in the case of a severe shortfall.

An enhanced cooperative approach will require agreements amongst the concerned parties on the organizational, commercial and regulatory terms and conditions of cooperation in case of a crisis. In order to build trust, clear rules need to be agreed beforehand at European or regional level. It is possible that enhanced cross-border cooperation may not be fully achieved in all aspects by the coming winter. Nevertheless, given the heightened current risk, neighbouring Member States and countries should start this process, or strengthen initiatives underway, immediately in order to come to an understanding on the most fundamental information as well as individual and joint actions during a possible crisis situation. Such arrangements, including measures that can be implemented in case of need during next winter, could be facilitated by the European Commission in order to conclude an agreement in a relatively short period of time.

Forms of cooperation need to kick in in order to alleviate the gas shortfall in a Member State by ensuring and enabling deliveries across the border, even if those deliveries would cause some sacrifices in the "donor" country as well. In applying such a principle, the coordinative role and security of supply responsibility of the TSOs need to be fully harnessed, with the support of national energy regulators, so as to allow them to provide flows to the neighbouring country even though they may not have ensured full system functioning in their area of responsibility. This could also be an opportunity to improve security of supply in the long-term through regional partnerships.

The Commission highlights in this context the special role of Member States through the territory of which gas is flowing towards markets further "downstream". As regards delivering supplies to Central and South Eastern Europe Germany, Czech Republic, Austria, Slovakia, Hungary and Slovenia all have particularly important infrastructure in place which needs to be used in an optimized manner already as a basis for a functioning internal market. In addition, in a specific security of supply situation it must also be ensured that these countries continue to allow gas to move to markets where shortages are significant.

It is clear however that this type of cooperation cannot just be a one-way street. It should allow for an appropriate allocation of costs of the measures necessary to cope with a crisis in the short but also in the medium and long term. The concept that consumers in a country bear the costs of the security of supply measures and should, consequently, enjoy higher levels of protection has often constituted a barrier for the development of cooperative schemes. Solidarity measures are not grants or gifts but operational emergency response measures to which the beneficiary will ultimately have to contribute. Solidarity that incentivizes free-rider behaviour is not solidarity. In any event it would be inappropriate to regard solidarity exclusively in a pure short term business context.

Enhanced cooperation will not only deliver short term tangible benefits for those Member States most exposed to the risk of emergencies in the upcoming winter. It is in the common interest of all that the introduction of the most far-reaching and radical measures – such as demand curtailments, trade restrictions or the release of strategic stocks – is delayed and reduced to the minimum, as these measures can undermine the internal energy market on a long-lasting basis. That, in turn, may damage the confidence of investors (e.g. in commercial storage) and reduce the attractiveness of the EU market for external supplies from existing and new sources. Approaches based on isolation and suspicions go against the solidarity that is needed to create a true Energy Union. This however will also require that the vulnerable Member States do the utmost to avoid an emergency situation by undertaking steps discussed further in Chapter 4.

4. RECOMMENDATIONS

Overall the EU energy policy seeks to complete the internal energy market, increase energy efficiency, reduce greenhouse gas emissions, diversify external supply sources and exploit indigenous sources; all of which improve the EU's security of supply. The present report focusses however on the specific recommendations that will ensure that the EU is better prepared for and in a position to respond to a concrete risk of supply disruptions from the East in the coming winter.

4.1 Urgent recommendations for the upcoming winter

The Commission has grouped the short-term recommendations along three themes of i) making the market work ; ii) defining clearly when the market stops working and when emergency measures are needed; and iii) coordinating and cooperating both in emergency planning and possible interventions.

i) Making the market work in the short term

1. Maximize capacity on interconnectors and remove or resist restrictions to cross-border trade

Capacity on interconnectors should be maximized and it should be ensured that this maximal capacity is made available to the market, e.g. by applying effective congestion management procedures[34] and capacity allocation mechanisms[35] without delay. In particular, export restrictions can have a detrimental effect in case of a gas crisis. As evidenced by the analysis carried out by ENTSOG, export restrictions can severely aggravate the damage of a gas crisis

[34] Pursuant to Commission Decision 2012/490/EU on amending Annex I to Regulation (EC) No 715/2009

[35] Pursuant to Commission Regulation (EU) No 984/2013. Valuable early implementations notwithstanding, this Regulation is to be implemented by 1 November 2015.

in the most affected Member States and would increase the number of countries which would face serious supply disruptions. The Commission recalls in this context Article 11(5) of the Security of Gas Supply Regulation, according to which "*no measures [should be] introduced which unduly restrict the flow of gas within the internal market"* or which *"are likely to endanger seriously the gas supply situation in another Member State."*

The Commission encourages the swift implementation of third party access rules to infrastructures (including storage) even in those cases where derogations to the Third Energy Package have been granted, such as for example in Latvia and Estonia.

2. Optimize the use of storage

Transparency on storage levels has greatly increased over the past years and the Gas Storage Europe (GSE) platform is a commendable initiative providing up-to-date information on nearly all EU storages. A last ditch effort should be made by Romania (Romgaz) to publish its storage level data[36], including on the GSE platform.

National regulators have tools at their disposal to provide economic incentives to market players – e.g. through lowering transmission tariffs for injecting gas in storage – to stimulate increased injections. This has worked effectively lately in Hungary which has led to solid growth in storage levels over the past weeks, even though storage levels in Hungary remain somewhat below EU average.[37]

Withdrawal patterns in storages are driven by economics and not necessarily by a security of supply strategy, particularly if the supply obligations are not properly enforced. Economic incentives may be given to dissuade market players from having too fast a recourse to storage when other gas sources such as LNG could be tapped as well. Such incentives, as already used by the Danish TSO, could be in the form of ultimately socialized *payments to owners of gas in storage to keep their gas in storage* instead of withdrawing it.

As a last resort and in duly justified circumstances, in case such economic incentives remain ineffective, introducing disincentivizing withdrawal tariffs for storages or even outright withdrawal caps/limitations for various timeframes throughout the winter may be considered. This should have the aim of ensuring a more prudent emptying of storages especially during periods when markets across the EU are less tight. However, it must be clear that any such tariffs or caps need to be proportionate in view of security of supply risks and should not aggravate the security of supply situation in neighbouring countries.

3. Ensure that infrastructure projects are implemented on time

[36] In line with Article 19.4 of the Regulation (EC) No 715/2009 on conditions for access to the natural gas transmission networks.

[37] At the same time the additional storage injection coming from increased Russian gas imports through Ukraine has brought with it the suspension of exports to Ukraine which is a lamentable consequence.

The Commission welcomes the forthcoming commissioning of the Klaipeda LNG terminal in Lithuania. The existence of such infrastructure enabling supply diversification is vital both in order to diversify supply but also to ensure a more flexible gas network. Therefore it must be ensured that the commissioning of projects scheduled for completion in the coming months is done without delay. Specifically as regards the coming winter, these include the Slovak-Hungarian interconnector (1 January 2015), the Świnoujście LNG terminal in Poland (1 February 2015). Member States should inform the Commission well in advance, specifying the reasons, if delays may be encountered with a view to jointly identifying possible immediate actions that would allow for the elimination or at least minimization of the delay.

ii) Defining clearly when the market stops working and when emergency measures are needed

4. Implement the supply standard obligation laid down in the Security of Gas Supply Regulation

Gas suppliers should be encouraged to prepare responsibly for various supply situations that could occur next winter. Ensuring security of supply is about preparing well for a possible disruption – this is a shared responsibility between public authorities and the industry. The Security of Gas Supply Regulation contains a supply standard that should be honoured, implemented and applied in practice. The European Commission will facilitate the full implementation of all provisions of this Regulation. However, it is for the national competent authorities to enforce the supply standard obligation and to monitor whether suppliers have secured sufficient supplies and flexibility options to supply their customers next winter under various scenarios.

If this is not the case, the national competent authorities should recommend or impose, depending on the tools they have at their disposal under national legislation, to procure additional gas or flexibility options on a commercial basis. As pointed out above, the possibility of additional pipeline gas to the EU is limited and some Member States have limited access to alternative pipeline sources other than Russian. Therefore LNG is the key alternative to increase supplies in case of serious shortfalls. However, in view of commercial and operational considerations, procuring LNG spot cargoes expediently during a crisis can be both expensive and require some time. Therefore additional volumes of gas in storage or contracting some form of "LNG insurance", e.g. in the form of LNG purchase options, can greatly reduce corporate exposure by hedging both price and operational risk.

Consideration may also be given to ways in which LNG purchases by market players can be executed in times of severe supply disruptions in a manner that – while staying true to market principle – does not further significantly deteriorate the economic situation in a given country. Such clearly circumscribed, dedicated cooperative agreements could be envisaged with other major LNG importers such as Japan.

5. For countries which have an increased supply standard, put in place measures to temporarily reduce it in case of regional or Union emergency

The Security of Gas Supply Regulation establishes an obligation on Member States to ensure the supply of protected customers under a series of demanding circumstances. However, it also obliges Member States to identify how any increased supply standard or additional obligation imposed on natural gas undertakings beyond those demanding circumstances may be temporarily reduced, in a spirit of solidarity, in the case of a Union or regional emergency. Any such temporary reduction could free up certain amounts of gas, which otherwise would not necessarily be used, thereby increasing liquidity in the market and possibly alleviating gas shortages in other regions. The analysis of the Preventive Action Plans and Emergency plans[38] shows that some Member States have already put in place detailed provisions for the application of such a reduction. The Commission will work with those that have not to agree on the appropriate measures.

6. Maximize fuel switching potential and ensure operational implementation

Fuel switching capabilities are a key element in preventing and overcoming supply disruptions. While Finland for instance is completely dependent on Russian gas and cannot be supplied with gas from any other source, it has put in place measures to ensure a very broad obligation as regards fuel switching providing a sustainable alternative. The national reports have shown that the fuel switching potential is very different between Member States and the Energy Community Contracting Parties. Given that Member States already plan[39] to switch approximately 10% of their heating needs to renewables, these plans should be advanced using the European Social and Investment Fund, and benefitting from the experience already gained. National competent authorities should ensure that all administrative and operational measures are in place that would facilitate large-scale fuel-switching to take place, particularly in district heating systems, including the testing of facilities to ensure they can effectively switch fuel. Given that this currently concerns largely oil, it is crucial to ensure that the logistical aspects of such a (possibly sustained) switch en masse are planned for ahead, including the possible use of strategic oil stocks under certain circumstances. The same goes for switching to biomass.

In industry, Combined Heat and Power (CHP) units can also be switched off and their production replaced by the heat-only boilers that most industrial CHP plants have as back-up capacity, provided that the electricity produced from CHP can be replaced with electricity from the grid, and that such replacement is financially interesting.

7. Implement short-term energy efficiency and demand moderation measures

[38] According to the Security of Gas Supply Regulation, Member States must establish a Preventive Action Plan, to remove or mitigate the risks identified, and an Emergency Plan with the measures to remove or mitigate the impact of a gas disruption.

[39] C.f. National renewable energy action plans

Achieving an appreciable level of demand reduction by encouraging users to decrease room temperatures or assisting them in undertaking other energy-saving measures can be effective to reduce a supply gap. Public campaigns to that effect have proven effective to absorb, at least in part, sudden supply shortages in the electricity sector following the Fukushima accident in Japan and the explosion of the Vasilikos power plant in Cyprus. Readily-available measures which can be implemented quickly and bear low upfront investment costs include e.g. draught proofing, fitting radiator reflector panels and pipe lagging. These measures can be implemented through various means, including energy provider obligations under the EU Energy Efficiency Directive. In industry, energy demand can be optimised in the short term through the introduction of energy audits and the implementation of energy management schemes.

8. Specify the role of the TSO in emergency situations and ensure that this role is well-understood by the TSO

It should be considered whether it may be necessary to vest the TSO with additional responsibilities, under the supervision of the national regulatory authorities, so as to allow it to go beyond the mere network-centric monitoring of the supply-demand balance and undertake broader preventive or reactive actions to ensure operational security of supply. These actions could possibly involve the TSO carrying out purchases of gas under specific, clearly defined circumstances as well as contracting transportation to its market area and possibly contracting storage capacities. Such a system exists for example in the Netherlands where the TSO is mandated to have gas in storage and release it in case the temperature drops below a certain level.

TSOs having such roles on a national level must coordinate effectively across borders. It must moreover be absolutely ensured that the role of the TSO is precisely circumscribed and explicitly limited to well defined circumstances of market failure. The public service function which would in this case be imposed on the TSO should not breach the fundamental market design feature of the EU internal energy market that TSOs should not be an active participant in the commodity trading or supply market.

iii) Coordinating and cooperating both in emergency planning and possible interventions

9. Need to further develop regional cooperation on security of gas supply

In principle all countries should closely coordinate and cooperate with their peers across the border either to establish interconnections or to ensure that those interconnections can be efficiently used for the benefit of both sides. In certain cases – for instance as regards Greece and Bulgaria – such cooperation should be even broader in view of addressing the possible specific security of supply risk of respective shortages of gas and electricity that could be alleviated by an agreement. Furthermore, regional cooperation may also focus on ensuring

supplies to protected customers such is envisioned between Lithuania and Estonia. Regional cooperation may also relate to the use of storages in the case of emergency.

Consideration may also be given to ways in which LNG purchases by market players can be executed in times of severe supply disruptions in a manner that – while staying true to market principles – does not further significantly deteriorate the economic situation in a given country. Such clearly circumscribed, dedicated cooperative agreements could be developed within the EU but could also be envisaged with other major LNG importers, such as Japan.

10. Need for more transparency

TSOs and national regulatory authorities but also Member States should strive for the highest level of transparency in their actions vis-á-vis each other, stakeholders and the general public. In an interconnected network and in the process of completing the internal market, actions by one Member State or country (or its market players) have repercussions on other markets. In a situation of heightened tensions such as the one we are experiencing currently, all actions may be interpreted in a political light. It is therefore crucial that such actions are explained to allay concerns and build trust.

11. Commission's continued monitoring role and the use of the Gas Coordination Group

The Gas Coordination Group was created in 2004[40] although it was substantially reinforced by the Security of Gas Supply Regulation. In the past years it has become a valuable platform for the exchange of information and discussions on security of gas supply. This, in turn, has contributed to increased transparency and the building of trust among all its members.

The Commission intends to closely monitor the security of supply situation in close cooperation with national competent authorities. It will continue to convene regular Gas Coordination Group meetings to exchange with Member States and stakeholders on the matter and will also use emergency meetings of the Gas Coordination Group to share information and discuss measures taken in the case of possible or actual supply disruptions. The Commission will also coordinate action and ensure that emergency is declared and non-market based measures are implemented in accordance with the Security of Gas Supply Regulation.

Furthermore, as the analysis of the effects of the gas disruption on the electricity sector has been so far inconclusive, the Gas Coordination Group should, with the assistance of ENTSOG and ENTSO-E, follow-up on this matter to determine likely spill-over effects.

12. Cooperation with non-EU countries

The European Commission invited key international energy partners to provide contributions to this Report, particularly any observations or suggestions with respect to the potential flexibility for additional supplies of gas. These partners included the non-EU members of the

[40] Pursuant to Directive 2004/67

G7 as well as Norway, Switzerland, Turkey and the International Energy Agency (IEA). The Commission further invites these key external energy partners, including those with LNG export capacities and potential as well as those importing LNG, to continue the cooperation that has started with this Report, also in the context of the G7 and the IEA.

4.2 Medium term measures (by end 2015)

13. Commission's Recommendation on application of internal energy market rules between the EU Member States and the Energy Community Contracting Parties

Closer cooperation of authorities and consistent application of the EU internal market legislation on the borders between the Contracting Parties and the EU Member States are elements that could improve the security of supply deficits in the Contracting Parties and the EU Member States. Positive examples include the solutions found around the reverse flow from Slovakia to Ukraine. Consistent application of the Third Package internal market legislation is a fundament on which cross-border cooperation can further be developed.

In order to facilitate such cooperation with a formal act, the Commission will issue a Recommendation to the EU Member States to cooperate with the Contracting Parties in application of the Third Package and on questions of security of supply. The Commission stresses however that in the absence of functioning gas markets and lack the of implementation of the Third Package on the side of the Contracting Parties, the recommendations of the EU will not replace the necessary negotiations to take place between the EU Member States and the Contracting Parties in the region on how to use common infrastructure and on which terms it can be used in case of a crisis.

14. Speed up the commissioning and implementing of key Projects of common Interests or Projects of Energy Community Interest

All necessary measures should be taken to speed up and, where applicable, avoid further delays in implementing key infrastructure projects which are deemed to be of crucial importance from a security of supply point of view[41]. These include for instance the Romanian-Bulgarian interconnector, the Greek-Bulgarian, Bulgarian-Serbian interconnector and the Romanian-Moldovan interconnector which the Commission selected on the basis of clear and proximate commissioning dates. These projects should be taken forward swiftly and completed by end 2015. The Commission will follow up such projects and also stands ready to facilitate any outstanding negotiations between parties with a view to push forward all these project towards an expedited completion.

15. Re-evaluation of physical reverse flow exemptions

[41] See projects specifically enumerated in the Commission's European Energy Security Strategy Communication, page 23 and 24

Physical reverse flows allow Member States to be truly connected flexibly with each other. Often such investments are relatively minor but have a significant impact on the security of supply of an entire region, as demonstrated by the investment of in reverse flow on the Yamal-pipeline on the German-Polish border and more recently on the Slovak-Ukrainian border. Member States should work together to reassess whether the circumstances under which exemptions were requested for a physical reverse flow project have not changed particularly in light of the heightened security of supply situation as well as the fact that many Member States have lately significantly benefited from the additional trading and supply options such new trajectories offer. This is particularly the case for the reverse flow capability of some major trunk gas pipelines running today only from the East to the West (Obergailbach, Waidhaus and the BBL interconnector between Netherlands and the UK) as well as for the interconnector between Austria and Hungary.

16. Fuel switching through district heating and cogeneration in the residential/tertiary and industry sectors

District heating networks provides technological flexibility, as they can be run on many and multiple supply sources. Networks built on natural gas can be switched to alternative sources, such as biomass, waste heat, cogeneration, solar and geothermal, heat pumps, municipal waste, etc. The transitions can be implemented in 1-2 years, depending on the specific size and capacity requirements.

Where district heating systems already exist but do not connect all buildings in the area, the expansion of those systems, replacing gas supply to individual gas boilers, can be a cost-effective way to switch to local renewable and other low carbon sources.

Switching industrial Combined Heat and Power (CHP) plants and medium-size CHP in the tertiary sector (hospitals, shopping malls, office complexes) to renewable or low carbon supply sources can be implemented in 1-2 years' time, depending on the specific size and capacity requirements.

Industries with large heat requirements (e.g. pulp and paper) that are auto-producers, based on gas-fired CHP or/and heat-only boilers, could also invest in flexibility to store heat or switch between heating based on gas and heating based on electricity. This would be profitable if it would be flexible enough to benefit from low prices in times of excess (renewable) electricity production.

17. Heat demand reduction in industry and energy transformation

Industry and the energy transformation sector (generation, distribution) have large potential for energy efficiency measures that reduce demand at low cost with short (less than 2 years) pay-back time, for example by better process-monitoring and control, preventative maintenance. Identifying the short-term low or zero cost energy efficiency improvement potentials requires speeding up the implementation of energy audits or energy management systems under the Energy Efficiency Directive in the energy intensive industries.

5. NEXT STEPS

Experience with the application of the Security of Gas Supply Regulation indicates clear improvements in the EU security of supply situation since 2009 but also further margins for strengthening the EU's regulatory framework. As stated in its European Energy Security Strategy of 28 May 2014, the Commission will review existing mechanisms to safeguard security of energy supply and propose their reinforcement, where necessary.

In parallel the Commission intends to (continue to) work together with specific (groups of) Member States in order to develop solutions to issues that were identified as potential risk factors in the course of this stress test exercise.

Consequently the Commission intends to pursue the above recommendations via two separate work streams. Firstly, it intends to set up – together with ACER and ENTSOs – permanent monitoring of the implementation of the short-term recommendations and provide – where necessary – assistance in facilitating or driving forwards projects and discussions. Furthermore, it will continue working with Member States, the European Parliament and stakeholders to define the key objectives of security of electricity and gas supply for the EU in the years to come.

Rome Initiative – Action Item N° 4

"Working with institutions such as the IEA, the International Renewable Energy Agency and international financial institutions, we will supply technical assistance, including leveraging the private sector, and facilitate exchanges with Ukraine and other European countries seeking to develop their indigenous hydrocarbon resources and renewable energies, and improve energy efficiency."

Canada - Activity: Assessment mission to Ukraine in the field of geological and geoscience capacity

Natural Resources Canada (through the Earth Sciences Sector) collaborated with US Geological Survey (USGS) to undertake an initial assessment of the geological and geoscience capacity of Ukraine to explore which steps Canada and the United States can take to help Ukraine be able to provide independent, authoritative and quality advice as well as primary information to other public agencies as well as industry and academia to make informed decisions affecting economic development and environmental sustainability.

This mission took place from September 6-12, 2014, in Kiev; discussions were conducted with Government of Ukraine agencies, state enterprises, academia as well as retired experts within civil society. This initial assessment included considerations of the current state of governance of the various state administrations of geological science, the management of geological and geoscience data, previous reform efforts as understood by the key agencies involved including state enterprises, Ukraine's current approach and management of Open Data, information sharing and use by the private sector for purposes of exploration and development, and the capacity of one learning institution to support a robust extractives sector with a skilled workforce.

Ukraine has an established base of trained geologists as well as a recognized tradition of achievements in this field, and considerable technical expertise and scientific knowledge.

However, Ukraine needs to build a modern geological survey agency that plays an impartial and objective role to provide reliable and accessible data to the extractives exploration and investment community. Consequently, significant reforms need to be undertaken. These reforms should be targeted on the following:

- New client-oriented policies, standards and practices on Open Data that protect the public interest
- A new legal mandate and strategic vision of a modern geological survey agency
- A modern management framework appropriate for an independent geological science agency
- Centralization of or open access to all geologic data collected with public funds
- Incorporate use of Multidisciplinary tools and approaches in data analysis and interpretation

Next Steps

Follow up steps include inviting senior level officials from Ukraine to Canada and the US in March 2015 to understand how the role of modern geological surveys in the mapping and assessment of energy resources, and how they interact with regulatory authorities for exploration and development. A second assessment visit to Ukraine is planned for late March or April 2015.

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Canada - Activity: Support Ukraine's development of regulatory frameworks to stimulate the development of its domestic unconventional oil and gas resources

Ukraine is well-endowed with energy resources. It is a major coal producer with production sufficient to cover most domestic demand. However, Ukraine is very dependent on gas and oil imports, particularly from Russia. The country consumed 58 billion cubic meters (bcm) of natural gas in 2011. Natural gas demand in Ukraine has declined by over 20% since 2000, and estimates suggest demand fell to nearly 50 bcm in 2013. Ukraine produced approximately 20 bcm of gas in 2011, accounting for over one-third of domestic consumption.

Ukraine has substantial yet largely untapped natural gas reserves. The International Energy Agency estimates total natural gas reserves at 1.1 Trillion cubic meters (Tcm) of proved reserves, and a U.S. Energy Information Administration in a global shale resources study using data from the Government of Ukraine estimated Ukrainian unconventional gas reserves at 7 Tcm.

In an effort to support the Government of Ukraine develop a competitive and streamlined regulatory framework to ensure responsible resource management and development of its natural gas reserves, Canadian officials from the Alberta Energy Regulator (AER) took part in a Canada/UK/Shell Conventional Energy Resource Regulatory workshop in Kyiv on 4 December 2014. Officials of the AER also undertook a 3-day scoping mission prior to the workshop to identify key barriers to oil and gas industry investment and to better understand the Ukrainian regulatory framework and areas which could be adapted to improve its competitiveness, clarity and transparency.

Canada believes that its long-standing experience regulating the responsible development of its natural resources could serve the Government of Ukraine well as it seeks to adapt and modernize its own regulatory framework to stimulate investment in domestic resource development and reduce its natural gas import dependency. In Canada, the Alberta Energy Regulator ensures the safe, efficient, orderly, and environmentally responsible development of hydrocarbon resources over their entire life cycle. This includes allocating and conserving water resources, managing public lands, and protecting the environment while providing economic benefits. Energy regulation in Alberta spans more than 75 years and has evolved over time. This evolution continued in 2013 when the AER became the single regulator of energy development in Alberta—from application and exploration, to construction and development, to abandonment, reclamation, and remediation.

Next Steps

The United States and Canada, in coordination with Ukrainian authorities, are developing Unconventional Gas Workshops to assist the Government of Ukraine in the development of its regulatory, fiscal and environmental framework in support of sustainable unconventional natural gas development. A government-to-government only workshop with the Ukrainians tentatively scheduled for March 2015 intends to share the North American experience with establishing regulations and putting into place strong environmental protection best practices in support of sustainable unconventional natural gas development in Ukraine.

Rome Initiative – Action Item N° 4

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Canada - Activity: Assessment mission to Ukraine in the field of energy efficiency

At the invitation of the Federation of Canadian Municipalities, the Department of Natural Resources Canada (NRCan) participated in a mayors' forum in Odessa in mid-September 2014. The annual Ukrainian Municipal Forum (September 18-19, 2014 in Odessa) was organized by the Association of Ukrainian Cities with support of the Federation of Canadian Municipalities. The President of the Federation of Canadian Municipalities and Mayor of Fredericton as well as a high level municipal officials from Edmonton attended as well. Also attending were over 300 municipal and federal Ukrainian officials whose constituents are increasingly concerned about energy security.

At the request of their Ukrainian counterparts, the Federation of Canadian Municipalities created an agenda item at the Association of Ukrainian Cities Municipal Forum on energy efficiency as a means to improve energy security, economic development and environmental performance. NRCan's objective was to use interaction with Ukraine's mayors, federal, regional and aid group officials to gather facts on how Canada might assist Ukraine to improve energy efficiency in the short and longer term. Ukraine has many fundamental issues which need to be resolved before energy efficiency can provide benefit on a large scale (e.g. ownership of residential buildings is split between many parties; laws make natural gas fuel substitution difficult).

Meetings helped to define more precisely Ukraine's energy efficiency needs and determine targeted solutions Canada could provide unilaterally and in conjunction with the United States. NRCan has many tools that could be useful. Short-term measures include practical training for city and business officers on how to quickly realise low cost energy-savings. Longer term, building codes and Canadian expertise with tools for cold northern climates could be relevant to Ukraine.

Potentially useful NRCan tools include:

- Dollars-to-$ense training materials for municipal and industrial energy managers to systematically identify and implement low cost energy-saving opportunities;
- Certification schemes for auditors of energy management systems;
- A systematic framework for businesses to actively optimize energy use; and
- Energy codes for new buildings, building performance modelling software and benchmarking tools for existing buildings.

The Mission helped in assessing Ukraine's energy efficiency needs and matching them to Canadian strengths, laying the foundation for future targeted Canada-Ukraine collaboration.

Rome Initiative – Action Item N° 1

"G7 members will work to complement the efforts of the European Commission to develop energy emergency plans for winter 2014-2015 at a regional level."

Germany - Activity: technical support to Ukraine

The cooperation in the field of the energy sector is one of the 3 strategic pillars of the German bilateral cooperation with Ukraine. Together with the Ukrainian authorities it has been decided to focus thereby on the field of energy efficiency, renewable energies as well as on the revitalization of damaged infrastructure related to energy production and transport in the Eastern part of the country. The cooperation combines technical and advisory assistance with financial support for investments, pilot projects and revitalization of energy related measures. Germany (i.e. German public institutions) implements currently projects and investments with a volume of about 150 Million Euro in the energy sector in the Ukraine. Technical assistance is mainly provided in the field of advising central and municipal authorities in the field of energy management and energy efficiency. For the next year additional support is being planned explicitly to improve energy efficiency standards within public buildings, i.e. hospitals. Financial assistance is mainly provided for modernizing insulation of buildings, revitalization of transport facilities, energy efficient modernization of machinery, investments in biomass power stations, wind parks and hydroelectric power stations.

The German government supports the reconstruction in the Eastern part of Ukraine with an untied loan scheme of additional EUR 500 M€. The amount of EUR 300 M€ thereof will be used for infrastructure projects and – to a large extent – in particular for the rehabilitation of energy related infrastructure that has been damaged or destroyed in the course of the conflict in the Eastern part of Ukraine. Currently representatives from the involved German ministries and the Ukrainian authorities are jointly identifying priorities and targeted investment fields. Initial talks have taken place with the relevant Ministries in Kiev on 21 October and 22 October 2014 (fact-finding mission). They will be continued with the new government. Within the bilateral German-Ukrainian High-Level Group on Commerce and Trade the Ukrainian counterparts have requested assistance in the field of regulation of gas networks, power grids and energy efficiency. Germany has proposed the establishment of a separate bilateral subworking group for energy issues.

The German government has been supporting a number of capacity-building projects to create an enabling environment for scaling up energy efficiency and the use of renewable energy in Ukraine. This includes, amongst others, support to the Ministry of Regional Development for establishing regional energy agencies in Ukraine including the development of sustainable business concepts for municipal energy efficiency services (piloting approach), support for developing a strategy for low-carbon growth in Ukraine by means of complex economic models to identify most efficient approaches as well as the promotion of pilot bioenergy projects, which demonstrate economically and technically feasible solutions for scaling up the energetic use of residuals from the agricultural sector.

Moreover, the German government is about to launch a pilot project in Lviv, which aims at developing and implementing a comprehensive energy efficiency modernization concept for municipal heat supply along the entire supply-demand chain (including buildings) in a selected neighborhood in cooperation with a project by the European Bank for Reconstruction and Development.

Furthermore, the German government together with the Ukrainian Government and supported by EBRD has elaborated a concept for an investment program for "turning subsidies into investments", which shall contribute to scaling up energy efficiency in the municipal heat supply, reducing gas consumption and related subsidies. The program will include a 900 Million Euro investment program with the support of 200 Million Euro donor funding. In support of this initiative, the German government is ready to contribute initial funding of up to 20 Million Euro.

Rome Initiative – Action Item N° 4

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Italy - Activity: Assessment mission to Ukraine in the field of efficiency measures and follow up

The Italian assessment mission, headed by the Ministry of Economic Development, that visited Kiev on the 30th of September and the 1rst of October 2014 as a follow up of the "G7 Rome Initiative", had numerous meetings in order to get qualified information about the needs for energy efficiency, specifically in the Ukraine public and residential sectors.

The energy efficiency sector is still in its first legislation stage and many requests for technical assistance came out from the Ukraine side. Ukraine energy Authorities expressed also their interest towards energy efficiency policies and support schemes, developed by G7 Countries such as the White Certificates system. The Ukrainian Ministry of Regional Development has prepared a draft law for the energy certification of the buildings, which will be mandatory from 2015 for all public buildings.

The experience of the G7 Energy Saving Companies (ESCO) could be useful not only for the efficiency measures to be taken, but also to assist Ukraine Government in further regulatory aspects. The meetings revealed that the low development of the energy efficiency sector in Ukraine was caused by (i) the absence of a legislation on ESCOs and a lack of involvement of the private sector; (ii) the subsidised and very low price of electricity (about 2,4 €cents/kWh paid by final customers); (iii) the difficulties in identifying the ownership rights of the private use buildings (Parliament is currently discussing a bill in to define the ownership of the housing units). Despite the shortcomings of energy efficiency sector, some interventions on private buildings were implemented in order to raise the values of property.

Moreover the national energy situation and the commitments and objectives towards renewable energy sources (the current production from RES is equal to 2% with the aim of increasing it to 11% in 2020), has revealed an interest in developing renewable energy systems through the introduction of new incentive models. The incentives currently in force have a feed-in tariff system of about 40€cents/kWh depending on the various sustainable energy sources, and the needs to use "made in Ukraine" products and components for 50% of the investment limit the development of foreign investments.

Renewables are an untapped potential and their development is a priority expressed by all Ukrainian counterparties. In Ukraine the installed capacity is 800 MW of PV with the target of reaching 3GW in 2020, while the installed bioenergy capacity is equal to 20 MW with the goal of reaching 1 GW.

Follow up

Due to the strong interest of the Ukrainian public counterparts in technical assistance on efficiency measures the possibility to host an official Ukrainian delegation on a study tour in Italy in early 2015 is being developed. Technical assistance is requested on the following topics: White Certificates, renewable energy heating and cooling supporting schemes, involvement of the private sector through the role of the Energy Service Companies (ESCOs), management of incentives and tax breaks, monitoring of installations and production of electricity from RES.

International Energy Agency

IEA – G7
Recommendations for enhancing gas supply security

April 2015

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IEA – G7 Recommendations for enhancing gas supply security

Executive Summary

The 2014 May G7 summit requested the IEA to formulate recommendations to enhance gas supply security. The analysis has drawn upon the IEA's energy security mandate and they are consistent with the IEA recommendations made during the In Depth Review of EU Energy Policy in 2014.

Natural gas has a growing role in the global energy system and is crucial for maintaining both electricity security as well as residential winter heating in temperate climates. Resources are sufficient for decades, but infrastructure constrains lead to more rigid and less connected markets than oil. Given the significant regional discrepancies, the recommendations the IEA formulated should be seen as menu of policy options of which some might not be justified in some countries given the local geographical and policy context. Due to the regional rather than global nature of supply security exposures a coordinated strategic stockpile policy modelled on oil is not justified. The increasing use of gas as a balancing fuel for renewables and the depletion of conventional reservoirs create additional infrastructure need. The first set of recommendations aims to enhance flexibility and market functioning: An adequate pipeline infrastructure with reverse flow capability and market based capacity allocation has a key contribution to supply security. Regulatory measures should encourage demand side response and storage utilisation.

While the analysis was not narrowed exclusively on Russian gas dependency, it is relevant that under IEA baseline projections Europe's gas imports from Russia will increase further. The growth of renewables is significant but fails to compensate for the simultaneous decline of coal, nuclear and domestic gas upstream. The second set of recommendations aim at more effective diversification. LNG as the only intercontinental gas transportation option plays a crucial role. Policy efforts to create a more transparent and liquid LNG market should be continued and completed. LNG importing regions should ensure adequate internal infrastructure from the terminals to demand centres. For pipeline gas, the Middle East and the Caspian could potentially play an important role, but it depends on a deeper energy diplomacy engagement and investment facilitation. There are mutual benefits in enhancing energy efficiency and deploying renewables in key gas exporters.

Given the strong interactions of gas across the energy system the third set of recommendations aims to address gas supply security concerns by promoting an efficient energy system with diversified primary energy use. The most important is the transformation of the building sector by accelerated energy efficiency retrofits as well as renewable heating. In countries that chose to use this option nuclear power could play a major role in reducing gas import dependency, but policies need to be designed that facilitate investment. Wind and solar deployment could constrain power generation gas demand around half of the current in Europe. But a flexibility oriented redesign of the power system and better transmission links are essential.

The IEA does not advocate and would not support policies that enhance gas supply security at the price of jeopardising climate change targets. In fact given the strong contribution of energy efficiency and low carbon energy sources in reducing gas dependency the IEA gas supply security recommendations overall have a negative impact on CO2 emissions compared to the baseline, although insufficient for a 450ppm stabilisation that requires additional policy action.

Introduction

The 2014 May G7 summit -- convened in the context of the escalating conflict in Ukraine -- requested the IEA to conduct a comprehensive analysis on current gas supply security challenges and to formulate individual and collective recommendations to enhance gas supply security. The analysis has drawn upon the IEA's core energy security mandate and market analysis. This paper provides a summary of the analysis and key findings which are elaborated in the background papers in greater detail.

Natural gas has a growing role in the global energy system and is crucial for maintaining both electricity security as well as residential winter heating in temperate climates. Due to the social sensitivity of supply security in these fields, gas security is rightly on the policy agenda.

Geological resources of natural gas are sufficient to cover projected global gas demand for decades. On the other hand, due to the physics of gas transportation, gas infrastructure is several times more capital intensive than oil infrastructure, leading to more rigid and less connected global markets and a higher likelihood of region-specific exposure to risks resulting from a single supply source. Due to the persistence of segmentation by infrastructure bottlenecks and logistics costs IEA baseline projections do not assume the emergence of a seamless global natural gas market in the foreseeable future. As a result, IEA member states and regions have broad differences in gas market fundamentals, resilience and potential exposure to supply security risks. In addition, gas has strong interactions with the electricity system where regulatory systems, technology and capacity choices are country or region specific. Consequently the IEA recommendations should be interpreted as a menu of possible policy options that need to be fit into both the country specific supply security assessment as well as the regulatory institutions and industry structure of the given country. The recommendations are not assumed to be all applicable in every individual country in all circumstances.

In a decarbonising energy system, gas is increasingly used to balance renewables. This leads to a more rigid gas demand with less demand side response capability. As the coal – gas interaction of the conventional system is replaced by the wind (solar) – gas interaction of a low-carbon system where gas is used only when the renewable resource is not available, the ability to switch to another fuel at short notice in the case of a market disruption declines. As a result, the contribution of gas to a low-carbon system requires a more resilient gas infrastructure.

Conventional gas fields provide swing production capability. However, they have been increasingly replaced by long distance imports (in Europe) or shale gas(in North America) which have considerably less short-term upswing potential. Structural changes on the supply side reinforce this transformation on the demand side to create more rigid gas markets and call for an enhanced infrastructure and storage flexibility. The first group of recommendations (Cluster A) aim at enhancing short term resilience, gas storage and demand side response.

Under IEA baseline projections, Europe's gas imports from Russia will increase further. The growth of renewables is significant but fails to compensate for the simultaneous decline of coal, nuclear and domestic gas upstream. Given policy and infrastructure constraints in the Middle East and the Caspian, pipeline diversification (the Southern Corridor) will not reach a transformative scale, at least in the medium term. Global LNG supplies expand, but under baseline projections, Gazprom

retains the ability to price out North American LNG from the European gas market if it chose to do so. The IEA does not form a judgement on the possible interactions between Russian gas exports and Russian foreign policy, but only evaluates the possibilities for reducing European dependency on Russian gas should European policymakers set this goal. The main measures analysed as means to lower dependence on Russian gas are the following:

- Transforming the building sector by energy efficiency retrofits and deployment of renewable heat.
- Further increasing the deployment of wind and solar into the power system and maintaining nuclear as a viable low-carbon component in countries that choose to do so, which together would constrain gas-fired power generation to the level necessary for system balancing and cogeneration.
- Applying "Golden Rules' for shale gas which, instead of blanket bans, would allow shale development while maintaining high environmental and safety standards.
- Enhancing efforts for diversification and infrastructure development beyond the current approach with a special focus on Azerbaijan, Iraq and Turkmenistan.

Several of the proposed measures (Cluster B aiming at a diversified and efficient energy system) are low-carbon and would have additional benefits from the point of view of EU climate policy as well. Overall, the "Dependency Reduction case" would have significantly lower emissions than the current baseline due to the strong component of energy efficiency and renewables, although not at the level of a 450ppm pathway. A detailed assessment of investment costs and impact on interregional trade flows would require further analysis.

LNG plays a crucial role as it increasingly links the major regions and could enable a global response to a regional shock, such as the way European coal power plants enabled reduction of EU LNG imports and LNG redirection to Japan. The emergence of Australia and North America as major LNG suppliers will lead to a more efficient and competitive gas market, but the supply side investments need to be accompanied by a coordinated effort to remove the institutional and contractual barriers to more liquid and efficient LNG trade. On the other hand, since no LNG exporter is likely to adopt a Saudi-style policy to maintain swing production capability, LNG markets could only redirect existing supplies over the short term. For example high spot prices of the past three years have failed to trigger a meaningful short-term supply upswing. Nevertheless, by efficiently linking regions, they improve supply security as supply-demand adjustment in a distant region can respond to a disruption.

The structural changes in the energy system mandate a new approach to gas supply security. Moreover, the Ukraine conflict has the potential to change the energy security perception of Russian gas, which is -- and in the baseline case would remain -- the biggest export source for international gas trade. Consequently the recommendations included in this analysis (Cluster C) also focus on addressing these new challenges and look at ways to enhance market efficiency and incentivise diversification in order to reduce dependency on a single supplier.

Ukraine itself is facing an energy security crisis that is qualitatively different from the energy security risks of IEA member states. Reverse flows from the European Union are especially important as an alternative supply source for Ukraine as neither other pipeline nor LNG alternatives are feasible in the medium term. Given that the Energy Community expands the single market to Ukraine, contractual as well as non-market based efforts to limit reverse flows to Ukraine should be countered by a vigorous enforcement of EU competition law. The current Ukraine – Russia gas agreement should be sufficient to maintain gas supplies in Ukraine during winter 2014/15, but given the overall lack of conflict resolution, it is not guaranteed to hold. Even if it does, a substantially larger volume will be needed from spring 2015 to refill Ukrainian storages.

Short-term crisis management should not distract from the longer term task of putting the Ukrainian energy system on an economically sustainable path. In addition to reverse flows, the EU in cooperation with other G7 countries should be prepared to provide a substantial and persistent assistance for the modernisation of the energy sector, with special focus on regulatory and policy institutions, end user efficiency, domestic gas production as well as modern clean coal technologies.

Notwithstanding the need to enhance reverse flow capacities within the EU and on the EU-Ukraine border, even the current infrastructure could deliver substantial quantities of LNG to the regions that are dependent on Russian gas. If, in the case of a pipeline disruption, Europe increased LNG purchases, markets would have to redirect existing supplies, especially from Asia. In recent years, Europe's LNG imports have fallen by half as markets reacted to a sudden demand jump in Asia. Europe replaced LNG imports by switching to coal in the power sector and ramping up pipeline supplies from Russia. Unfortunately, such a cost efficient and scalable fuel switching or alternative supply option does not exist in Asia, so reducing Asian LNG consumption would not be straightforward.

Asian gas demand is price inelastic, with switching to oil-fired power generation being the only large-scale demand response capability. Given the structure of the power systems in the Asian LNG importing countries, their oil switching could supply the LNG quantities that Europe would need in the case of a disruption of Ukrainian transit, but only at high spot prices. LNG spot markets function with increasing efficiency and, in the case of rising European hub prices, they would be able to readjust without a policy intervention. However, any price cap or administrative regulation would prevent market adjustment.

In the medium-term time horizon, large Australian projects will come online and provide new baseload supply for Asian buyers reducing their spot purchases, and North America will emerge as a new, flexible spot LNG source. LNG supply is projected to expand more rapidly than demand in Asia and other importing regions, allowing for a recovery of EU LNG use. Undoubtedly this will greatly enhance the energy security contribution of LNG, but it should not lead to complacency. In the medium-term horizon, the amount of North American LNG that is projected to arrive in Europe is roughly equivalent to the decline of EU gas production, leaving the need for other gas sources intact.

Recommendations for collective and individual action for enhancing gas supply security

Cluster A: Measures to improve better short term resilience and demand side response.

1. ***Let the market do its job.***
   Governments must ensure that price signals achieve optimal reorientation of gas flows, demand response and storage operations by avoiding such interventions as price caps and export restraints.
   Efficient, competitive markets are generally the best platform for gas supply security. In efficient markets based on adequate infrastructure changes in spot prices will reorient gas flows, motivate demand side response and together with a liquid forward price signal incentivize storage operations. Given the limited elasticity in a gas system, this means very high spot prices in the case of a supply disruption. In such cases, governments generally should refrain from intervention for political or social reasons. Price caps prevent demand side response and interfere with the allocative role of spot prices. Their application requires administrative allocation of gas supplies and regulatory decisions on storage which are very likely to lead to inferior efficiency compared to market based outcomes. There are narrow instances where excessive geopolitical risk, market power or security externalities lead to clear market failures. Those might necessitate special regulatory measures such as ranking of consumers with different levels of protection from disruption. However, such regulatory exemptions need to be well-defined in a transparent manner as a part of a prepared crisis management plan rather than introduced in an arbitrary fashion during a disruption. In the European context, the effective functioning of the single market which enables the utilisation of storages and available LNG supplies optimised on a continental scale is essential to mitigate the economic and social consequences of a supply disruption. Consequently restrictive measures such as export bans are harmful as they would undermine the ability of the market to function and would prevent solidarity in crisis management.

2. ***Maintain the dual fuel capability of gas-fired power generation***.
   Governments should consider policies to mandate operators of gas-fired generation plants to add dual fuel capability, which can be done without large investment costs.
   The largest gas demand side response potential is fuel switching to oil in power generation and combined heat and power. Oil has been declining as a power generation source for decades, and had all but disappeared in a number of IEA member states. Given the cost and environmental impact of oil burn, this is overall a positive phenomenon and the return to medium load factor mid-merit generation running on oil is neither desirable nor feasible. Nevertheless, for short-term emergencies, oil-fired power generation still has a valuable supply security contribution due to easy storability, well developed infrastructure and liquid global markets of oil products. In Japan, it would have been impossible to maintain electricity supplies since the Great Earthquake without the oil-fired units that are still in the

system (many with an average age over 40 years). 1970s vintage gas-fired steam plants routinely had the ability to switch to heavy fuel oil, usually with only a couple of hours' notice.

Combined cycle gas turbines (CCGTs) that have dominated investment since the 1990s can have the capability to switch to jet fuel, but do not switch under normal market conditions without a regulatory obligation; only a minority of these newer units decide to invest in this capability. Since the previous technology generation of gas-based steam plants are being progressively decommissioned, the gas fleet will have less and less fuel-switching flexibility, with potentially negative consequences on gas supply security. Some IEA member states have a regulatory policy to mandate fuel-switching capability as a licencing condition for CCGTs; this should be considered as a potential measure to improve gas supply security.

3. In the European context, this step alone is likely to be insufficient. Due to systematic excess capacity, deficiencies in electricity market design and the very challenging experience with the business model of CCGTs, a significant scale of new investment into CCGTs is extremely unlikely in the next decade. Consequently, a regulatory condition applied on new investment is unlikely to have a meaningful impact. Retrofitting existing CCGTs to dual fuel capability is possible and not expensive at around 3-5% of the original investment cost. The most significant challenge is usually the provision of oil supply infrastructure, especially in urban regions where many CCGTs are located. Despite this drawback, such an investment can provide a large demand-side response capability at short notice and, given the large cost differential between gas and oil storage, it is potentially a cost efficient flexibility solution. But while the investment cost is small, if there is no private market to finance it, there would have to be a regulatory intervention. Such an intervention should not be undertaken in isolation from the broader considerations of electricity market design. There are serious concerns over the ability of "energy only" wholesale markets to provide a viable business model for flexible power generation in the context of rapidly growing renewable generation. Consequently a number of jurisdictions have introduced or are considering capacity mechanisms, strategic reserves long term contracts or similar measures in order to maintain the investment viability of flexible gas plants. Such interventions typically result in additional cash flows for gas plants over electricity wholesale market sales and any measure to finance fuel switching capability can and should be integrated into these regulatory measures. Governments should review their oil infrastructure and gas storage possibilities. If the maintenance of fuel switching capability is seen as desirable they should implement policies that are properly integrated with their electricity market design. ***Maintain gas to coal substitution capability without jeopardising climate change objectives***.

Governments should establish a mechanism for requiring and possibly financing utilities to maintain retiring coal power plants in cold reserve instead of demolishing them.

A conventional power system has an elastic, price-driven substitution between gas and coal-fired power generation. Given the lack of geopolitical risk and almost free storability of coal, this is a powerful contribution to flexibility and gas supply security. The upswing in European coal-fired generation in 2011/13 played a critical role in maintaining energy security in Japan by enabling Europe to reduce gas demand and thus redirect LNG. Even with abundant shale

gas resources, without coal swing production in the winter of 2013/14, the US energy system would have been stretched to maintain supply security during the polar vortex.

In both Europe and North America, the aging coal fleet is facing accelerated decommissioning due to environmental regulations and the price driven coal – gas substitution is progressively replaced by a rigid gas – renewables interaction when gas dispatch and, consequently, demand are determined by renewable production patterns rather than relative prices. This is a potentially significant challenge for gas supply security. Unfortunately, the large-scale continuing operation of those low efficiency old coal plants is not compatible with environmental objectives, as was highlighted in the four key IEA recommendations for immediate climate action. On the other hand, given the easy storability and lack of geopolitical risk of coal there are possible policy measures to safeguard their potential crisis management contribution. Due to the robust design of that generation of coal plants, keeping them in cold reserve instead of demolition is not expensive -- only a couple of percent of the long-term marginal cost of a new plant, since capital costs have already been depreciated. Given other short-term flexibility options -- such as linepack gas or storage -- they do not have to have the capability to come online on an hourly basis, but they can plug the gap in the weekly time horizon between the depletion of storages and the resolution of a supply disruption. A temporary suspension of emission limits on local air pollutants in a gas supply security emergency could be a justified policy given the temporary nature of excess pollution and the high social and economic costs of a supply disruption. Similar temporary suspension of some environmental regulations such as fuel quality standards have been applied in the United States as a crisis management response to the Rita Hurricane in 2005. In the current EU context even a temporary relaxation could be legally difficult under the Large Combustion Plant and the Industrial Emission Directives, so if a coal cold reserve is deemed as a suitable policy legislative steps might be needed. Similar to the considerations about oil dual fuel capacity, policies on coal fuel switching should not be undertaken in isolation from broader electricity market design. A suitable mechanism would need to be designed to finance the maintenance of cold reserves in the context of electricity capacity mechanisms and strategic reserve policies of countries that adopt them.

An emerging fuel switching capability is gas to biomass. In contrast to wind and solar, biomass plants can store their fuel, and can provide flexible balancing as well as gas demand side response. Unfortunately, in most IEA member states, this potential flexibility is lost since the prevailing renewable support mechanism, typically a feed-in tariff, rewards every kwh and consequently the incentive is to produce baseload from biomass. Governments should review their renewable support schemes and make sure that biomass plants have the incentive to mobilize their flexibility and react to market signals.

4. ***Strengthen gas storage.***
   Policymakers should review and redesign current regulations and tariff structures to give stronger incentives to gas storage investment and storage fill.
   Gas storage can make a very powerful contribution to supply security. Gas storage was the single most important channel for responding to both the 2009 Russia – Ukraine gas disruption in Europe and to the 2013/14 polar vortex in North America. Europe has

expanded gas storage capacities; increasingly well-functioning gas markets have provided strong incentives for storage fill in the run up to the 2014 winter. In a theoretically perfect market, spot and forward price signals would create an incentive to store gas, and widening price differentials create incentives for new storage investment. Unfortunately, it is debatable whether this perfect market case is an adequate basis for regulatory policy. While winter – summer demand fluctuations are typically well reflected in the forward price curve, the possibility of low probability – high impact events -- such as a transit disruption or a sudden demand upswing -- is not necessarily. In Japan and Korea, geology constrains gas storage options while in Europe, the overwhelming majority of gas storage capacity has been designed for a winter – summer cycle and has a rigid operation. Raising the peak withdrawal rate compared to the mobile capacity (the gas stored annually) and enabling multiple cycles is a very significant additional investment; many storage operators would be reluctant to commit this financing on the basis of forward price signals only. In the absence of very high balancing charges that reflect the social and economic cost of a disruption, market participants could have an incentive to undercontract and rely on spot markets; but this, in turn, could lead to liquidity disappearing in less than perfect markets.

The experience of countries that adopted strategic stockpile policies has been that it is a rather expensive policy and is difficult to set up without causing market distortions. While governments in especially exposed regions might consider strategic stockpile policies, recommending it as an overall IEA best practice does not appear to be justified. In certain systems with more rigid demand and high levels of dependency and infrastructure risk it could be a legitimate initiative. Nevertheless, even for Central Eastern Europe expanding reverse flow interconnections with Western Europe appears to have a more powerful crisis mitigating impact than a strategic stockpile policy. Should governments decide to introduce it, a strategic stockpile policy has to be carefully designed to avoid market distortions.

On the other hand, there are options to fine tune the regulatory policies to improve the supply security contribution of storage. Transmission tariffs could be redesigned to improve the business viability of gas storage. In several countries, storage tariffs are regulated which creates the opportunity to design tariff bands that incentivize a higher level storage fill, taking into account the high fixed costs of storage facilities. Better interconnections and market integration enables the optimal utilisation of storage capacities on a regional or even continental basis provided that institutional guarantees maintain the functioning of the single market even in crisis situations. Governments should maintain trust in market functioning. At the same time, market participants need to be confident that their title for gas stored in another country will be respected even in a crisis situation, with governments refraining from intervening in storage allocation and interconnection flows in order to gain security benefits at the expense of their neighbors.

Cluster B: avoid overreliance on gas by maintaining an diversified and efficient energy system

5. ***Transform the building sector.***

Governments should accelerate energy efficiency improvements and deployment of low carbon heating systems in new and existing building stocks.

In key regions including the European Union and the United States, building heating is the single biggest component of gas demand, significantly exceeding power generation. Building sector heating demand is temperature dependent, it has a very high cross correlation in a given region and it is rigid due to the lack of short-term substitution possibilities. It is also a socially and politically sensitive component of energy use. As a result, its importance for energy security is probably even higher than its share in energy balances. There is a general understanding that the building sector offers a large and cost-efficient energy efficiency potential; unfortunately practically no country is on track to achieve this. Governments should redouble efforts to accelerate energy efficiency improvements, especially through the refurbishment of the existing building stock. This will require strong policies, information dissemination, and careful management of the energy efficiency supply chain as well as the provision of creative financing solutions to tackle credit rationing problems. In addition to the improvement of energy efficiency, further efforts are needed to accelerate the deployment of low-carbon heating systems such as renewable heat and electric heat pumps. Very often the policies on renewable heat and heat pumps lack ambition and are hindered by transaction costs, investment barriers and inadequate financing. Governments will need to make sure that the policy attention and financial resources committed to renewable heat are proportional to its potential contribution to emission reduction and gas supply security.

6. ***Continue to deploy wind and solar into the power system while maintaining electricity security.***

Governments should establish an electricity market design and regulations to allow higher penetration of variable renewable sources to fully achieve their potential security and sustainability contributions.

Wind and solar deployment has already had a major impact on both CO_2 emissions and gas supply security: without wind and solar deployment, the emission reductions achieved to 2013 would have increased EU gas imports by 80 bcm, and would have driven up US domestic demand by a further 50 bcm, jeopardising the energy security contribution from US LNG exports. While the improving cost efficiency of wind and solar technologies is a major achievement, large-scale deployment necessitates a system transformation to facilitate the integration of variable production. The beneficial impact of reducing import dependency must not be achieved at the price of deteriorating electricity security. In a number of IEA member states, including Japan and Germany, electricity grid constraints and system operation difficulties are a more serious obstacle to wind and solar deployment than the cost of support policies. In order to fully achieve the potential energy security and sustainability contribution of wind and solar power, a system transformation is needed. Instead of rigid, infant industry policies, renewable support schemes should increasingly create incentives for system-friendly deployment by exposing wind and solar to price signals from a technology neutral balancing market as well as to location signals that incorporate network bottlenecks and costs. Electricity system operation should embrace the capabilities

of modern IT systems with close to real-time system operation and grid monitoring. Enhancing interconnection capabilities and integrating control zones enable a more cost-efficient and secure renewable deployment. Retail market regulation and metering policies should encourage a more elastic demand side response. Last but not least, flexible conventional balancing capacity -- especially gas turbines -- will remain essential to maintain grid stability for decades to come. As a result, an electricity market design is needed that maintains the investment viability of these capacities, taking into consideration their evolving role in the power system.

7. ***Maintain the viability of nuclear power in countries that decide to rely on it.***
Governments with policies to continue reliance on nuclear power should adopt regulatory systems to ensure investments in the nuclear sector without compromising safety.
In both the EU and the US, nuclear generates over three times more low-carbon power than wind and solar combined. In Japan, even the current ambitious renewable policy will not reach the scale of the pre-earthquake nuclear production for decades. Uranium supplies are secure and well diversified, and several months' fuel supply is routinely stored at the plant sites. IEA member states have strong domestic technological capabilities for nuclear power generation and the fuel cycle. Nuclear plants generate baseload power that is straightforward to integrate into a conventional transmission system. Some IEA member states have made a legally binding decision to not use or phase out nuclear power. This set of recommendations accepts the sovereign decision of these countries, and instead focuses on those countries who, in their energy policy strategies, count on a contribution from nuclear. Nuclear capacity is aging in IEA member states; without new investment a substantial fall is expected in the foreseeable future. A combination of project management risk, very long lead times and high initial capital commitment as well as low or non-existent carbon prices means that it is highly debatable whether private nuclear investment is possible on the basis of wholesale electricity market signals. Countries that aim to maintain a viable nuclear production fleet should adopt licencing and regulatory regimes that minimalise the risk of project management problems without jeopardising nuclear safety. In addition, such countries should consider the introduction of risk management methods that enable the mobilisation of investment that will be necessary to replace aging reactors. Such measures can take the form of long-term contracts or contract for difference structures, capital and credit guarantees as well as the enabling of vertical integration in the regulatory system.

8. ***Cooperate with key LNG exporters to enhance energy efficiency and low carbon deployment in their domestic economies.***
IEA member governments should support key LNG exporting countries' efforts to accelerate renewable deployment and energy efficiency improvements to maintain their gas export capacities, which could otherwise deteriorate due to growing domestic gas demand.
Several key LNG exporters have very rapidly growing domestic gas demand, very often driven by low efficiency power generation. In several cases, the need to maintain domestic gas and electricity security constrains LNG exports despite the substantial capital investment

already made in liquefaction trains. This phenomenon has greatly contributed to LNG market tightness in recent years and can potentially limit the energy security contribution of LNG supply. Switching from low-efficiency combustion plants to modern combined cycle turbines is generally cost efficient; some of the key LNG exporting countries have a renewable energy potential that is considerably more favourable than what can be observed in IEA member states, such as solar and wind in North Africa or geothermal in Indonesia. Unfortunately non-cost reflective price regulation and subsidies on domestic gas prices hinder the realisation of this energy efficiency and renewable potential. Fossil fuel subsidies such as not cost reflective gas prices are generally recognized to have a detrimental impact on both environmental quality and energy security while failing to concentrate resources on the most vulnerable segments of society. On the other hand in some countries they have been in place for decades, so their abrupt removal might lead to economic and social dislocation. As a result transitional measures and targeted social transfers can be justified. Reform of fossil fuel subsidies is recognized as a priority by the G20, in the context of gas supply security they should be seen as a cost effective measure to enhance supply security at a global level while delivering local economic and environmental benefits as well. IEA member states should work together with the governments of the key LNG exporters to ensure that adequate domestic renewable deployment and energy efficiency improvements enable the optimal utilisation of the sunk cost LNG export capital stock.

Cluster C:

9. ***Complete market opening and integration.***
Governments should advance gas market integration and liberalisation to a higher level by establishing physical and legal infrastructure for better interconnection, including reverse-flow capabilities.

Most OECD regions are progressing towards the establishment of a properly integrated single market that is an important component to enhance energy security and facilitates the entry of new gas sources. Such a single market requires a pipeline infrastructure that can serve as a physical platform and a regulatory environment that enables genuine open access and market-based pricing. From a regulatory point of view, this process has long been completed in North America, but significant infrastructure bottlenecks persist even in that region. In Japan and Korea due to geography, effective access to LNG terminals probably plays a more important role than internal pipelines. Without doubt the region where internal infrastructure development and market integration can have the biggest positive impact is Europe. Since 2009, Europe has made impressive progress in implementing reverse flows and establishing a single market. Nevertheless, challenges and bottlenecks remain.

While Europe has large underutilised LNG import capacities, persistent internal bottlenecks constrain the contribution of LNG in responding to potential disruption of Russian pipeline supplies. IEA analysis shows that even the already existing infrastructure could play a major role in mitigating a disruption if adequate LNG supplies are available. Several EU countries that directly import Russian gas have underutilised LNG capacity such as Italy, Greece and France. Zeebrugge and Rotterdam and from 2015 Dunkerque could directly deliver LNG volumes to North Western Europe and replace Russian imports to Germany and France. The

largest excess LNG capacities are in two countries that are not dependent on Russian gas, the UK and Spain, so their contribution would rely on swap transactions and would face bottlenecks. LNG capacities in Spain and the United Kingdom would remain underutilised even in the case of a supply disruption due to the infrastructure limitations of the European system. In the case of the United Kingdom, the key constraints are the lack capacity to redirect Norwegian gas to Germany and the insufficient capacity to forward UK gas through Belgium towards Germany. In the case of Spain, given the limitations of the pipeline infrastructure through France (limited Spain – France interconnection and lack of reverse flow capability from France to Germany) the practical flexibility would be redirection of export flows within Algeria towards Italy. This is feasible even in large volumes, but would require deep cooperation. If LNG markets have appropriate flexibility, redirecting an LNG tanker in the last leg of its journey is usually considerably cheaper than building and onshore pipeline. Consequently new pipeline infrastructure that would link two regions that both have underutilised LNG import capacity is unlikely to be financially viable on a commercial basis. This is visible both in Europe as well as in Japan.

Moreover, any LNG supplies forwarded to Germany and Italy would face further bottlenecks towards the Central and South Eastern European region that is highly dependent on Russian gas. Such bottlenecks affect reverse flow from Germany to Poland as well as from Italy to Austria and then onward to South Eastern Europe.

In some important cases such as France to Germany operational standards (different odorization methods) create significant cost barriers to reverse flow operation that is nevertheless technically available as a crisis management option. However, as a general principle establishing reverse-flow capability should be seen as a cost-efficient method to enhance supply security and market functioning. Unfortunately, it seems that exceptions from the reverse-flow capability obligation have been granted too lightly. The European Commission and the national regulatory agencies should review reverse-flow exceptions with a full consideration of the potential security benefits. In addition to reverse flows, new physical infrastructure will also be needed to complete the single market, especially in the North – South direction. Such projects are often held up by disputes on cost allocation, despite the fact that their investment cost is trivial compared to the EU import bill. The Commission and the regulatory agencies should take a strategic approach towards supporting projects that complete the market integration. Last but not least, an effective single market needs not only physical infrastructure but also an appropriately functioning market as well. The overall principle of transparent market-based allocation of cross-border capacity is absolutely correct, but needs to be consistently applied and enforced. In several cases, interconnection capacity has been allocated in a non-market based fashion, often to the incumbent monopoly; long- term contracts often create contractual congestion. The development and implementation of the new gas target model needs to be kept on track and adequate competition oversight should be vigorously applied.

10. ***Enhance LNG market functioning, liquidity and transparency***.

Governments should take further steps to achieve more flexible and transparent LNG markets, in Asia in particular, to enable LNG's contribution to global gas supply security.
Given the geographical and political challenges of new pipeline routes, LNG is the most credible diversification source in importing regions, and the only practical channel for the abundant gas resources of North America and Australia to contribute to global gas supply security. In the past three years global LNG markets did succeed in maintaining energy security in Japan in the wake of a sudden gas demand surge due to the loss of nuclear power. However, this was achieved at a very high cost and with visible inefficiencies. The upswing of the gas needs of Japan coincided with an unusual demand weakness and uninterrupted flows of Russian gas which might not always be the case. Consequently the experience of supplying Japan should not lead to complacency. G7 governments should engage the other stakeholders in the LNG value chain to promote the development of more efficient and liquid LNG markets. The priority actions should be the removal of destination restrictions from contractual practices while respecting the commercial nature of the relationship between exporters and importers. Policy action and market design should promote and provide regulatory support for a seaborne secondary market for LNG as well as the establishment of LNG trading hubs. Hub development will require physical infrastructure, including bi-directional storage capacities as well as regulatory changes, especially open access to terminals and storage. Countries that have the resource potential to be LNG exporters should make sure that their regulatory and export licencing procedures do not create artificial delays for private project development.

11. ***Facilitate upstream and infrastructure investment in order to accelerate diversification.***
Governments should render policy support and mitigate risks for energy infrastructure projects that aim to import gas from diverse regions.
Natural gas resources are abundant; there is no geological constraint on gas supply security for decades. Unfortunately, a substantial proportion of the gas resources that could in principle be developed to enhance diversification in importing regions is affected by a considerable degree of political and security risk. This set of recommendations does not assume that the foreign policy considerations that drive the sanction policy on Iran would be overruled by the objective of gas supply diversification. On the other hand there are other large gas resources, notably in Iraq and Turkmenistan, that are not subject to such sanctions, but given the scale of political risks involved it is difficult to see them developed to their full potential on a purely private basis. Moreover, such gas resources, especially landlocked ones typically require politically complex and capital intensive transit infrastructure development. The capital investment need of gas infrastructure can easily exceed the investment need of upstream, and is a completely sunk investment which can become stranded as a result of changes in supply – demand fundamentals, geopolitical events or energy policy changes in either the exporting or importing region. In some cases, there are serious doubts about the ability of the private sector to execute the necessary infrastructure investments that enable the mobilisation of new upstream sources. In such cases, the energy infrastructure projects should receive strong and coordinated foreign policy support from the G7 and other IEA member states. In certain cases, it could be legitimate to apply financial risk mitigation to facilitate infrastructure investment in the form of capital guarantees, interest rate insurance

as well as the involvement of official development finance and export credit institutions. Given that LNG is transported on the open seas, it is less reliant on sunk investment into transit infrastructure. On the other hand it has long lead times and a large concentration of upstream and liquefaction related investment concentrated in the exporting country. For some important frontier resources this can face difficult political risks, in which case similar considerations about the need for risk mitigation might apply, especially in Sub-Saharan Africa.

12. ***Support shale development with an adequate regulatory framework in countries that decide to use this resource***.
Governments should adopt regulations based on "Golden Rules" to obtain a "social license" to develop shale gas resources.

Shale gas development has a potentially transformative impact on gas supply security and international gas markets. Experience from large-scale commercial development in North America suggests that while the key technologies used, especially hydraulic fracturing, have a potential environmental impact leading to legitimate concerns, those concerns can be comprehensively addressed by existing technologies with appropriate regulatory and management oversight. Consequently the shale gas bans and moratoria that some highly import-dependent countries have applied can have a detrimental impact on energy security while bringing few if any benefits; with an adequate regulatory environment, the potential environmental impacts can be managed without jeopardising the economic and security benefits of shale gas. Moreover, the licencing and regulatory regime must take into account the technological characteristics of shale development, especially the need for scalability, standardisation and mass production methods. An overly intrusive licencing policy leading to project delays and high transaction costs can destroy the economic viability of shale and could lead to the same outcome as a moratorium. Instead of blanket moratoria, governments should adopt a "Golden Rules"' regulatory environment that enables large-scale shale development to strengthen energy security while ensuring social acceptance and environmental integrity.