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SPECIAL EDITION : TRIP TO RUSSIA

2 EDITORIAL AND SUMMARY

Editorial

This year, the Mastère OSE class went to Russia from February 28th to March 9th and discovered Moscow, Uglich and Saint Petersburg. Although the purpose of the trip was to visit a range of academic and industrial sites, it was also an opportunity to experience the rich culture of these cities.
During these few days, the 2013 class was able to share its work on the issue of unconventional resources thanks to two conferences at the Gubkin Russian State University of Oil and Gas and the Saint Petersburg Mining Institute. Students also had a glimpse of the Russian activities of the French groups Renault, Soufflet, Total and GDF Suez.
In addition, the class now has a broader vision of the Russian energy sector thanks to visits organised at GazProm, Rossetti, InterRao and RusHydro.

We hope that this issue will take you on a journey.

Приятного чтения !

В этом году студенты магистратуры OSE побывали в России с 28 февраля по 9 марта, посетив Москву, Углич и Санкт-Петербург. За эту неделю студенты посетили большое количество предприятий, представляющих различные направления энергетики, и познакомились с богатым культурным наследием Москвы и Санкт-Петербурга.
В эти несколько дней выпускники 2013 - 2014 гг. смогли представить свои работы на двух конференциях: в Российском государственном университете нефти и газа им. Губкина и в Санкт-Петербургском горном университете. Выпускники магистратуры OSE также ознакомились со спецификой работы французских концернов Renault, Soufflet, Total и GDF-Suez на территории России.
Кроме того, студенты теперь имеют широкое представление о российском энергетическом секторе, его стратегических целях и ориентирах, благодаря рабочим визитам на предприятия таких компаний, как Газпром, Россети, Интер РАО ЕЭС и РусГидро.

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3 INTRODUCTION TO RUSSIA

Introduction to Russia

History

The Russian Federation is the largest country in the world, covering more than 17 million square kilometers. Consequently, it possesses massive reserves in terms of mining and energy. However, the management of energy remains a complex issue for this federation and its 144 million inhabitants, who live in nine different time zones.

Since its origin in 1000, the Russian state has undergone deep social and political upheavals that eventually led to the development of a market economy in the 1990s.

Nowadays, the country is a key player in the global energy landscape.

Key dates: from the beginnings of Russia to the fall of the USSR :


Catherine II the Great

988. Prince Vladimir converts Russians to Christianity

1000. Origin of the Russian state

1147-1397. Mongolian invasions

1613. Michel Romanov becomes tsar and founds a dynasty that will reign over Russia until the Revolution of 1917

1689. Tsar Peter I (the Great) rises to power

1762-96. Catherine II (the Great) modernises the country and makes it more European

1812. The Patriotic War ends with the eviction of the Napoleonic troops from the Russian Empire

1917. Nicolas II abdicates after the triumph of the February Revolution and Russia becomes a republic

Oct 1917. The Bolshevik Revolution brings Lenin to power and he becomes the leader of the «first government of workers and farmers»

1922. Creation of the Soviet Union comprising several republics, including Russia

1924. Death of Lenin: Stalin takes power at the end of the 1920s

1928. Intense race for industrialisation in line with the first five-year plan

1953. Intense race for industrialisation in line with the first five-year plan

1985. Mikhail Gorbatchev becomes General Secretary of the Communist Party and launches Perestroika

1989. End of communism in the USSR and in the satellite people's states

12 juin 1991. Boris Yeltsin elected president

8 déc 1991. The USSR is dissolved and the Commonwealth of Independent States (CIS) is created

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Since the fall of the USSR

In 1991, the Soviet Union became the Russian Federation.
Boris Yeltsin became the first president of the government elected by the people.
He initiated numerous reforms: privatisation of companies, signature of the NATO agreement in 1997, etc.
He resigned in 1999, making way for Vladimir Putin, former member of the KGB. The new president benefitted from the soaring prices of raw materials largely produced by Russia.
Since 2000, Russia has seen remarkable economic growth (average 7 % increase in GDP - Gross Domestic Product). This boom has been supported by the expansion of the tertiary sector (bank, insurance, distribution) and the growth of domestic consumption.
Under Vladimir Putin's three mandates, Russia has progressively regained its major international role. Vladimir Putin is attempting to reassert Russia's leading role on the international scene by taking advantage of global events such as the American setbacks in Iraq. He also continues to re-establish special relationships with the former USSR republics, either strong-arming them (Belarus, Ukraine) or taking a more diplomatic approach.

Economics

The Russian economy underwent radical transformations in the wake of the reforms started by Gorbachev in the 1980s.
The move from a planned economy controlled by the state to a liberal, market-based economy led to a deep financial crisis from which Russia only started recovering at the start of this century.
In August 1998, Russia was still in a huge financial crisis with a de facto devaluation of more than 60% of the ruble and suspended payments of debt.
The transition from planned economy to exaggerated market rules was very difficult for a majority of the population.
Rising prices of raw materials promoted economic recovery starting from 1998. With much higher GDP growth than western countries (despite the economic crisis, it was still 4.2 % in 2011 and 3.7 % in 2012), the Russian state was able to make anticipated payments of loans contracted during the financial crisis, bringing its national debt down to 2% at the end of 2009.
Major sectors of Russian industry face competition from foreign companies, but Russia remains the leading exporter of weapons. The growth of an economy focused on a few key sectors is very sensitive to changes in prices of raw materials, but Russia still ranks among the top ten states in terms of its economy. In 2010, Russia became the leading producer of oil outside of OPEC.

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Energy

Indicator	Russia	France
Primary energy production (Mtoe) :	1 314.88	136.07
Imports (en Mtoe) :	27.688	159.101
Exports (en Mtoe) :	599.497	32.705
Primary energy consumption (Mtoe) :	730.970	252.827
Final energy consumption (Mtoe) :	458.571	152.203
Remainder	1 toe = 41.87 GJ = 11.63 MWh	

Energy in a few key figures

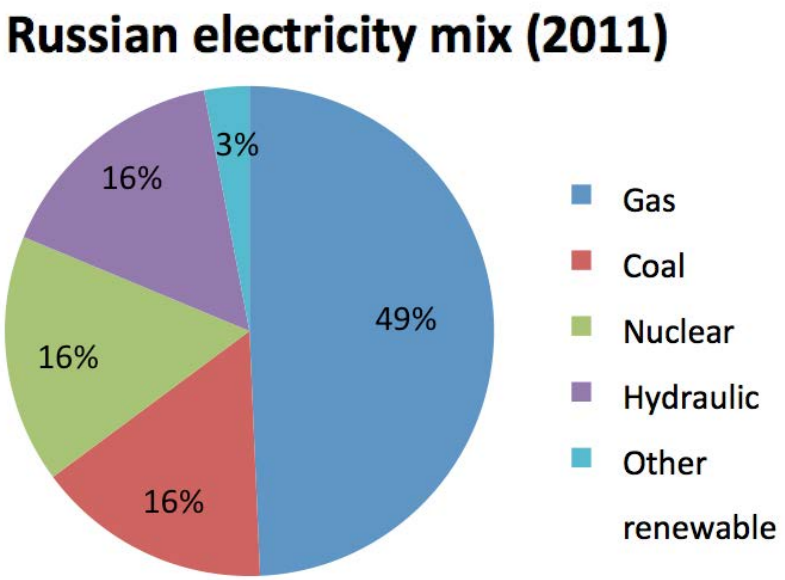
Russia has over 140 million inhabitants. This is more than twice the French population spread over an area twenty five times larger, for a country that produces ten times more primary energy and consumes three times more final energy.

Russian electricity is mostly produced from fossil resources, as shown in the chart below, which gives an overview of the principal resources present on the Russian territory.

Oil

Russia is the leading oil producer among non-OPEC countries and the second after Saudi Arabia. In 2010, it possessed 10,647 million tons of recoverable proven oil reserves according to the World Energy Council. This represented 6.5 % of global reserves and a Reserves/Production ratio of about 22 years.

Russian oil production hit a record in 2013 with an annual production of 523.3 million tons, which is equivalent to around 10.51 million barrels per day (13 % of world production).



Natural gas

The Russian economy's second main asset is, of course, its natural gas reserves, which it considers as a sector of strategic importance.
The share of natural gas as a primary energy source is, indeed, remarkably high in comparison with the rest of the world. Russia is, incidentally, the first natural gas exporter in the world. Moreover, Russian natural gas production increased by 2.1 % in 2013, to reach 668 billion cubic meters.
Russia harbours the world largest natural gas reserves, mainly possessed and exploited by the Russian monopolist Gazprom.
However, Gazprom production decreased for the second year running to 4,761 billion cubic meters in 2013. This drop is due to the collapse of European sales.
The giant gas producer-operator also suffers from its delay in refocusing on the liquefied gas market, a source of major opportunities given the interest of emerging economies such as Asia and Latin America.

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Coal

Coal miners under the Soviet regime were key players in the proletarian revolution.
With 49 billion tons of anthracite coal reserves, and 108 billion tons of lignite reserves, the country has 18.2 % of the world reserves at its disposal.
Compared to some huge coal-producing countries, Russia thus has a clear advantage: it is one of the few countries in the world to possess plentiful reserves for future strategic production. China, the global number one producer, produces 49.5 % of the world's coal while only possessing 13.3 % of world reserves.
This means that China has a reserves/production ratio of around 35 years when it comes to coal while, at current rates of production, Australia has 180 years of exploitation ahead, the United States has 291 years and Russia has 495 years.
Currently, 90% of the production comes from two deposits in Central Siberia: one at Kouzbass (around the huge mines of Kemerovo) and the one at Kansk-Atchinsk.

Hydraulic energy

Most Russian hydropower resources are located in Central and Oriental Siberia, to the extreme East and, to a lesser extent, in the North of Caucasia and in the West of the Ural. However, it is in the European part of the country that this type of energy is exploited most.

In total, Russia currently exploits 20 % of its hydropower potential, compared to 65 % for Canada and 95 % for France.
The main operator is RusHydro, which manages 55 power plants for a total capacity of 25.3 GW.

Nuclear

The Russian nuclear industry is the successor of the USSR nuclear program. In 2011, Russia had 32 nuclear reactors in service, shared between 11 power plants, making Russia the 4th producer of nuclear electricity in the world. Eleven other reactors are under construction and 44 new installations are planned by 2030.

Energy challenges

The energy efficiency of the Russian economy is very low compared to Western Europe: according to the World Bank, it takes on average 3 or 5 times more energy in Russia than in the European Union to produce the same quantity of wealth. After ignoring this issue for many years, Russian authorities are now keen to act in this field.
The improvement of Russian energy efficiency is, indeed, a major concern for the country's competitiveness and for the protection of their capacity to export hydrocarbons. Two thirds of the gas produced in Russia is consumed in the country and would be more valuable if sold on the international market.
Domestic energy prices are indeed much lower than world market prices, but they are gradually being deregulated to encourage users to reduce their consumption. However, the appropriate tools (consumer awareness, legal and fiscal incentives, financial aid, technologies) are not yet sufficiently developed for this policy to have any real large-scale impact.
According to estimations, the economic potential of renewable energy is between 25 % and 35 % of Russia's primary energy consumption, most of it thanks to hydropower.
Moreover, despite its northern location, Russia has considerable solar resources, the largest of which are in the South West (northern Caucasia, Black and Caspian Seas areas), southern Siberia and the extreme East.
Harnessing the power of the sun would largely improve the efficiency of heat networks, as it would reduce the need for boiler rooms that run on fossil energies

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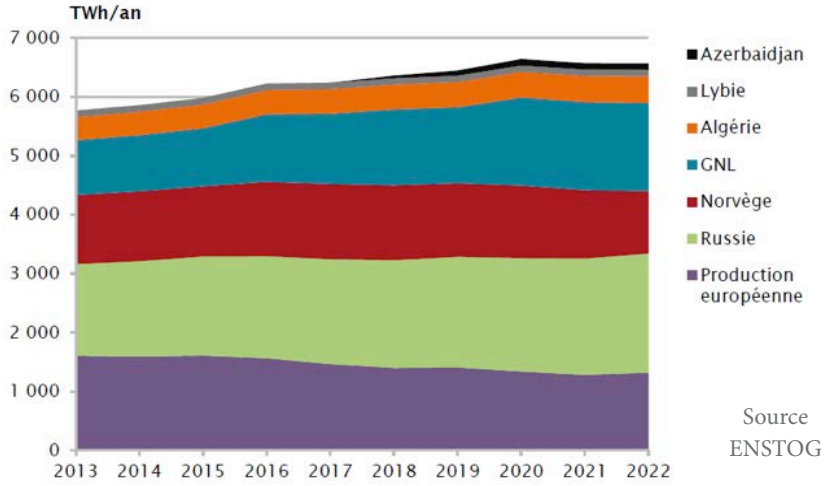
Focus on Russian gas

Interdependency between Russia and Europe

The European Union is Russia's leading commercial partner. It represents 50.2 % of the imports and 44.8 % of Russian exports.
Growing fossil energy demand in the European Union and the recent strains between Russia and Ukraine show the importance of security for European supplies. Indeed, the European Union consumes 15.5 % of the world's natural gas, whereas it only possesses 1.3 % of proven reserves and faces an increase in natural gas demand from emerging countries and China.
Nowadays, Russia supplies a quarter of European natural gas consumption, or more than 30 % of European gas imports. Situations vary within the European Union as all countries are not equally reliant on Russia for supply, as shown in the chart below.

Russia's geographic situation, its reserves and its numerous existing infrastructures are all factors that favour Russian natural gas exports toward the European Union, so the giant gas producer-operator will probably remain a major supplier for Europe. The following chart presents ENTSOG's forecasts linked to European supply capacities of natural gas by 2022. LNG numbers do not take into account source countries.



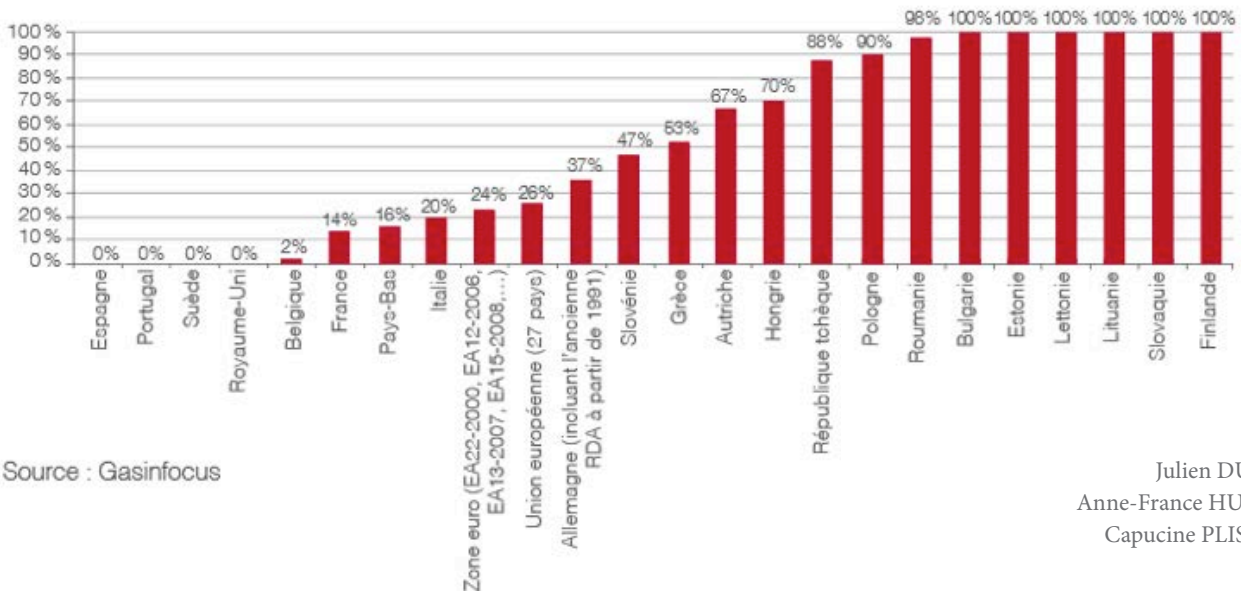
Source ENSTOG

New ways of exporting toward Europe

Nord Stream opens up a new route for Russian gas exports to Europe, and is the first route without any transit countries. Measuring 1,224 km, this submarine pipeline, composed of two parallel pipes, links Russia to the German coast through the Baltic Sea. Nord Stream's two pipes, set up successively at the end of 2011 and 2012, have a combined capacity of 55 billion cubic meters per year.
The Nord Stream AG shareholders are Gazprom (51 %), Wintershall and E.ON (15.5 % each), Gasunie and GDF Suez (9 % each).

The South Stream project draws from the experience of Blue Stream, a pipeline linking Russia and Turkey through the Black Sea, built and set up by Gazprom and Eni in 2003.
South Stream will have to solve the technological challenge of crossing the Black Sea over a long distance (around 900 km) and at a significant depth (2000 m). The consortium was created in 2011 comprising Gazprom (50 %), Eni (20 %), EDF (15 %) and Wintershall (15 %).
The onshore part of the project will be carried out by Gazprom, in partnership with local gas stakeholders from each of the countries crossed by the pipeline. Installation is announced for December, 2015.

Europe's dependence on Russian gas



Source : Gasinfocus

Julien DUPRE
Anne-France HUSUM
Capucine PLISSON

Presentation of visits

Renault

Our Russian trip began at the Avtoframos factory in Moscow, the symbol of the international expansion strategy of the French car manufacturer, Renault.

Mr Gobard, the director of the plant, welcomed us, and our visit started with a brief overview of the factory and the Russian automotive market.

With a market share of 5.8 % in 2011, Renault ranked fourth on the Russian market behind Lada, Hyundai and Chevrolet. Since then, Renault's market share has continued to increase and reached 8.4 % in January 2014. Renault now ranks second behind the historic manufacturer, Lada.

Avtoframos is an assembly plant with no stamping facilities, which means that it uses preformed metal sheets from around the world as a raw material. The annual production of the plant is currently 200,000 vehicles. Five car models are produced: Logan, Sandero, Duster, Fluence and Mégane. All are intended exclusively for the Russian market. Renault is trying to increase its productivity in order to meet the growing needs of the Russian market. To achieve this, many projects are under study: for example, the merger of two paint units and increased use of robotics and automation in the factory.

Renault takes energy and environmental problems very seriously. Indeed, the factory has been ISO-certified 14001 since 2008. The Environmental, Health, Safety and Quality manager highlighted the issue of waste management. Currently, 130 kg of waste are generated by the assembly of each vehicle. This amounts to 100 tons of waste per day on the production site, including 15 tons of cardboard, 35 tons of wood and 3 tons of plastic. Renault's goal is two-fold: to decrease the amount of packaging and to recover some of the waste. Wood packaging is for instance quite common and very difficult to recover for Renault, unlike metal. One line of approach is therefore to replace wooden crates with metal containers, which is what is being done today for raw materials from India.

Particular emphasis is also laid on training staff through internal communications as well as specific courses. For example, since waste sorting is rare in Russia, Renault is trying to set up a waste management system in its Moscow plant. Mr Gobard, when addressing his EHSQ Manager, Alina Sobina was heard to say: «I admire the courage of people working on this subject. We are progressing at our own pace but at least we are progressing!». Moreover, the waste management issue at plants like Avtoframos is closely followed by the Russian authorities, which has the effect of pulling the entire chain of waste management forward.

In terms of energy, Renault has set ambitious targets for reducing consumption. In 2013, the Group reduced its energy consumption by 20 % despite the fact that production increased by 30,000 vehicles. An exchange of best energy management practices between all Renault and Nissan plants contributed significantly to this good result.

Xavier DRAN
Jean-Baptiste PETRY

Rosseti

For our second visit to a Russian company, we were welcomed by the director of international relations at the Rossetti group, which owns and operates the Russian transmission network and electricity distribution. The director first told us the history of the group and then detailed its future projects.

A large electrification program was launched in 1923 throughout the Soviet Union in order to combine all of the regions into a single synchronous area of electricity transmission with a shared frequency (50 Hz ± 0.2 Hz). After the fall of the USSR in 1992, a company was created comprising 83 local entities.
In 2002, the generation, transmission and distribution activities were separated to ensure the necessary investments and develop competition between suppliers.
The transmission network was divided into two: the federal company managed the 220-kilovolt (kV) lines while local entities were in charge of lines under 110-kV.
However, this system proved inefficient, as finding the cause of an accident on the network could be complicated. It resulted in blackouts that exceeded than the authorised 12–hour limit, and thus the idea of a single network reappeared.

In 2013, a new Russian company was created called Rossetti. Rossetti is state owned (85 % state share) and currently has: 14 distribution companies, 478,000 transformer substations, and over 2.2 million kilometres of power lines. Its network is spread over 75 regions and transports 739 GWh every year. Rossetti also has 140 750-kV power lines connected to 11 countries bordering Russia. These countries (excluding China and Finland) all belong to the same synchronous network. However exports to these countries have declined in the past seven years and the price of electricity increased six times in a row during this period in Russia.
These increases were due to rising gas prices, but also to the fact that the price did not reflect the real costs of electricity during the Soviet period. Siberia and the East of the country are the most difficult areas to electrify, because of their remoteness and low population density. In these areas, 4,000 towns are still powered by diesel generators.

Rossetti has many projects for the coming years. The group actively participated in the electrification of the Sochi Olympic sites and intends to do the same for the 2018 Football World Cup that will be held in several cities.
The group plans a budget of € 15 billion for the construction and rehabilitation of 20,000 km of new lines by 2017.
Rossetti was also the first Russian company to focus on electric mobility, particularly on the development of the charging infrastructure. However this field is still very much in need of research, since the batteries of electric vehicles currently only allow for 30 km of travel in the country's frequently harsh climatic conditions.

To conclude our visit, we went to the national dispatching room that handles serious accidents on the network. There are seven other local dispatching entities in the country, all of which interact. Every year, 120,000 incidents are identified and managed.
We also learned that the Russian system has been developed according to the N-1rule, meaning that the whole system can continue to function in the event of the loss of one of the original N lines.

Jerome HOUËL
Anne-France HUSUM

Gubkin University

To conclude our first day of visits, we went to the University of Gubkin, located in Moscow. Founded in 1917, the university, which is also called «Kerosinka» (stove fuel), takes its name from the geologist Ivan Gubkin who managed the Petroleum Committee created by Lenin. His work on the theory of the origins of petroleum won him many prizes and he was named director of the school in 1920. Thanks to its quality teaching, the university ranks as one of Russia's top three schools specialising in oil and gas, along with Saint Petersburg and Tyumen.

Two curriculums are possible in these universities:

- a «first level» course which leads to a Bachelor's degree in four years;
- a «complete», more technical, course which leads to the title of engineer in five years.

Since its creation, 70,000 engineers and doctors have graduated from the university. Gubkin school specialises in the mining industry as well as the extraction and refining of hydrocarbons, and has a dense network of links with international universities, including a partnership with the French Petroleum Institute (IFP School). It also collaborates with many companies such as Schlumberger, Total, StatoilHydro and Wintershall. Moreover, the university has developed a major research centre which has helped develop new methods for oil exploration, production, transportation and refining .

Dr Ludmila Studenikina, Deputy Director of the International School of Business at the Gubkin Russian State University of Oil and Gas, presented us with the Russian position regarding these types of resources, followed by a general discussion. It emerged from our talks that even though Russia still possesses massive reserves of conventional resources, the country would like to master extraction of unconventional resources and exploitation technologies to position itself in this sector in the future. Indeed, operating tests of these technologies could be easily performed in the vast and scantly occupied territories that are thought to harbour reserves of unconventional resources.

Fabienne BREMOND
Jerome HOUËL

Source : http://www.gubkin.ru/

RusHydro

Our second day of travel took us to the town of Uglich, home to 35,000 people and situated 230 km northeast of Moscow. Although its history is fascinating (summarised below), we mainly went to Uglich to visit its museum of hydroelectric power and its dam operated by RusHydro.

RusHydro is a state-owned company and the world's second-largest hydroelectric power producer. The jewel in the crown at RusHydro is the Sayano Shushenskaya dam, as its 6,400 MW make it the largest dam in Russia and the sixth largest in the world. The volume of concrete used to build this huge structure could build a road from St Petersburg to Vladivostok.

Uglich's dam is somewhat smaller (120 MW with a 12 m head) but it is the first dam in the Volga-Kama Cascade of dams. This system of dams represents a total power of 12 GW and makes it possible to control the level of the Volga, thus mitigating flood risks and making it navigable from April to November (compared to one month per year before it was constructed).

The dam was built in the 1930s by gulag workers and it started producing electricity in 1940. One of the dam's two original turbines is still working, while the other was replaced for the first time in 2011 after operating for 15 months . This plant did not require the installation of a fish pass as no migrating species swim that far upstream on the Volga. However, the dam still had a considerable environmental impact as its operation created a reservoir that flooded the former abbeys of Uglich and Kaliazin.

As mentioned above, Uglich is also home to a museum of hydroelectric power. This museum presents the principles of the technology and the history of its development in Russia. Rooms are dedicated to the main Russian dams and the living conditions of the gulag workers that built them. We learnt that only two pump-storage hydroelectric power stations exist in Russia: one in Serguiev Possad (formerly Zagorsk) near Moscow (1,200 MW) and a smaller one in the south of the country.

We cannot conclude this article without saying that this day in the countryside gave us the opportunity to discover another side of Russia, with its quaint wooden houses, endless forests, ice fishermen and hazardous roads, which got the better of one of the tyres on our bus.

Gratien BONVIN
Yoann DESGRANGE

A bit of history :

The town of Uglich was created in 937 and its history was marked by the death of Tsesarevich Dmitry Ivanovitch, aged 8, in 1591. He was the youngest son of Ivan the Terrible and his elder brother Fyodor the 1st was crowned tsar after their father died. In truth, Fyodor was only a nominal ruler and it was his brother-in-law, Boris Godunov, who was really in charge. He exiled Dmitry and his mother to Uglich to ensure that no one contested him. Dmitry's death is shrouded with doubt as some people think Godunov was responsible. In any case, Dmitry was canonised in 1606 and the small Church of St Demetrios on the Blood was built on the site of his death.

Total

On the third day of our study trip in Moscow, we visited the R&D centre of Total E&P Russia in order to talk about gas market prospects. We focused on unconventional reserves and the strengthening of the LNG chain in Russia. Since its arrival in Russia twenty years ago, TOTAL has managed to prove its know-how and technical skills to Russian leaders through the exploitation of the Kharyaga onshore gas field (production rate 30 Mboe / day) which contains hydrogen sulphide. Today, the oil giant continues to develop its activities in Russia by creating strong partnerships with Russian companies such as Novatek.

Thanks to its massive fossil fuel resources, the land of the tsars is currently the number one gas producer and the number two oil producer in the world. In order to maintain its status and cope with highly competitive gas prices on the US market, Russia has diversified its production fields with the recent discovery of large shale deposits in Western Siberia. Overall, the country's conventional oil and gas resources have started to decline (beginning of peak oil and peak gas) but, simultaneously, technological breakthroughs have made the exploitation of hydrocarbons scattered in mother rock economically viable. These new technologies have radically changed the general energy equilibrium. TOTAL geoscience, survey and exploitation specialists are currently working on ways to address issues related to the specificities of shale – its degree of permeability (between milliDarcy and nanoDarcy) and its composition (high heterogeneity) – in order to move its production costs closer to those of conventional sources. The most complex challenge for non-conventional resources is to create an artificial reservoir kept permanently open with proppants and viscosifiers. TOTAL is optimistic about the future of shale gas, given that the clay's gas content is much higher than in «tight reservoirs». TOTAL predicts industrial development of unconventional resources in Russia within 5 years. The Bazhenov project in

Implementation of TOTAL oil and gas projects in Russia

Siberia, with estimated reserves of around 100 Bboe, illustrates the Russian interest in these new resources.

TOTAL has become a major player in the oil sector in Russia by promoting LNG technology, especially with liquefaction terminal projects such as Shtokman or the Yamal Peninsula, located in the Arctic Circle. With production planned for 2017, the LNG plant YAMAL represents an investment of € 19.7 billion for TOTAL and Novatek. This region contains one of the richest hydrocarbon deposits in the world (South Tambey) with reserves exceeding 5 Bboe. This project is more than a simple experiment for the French group and represents a real technological and economic challenge. The three LNG trains are located in a hostile environment as the site will be anchored on permafrost and the water will remain frozen for more than nine months every year. Capacity is planned at a maximum flow of 465 kboe per day and will involve managing 16 "icebreaker LNG carriers". The gas is intended for the Asian market which is boosted by very attractive spot prices. Still in association with Novatek, TOTAL is developing the Termokarstovoye project, an onshore gas and condensate field (capacity 65 Mboe/ day), located in the province of Yamalo-Nenets. Production should start in 2015.

In the years to come, Russia will remain a strategic territory in the energy landscape and is likely to continue welcoming many foreign companies such as TOTAL. Thanks to its flagship projects in the Arctic regions, the French multinational corporation has the ambition to become a world leader in the LNG industry and geoscience techniques related to unconventional resources.

Henry-Pierre DEMAY
Caroline HENNES

GDF SUEZ

Students and lecturers received a warm welcome at GDF Suez's Russian headquarters on 5th March. Albert Grigoryan, the office manager, described the company's activity in both Ukraine and Russia, as these two countries have been jointly managed since the creation of this subsidiary in 1992.

Today, Russia remains one of France's main gas suppliers, which explains GDF-Suez's presence in the country . The partnership with Gazprom dates back to the first long-term contract signed between the two firms, in 1975. It has been continuously developing ever since, and GDF-Suez now ranks as Gazprom's 7th biggest customer. The cooperation took another step in June 2010, when GDF-Suez took part in the Nord Stream project, which brings Russian gas to continental Europe through the Baltic Sea, and acquired up to 9% of its shares. An extension towards the United Kingdom is also being considered.

The Moscow office aims to protect the company's interests in Russia, ensure the firm's communication in the country, and maintain good relations with Gazprom. The cooperation between the two firms also includes technical and human aspects. Mr Grigoryan's team of 16 people divided between Moscow and Kiev ensure that objectives are met, and protect this historical and strategic partnership.
The cooperation between the two companies takes three main forms.

1. Public relations and communication: the presence of GDZ-Suez in Russia allows joint operations such as the organisation of sports events, cultural patronage and even seminars. This collaboration is supported by agreements that run for several years; the last one was signed in February, 2011.

2. Scientific and technical: the objective is for the Russian subsidiary to indicate potential scientific and technological exchanges that could eventually be converted into solid partnerships between both companies. The first agreement of this type was signed in 2008 between GDF-SUEZ's Innovation and Research Department and Gazprom's Long-term Projects Department; it was renewed in May, 2012.

3. Human resources: initiated in 2007 and renewed in 2009 for an indefinite duration, this collaboration involves organising training programs and workshops common to both companies that take place either in Russia or France.

Another positive side of the collaboration is that it occasionally takes the form of a joint venture. A good example is Cathode, a production company created in 1998 by Gazprom and GDF-SUEZ. Seventy per cent of its customers are in the oil industry and 20 % in the gas sector, and its 2012 turnover amounted to € 3.5 M. Ecoservices, another joint venture, was created in 2010 and manages a range of installations, from the Moscow Gazprom bank to the Slovak Embassy and Peking hotel.

Overall, our visit emphasised the importance of bilateral collaborations and how committed both GDF-Suez and Gazprom are in developing joint projects. This established fact seems natural in the gas sector, which is characterised by major companies, long-term contracts and herculean facilities.

Elsa BRUNET
Martin COATALEM

NATIONAL MINERAL RESOURCES UNIVERSITY (UNIVERSITY OF MINES)

Conference at St Petersburg Mining Institute

The day after our arrival in St Petersburg, on the morning of Thursday 6th March, we had the honour of being received at the famous Mining Institute of St Petersburg. This institute was created in 1773 and is one of the oldest Russian higher education institutions and one of the oldest mining schools in Europe. Students there graduate in Geology and Mining from seven different faculties that include geological prospecting and mining economics.

The class visiting the gem collection. Source : http://www.spmi.ru/en/node/8535

Before giving a conference on the role of shale gas in the future European gas supply mix, Svetlana Federova took us on a tour of the Institute. We namely discovered the Institute's collection of gems, one the finest and most exclusive in the world. Many treasures are housed in rooms that are works of art themselves. We then visited some of the rooms dedicated to practical work and had the opportunity to talk with students at the School of Oil & Gas.

After a two-hour visit, we returned to the Institute's conference room, where five of our students gave a presentation on the potential impacts of shale gas on the European gas supply mix to students and lecturers at the St Petersburg Mining Institute. Despite a few technical issues due to the need for English-Russian translation, the audience enjoyed this presentation. The second half of the conference was a lecture on shale gas given by Aleksander Petukhov, Professor at the Department of Oil and Gas Fields Development and Operation. He focused on the history of Russian oil and gas, which has been exploited since 1792, on the development on shale gas in North America, and on common confusions relating to unconventional resources. He concluded his talk with a summary of the Russian position: to make the most of its massive reserves of unconventional gas.

The conference room. Source : http://www.spmi.ru/en/node/8535

Yoann DESGRANGE
Nicolas GARCIA

MINING INSTITUTE 1773 ST-PETERSBURG

Gazprom Transgaz

In the afternoon of Thursday 6th March, the class received a warm welcome at the regional dispatching centre of Gazprom Transgaz in Saint Petersburg. Located in the heart of the city, this subsidiary of Gazprom has been responsible for managing and ensuring the transport of gas in north-west Russia for over 60 years.

The centre was created in 1948 with the installation of the "Kohtla-Leningrad" pipeline from Estonia, which provided shale gas to the city of Leningrad (former name of Saint Petersburg).

Today, the centre occupies a strategic place within the group. It secures the energy supply for north-west Russia and implements Gazprom gas export contracts. These exports represent 70 % of the gas passing through the area and 30 % of Gazprom Russia's total production.

To deal with more than 130 billion cubic meters of gas arriving from deposits in Eastern Siberia each year, the company operates a network of over 10,000 km of pipelines, including 230 distribution stations and 32 compressor stations for a total capacity of 1,795 MW. Several storage structures are connected, which makes it possible to manage fluctuations in consumption.
Exports to Europe mainly involve two recent pipelines called "Yamal Europe" and "Nord Stream".

"Yamal Europe" is a pipeline over 4000 km long that crosses Russia in order to supply Western Europe with natural gas. It arrives in Germany after passing through Belarus and Poland and provides the equivalent of 33 billion cubic meters every year. A project called "Yamal-II", which aims to double the pipeline capacity is also under discussion.

Nord Stream comprises a series of pipelines between Russia and Germany that bypass the usual transit countries by crossing the Baltic Sea. The project began in 1997 and was inaugurated on September 6th 2011. The first pipe is composed of an overland section measuring 900 km and representing 1,177 MW, and a 1,200 km maritime section. With a unit power of 52 MW, four of the seven compressing stations are located in the Gazprom Transgas area of Saint Petersburg. The submerged section that begins in Vilborg has no compressing post. At the exit in Germany, the pipe splits in two: OPAL goes to the Czech Republic and NEL travels to the west of Europe. A second pipe was inaugurated in October 2012 with a capacity of 27 bcm per year. Another two pipes to the Netherlands and the United Kingdom are in a project phase.
After the presentation of the Gazprom Transgaz activities summarised above, our trip ended with a discussion with the manager of the dispatching activity, Mr Vladimir Ivanovich, and a visit to the dispatching room.

The class visiting the dispatching center

The area of activity of Gazprom Transgaz

Nicolas GARCIA
Jean MEYER

INTER RAOUES

Inter Rao

On Friday 7th March, we visited InterRAO's CCGT plant, Severo-Zapadnaya. The plant supplies the city of Saint Petersburg with electricity as well as heat and hot water thanks to a district-heating network. Of the 350 employees at the plant, 16 must be present constantly. After a review of the safety rules and a general presentation of the company, we went through the huge engine room to the dispatching room for a discussion.

Electricity generation:

The area's base production is supplied by the Leningrad NPP nuclear power plant, and so Severo-Zapadnaya's role is to balance supply and demand. The plant is divided in two 450 MW blocks. Each block comprises two gas turbines and one steam turbine. The natural gas consumption of the plant in 2013 was around 1.2 billion m^3. The natural gas is purchased through long-term contracts with Novatek, the first independent natural gas producer in Russia. To produce 1 kWh of electricity requires 250 grams of natural gas; this corresponds to an electricity generation efficiency of 49.5 %. In absence of gas reserves, an emergency diesel block of 120 MW allows the plant to run for at least three days. This gives the maintenance teams some time to solve the problem.

A specific feature of the plant is that one of its two electricity production blocks is devoted to exporting energy to Finland, despite the fact that the Finnish network is not synchronized with the Russian one. This activity is highly dependent on Finland's water reserves, as hydropower plants constitute the bulk of the Finnish electricity production system.

Heat generation:

The plant's heat production is around 7 Gcal and supplies an average 400,000 people. Hot water exits the system at approximately 100°C with a flow of 5,000 m^3/h and returns at 45°C. The heat used is recovered downstream from the steam turbines. It takes about 130 grams of natural gas per giga-calorie produced.

Data for 2012	Inter RAO
Number of employees	57,000
Power installed	33.5 GW
Installed capacity	33.5 MW
Rate of capacity usage	50.3%
Total electricity production	127.438 TWh
Total heat production	26,193,000 Gcal
Sales turnover	556.2 bill RUB (11.1 bill euro)
Budget for innovation	3.2 bill RUB 64 million euro

This hot water is then sold to the companies that manage the district heating and domestic hot water (DHW) in Saint Petersburg. Heating runs from 10th October to 5th May, but DHW requires constant supply throughout the year. The heat generation is directly linked to the electricity production and, in order to ensure that the right amount of heat is generated, a maximum and a minimum capacity have to be set for the blocks every month, especially in the winter.

Atmospheric emissions:

The only environmental stress generated by the plant is the amount of NOx emitted into the atmosphere. Standard requirements are 200 ppm/Nm^3 whereas the plant emits just 25 ppm/Nm^3.

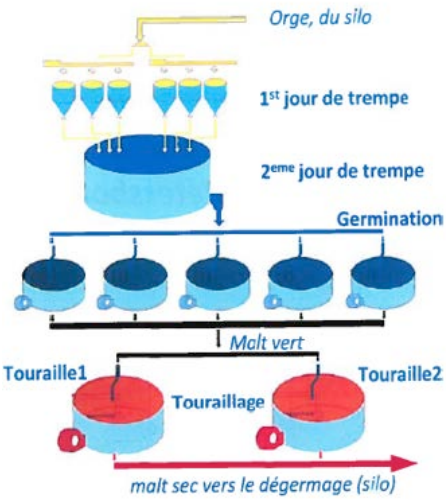
Antoine GIRARD
Anne-France HUSUM

Soufflet Malt House

The Soufflet Malt House near Saint Petersburg was created in 1998 by the French group Soufflet in partnership with the Russian brewery Baltika. Soufflet is a French agro-industrial group specialised in cereals. It employs more than 4,000 people in 17 countries.

With its 110,000 tons of malt production per year, this malt house is the largest and the most modern in Russia. The factory is located only 34 km from Saint Petersburg's commercial port, which is a key factor as it facilitates the barley supply.
The barley transformation process to produce malt is shown in the diagram above. First, the barley arriving on site is soaked for one day in six 60-ton cisterns. During the second day, the six cisterns are gathered into a 360-ton cistern for another soaking operation. Then the cereals are stored in germination couches for five days. During this operation, CO_2 is emitted and O_2 is consumed so that ventilation is required. At this step, the product is called "green malt". This green malt is placed in kiln-dryers for 38-42 hours. Once dried, the malt is sieved to remove the shoots, batched, weighted and stored in silos. Finally, the malt is sent to breweries to be used in the beer production process.

This malt house is one of the Soufflet group's most efficient factories in terms of process and energy management, which stands at about 15 % of the costs. It is even regarded as the best factory in several aspects. For each ton of malt, the malt house requires 84 kWh of electricity, 550 kWh of heat and 3.2 m³ of water. Such performances are made possible by optimising key processes. First, the barley ventilation speed is controlled with the temperature. The heat is also collected at different naturally exothermic steps. For instance, the plant uses a heat exchanger with 10,000 glass tubes. The peripheral tubes are made of stainless steel as glass tubes could break when the outside temperature is too low, creating freezing conditions in the tubes. The plant also uses new gas varinox as a barley heating system instead of an inefficient and costly vapour system. This investment cuts energy costs by 32 % with a payback time of only two years.



Malting Plant

As mentioned above, the malt house is very efficient and constantly looking for innovative ways to manage process, energy and environmental issues. This healthy competition between the different Soufflet group factories is led and conveyed by the Technical Director Alexandre Gladiline and his team, who shared their ingenious ideas with us and who clearly have no intention of stopping there!

Maxime CARDINAL
Julien MAGIN

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TSAR VOYAGES

19 CONTACTS

КОНТАКТЫ

EMBASSY OF FRANCE IN RUSSIA
ulitsa Bolshaya Yakimanka, 45,
115127 Moscou
M. GEBEL Julien
Attaché for Energy
M. VENETZ Ronan
Advisor for Transport, Industry and Sustainable Development
M. BALAZARD Michel
Attaché for Science and Technology
M. MAITRE Daniel
Head of the Regional Economic Service Moscow

AVTOFRAMOS - RENAULT
Volgogradsky prospect., 42-27
109316 Moscou
M. GOBARD Gérard
Plant Director
Mme. SOBINA Alina
Head of Environmental department
Mme. ANTONOVA Nina
Responsible for internal plant communications

ROSSETI
4 Belovezhskaya street
121353 Moscou
Mrs. BESSARABOVA Anna
Chief Expert - International Activities section

GUBKIN Russian State University of Oil and Gas
65, Leninsky prospect
119991 Moscou
Mrs. STUDENIKINA Ludmila
Deputy Director , International School of Business

RUSHYDRO
7, Malaya Dmitrovka
127006 Moscou
M. LEVANKOVSKIY Vladislav
Deputy Head of International Cooperation Department - Head of Europe and America Division

TOTAL E&P
21, 1st Tverskaya-Yamskaya
125047 Moscou
M. DE BOISSESON Jacques
General Director and General Representative of Total Russia
M. DAUBOIN Pascal
Research and Innovation Director
M. GAUCHET Renaud
Geosciences Director
M. MARCHENKO Maxim
Project Manager

GDFSUEZ Europe Energy Branch
4e Dobryninsky Péréoulok, Bat 8
119049 Moscou
M. GRIGORYAN Albert
General Representative of GdfSuez Russia
Mme. PLOTKINA Olga
Interprets Executive Assistant

NATIONAL MINERAL RESOURCES UNIVERSITY (UNIVERSITY OF MINES)
V.O. 21 Line 2
199226 Saint-Petersburg
Mrs. FEDOROVA Svetlana
Head of the Department of International Academic Programs
M. LITVINENKO Vladimir
University Rector
M. BORZENKOV Vladimir
Head of the Centre of International Programs

GAZPROM TRANSGAZ
Str. Warsaw 3
196128 Saint-Petersburg
Mrs. KUZYURIN Irina
Deputy. Head of Department training URP
M. IVANOVICH Vladimir
Head of the Dispatching centre

INTER RAOUES
Entrance7 World Trade Center-2
12 Krasnopresnenskaya naberezhnaya
123610 Moscou
M. LEONOV Viacheslav
Senoir Manager

SOUFFLET MALTHOUSE
6ème Verkhny pereoulok, 7
194292 Saint-Petersburg
Mme. SKOUKOVSKAYA Tania
Deputy Director
Mme. LEBEDINSKAYA Irina
Quality Director
M. GLADILINE Alexandre
Technical Director

Youth Mining Leaders Forum (YMLF)
15 New Arbat Str. bld 1 - Office 604
119019 Moscou
M. KOROLEV Artem
Founder
M. LEVANKOVSKIY Vladislav
Co-Founder

Editorial staff:

Chief editors :
Fabienne BREMOND & Capucine PLISSON

Graphic designer :
Jérôme HOUËL

Writers :
Advanced Master OSE's students

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Contacts :

Contact
infose@cma.mines-paristech.fr
Phone
+334 97 15 70 73
Advanced Master's Degree
Energy Systems Optimization
Centre for Applied Mathematics
Mines ParisTech
Rue Claude Daunesse - CS 10.207
06 904 SOPHIA ANTIPOLIS Cedex

Centre for Applied Mathematics

ParisTech's Chair Modeling for sustainable development

Energy Systems Optimization