The geopolitics of energy in Europe: Short-term and long-term issues

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Abstract

Russia's invasion of Ukraine has forced a rapid and profound rethink of the European Union's energy supply architecture. This article first focuses on the consequences of an EU stop to Russian imports of the three key fossil fuels: natural gas, crude oil including oil products, and coal. It then takes a longer-term perspective and discusses the various geopolitical implications rising from the EU's clean energy transition.

Keywords: EU, Energy security, Russia, Ukraine war, Geopolitics, Energy transition.

1. INTRODUCTION

Russia's invasion of Ukraine has forced a rapid and profound rethink of the European Union (EU)'s energy supply architecture. Questions about the ability of the bloc to live without Russian energy loom large. Given the historical importance of the EU's current U-turn on Russian energy, the first section of the article focuses on the consequences of an EU stop to Russian imports of the three key fossil fuels: natural gas, crude oil including oil products, and coal. To do so, it will notably explore the possibilities for addressing the energy supply gap left by Russia, illustrating the possible alternatives on both by the supply and demand side.

The second section of the article then takes a longer-term perspective and discusses the various geopolitical implications rising from the EU's clean energy transition. In particular, the section focuses on key emerging issues such as the economic and geopolitical implications of the European Green Deal on the EU's key oil and gas suppliers – most notably in the Middle East and North Africa, its potential impacts on the global oil market. The EU's dependency on critical

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raw materials for the green transition and the trade implications of the EU's decarbonisation process will also be discussed.

2. THE UKRAINE WAR AND THE EU'S DIVERSIFICATION AWAY FROM RUSSIAN ENERGY

Russia has traditionally been a key energy supplier for the EU. In 2021, Russian exports covered 40% of the EU's natural gas demand, 30% of the EU's crude oil demand, and 30% of EU's hard coal demand. Following the Russian invasion of Ukraine, the EU has embarked into a strong diversification effort to rapidly cut its reliance on Russian energy. To understand what this implies for Europe in the short term, it is necessary to take two successive steps: first understand the maximum available alternative supply options for natural gas, oil and coal – and then explore the various bottlenecks in each of these three areas.

As far as natural gas is concerned, the EU should be able to replace approximately 50% of Russian gas imports in a matter of 12 months. This would be done by maintaining flows through pipelines from Norway, Algeria, and Azerbaijan to the EU at high volumes and most importantly by securing record volumes of liquefied natural gas (LNG) imports. The remaining 50% gap will need to be compensated by reduced demand. Running LNG terminals between their historical and technical maximum capacity would allow the EU to import a record 1,250 – 1,700 TWh LNG compared to 750 TWh in 2021, an increase of 500 – 950TWh. In the first quarter of 2021, the EU imported 302 TWh of LNG, offering evidence that market forces are already tapping into this option strongly. EU-UK cooperation could see the UK export large shares of LNG to Belgium and the Netherlands – over 200 TWh annually – if the necessity arose. Theoretically increased LNG imports could therefore offset around 50% of the missing Russian gas. In 2021, 1,400 TWh were imported by pipeline from Norway, North Africa, and Azerbaijan. These supply routes were already operating at close to maximum capacity and only marginal additional flows can be expected in 2022. But more might come soon. On April 11th, an agreement was signed between ENI and Sonatrach to boost Algerian exports to Italy by 90TWh by 2023/24 with some ramp-up expected in 2022.

As far as oil is concerned, should the EU completely halt its imports of Russian oil, around 3 mb/d of Russian crude supply and around 1 mb/d of oil products would have to be replaced. OPEC spare capacity estimates range up to 4 mb/d. This includes 1-2 mb/d from Saudi Arabia, around 0.75 mb/d from the United Arab Emirates and 0.5 mb/d from Iraq. Iran, currently locked in negotiations on the Iran nuclear deal, which will determine if it can export oil, is reported to have 1 mb/d of spare capacity complemented with floating storage unwind. Outside of OPEC, US production dropped by around 3mb/d at the start of the pandemic, and has gradually clawed back around half of this. Over a timescale of 6-12 months, it can be expected that in a scenario of very high prices US shale could add another 1.5 mb/d. Finally, OECD members hold strategic oil reserves of 1.5 billion barrels. This supply alone could compensate for at-risk Russian exports for around one year. Industry holdings are another 3 billion barrels. Therefore, an embargo on Russian oil can be partially mitigated by slowly drawing down on strategic stockpiles whilst boosting alternative output.

As far as coal is concerned, this can be replaced pretty easily by the EU because global coal markets are well supplied and flexible. In principle, shipments from countries that have reduced exports to the EU are still largely available to substitute for Russian coal. Comparing the maximum yearly global exports of the main exporting countries in the last six years (2016-2021) against their 2021 export levels, shows significant margin to replace Russian global exports of coal entirely. If China and India (the two main consumers of coal worldwide) were to buy more coal from Russia, the export margin from other global suppliers may increase further. Similarly, increasing EU domestic production which reached a new low in 2021 (329 MT *vs.* 373 MT in 2019) by some 40 MT might be possible in an emergency.

However, it is important to appreciate that several physical infrastructure bottlenecks in each of these areas, and that political considerations might also constrain imports to levels below their theoretical maximum which we outline above. Let's review these bottlenecks in detail.

The first bottleneck relates to global supply-side capacities

For natural gas, the previous figures assumes that the EU does not face restrictions in importing additional LNG. In reality, global LNG markets are already extremely tight and an additional annual demand of 500-950 TWh from the EU will exacerbate the situation. In 2021, worldwide LNG trade totalled 5,400 TWh, with China, Japan and South Korea as the world's largest importers. In 2022 global production is forecasted to increase between 63 and 300 TWh (1.2 to 5.5%) from 2021. Global liquefaction capacity is almost fully utilised significantly constraining the amount of additional LNG volumes that can be brought to the global market anytime soon. Liquefication facilities take multiple years to build and thus in the next 2 to 3 years the EU must compete with other countries for these limited supplies. The effect of skyrocketing European natural gas prices will be to redirect LNG cargos away from importing countries in the developing and emerging world that can no longer afford them.

For crude oil, while estimates are that OPEC members do have spare capacity, the reality is that many members are already struggling to hit production quotas. Like the LNG market, prior to Putin's invasion, global oil markets were already tight. In December 2021, OPEC+ output increased by 0.25 mb/d compared with the target of 0.4mb/d, implying that members cannot already meet existing quotas.

For coal, constraints in demand and production by exporting countries may also prevent full exploitation of the export margin. For example, in January 2022 Indonesia introduced a temporary ban on coal exports and appears set to do the same in April. Similarly, Australia is experiencing temporary supply interruptions as wildfires and flooding hamper the country's ability to exploit its export potential to the fullest. Colombia is forecasting a 7 MT increase in output for 2022, far from the full export margin of 50 MT. Finally, South Africa's main coal terminal is expecting exports to increase by 10 MT in 2022, against the 26 MT that could be technically feasible.

The second bottleneck relates to EU import capacities

Non-Russian gas pipeline imports into the EU are close to being maxed out. For LNG, the broad constraint on the EU's ability to import is the availability

of regasification facilities. Our upper bound assumption involves running regasification facilities at full capacity all year round which is not likely to be possible owing to technical reasons and the likelihood of scheduled or unforeseen maintenance work.

For crude oil, ports can relatively simply receive supplies from non-Russian sources. Certain European refineries are however optimised to use Russian oil and will be less efficient if producing with a different quality of crude resulting in different profiles of products production. Particularly vulnerable are six large refineries along the Druzhba pipeline (in Poland, Germany, Czechia, Austria, Hungary and Slovakia). These refineries have historically been dependent on Russian crude; however, in the last years efforts have been made to diversify import structure. In 2019, when contamination forced the Druzhba pipeline to close for two months the refineries were able to survive. Beyond crude oil supply, the EU must also consider replacing Russian refining capacity that produces diesel, naphtha and fuel oil. European refiners could try to compensate for this by increasing refinery throughput. To replace lost Russian diesel supply, for example, European refineries would have to raise runs by about 10 percentage points, taking them to almost 90% of total capacity of 15-16 mb/d. It would be the highest utilisation rate this century. Refineries will face additional challenges replacing lost supplies of Russian vacuum gasoil to service these runs.

For coal, European ports will be able to receive coal cargoes from alternative countries. The logistics of transporting this coal to points of consumption should remain the same as under a scenario of Russian imports. Indeed, Poland – seen as a country exposed to Russian coal imports, already by March 29th announced a ban on Russian coal imports. Most European coal consumers already source from different suppliers and should be able to build on existing relationships.

The third bottleneck relates to intra-EU infrastructure

The availability of global supply to replace Russian imports does not suffice – fuels must be able to move from points of import to points of final consumption. And the EU energy market, particularly for natural gas, has evolved from a dependency on low-cost Soviet Union/Russian supplies from the east. The result

is that EU gas markets are not designed for supplying all of central and eastern Europe from the west and it will be a large challenge to successfully reorientate gas flows.

The Iberian Peninsula, for example, is a hub for LNG import terminals. As a result, the region can import around 50 TWh per month, but only consumes 30 TWh and existing pipelines permit a maximum transfer of 5 TWh a month to France. Gas in the north-west European market has different qualities (domestically produced low-calorific L-gas in parts of Germany and the Netherlands vs. imported high-calorific H-gas in the rest of Europe) that use different infrastructures again impeding easy transit.

Moreover, the central and eastern European pipeline system is designed to bring imports from the east to final consumers. Despite investment in reverse-flow capacities and new pipelines, if too much gas were to come from the west, pipeline bottlenecks could prevent sufficient deliveries to the easternmost parts of the EU or Ukraine. It is of the upmost importance that flows already begin from west-to-east to fill up storage facilities in countries most dependent on Russian gas – particularly in order to meet the proposed targets of 80% storage fill by 1st October 2022.

For crude oil, while the supply to ports can be relatively easily substituted, it will be necessary and challenging to reroute supplies from the ports of Gdansk, Rostock, and on the Adriatic Sea to feed refineries on the Druzhba pipeline. Large volumes of this oil would flow by existing pipelines, but capacities are not enough to offset Russian crude. Therefore, additional supplies would likely be necessary by rail with logistical difficulties. Action is already being taken with the German Leuna refinery cutting its dependence on Russian crude by half in April.

Oil products must also be transported to the correct place. For example, if the Leuna and Schwedt refineries are forced to reduce output owing to disruptions to Druzhba, refineries elsewhere in Europe may take up the slack. But then, products such as diesel must be transported to east Germany in huge quantities which would be a considerable task using trains and trucks.

Certain EU countries still have high shares of coal in their energy mixes and will find an end to Russian imports more difficult to manage. Germany in particular is reliant on imports for its domestic needs of hard coal and half of these come from Russia. While brown coal in Germany is by far the most important coal type in domestic consumption, a complete stop of the hard coal imports from Russia would represent an important challenge for industry. On the other hand, Poland is in a better position as much of its domestic needs are met by internal production, and accordingly implemented a national ban on Russian coal before the EU took action. The weight of Russian coal in the energy mix of the other EU countries is so limited to cause no concern.

The fourth bottleneck relates to politics outside the EU

The contractual structure of the global LNG market may place limits on the possibility of re-directing volumes to Europe. The LNG business developed on the basis of long-term 20–25-year contracts, necessary for both sellers and buyers to justify the significant investments required for the construction of liquefaction plants and receiving terminals.

LNG contracts are today more flexible than in the past and as such they can provide important short-term flexibility to international gas markets. This flexibility is provided by two elements. First, the number of contracts with flexible destination clauses has grown from an average of 34% in 2015-2017 to an average of 64% in 2018-2020, driven by new US LNG projects. Second, an increasing share of LNG contracts has been signed by portfolio players – ie energy companies that procure a mix of LNG supplies from various origins and resell to customers according to their requirements via term and spot contracts, among which European majors feature prominently.

These sources of flexibility underpin Europe's current capacity – due to its higher prices – to attract US LNG cargos otherwise destined for Asia. They also provide grounds for the high-level political requests advanced by both the European Commission and US administration to large Asian LNG consumers such as Japan and South Korea to divert cargos to Europe. The EU and US formalised

this narrative announcing a task force on March 25th with a goal of ensuring "additional LNG volumes for the EU market of at least 15bcm in 2022". The exact implications are unclear given that the EU already imported 13bcm more LNG in the first quarter of 2022 compared to 2021.

The key question is at what scale and for how long this flexibility can be used. In the first quarter of the year, Asian demand was weak for LNG as higher spot prices encouraged increasing use of coal and oil alongside lower demand on the back of a relatively mild winter. Were this situation to change, the EU would face a steeper challenge importing similar quantities of LNG in later parts of the year.

Long-term contracts are not as prevalent in the oil market and this would not be as serious an issue for the EU to confront. However, OPEC members currently have an agreement with Russia and Central Asian partners known as OPEC+, under which it has been agreed to constrain supply growth to 0.4 mb/d per month. So far, Saudi Arabia and the UAE have notably refused to increase production. The United States and its allies face a difficult question of how much political pressure to exert and where to compromise. Geopolitical tensions, for example relating to the conflict in Yemen, influence this relationship. The Iranian nuclear deal is another controversial point. The US has already spoken to Venezuela, indicating that Western sanctions on Russia may come at the cost of removing sanctions elsewhere.

The fifth bottleneck relates to politics within the EU

Finally, and most importantly, what is technically feasible might not be politically feasible. Notwithstanding infrastructure limitations, EU members states will need to display significant solidarity. Recent history does not bode well – at the beginning of the COVID pandemic, certain EU member states imposed a de facto export ban of protective equipment. Were Russian gas to stop flowing the effects would be highly idiosyncratic. There is a risk that countries with better supply might be unwilling to share scare gas resources with countries in worse situations. Particularly regarding the synchronisation of storage fills and draws to precent gas-disruptions anywhere in the EU, member states would need to closely

cooperate in a manner that will not be easy in an environment of rising energy prices. This risk is amplified by an inability to predict the length and severity of any shortage while, under worst-case scenarios, infrastructure constraints would call for anticipatory movements of volumes across borders. Similar questions will arise for oil markets. For example, the German government are currently exploring with Poland the potential for using the port of Gdansk (in Poland) to feed the Leuna and Schwedt refineries (in Germany).

All in all, over the next 12 months it will not be possible for the EU to replace each oil and natural gas molecule from Russia one-by-one. Therefore, a complementary and coordinated demand response mechanism is essential, both by switching to alternative fuel sources and by absolute reductions in final demand. This need contrasts strikingly with the approach deployed by most European governments so far of cutting taxes and subsidising consumption of energy, which will ultimately become too expensive and lead only to bidding wars across Europe.

Large demands for natural gas come from the power sector, the industrial sector and heating buildings. In the power sector, the primary option for reducing gas demand is fuel-switching. While in recent years the rising ETS price encouraged a switch from coal to gas-fired power generation, high gas prices have reversed this trend in previous months. There might be a potential for 270 TWh gas to be saved by switching to coal-fired power plants based on a comparison to coal output in 2019. Additionally, estimates suggest around 10% of gas-fired power plants could run on oil, saving another 90 TWh – although obviously placing strains on oil demand. Finally, extending the lifeline of three German nuclear plants set to close down at the end of this year could save 120 TWh.

While in the long-run an accelerated deployment of renewable technologies is the solution, timelines for projects to be approved and constructed limit short-run options. We estimate that rapid solar PV deployment could save 30 TWh. Meanwhile, faster deployment of heat pumps (achieving 3 million air-source heat pumps installed per year) has the potential to save 30 extra TWh yearly.

In reality, replacing gas in power production will face complexities. In certain regions and at certain times, gas-fired power plants remain the only option for balancing markets. The geographic positioning of power generation capacity

and load profiles of different sources mean that some gas demand will remain essential.

In the industrial sector, the only short-term option is demand curtailment. Industries with high consumption of gas are chemicals (particularly ammonia), non-metallic mineral products, basic metals, food & beverages and tobacco, coke and refined petroleum products, and paper. Industries such as Aluminium are acutely indirectly affected by natural gas price pass-through into power prices. Anecdotal evidence suggests rolling cuts at many plants since gas prices reached record levels in the second half of 2021. Steel and aluminium makers (top European smelter, Aluminum Dunkerque, has announced reduced production), silicon producers (Ferroglobe switched off two furnaces in Spain), chemicals (the biggest Italian manufacturer of AdBlue, an additive that reduces diesel vehicle emissions, announced a temporary closure months ago) and fertilisers have already reacted to high prices.

Beyond market-based curtailments, EU countries also have emergency plans which include forcing non-critical industries to shut down in emergency scenarios. Germany enacted the first phase of its plan in March and is holding discussions with industry to determine how "system relevant" they are. Simultaneously, the reduction of heating in commercial/office buildings and homes could also be mandated.

In the buildings sector, approximately 130 TWh gas consumption could be saved by a political campaign encouraging households to turn down their heating by 1 degree Celsius and implement quick energy efficiency fixes such as isolating windows and doors. To encourage this, European governments might consider giving money back to households by 'paying them for saving', giving households a payment based on their 2022 energy demand compared to their 2021 energy demand.

In the longer run, the potential for retrofitting and more substantial energy efficiency improvements in the buildings sector is vast and must be exploited. However, the required investments and physical works are too slow to provide a significant contribution in the near future.

As far as oil is concerned, the transport sector is the area where demand-side measures have the highest potential to reduce use. The IEA detailed these measures in 2018 and more recently explicitly outlined the ability of demand measures to reduce demand for Russian oil. Each IEA member must maintain a programme of demand reduction measures which are able to achieve a rapid drop in oil demand of 7%, and as much as 10% in the case of a severe supply shock – which a stop on the flow of Russian oil to the EU would be.

These measures are designed to have as little as possible negative effect on the economy and it is highly desirable that they be implemented before extraordinarily high oil prices destroy demand in a manner that will not be efficient from a societal welfare standpoint. Measures include a focus on public transport, such as making services free on weekends and campaigns to encourage car-sharing by employees, which businesses can be incentivised to support. Stricter measures such as restrictions on when certain vehicles can drive may be necessary. Governments should also liaise closely with freight companies to discuss options for route and fuel sharing.

In 2021, total EU oil imports amounted to 15 mb/d, of which 3.5 mb/d came from Russia. Of this 3.5 mb/d around a fifth (0.4 mb/d) could be displaced in just four months adopting quickly deployable measures. Given the nature of global oil markets, cooperation on this front from other IEA members, notably the USA, would be highly beneficial.

To conclude, it is possible to summarize the European short-term energy geopolitics issues as follows. The EU will be well able to replace supplies of Russian coal, and measures are already in place to do so by mid-August. However, switching supply away from Russia and potentially boosting coal demand to offset gas-fired production will have second-round effects on emerging and developing economies by pushing prices higher.

Europe can also manage without Russian oil supplies but significant coordination and logistical problems will have to be tackled. While ports can more readily switch suppliers, inland refineries dependent on the Druzhba pipeline require special attention and emergency planning. Similarly, action must be taken to alleviate pressure on key oil products, most pertinently diesel. Here, international

cooperation (with the USA) would be essential to make direct and indirect spare capacities available. Joint diplomatic efforts towards OPEC products can help. Short-term deficits can be met by large oil and product stockpiles, and by activating government plans to reduce demand significantly. A stop to oil imports from Russia will imply higher oil prices for Europe, but global markets will ensure Europe gets all the oil it is willing to pay for, and markets will ultimately rebalance.

For natural gas, a crisis-scenario would unfold, requiring improvisation and entrepreneurial spirit. The EU would not be able to replace about 50% of the imports coming from Russia and therefore demand for natural gas would need to contract by around 20% compared to 2021. This will require hard political, logistical and economic decisions to reduce demand in a coordinated manner. If done correctly, people will not freeze and black-outs will not be commonplace.

In all cases, the EU will pass through a short and painful period until markets adjust, while the effects on Russia will be devastating and long-lasting. Moreover, if measures are accompanied by renewed impetus for the transition towards zero-carbon energy sources then Russia's leverage over EU energy supplies will disappear forever.

3. THE LONGER-TERM PERSPECTIVE: THE GEOPOLITICS OF THE EUROPEAN GREEN DEAL

While the EU focuses on the historical energy challenges brought by the Russian invasion of Ukraine, it also needs to identify and mitigate the longer-term geopolitical challenges arising from its green transformation. Such challenges are indeed multiple, as it will be now illustrated.

To make Europe climate neutral by 2050, the European Green Deal has to pursue one main goal: to reshape the way energy is produced and consumed in the EU. The production and use of energy across economic sectors indeed account for more than 75 percent of the EU's GHG emissions.

Today, almost three-quarters of the EU energy system relies on fossil fuels. Oil dominates the EU energy mix (with a share of 34.8 percent), followed by natural

gas (23.8 percent) and coal (13.6 percent). Renewables are growing in share but still play a more limited role (13.9 percent), as does nuclear (12.6 percent).

Should the European Green Deal be successfully implemented, this situation will be upturned by 2050. But change will not happen overnight. According to European Commission's projections, fossil fuels are due to still contribute to half of the EU's energy mix in 2030. But fossil fuels differ in their pollution intensity. The role of coal – the most polluting element in the energy mix – has to be substantially reduced by 2030, while oil and especially natural gas can be phased out later to achieve the climate targets. It is between 2030 and 2050 that most of the change for oil and gas is due to happen. Within this timeframe, oil is expected to be almost entirely phased-out, while natural gas is expected to contribute just to a tenth of the EU energy mix in 2050.

According to this evolution of the energy mix produced by the European Commission, which in itself is controversial and not debated here, EU imports of coal are expected to decrease by 71-77 percent between 2015 and 2030, while imports of oil will drop by 23-25 percent and imports of natural gas by 13-19 percent – depending on the scenario. Beyond 2030, oil and natural gas imports are expected to dramatically shrink – with oil imports down 78-79 percent and natural gas imports down 58-67% compared to 2015.

This profound transformation of the EU energy system is set to have a wide variety of geopolitical repercussions. These can be grouped into four distinct channels: i) Repercussions for oil and gas producing countries in the EU neighbourhood; ii) Repercussions on global energy markets; iii) Repercussions for European energy security; and iv) Repercussions on global trade, notably via carbon border adjustment measures.

First, repercussions on oil and gas producing countries in the EU neighbourhood

Discussions on the potential repercussions of global decarbonisation naturally focus on the impacts that a reduced need for oil and gas in large markets can have on producing countries. For Europe, this is notably the case of its major gas

suppliers from the MENA region to the Caspian and Central Asia, that base their economies on the fossil fuels rent, and mostly export their fossil fuels to Europe.

The anticipated decline of EU imports of oil and gas will have an almost immediate effect as it will decrease investment in new fossil fuel infrastructure and even reduce maintenance efforts for existing infrastructure. This is despite the fact that, as noted above, the EU is expected to keep importing oil and natural gas at more or less unchanged scale for at least another decade. It is important to note that – as far as gas is concerned – in the 2030 timeframe Europe's main energy supplier – Russia – could even benefit from the European Green Deal, as a coal-to-gas switch is necessary to quickly curb emissions in the EU energy sector. The temporary role of natural gas as a transition fuel in the continent is likely to increase.

It is also important to outline a different, potential, long-term impact of the European Green Deal on the neighbourhood: a possible surge in green electricity and green hydrogen trade.

One of the major drivers to deliver the European Green Deal will be electrification. To meet its increasing need for renewable electricity, Europe might well resort over the next decades also to the import of solar and wind electricity from neighbouring regions that due to their natural endowment are particularly fit for that purpose. This is especially the case of the MENA region, which benefits from one of the best solar irradiations in the world, as well as with world-class wind energy locations. While these renewable resources will primarily be exploited to meet MENA countries' own rapidly growing energy demand, there might well be a case for future exports to Europe. Decreasing generation and transport technology costs might indeed allow economies of scale that have so far prevented the realisation of such cooperation schemes.

While renewable electricity is expected to decarbonise a large share of the EU energy system by 2050, hydrogen is increasingly seen as a way to decarbonise parts of the energy system electricity cannot reach. This is the reason why the EU has launched a hydrogen strategy in the context of the European Green Deal, aimed at developing 40 gigawatts (GW) of renewable hydrogen electrolysers by

2030. Considering North Africa's renewable energy potential and geographic proximity to Europe, the region is being considered as a potential supplier of cost-competitive renewable hydrogen to Europe. Germany, for example, has recently launched a cooperation with Morocco for the development of Africa's first industrial plant for green hydrogen - with intention of future exports to Germany.

Future imports of renewable electricity or green hydrogen from MENA countries (or other neighbours, such as Ukraine) could lead to new energy security concerns, which will have to be mitigated with proper diversification.

Second, repercussions for global energy markets

Given the size of the European economy, the European Green Deal is also likely to have repercussions for global energy markets. Today, Europe indeed represents the second oil importing region in the world after Asia Pacific.

The fall in global oil demand resulting from Europe's transition to clean energy will have an impact on the global oil market, notably by depressing prices. The extent of the price decline will, of course, also depend on other countries' decarbonisation trajectories. Should Europe be the only one significantly cutting oil consumption and other countries continue to rely on fossil fuel in their growth, markets and demand in Asia, Latin America and Africa might partially – and temporarily – counterbalance Europe's withdrawal. But overall, Europe's global share in oil imports is so significant that general equilibrium effects are likely to lead to a sizeable reduction in the value of the oil assets.

Oil producers will be differently affected depending on their economies' concentration on oil export, as well as their breakeven oil price. For instance, Saudi Arabia and Iraq can produce oil relatively cheaply, not needing a price of more than approximately USD 30 per barrel to break even, while countries like Venezuela and Nigeria have higher break even prices.

Low-cost oil producers, such as Saudi Arabia, are thus better positioned to deal with declining global oil prices resulting from the European Green Deal. In the

medium term, they might even increase their market share, as high-cost producers will be kicked off the market.

However, even low-cost oil producers will feel the impact of declining prices. With this regard, it is important to remind that already at the current oil price of USD 40 per barrel, Saudi Arabia's budget deficit is at 12% of GDP. This implies that economic diversification away from the oil rent is a must for all oil exporting countries, albeit to different degrees.

Third, repercussions for Europe's energy security.

In Europe, energy security has traditionally been associated with the need to ensure sufficient oil and gas supply in the short term. Being poorly endowed with domestic resources, the EU has to import 87 percent of the oil and 74 percent of the natural gas it consumes. Moreover, being reliant on a limited number of suppliers, the EU has developed over-dependency concerns. This has particularly been the case for natural gas, given its rigidities due to the reliance on pipeline infrastructure and long-term contracts. These features contrast with the flexibility of the global oil market in which bilateral dependencies are limited due to a global transport infrastructure (oil tankers).

Europe's core energy security concern is now to cut its dependence on Russian energy. However, the European Green Deal can also create new energy security risks, most notably from the import of minerals and metals underpinning the manufacturing of solar panels, wind turbines, LEDs, Li-ion batteries, fuel cells or electric vehicles. Minerals and metals that have particular properties, and that currently have few to no substitutes.

While some of these minerals and metals are widely available across the world and are relatively easy to mine, others are either geographically concentrated in a few resource-rich countries, or treated and processed in a few countries. Europe itself has no significant mining and processing capacities of these critical raw materials. For instance, it produces only around 3 percent of the overall raw materials required in Li-ion batteries and fuel cells.

In 2011, the European Commission produced a first list of critical raw materials, which has been updated every three years . It currently enlists 27 materials that are judged critical because of their importance for the high-tech and green economies, because of their scarcity, and/or because of the risk of supply disruption.

China is a leading producer and user of a majority of critical raw materials. The import of rare earths from China is probably the most critical issue in this area, also given the fact that Europe does not have any mining or processing activity of these important minerals.

For Europe, the situation of dependency on China is set to further increase in the future as demand for green technologies will increase. Just to provide an example, the JRC estimates that the EU's annual critical raw material demand for wind turbines will increase between 2 and 15 times over the next three decades. Overall, the EC expects Europe's demand for raw materials to double by 2050.

Fourth, repercussions for global trade, notably via carbon border adjustment measures

Taxing the carbon content of domestic production without taxing imports in a broadly similar way would disadvantage domestic production. The incentive for consumers would be to continue buying the same products but shift to suppliers from abroad instead of switching to more efficient domestic producers. In line with a group of more than 3,000 distinguished American economists, the European Commission has therefore proposed to introduce border carbon adjustment. The rationale of the proposal is clear: if Europe puts in place a stringent climate policy while other parts of the world do not, there is a risk that emissions-intensive companies might leave the EU with its high emission prices, and relocate to places with significantly lower or no emission prices. This leakage issue is set to become more relevant with the EU pursuing a more ambitious climate policy, even if the exact order of magnitude of the issue is unclear.

A carbon border tax would have a double aim: i) Preventing carbon leakage by ensuring that all goods consumed in the EU, whether imported or produced domestically, are treated the same; ii) Incentivising other countries across the

world to also decarbonise, thereby contributing to the permanence of the climate coalition. This would be achieved by putting a tax or tariff on the emissions embedded in imported products. In addition, EU exporters might reclaim the cost of the emissions embedded in their products to ensure that European companies are not at a competitive disadvantage when selling abroad. Given that already now, the EU imports significantly more CO_2 than it exports, the issue of carbon leakage cannot be ignored.

Yet, introducing a carbon border tax represents a substantial practical and political challenge – and indeed no country in the world has so far adopted it. Such an initiative indeed presents two main difficulties. The first, of technical nature, relates to the difficulty of calculating the emissions content of imports, as all emissions along the entire value chain would need to be considered. The second, of geopolitical nature, relates to the risk of potential retaliations from trade partners. President von der Leyen made clear that a carbon border tax should be compatible with the rules of the World Trade Organisation (WTO), to ensure that countries cannot retaliate based on WTO rules.

But even if the carbon border tax is safeguarded against formal objections, trade partners might still perceive it as overreach and threaten or adopt retaliatory measures. After all, this already happened in 2012, when the EU directive on aviation emissions went into effect. The directive substantially entailed a form of carbon border adjustment, by extending the EU emissions trading system (ETS) to the aviation sector. A group of 23 countries – including the United States, China, India, Japan, Russia – strongly opposed the EU move and came up with a list of retaliatory measures they would have taken should the EU not withdraw the directive. As a result of this strong reaction, and in view of some developments in international negotiations on emissions controls, the EU withdrew the measure for intercontinental flights.

International reactions to the introduction of an EU carbon border tax are likely to be profoundly diverse. Countries putting a strong emphasis on the climate problem are likely be supportive of the initiative, and potentially replicate it. On the other hand, countries that export emissions-intensive goods to Europe are likely to oppose it.

To conclude, it is important to outline that the EU needs to wake up to the geopolitical risks of the European Green Deal and prepare a foreign policy strategy to manage them. This strategy needs to include both actions to manage the direct geopolitical repercussions of the European Green Deal, and actions to foster EU global green leadership.

Measures in the first category would primarily involve helping neighbouring oil and gas-exporting countries prepare for EU decarbonisation. The EU should work with these countries on their economic diversification, including into renewable energy and green hydrogen that could in future be exported to Europe. The EU must also improve the security of its critical raw materials supply and limit dependence, first and foremost on China. Essential measures include greater supply diversification, increased recycling volumes and substitution of critical materials. Finally, to the EU must work with the United States and other partners to establish a "climate club", whose members will apply similar carbon border adjustment measures. All countries, including China, would be welcome to join if they commit to abide by the club's objectives and rules.

To be the global leader in climate action, the EU should aim to become a global standard-setter for the energy transition, particularly in hydrogen and green bonds. Requiring compliance with strict environmental regulations as a condition to access the EU market will be strong encouragement for all trade partners to go green. Furthermore, the EU should export the European Green Deal through sustainable energy investment in developing countries. This in any case makes economic sense, as developing countries have lower marginal emissions abatement costs than European countries, it would help EU companies enter rapidly growing markets, and it would boost economic development and diversification in partner countries, providing an invaluable foreign policy dividend for the EU. Furthermore, the EU should promote global coalitions for climate change mitigation, for example through a global coalition for the permafrost and a global coalition for CO_2 emissions removal. Such initiatives would fund global common goods that require international cooperation.

Together, these actions make up a foreign policy framework for the European Green Deal. They respond to the geopolitical challenges other countries are likely

to face from the Green Deal and from increasing global warming more generally, and offer ways to expand the decarbonisation push beyond the EU – which will be a necessary to the European Green Deal's success.