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Saving Energy in a Hurry

Reducing Dependence on Russian Hydrocarbons Requires Resolute Demand and Supply Sides Action

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Key Takeaways

- **Facing Russia's aggression on Ukraine, European countries have enacted economic and financial sanctions against Russia. However, heavily dependent on Russian gas, they fear possible countersanctions.**
- **On the other hand, Russia is heavily dependent, first and foremost, on oil exports, but also, yet to a lesser extent, on gas exports to Europe. Oil and gas represent more than half its total export revenues.**
- **European countries should distinguish two policy needs: reducing their dependence on Russian gas to mitigate the impacts of possible countersanctions; reducing the demand for Russian oil to increase the economic pressure on Russia.**
- **Reducing demand for Russian oil can be much easier for European countries to endure and can be done immediately with an active involvement of the civil society, from companies to citizens. It would ease the cost impacts on European citizens and give them ways to express their solidarity with Ukraine.**

The reciprocal EU-Russia dependencies

Facing the Russian aggression of Ukraine, the European countries are reconsidering their energy situation and in particular their strong addiction to Russian fossil gas imports (Figure 1). While the United States have decided an embargo on oil and gas imports from Russia, many European countries are reluctant to follow, as this economic sanction on Russia would also have heavy economic consequences for countries that are highly dependent on Russia for their fossil fuels consumption.

Figure 1: Shares in EU natural gas imports, 2021.

Source: European Commission

The EU imports 90% of its gas consumption, with Russia providing 45% of the European Union (EU)'s total gas imports in 2021. EU's gas import dependency has worsened in 30 years: it was around 50% in the early 90s, hovered around 70% in the 2000s and 2010s before escalating to current levels.

The dependency on Russian gas is maximal (>99%) for Estonia, Finland, Moldova, North Macedonia and Bulgaria, extreme (>80%) for Latvia, Serbia, Austria, Slovenia and Hungary, very high (>50%) for Germany, Lithuania, Luxembourg, Czechia, and Poland, high (>30%) for Denmark, Italy, Romania, Switzerland, Ukraine, and significant (>20%) for Croatia and Greece. Of course, the role of gas in the energy mix can be more or less important.

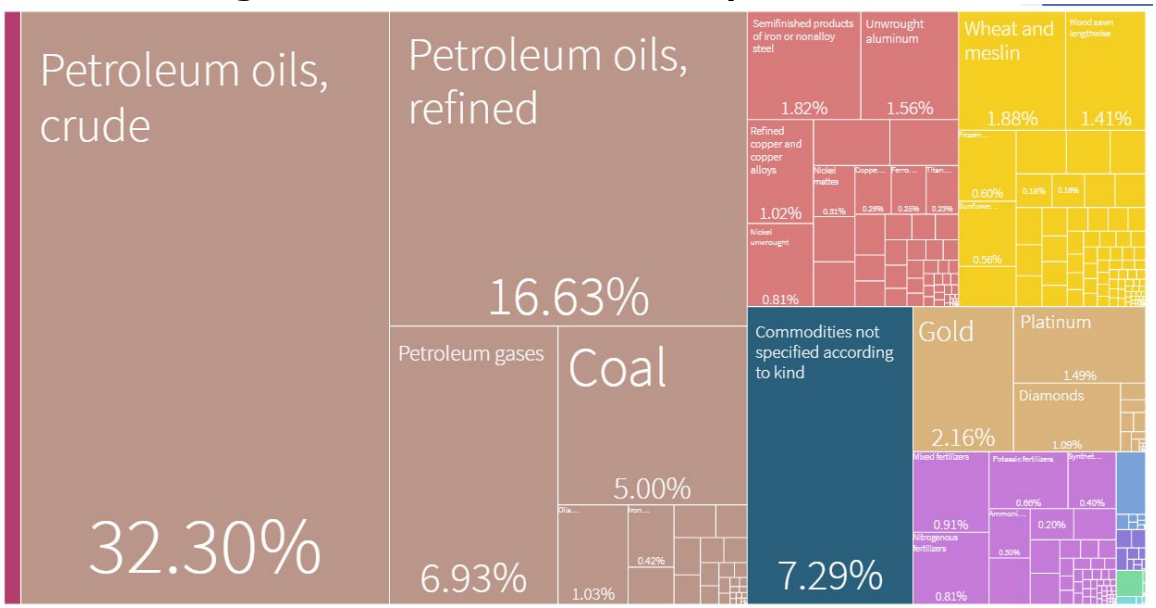
Furthermore, this dependency is often hard-wired in the pipeline networks. Several countries have few options to shift to other suppliers, when they do not have liquefied natural gas (LNG) import terminals, such as Germany, or too little spare capacity, like the Netherlands.

The Russian addiction to oil exports

The Russian economy and its trade balance is heavily dependent on its exports of hydrocarbons. Crude oil and oil products (notably Diesel) alone count for about half the

total net value of Russian exports with 7 to 8 million barrels per day (mb/d), of which half is sent to Europe. Meanwhile, natural gas exports ("petroleum gases") count for 7%, seven times less than oil, barely more than coal exports (5%), in 2019 at "normal" hydrocarbon prices (see Figure 2).

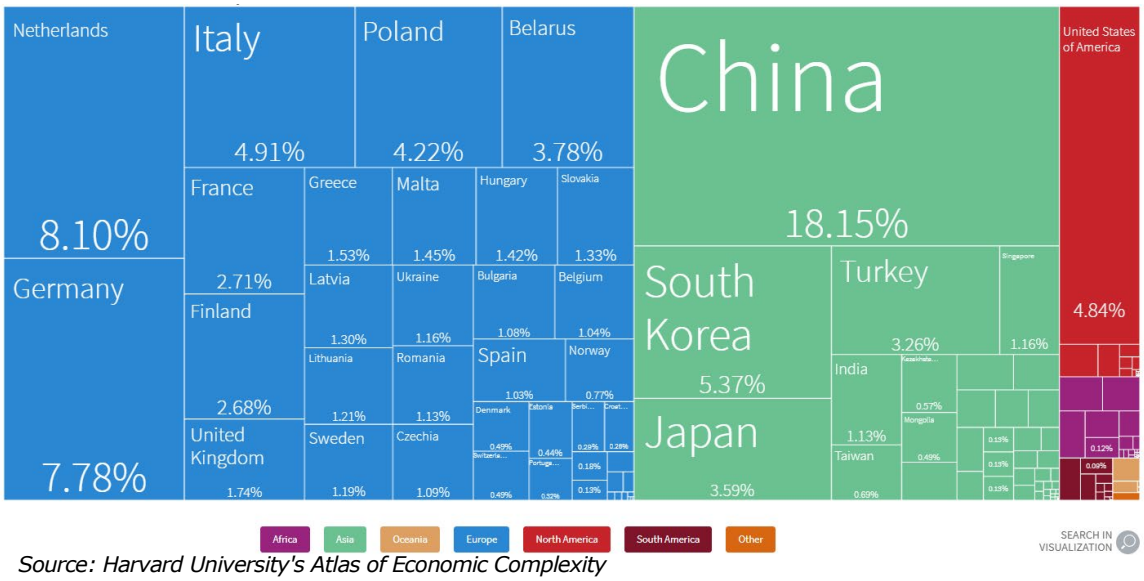
Figure 2: Net value of Russian exports in 2019



Source: Harvard University's Atlas of Economic Complexity

Hydrocarbon prices have "exploded" since 2019, increasing further their role in financing the Russian war. The EU imports almost all its oil, and Russia accounts for 27% of these imports. Nine other countries (Iraq, Nigeria, Saudi Arabia, Kazakhstan, Norway, Libya, the United States, the United Kingdom and Azerbaijan) account each for 4.5 to 9% of total imports. Conversely, Russia exports to Europe most of its mineral fuels (Figure 3).

Figure 3: Shares of Russian exports of mineral fuels (2019, in value)



Source: Harvard University's Atlas of Economic Complexity

While most gas is transported in pipelines, only about a third of Russian oil exports to Europe is delivered to a pipeline, the Druzhba pipeline (or rather pipeline networks) with branches crossing Belarus and Ukraine extending to Poland, Hungary, Slovakia, the Czech Republic and Germany. The remaining shipments come by ships.

Oil is a more fungible global commodity than fossil gas. This plays both ways: it facilitates European countries getting oil and products from other suppliers, but it also helps Russia redirecting its shipments to other buyers. As several European buyers refrain from taking Russian oil, this has already begun towards China, India and other Asian countries, but at the cost of sharp discounts (20-25%).

A two-pronged approach

In this context, possible European policies relative to Russian gas and oil, beyond similarities, would differ in their objectives and their means. Reducing the demand for Russian oil would primarily aim at reducing the Russian financing of the war effort, the reduction of the demand for Russian gas would primarily aim at reducing the European exposure to possible countermeasures or physical disruptions.

The gas storages in Europe are currently low but the winter is close to its end; of the three major gas-consuming uses, two – direct building heating and electricity production – are linked to meteorological conditions, while industry use is not. The most critical issue is thus linked to the replenishment of gas storage before the next winter begins.

The need to reduce oil imports from Russia is much more immediate, as the war rages, soldiers on both sides and Ukrainian civilians pay a growing price by the day, cities are being destroyed, and the independence and freedom of Ukraine are under severe threat.

> Reducing the demand for Russian oil would primarily aim at reducing the Russian financing of the war effort

International Energy Agency (AIE) member countries have an obligation to hold oil stocks corresponding to ninety days of net imports. They decided on March 1 to release 61.7 million barrels. This represents about 3% of the total storage obligations.[1] These "emergency oil stocks" offer a considerable lever to simultaneously and immediately reduce global prices and the oil demand addressed to Russia.

There is a deep difference between reducing the demand voluntarily and facing reduced supply. In the first case, prices are likely to drop, doubling the impacts on the supplier and reducing them on the buyer. In the second, prices are likely to increase,

1. "IEA Confirms Individual Contributions to Collective Action to Release Oil Stocks in Response to Russia's Invasion of Ukraine", International Energy Agency (IEA), *Press Release*, March 4, 2022, available at: www.iea.org.

doubling the impacts on the buyer and reducing them on the supplier. Identical physical hydrocarbon flows may correspond to very different economic situations, depending on the initiator of the restrictions.

Voluntary actions to reduce oil and gas consumption are very diverse and their short-term potential seems comparable or higher than that of other forms of action.

Reducing the energy dependence on Russia

The European Commission (EC) will make a legislative proposal in April to require that existing gas storages are filled up to at least 90% of their capacity by 1 October each year and propose to "increase the rebate level to 100%" as an incentive to refill storage. Indeed, the current high gas prices are a true disincentive for market participants, which may fear that a possible price relaxation in a few months' time would lead them to resell at a lower price during the next heating season – exactly the opposite of their normal business.[2] The EC rightly notes that the risks should be shared among EU countries as an "EU gas storage policy" allowing Member States to provide aid to suppliers, e.g. in the form of guarantees.

In its RePowerEU communication,[3] the EC aims at reducing the dependence on Russian fossil fuels, "based on two pillars: diversifying gas supplies, via higher LNG imports from non-Russian suppliers, and higher levels of biomethane and hydrogen; reducing faster our dependence on fossil fuels at the level of homes, buildings and the industry, and at the level of the power system by boosting energy efficiency gains, increasing the share of renewable and addressing infrastructure bottlenecks."

But while the EC proclaims that "energy efficiency first principle is more relevant than ever", the Versailles declaration from the EU Summit of March 10-11[4] only mentions it at the seventh place, after "diversifying our supplies and routes through the use of LNG and the development of biogas", "further developing a hydrogen market for Europe", "speeding up the development of renewables", "completing and improving the interconnection of European gas and electricity networks" and "reinforcing EU contingency planning for security of supply".

The 27 Heads of State and government invite the EC to propose a RePowerEU plan "by the end of May" and "a plan to ensure security of supply and affordable energy prices during the next winter season by the end of March". They add that (they) "will continue working (to) ensuring sufficient levels of gas storage and putting in place coordinated refilling operations, monitoring and optimizing the functioning of the electricity markets," and "channeling coordinated investment in energy systems, including providing LNG infrastructure."

2. See e.g., B. McWilliams *et al.,* "Preparing for the First Winter without Russian Gas", blog post, Bruegel, February 28, 2022.
3. "REPowerEU: Joint European Action for More Affordable, Secure and Sustainable Energy", European Commission, COM(2022) 108 final, March 8, 2022.
4. "The Versailles Declaration", French Presidency of the Council of the European Union, March 10-11, 2022.

The shift to alternative suppliers is limited by the capacities of infrastructures, both for LNG ships and pipelines. The EC estimates the potential of Russian gas replaced by LNG diversification by the end of 2022 to 50 billion cubic meters (bcm), plus 10 bcm through pipeline import diversification. By reference, the annual gas consumption of the EU was about 450 bcm in 2017, 2018 and 2019.

The IEA has assessed a similar potential of 10 bcm through pipelines but of only 20 bcm as LNG imports, mostly because of very high LNG prices globally, out of a theoretical potential of 60 bcm. The potential for regasification would be even higher with more interconnection capacities, notably from Spain to France.[5]

This suggests that reducing gas consumption could, beyond its direct effect on volumes, also ease the diversification of supplies in reducing global gas prices. It also shows that the efforts to reduce gas consumption should not be limited to the EU but extend to the entire world, while many countries have sided with Ukraine in a massive vote at the UN General Assembly on March 2. The IEA also recalls the need to reduce methane leaks, estimated at 2.5 bcm across Europe, in both consumer and producer countries, in which significant quantities of natural gas are still flared.

> The efforts to reduce gas consumption should extend to the entire world

The EC assessed the possibility of increasing biomethane production at 3.5 bcm by the end of 2022 and 35 bcm by 2030, twice as much as expected from its own *Fit for 55* by 2030 legislative proposal. The IEA sees a very limited potential in the short term due to the lead time for new projects.

Despite similar lead time issues, the potential to increase solar and wind capacity deployment above and beyond what is already expected in 2022 – an addition of 100 terawatt-hours (TWh) – would reach about 35% more, according to the IEA. This would combine tackling delays with permitting for utility-scale wind and photovoltaic (PV) projects and doubling the pace of rooftop PV systems via a short-term grant program covering 20% of installation costs. This latter point has been taken up by the EC, who assesses at 2.5 bcm the additional gas demand reduction it could deliver in one year, above and beyond ~7.5 bcm from already planned projects. For reference, *Fit for 55* foresees the doubling of the EU's photovoltaic and wind capacities by 2025 and tripling by 2030, saving 170 bcm of yearly gas consumption by 2030.

The IEA also mentions the value of accelerating the replacement of gas boilers with heat pumps (2 bcm in one year), and energy efficiency improvements in buildings and industry (close to another 2 bcm within a year). It suggests targeting the least efficient homes and non-residential buildings. These suggestions too have been taken up by the EC.

5. "10-point Plan to Reduce the EU's Reliance on Russian Natural Gas", IEA, Paris, March 3, 2022.

Measures still to be taken: heat and cooling

There is significant potential from actions that could be taken by citizens, especially if encouraged by public campaigns and in some cases support from employers.

A temporary thermostat adjustment by one to a few Celsius degrees would play across the board, impact gas, oil and electricity consumptions, in homes as well as other buildings, offices, shops, public buildings. Each degree would allow an economy of 6-7%, and if generalized would represent 10 bcm of fossil gas. Turning off radiators in empty rooms, opting for showers instead of baths, shortening showers, installing more thermostats or flow reducers would also help.

In a few months' time, one may advise shops and offices to set thermostats at 28°C to reduce the consumption of air-conditioning systems – as was organized in Japan after the Fukushima Daichi disaster.

Saving oil in a hurry

Many actions can help save oil immediately, such as limiting the speed on Europe's highways to 110 km/h, ensuring full charge of heavy and light-duty vehicles, dissuading same and next day deliveries, developing carpooling and teleworking – these latter two with involvement of employers. Drivers could be invited to eco-driving and checking tire pressure and public transport use should be encouraged further.

Many actions can help save oil immediately

The International Energy Agency had listed and assessed a wide range of possible measures in *Saving Oil in a Hurry*, based on multiple real-life past experiences[6]. Savings of 10 to 30% might be possible without too heavy inconvenience, saving consumers' money.

The role of electricity

About a third of the gas consumption is absorbed in power plants, although it only provides 14% of total electricity generation in the EU in 2019. As mentioned above, an accelerated deployment of electricity-generating renewable capacities would be key, as it only represents an anticipation of what is planned in Europe in the framework of the *Fit for 55*. It would also make sense to differ the planned demise of some nuclear reactors, under the control of nuclear safety authorities.

An accelerated deployment of renewable capacities would be key

6. "Saving Oil in a Hurry", *Insight Series*, IEA, 2018.

In this respect, it would be important to dissipate some misconceptions. Solar and wind power are variable and not dispatchable (some say "intermittent"). This leads some to claim that they would thus increase the need for fossil gas use as "back-up" – and increase the EU dependency on Russian exports. But this is not the case.

All studies show that the amount of gas use required to shoulder systems with very large shares of variable renewables is low, and only needed to ride through "dark doldrums" (from the German "Dunkelflaute") – week-long periods of low sunshine and low winds in winter, when the demand is highest. In Germany, the need would be 36 TWh per year[7]. In France, from 20 to 35 TWh per year by 2050 in a 100% renewable electricity scenario[8]. In Germany, this is significantly less than now (86 TWh in 2019); in France, this is equal to the average generation from gas 2016-2020 – but for a system that provides then 55% of the country's energy (versus 25%) and has thus replaced most of gas and oil use directly in buildings, industry and transports. In both countries, a mix of biomethane and green hydrogen will substitute fossil gas progressively from 2035 to 2050, thus putting fossil fuel use to an end in the power sector and achieving its full decarbonation.

EU governments seem essentially preoccupied by the impact of the rise in gas prices on the costs of electricity: the Versailles Declaration mentions a continued work to "monitoring and optimizing the functioning of the electricity market". This impact is due to the prices paid to electricity market participants according to the marginal price of the "last unit" put in service to respond to the demand – and it reveals that fossil fuels are "marginal" in a proportion of time that is significantly higher than their overall share in generation. This is especially true for fossil gas, which is a fuel for mid-peak and peak hours: the relatively low cost of gas turbines makes them optimal for running part-time, while coal or nuclear are more "baseload" generators.

Increase the time flexibility in the use of electricity

A more strategic option would be to increase the time flexibility in the use of electricity – as already organized with tariff options such as "night/day", "peak/off-peak hours" and "critical peak day" pricing. Extension of time-based pricing would be a powerful option to harvest the demand-side response potential from all sorts of electricity consumers but may take weeks or months to put in place.

A measure with immediate effect, however, would be to inform and invite them, on a voluntary basis, to shift some electric loads from peak hours to off-peak ones – notably from the evening to the second part of the night. As the IEA "Ten-points" document puts it, "flexibility measures to reduce industrial electricity and gas demand in peak hours are particularly important to alleviate the pressure on gas demand for electricity generation."

7. O. Ruhnau and S. Qvist, "Storage requirements in a 100% renewable electricity system: Extreme events and inter-annual variability", ZBW – Leibniz Information Centre for Economics, 2021.
8. Chapter 7 "Sécurité d'approvisionnement", in : *Energy Futures 2050*, Réseau de Transport d'Électricité français, 2022.

The Agency had previously listed and assessed the many measures that could save electricity very rapidly.[9]

Electrification of end-uses to displace direct fossil fuel uses is a major lever to decarbonization, as made clear for example by the IEA *Net Zero by 2050* publication[10]. Heat pumps have been mentioned already due to their impact on gas consumption but accelerating the electrification of transports would help reduce oil consumption rapidly. It brings about important efficiency improvements (1 kWh of electricity replaces 3-4 kWh of fuel in a vehicle) but also significant flexibility potential as most electric vehicles have a battery. Smart recharging strategies would make best use of domestic low-carbon electricity generation, and vehicle-to-grid strategies could further reduce fossil gas use.

Electrification of end-uses to displace direct fossil fuel uses

In individual and collective kitchens, electrification may also bring about large efficiency improvements and displace more fossil gas, as for long cooking times efficient electric pressure cookers consume a fifth of the energy needed on gas-fired stoves.[11]

Significant energy savings are also available in the electrification of industries. Studies show that existing and under-development technologies could electrify all processes.[12] Emerging high-temperature thermal storage options can introduce significant flexibility in electricity consumption and help displace gas consumption both within industrial plants and thermal power plants[13]. Simple heat management can suffice, as Trimet showed in Essen (Germany) introducing a large variability for intensive electricity consumption of aluminum electrolysers – equivalent to creating a large battery but at a much lower cost.[14]

A role for hydrogen?

The Versailles Declaration mentions "further developing a hydrogen market for Europe" among the means to "to phase out our dependency on Russian gas, oil and coal imports as soon as possible".

The EC gives more details on its "Hydrogen Accelerator": "An additional 15 Mt of renewable hydrogen on top of the 5.6 Mt foreseen under the *Fit for 55* can replace

9. "Saving Electricity in a Hurry", IEA, Paris, 2018.
10. "Net Zero by 2050 – A Roadmap for the Global Energy Sector", IEA, Paris, 2021.
11. See C. Philibert, "Power to the Cooks! New Clean Cooking Opportunities for Sustainable Development in Sub-Saharan Africa", *Briefings de l'Ifri, Ifri,* February 1st, 2022, available at: www.ifri.org.
12. See e.g., S. Maddedu *et al.*, "The CO_2 Reduction Potential for the European Industry via Direct Electrification of Heat Supply", *Environmental Research Letters,* Vol. 15, No. 12, 2020.
13. See e.g., E. Ballard, "Startup Wants to Store Spare Renewable Electricity to Power Heavy Industry", *Wall Street Journal*, February 8, 2022.
14. G. Matthews, "Learning to Use Variable Renewable Energy Key to the Greening of Metal Production", Presentation at the HiTeMP-2 Forum, Adelaide, March 2020.

25-50 bcm per year of imported under the *Fit for 55* can replace 25-50 bcm per year of imported Russian gas by 2030. This would be made of an additional 10 Mt of imported hydrogen from diverse sources and an additional 5 Mt of hydrogen produced in Europe, going beyond the targets of the EU's hydrogen strategy and maximizing the domestic production of hydrogen. Other forms of fossil-free hydrogen, notably nuclear-based, also play a role in substituting natural gas."

However, the amounts of low-carbon electricity generated in Europe by 2030 will remain too low by 2030 for cost-effective hydrogen production and would likely be used in direct electrification with a greater potential for both greenhouse gas emission reduction and displacement of fossil fuels – including Russian fossil gas. With respect to imports, few countries would be in position at the time to export significant amounts of hydrogen-based feedstocks and fuels – long-distance dihydrogen transport being a rather inefficient and costly option – as they too would often make more effective use of green electricity in displacing fossil-fuelled electricity generation, rather than electrolyzing water.

"Blue" hydrogen (with carbon capture and storage) could be a better option, especially if produced in electrified steam methane reformers, and an improvement over grey or black hydrogen from a climate change mitigation perspective[15]. However, with respect to gas demand and diversification of supply, it may not be the most straightforward option and its short-term (one year) potential is close to nil.

Fertilizers, agriculture and food

One important use of fossil gas, absorbing 6% of it globally, is the production of hydrogen. Half of it is then turned into ammonia, and 80% of ammonia ends up in the production of nitrogen fertilizers. Russia is the third ammonia exporting country, and much goes through an ammonia pipeline that links Togliatti in Russia to Odessa in Ukraine, where the ammonia is loaded on ships (now stopped due to the war).

An evolution towards more resilient and sustainable agricultural practices

The continuous gas cost increase in 2021 may have already led farmers to use lesser quantities, but much more could be done in this field – in the fields, especially as the Russian war is also disrupting the capacity of both Russia and Ukraine to export cereals and legumes, in particular oilseeds such as sunflowers.

This should incite the EU to engage without further ado in an evolution towards more resilient and sustainable agricultural practices. It should use less chemical fertilizers (and thus less pesticides), cultivate more legumes (oilseeds and protein crops) that can procure nitrogen from the air, thus reducing ammonia and nitrogen

15. See C. Philibert, "After the Hydrogen Bubble Bursts: The Factors Shaping and Possibly Unfolding International Hydrogen Value Chains", *Briefings de l'Ifri*, Ifri, September 17, 2021, available at: www.ifri.org.

disruption of natural ecosystems and lowering GHG emissions. It would favor extensive farming breeding over intensive livestock. less.

A healthier diet would contain more vegetables and less animal proteins, reducing the overall demand for vegetable proteins if less are used as animal food. In short, an acceleration of the EU *From farm to fork* Strategy would offer a major help to ride through the likely import disruptions. If we want to see hundreds of sunflowers bloom, seeds are to be planted in the coming weeks.

Using domestic coal?

While all measures considered above are fully consistent with our collective climate ambition, a temporary increase in the use of coal would obviously not be. Such a reverse fuel switch only finds its place when all other measures have been exhausted and provided it does not postpone other ongoing efforts to eliminate coal where it subsists in the European economy, in the steel-making industry, where blast furnaces ought to be replaced with hydrogen-direct iron reduction and electric arc furnaces. In this respect, the apparent disinterest of the EU leaders in soliciting an active demand response from energy consumers may widen the gap between our short-term policy to reduce our dependence on Russian hydrocarbon exports, and our slightly longer-term climate goals.

Solidarity is a condition of solidarity

The IEA pointed out the windfall profits of utilities and suggested taxing them away, then redistributing the receipts to "cushion impacts on vulnerable groups", at a level of up to €200 billion. The EC endorsed this suggestion, which is for Member States to implement. Indeed, fairness in sharing the costs of hydrocarbon price hikes and countermeasures seems to be an obvious pre-condition of the success of any further call to solidarity with Ukraine, and citizen activism. This is not to be confused with broad, indiscriminate cost freezes or tax exemptions on hydrocarbon consumptions, which would do the opposite, and only disincentivize energy savings.

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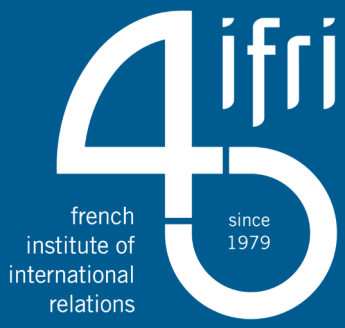

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