Full Russian gas embargo: a fallback scenario that secures European industry by reduced heating

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(Working draft, feedback welcome!)

Version 0.06 of 23 April 2022 (Data and most recent version: <https://github.com/hblasum/stop-gas-imports> )

**Abstract:** Based on current Eurostat energy data available for 2019/2020, if we take as economic entity the EU plus Iceland, Liechtenstein, Norway, United Kingdom, Montenegro, North Macedonia, Albania, Bosnia and Herzegovina, Kosovo, Moldova and Ukraine, then one in principle can immediately implement a gas embargo without touching industry consumption or power generation at all, by a stop on heating, as the overall consumption of gas by household / commercial / public end users is larger than the Russian gas imports. Also a scenario without Russian gas imports as well as without any additional external gas imports can be sustained by household / commercial / public consumption gas savings by 73%, electricity generation gas substitution by 20% (i.e. keeping the remaining 80% unchanged), industrial gas savings by only 8% (i.e. keeping the remaining 92% unchanged). If we take into account additional imports of LNG, Algerian pipelines etc then the savings demands for end user consumption reduction go down further.

If we take as economic entity only the EU without the aforementioned non-EU countries, then if household / commercial / public consumption gas is saved by 85%, gas for electricity generation is 50% substituted, gas for industry is saved by 8%, then the EU can do without Russian gas imports as well as without any additional external gas imports.

# Introduction and objective

The cruel war in Ukraine is being financed by Europe to the extent of more than 30 billion EUR since 24 February.[[1]](#footnote-1) As an excuse, it has been frequently argued that European industry depends on gas so much that an embargo cannot be done. We argue that an embargo is possible without almost touching industry consumption, largely by cutting private consumptions. With the hypothetical scenario full embargo without any new imports and sourcing and with almost no contribution for industry, the cut in private consumption is very large. The objective of the write-up is not to state that such a radical industry protection is the only way to go ahead, as presumably larger savings are also possible in the industry, but to give assurance that even if it would turn out that realizable industry savings and substitution options were in fact minuscule, then a gas embargo still would not lead to any industrial breakdown.

Ethically there are strong arguments why there is an obligation for Europe to stop gas imports and why they have impact.[[2]](#footnote-2) In addition, numerous economic studies have argued that, based on price elasticity, a gas embargo can be done with only moderate costs for instance to the German economy at a cost of less than 3% GDP,[[3]](#footnote-3) comparable to the financial crisis or COVID-19 economical shrinking.

However, the German government seems to refuse to accept arguments based on price elasticity, worrying that in worst-case scenarios that (1) price elasticity values derived from normal situations do not carry over to a deep economic transformation and (2) core industries that are at the bottom of the value chain are especially endangered, such as for instance the chemical industry that has been relatively strong in Germany since the 19th century. A BDEW working paper only assumes 8% savings in industry to be feasible.[[4]](#footnote-4)

For the public electricity grid, there is enough capacity for power generation from coal and overall for electricity generation gas only plays a minor role, e.g. 12.6% in Germany in 2021,[[5]](#footnote-5) however gas electricity plants are used for peak load generation. The aforementioned BDEW working paper projected 54% gas savings potential for public electricity generation.[[6]](#footnote-6) For now, given that gas plants are used to balance peak loads, we consider this number high and assume a more modest reduction for electricity generation.

In the following we show that it is possible to stop immediately Russian gas imports without little (8%) reduction in industry consumption and moderate reduction for public grid electricity generation when gas consumption in the private / commercial / public sectors is cut down by 73-85% (this consumption is mostly used for heating[[7]](#footnote-7)). Unlike many price elasticity models, mathematically our approach is very simple: it is just an addition of Eurostat publicly available numbers. We show both a European as well as a German view.

# European view

Table 1 and Table 2 show that for Europe 2019 numbers (EU plus Iceland, Liechtenstein, Norway, United Kingdom, Montenegro, North Macedonia, Albania, Bosnia and Herzegovina, Kosovo, Moldova and Ukraine) the consumption by households + public and commercial of 5627 PJ + 2032 PJ = 7659 PJ alone, which is largely used for heating, is larger than Russian gas imports of 7038 PJ. That is, a gas embargo borne by households/public/commercial users could be done with neither touching industry use nor electricity generation at all. 2019 has been intentionally selected as the year with the highest imports Europe and the EU had made, e.g. 2020 imports slightly lower (due to COVID-19).

As shown in Table 3 and Table 4, also on EU level, almost everywhere cutting off all Russian gas imports could be entirely balanced by household and commercial and public services and a small part of power generation. Moreover, the pattern that household + commercial and public sector consumption + electricity generation is larger than Russian imports holds for most European countries, limiting the needs for intercountry flows. Again, arguing with 2019/2020 numbers, is a conservative estimate, as e.g. Lithuania, Latvia and Estonia have already become independent of Russian energy ties.

Table 1: Russian gas imports into Europe in PJ (petajoule = 1015 Joule).

|  |  |  |
| --- | --- | --- |
|  | Eurostat 2019[[8]](#footnote-8) | Eurostat 2020 |
| Gas imports from Russia to Europe | 7094 PJ | 6500 PJ |

Table 2: Gas consumption in Europe (derivation see Section 6).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Primary energy consumption Eurostat 2019[[9]](#footnote-9) | % | Primary energy consumption Eurostat 2020 | % |
| SUM | 15318 PJ |  | 14670 PJ |  |
| Households | 5627 PJ | 28 | 5578 PJ | 28 |
| Commercial and public services | 2032 PJ | 10 | 1955 PJ | 10 |
| Power generation (public grid) | 4622 PJ | 23 | 4550 PJ | 23 |
| Industry | 7515 PJ | 37 | 7342 PJ | 37 |
| Transport | 93 PJ | 1 | 90 PJ | 0 |
| Other | 160 PJ | 0 | 150 PJ | 1 |

Table : Russian gas imports into EU in PJ (petajoule = 1015 Joule).

|  |  |  |
| --- | --- | --- |
|  | Eurostat 2019[[10]](#footnote-10) | Eurostat 2020 |
| Gas imports from Russia to EU | 7038 PJ | 6443 PJ |

Table : Gas consumption in EU (derivation see Section 6).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Primary energy consumption Eurostat 2019[[11]](#footnote-11) | % | Primary energy consumption Eurostat 2020 | % |
| SUM | 15318 PJ |  | 14670 PJ |  |
| Households | 3959 PJ | 26 | 3913 PJ | 26 |
| Commercial and public services | 1681 PJ | 11 | 1605 PJ | 11 |
| Power generation (public grid) | 3640 PJ | 24 | 3531 PJ | 23 |
| Industry | 6050 PJ | 39 | 5894 PJ | 39 |
| Transport | 86 PJ | 1 | 84 PJ | 1 |
| Other | 72 PJ | 0 | 61 PJ |  |

Table 5 shows a scenario where household / commercial / public consumption gas is saved by 85%, gas for electricity generation is 50% substituted, gas for industry is saved by 8%, this is possible when we assume gas exchange within the EU alone, without any additional imports on the world market. “Old” is the 2020 baseline scenario, “new” is the scenario with above-mentioned savings implemented. The balance is substitution minus Russian gas imports, where this balance is positive, the country / geographic unit can cut Russian gas without European imports; where this balance is negative, the country needs other (non-Russian) European imports (taken from the positive balance of other countries: e.g. the surplus of172 PJ of Belgium can be fed into the deficit of 76 PJ of Germany).

Table 6 shows a scenario where household / commercial / public consumption gas is saved by 73%, gas for electricity generation is 20% substituted, gas for industry is saved by 8%, this is possible when we assume gas exchange within the EU plus Iceland, Liechtenstein, Norway, United Kingdom, Montenegro, North Macedonia, Albania, Bosnia and Herzegovina, Kosovo, Moldova and Ukraine, without any additional imports on the world market.

Table : Scenario where household / commercial / public consumption gas is saved by 85%, gas for electricity generation is 50% substituted, gas for industry is saved by 8%.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Country | Gas imports Russia old | Household old | Household new | Commercial / public old | Commercial / public new | Electricity old | Electricity new | Industry old | Industry new | Substitution new | Balance |
| Belgium | 150 | 151 | 23 | 88 | 13 | 148 | 74 | 318 | 292 | 302 | 152 |
| Bulgaria | 91 | 11 | 2 | 4 | 1 | 29 | 15 | 52 | 48 | 32 | -59 |
| Czechia | 364 | 103 | 15 | 55 | 8 | 48 | 24 | 119 | 109 | 167 | -197 |
| Denmark | 0 | 40 | 6 | 9 | 1 | 19 | 10 | 57 | 53 | 56 | 56 |
| Germany | 1803 | 1118 | 168 | 440 | 66 | 592 | 296 | 1365 | 1255 | 1730 | -73 |
| Estonia | 19 | 8 | 1 | 3 | 1 | 0 | 0 | 6 | 6 | 10 | -9 |
| Ireland | 0 | 27 | 4 | 19 | 3 | 105 | 53 | 57 | 53 | 97 | 97 |
| Greece | 65 | 18 | 3 | 7 | 1 | 127 | 63 | 54 | 49 | 89 | 24 |
| Spain | 256 | 161 | 24 | 91 | 14 | 417 | 209 | 750 | 690 | 482 | 226 |
| France | 707 | 558 | 84 | 278 | 42 | 249 | 124 | 636 | 585 | 885 | 179 |
| Croatia | 0 | 23 | 4 | 10 | 1 | 25 | 12 | 50 | 46 | 44 | 44 |
| Italy | 1274 | 762 | 114 | 330 | 49 | 973 | 486 | 712 | 655 | 1471 | 197 |
| Cyprus | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Latvia | 51 | 13 | 2 | 5 | 1 | 26 | 13 | 6 | 6 | 29 | -22 |
| Lithuania | 46 | 11 | 2 | 3 | 1 | 6 | 3 | 67 | 61 | 20 | -26 |
| Luxembourg | 9 | 12 | 2 | 5 | 1 | 2 | 1 | 13 | 12 | 16 | 8 |
| Hungary | 689 | 152 | 23 | 49 | 7 | 73 | 36 | 112 | 103 | 217 | -472 |
| Malta | 0 | 0 | 0 | 0 | 0 | 14 | 7 | 0 | 0 | 7 | 7 |
| Netherlands | 733 | 318 | 48 | 130 | 19 | 418 | 209 | 618 | 569 | 639 | -93 |
| Austria | 0 | 75 | 11 | 17 | 3 | 86 | 43 | 179 | 165 | 135 | 135 |
| Poland | 371 | 177 | 27 | 63 | 9 | 62 | 31 | 413 | 380 | 268 | -102 |
| Portugal | 8 | 13 | 2 | 11 | 2 | 87 | 44 | 122 | 112 | 74 | 67 |
| Romania | 37 | 129 | 19 | 38 | 6 | 65 | 32 | 179 | 165 | 189 | 152 |
| Slovenia | 4 | 6 | 1 | 1 | 0 | 4 | 2 | 22 | 20 | 10 | 6 |
| Slovakia | 260 | 59 | 9 | 19 | 3 | 28 | 14 | 73 | 67 | 86 | -174 |
| Finland | 101 | 11 | 2 | 1 | 0 | 32 | 16 | 37 | 34 | 30 | -71 |
| Sweden | 0 | 1 | 0 | 5 | 1 | 5 | 2 | 34 | 31 | 10 | 10 |
| SUM EU | 7038 | 3959 | 594 | 1681 | 252 | 3640 | 1820 | 6050 | 5566 | 7098 | 60 |
| Iceland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Liechtenstein | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 |
| Norway | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 258 | 238 | 23 | 23 |
| United Kingdom | 0 | 1116 | 167 | 305 | 46 | 836 | 418 | 851 | 783 | 1694 | 1694 |
| Montenegro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North Macedonia | 11 | 1 | 0 | 0 | 0 | 8 | 4 | 2 | 2 | 5 | -6 |
| Albania | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 |
| Bosnia and Herzegovina | 9 | 4 | 1 | 1 | 0 | 0 | 0 | 4 | 4 | 4 | -4 |
| Kosovo | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Moldova | 35 | 14 | 2 | 4 | 1 | 10 | 5 | 5 | 5 | 21 | -15 |
| Ukraine | 0 | 533 | 80 | 38 | 6 | 128 | 64 | 342 | 315 | 577 | 577 |
| SUM Europe | 7094 | 5627 | 844 | 2032 | 305 | 4622 | 2311 | 7515 | 6914 | 9422 | 2328 |

Table : Scenario where household / commercial / public consumption gas is saved by 73%, gas for electricity generation is 20% substituted, gas for industry is saved by 8%.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Country | Gas imports Russia old | Household old | Household new | Commercial / public old | Commercial / public new | Electricity old | Electricity new | Industry old | Industry new | Substitution new | Balance |
| Belgium | 150 | 151 | 41 | 88 | 24 | 148 | 118 | 318 | 292 | 229 | 79 |
| Bulgaria | 91 | 11 | 3 | 4 | 1 | 29 | 23 | 52 | 48 | 21 | -70 |
| Czechia | 364 | 103 | 28 | 55 | 15 | 48 | 38 | 119 | 109 | 134 | -230 |
| Denmark | 0 | 40 | 11 | 9 | 3 | 19 | 15 | 57 | 53 | 45 | 45 |
| Germany | 1803 | 1118 | 302 | 440 | 119 | 592 | 473 | 1365 | 1255 | 1365 | -438 |
| Estonia | 19 | 8 | 2 | 3 | 1 | 0 | 0 | 6 | 6 | 9 | -11 |
| Ireland | 0 | 27 | 7 | 19 | 5 | 105 | 84 | 57 | 53 | 60 | 60 |
| Greece | 65 | 18 | 5 | 7 | 2 | 127 | 102 | 54 | 49 | 48 | -17 |
| Spain | 256 | 161 | 43 | 91 | 24 | 417 | 334 | 750 | 690 | 327 | 71 |
| France | 707 | 558 | 151 | 278 | 75 | 249 | 199 | 636 | 585 | 711 | 4 |
| Croatia | 0 | 23 | 6 | 10 | 3 | 25 | 20 | 50 | 46 | 33 | 33 |
| Italy | 1274 | 762 | 206 | 330 | 89 | 973 | 778 | 712 | 655 | 1049 | -226 |
| Cyprus | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Latvia | 51 | 13 | 4 | 5 | 1 | 26 | 21 | 6 | 6 | 19 | -32 |
| Lithuania | 46 | 11 | 3 | 3 | 1 | 6 | 5 | 67 | 61 | 17 | -30 |
| Luxembourg | 9 | 12 | 3 | 5 | 1 | 2 | 2 | 13 | 12 | 14 | 5 |
| Hungary | 689 | 152 | 41 | 49 | 13 | 73 | 58 | 112 | 103 | 171 | -518 |
| Malta | 0 | 0 | 0 | 0 | 0 | 14 | 11 | 0 | 0 | 3 | 3 |
| Netherlands | 733 | 318 | 86 | 130 | 35 | 418 | 335 | 618 | 569 | 460 | -273 |
| Austria | 0 | 75 | 20 | 17 | 5 | 86 | 68 | 179 | 165 | 98 | 98 |
| Poland | 371 | 177 | 48 | 63 | 17 | 62 | 49 | 413 | 380 | 221 | -150 |
| Portugal | 8 | 13 | 4 | 11 | 3 | 87 | 70 | 122 | 112 | 45 | 37 |
| Romania | 37 | 129 | 35 | 38 | 10 | 65 | 52 | 179 | 165 | 149 | 112 |
| Slovenia | 4 | 6 | 2 | 1 | 0 | 4 | 3 | 22 | 20 | 8 | 4 |
| Slovakia | 260 | 59 | 16 | 19 | 5 | 28 | 23 | 73 | 67 | 68 | -192 |
| Finland | 101 | 11 | 3 | 1 | 0 | 32 | 26 | 37 | 34 | 19 | -82 |
| Sweden | 0 | 1 | 0 | 5 | 1 | 5 | 4 | 34 | 31 | 8 | 8 |
| SUM EU | 7038 | 3959 | 1069 | 1681 | 454 | 3640 | 2912 | 6050 | 5566 | 5329 | -1709 |
| Iceland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Liechtenstein | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 |
| Norway | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 258 | 238 | 22 | 22 |
| United Kingdom | 0 | 1116 | 301 | 305 | 82 | 836 | 669 | 851 | 783 | 1273 | 1273 |
| Montenegro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North Macedonia | 11 | 1 | 0 | 0 | 0 | 8 | 6 | 2 | 2 | 3 | -8 |
| Albania | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 |
| Bosnia and Herzegovina | 9 | 4 | 1 | 1 | 0 | 0 | 0 | 4 | 4 | 4 | -5 |
| Kosovo | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Moldova | 35 | 14 | 4 | 4 | 1 | 10 | 8 | 5 | 5 | 15 | -20 |
| Ukraine | 0 | 533 | 144 | 38 | 10 | 128 | 102 | 342 | 315 | 470 | 470 |
| SUM Europe | 7094 | 5627 | 1519 | 2032 | 549 | 4622 | 3698 | 7515 | 6914 | 7117 | 22 |

# Observations on Germany

## Overall gas consumption in Germany

Table : Gas imports from Russia to Germany

|  |  |  |
| --- | --- | --- |
|  | Eurostat 2019[[12]](#footnote-12) | Eurostat 2020 |
| Gas imports from Russia to Germany | 1803 PJ | 2045 PJ |

Table : Gas consumption in Germany.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Primary energy gas consumption Eurostat 2019[[13]](#footnote-13) | % | Primary energy gas consumption Eurostat 2020[[14]](#footnote-14) | % | For comparison: Final energy consumption BMWK 2020[[15]](#footnote-15) | % |
| SUM | 3502 PJ |  | 3502 PJ |  |  |  |
| Households | 1118 PJ | 32 | 1090 PJ | 31 | 914 PJ | 44 |
| Commercial and public services | 440 PJ | 13 | 463 PJ | 13 | 353 PJ | 17 |
| Power generation (public grid) | 592 PJ | 17 | 627 PJ | 18 | N.A. | N.A. |
| Industry (including any non-energy use and on-site power autogeneration) | 1365 PJ | 39 | 1317 PJ | 38 | 624 PJ | 39 |
| Transport | 7 PJ | 0 | 6 PJ | 0 | 7 PJ |  |
| Other | 0 PJ | 0 | 0 PJ | 0 |  |  |

## Gas consumption in Germany during summer 2021 as a model

Concerns have been raised that the gas network would fail under low gas pressure when the Russian gas imports are removed. However, a low gas consumption scenario, with less than 50% of normal gas consumption, is exercised every summer as can be seen Figure 1. One can clearly see that turning off heating units in summer results in correspondingly lower consumption, that is cutting consumption by more than half in comparison to the winter consumption.

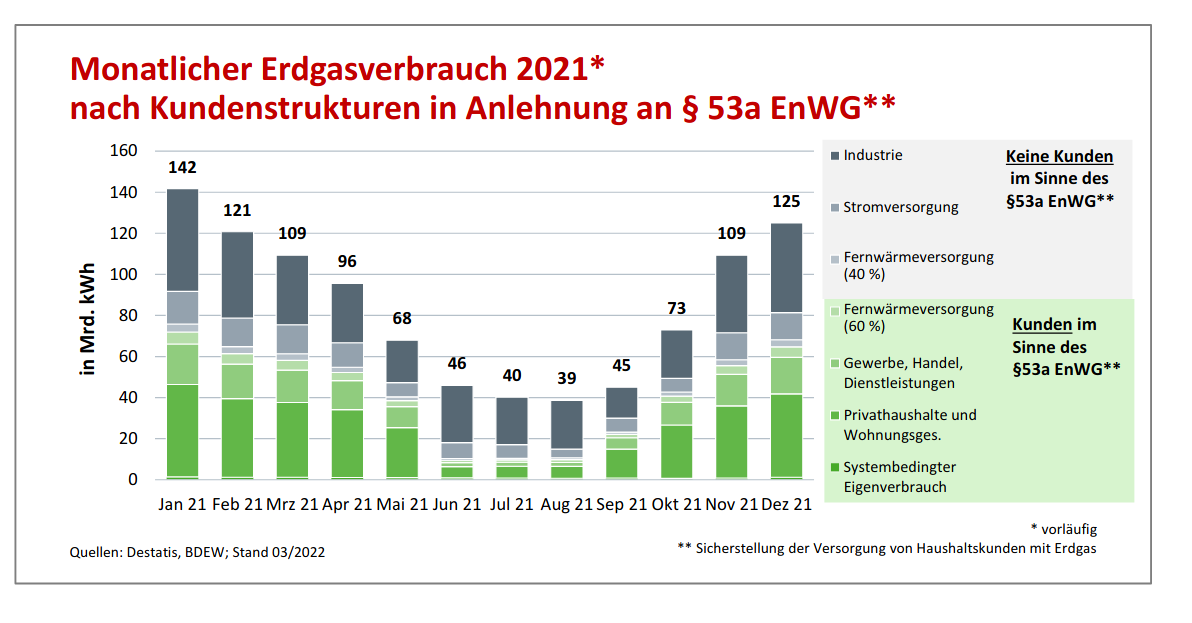


Figure 1: BDEW annual gas consumption[[16]](#footnote-16): monthly energy consumption in billion kWh in 2021, with industry (in blue) and private consumption (in green).

## Emergency economy scenario for the next winter

Note that if the German populace agrees that turning off the heating in winter would be acceptable (for instance, in the 19th century people did not have access to modern heating and dressed more warmly) if all other means fail, this would be a 100% guarantee to German industry. As space heating has no place in the value chain, cutting down heating would be a purely consumption costs and not cut any productivity.

Again let us emphasize that want to demonstrate that it is possible to secure industry in a scenario where there is no substitution at all. We are aware that in the past, public policy has secured household consumer at the expense of industry. However, in a situation of national crisis, this policy needs to be and can be reversed, by prioritizing industry over households.

However, first, as discussed before, the EU can balance this high savings number by exporting gas from other countries to Germany. We point out that instead of using purely price mechanisms, some sort of rationing might give a better feeling of social justice, which is needed in a national crisis situation. In any case, the enforcement of any strong savings is probably best *not* left to market forces alone, e.g. a fair distribution mechanism in case of rationing gas at a modest price could be to provide gas in the distribution networks only daily at certain hours (e.g. at noon / evenings) at that price.

# Discussion

## Policy implications

The advantage of saving on heating is that heating, unlike industry, typically has an “end consumption” place in the value chain, it is pure consumption and could be avoided by e.g. insulation / warmer clothing.

The given calculations also assume that e.g. France would support Germany with gas (or energy) exports.

The EU has already stipulated solidarity mechanisms in case of gas supply crisis.[[17]](#footnote-17) The task at hand is to (1) create European solidarity – here e.g. Germany could ask for this in turn for agreeing to energy sanctions (2) convincing public opinion for strong energy savings. For the latter, numerous polls[[18]](#footnote-18) had shown that there was already initially support for energy savings, which the governments should strengthen rather than curb. For instance, it has to be avoided that switching en masse to electricity for heating endangers the stability of electricity networks. Here appeals to energy savings, e.g. model roles of public ministeries such as practiced in Japan in 2011/2012 are needed, e.g. during a cold wave in Tokio the electricity grid did *not* break down after the government asked for careful heating. Putting a strong focus on industry would also mean that a general prioritization of private consumers as stipulated e.g. in the current German energy law[[19]](#footnote-19) has to be removed, which could be done by legislative act.

## Technical feasibility of changing gas flows

Gas pipelines from Russia have been shut down e.g. for a few days regularly for system maintenance and a long shut down additionally would mean to seal the gas fields for a longer time (e.g. until the war is over), which technically can be done.[[20]](#footnote-20)

# Notes and limitations

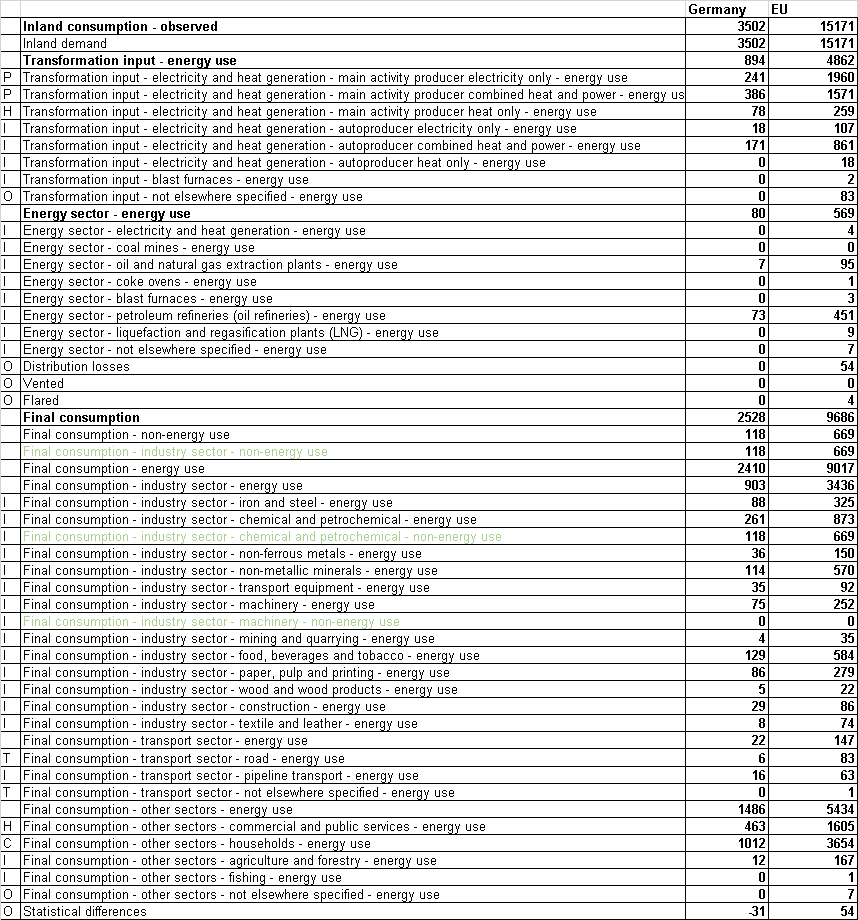
Eurostat figures in general are from 2019/2020, which is the newest dataset available. Eurostat UK figures are from 2019 (for UK, the 2020 figures are not yet available). Some nuclear power plants have been shut down in Germany in 2021, which then is however overall balanced by additional renewable energy capacities. As shown in Table 9, we have ignored about 0.5% of gas consumption used for transportation (“T”) and about 0.5% gas consumption flared, which are lost in statistical discrepancies (“O”). In sum, all the aforementioned effects appear minor.

Obviously 2020 was the year when COVID-19 hit, so we have mostly focused on 2019 as baseline which of the available data with 7094 PJ of Russian gas imports rather than 6500 PJ of Russian gas imports in 2020, 2019 being the year with the highest imports from Russia ever, so we are maximally pessimistic here. Possibly it also can be observed that the trend to reduce own production and to rely more on Russian imports has continued in 2021, however this was balanced by a reduction in Q3 2021 due to higher gas prices.[[21]](#footnote-21) Our scenario is also very conservative / pessimistic, as it does not assume the new availability of any gas (e.g. LNG; Algerian/Libyan gas pipelines) for substitution on the market at all. E.g., other substitution scenarios assume that more of half of the gas consumption can be substituted from a combination of substitution by other energy sources, Norwegian, British, Libyan, Dutch and Algerian gas via pipelines and LNG imports and e.g. calculate for an overall savings of 11%,[[22]](#footnote-22) or equivalently around 20% if we only do savings on heating consumption and not energy which is much more doable than the emergency scenario described.

# Appendix: Derivation of industrial use data: Germany and Europe

Table 9 shows how we have grouped the Eurostat data[[23]](#footnote-23). We did this exercise to make sure that we did not misunderstanding the Eurostat classification. Non-energy use, e.g. as input to chemical processes (overall relatively minor in the 3-4% range) is marked in green. Details on data see <https://github.com/hblasum/stop-gas-imports> .

Table 9: Assignments to “P“ power, “H” households, “I” industry, “T” transport, “C” commercial / public “O” other, from Eurostat data, in PJ.



1. <https://beyond-coal.eu/russian-fossil-fuel-tracker/> [↑](#footnote-ref-1)
2. L Rachel. “RUSSIA ENERGY BAN MYTH BUSTER: Frequent Arguments against Taking Action Now, and Why They Don’t Stack up,” <https://t.co/L26ZGfX9IK> [↑](#footnote-ref-2)
3. E.g. Bachmann, R., Baqaee, D., Bayer, C., Kuhn, M., Löschel, A., Moll, B., Peichl, A., Pittel, K., & Schularick, M. 2022. Was wäre, wenn...? Die wirtschaftlichen Auswirkungen eines Importstopps russischer Energie auf Deutschland. <https://www.econtribute.de/RePEc/ajk/ajkpbs/ECONtribute_PB_029_2022.pdf>; Leopoldina. (2022). Wie sich russisches Erdgas in der deutschen und europäischen Energieversorgung ersetzen lässt. <https://www.leopoldina.org/fileadmin/redaktion/Publikationen/Nationale_Empfehlungen/2022_Stellungnahme_Energiesicherheit.pdf>; Zimmer, Markus, Katharina Utermöhl, and Ano Kuhanthan, Allianz Research, “CAN EUROPE DO WITHOUT RUSSIAN GAS?,” 2022. <https://www.allianz.com/content/dam/onemarketing/azcom/Allianz_com/economic-research/publications/specials/en/2022/march/2022_03_03_EU_without_russian_gas.pdf> [↑](#footnote-ref-3)
4. BDEW. “Fakten Und Argumente Kurzfristige Substitutions- Und Einsparpotenziale Erdgas in Deutschland,” March 17, 2022. <https://web.archive.org/web/20220323050005/https://www.bdew.de/media/documents/BDEW_Analyse_Kurzfristige-Gassubstitution-Deutschland_17032022_korr.pdf>; also BDEW. “Monatlicher Erdgasverbrauch in Deutschland 2021 - Vorjahresvergleich.” <https://www.bdew.de/service/daten-und-grafiken/monatlicher-erdgasverbrauch-deutschland/> page 3 [↑](#footnote-ref-4)
5. Statistisches Bundesamt. “Stromerzeugung 2021: Anteil konventioneller Energieträger deutlich gestiegen.” Accessed April 15, 2022. https://www.destatis.de/DE/Presse/Pressemitteilungen/2022/03/PD22\_116\_43312.html. [↑](#footnote-ref-5)
6. BDEW, cited previously, page 3. [↑](#footnote-ref-6)
7. For instance, in Germany about 80% of household gas consumption is used for space heating, followed by warm water. BDEW, cited previously, page 18. [↑](#footnote-ref-7)
8. Eurostat. “Custom Dataset: Imports of Natural Gas by Partner Country.” Accessed April 4, 2022. <https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_GAS__custom_2428849/default/table?lang=en>. This custom dataset is based on Eurostat. “Imports of Natural Gas by Partner Country - Products Datasets - Eurostat.” Accessed April 4, 2022. <https://ec.europa.eu/eurostat/web/products-datasets/-/nrg_ti_gas> [↑](#footnote-ref-8)
9. “Eurostat: Custom Dataset: Supply, Transformation and Consumption of Gas.” Accessed March 30, 2022. <https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GAS__custom_2395063/default/table?lang=en> .This custom table is based on Eurostat. Statistics “Supply, Transformation and Consumption of Gas.” Accessed March 30, 2022. <https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GAS/default/table?lang=en&category=nrg.nrg_quant.nrg_quanta.nrg_cb> . [↑](#footnote-ref-9)
10. Eurostat. “Custom Dataset: Imports of Natural Gas by Partner Country.” Accessed April 4, 2022. <https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_GAS__custom_2428849/default/table?lang=en>. This custom dataset is based on Eurostat. “Imports of Natural Gas by Partner Country - Products Datasets - Eurostat.” Accessed April 4, 2022. <https://ec.europa.eu/eurostat/web/products-datasets/-/nrg_ti_gas> [↑](#footnote-ref-10)
11. “Eurostat: Custom Dataset: Supply, Transformation and Consumption of Gas.” Accessed March 30, 2022. <https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GAS__custom_2395063/default/table?lang=en> .This custom table is based on Eurostat. Statistics “Supply, Transformation and Consumption of Gas.” Accessed March 30, 2022. <https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GAS/default/table?lang=en&category=nrg.nrg_quant.nrg_quanta.nrg_cb> . [↑](#footnote-ref-11)
12. Eurostat. “Custom Dataset: Imports of Natural Gas by Partner Country.”, cited previously. [↑](#footnote-ref-12)
13. “Eurostat: Custom Dataset: Supply, Transformation and Consumption of Gas.”, cited previously. [↑](#footnote-ref-13)
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19. §53a EnWG [↑](#footnote-ref-19)
20. E.g. see statements by Winterhall Dea speaker Stefan Leunig, in: Pötter, Bernhard. “Öl- und Gasembargo gegen Russland: Nichts in der Pipeline.” taz, April 19, 2022, sec. Politik. https://taz.de/!5846266/. [↑](#footnote-ref-20)
21. BDEW „Fakten und Argumente“, cited, Page 3. [↑](#footnote-ref-21)
22. E.g. Dr. Manuel Köhler von Aurora Energy Research <https://youtu.be/ab7jFm8CUnU> ab Minute 9 "Halt to Russian gas imports scenario": [↑](#footnote-ref-22)
23. Eurostat: Custom Dateaset: Supply, Transformation and Consumption of Gas, cited previously. The table itself in editable form is at <https://github.com/hblasum/stop-gas-imports/blob/master/data/mapping-of-fine-granular-data.xlsx> [↑](#footnote-ref-23)