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

Holger Blasum, Christina Steelbeach, Elena N., xxx,

Version 0.1 of 14 April 2022 (Data: <https://github.com/hblasum/stop-gas-imports> )

**Abstract:** If household / commercial / public consumption gas is 55% saved, and gas for electricity generation is 97% substituted, then Europe can do without Russian imports without touching industry gas consumption at all. In a scenario with a modest 20% savings in industry consumption, now it suffices that household / commercial / public gas consumption savings are 35%. As shown by intra-annual variation of consumption, savings of 55% and/or 35% of household / commercial / public consumption can be achieved by reducing gas consumption for heating.

# 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 touching industry consumption at all, by cutting private consumptions.

Ethically there are strong arguments why there is an obligation for Europe to stop gas imports.[[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 is refusing to accept this economical evidence, arguing with 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.

So we pick up that worst-case scenario and in the following we show that it is possible to stop immediately Russian gas imports without any (0%) or little (20%) reduction in industry consumption when gas consumption in the private / commercial / public sectors is cut down (this consumption is mostly used for heating). Unlike many price elasticity models, our approach is very simple: just an addition of Eurostat publicly available numbers. We show both a European as well as a German view.

# European view

As shown in Table 1 and Table 2, 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, hence only limited additional intercountry flows would needed (only 417 PJ would need to be redistributed across European countries = 4% in comparison to total consumption). Again, arguing with 2020 numbers, is a conservative estimate, as e.g. Lithuania, Latvia and Estonia have already become independent of Russian energy ties.

Table : Russian gas imports in Europe in bcm (billion cubic meters of gas) and PJ (petajoule).

|  |  |  |
| --- | --- | --- |
|  | Eurostat 2020 (bcm)[[4]](#footnote-4) | Eurostat 2020 (PJ) |
| Gas imports from Russia to EU | 155019 bcm | 6443 PJ |

Table : Gas consumption in Europe (derivation see Section 9).

|  |  |  |
| --- | --- | --- |
|  | Primary energy consumption Eurostat 2020[[5]](#footnote-5) | % |
| Industry | 5797 PJ | 38 |
| Transport | 83 PJ | 1 |
| Commercial and public services | 1605 PJ | 10 |
| Households | 3654 PJ | 26 |
| Power generation (public grid) | 3531 PJ | 23 |

Table 5 shows that the if household / commercial / public consumption gas is 55% saved, and gas for electricity generation is 97% substituted, this would be well covered by European production. Inner-EU transfers (“Imports from other EU”) would be 1467 PJ.

Table 6 shows a quite similar scenario with a modest 20% savings in industry consumption, now it suffices that household / commercial / public gas consumption is 35% saved, and gas for electricity generation is 97% substituted, and Inner-EU transfers (“Imports from other EU”) would be 1458 PJ.

Table : Consumptions and imports with 55% savings in households, commercial and 97% savings in electricity generation (PJ)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Country | Households savings | | Public and commercial sector savings | Electricity generation substitution | Total savings/ substitution | Industry use | Russian imports substituted | Imports from other EU countries | Possible exports to other EU countries |
|  | 55% Savings | | | 97% Substitution | Untouched |  |  |  |
| Belgium | 45 | 78 | | 152 | 276 | 314 | 111 | 0 | 165 |
| Bulgaria | 7 | 2 | | 29 | 39 | 51 | 85 | 46 | 0 |
| Czechia | 38 | 47 | | 48 | 133 | 122 | 291 | 158 | 0 |
| Denmark | 11 | 15 | | 10 | 36 | 49 | 0 | 0 | 36 |
| Germany | 297 | 556 | | 608 | 1462 | 1285 | 2045 | 584 | 0 |
| Estonia | 4 | 1 | | 0 | 6 | 5 | 9 | 3 | 0 |
| Ireland | 11 | 15 | | 103 | 129 | 55 | 0 | 0 | 129 |
| Greece | 4 | 11 | | 129 | 144 | 65 | 89 | 0 | 55 |
| Spain | 46 | 89 | | 321 | 456 | 693 | 274 | 0 | 182 |
| France | 153 | 275 | | 217 | 645 | 577 | 475 | 0 | 171 |
| Croatia | 6 | 12 | | 30 | 48 | 48 | 0 | 0 | 48 |
| Italy | 178 | 408 | | 900 | 1486 | 675 | 1094 | 0 | 392 |
| Cyprus | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Latvia | 7 | 3 | | 17 | 27 | 6 | 43 | 16 | 0 |
| Lithuania | 3 | 4 | | 13 | 20 | 64 | 46 | 26 | 0 |
| Luxembourg | 2 | 7 | | 2 | 11 | 11 | 8 | 0 | 3 |
| Hungary | 40 | 77 | | 74 | 191 | 109 | 450 | 259 | 0 |
| Malta | 0 | 0 | | 14 | 14 | 0 | 0 | 0 | 14 |
| Netherlands | 71 | 162 | | 392 | 625 | 619 | 734 | 109 | 0 |
| Austria | 13 | 36 | | 74 | 124 | 170 | 0 | 0 | 124 |
| Poland | 34 | 98 | | 73 | 205 | 417 | 371 | 166 | 0 |
| Portugal | 5 | 8 | | 88 | 101 | 118 | 46 | 0 | 54 |
| Romania | 26 | 70 | | 60 | 156 | 188 | 36 | 0 | 120 |
| Slovenia | 1 | 3 | | 4 | 8 | 21 | 3 | 0 | 6 |
| Slovakia | 13 | 29 | | 32 | 75 | 64 | 143 | 68 | 0 |
| Finland | 6 | 1 | | 33 | 40 | 37 | 72 | 33 | 0 |
| SUM | 1860 | 3653 | | 3530 | 6456 | 5762 | 6426 | 1467 | 1498 |

Table : Consumptions and imports with 35% savings in households, commercial, 20% savings/substitution in industry and 97% substitution in electricity generation (PJ)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Country | Households savings | | Public and commercial sector savings | Electricity generation substitution | Industry savings | Total savings/ substitution | Industry use | Russian imports substituted | Imports from other EU countries | Possible exports to other EU countries |
|  | 35% Savings | | | 97% Substitution | 20% Savings | 80% remaining |  |  |  |
| Belgium | 29 | 50 | | 152 | 63 | 294 | 251 | 111 | 0 | 183 |
| Bulgaria | 4 | 2 | | 29 | 10 | 46 | 41 | 85 | 40 | 0 |
| Czechia | 24 | 30 | | 48 | 24 | 126 | 98 | 291 | 165 | 0 |
| Denmark | 7 | 10 | | 10 | 10 | 37 | 39 | 0 | 0 | 37 |
| Germany | 189 | 354 | | 608 | 257 | 1408 | 1028 | 2045 | 637 | 0 |
| Estonia | 3 | 1 | | 0 | 1 | 5 | 4 | 9 | 4 | 0 |
| Ireland | 7 | 10 | | 103 | 11 | 131 | 44 | 0 | 0 | 131 |
| Greece | 2 | 7 | | 129 | 13 | 152 | 52 | 89 | 0 | 62 |
| Spain | 29 | 57 | | 321 | 139 | 545 | 554 | 274 | 0 | 271 |
| France | 97 | 175 | | 217 | 115 | 605 | 462 | 475 | 0 | 130 |
| Croatia | 4 | 8 | | 30 | 10 | 51 | 39 | 0 | 0 | 51 |
| Italy | 113 | 259 | | 900 | 135 | 1408 | 540 | 1094 | 0 | 314 |
| Cyprus | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Latvia | 5 | 2 | | 17 | 1 | 24 | 5 | 43 | 18 | 0 |
| Lithuania | 2 | 3 | | 13 | 13 | 30 | 51 | 46 | 16 | 0 |
| Luxembourg | 1 | 4 | | 2 | 2 | 10 | 9 | 8 | 0 | 2 |
| Hungary | 25 | 49 | | 74 | 22 | 171 | 87 | 450 | 280 | 0 |
| Malta | 0 | 0 | | 14 | 0 | 14 | 0 | 0 | 0 | 14 |
| Netherlands | 45 | 103 | | 392 | 124 | 664 | 495 | 734 | 70 | 0 |
| Austria | 8 | 23 | | 74 | 34 | 140 | 136 | 0 | 0 | 140 |
| Poland | 22 | 63 | | 73 | 83 | 241 | 334 | 371 | 131 | 0 |
| Portugal | 3 | 5 | | 88 | 24 | 120 | 94 | 46 | 0 | 73 |
| Romania | 16 | 44 | | 60 | 38 | 158 | 150 | 36 | 0 | 123 |
| Slovenia | 1 | 2 | | 4 | 4 | 11 | 17 | 3 | 0 | 8 |
| Slovakia | 9 | 19 | | 32 | 13 | 72 | 51 | 143 | 71 | 0 |
| Finland | 4 | 0 | | 33 | 7 | 44 | 30 | 72 | 28 | 0 |
| SUM | 1860 | 3653 | | 3530 | 1152 | 6506 | 5762 | 6426 | 1458 | 1539 |

# The case of Germany

## Overall gas consumption in Germany

Table : Gas imports from Russia to Germany

|  |  |  |
| --- | --- | --- |
|  | Eurostat 2020 (bcm)[[6]](#footnote-6) | Eurostat 2020 (PJ) |
| Gas imports from Russia to Germany | 52464 bcm | 2045 PJ |

Table : Gas consumption in German.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Primary energy gas consumption Eurostat 2020[[7]](#footnote-7) | % | For comparison: Final energy consumption BMWK 2020[[8]](#footnote-8) | % |
| Total | 3502 PJ |  |  |  |
| Industry (including any non-energy use and on-site power autogeneration) | 1285 PJ | 37 | 624 PJ | 39 |
| Transport | 6 PJ | 0 | 7 PJ |  |
| Commercial and public services | 463 PJ | 13 | 353 PJ | 17 |
| Households | 1012 PJ | 31 | 914 PJ | 44 |
| Power generation (public grid) | 627 PJ | 18 | N.A. | N.A. |

As can be seen in Table 5 and Table 6, even if all Russian imports of 2045 PJ are cancelled, and there would be no support from other EU countries, this would mean that still 1457 PJ were available which is more than the industry need of 1285 PJ. Assuming that use of gas for power generation for the public electricity grid can be substituted by coal, then even in this otherwise completely worst-case scenario, the left over 172 PJ (14%) would allow to operate facilities such as hospitals at unchanged room temperature (i.e. savings of 86% on for household / commercial / public consumption). We have already argued that Europe-wide much less is needed, e.g. 35% savings for household / commercial / public consumption in scenario in Table 4 thanks to the capability of inner-EU gas exchange.

## 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.

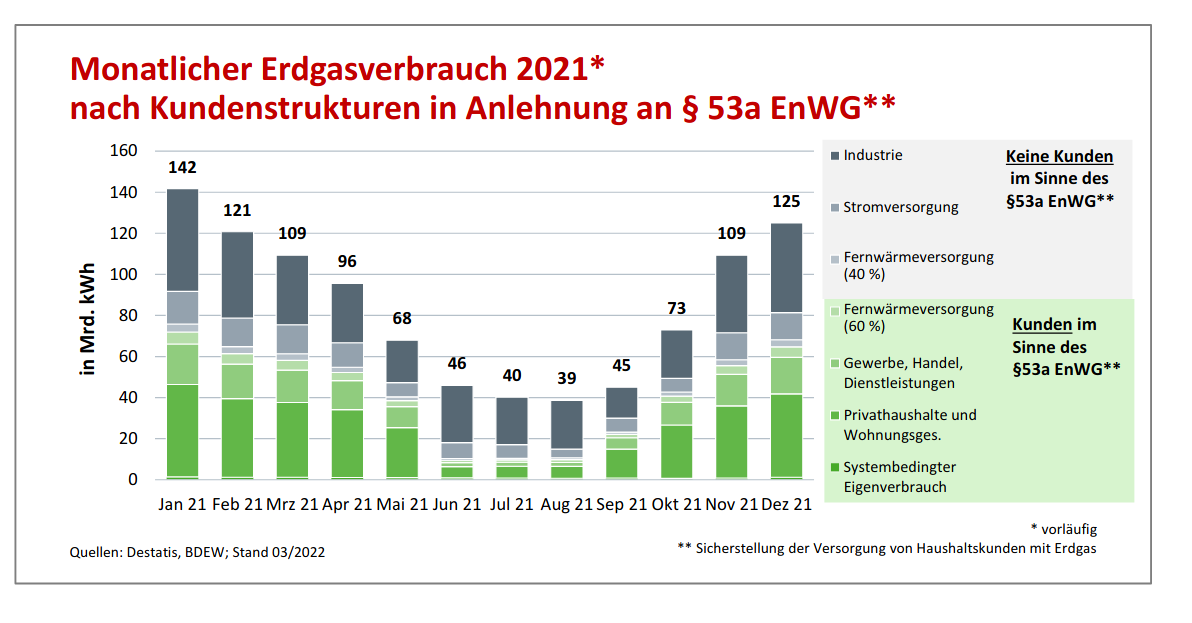


Figure 1: BDEW annual gas consumption[[9]](#footnote-9): monthly energy consumption in billion kWh in 2021, with industry (in blue) and private consumption (in green).

## 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. Moreover, 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%.[[10]](#footnote-10), or equivalently around 20% if we only do savings on heating consumption and not energy which is much more doable than the 86% reduction emergency scenario described in Section 3.1. 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.

# Appendix: European consumption scenarios based on 2020 data with minimal inner-EU transfer

As an extreme scenario, Table 7 shows that the if household and commercial gas is 100% saved, and electricity is 100% substituted, this would be well covered by European production and inner-European transfers (“Imports needed for industry”) would just be 483 PJ in sum.

Note that the incoming transfers needed based on 2020 data are already obsolete for the Baltics, who have already achieved independence from Russian imports

Table : Consumptions and imports with 100% savings in households, commercial and electricity generation

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Country | Households savings | | Public and commercial sector savings | Electricity generation substitution | Total savings/ substitution | Industry use | Russian imports substituted | Imports from other EU countries | Possible exports to other EU countries |
|  | 100% Savings | | | 100% Substitution | Untouched |  |  |  |
| Belgium | 82 | 142 | | 157 | 382 | 314 | 111 | 0 | 271 |
| Bulgaria | 13 | 4 | | 30 | 47 | 51 | 85 | 38 | 0 |
| Czechia | 69 | 86 | | 49 | 204 | 122 | 291 | 87 | 0 |
| Denmark | 20 | 28 | | 10 | 58 | 49 | 0 | 0 | 58 |
| Germany | 541 | 1012 | | 627 | 2179 | 1285 | 2045 | 0 | 134 |
| Estonia | 7 | 3 | | 0 | 10 | 5 | 9 | 0 | 1 |
| Ireland | 19 | 27 | | 106 | 153 | 55 | 0 | 0 | 153 |
| Greece | 6 | 21 | | 133 | 160 | 65 | 89 | 0 | 71 |
| Spain | 84 | 162 | | 331 | 576 | 693 | 274 | 0 | 302 |
| France | 278 | 500 | | 224 | 1002 | 577 | 475 | 0 | 527 |
| Croatia | 11 | 23 | | 30 | 64 | 48 | 0 | 0 | 64 |
| Italy | 324 | 741 | | 928 | 1993 | 675 | 1094 | 0 | 899 |
| Cyprus | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Latvia | 14 | 5 | | 17 | 36 | 6 | 43 | 7 | 0 |
| Lithuania | 6 | 8 | | 13 | 27 | 64 | 46 | 19 | 0 |
| Luxembourg | 4 | 12 | | 2 | 18 | 11 | 8 | 0 | 10 |
| Hungary | 73 | 141 | | 76 | 290 | 109 | 450 | 160 | 0 |
| Malta | 0 | 0 | | 15 | 15 | 0 | 0 | 0 | 15 |
| Netherlands | 130 | 294 | | 404 | 828 | 619 | 734 | 0 | 94 |
| Austria | 24 | 66 | | 76 | 167 | 170 | 0 | 0 | 167 |
| Poland | 62 | 179 | | 75 | 316 | 417 | 371 | 55 | 0 |
| Portugal | 9 | 14 | | 91 | 114 | 118 | 46 | 0 | 67 |
| Romania | 47 | 126 | | 62 | 235 | 188 | 36 | 0 | 200 |
| Slovenia | 3 | 5 | | 5 | 12 | 21 | 3 | 0 | 9 |
| Slovakia | 24 | 53 | | 33 | 111 | 64 | 143 | 32 | 0 |
| Finland | 11 | 1 | | 34 | 46 | 37 | 72 | 26 | 0 |
| SUM | 1860 | 3653 | | 3530 | 9043 | 5762 | 6426 | 425 | 3042 |

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

Assignments to power „P“, heating “H”, “I”industry, “T” transport, “O” other, from Eurostat data in TW.[[11]](#footnote-11)



1. <https://beyond-coal.eu/russian-fossil-fuel-tracker/> [↑](#footnote-ref-1)
2. 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. 35. <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. 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.

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5. “Statistics | Eurostat: Custom Table: 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. [↑](#footnote-ref-5)
6. 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.

   Eurostat. Eurostat. “Imports of Natural Gas by Partner Country - Products Datasets - Eurostat.” Accessed April 4, 2022. https://ec.europa.eu/eurostat/web/products-datasets/-“Custom Table: Imports of Natural Gas by Partner Country - Products Datasets - Eurostat.” Accessed April 4, 2022. `/nrg\_ti\_gas.https://ec.europa.eu/eurostat/databrowser/view/NRG\_TI\_GAS\_\_custom\_2428797/default/table?lang=en. [↑](#footnote-ref-6)
7. “Statistics | Eurostat: Custom Table: 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. [↑](#footnote-ref-7)
8. Tabellenblatt 6a BMWK. “Zahlen Und Fakten: Energiedaten,” 20.Januar, 2022. https://www.bmwi.de/Redaktion/DE/Binaer/Energiedaten/energiedaten-gesamt-xls-2022.xlsx?\_\_blob=publicationFile&v=8 [↑](#footnote-ref-8)
9. 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/ [↑](#footnote-ref-9)
10. Dr. Manuel Köhler von Aurora Energy Research <https://youtu.be/ab7jFm8CUnU> ab Minute 9 "Halt to Russian gas imports scenario": [↑](#footnote-ref-10)
11. “Statistics | Eurostat: Custom Table: 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. [↑](#footnote-ref-11)