Comments on Europe gas data

Overall, a very good product with easy-to-use data. Needs some ‘fixing’ before publication in ESSD/

Paragraph beginning at line 68: here authors report attempts to differentiate - for heating, power and industrial sectors - whether reduced energy consumption by sector derives from behavioral, meteorological, source or efficiency changes. They use, variously, behavior-climate attribution models (driven with ECMWF land temperature data) for heating, gas consumption with CM electricity data (for power), etc. For industrial sector they assume incorporation of heat pumps does not decrease industrial production but conclude with statement that “industrial consumption reduction could be explained by the increments of total electricity generation with certain conversion efficiency”. Not clear what this statement refers to? This particular approach “similar” to approaches applied for heating or power sectors? Slight revision could clarify? Does this assumption impact subsequent discussions of uncertainties and biases? Same topics discussed with more detail in paragraph starting at line 174. Assumption clarified (somewhat) but still without attribution? Later paragraph refers to specific (= constant over this time period?) gas-to-electricity conversion ratio. Based on Fig S16, which unfortunately does not quantify this relationship, authors assumed a conversion ration of 1:1? Authors allow this reader to stumble over this issue; needs clarification?

Line 83: “LNG imports replaced Russian pipeline imports and become the primary gas supply source to the EU.” But, in abstract and throughout paper and data sets reader learns that LNG represented 38% (37.5) of total gas supply. Largest single source, perhaps, but not the “primary” source?

Line 108: Periods of Analysis. Good. But, EUGasSC and EUGasNet files both start with data from 2016? Not explained here nor mentioned elsewhere in this manuscript nor in associated supplement?

Line 188, “0.55±0.21”: Readers need to know what ‘+0.21’ means? SD? 95CI? Authors should use identical designation throughout, defined clearly at first use.

Line 188: Fig S9 includes two panels, not one. No composite r2 available? This reader doubts composite as high as 0.55 and gets nothing from 9a or 9b that conveys “effective capture” of TGC data?

Line 191: Reference here “previous study” means Zhou et al 2023? Use citation? So ‘overage’ in Fig 6, right panel, represents - at top - <5% overproduction? But, authors apparently ignore equal-sized overage at bottom of that panel? Something wrong somewhere?

Line 195 and remainder of paragraph: if pre- vs post- energy uses remained constant, not clear to this reader why that constancy would necessarily lead to overestimation of shortages or drops in production? Need clarification here? Increased energy prices or conservation would lead to same overestimation? Reader assumes grid “interconnection” refers to connections across EU countries but sentence eventually refers to “supply and demand” changes within country? Again, clarification needed?

Lines 199 to 201: Nice list but given these assumptions and residual uncertainties, plus lack of proper validation (probably impossible for these particular data - authors should comment?), this reader feels uncomfortable with numbers to 3 sig figs, e.g. 36.3; authors should round to two sig figs max, throughout?

Paragraph covering lines 206 to 214: Some numbers make sense (add correctly) here but authors would make such checks much easier by consistently adopting either “per winter” or “two post-invasion winters”. Mixing one vs two years adds confusion?

Line 215, “decrease in gas consumption (25.5±16.0%)”: One year, two year, winter, annual?

Line 228: These represent annual numbers (-2427.5) compared to earlier (976.8, line 206) numbers that represented winter-only? Please ensure that readers know when authors report annual vs winter-only data? Also not clear when authors refer to Western EU countries (France?, Spain?) vs Eastern EU countries (Hungary?, Poland?). Where do Germany, Austria, Italy fit in geographic dichotomy? This reader finds (line 225) delineation of “Central” as well? Nowhere defined? Need a table or map?

Line 315, authors reference gas-electricity conversion efficiency of 0.7. As in Fig 5 but not in Fig S16?

Line 318 - typos

Line 364, “resolving the different gas odorization systems”: did this significant accommodation occur only for gas transported eastward from France to Germany, or for all French gas usage? In prior manuscript (Zhou et al 2023) odorization policies represented a significant barrier? Did author’s predictions anticipate this change? Significant but not largest among adjustments in Germany but highly significant as a French adjustment?

Line 381: interesting conclusion! Do authors need to apply some uncertainly here? Or, strong prediction?

Line 407, citation lists “Four” but authors list only 3. Readers might prefer to trust authors but will need to understand basis for apparent change?

Line 413, Data availability: Data very good, very easy to find, download and use. Good documentation! Compliments to authors.

Line 453, Figure 2: colors applied in wide bars too dilute? E.g. particularly the gray/black ‘Pro’ bars, diffuse in wide bars. From constancy reader can assume ‘Pro’ but not clear enough to un-careful readers?

Line 459, Figure 3: data availability would certainly support reader reproduction of this figure. I started in QGIS, did not finish to this quality but can see how authors came up with these numbers and this figure. Authors should assure readers that open-access tools (e.g. QGIS) will work, even if they used e.g. ArcGIS?

Line 467, Figure 4: “Green energy importance %” not defined nor quantified. Reader must assume that persistent values near 100% represent max possible utilization?

Line 471, referring to Figure 4: not ‘yellow’ in the version I see?

Line 475, Figure 5: Readers needs to know what color bands around lines in panel b mean? Range, SD, what? Emphasize scale in panel C? No EU country can explain more than 50% of reduction. Major (‘Central’?) EU countries - Germany, France, UK, Italy, Belgium - must admit 80% of reductions not explainable? Uncertainty conveyed here not repeated in narrative?

Line 481, Figure 6: Interesting, perhaps key, figure. Takes too long to understand. Very difficult to reproduce. Black block at bottom of right panel already questioned (see above, ref. Line 191). Need some indication of uncertainties? E.g. Baltic or BeneLux: can authors expect readers to rely on such small numbers? Gray or blurred zone must exist between Gap > reduction countries and reduction > gap countries? Authors could assist readers with small attention to details of this figure?

References should - where possible - point to original DOI? Journal will know proper format for references, e.g. when “n.d.” might prove appropriate and for numerous EU organizational or news media citations (not trackable nor available to this reader unless they carry DOI).

Confusion in references at end: Zhou et al 2024 (Zenodo data) vs Zhou et al 2023 (prior ESSD paper) not in correct order?

Supplement:

Fig S1: Bars in this graph need to show errors/uncertainties? Looking at bottom (3rd) panel, this reader estimates that only Germany, Hungary, France, Netherlands and UK engaged in significant storage? In every other EU country, data remain within noise limits?

Fig S2: Strong need for uncertainties! For this reader on quick glance: a) no sig differences any sector during summer; and b) authors have not shown, here at least, that pre-war differs statistically from post-war?

Fig S3: Interesting chart. This reader sees France with neither strong need nor strong source? How then did France come up with 225 TWh (Figure 3) for export to Germany?

Fig S4: Date units in top panel not correct? In lower panel, readers learn that storage accumulates during EU summers but supply for that storage arrives during winter? Evidence for annual “flow mass balance” but not for seasonal or monthly? Need to see uncertainties around these graphs?

Table S2: In this data, France shows significant (?) increase in transmission over within-country consumption. Most French export went to Germany? Because authors present data as ratios, readers can’t, from this Table at least, determine amounts?

Fig S5: From this graph, reader concludes that Nordstream disruptions had larger impact, in terms of price, than invasion? Time required for sanctions / interuptions to impact prices? Additional source(s) of uncertainty?

Fig S6: Reader needs information about uncertainty bands around gas and electricity prices?

Fig S7: Arrow widths provide only weak indicators? This figure does not show significant export France to Germany?

Fig S8: Daily flows clearly show impact of invasion but, for some exchanges, with lags of up to 6 months? One can get some info about temporal uncertainties from this figure?

Figs S9a, S9b: need author declaration of pre-(orange?) and post-(blue?).
Why does Portugal data show two separate clusters, unlike (for example) Spain?

Fig S11: No uncertainties here? From panels shown in S10, reader has no confidence in values below 0.3, or 0.5?

Fig S12: Again, no uncertainties? This reader concludes that e.g. Austria used high proportions of renewables prior to invasion and that those proportions did not change post-invasion?

Fig S13: Reader needs information about uncertainties represented by color bands?

Fig S14: Difficult but important figure? For this reader, only Germany, Italy, France and UK, perhaps with Spain and perhaps with Austria, showed significant changes over two winters? Everything else (all other countries) within noise?

Fig S15: Uncertainties? Reader finds this figures potentially useful but not without some indication of uncertainty?

Table S4: Very useful! Should appear as Appendix, referenced on Zenodo and in section 6?